

Research Article

Birds in the Wild: Exploring Avian Diversity along the Chenab River in Punjab, Pakistan

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SB collected data and helped with the manuscript write-up. MA has collected data and wrote the manuscript. MSHK and TH critically reviewed the manuscript.

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Abstract | Pakistan has a magnificent avian history that has long enthralled both bird enthusiasts and nature lovers, with its various landscapes spanning high mountains, scorching deserts, lush wetlands, and riverine forests, including river Chenab. Field surveys were carried out to assess the bird diversity along the Chenab River from 2018 to 2023. Data were collected through direct and indirect methods. The Chenab River region was the focus of this extensive investigation, which revealed a tapestry of 211 bird species, with important diversity indicators highlighting the avian wonders there. During the research noted that out of total, 114 species were residents, 72 species were non-native breeders, 19 species were native breeders and 6 species of passage migrants. It is noted that, several species are abundant, such as the Bar-headed Goose and Black Stork. We quantitatively investigated a complex avian community comprised of 211 unique bird species in our extensive survey along the Chenab River. Diversity indices show i.e. dominance index (0.04022), Simpson's diversity index (0.9598), Shannon's diversity index (4.289), Brillouin (4.058), Menhinick (5.745), Margalef's abundance index (29.14), Equitability (0.8014), Fisher alpha (70.17), Berger-Parker (0.1475), and Chao-1 (270.8) that study area has high diversity. These quantitative values provide a full picture of the variety of the avian ecosystem, offering vital insights into its complexity and the potential for future study and conservation initiatives.

Novelty Statement | This is detailed research about wetland birds, where many species are documented for the first time. It is also noted that this wetland is good for migratory and resident birds.

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Introduction

Birds are an important component of Pakistan's rich natural biodiversity, displaying an incredible diversity that charms both bird and nature lovers (Grimmett *et al.*, 2008, 2016). Pakistan, stretching from the peaks of

the Himalayas to the deep offshore islands of the Arabian Sea, and from fertile plains to arid deserts, is home to an astonishing diversity of bird species, making it a vital habitat for both resident and migratory birds. Because of its diverse topography, Pakistan experiences a wide range of weather conditions. Pakistan is a notable bird-watching destination in the Indian subcontinent, with over 700 species of birds documented (Grimmett *et al.*, 2016; Aslam *et al.*, 2022).

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Pakistan's varied avifauna includes migratory birds that come here from faraway regions at different times of the year. These migratory birds find refuge in Pakistan's hospitable settings (Grimmett *et al.*, 2008), making Pakistan an important resting place on their lengthy treks (Altaf, 2016). The birdlife of the country is not only fascinating, but it also plays an important role in maintaining ecological balance and conserving the natural beauty of this unique area (Roberts, 1991, 1992).

Birds around the world are facing threats due to human activities (Douglas *et al.*, 2023; Irshad *et al.*, 2025) and environmental changes (Matthews *et al.*, 2022). The primary factors driving declines in bird populations include habitat loss and fragmentation caused by deforestation, agricultural expansion (Douglas *et al.*, 2023), urban development (Humbal *et al.*, 2023), and infrastructure growth (Bodo *et al.*, 2021; Khan *et al.*, 2024). Climate change disrupts migratory routes, reproductive habits, and food availability, making survival increasingly difficult for many species (Isah *et al.*, 2023; Shakil *et al.*, 2023). Pollution, particularly from pesticides, heavy metals, and plastic waste, harms bird health (Adekanmi, 2021) and reproductive success (Faiz, 2022; Hussain and Tanveer, 2023; Laraib *et al.*, 2024a). Additionally, illegal hunting, poaching, and the trapping of wild birds for sale or consumption pose significant risks, especially to endangered and migratory species (Lavadinović *et al.*, 2021). Collisions with structures, electrical lines, and wind turbines, along with predation by non-native species like house cats and rodents, further exacerbate mortality rates (Travers, 2023). These combined pressures threaten global bird diversity and disrupt ecosystems where birds play crucial roles in pollination, seed dispersal, and pest control (García *et al.*, 2024).

The country's climate zones range from the harsh winters of the northern highlands to the blazing heat of the southern deserts. These climatic changes create distinct habitats that support a diverse array of bird species that have evolved to various temperature and precipitation patterns. Pakistan is rich in wetlands, rivers, lakes, and coastal areas that provide critical habitat for both resident and migratory waterfowl. Every year, migratory birds flock to wetlands (Altaf *et al.*, 2018; Hussain *et al.*, 2025). A wide variety of bird species use these sources of water for nesting, feeding, and resting. Hence the current study was designed to find out the diversity of birds (including both visiting and resident) of birds along the River Chenab in Punjab, Pakistan.

Materials and Methods

Study area

The Chenab River, which runs across the Indian subcontinent, originates in the Himalayas of Northern

India (Singh *et al.*, 1997), flows through Jammu and Kashmir in India (Khadse *et al.*, 2016), and enters Pakistan in the province of Punjab (Altaf *et al.*, 2015). As one of the region's major rivers, the Chenab River plays an important role in supporting agriculture (Hassan and Hassan, 2017) and providing water supplies to the communities along its route (Rehman *et al.*, 2016). It eventually merges with the Sutlej River to form the Panjnad River, which finally merges at the great Indus River. This river system provides a lifeline for the region's residents, facilitating agriculture, transportation, and a variety of other socioeconomic activities (Figure 1). The Sutlej River converges with the Chenab River close to Uch Sharif in the Bahawalpur district of Punjab, Pakistan, creating the Panjnad River. The Panjnad River subsequently travels southwest and converges with the Indus River close to Mithankot in Rajanpur District, Punjab, Pakistan.

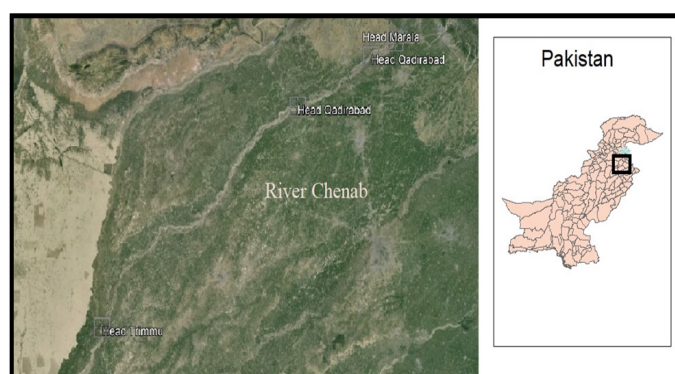


Figure 1: Map of the river Chenab, along with study areas i.e. head Marala, head Qadirabad, and head Khanki.

Biodiversity

The riverine landscape includes a mix of riparian vegetation, cultivated fields, sandbanks, and shallow wetlands, providing diverse ecological habitats including plant diversity which attracts avifauna diversity. The collection included 120 plants from 51 families belonging to 105 genera, with 40 dicot families dominating with 85 genera and 97 plant species. Three families, 13 genera, and 16 plant species were identified in monocots. A few species of pteridophytes and bryophytes were also discovered in the vicinity. Furthermore, the angiospermic group was divided into two groups: dicots (n=96 species) and monocots (n=17 species), with the important families Poaceae and Cyperaceae. In terms of plant habit, 89 herbaceous plants, 16 shrubs, and 15 tree species were discovered in the Chenab River. Herbs dominated this site, including *Marsilea quadrifolia*, *Azolla pinnata*, *Osmunda regalis*, *Cynodon dactylon*, and *Ranunculus muricatus*. Shrubs included *Calotropis procera* and *Ipomoea carnea*, while trees included *Acacia nilotica* and *Broussonetia papyrifera*. The diversity of birds, mammals, fishes, and herptiles (Qadir, 2010; Altaf, 2016; Umair *et al.*, 2019; Altaf *et al.*, 2020, 2023) was also reported from the Chenab River are documented by various wildlife biologists.

