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## Assessment of Cyclical Spreading and Ecological Extortions to the Avian Species in Distt. Jhang, Punjab, Pakistan

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**ABSTRACT:** *The study was conducted to estimate the bird diversity and the risks they confront at Head Trimmu, Distt. Jhang, Punjab, Pakistan. A number of field surveys were managed over 12-months by employing both direct and indirect means during certain hours of a day. The study found a total of 54 species from 15 orders and 31 families. The bird species were classified as residents (64.4%), breeders (8%), migrants (26%), and passage migrants (1.4%). The most frequent species observed during the study were house sparrow, house crow, domestic rock pigeon, ring-necked dove and common myna. Overall, the study revealed a diversified avian community with Shannon-Wiener diversity index of 3.3367. Only two species found near threatened like the Houbara bustard (*Chlamydotis undulata*) and Alexandrine parakeet (*Psittacula eupatria*) but the majority of the species are of least concern. The ecological richness of the area is under threat by urban development due to growing human population. So, the major threats to avian species in the study area are habitat degradation, Illegal hunting and lack of awareness. It is suggested to preserve avian diversity by the involvement of government agencies, private groups (WWF, IUCN, BirdLife International) and the general public.*

**Keyword:** Avian diversity, Cycling spreading, Ecological extortion, Head Trimmu.

## INTRODUCTION

Birds are endothermic, bipedal, oviparous, vertebrate animals with feathers on their bodies that live in hilly regions, agricultural fields, urbanised areas, rural areas, and water bodies at different elevations (Govender, 2021; Umar et al., 2018). The Aves are the main class of birds, which includes the flightless birds (Palaeognathae), the weak-flying species (Tiramusu), and the flying birds (Neognathae) (Platt et al., 2021). Birds are great producers of ecosystem services; they may disseminate seeds, eat pests, scavenge carrion, pollinate flowers, cycle nutrients, and improve the environment for the benefit of humans and other animals (Sekercioglu, 2006; Whelan et al., 2015).

Numerous zoogeographical zones, i.e., the Ethiopian, Palaearctic, and Oriental are home to a variety of bird species. Among them, Pakistan is recognised for its miscellaneous climate and floral zones, which are considered one of the most significant homelands for avian species (Khan & Pervaiz, 2001). There are a total of 10960 bird species worldwide (BirdLife, 2016), while 2700 avian species have been reported from Asia (Altaf et al., 2012). Pakistan harbours a very diverse avian fauna due

to its geographical structure and is home to more than 750 species of birds (Mehmood et al., 2018). The winter season in Pakistan is particularly significant for certain migratory bird species (Grimmett et al., 2001; Mirza and Wasiq, 2007). To avoid extremely cold weather, a large number of birds migrate from Middle Eastern countries to Europe and to the wetlands of Pakistan (Ali, 2005). Now there is a decline in the population of migratory birds in Pakistan too. One particular instance is the decreasing number of Pakistani wetland bird species, *Sterna acuticauda*, due to habitat degradation, i.e., overgrazing, poaching, and summer floods (Altaf et al., 2015). With the rapid urban expansion of the late 20th century in response to the growing human population, maintaining and restoring ecosystems in urban settings became a difficulty (Miller and Hobbs, 2002; Ahern, 2013). This is in accordance with the conservation strategies suggested at several environmental conferences (Kheraa et al., 2009).

The earth biodiversity is negatively impacted by unfavourable effects of environmental changes, including climate change, pollution, habitat loss, deforestation, and the introduction of invasive species (Karina et al., 2009;

Scenes, 2018). In the observed area, the primary risks to species variety are habitat degradation, human population pressure, and illegal hunting. Parrots are rare and endangered bird group, with 95 (28.6%) of the 354 recognised species facing challenges. One of them is the Alexandrine Parakeet (*P. eupatria*), which is distributed in South and Southeast Asia, extending to Pakistan and India (Abed et al., 2020). The houbara bustard is on the IUCN red list, and Pakistan uses it as a fungible reserve (Ralph Adler, 2020). The Asian houbara (*C. macqueenii*) is a migratory species, and its number has been affected by unsustainable hunting and trapping (Dolman et al., 2018). Both the Asian (*C. macqueenii*) and African (*C. undulata*) houbara are listed as vulnerable due to uncertainties that the release of captive-bred birds could have an adverse effect on wild populations (IUCN, 2019).

