

Research Article

A preliminary assessment of bird diversity in unprotected wetlands of Gonda district, Uttar Pradesh, India

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Abstract

There have been numerous studies on assessing bird diversity in protected wetlands, but those in unprotected wetlands are the least studied. The present study aimed to assess the bird species diversity of four unprotected wetlands located in Gonda district, Uttar Pradesh, India, from September 2024 to August 2025. The data was collected monthly using a point count of 20 m radius. Altogether, 119 bird species belonging to 104 genera, spread across 52 families and 19 orders, were observed. Passeriformes, with 51 species belonging to 23 families, had the highest diversity. Accipitridae (9 species; 7.56%) was the most dominant family. These wetlands supported 94 resident bird species, 23 winter visitors, one summer visitor i.e. *Merops philippinus* (Blue-tailed Bee-eater) and one passage visitor i.e. *Ixobrychus cinnamomeus* (Chestnut Bittern). The unprotected wetlands provided habitat for three Near Threatened species – *Esacus recurvirostris* (Great Thick-knee), *Cursorius coromandelicus* (Indian Courser) and *Ciconia episcopus* (Asian Woollyneck), two Vulnerable species – *Aythya ferina* (Common Pochard) and *Grus Antigone* (Sarus Crane) and one Endangered species – *Neophron percnopterus* (Egyptian Vulture). Most species showed a declining global population trend (n=40) for e.g. *Pernis ptilorhynchus* (Oriental Honey-buzzard), *Anas poecilorhyncha* (Indian Spot-billed Duck), *Dendrocygna javanica* (Lesser Whistling-duck), *Querquedula querquedula* (Garganey), *Sarkidiornis melanotos* (Knob-billed Duck), *Spatula clypeata* (Northern Shoveler), *Actitis hypoleucos* (Common Sandpiper), *Motacilla flava* (Western Yellow Wagtail), *Ardea purpurea* (Purple Heron), *Nycticorax nycticorax* (Black-crowned Night-heron), *Pseudibis papillosa* (Red-naped Ibis), *Tachybaptus ruficollis* (Little Grebe). This study highlights the importance of unprotected wetlands as valuable bird habitats amid anthropogenic pressures, underscoring the need for immediate conservation measures.

Keywords: Bird species, Global population trend, Human-dominant areas, International Union for Conservation of Nature (IUCN) status, Migratory birds

INTRODUCTION

Wetlands are among the most productive ecosystems, connecting aquatic and terrestrial habitats (Zedler and Kercher, 2005). Wetlands are reservoirs of rich biodiversity (Ghermandi *et al.*, 2010), as they harbour diverse invertebrates, fish, mammals, birds, amphibians, reptiles, and plants. In addition, it provides ecosystem services such as flood regulation, water purification, and carbon sequestration (Dar and Dar, 2024). Though, wetlands cover 5-8% of the Earth's surface (Anand *et al.*, 2023), the rapid loss and degradation of wetlands due to agricultural expansion and urbanization, have turned it into one of the most threatened ecosystems

(Kingsford *et al.*, 2016) and their area has shrunk by 54%-87% over the past three centuries (Davidson, 2014). This has led to increased pressure on wetland dependent taxa (Prigent *et al.*, 2012), especially waterbirds (Bakker, 2005). In the past, protected area – an in-situ conservation strategy was seen as a promising solution to species conservation. But it was soon realised that many rare and threatened species occur outside protected areas (Chakravarty *et al.*, 2012). Many studies conducted outside protected areas have shown that unprotected areas are also rich in biodiversity, provide alternative habitats for refugees, and are essential for maintaining viable populations of species (Cox and Underwood, 2011, Dudley *et al.*, 2014).

Birds play a very important role in the nutrient cycle of wetland ecosystems (Rajpar *et al.*, 2022). Birds use wetland habitats for foraging, roosting, breeding, nesting, as stopover sites etc. (Muralikrishnan *et al.*, 2023). Birds also indicate the quality, productivity, and equilibrium of the wetland, as this taxon is extremely sensitive to habitat changes such as degradation, siltation, eutrophication, pollution, and poisoning (Amat and Green, 2010). So, unprotected areas complement protected areas in conserving biodiversity (Adhikari *et al.*, 2022). Many unprotected wetlands are not given the due attention and protection, even though they harbour immense biodiversity.

Citizen science portals have reported 562 bird species from Uttar Pradesh (ebird, 2025). It has 10 Ramsar-designated wetlands, making it the 2nd highest in India after Tamil Nadu (MOEFCC, 2025), and 31 Important Bird Areas (Birdlife International, 2022), of which 24 are wetland ecosystems, as well as many other unprotected wetlands. But many studies on birds in Uttar Pradesh have focused on protected areas such as Wildlife sanctuaries (Khan *et al.*, 2013, Mishra *et al.*, 2020) and Bird sanctuaries (Mazumdar, 2019, Khan and Khalid, 2024, Joshi *et al.*, 2024, Yashmita-Ulman and Singh, 2025). A few studies on bird diversity have been conducted in unprotected areas such as unprotected wetlands (Kanaujia *et al.*, 2013, Manral and Khudsar, 2013, Mishra *et al.*, 2016, Kumar and Kanaujia, 2017, Singh *et al.*, 2021, Yashmita-Ulman and Singh, 2022, Yashmita-Ulman, 2023a), agricultural fields (Yashmita-Ulman and Singh, 2021), riverscapes (Yashmita-Ulman, 2022) and university campus (Yashmita-Ulman, 2023b). The above literature survey shows that no previous studies have examined bird diversity in the unprotected wetlands of Gonda district. To address this knowledge gap and establish a baseline, the study was designed to develop a checklist of bird diversity in selected unprotected wetlands of Gonda district.

MATERIALS AND METHODS

Study area

Based on access, logistics, and finance, four wetlands, namely Raipur taal, Pipra taal, Pandey talab, and Khyra Mandir taal in Gonda district, Uttar Pradesh were selected for regular monitoring of bird diversity (Fig. 1). The description of the selected four unprotected wetlands is given in Table 1.

Gonda district is located in the Uttar Devipatan Commissionery, on the Ghagra River in eastern Uttar Pradesh (GoUP, 2025). It is situated between 28°47' and 27°47' North latitude and 81°30' and 82°46' East longitude (KVK, 2025), and has an elevation of 180.7 m above sea level (KVK, 2025). This district has an area of around 4003 km² (GoUP, 2025). The climate is relatively humid and has three distinct seasons: summer,

rainy, and winter. The district's annual rainfall is around 1,552 mm (KVK, 2025). The average temperature varies from 1.0 °C to 49 °C (KVK, 2025). Three rivers flow in this district, namely Ghaghra, Saryu, and Kuano (GoUP, 2025). Major crops grown are *Oryza sativa*, *Triticum aestivum*, *Saccharum officinarum*, *Brassica juncea*, *Sorghum bicolor*, *Cajanus cajan*, *Cicer arietinum*, *Pisum sativum*, *Lens culinaris*, *Zea mays* and *Arachis hypogaea* along with horticultural crops (*Mangifera indica*, *Psidium guajava*, *Phyllanthus emblica*, *Citrus limon*, *Artocarpus heterophyllus*, *Carica papaya* and *Musa* sp.) (KVK, 2025).