Methodology

Field surveys were conducted from 2018 to 2023 to collect the information about bird's diversity of Chenab River. Data were collected through direct and indirect method.

Direct observation

- Data evaluators counted avian species in the study area using binoculars (Altaf, 2010) or telescopes (Altaf *et al.*, 2018) to detect birds in the distance (Altaf, 2016). This method involves directly monitoring birds (Ali and Akhtar, 2005) and recording their numbers (Ali *et al.*, 2011; Bibi *et al.*, 2016; Isah *et al.*, 2023).
- The team was constituted on the Bird photographers whose name are (Ahmed Birdography, Sajjad Tufail, Muhammad Ayaz Mehmood, Sajid Saeed, Asim Bashir, Arshad Aashraf, Jawad Ahmad, Azmat Raza, Ali Usman Baig, Atif Riaz Baba, Zaghama Awan, Ehtasham Ul Haq, Tahir Abbas Awan, Ali Hasaan, Tahir Manzoor Aatir, Usama Tabani, Jamal Leghari, Naila Shafi, Aasif Latif, Muhammad Asif Sherazi and Imran Bhutto) to photograph the birds species in the study area, which were then evaluated later on the available Field guides. This method is particularly useful for identifying birds that are difficult to observe directly or are only present for a brief duration of time.
- In the study region, the researchers used acoustic rhythmus to record bird vocalizations (Altaf, 2010; Kazam *et al.*, 2022), which were then rigorously studied to identify the species present (Grimmett *et al.*, 2008; Grimmett *et al.*, 2016). This strategy is especially useful for identifying birds that are hard to observe directly or just active during dawn and dusk when visibility is confine (Kazam *et al.*, 2022).

Indirect observation

- This study particularly for indirect sighting were carried out to explore the cryptic species and to ensure the presence of certain species in the region nest structure and designs and selection of material in nests. The types of nests and their locations can reveal important information about the bird species that

inhabit in the area. A certain type of nest, for example, may indicate the presence of a particular species (Lee *et al.*, 2017).

- We investigated the research area for bird carcasses (Altaf, 2016), which can provide important information regarding the Apex predator species diversity and its presence in the region. The location and condition of corpses can also reveal information about the circumstances that led to the bird's death (Ali *et al.*, 2016, 2017; Altaf, 2016).
- We discussed with residents, such as farmers and hunters, to learn about the region's bird species. Locals may be aware of the existence of specific species or the places in which they like to spend time, and this knowledge may be utilized to familiarize future observations (Isah *et al.*, 2023).

Statistical analysis

"PAST version 2.17C" Computer-based software was used to calculate indices of local bird data (Hammert, 2001).

Results and Discussion

The extensive surveys were conducted throughout the Chenab river from 2018 to 2023 which reveals the huge potential of avian influx in the area and counted with a total of 211 bird species that found our research region, totaling a surprising 1349 in number (Table 1). The bird community's characteristics were shown by different measurements, including dominance at 0.04022, Simpson's diversity index at 0.9598, and Shannon's diversity index at 4.289, displaying a diversity of avian wonders. Brillouin exhibited diversity with a score of 4.058, and Menhinick demonstrated richness with a score of 5.745. Margalef's abundance index was 29.14, and equitability was 0.8014, indicating harmony. Fisher alpha was 70.17, Berger-Parker was 0.1475, and Chao-1 indicated potential richness at 270.8. In this research, these numbers exemplify the diversity of the avian realm, making our river even more beautiful (Table 2).

Table 1: Status, diversity, distribution, feeding type of birds along river Chenab.

Sr.	Common Name	Scientific Name	No.	Order	Family	Sta- tus	Distri- bution	Feeding type
1	Grey Francolin	<i>Francolinus Pondicerianus</i>	7	Galliformes	Phasianidae	LC	R	Omnivore
2	Lesser Whistling-duck	<i>Dendrocygna javanica</i>	20	Anseriformes	Anatidae	LC	NB	Omnivore
3	Greylag Goose	<i>Anser anser</i>	18	Anseriformes	Anatidae	LC	NNB	Herbivore
4	Lesser White-fronted Goose	<i>Anser erythropus</i>	3	Anseriformes	Anatidae	VU	NNB	Herbivore
5	Bar-headed Goose	<i>Anser indicus</i>	199	Anseriformes	Anatidae	LC	NNB	Herbivore
6	Knob-billed Duck	<i>Sarkidiornis melanotos</i>	4	Anseriformes	Anatidae	LC	P	Omnivore
7	Ruddy Shelduck	<i>Tadorna ferruginea</i>	72	Anseriformes	Anatidae	LC	NNB	Omnivore

Table continues on next page.....