Several species diversity indices are used to evaluate variety; these include the Shannon-Weiner, Simpson, Evenness, and Richness indices. The indices rise as the number of species, populations, and similar numbers within species groups rise (Altaf et al., 2013, 2015). The diversity of various birds at Taunsa Barrage, Head Trimmu Barrage, Changa Manga, Head Qadirabad, and

Ravi Siphon as well as their ecological impacts, have already been examined (Ali, 2005; Mahboob and Nisa, 2009; Altaf, 2010; Munir, 2010; Irfan, 2010). So, we are the first to investigate the avian diversity of the Head Trimmu junction area, which is regarded as a wetland in the Jhelum and Chenab rivers. According to the irrigation and power department, the diversity of flora and fauna in that region is also poorly impacted by the pH of the water, which varies from 7.1 to 8.1 (Irrigation and Power Department, Punjab, 2007). pH levels can stress animal systems, reduce hatching and survival rates, and increase mortality rates. Species with higher sensitivity are more affected by pH changes.

So, the current study has been designed to access cyclical spreading and ecological extortions to the avian species in Distt. Jhang, Punjab, Pakistan. This work would provide valuable resources on the conservation of cyclical spreading and ecological extortions to the avian species in Distt. Jhang, Punjab, Pakistan.

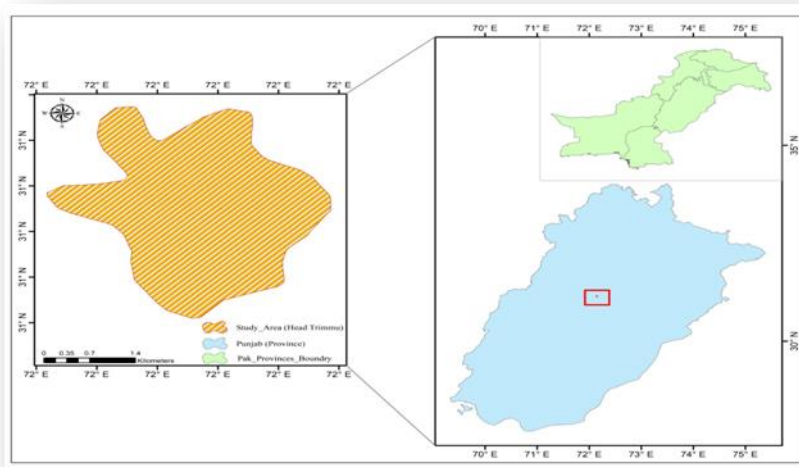
## **MATERIALS AND METHODS**

### **Study area:**

Head Trimmu is considered an agro-forest land with a highly variable avian diversity. Its ecosystem includes a

multifacet of aquatic, woodland, and agricultural territory. It is located in Tehsil 18 Hazari, district Jhang, at the intersection of the rivers Chenab and Jhelum in the village "Basti Sanga." The climate of this region is temperate, with four seasons. Summer is comparatively

longer, and temperatures range from 3°C to 45°C, with very rare excursions below 2°C or above 44°C. Relative humidity is typically between 20 and 25% in the summer and 40 to 65% in July and August (the rainy season) (Fig. 1).