Method

Point-count method (Bibby *et al.*, 2000) was used for conducting bird surveys from September 2024 to August 2025. For this study, the point counts were restricted to two per wetland irrespective of the wetland size due to time constraint but more point counts will be included in the upcoming surveys for large-sized wetlands. A total of eight point counts of 20 m radius each (two points counts placed nearly 250 m apart in each wetland) were fixed on the perimeter of each wetland. Each point was surveyed 24 times during clear weather for a period of one year. At a single point count, bird species and their number were recorded for 15 minutes using field binoculars (Nikon 7x35). Birds flying across were not counted. No detectability corrections were applied, as the present study aimed to assess the presence or absence of bird species rather than to obtain an accurate estimate of population size or density. For species identification, taxonomic position and names, Grimmett *et al.* (2011) and Praveen *et al.* (2020) were referred respectively. IUCN (2025) was followed to compile the conservation status and global population trend (decreasing, increasing, stable, unknown). The observed bird species were classified by residential status based on temporal patterns and occurrence duration (Grimmett *et al.*, 2011).

Bird species were classified according to their frequency of observations as Abundant (observed 19-24 times/24 visits), Common (13-18 times/24 visits), Fairly common (7-12 times/24 visits) and Rare (1-6 times/24 visits) for residential species and Abundant (observed 7-8 times/8 visits), Common (5-6 times/8 visits), Fairly common (3-4 times/8 visits) and Rare (1-2 times/8 visits) for migratory species (Mackinnon and Philips, 1993). This data for all the eight point counts were aggregated and averaged to derive the frequency of observations for each bird species. The Relative diversity of bird families (RDi) (Torre-Cuadros *et al.*, 2007) was derived using the formula:

$$RDi = \frac{\text{Number of bird species in a family}}{\text{Total number of species}} \times 100 \quad \text{Eq.1}$$