Sr.	Common Name	Scientific Name	No.	Order	Family	Sta- tus	Distri- bution	Feeding type
8	Cotton pygmy-goose	<i>Nettapus coromandelianus</i>	3	Anseriformes	Anatidae	LC	R	Herbivore
9	Indian Spot-billed Duck	<i>Anas poecilorhyncha</i>	13	Anseriformes	Anatidae	LC	R	Omnivore
10	Little Grebe	<i>Tachybaptus ruficollis</i>	14	Podicipediformes	Podicipedidae	LC	R	Carnivore
11	Painted Stork	<i>Mycteria leucocephala</i>	37	Ciconiiformes	Ciconiidae	NT	NNB	Carnivore
12	Asian Openbill	<i>Anastomus oscitans</i>	2	Ciconiiformes	Ciconiidae	LC	R	Carnivore
13	Black Stork	<i>Ciconia nigra</i>	121	Ciconiiformes	Ciconiidae	LC	P	Carnivore
14	Woolly-necked Stork	<i>Ciconia episcopus</i>	14	Ciconiiformes	Ciconiidae	NT	R	Carnivore
15	Red-naped Ibis	<i>Pseudibis papillosa</i>	2	Pelecaniformes	Threskiornithidae	LC	NNB	Carnivore
16	Glossy Ibis	<i>Pseudibis Falcinellus</i>	4	Pelecaniformes	Threskiornithidae	LC	NNB	Carnivore
17	Eurasian Spoonbill	<i>Platalea leucorodia</i>	11	Pelecaniformes	Threskiornithidae	LC	NNB	Omnivore
18	Yellow Bittern	<i>Dupetor flavicollis</i>	5	Pelecaniformes	Ardeidae	LC	NB	Omnivore
19	Black Bittern	<i>Lxobrychus sinensis</i>	3	Pelecaniformes	Ardeidae	LC	NB	Omnivore
20	Cinnamon Bittern	<i>Lxobrychus cinnamomeus</i>	3	Pelecaniformes	Ardeidae	LC	R	Omnivore
21	Great Bittern	<i>Botaurus stellaris</i>	2	Pelecaniformes	Ardeidae	LC	NNB	Omnivore
22	Black-crowned Night Heron	<i>Nycticorax nycticorax</i>	2	Pelecaniformes	Ardeidae	LC	R	Omnivore
23	Indian Pond Heron	<i>Ardeola grayii</i>	8	Pelecaniformes	Ardeidae	LC	R	Omnivore
24	Grey Heron	<i>Ardea cinerea</i>	6	Pelecaniformes	Ardeidae	LC	NNB	Omnivore
25	Purple Heron	<i>Ardea purpurea</i>	7	Pelecaniformes	Ardeidae	LC	R	Omnivore
26	Cattle Egret	<i>Bubulcus ibis</i>	4	Pelecaniformes	Ardeidae	LC	R	Insectivore
27	Great Egret	<i>Bubulcus albus</i>	26	Pelecaniformes	Ardeidae	LC	R	Piscivore
28	Intermediate Egret	<i>Mesophoyx intermedia</i>	3	Pelecaniformes	Ardeidae	LC	NNB	Carnivore
29	Little Egret	<i>Egretta garzetta</i>	5	Pelecaniformes	Ardeidae	LC	R	Carnivore
30	Western Reef Egret	<i>Egretta gularis</i>	1	Pelecaniformes	Ardeidae	LC	NB	Piscivore
31	Little Cormorant	<i>phalacrocorax niger</i>	4	Suliformes	Phalacrocoracidae	LC	NNB	Piscivore
32	Great Cormorant	<i>phalacrocorax carbo</i>	7	Suliformes	Phalacrocoracidae	LC	NNB	Piscivore
33	Common Kestrel	<i>Falco tinnunculus</i>	2	Falconiformes	Falconidae	LC	NNB	Carnivore
34	Red-necked Falcon	<i>Falco chicquera</i>	1	Falconiformes	Falconidae	NT	NNB	Carnivore
35	Peregrine Falcon	<i>Falco peregrinus</i>	2	Falconiformes	Falconidae	LC	NNB	Carnivore
36	Eurasian Hobby	<i>Falco subbuteo</i>	2	Falconiformes	Falconidae	LC	NB	Carnivore
37	Black Winged kite	<i>Elanus caeruleus</i>	7	Accipitriformes	Elanidae	LC	R	Carnivore
38	Black kite	<i>Milvus migrans</i>	4	Accipitriformes	Accipitridae	LC	R	Carnivore
39	Osprey	<i>Pandion haliaetus</i>	7	Accipitriformes	Pandionidae	LC	NNB	Carnivore
40	Oriental Honey-buzzard	<i>Pernis ptilorhynchus</i>	1	Accipitriformes	Accipitridae	LC	R	Carnivore
41	Egyptian Vulture	<i>Neophron percnopterus</i>	2	Accipitriformes	Accipitridae	EN	R	Carnivore
42	Crested Serpent Eagle	<i>Spilornis cheela</i>	5	Accipitriformes	Accipitridae	LC	NB	Carnivore
43	Eurasian Marsh Harrier	<i>Circus aeruginosus</i>	11	Accipitriformes	Accipitridae	LC	NNB	Carnivore
44	Hen Harrier	<i>Circus cyaneus</i>	1	Accipitriformes	Accipitridae	LC	NNB	Carnivore
45	Shikra	<i>Accipiter badius</i>	8	Accipitriformes	Accipitridae	LC	R	Carnivore
46	Long-legged Buzzard	<i>Buteo rufinus</i>	7	Accipitriformes	Accipitridae	LC	NNB	Carnivore
47	Indian Spotted Eagle	<i>Aquila hastata</i>	5	Accipitriformes	Accipitridae	VU	R	Carnivore
48	Steppe Eagle	<i>Aquila nipalensis</i>	2	Accipitriformes	Accipitridae	EN	NNB	Carnivore
49	Eastern Imperial Eagle	<i>Aquila beliaica</i>	1	Accipitriformes	Accipitridae	VU	NNB	Carnivore
50	Bonelli's Eagle	<i>Aqtauila fascia</i>	1	Accipitriformes	Accipitridae	LC	R	Carnivore
51	Booted Eagle	<i>Hieraaetus Pennatus</i>	1	Accipitriformes	Accipitridae	LC	NNB	Carnivore

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Sr.	Common Name	Scientific Name	No.	Order	Family	Sta- tus	Distri- bution	Feeding type
52	Western Water Rail	<i>Rallus aquaticus</i>	4	Gruiformes	Rallidae	LC	NNB	Omnivore
53	Baillon's Crake	<i>Porzana pusilla</i>	3	Gruiformes	Rallidae	LC	P	Omnivore
54	Ruddy-breasted Crake	<i>Porzana Fusca</i>	4	Gruiformes	Rallidae	LC	NNB	Omnivore
55	White-breasted Waterhen	<i>Amaurornis phoenicurus</i>	2	Gruiformes	Rallidae	LC	R	Omnivore
56	Brown Crake	<i>Amaurornis akool</i>	1	Gruiformes	Rallidae	LC	R	Omnivore
57	Eurasian Coot	<i>Fulica atra</i>	4	Gruiformes	Rallidae	LC	R	Omnivore
58	Great Thick-knee	<i>Esacus recurvirostris</i>	15	Charadriiformes	Burhinidae	NT	R	Carnivore
59	Pheasant-tailed Jacana	<i>Hydrophasianus chirurgus</i>	10	Charadriiformes	Jacanidae	LC	R	Omnivore
61	Greater Painted Snipe	<i>Rostratula benghalensis</i>	5	Charadriiformes	Rostratulidae	LC	R	Omnivore
62	Northern Lapwing	<i>Vanellus vanellus</i>	2	Charadriiformes	Charadriidae	NT	NNB	Insectivore
63	White tailed Lapwing	<i>Vanellus leucurus</i>	3	Charadriiformes	Charadriidae	LC	NNB	Insectivore
64	Red-wattled Lapwing	<i>Vanellus indicus</i>	2	Charadriiformes	Charadriidae	LC	R	Insectivore
65	Little Ringed Plover	<i>Charadrius dubius</i>	2	Charadriiformes	Charadriidae	LC	R	Insectivore
66	Kentish Plover	<i>Charadrius alexandrinus</i>	3	Charadriiformes	Charadriidae	LC	R	Insectivore
67	Common Snipe	<i>Gallinago Gallinago</i>	4	Charadriiformes	Scolopacidae	LC	NNB	Insectivore
68	Eurasian Wigeon	<i>Anas penelope</i>	3	Anseriformes	Anatidae	LC	NNB	Herbivo- rous
69	Mallard	<i>Anas platyrhynchos</i>	1	Anseriformes	Anatidae	LC	NNB	Omnivore
70	Northern shoveler	<i>Spatula clypeata</i>	11	Anseriformes	Anatidae	LC	NNB	Insectivore
71	Red-crested Pochard	<i>Netta rufina</i>	4	Anseriformes	Anatidae	LC	NNB	Omnivore
72	Ferruginous Duck/White eyed pochard	<i>Aythya nyroca</i>	3	Anseriformes	Scolopacidae	NT	NNB	Omnivore
73	Black-tailed Godwit	<i>Limosa limosa</i>	7	Charadriiformes	Scolopacidae	NT	P	Insectivore
74	Eurasian Curlew	<i>Numenius arquata</i>	6	Charadriiformes	Scolopacidae	NT	NNB	Insectivore
75	Spotted Redshank	<i>Tringa erythropus</i>	22	Charadriiformes	Scolopacidae	LC	NNB	Insectivore
76	Common Redshank	<i>Tringa totanus</i>	2	Charadriiformes	Scolopacidae	LC	NNB	Insectivore
77	Common Greenshank	<i>Tringa nebularia</i>	4	Charadriiformes	Scolopacidae	LC	NNB	Insectivore
78	Green Sandpiper	<i>Tringa ochropus</i>	2	Charadriiformes	Scolopacidae	LC	NNB	Insectivore
79	Wood Sandpiper	<i>Tringa glareola</i>	1	Charadriiformes	Scolopacidae	LC	NNB	Insectivore
80	Common Sandpiper	<i>Actitis hypoleucos</i>	1	Charadriiformes	Scolopacidae	LC	NNB	Insectivore
81	Temminck's Stint	<i>Calidris temminckii</i>	1	Charadriiformes	Scolopacidae	LC	NNB	Insectivore
82	Little Pratincole	<i>Glareola lactea</i>	4	Glareolidae	Glareolidae	LC	NB	Insectivore
83	Pallas's Gull/ Great Black-headed Gull	<i>Ichthyiaetus ichthyiaetus</i>	1	Glareolidae	Laridae	LC	NNB	Omnivore
84	Heuglin's Gull	<i>Larus heuglini</i>	1	Charadriiformes	Laridae	LC	NNB	Insectivore
85	Black-headed Gull	<i>Chroicocephalus ridibundus</i>	7	Charadriiformes	Laridae	LC	NNB	Omnivore
86	Gull billed Tern	<i>Geliocelidon nilotica</i>	1	Charadriiformes	Laridae	LC	R	Insectivore
87	Whiskered Tern	<i>Chilonias hybrida</i>	25	Charadriiformes	Laridae	LC	NNB	Carnivore
88	Eastern Spotted Dove or Chinese Dove	<i>Streptopelia chinensis</i>	2	Columbiformes	Columbidae	LC	R	Granivore
89	Eurasian Collared Dove	<i>Streptopelia decaocto</i>	1	Columbiformes	Columbidae	LC	R	Granivore
90	Laughing Dove	<i>Stegmatopelia senegalensis</i>	3	Columbiformes	Columbidae	LC	R	Granivore
91	Yellow-footed Green Pigeon	<i>Treron phoenicopterus</i>	3	Columbiformes	Columbidae	LC	R	Granivore
92	Rose ringed Parakeet	<i>Psittacula krameri</i>	7	Psittaciformes	Psittaculidae	LC	R	Omnivore
93	Jacobin Cuckoo	<i>Clamator jacobinus</i>	1	Cuculiformes	Cuculidae	LC	NB	Insectivore