**Fig.1: Map of the study area Head Trimmu, showing sampling site.**

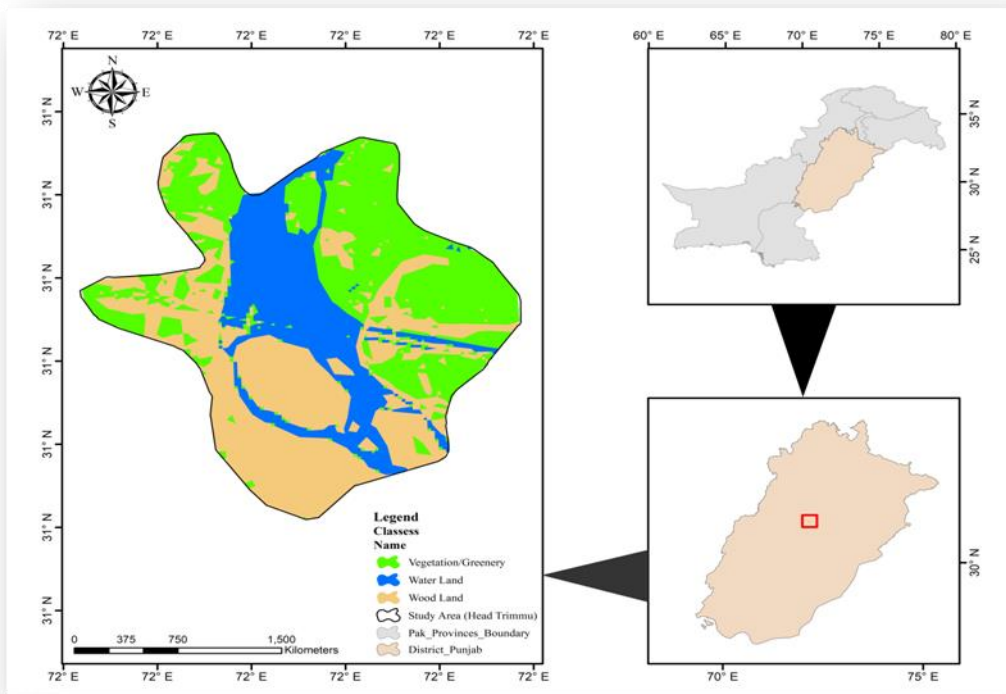
### **Study design:**

All the field information being used in the assessment was gathered based on direct surveillance of the birds, i.e., numbering birds through vision and echo ("Avies surveys and information collection"). The present study was conducted on the birds' fauna at Head Tirmmu from January 2019 to December 2019, specifically focusing on the distribution, diversity, and ecology of the birds. Data were collected from dawn (5:00 a.m. to 8:00

a.m.) to the early sunset (5:00 p.m. to 7:00 p.m.) throughout the assessment period. Throughout the assessment process, a range of field techniques, including direct land observations and indirect interpretation i.e., filling questionnaire and interviews from the restricted community, were employed. The parallel observational area was divided into three main groups: stream areas, woodlands (with trees and orchards surrounding the living enclosures), and vegetation/greenery

planted (around the grassy territory and housing colony) to be observed and identified in order to estimate the number of birds (Fig. 2). Small cameras were installed to document the habitats and landscapes. Additionally, focused

group debates and interviews were conducted. "Fauna of Pakistan" as a field reference was used to identify the bird's life in the observation area (Grimmett et al., 2008).



**Fig. 2: Map showing the area in study site covered by water land, woodland, and vegetation/greenery.**

Five diversity indices (Dominance, Shannon-Wiener diversity Index, Simpson Index, Margalef and Evenness) were used to calculate the avian diversity by means of documented data (Hammert et al., 2001).

### Shannon-wiener diversity Index:

Shannon-wiener diversity Indices was designed with the following formula (Shannon and Weaver, 1963):

$$H' = - [\sum PI \ln PI]$$

H' is Shannon-wiener diversity Indices  
PI is relative abundance of bird species to entire population (Ashraf et al., 2019).