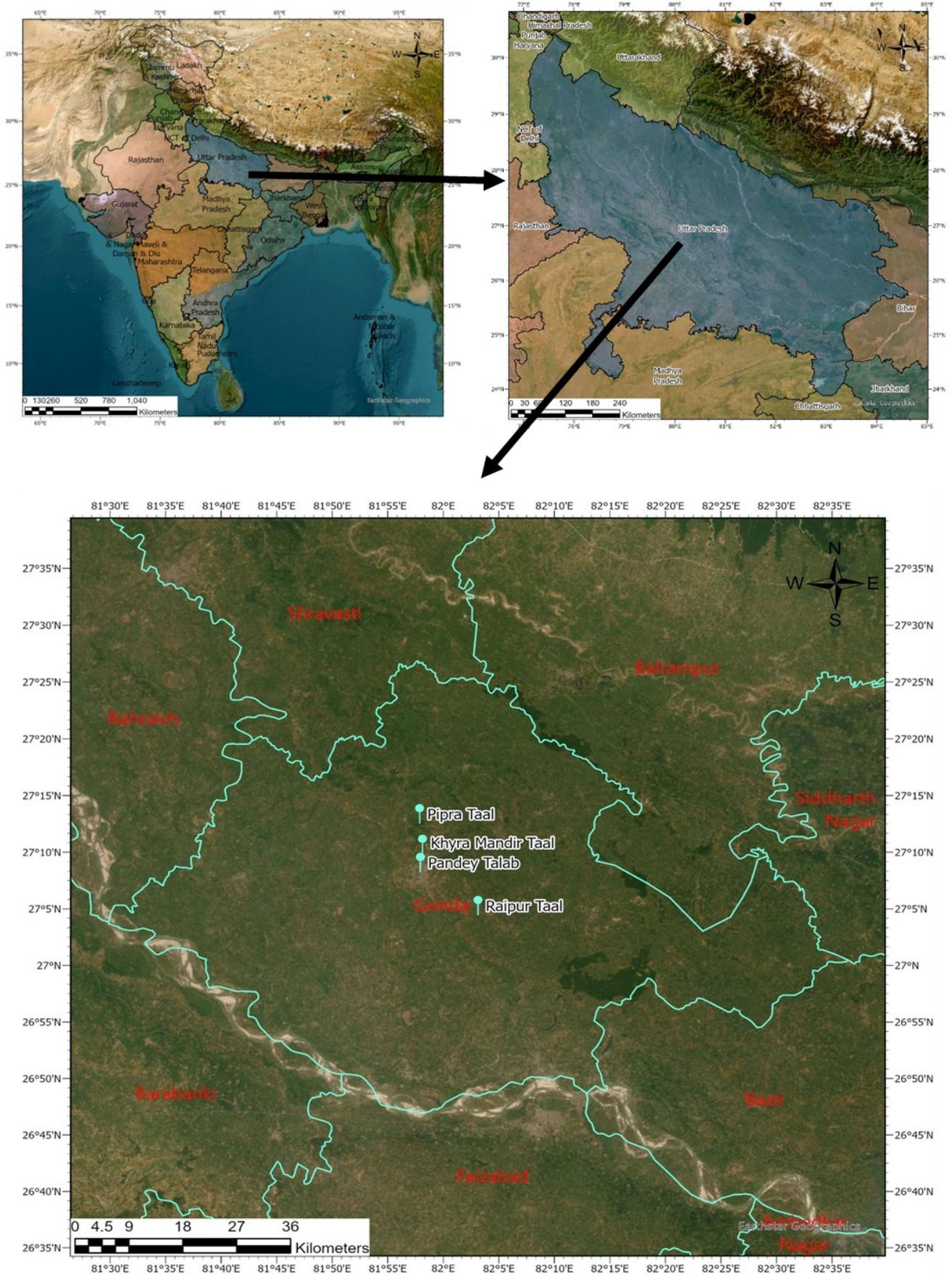


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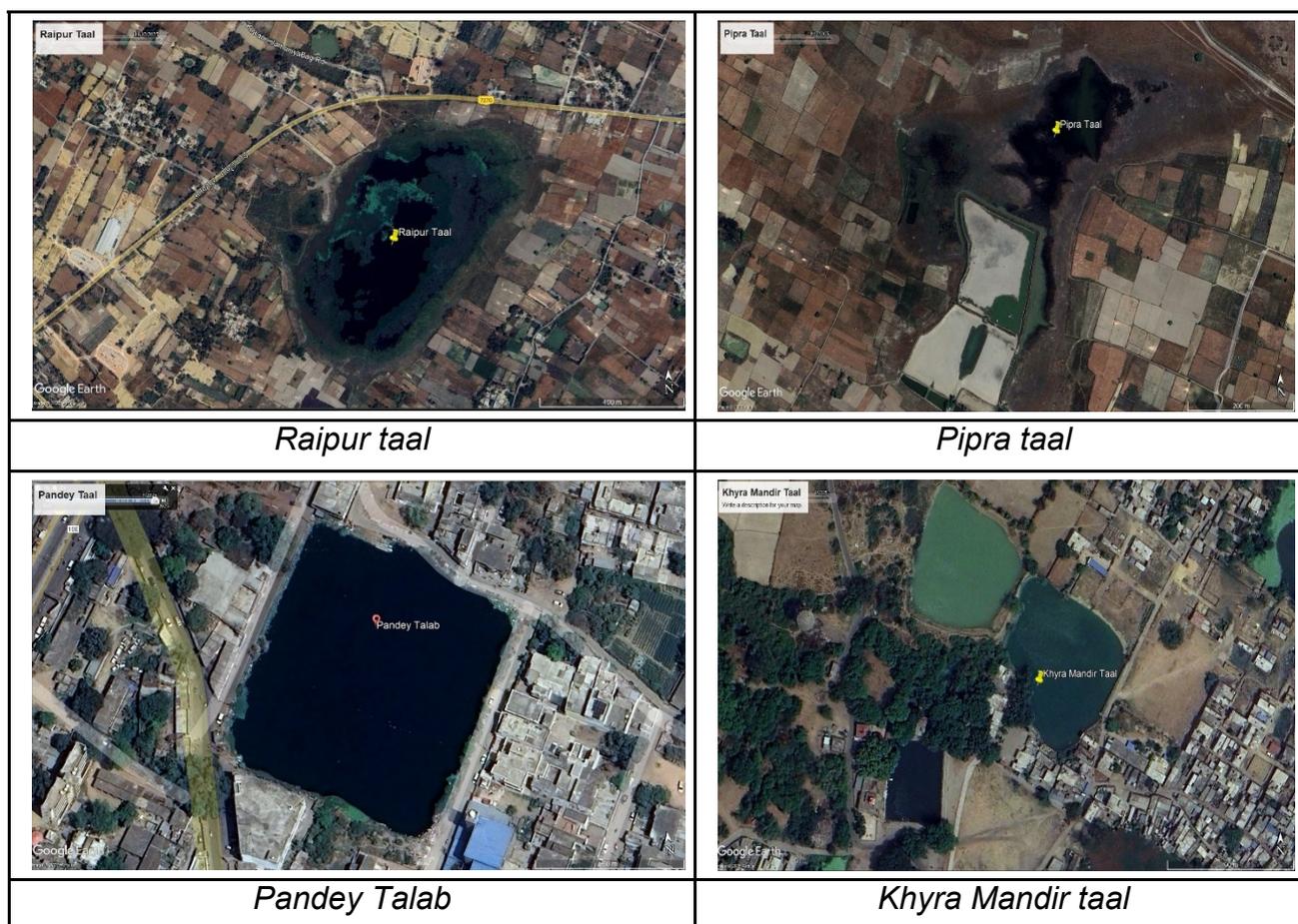


Fig. 1. Study area showing the details of selected unprotected wetlands of Gonda district, Uttar Pradesh, India

Table 1. Brief description of the selected unprotected wetlands of Gonda district, Uttar Pradesh, India

Sr. No.	Name of wetland	Name of tehsil	Co-ordinates	Size (ha)	Features	Fig. No.
1	Raipur taal	Colonelganj	27° 4'23.23"N 82° 3'7.51"E	33	This perennial wetland is surrounded by agricultural lands. It has aquatic plants and trees around it. This is a disturbed site, and human activities such as fishing and cattle grazing are carried out.	1a
2	Pipra taal	Mankapur	27° 12'29.38"N 81° 57'52.06"E	57	This rainfed wetland is surrounded by agricultural fields, habitations, and plantation trees. It has abundant aquatic weeds supporting aquatic zooplankton.	1b
3	Pandey talab	Gonda	27° 8'10.82"N 81° 57'55.92"E	1	This wetland is primarily maintained for fishing and is free of aquatic vegetation.	1c
4	Khyra Mandir taal	Gonda	27° 9'47.28"N 81° 58'7.62"E	0.59	This wetland is mainly maintained for religious activities and is clear of aquatic vegetation.	1d

RESULTS

A total of 119 bird species belonging to 104 genera, distributed among 52 families and 19 orders were recorded from four unprotected wetlands of Gonda district, Uttar Pradesh, India during the one-year study (Table

2). Among the 119 bird species recorded, 46 species were found at all four unprotected wetlands (Table 2). Passeriformes with 51 species belonging to 23 families recorded the maximum number of bird species, followed by Charadriiformes with 10 species belonging to six families (Table 2). The relative diversity revealed

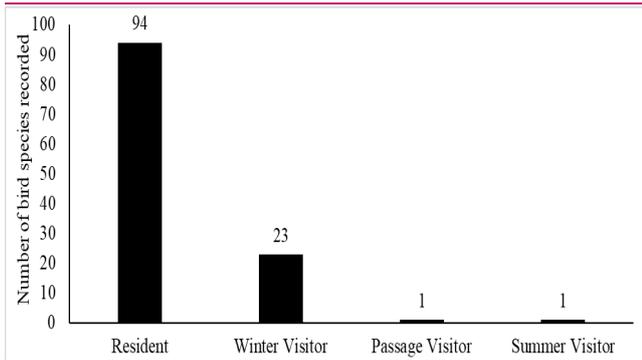


Fig. 2. Residential status of bird species recorded in selected unprotected wetlands of Gonda district, Uttar Pradesh, India (Numbers represent the number of species classified in different categories)

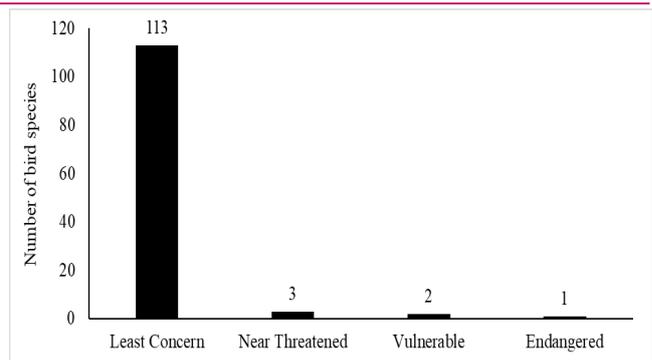


Fig. 3. Threat status (IUCN) of bird species recorded in selected unprotected wetlands of Gonda district, Uttar Pradesh, India (Numbers represent the number of species classified in different categories)