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Sr.	Common Name	Scientific Name	No.	Order	Family	Sta- tus	Distri- bution	Feeding type
94	Common Hawk Cuckoo	<i>Hierococcyx varius</i>	3	Cuculiformes	Cuculidae	LC	NB	Insectivore
95	Asian koel	<i>Eudynamys scolopaceus</i>	1	Cuculiformes	Cuculidae	LC	NB	Omnivore
96	Greater Coucal	<i>Centropus sinensis</i>	4	Cuculiformes	Cuculidae	LC	R	Carnivore
97	Barn Owl	<i>Tyto alba</i>	3	Strigiformes	Tytonidae	LC	R	Carnivore
98	Indian Scops Owl	<i>Otus bakkamoena</i>	2	Strigiformes	Strigidae	LC	R	Carnivore
99	Short-eared Owl	<i>Asio flammeus</i>	1	Strigiformes	Strigidae	LC	NNB	Carnivore
100	Spotted Owlet	<i>Athene brama</i>	10	Strigiformes	Strigidae	LC	R	Carnivore
101	Eurasian Eagle Owl	<i>Bubo bubo</i>	2	Strigiformes	Strigidae	LC	R	Carnivore
102	Asian Barred Owlet	<i>Glaucidium cuculoides</i>	1	Strigiformes	Strigidae	LC	R	Carnivore
103	Savanna Nightjar	<i>Caprimulgus affinus</i>	1	Caprimulgi- formes	Caprimulgidae	LC	NB	Insectivore
104	Little Swift	<i>Apus affinis</i>	1	Apodiformes	Apodidae	LC	R	Carnivore
105	Common Hoopoe	<i>Upupa epops</i>	6	Bucerotiformes	Upupidae	LC	R	Carnivore
106	Indian Roller	<i>Coracias benghalensis</i>	8	Coraciiformes	Coraciidae	LC	R	Carnivore
107	White throated kingfisher	<i>Halcyon smyrnensis</i>	2	Coraciiformes	Alcedinidae	LC	R	Insectivore
108	Common Kingfisher	<i>Alcedo atthis</i>	9	Coraciiformes	Alcedinidae	LC	R	Piscivore
109	Pied kingfisher	<i>Ceryle rudis</i>	5	Coraciiformes	Alcedinidae	LC	R	Piscivore
110	Asian Green Bee eater	<i>Meropes orientalis</i>	6	Coraciiformes	Meropidae	LC	R	Insectivore
111	Blue-tailed Bee Eater	<i>Merops philippinus</i>	12	Coraciiformes	Meropidae	LC	NB	Insectivore
112	Indian Grey Hornbill	<i>Ocyrceros birostris</i>	9	Bucerotiformes	Bucerotidae	LC	R	Omnivore
113	Blue Throated Barbet	<i>Megalaima asiatica</i>	1	Piciformes	Megalaimidae	LC	R	Frugivore
114	Coppersmith Barbet	<i>Megalaima haemacephala</i>	1	Piciformes	Megalaimidae	LC	R	Frugivore
115	Eurasian Wryneck	<i>Jynx torquilla</i>	5	Piciformes	Picidae	LC	NB	Insectivore
116	Brown Fronted Woodpecker	<i>Dendrocopos auriceps</i>	1	Piciformes	Picidae	LC	R	Omnivore
117	Yellow crowned Woodpecker	<i>Dendrocopos mabrattensis</i>	1	Piciformes	Picidae	LC	R	Omnivore
118	Lesser Goldenback/ Black- rumped Flameback	<i>Dinopium benghalense</i>	6	Piciformes	Picidae	LC	R	Omnivore
119	Rosy Pipit	<i>Anthus roseatus</i>	2	Passeriformes	Motacillidae	LC	NNB	Insectivore
120	Western Yellow Wagtail	<i>Motacilla flava</i>	2	Passeriformes	Motacillidae	LC	P	Insectivore
121	Large Pied Wagtail/ White browed wagtail	<i>Motacilla maderaspatensis</i>	1	Passeriformes	Motacillidae	LC	R	Insectivore
122	Isabelline Shrike	<i>Lanius isabellinus</i>	2	Passeriformes	Laniidae	LC	NNB	Carnivore
123	Rufous-backed Shrike	<i>Lanius schach</i>	5	Passeriformes	Laniidae	LC	R	Carnivore
124	Black Drongo	<i>Dicrurus macrocercus</i>	1	Passeriformes	Dicruridae	LC	R	Insectivore
125	Indian Golden Oriole	<i>Oriolus kundoo</i>	1	Passeriformes	Oriolidae	LC	NB	Omnivore
126	White throated Fantail	<i>Rhipidura albicollis</i>	4	Passeriformes	Rhipiduridae	LC	NNB	Insectivore
127	White browed Fantail	<i>Rhipidura aureola</i>	1	Passeriformes	Rhipiduridae	LC	R	Insectivore
128	Indian Paradise flycatcher	<i>Terpsiphone paradisi</i>	9	Passeriformes	Monarchidae	LC	NB	Insectivore
129	Black-headed Jay	<i>Garrulus lanceolatus</i>	1	Passeriformes	Corvidae	LC	R	Omnivore
130	Rufous Treepie	<i>Dendrocitta vagabunda</i>	3	Passeriformes	Corvidae	LC	R	Omnivore
131	Rook	<i>Corvus frugilegus</i>	1	Passeriformes	Corvidae	LC	NNB	Omnivore
132	House Crow	<i>Corvus splendens</i>	1	Passeriformes	Corvidae	LC	R	Omnivore
133	Streak throated Swallow	<i>Petrochelidon fluviicola</i>	1	Passeriformes	Hirundinidae	LC	R	Insectivore
134	Wire tailed Swallow	<i>Hirundo smithi</i>	2	Passeriformes	Hirundinidae	LC	R	Insectivore
135	Crested Lark	<i>Galerida cristata</i>	5	Passeriformes	Alaudidae	LC	R	Omnivore