### **Species richness (SR)**

Species richness calculated with the formula given below (Margalef, 1951).

$$“SR = (S - 1)/\log_n N”$$

S is the whole numeral of bird's species

N is the numeral of birds there in the sample

### **Species evenness (E)**

Species evenness was considered with the formula presented forward (Pielou, 1966).

$$“E = H' / \log_n S”$$

Where

S is Whole numeral of avian species

H' is Shannon-wiener diversity indices

## **RESULTS**

The Trimmu barrage is a dominant site for avian fauna as it shows the features of both terrestrial and aquatic habitats. The study area offers abundant food resources, including insects, crustaceans, invertebrates, arachnids, grains, seeds, fruits, and human waste, supporting Passeriformes species like the common myna, barn swallow, and house sparrow. The area features a variety of tree species, including Siris, Egyptian mimosa, Bo tree, River redgum, Date palm, Rosewood, Indian jujube, and Wild jujube. Ground flora includes lamb's quarters, Cheese weed mallow, Camel thorn, Toothed medick, Sweet Clover, Bermuda grass, Syrian

rue, and Puncture vine. Aquatic plant species include Water-thyme, Striate vallis, Sacred lotus, Bengal cane, Wild cane, Tamarisk, and Southern cattail. Out of the five dominant species, four are Passeriformes species, influenced by food abundance. The number of birds is linked to breeding season, habitat quality, and food enrichment (Bibi and Ali, 2013).

During the 12-month field survey, 54 species of birds were identified from 15 orders and 31 families (Table. 1). In the present study, the most dominant order was Passeriformes, representing 19 species of birds belonging to 14 families, followed by Columbiformes with 9 species, Accipitriformes with 5 species, Pelecaniformes with 4 species, Falconiformes, Galliformes with 3 species, Cuculiformes, and Psittaciformes with 2 species, while Apodiformes, Otidiformes, Strigiformes, Bucerotiformes, Charadriiformes, Gruiformes, and Anseriformes are represented by single specie each. We took references of classification from (BirdLife International, 2019).

Out of 54 bird species observed during our survey, we reported 37(69%) species as Residents including the house crow, tufted titmouse, house sparrow, common starling, rosy starling, bank

myna, oriental magpie robin, black drongo, indian silverbill, red vented bulbul, common babbler, steep grey shrike, common tailorbird, rock doves, ring necked doves, Laughing doves, red collared doves, Asian green bee eaters, Indian roller, little swifts, Eurasian sparrow hawks, black kites, shikras, golden eagles, night herons, cattle egrets, little egrets, Pied Crusted Cuckoo, peregrine falcons, ring necked pheasants, Harlequin quails, Common quail, rose ringed parakeets, alexandrine

parakeets, spotted owlets, African hoopoes and red wattled lapwings. 17 (31%) species as migrants, including common myna, river tern, yellow wagtail, pied winged swallow, sand martin, purple sunbird, blue cheeked bee eaters, desert wheat eaters, white throated kingfishers, common buzzards, Indian pond herons, great coucals, laggar falcons, common kestrels, houbara bustards, common coots, and northern shovlers (Table. 1) (Fig. 3).

**Table 1: Summary of diversity Index and distribution at Head Trimmu Jhang**

Order	Family	Scientific name	Common name	Diversity Index	Distribution
Passeriformes	Corvidae	<i>Corvus splendens</i>	House crow	-0.255	RESIDENT
	Paridae	<i>Baeolophus bicolor</i>	Tufted titmouse	-0.1657	RESIDENT
	Passeridae	<i>Passer domesticus</i>	House sparrow	-0.23165	RESIDENT
	Sturnidae	<i>Acridotheres tristis</i>	Common myna	0.22104	MIGRANT
		<i>Sturnus vulgaris</i>	Common starling	-0.07659	RESIDENT
		<i>Pastor roseus</i>	Rosy starling	0.06119	RESIDENT
		<i>Sterna aurantia</i>	River Tern	-0.1245	MIGRANT
		<i>Acridotheres ginginianus</i>	Bank Myna	0.05255	RESIDENT