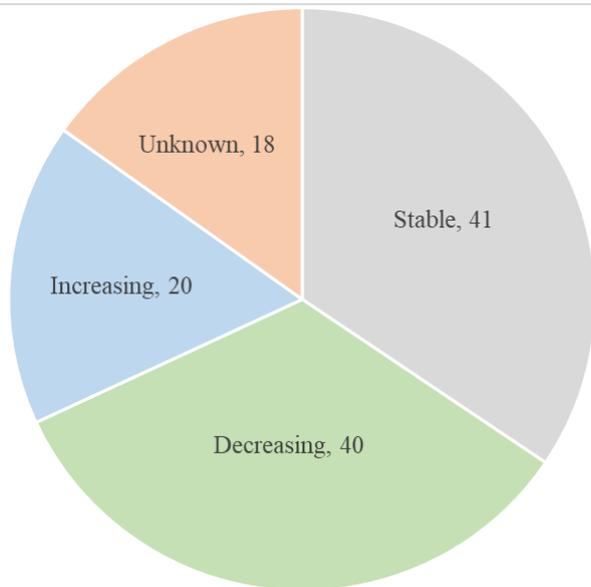


Fig. 4. Global population trend (IUCN) of bird species recorded in selected unprotected wetlands of Gonda district, Uttar Pradesh, India (Numbers represent the number of species classified in different categories)

that Accipitridae (9 species; RDi = 7.56%) was the most dominant family, followed by Anatidae and Muscipidae (8 species; RDi = 6.72% each), and 27 families were represented by a single species (RDi = 0.84% each) (Table 2).

According to the residential status, 94 species were resident, 23 species were winter visitors and one species was summer visitor and one species was passage visitor (Table 2, Fig. 2). As per the IUCN RedList status, 113 species were under Least Concern (Table 2, Fig. 3). Besides these, the unprotected wetlands provided habitat for three Near Threatened species – *Esacus recurvirostris* (Great Thick-knee), *Cursorius coromandelicus* (Indian Courser) and *Ciconia episcopus* (Asian Woollyneck), two Vulnerable species – *Aythya ferina* (Common Pochard) and *Grus Antigone* (Sarus Crane) and one Endangered species - *Neophron percnopterus* (Egyptian Vulture) (Table 2, Fig 3). Addi-

tionally, these unprotected wetlands also supported 40 bird species and 18 bird species having a declining and unknown global population trend respectively (Table 2, Fig. 4). The bird species were classified based on frequency of observations, revealing that out of 94 resident species, 25, 23, 17 and 29 bird species and out of 23 winter visitors, 3, 4, 3, 13 species were species were Abundant, Common, Fairly common and Rare respectively, and both the summer and passage visitors had one rare species each (Table 2, Fig. 5).

DISCUSSION

The present study recorded 119 bird species which is higher than the bird species recorded in unprotected wetlands of Ayodhya, Uttar Pradesh (105 species) (Yashmita-Ulman and Singh, 2022), but lower than that recorded in Parwati Arga Bird Sanctuary, Gonda, Uttar Pradesh (Yashmita-Ulman and Singh, 2025), Saman Wetland Complex, Uttar Pradesh (126 species) (Joshi *et al.*, 2024), Sultanpur National Park, Haryana (149 species) (Rani *et al.*, 2023) both of which are protected areas and Basai wetlands, Haryana– an Important Bird Area (171 species) (Rai *et al.*, 2019). The low diversity found in the selected unprotected wetland, as compared to the high diversity in Parwati Arga Bird Sanctuary in the same district and other protected areas, might be due to regular disturbances from human activities, pollution, uncontrolled resource extraction, and encroachment. This might be putting pressure on the unprotected wetlands, reducing their habitat suitability for birds. But despite these disturbances, these wetlands attract 119 bird species, highlighting the wetlands potential for conservation. The low diversity reported in the current study might also have been due to the differences in the sampling effort. For example, the study in the Saman Wetland complex, Uttar Pradesh, was conducted for 2 years, compared to the current 1-year study. Another reason for the low bird diversity reported in the current study might also be the habitat. For ex-

Table 2. Checklist of bird species recorded at selected unprotected wetlands of Gonda district, Uttar Pradesh, India

Sr. No.	Scientific name	Common name	IUCN status	Global population trend	Frequency of observation	Residential status	Bird occurrence in unprotected wetlands			
							Raipur taal	Pipra taal	Pandey talab	Khyra man-dir taal
Accipitriformes (No. of species = 9 and No. of family = 1)										
1.1. Accipitridae (9), RDI value = 7.56%										
1	<i>Accipiter badius</i>	Shikra	LC	↑	A	RE	*	*	*	*
2	<i>Aquila rapax</i>	Tawny eagle	LC	↓	R	RE	*	*	*	*
3	<i>Buteo rufinus</i>	Long-legged Buzzard	LC	↓	R	WV	*	*	*	*
4	<i>Circus gallicus</i>	Short-toed eagle	LC	→	R	RE	*	*	*	*
5	<i>Elanus caeruleus</i>	Black-winged kite	LC	→	C	RE	*	*	*	*
6	<i>Milvus migrans</i>	Black kite	LC	→	A	RE	*	*	*	*
7	<i>Neophron percnopterus</i>	Egyptian vulture	EN	↓	R	RE	*	*	*	*
8	<i>Pernis ptilorhynchus</i>	Oriental honey-buzzard	LC	↓	R	RE	*	*	*	*
9	<i>Spilornis cheela</i>	Crested serpent-eagle	LC	→	R	RE	*	*	*	*
Anseriformes (No. of species = 8 and No. of family = 1)										
Anatidae (8), RDI value = 6.72%										
10	<i>Anas poecilorhyncha</i>	Indian spot-billed duck	LC	↓	A	RE	*	*	*	*
11	<i>Aythya ferina</i>	Common pochard	VU	↓	R	WV	*	*	*	*
12	<i>Dendrocygna javanica</i>	Lesser whistling-duck	LC	↓	A	RE	*	*	*	*
13	<i>Mareca strepera</i>	Gadwall	LC	↑	R	WV	*	*	*	*
14	<i>Nettion coromandelianus</i>	Cotton pygmy-goose	LC	?	R	RE	*	*	*	*
15	<i>Querquedula querquedula</i>	Garganey	LC	↓	R	WV	*	*	*	*
16	<i>Sarkidiornis melanotos</i>	Knob-billed duck	LC	↓	R	RE	*	*	*	*
17	<i>Spatula clypeata</i>	Northern shoveler	LC	↓	F	WV	*	*	*	*
Apodiformes (No. of species = 1 and No. of family = 1)										
Apodidae (1), RDI value = 0.84%										
18	<i>Cypsiurus balasensis</i>	Asian palm-swift	LC	→	A	RE	*	*	*	*
Bucerotiformes (No. of species = 2 and No. of family = 2)										
Bucerotidae (1), RDI value = 0.84%										
19	<i>Ocyroceros birostris</i>	Indian grey hornbill	LC	→	C	RE	*	*	*	*
Upupidae (1), RDI value = 0.84%										
20	<i>Upupa epops</i>	Common hoopoe	LC	↓	C	RE	*	*	*	*
Charadriiformes (No. of species = 10 and No. of family = 6)										
Burhinidae (2), RDI value = 1.68%										
21	<i>Burhinus indicus</i>	Indian thick-knee	LC	?	F	RE	*	*	*	*
22	<i>Esacus recurvirostris</i>	Great thick-knee	NT	↓	R	RE	*	*	*	*
Charadriidae (2), RDI value = 1.68%										
23	<i>Charadrius dubius</i>	Little tinged plover	LC	→	C	RE	*	*	*	*
24	<i>Vanellus indicus</i>	Red-wattled lapwing	LC	?	A	RE	*	*	*	*
Glareolidae (1), RDI value = 0.84%										
25	<i>Cursorius coromandelicus</i>	Indian courser	NT	↓	R	RE	*	*	*	*