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Sr.	Common Name	Scientific Name	No.	Order	Family	Sta- tus	Distri- bution	Feeding type
136	Red-vented Bulbul	<i>Pycnonotus cafer</i>	5	Passeriformes	Pycnonotidae	LC	R	Omnivore
137	Rufous-vented Prinia	<i>Prinia burnesii</i>	1	Passeriformes	Pellorneidae	NT	R	Insectivore
138	Graceful Prinia	<i>Prinia gracillis</i>	2	Passeriformes	Cisticolidae	LC	R	Insectivore
139	Yellow-bellied Prinia	<i>Prinia flaviventris</i>	3	Passeriformes	Cisticolidae	LC	R	Insectivore
140	Ashy Prinia	<i>Prinia socialis</i>	3	Passeriformes	Cisticolidae	LC	R	Insectivore
141	Plain Prinia	<i>Prinia inornata</i>	6	Passeriformes	Cisticolidae	LC	R	Insectivore
142	Clamorous Reed Warbler	<i>Acrocephalus stentoreus</i>	1	Passeriformes	Acrocephalidae	LC	NNB	Insectivore
143	Grasshopper Warbler	<i>Locustella naevia</i>	2	Passeriformes	Locustellidae	LC	NNB	Insectivore
144	Moustached Warbler	<i>Acrocephalus melanopogon</i>	1	Passeriformes	Acrocephalidae	LC	NNB	Insectivore
145	Common Chiffchaff	<i>Phylloscopus collybita</i>	1	Passeriformes	Phylloscopidae	LC	R	Insectivore
146	Plain Leaf Warbler	<i>Phylloscopus neglectus</i>	1	Passeriformes	Phylloscopidae	LC	NNB	Insectivore
147	Grey-hooded Warbler	<i>Phylloscopus xanthoschistos</i>	1	Passeriformes	Phylloscopidae	LC	R	Insectivore
148	Yellow-eyed Babbler	<i>Chrysomma sinense</i>	3	Passeriformes	Paradoxornithidae	LC	R	Insectivore
149	Common Babbler	<i>Turdoides caudata</i>	1	Passeriformes	Leiothrichidae	LC	R	Insectivore
150	Striated Babbler	<i>Turdoides earlei</i>	3	Passeriformes	Leiothrichidae	LC	R	Insectivore
151	Jungle Babbler	<i>Turdoides striata</i>	3	Passeriformes	Leiothrichidae	LC	R	Insectivore
152	Oriental White-eyed	<i>Zosterops palpebrosus</i>	1	Passeriformes	Zosteropidae	LC	R	Omnivore
153	Bar-tailed Treecreeper	<i>Certhia himalayana</i>	1	Passeriformes	Certhiidae	LC	NNB	Omnivore
154	Eurasian treecreeper	<i>Certhia familiaris</i>	1	Passeriformes	Certhiidae	LC	P	Insectivore
155	Bank Myna	<i>Acridotheres ginginianus</i>	15	Passeriformes	Sturnidae	LC	R	Omnivore
156	Common Myna	<i>Acridotheres tristis</i>	1	Passeriformes	Sturnidae	LC	R	Omnivore
157	Brahminy Starling	<i>Sturnia pagodarum</i>	2	Passeriformes	Sturnidae	LC	R	Omnivore
158	Common Starling	<i>Sturnus vulgaris</i>	5	Passeriformes	Sturnidae	LC	R	Omnivore
159	Bluethroat	<i>Luscinia svecica</i>	6	Passeriformes	Muscicapidae	LC	NNB	Omnivore
160	Himalayan Rubythroat	<i>Luscinia pectoralis</i>	1	Passeriformes	Muscicapidae	LC	NNB	Insectivore
161	Oriental Magpie Robin	<i>Copsychus saularis</i>	1	Passeriformes	Muscicapidae	LC	R	Insectivore
162	Indian Robin	<i>Saxicoloides falicatus</i>	1	Passeriformes	Muscicapidae	LC	R	Omnivore
163	Plumbeous Water Redstar	<i>Rhyacornis fuliginosa</i>	2	Passeriformes	Muscicapidae	LC	R	Insectivore
164	White-capped Redstar	<i>Chaimarrornis leucocephalus</i>	2	Passeriformes	Muscicapidae	LC	R	Insectivore
165	Black Redstar	<i>Phoenicurus ochruros</i>	1	Passeriformes	Muscicapidae	LC	NNB	Insectivore
166	Brown Rock-chat	<i>Cercomela fusca</i>	2	Passeriformes	Muscicapidae	LC	R	Carnivore
167	Pied Bushchat	<i>Saxicola caprata</i>	4	Passeriformes	Muscicapidae	LC	R	Insectivore
168	Grey Bushchat	<i>Saxicola ferreus</i>	6	Passeriformes	Muscicapidae	LC	NNB	Insectivore
169	Isabelline Wheatear	<i>Oenanthe isabellina</i>	1	Passeriformes	Muscicapidae	LC	NNB	Insectivore
170	Variable Wheater	<i>Oenanthe picata</i>	1	Passeriformes	Muscicapidae	LC	NNB	Insectivore
171	Black-throated Thrush	<i>Turdus atrogularis</i>	1	Passeriformes	Turdidae	LC	NNB	Insectivore
172	Red-breasted Flycatcher	<i>Ficedula parva</i>	4	Passeriformes	Muscicapidae	LC	NNB	Insectivore
173	Slaty-blue Flycatcher	<i>Ficedula tricolor</i>	1	Passeriformes	Muscicapidae	LC	NNB	Insectivore
174	Barn Swallow	<i>Hirundo rustica</i>	2	Passeriformes	Hirundinidae	LC	R	Granivore
175	Garganey	<i>Anas querquedula</i>	2	Passeriformes	Anatidae	LC	NNB	Insectivore
176	Purple Sunbird	<i>Cinnyris asiaticus</i>	5	Passeriformes	Nectariniidae	LC	R	Omnivore
177	House Sparrow	<i>Passer domesticus</i>	2	Passeriformes	Passeridae	LC	R	Omnivore
178	Sind Sparrow	<i>Passer pyrrhonotus</i>	2	Passeriformes	Passeridae	LC	R	Omnivore