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	Muscicapidae	<i>Copsychus saularis</i>	Oriental Magpie Robin	-0.0727	RESIDENT
	Motacillidae	<i>Motacilla flava</i>	Yellow wagtail	-0.0272	MIGRANT
	Dicruridae	<i>Dicrurus macrocercus</i>	Black drongo	-0.1249	RESIDENT
	Estrildidae	<i>Euodice malabarica</i>	Indian silverbill	-0.0264	RESIDENT
	Hirundinidae	<i>Hirundo leucosoma</i>	Pied winged swallow	-0.0288	MIGRANT
		<i>Riparia riparia</i>	Sand martin	-0.002	MIGRANT
	Nectariniidae	<i>Cinnyris asiaticus</i>	Purple sunbird	-0.0611	MIGRANT
	Pycnonotidae	<i>Pycnonotus cafer</i>	Red vented bulbul	-0.0721	RESIDENT
	Leiothrichidae	<i>Argya caudata</i>	Common babbler	-0.0699	RESIDENT
	Laniidae	<i>Lanius sexcubitor</i>	Steppe grey shrike	-0.0611	RESIDENT
	Cisticolidae	<i>Orthotomus sutorius</i>	Common tailorbird	-0.028	RESIDENT
Columbiformes	Columbidae	<i>Columba livia</i>	Rock dove	0.175	RESIDENT

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		<i>Streptopelia capicola</i>	Ring necked dove	-0.1523	RESIDENT
		<i>Spilopelia senegalensis</i>	Laughing dove	-0.0676	RESIDENT
		<i>Streptopelia tranquebarica</i>	Red collared dove	0.0311	RESIDENT
	Meropidae	<i>Merops orientalis</i>	Asian green bee eater	-0.1023	RESIDENT
		<i>Merops persicus</i>	Blue cheeked bee eater	-0.0248	MIGRANT
		<i>Oenanthe deserti</i>	Desert wheat eater	-0.0272	MIGRANT
	Coraciidae	<i>Coracias benghalensis</i>	Indian roller	-0.01634	RESIDENT
	Alcedinidae	<i>Halcyon smyrnensis</i>	White throated kingfisher	-0.0198	MIGRANT
Apodiformes	Apodidae	<i>Apus affinis</i>	Little swift	-0.02727	RESIDENT
Accipitriformes	Accipitridae	<i>Accipiter nisus</i>	Eurasian sparrow hawk	-0.019	RESIDENT
		<i>Milvus migrans</i>	Black kite	-0.0916	RESIDENT
		<i>Buteo buteo</i>	Common buzzard	-0.0699	MIGRANT
		<i>Accipiter badius</i>	Shikra	-0.0333	RESIDENT

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		<i>Aquila chrysaetos</i>	Golden eagle	-0.0525	RESIDENT
Pelecaniformes	Ardeidae	<i>Ardeola grayii</i>	Indian pond heron	-0.0961	MIGRANT
		<i>Nycticorax nycticorax</i>	Night heron	-0.0377	RESIDENT
		<i>Bubulcus ibis</i>	Cattle egret	-0.1186	RESIDENT
		<i>Egretta garzetta</i>	Little Egret	-0.0398	RESIDENT
Cuculiformes	Cuculidae	<i>Centropus sinensis</i>	Great coucal	-0.067	MIGRANT
		<i>Clamator jacobinus</i>	Pied Crusted Cuckoo	-0.0296	RESIDENT
Falconiformes	Falconidae	<i>Falco jugger</i>	Laggar falcon	-0.0163	MIGRANT
		<i>Falco tinnunculus</i>	Common kestrel	-0.0419	MIGRANT
		<i>Falco peregrinus</i>	Peregrine falcon	-0.0377	RESIDENT
Galliformes	Phasianidae	<i>Phasianus colchicus</i>	Ring necked pheasant	-0.0405	RESIDENT
		<i>Coturnix delegorguei</i>	Harlequin quail	0.01724	RESIDENT
		<i>Coturnix coturnix</i>	Common quail	-0.0377	RESIDENT