Contd.....

Table 2. Contd...

26	Jacaniidae (1), RDI value = 0.84% <i>Metopidius indicus</i>	LC	?	A	RE	*	*	*
27	5.5. Recurvirostridae (1), RDI value = 0.84% <i>Himantopus himantopus</i>	LC	↑	A	WV	*	*	*
28	Scolopacidae (3), RDI value = 2.52% <i>Actitis hypoleucos</i>	LC	↓	C	WV	*	*	*
29	<i>Ereunetes minutus</i>	LC	↑	C	WV	*	*	*
30	<i>Tringa nebularia</i>	LC	→	C	WV	*	*	*
31	Ciconiiformes (No. of species = 3 and No. of family = 1) 6.1. Ciconiidae (3), RDI value = 2.52% <i>Anastomus oscitans</i>	LC	?	C	RE	*	*	*
32	<i>Ciconia episcopus</i>	NT	↓	C	RE	*	*	*
33	<i>Mycteria leucocephala</i>	LC	↑	R	WV	*	*	*
34	7.1. Columbidae (3), RDI value = 2.52% <i>Columba livia</i>	LC	↓	C	RE	*	*	*
35	<i>Spilopelia chinensis</i>	LC	↑	C	RE	*	*	*
36	<i>Treron phoenicopterus</i>	LC	↑	A	RE	*	*	*
37	Coraciiformes (No. of species = 5 and No. of family = 3) 8.1. Alcedinidae (2), RDI value = 1.68% <i>Alcedo atthis</i>	LC	↓	A	RE	*	*	*
38	<i>Halcyon smyrnensis</i>	LC	↑	A	RE	*	*	*
39	8.2. Coraciidae (1), RDI value = 0.84% <i>Coracias benghalensis benghalensis</i>	LC	↑	C	RE	*	*	*
40	8.3. Meropidae (2), RDI value = 1.68% <i>Merops orientalis</i>	LC	↑	A	RE	*	*	*
41	<i>Merops philippinus</i>	LC	→	R	SV	*	*	*
42	Cuculiformes (No. of species = 1 and No. of family = 1) Cuculidae (1), RDI value = 0.84% <i>Centropus sinensis</i>	LC	→	C	RE	*	*	*
43	Falconiformes (No. of species = 1 and No. of family = 1) Falconidae (1), RDI value = 0.84% <i>Falco tinnunculus</i>	LC	↓	F	RE	*	*	*
44	Phasianidae (3), RDI value = 2.52% <i>Coturnix coturnix</i>	LC	↓	R	WV	*	*	*
45	<i>Francolinus pondicerianus</i>	LC	→	R	RE	*	*	*
46	<i>Pavo cristatus</i>	LC	→	F	RE	*	*	*
47	Gruiformes (No. of species = 4 and No. of family = 2) Gruidae (1), RDI value = 0.84% <i>Grus antigone</i>	VU	↓	C	RE	*	*	*

Contd.....

Table 2. Contd...

48	<i>Amaurornis phoenicurus</i>	White-breasted waterhen	LC	?	C	RE	*	*	*
49	<i>Gallinula chloropus</i>	Common moorhen	LC	→	A	RE	*	*	*
50	<i>Porphyrion poliocephalus</i>	Grey-headed swamphen	LC	?	A	RE	*	*	*
Passeriformes (No. of species = 51 and No. of family = 23)									
Aegithinidae (1), RDi value = 0.84%									
51	<i>Aegithina tiphia</i>	Common lora	LC	?	F	RE	*	*	*
Alaudidae (1), RDi value = 0.84%									
52	<i>Mirafra assamica</i>	Bengal bushlark	LC	→	R	RE	*	*	*
Campephagidae (2), RDi value = 1.68%									
53	<i>Coracina macei</i>	Large cuckooshrike	LC	↓	R	RE	*	*	*
54	<i>Pericrocotus cinnamomeus</i>	Small minivet	LC	↓	R	RE	*	*	*
Cisticolidae (5), RDi value = 4.20%									
55	<i>Cisticola juncidis</i>	Zitting cisticola	LC	?	R	RE	*	*	*
56	<i>Orthotomus sutorius</i>	Common tailorbird	LC	→	A	RE	*	*	*
57	<i>Prinia hodgsoni</i>	Grey-breasted prinia	LC	↓	A	RE	*	*	*
58	<i>Prinia inornata</i>	Plain prinia	LC	→	A	RE	*	*	*
59	<i>Prinia socialis</i>	Ashy prinia	LC	→	A	RE	*	*	*
13.5. Corvidae (3), RDi value = 2.52%									
60	<i>Corvus macrorhynchos</i>	Large-billed crow	LC	↓	C	RE	*	*	*
61	<i>Corvus splendens</i>	House crow	LC	→	C	RE	*	*	*
62	<i>Dendrocitta vagabunda</i>	Rufous treepie	LC	↓	F	RE	*	*	*
Dicruridae (2), RDi value = 1.68%									
63	<i>Dicrurus leucophaeus</i>	Ashy drongo	LC	?	A	RE	*	*	*
64	<i>Dicrurus macrocerus</i>	Black drongo	LC	?	A	RE	*	*	*
Estrildidae (3), RDi value = 2.52%									
65	<i>Amandava amandava</i>	Red avadavat	LC	→	F	RE	*	*	*
66	<i>Euodice malabarica</i>	Indian silverbill	LC	→	F	RE	*	*	*
67	<i>Lonchura punctulata</i>	Scaly-breasted munia	LC	→	F	RE	*	*	*
Hirundinidae (1), RDi value = 0.84%									
68	<i>Hirundo rustica</i>	Barn swallow	LC	↓	C	WV	*	*	*
Laniidae (2), RDi value = 1.68%									
69	<i>Lanius cristatus</i>	Brown shrike	LC	↓	R	WV	*	*	*
70	<i>Lanius schach</i>	Rufous-backed Long-tailed shrike	LC	?	R	RE	*	*	*
13.10. Leiothrichidae (2), RDi value = 1.68%									
71	<i>Turdoides caudata</i>	Common babbler	LC	↓	F	RE	*	*	*
72	<i>Turdoides striata</i>	Jungle babbler	LC	→	F	RE	*	*	*
13.11. Monarchidae (1), RDi value = 0.84%									
73	<i>Terpsiphone paradisi</i>	Asian paradise flycatcher	LC	→	R	RE	*	*	*

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Table 2. Contd...