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Sr.	Common Name	Scientific Name	No.	Order	Family	Sta- tus	Distri- bution	Feeding type
179	Chestnut-shouldered Petronia	<i>Gymnoris xanthocolis</i>	1	Passeriformes	Passeridae	LC	R	Omnivore
180	Black-breasted Weaver	<i>Ploceus benghalensis</i>	5	Passeriformes	Ploceidae	LC	R	Omnivore
181	Streaked Weaver	<i>Ploceus manyar</i>	1	Passeriformes	Ploceidae	LC	R	Omnivore
182	Baya Weaver	<i>Ploceus philippinus</i>	69	Passeriformes	Ploceidae	LC	R	Omnivore
183	Indian Silverbill	<i>Euodice malabarica</i>	2	Passeriformes	Estrildidae	LC	R	Granivore
184	Scaly-breasted Munia	<i>Lonchura punctulata</i>	9	Passeriformes	Estrildidae	LC	R	Granivore
185	Yellow-breasted Greenfinch	<i>Carduelis spinoides</i>	4	Passeriformes	Fringillidae	LC	NNB	Granivore
186	Common Rosefinch	<i>Carpodacus erythrurus</i>	2	Passeriformes	Fringillidae	LC	NB	Granivore
187	Crested Bunting	<i>Melophus lathami</i>	3	Passeriformes	Emberizidae	LC	NB	Insectivore
188	Black-headed Bunting	<i>Emberiza melanocephala</i>	1	Passeriformes	Emberizidae	LC	NB	Insectivore
189	Red-headed Bunting	<i>Emberiza bruniceps</i>	7	Passeriformes	Emberizidae	LC	NB	Insectivore
190	Chestnut-tailed Starling	<i>Sturnia malabarica</i>	1	Passeriformes	Sturnidae	LC	R	Omnivore
191	Barred Buttonquail	<i>Turnix suscitator</i>	1	Charadriiformes	Turnicidae	LC	R	Omnivore
192	White Breasted wagtail	<i>Motacilla alba Linnaeus</i>	1	Passeriformes	Motacillidae	LC	NNB	Omnivore
193	White wagtail	<i>Motacilla alba</i>	1	Passeriformes	Motacillidae	LC	NNB	Carnivore
194	Tricoloured munia	<i>Lonchura malacca</i>	13	Passeriformes	Estrildidae	LC	R	Granivore
195	Black-headed ibis	<i>Threskiornis melanocephalus</i>	15	Pelecaniformes	Threskiornithidae	NT	R	Carnivore
196	Yellow-breasted Bunting	<i>Emberiza aureola</i>	3	Passeriformes	Emberizidae	CR	R	Omnivore
197	Eurasian Thick-knee	<i>Burhinus oedicnemus</i>	4	Charadriiformes	Burhinidae	LC	R	Carnivore
198	Paddyfield Pipit	<i>Anthus rufulus</i>	8	Passeriformes	Motacillidae	LC	R	Insectivore
199	River Lapwing	<i>Sterna aurantia</i>	6	Charadriiformes	Charadriidae	NT	R	Carnivore
200	Brown shrike	<i>Lanius cristatus</i>	1	Passeriformes	Laniidae	LC	R	Omnivore
201	Siberian Stonechat	<i>Saxicola maurus</i>	6	Passeriformes	Muscicapidae	LC	R	Insectivore
202	Purple Swamphen	<i>Porphyrio porphyrio</i>	22	Gruiformes	Rallidae	LC	R	Carnivore
203	Crested Bunting	<i>Emberiza lathami</i>	3	Passeriformes	Emberizidae	LC	R	Insectivore
204	Common iora	<i>Aegithina tiphia</i>	1	Passeriformes	Aegithinidae	LC	R	Insectivore
205	Bengal Bushlark	<i>Mirafra Assamica</i>	1	Passeriformes	Alaudidae	LC	R	Omnivore
206	Striated grassbird	<i>Megalurus palustris</i>	1	Passeriformes	Locustellidae	LC	R	Insectivore
207	Brown Headed Barbet	<i>Psilopogon zeylanicus</i>	7	Piciformes	Megalaimidae	LC	R	Omnivore
208	Indian eagle owl	<i>Bubo bengalensis</i>	2	Strigiformes	Strigidae	LC	R	Carnivore
209	Gadwall	<i>Anas strepera</i>	1	Anseriformes	Anatidae	LC	NNB	Omnivore
210	Common pochard	<i>Aythya ferina</i>	1	Anseriformes	Anatidae	VU	NNB	Piscivore
211	Northern pintail	<i>Anas acuta</i>	4	Anseriformes	Anatidae	LC	NNB	Omnivore

R, Resident; NB, Native breeding; NNB, Non Native Breeding; P, Passage Migrant.

Table 2: Diversity indices of the avian species of the selected study area.

Indices	Values
Species	211
Population	1349
Dominance (D)	0.04022
Simpson (S)	0.9598
Shannon (H')	4.289
Evenness (E)	0.3455
Brillouin (B)	4.058
Menhinick (M)	5.745
Margalef (R)	29.14
Equitability (J)	0.8014
Fisher alpha (A)	70.17
Berger-Parker (P)	0.1475
Chao-1 (C)	270.8

The diversity indices determined in this research indicate a richly varied ([Anderle et al., 2023](#); [Aziz et al., 2024](#)) and well-balanced bird community residing in the river ecosystem ([Prasetyo and Wulandari, 2021](#); [Bashir et al., 2025](#)). The existence of multiple species with a fairly uniform distribution suggests a stable and thriving ecosystem that accommodates various ecological niches ([Trappes, 2021](#)). This variety implies that the environment provides plentiful food sources, appropriate nesting locations, and limited human interference, which are crucial for supporting both ordinary and uncommon bird species. The values of richness and evenness together emphasize the ecological intricacy and resilience of the bird community ([Blowes et al., 2022](#); [Laraib et al., 2024b](#)), which might also act as a bioindicator for the river's overall health ([Babar and Kanwal, 2021](#); [Bhowmick, 2021](#)). This

lively bird collection highlights the necessity of preserving riparian ecosystems, not just for the birds but also for the wider ecological roles they fulfill (Qiu *et al.*, 2024).

A remarkable total of 211 bird species have been thoroughly documented in our study region. Within this bird study, we discovered that one precious species is on the verge of extinction, categorized as Critically Endangered, while two others are on the verge of extinction, classified as Endangered. Furthermore, our investigations have revealed 10 species that are Near Threatened, indicating the need for conservation measures. One species is Not Evaluated by the IUCN. Five bird species have been designated as Vulnerable, underlining the importance of vigilant care. Fortunately, a reassuring majority of remaining 192 species have been designated as Least Concern, but they, too, require our continual attention and care in order to thrive in our natural world (Figure 2).

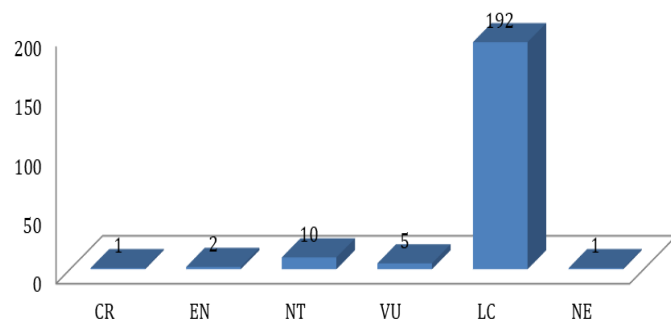


Figure 2: Status (IUCN) of avian species of River Chenab i.e. CR (i.e. Critically Endangered), EN (Endangered), NT (Near Threatened), VU (Vulnerable), LC (Least Count) and NE (Not Evaluated).

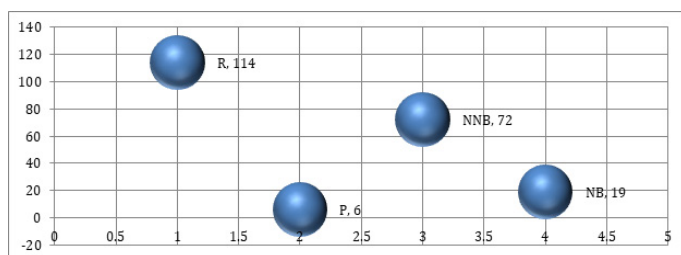


Figure 3: Distribution of birds in the study area i.e. R (Resident), P (Passage Visitor), NNB (Non-native breeders), and NB (Native breeders).