Psittaciformes	Psittaculidae	<i>Psittacula kramera</i>	Rose ringed parakeet	0.0041	RESIDENT
		<i>Psittacula eupatria</i>	Alexandrine parakeet	-0.0075	RESIDENT
Otidiformes	Otididae	<i>Chlamydotis undulata</i>	Houbara bustard	-0.0053	MIGRANT
Strigiformes	Strigidae	<i>Athene brama</i>	Spotted owlet	-0.0126	RESIDENT
Bucerotiformes	Upupidae	<i>Upupa africana</i>	African hoopoe	-0.0154	RESIDENT
Charadriiformes	Charadriidae	<i>Vanellus indicus</i>	Red wattled lapwing	-0.0215	RESIDENT
Gruiformes	Rallidae	<i>Fulica atra</i>	Common Coot	-0.0135	MIGRANT
Anseriformes	Anatidae	<i>Anas clypeata</i>	Northern shovler	-0.0135	MIGRANT

The study reveals 54 species among 5405 individuals, with relative abundance (IP) of 1.004. Shannon Wiener's index (H') of 3.3367 and Simpson's index (S) of 0.997 that provide insights into species diversity and dominance. Evenness index (E) of 0.5218 and Richness (R) of 0.733 indicate species abundance distribution. Margalef index (I) of 6.1645 shows

species richness relative to the number of individuals. These indicators provide valuable understandings into the avian diversity and ecological dynamics of the population (Table. 2). Only a two species found near threatened like the Houbara bustard (*Chlamydotis undulata*) and Alexandrine parakeet (*Psittacula eupatria*) but the majority of the species are of least concern.

**Table 2: Diversity Indices of Avian Fauna at Head Trimmu**

DIVERSITY INDICIES	VALUES
Number of species(S)	54

Population (P)	5405
Relative Abundance (IP)	1.004
Shannon wiener index (H')	3.3367
Simpson index (s)	0.997
Evenness index (E)	0.5218
Richness (R)	0.733
Margalef index (I)	6.1645