13.12. Motacillidae (5), RDI value = 4.20%									
74	<i>Anthus rufulus</i>	Paddyfield pipit	LC	→	R	RE	*	*	*
75	<i>Motacilla alba</i>	White wagtail	LC	→	A	WV	*	*	*
76	<i>Motacilla cinerea</i>	Grey wagtail	LC	→	R	WV	*	*	*
77	<i>Motacilla citreola</i>	Citrine wagtail	LC	↑	A	WV	*	*	*
78	<i>Motacilla flava</i>	Western yellow wagtail	LC	↓	R	WV	*	*	*
13.13. Muscicapidae (8), RDI value = 6.72%									
79	<i>Copsychus saularis</i>	Oriental magpie-robin	LC	→	F	RE	*	*	*
80	<i>Eumyias thalassinus</i>	Verditer flycatcher	LC	↓	R	WV	*	*	*
81	<i>Ficedula parva</i>	Red-breasted flycatcher	LC	↑	F	WV	*	*	*
82	<i>Luscinia svecica</i>	Bluethroat	LC	→	F	WV	*	*	*
83	<i>Oenanthe fusca</i>	Brown rockchat	LC	→	F	RE	*	*	*
84	<i>Phoenicurus ochruros</i>	Black redstart	LC	↑	R	WV	*	*	*
85	<i>Saxicola caprata</i>	Pied bushchat	LC	→	F	RE	*	*	*
86	<i>Saxicola ferrea</i>	Grey bushchat	LC	→	R	WV	*	*	*
13.14. Nectariniidae (1), RDI value = 0.84%									
87	<i>Cinnyris asiaticus</i>	Purple sunbird	LC	→	A	RE	*	*	*
13.15. Oriolidae (1), RDI value = 0.84%									
88	<i>Oriolus xanthornus</i>	Black-hooded oriole	LC	→	R	RE	*	*	*
13.16. Paridae (1), RDI value = 0.84%									
89	<i>Parus cinereus</i>	Cinereous tit	LC	→	R	RE	*	*	*
13.17. Passeridae (1), RDI value = 0.84%									
90	<i>Passer domesticus</i>	House sparrow	LC	↓	F	RE	*	*	*
13.18. Ploceidae (1), RDI value = 0.84%									
91	<i>Ploceus philippinus</i>	Indian baya weaver	LC	→	F	RE	*	*	*
13.19. Pycnonotidae (2), RDI value = 1.68%									
92	<i>Pycnonotus cafer</i>	Red-vented bulbul	LC	↑	C	RE	*	*	*
93	<i>Pycnonotus jocosus</i>	Red-whiskered bulbul	LC	↓	C	RE	*	*	*

Contd.....

Table 2. Contd...

94	13.20. Sittidae (1), RDI value = 0.84% <i>Sitta castanea</i>	Indian nuthatch	LC	?	R	RE	*	*	*	*
95	13.21. Stenostiridae (1), RDI value = 0.84% <i>Culicicapa ceylonensis</i>	Grey-headed Canary-flycatcher	LC	↓	R	WV	*	*	*	*
96	13.22. Strunidae (5), RDI value = 4.20% <i>Acridotheres fuscus</i>	Jungle myna	LC	↓	R	RE	*	*	*	*
97	<i>Acridotheres ginginianus</i>	Bank myna	LC	↑	A	RE	*	*	*	*
98	<i>Acridotheres tristis</i>	Common myna	LC	↑	A	RE	*	*	*	*
99	<i>Gracupica contra</i>	Asian pied starling	LC	↑	R	RE	*	*	*	*
100	<i>Sturnia pagodarum</i>	Brahminy starling	LC	?	R	RE	*	*	*	*
101	13.23. Zosteropidae (1), RDI value = 0.84% <i>Zosterops palpebrosus</i>	Oriental white-eye	LC	↓	R	RE	*	*	*	*
102	Pelecaniformes (No. of species = 9 and No. of family = 2) Ardeidae (7), RDI value = 5.88% <i>Ardea cinerea</i>	Grey heron	LC	?	C	RE	*	*	*	*
103	<i>Ardea purpurea</i>	Purple heron	LC	↓	C	RE	*	*	*	*
104	<i>Ardeola grayii</i>	Indian pond-heron	LC	?	A	RE	*	*	*	*
105	<i>Bubulcus ibis</i>	Cattle egret	LC	→	A	RE	*	*	*	*
106	<i>Egretta garzetta</i>	Little egret	LC	↑	C	RE	*	*	*	*
107	<i>Ixobrychus cinnamomeus</i>	Chestnut bittern	LC	?	R	PV	*	*	*	*
108	<i>Nycticorax nycticorax</i>	Black-crowned Night-heron	LC	↓	C	RE	*	*	*	*
109	14.2. Threskiornithidae (2), RDI value = 1.68% <i>Pseudibis papillosa</i>	Red-naped Ibis	LC	↓	C	RE	*	*	*	*
110	<i>Threskiornis melanocephalus</i>	Black-headed Ibis	LC	↑	F	RE	*	*	*	*
111	Piciformes (No. of species = 1 and No. of family = 1) 15.1. Megalaimidae (1), RDI value = 0.84% <i>Xantholaema haemacephala</i>	Coppersmith barbet	LC	↑	R	RE	*	*	*	*
112	Podicipediformes (No. of species = 1 and No. of family = 1) 16.1. Podicipedidae (1), RDI value = 0.84% <i>Tachybaptus ruficollis</i>	Little grebe	LC	↓	C	RE	*	*	*	*

Contd.....

Table 2. Contd...