During our study, we made several fascinating observations concerning the local avifauna. A considerable fraction (114 species) of the 211 species we found were devoted residents, deeply attached to their environment. We were also fortunate to observe six species of passage migrants, who stopped in the area on their travels. Furthermore, 72 species were non-native breeders, leaving their mark of feeding and breeding on this habitat, while 19 species proudly claimed the label of native breeders, adding to the local bird diversity (Figure 3).

Some species stood out prominently in terms of abundance, with the majestic Bar-headed Goose leading with an impressive total of N=199 sightings. The striking Black Stork ranked second with N=121 observations, followed by the attractive Ruddy Shelduck with N=72. The Baya Weaver delighted observers with N=69 sightings, while the beautiful Painted Stork was recorded N=37 times. Other notable species included the Great Egret (N=26), Whiskered Tern (N=25), Spotted Redshank (N=22), Purple Swamphen (N=22), and Lesser Whistling Duck (N=20) (Figure 4).

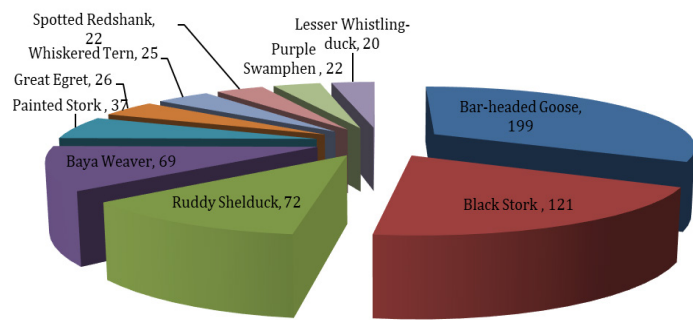


Figure 4: The most common species of River Chenab.

Our findings also unmask the avian feeding behavior. The majority of them, a total of 73 species, were insectivores, demonstrating their exceptional hunting abilities. The omnivores, with a diverse palate, came in second at 65. Meanwhile, 49 species were recognized as carnivores, enjoying the thrill of the hunt, and 10 species as granivores, preferring a diet rich in grains. We also found 8 piscivores, 4 herbivores, and 2 frugivores, all of which contributed distinct flavors to this eclectic avian feast. The least food habit was prepared from book known as Birds of Pakistan (Roberts, 1991, 1992). These findings shed light on the diverse lifestyles and food preferences of our feathery friends, adding complexity and mystery to our research (Figure 5).

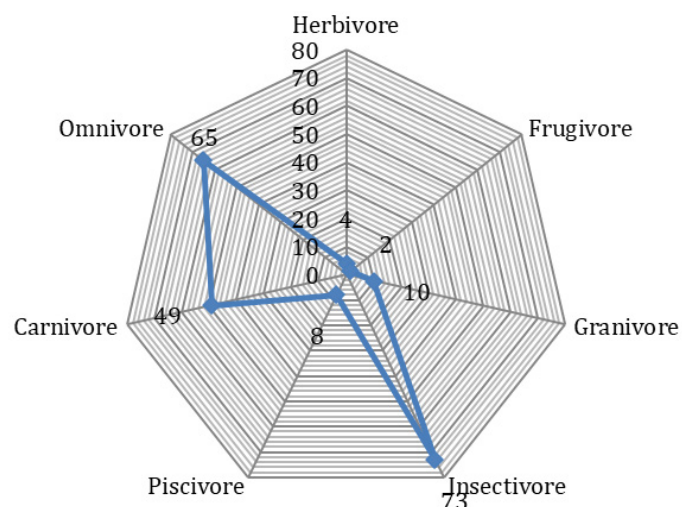


Figure 5: Feeding habits of avian species of River Chenab.

Lesser white-fronted goose *Anser erythropus*

The Lesser White-fronted Goose (*Anser erythropus*) is a Vulnerable species, and the sighting of three birds in Head Marala, and Dinga is notable. These findings emphasize the necessity of protecting these places, especially during the breeding season, which normally begins in late May or early June. The existence of this species in non-native areas highlights the importance of conservation efforts to conserve their habitats and ensure the survival of fragile species such as the Lesser White-fronted Goose.

Tourism, angling, and deer breeding have created a lot of turbulence to nesting birds. Disturbance by hunting activity decreases breeding activity; illegal spring hunting and moulting bird round-ups, whereas, illegal shooting is going on in many countries. Sea are degraded because the environment is polluted, drained, covered by reeds, peat is harvested and reedbeds are destroyed (Madsen, 1995; Grishanov *et al.*, 2006; Wang *et al.*, 2012, 2013).

Woolly-necked stork *Ciconia episcopus*

From 2018 to 2023, the presence of Near Threatened and Resident bird species in the research region is remarkable. Several pairs of these birds have been seen along the riverbanks on a regular basis throughout the year. Although no breeding activity has been observed, sightings of juveniles during the post-monsoon season imply that reproduction may take place nearby. During this time, 14 individuals were observed, with an annual incidence ranging from 3 to 6 sightings per year, which were frequently accompanied by reports of a small number of nests.

Hunting was previously measured a primary threat to this species, though its current impact on breeding populations remains unclear. The species faces threats from urbanization, habitat loss, fragmentation, nest destruction, and pollution, particularly affecting lowland forests with nesting trees (Sundar, 2006; Hancock *et al.*, 2010; BirdLife-International, 2020).

Egyptian vulture *Neophron percnopterus*

It is a notable occurrence to see the Endangered and resident Egyptian Vulture (*Neophron percnopterus*) in the Head Marala and Head Dinga districts. Although just two members of this species were noted in the research region, their existence is significant due to the Egyptian Vulture's endangered status. These findings emphasize the significance of these specific locations for the conservation of this species. It emphasizes the importance of continued efforts to protection their habitats and the surrounding environment, as well as raising awareness about the Egyptian Vulture and other vulnerable species in the region's conservation status. These discoveries highlight the critical necessity for conservation efforts to preserve the survival of vulnerable resident species like the *Neophron*

percnopterus.

The Egyptian Vulture species faces multiple threats throughout its range, including disturbances, lead poisoning, collisions with wind turbines, reduced food availability, and habitat changes. The most significant threat is illegal poisoning, primarily targeting carnivores, with a notable impact on breeding grounds in Spain and the Balkans. In parts of Africa, declines in vulture populations are likely driven by the loss of wild ungulate populations, overgrazing by livestock, and improved sanitation at slaughterhouses. In the Cape Verde Islands, a population crash has been linked to increased mortality resulting from the historical use of long-lasting pesticides, ongoing poisoning of stray dogs, and decreased food availability due to urbanisation, rural abandonment, and improved sanitation. The non-steroidal anti-inflammatory drug (NSAID) diclofenac, which is lethal to *Gyps* spp. when ingested from livestock carcasses, it is contributing to rapid declines in India. Additionally, mortality from power lines is particularly common in the Canary Islands and poses a risk in other regions of Spain and Africa. Competition with Griffon Vultures for suitable nesting sites may also hinder short-term breeding success (Zuberogoitia *et al.*, 2008, 2014; Cortés-Avizanda *et al.*, 2016; Donázar *et al.*, 2016; Danturay *et al.*, 2025).