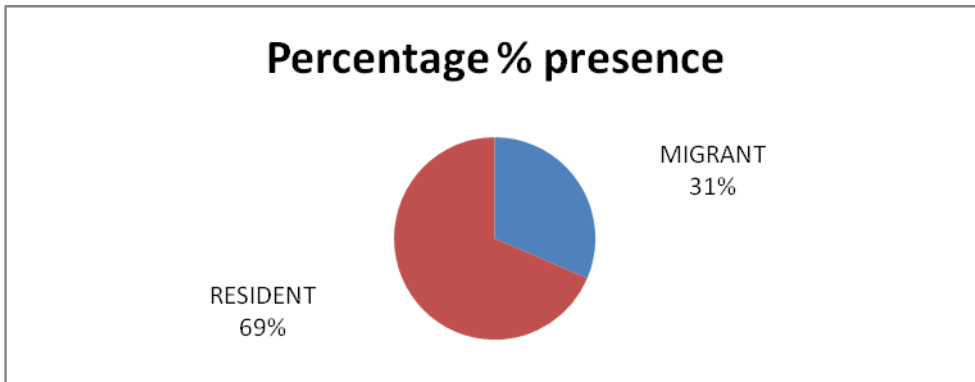


Fig.3: Percentage of resident, migratory bird species

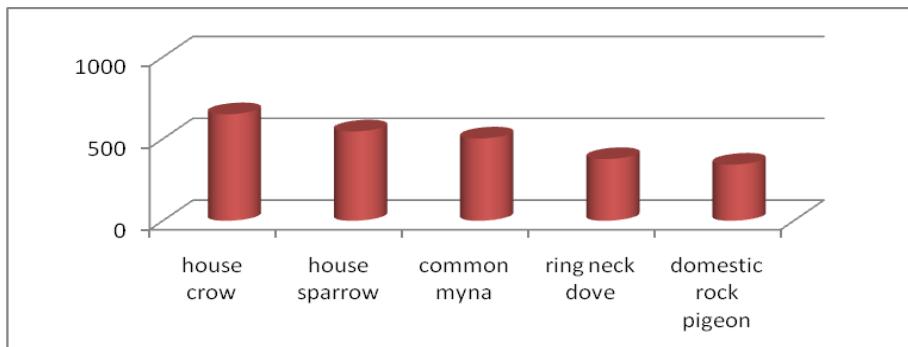


Fig.4: Relative abundance and percentage of 5 most dominant species

**Threats:** A few common threats recognized were deforestation, rapid and haphazard urbanization, and a lack of public awareness to care for avian diversity.

**Deforestation:** As part of the barrage renovations, some bird houses have

been cleared, which has led to a decrease in the number of birds.

**Rapid and haphazard urbanization,** particularly in biodiversity-rich areas, is a lethal cause of diversity decline due to increased illegal hunting, netting, and

shelter decline, despite deforestation alone having fewer adverse effects.

**Lack of awareness:** The primary factor contributing to the decrease in avian diversity in developing nations like Pakistan is a lack of knowledge about the value of wildlife.

## **DISCUSSION**

A 12-month field survey recognised 54 bird species from 15 orders and 31 families, with Passeriformes being the most dominant order. This aligns with previous conclusions by Shahid et al. (2018), who reported Passeriformes as the main order, representing 37.52% of avian species. Raza et al. (2015) noted Passeriformes as the most common order, with 55.7% of bird species belonging to 17 families. Researchers at Head Khanki observed 51 waterfowl species, including 33 genera and 16 families. Other studies have found 59 bird species, with 24 being residents, 14 winter visitors, and 11 summer visitors. Irfan (2010) recorded 57 summer avifauna species, with 51 being SP. residents, 5 summer breeders, and 1 annual visitor. However, the exact percentages and number of families may vary due to differences in locations, methodologies, and survey durations. This study highlights the need for continued conservation efforts to protect

avian diversity. Despite the ban on extinctions since the CBD's inception, several species remain threatened and require constant conservation efforts (Díaz et al., 2019). The detrimental consequences of pollution, deforestation, climate change, loss of territory, and the influx of non-native species must be addressed. The study area is rich in diverse flora and fauna species, which provide food, shelter, and habitat for various bird species. However, the financial vulnerability of developing nations, coupled with dysfunctional political systems, an impotent judiciary, and ineffective regulatory mechanisms, can erode laws protecting the environment and the survival of threatened bird species. Greater efforts are needed to prevent extinction and improve the condition of 6,811 species listed as seriously endangered on the Red List (IUCN, 2020).

## **CONCLUSION**

Data from the agriculturally wetland-cultivated land formation revealed 54 bird species, which is a sign of a healthy ecosystem. Based on the results, it is highly recommended that to protect avian diversity, habitat preservation and minimizing threats are crucial. Regulations against hunting of

migratory bird species and strategies to prevent outside interference are essential. Public and private organizations have made progress in saving endangered species. Future research on avian diversity resources is recommended for improved conservation and management measures. The Wildlife Department should collaborate with universities for research and training and conduct community awareness campaigns.

### **ACKNOWLEDGEMENTS**

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### **STATEMENT OF CONFLICT OF INTEREST**

All the authors declared no conflict of interest in this publication.

### **AUTHORS CONTRIBUTION**

Iffat Abid, Ayesha Zulfiqar, and Sidra Hussain designed the study. Iffat Abid, Ayesha Zulfiqar, and Alina Sikandar collected the field data, interpretation results, and put up to writing the Research article. Alina Sikandar, Tariq Ahmad, Tahir Raza, and Nusrat Liaquat participated in statistical analysis and also revised the draft. The authors examined and officially permitted the manuscript.

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