Psittaciformes (No. of species = 1 and No. of family = 1)										
Psittaculidae (1), RDI value = 0.84%										
113	<i>Psittacula krameri</i>	Rose-ringed parakeet	LC	↑	C	RE	*	*	*	
Strigiformes (No. of species = 5 and No. of family = 2)										
Strigidae (4), RDI value = 3.36%										
114	<i>Athene brama</i>	Spotted owl	LC	↑	F	RE	*	*	*	
115	<i>Bubo bengalensis</i>	Indian eagle-owl	LC	↓	R	RE	*	*	*	
116	<i>Glaucidium radiatum</i>	Jungle owl	LC	↓	R	RE	*	*	*	
117	<i>Otus bakkamoena</i>	Indian scops-owl	LC	↑	R	RE	*	*	*	
18.2. Tytonidae (1), RDI value = 0.84%										
118	<i>Tyto alba</i>	Common barn-owl	LC	↑	R	RE	*	*	*	
Suliformes (No. of species = 1 and No. of family = 1)										
Phalacrocoracidae (1), RDI value = 0.84%										
119	<i>Microcarbo niger</i>	Little cormorant	LC	?	A	RE	*	*	*	
Total							116	110	54	57

IUCN status (IUCN, 2025): LC: Least concern, NT: Near Threatened, VU: Vulnerable, EN: Endangered; **Global Population Trend (IUCN, 2025):** → - Stable, ↓ - Decreasing, ↑ - Increasing, ? - Unknown; **Frequency of Observation:** A: Abundant, C: Common, F: Fairly common, R: Rare; **Residential Status:** RE - Resident, WV - Winter Visitor, SV - Summer Visitor, PV - Passage Visitor

ample, the Sultanpur National Park, Haryana, has diverse habitats such as low-lying marshes and forest patches (Rani *et al.*, 2023), which are absent in the current study area. Passeriformes (n=51) was the dominant order, consistent with studies by Singh *et al.* (2020) and Rai and Vanita (2022) conducted in Haryana, India, and by Adhikari *et al.* (2022) conducted in Nepal. The diversity of passerines in the study area may be due to their ability to utilise diverse habitats and a range of food items, including grains, nectar, insects, and fruits (Beresford *et al.*, 2005). Accipitridae (n=9) was the most dominant family, which contradicts the studies conducted by Mishra *et al.* (2020) in Bakhira Bird Sanctuary, Uttar Pradesh, Joshi *et al.* (2024) in Saman wetland complex, Uttar Pradesh, and Kumar *et al.* (2016) in rural ponds of Kurukshetra, Haryana as all these studies have reported Anatidae as the dominant family. The unprotected wetlands of Gonda district, Uttar Pradesh supported 25 migratory bird species which is less than that of Okhla Bird Sanctuary, Uttar Pradesh (40 species) (Mazumdar, 2019), and unprotected wetlands of Ayodhya district, Uttar Pradesh (42 species) (Yashmita-Ulman and Singh, 2022), and Mandothi wetlands of Haryana (54 species) (Yadav and Rai, 2024). The low number of migratory bird species in the current study might be due to the habitat. For example, the Okhla Bird Sanctuary in Uttar Pradesh is a wide floodplain along the stretch of the river Yamuna flowing through the national capital, Delhi, and serves as the only refuge for waterbirds in the capital city (Mazumdar, 2019), which is not the same situation as in the current study area. Another reason for the low number of migratory bird species in the current study might be the limited number of unprotected wetlands considered. For example, the results of the study conducted in Ayodhya district are based on a survey of six unprotected wetlands (Yashmita-Ulman and Singh, 2022), whereas the current study results are based on four unprotected wetlands. Only one summer visitor was recorded in the current study which is less than that reported in Mandothi wetlands of Haryana (20 species) (Yadav and Rai, 2025). The low number of summer visitors in the current study might be due to the survey method used. For example, the study conducted in Mandothi wetlands employed scan sampling, point count, and line transect techniques (Yadav and Rai, 2025), whereas the current study's results are based on the point count method alone. The presence of migratory birds emphasises the significance of the unprotected wetlands as critical wintering grounds en route to their migration. Six threatened species were reported in the present study which is similar to the results obtained by Khan *et al.* (2013) in Hastinapur Wildlife Sanctuary, Uttar Pradesh and higher than that reported in human-modified floodplain wetland on river Yamuna (4 spe-

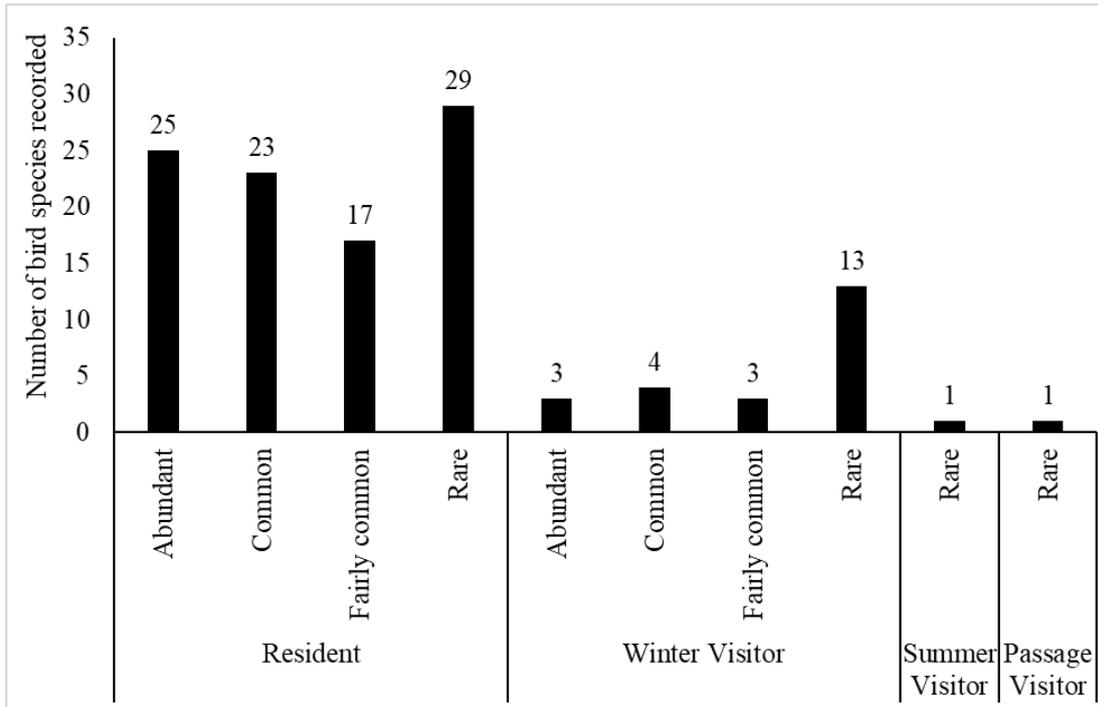


Fig. 5. Frequency of observations of bird species recorded in selected unprotected wetlands of Gonda district, Uttar Pradesh, India (Numbers represent the number of species classified in different categories)

cies) (Manral and Khudsar, 2013), but lower than that reported in Parwati Arga Bird Sanctuary, Uttar Pradesh (11 species) and Mandothi wetlands, Haryana (10 species) (Rai and Yadav, 2023). The present study reported 40 bird species with declining global population trends, which is slightly higher than that reported by Yashmita-Ulman and Singh (2022) in the unprotected wetlands of Ayodhya district, Uttar Pradesh (39 species), and by Rai and Vanita (2021) in the Otu reservoir, Haryana (37 species). The presence of threatened and declining species underscores the importance of these unprotected wetlands in conserving and protecting species of conservation importance. Moreover, only five threatened species found in Parwati Arga Bird Sanctuary in Gonda district were not recorded in these unprotected wetlands, which again highlights the potential of these wetlands to conserve vulnerable species. Based on the frequency of observations, 42 rare bird species were recorded in the unprotected wetlands. This knowledge helps in chalking out appropriate conservation plans necessary to maintain the diversity of these rare species in these sites.