Indian spotted eagle *Aquila hastata*

The presence of five Indian Spotted Eagles (*Aquila hastata*) in the areas of Head Marala, Head Qadirabad, and Head Trimmu is significant. These eagles are classified as vulnerable; therefore their existence in the area is critical for conservation efforts. The fact is that these eagles are resident of these areas emphasizes the necessity of these areas as habitats for their survival. These sightings highlight the importance of continuing to monitor and conserve these places in order to ensure the continued existence and well-being of fragile resident species such as the Indian Spotted Eagle. Conservation efforts and habitat preservation are critical to preserving their populations in these areas.

This species, though not well-studied, is clearly threatened by the conversion and disturbance of forested habitats within its range. Additionally, various other threats have negatively impacted many raptor populations in Asia. Further research is needed to understand the specific processes that may be affecting this species (BirdLife-International, 2016).

Steppe eagle *Aquila nipalensis*

It is an unusual event to see the Endangered and non-native nesting Steppe Eagle (*Aquila nipalensis*) in the Head Marala and Head Trimmu regions. Despite the fact that just two individuals of this species are recorded each year, these sightings have important conservation consequences.

Steppe Eagles' presence in this area emphasizes the relevance of these areas as prospective breeding grounds for this species.

The steppe eagle species was being exterminated from its breeding range and had also been extirpated from Romania, Moldova, and Ukraine as a result of agricultural conversion and direct persecution. Some negative consequences on the species are from the power lines and wind energy development. Various other causes include increased mortality rates, habitat destruction, undeterred breeding success, and illegal killing. Young eagles are frequently sold in western European countries. Other causes for its decline include illegal killing within Jordan, where the species has legal protection. Declining populations were also attributed to radioactive pollution and the veterinary drug diclofenac (Meyburg *et al.*, 2013; Sharma *et al.*, 2014; Eid and Handal, 2018).

Eastern imperial eagle *Aquila heliaca*

The vulnerable and non-native breeding Eastern Imperial Eagle (*Aquila heliaca*) in the Head Marala, Head Qadirabad, and Head Trimmu districts from 2018 to 2023 is noted. These sightings serve as a reminder of the importance of preserving various habitats, in order to maintain the Eastern Imperial Eagle and contribute to their conservation.

The Eastern Imperial Eagle, being a bird of prey, is threatened at its breeding grounds because of intensive forestry in mountain areas and the lack of native trees in lowland areas. Human disturbance and infrastructural development can limit its breeding area, with the Hungarian Plain suffering from more than 30% of its breeding potential lost. These threats include loss of breeding habitats, prey depletion, nest robbery, trade, shooting, poisoning, powerline electrocution, and vehicle collisions. Habitat changes from farming expansion also pose threats, with nest site competition from the Greater Spotted Eagle (*Aquila clanga*) in the Altai region, Russia (Horváth, 2009; Karyakin *et al.*, 2009).

Yellow-breasted bunting *Emberiza aureola*

The sighting of the Critically Endangered and resident Yellow-breasted Bunting (*Emberiza aureola*) in the Head Marala and Head Trimmu areas is of great concern and significance. Despite the fact that only 2 to 3 individuals are recorded in the study area each year, the existence of this highly endangered species highlights the importance of these areas for its survival. The yellow-breasted bunting population has been rapidly declining, and their presence in this location serves as a stark reminder of the crucial need for conservation efforts. It is crucial to preserve and conserve the habitat at Head Marala and Head Trimmu to ensure the continuous presence and eventual recovery of this severely endangered species. These findings emphasize

the necessity of worldwide efforts to address the threats to the Yellow-breasted Bunting and other endangered species, as well as the value of preserving different ecosystems and habitats.

The decline of a particular bird of prey species is largely due to excessive trapping at migration and wintering sites. This practice involves disturbing roosting flocks in reedbeds and cooking them, often marketed as "sparrows" or "rice-birds." The trend has intensified with rising affluence, leading to thousands of these birds being captured annually for food festivals in southern China and Cambodia. In China and Nepal, the species is regarded as a delicacy, with male birds often stuffed and sold as mascots. Additionally, agricultural intensification, a shift to irrigated rice production, and habitat degradation on breeding grounds are significant factors contributing to their decline. Changes in agricultural practices since the 1980s, particularly increased pesticide use, have further exacerbated the situation (BirdLife-nternational, 2017).

Common pochard *Aythya ferina*

With one individual recorded in the study region, the sighting of the Vulnerable and non-native breeding Common Pochard (*Aythya ferina*) in Head Marala, is a remarkable occurrence. With a vast range during both the breeding and winter seasons and a substantial population, this species is in an unstable position.

The Pochard is declining, largely as a result of its eastern European breeding habitats being taken over and losing nesting sites as wetlands are destroyed, as well as water chemistry (especially from farm fertilizers running into waterways). Land use changes such as the decline of lowland marshes and fish ponds (they have either been neglected, or intensively managed) have resulted in scrub and inappropriate habitats. Introduced and native mammalian predation as well as that on nests have been responsible for decline, due to preying (American Mink, Raccoon Dog, Raccoon *Procyon lotor*, Red Fox *Vulpes vulpes*) (e.g. and Wild Boar *Sus scrofa*). Hunting, water-based recreation and the sound of machinery from urban development is also a threat. The European hunting bag of Pochard is still high; but illegal hunting and avian influenza remain threats to the species. Global warming and changes in sex ratios are emerging threats to pochard, which have a narrow ecological niche and are sensitive to water conditions. An increasingly male-dominated sex ratio could contribute to worldwide population reductions (Melville and Shortridge, 2006; Fox *et al.*, 2016).

Overall threats

Bird populations along the Chenab River face numerous threats that endanger their survival, breeding, and migration. The main pressures include habitat loss due to agricultural development, deforestation, urban expansion,

and wetland drainage, all of which reduce available nesting and feeding sites. Illegal hunting, poaching, and trapping, particularly during migration and wintering seasons, significantly contribute to the decline of vulnerable and endangered species. Pollution from agricultural chemicals, industrial waste, and noise from human activities further degrades habitat quality. Invasive predators such as raccoons, red foxes, and wild boars, along with exposure to veterinary drugs and pesticides like diclofenac, increase mortality rates among birds. Additionally, interactions with power lines, disturbances from tourism and recreational activities, and climate change-related alterations in rainfall and temperature patterns threaten the stability of bird populations. These combined stressors highlight the urgent need for comprehensive conservation strategies, habitat restoration, and community engagement to protect the diverse bird life of the Chenab River and its surrounding ecosystems.

Conclusions

This region emerges as a vibrant avian biodiversity, covering 211 bird species within its diverse and dynamic ecosystem. Through detailed field surveys and quantitative analysis using multiple diversity indices, our study provides meaningful insights into the richness, distribution, and ecological balance of bird communities inhabiting this region. Our research contributes valuable data to the growing body of knowledge on Pakistan's avifauna and reinforces the urgent need for long-term conservation strategies. These findings underscore not only the ecological value of the Chenab River but also its role as a critical refuge for both resident and migratory bird species. The high diversity observed reflects the importance of maintaining this habitat amidst increasing environmental pressures. As we look to the future, protecting this area under sanctuary status would provide legal safeguards against habitat degradation, unregulated development, and human disturbance. It would also promote ecological research, environmental education, and sustainable ecotourism.

Declarations

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Generative AI and AI-assisted technology statement

The authors declare that they have used AI tools (<https://chatgpt.com/>) to correct English grammar only.

Statement of conflict of interest

The authors have declared no conflict of interest.

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