Raipur taal (116) had the maximum bird species, followed by Pipra taal (110), Khyra Mandir taal (57) and the least was at Pandey talab (54). This difference in bird species might have been due to factors such as wetland size, location, vegetation (Sundar and Kittur, 2013), human activities, alternative foraging grounds (Yashmita-Ulman and Singh, 2021), and water quality and depth (Saygili *et al.*, 2011), which affect bird diver-

sity and composition. The fact that both Pandey talab and Khyra Mandir taal are very small (1 ha or less) and isolated water bodies, devoid of surrounding agricultural landscapes, might be affecting bird diversity immensely. Also, both these wetlands are devoid of vegetation, as they are regularly cleaned up by people and maintained for fishing and religious activities, respectively, which might be restricting the invertebrate and fish prey bases essential for waders and piscivores, resulting in fewer bird species in the two wetlands. The Raipur taal and Pipra taal, surrounded by agricultural lands and human habitations, might provide foraging grounds and diverse food items, attracting diverse bird species. This might have resulted in the high bird diversity in these wetlands. Moreover, both the wetlands have shallow depth and aquatic vegetation. The shallow depths attract moorhens, wading birds such as cranes, ibises, herons, storks, and egrets, as well as dabbling ducks such as mallard, pintail, gadwall, and teal, and shorebirds such as sandpipers, plovers, curlews, stilts, and lapwings, whereas deeper depths deter these birds. The wetlands host floating plants such as *Azolla sp.*, *Eichhornia crassipes*, *Lemna minor*, *Pistia stratiotes*, and *Spirodela polyrrhiza*, submerged plants such as *Hydrilla verticillata*, *Vallisneria spiralis*, *Ceratophyllum demersum*, *Nechamandra alternifolia*, *Utricularia aurea*, and *Najas graminea*, rooted floating-leaved and emergent plants such as *Nelumbo nucifera*, *Nymphaea pubescens*, *Nymphaea rubra*, *Marsilea minuta*, *Ipomoea aquatica*, *Typha angustifolia*, *Scirpus articu-*

lates, *Butomopsis lanceolata* and *Hygrophila auriculata* which might be supporting diverse species by providing insects and fish for food and escape and refuge covers. Apart from the aquatic vegetation, these wetlands are surrounded by agricultural crops, tree plantations of *Tectona grandis* and *Eucalyptus* sp., and fruit trees of *Mangifera indica*, *Madhuca longifolia*, *Artocarpus heterophyllus*, and sparsely located trees of *Ficus religiosa*, *Ficus bengalensis*, etc., which provide roosting, nesting, and perching sites for the birds. All of these factors might be attracting the generalists bird species. These unprotected wetlands might also be acting as stopovers, as this falls along the Central Asian Flyway. Most of the unprotected wetlands studied in the adjacent Ayodhya district (Yashmita-Ulman and Singh, 2022, Yashmita-Ulman, 2023a) face similar challenges, but some lessons can be applied in this region based on these studies. As none of the selected wetlands have natural bunds, the forest department, with the help of local people, can create raised platforms or bunds in promising wetlands to provide artificial nesting sites for birds, as done at Samda Jheel in Ayodhya district (Yashmita-Ulman and Singh, 2022), thereby attracting birds.

During the survey, many anthropogenic activities that could affect the wetlands negatively were observed. The most pressing problem was the encroachment of wetlands due to agricultural expansion, similar to observations made in the Saman wetland complex, Uttar Pradesh – a protected wetland (Joshi *et al.*, 2024). During the summers, the Pipra taal almost gets dry and the area is used for agriculture by the villagers. The garbage from the adjacent villages is dumped in and around the edges of the wetlands, and the chemicals and pesticides applied in adjacent agricultural areas drain into the wetlands, thus increasing their nutrient load and causing pollution and eutrophication. Apart from this, the villagers were observed extracting lotus stems, reeds, singhada (water chestnut) and fishes from the wetlands. Livestock grazing also adds to the pressure on these wetlands, temporarily altering the habitat (Jha, 2015). To address these challenges, the government and local non-governmental organisations must plan effective awareness programmes for local people. Even with such anthropogenic factors, the unprotected wetlands of Gonda are still supporting diverse resident and migratory birds. This may be due to the combined effects of wetland size, aquatic and terrestrial vegetation, water depth, location within the Central Asian flyway, and other factors. However, the present study has a limitation: it is not designed to collect quantitative data on the possible factors influencing the occurrence of bird species across different wetlands. So, the study could not determine the individual effect or the correlation between bird occurrence and the factors affecting it, or pinpoint the actual causal factor for

differences in bird species occurrence across the unprotected wetlands. So, future studies are recommended that take into consideration environmental variables (e.g., water quality parameters, vegetation surveys) and human disturbance variables, based on which definitive causal explanations can be made. Attempts should also be made to study and quantify the effects of agricultural expansion, pollution, grazing, and resource extraction on bird diversity in these wetlands.

Conclusion

This study provides the baseline information on bird species in unprotected wetlands of Gonda district. The role of the unprotected wetlands in conserving six threatened species, 40 species with declining population trends, and 18 species with unknown population trends globally needs to be appreciated. Of which, five, 17, and 10 species, respectively, are wetland-dependent, making the selected unprotected wetland ecosystem a critical habitat for these vulnerable species. This fundamental information can be used for developing management plans to conserve these wetlands. Future studies should focus on other unprotected wetlands in this district so that similar promising wetlands can be identified. These unprotected wetlands, if conserved, might provide alternative habitats for bird populations, in addition to the Parwati Arga Bird Sanctuary in the same district. Thus, this study highlights the importance of unprotected wetlands as valuable bird habitats amid anthropogenic pressures, underscoring the need for immediate conservation measures.

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Conflict of interest

The authors declare that they have no conflict of interest.

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