



Bird Diversity of Jagdishpur Jheel: An Unprotected Wetland in Ayodhya District, Uttar Pradesh

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Abstract: Jagdishpur Jheel located in Ayodhya district, Uttar Pradesh, is an unprotected, perennial wetland which not only supports the economic activities of the local people but also acts as wintering and stopover site for migratory and resident birds. Point count surveys were conducted from October 2020 to September 2021 to record the diversity and status of birds in Jagdishpur jheel. A total of 78 bird species belonging to 61 genera, distributed among 33 families and 13 orders were recorded from Jagdishpur Jheel, of which 53 species (68%) were resident and 25 species (32%) were winter visitors. Ardeidae was the most dominant family with 8 species and the highest RDi value (10.26). The carnivore guild was the most dominant with 36 species (46%), followed by omnivore 31 species (40%), insectivore 10 species (13%) and frugivore with one species (1%). Of the species recorded, three species are classified as Vulnerable and four species as Near Threatened in the IUCN Red List of Threatened Species and supported 26 species (33%) of birds having a declining population trend globally. This study will provide a baseline for future research and monitoring of birds in this wetland.

Keywords: Avifauna, Conservation, Feeding guild, Relative diversity, Threatened

Wetlands ecosystems are the most productive systems (Mitsch et al. 2009) and constitute 4% of earth's ice-free land area (Panigrahy et al 2012). They regulate groundwater recharge, pollutants, recreational activity and sustain life of numerous species of flora and fauna (Crisman 2001). The fauna of the wetlands is affected by biotic factors like availability of food, hunting and poaching activities, wetland size (Paracuellos 2006) and abiotic factors (Lagos et al 2008). In India, wetlands cover an area of 58.2 million hectares (Prasad et al 2002). Nearly 310 wetland dependent bird species are reported from India (Kumar et al 2005). Birds which are totally dependent on the wetlands for the development of their behavioral and physiological characters are known as waterbirds (Vargiya and Chakraborty 2019). The other bird groups which are ecologically dependent on wetlands are known as wetland dependent and associated birds (Kumar et al 2005). In Uttar Pradesh, 5.16% of the total geographic area is covered by wetlands and Ayodhya district in Uttar Pradesh has just 1.86% of the total land cover is under wetlands (NWA 2010). But none of the wetlands in Ayodhya district enjoy protected status. So, these wetlands in Ayodhya district are under tremendous anthropogenic pressure such as, encroachment, conversion into agricultural lands, dumping grounds, fishing grounds, eutrophication, nutrient run-off from surrounding lands etc. which affect the structure of bird communities present in these wetlands (Reginald et al 2007). Long-term monitoring

of waterbirds provides information on the health and status of wetlands. Studies were conducted on bird diversity in protected wetlands such as Samaspur Bird Sanctuary, Rae Bareli (Kumar and Kanaujia 2015), Sandi Bird Sanctuary, Hardoi, (Kumar and Srivastava 2013), Nawabganj Bird Sanctuary, Unao (Kumar et al 2015) and unprotected wetlands of Lucknow district (Kanaujia et al 2013). Bird diversity has been studied in the riverine (Yashmita-Ulman 2022a) and agricultural areas (Yashmita-Ulman 2022b) of Ayodhya district. But there have been no studies done in wetlands of Ayodhya district. The present study is based on the documentation of avifaunal species both waterbirds and wetland associated birds in one of the perennial but unprotected wetlands named Jagdishpur Jheel in Ayodhya district.

MATERIAL AND METHODS

Study site: The Jagdishpur jheel is one of the suitable habitats for waterbirds as it is a perennial wetland. It is situated 10 km from Faizabad city and lies between 26°43'55.20" N and 82°1'4.80" E. This wetland is situated in the Jagdishpur village of Sohawal tehsil of Ayodhya district and covers an area of about 12.6 ha. The wetland is surrounded by agricultural field on one side and by human habitation on the other side. The wetland varies in depth, i.e. contains shallow water at the exterior but gets deeper towards the interior of the wetland. The surrounding marshy

and agricultural area is suitable for waders and stork species. The grassland and the scattered trees of *Eucalyptus tereticornis*, *Phyllanthus emblica*, *Mangifera indica*, *Ficus religiosa*, *Ficus bengalensis*, *Terminalia arjuna* etc. also support diverse bird species. The wetland harbors floating hydrophytes (*Azolla pinnata*, *Eichhornia cracipes*, *Jussiaea repens*, *Ipomoea aquatica*) and submerged hydrophytes (*Najas graminea*, *Potamogeton nodosus*). This wetland has a high human interference in the form of conversion of wetland into agricultural and fishing grounds, pumping of water for agricultural purpose and extraction of Water chestnut.

Method: Observations were recorded using point count method from October 2020 to September 2021. Two-point counts (Bibby et al 2000) were fixed 250 m apart from each other on the periphery of the Jagdishpur wetland such that the whole wetland could be covered visually. The observations were made whenever the visibility was good during winters (usually between 1100 to 1200 hrs) and early in the morning (from 0600 to 0700 hrs) during rest of the seasons. During the entire study period each point count was surveyed 24 times. At each point count, initial 5 mins was given for the birds to settle down and then bird species were recorded for the next 20 mins. Birds were observed with the help of binoculars (Nikon 7x35). Grimmett et al. (2011) was used for identification of birds and knowing its residential status. Praveen et al (2020) was referred for assigning the bird species its taxonomic positions and names and Ali and Ripley (1987) for classifying birds into feeding guilds. The conservation and global population status was assigned (IWPA 1972; CITES 2012; IUCN 2021). Torre-Cuadros et al (2007) was followed to calculate the relative diversity of bird families. The formula is given below:

$$RD_i = \frac{\text{Number of bird species in a family}}{\text{Total number of species}} \times 100$$

RESULTS AND DISCUSSION

A total of 78 bird species belonging to 61 genera, distributed among 33 families and 13 orders were recorded from Jagdishpur Jheel during the study period (Table 1). This is higher than the bird species recorded at Chhaya Rann wetland, Gujarat (70 species) (Vargiya and Chakraborty 2019) and Chhilchhila Wildlife Sanctuary, Haryana (57 species) (Kumar and Gupta 2013), but lower than the bird species recorded at Suraha Tal lake, Uttar Pradesh (91 species) (Srivastava and Srivastava 2012) and Khaparwas Bird Sanctuary, Haryana (164 species) (Gupta et al 2012). Passeriformes had the highest diversity with 20 species and 11 families, followed by Charadriiformes with 18 species and

7 families. This result is similar to the findings of Kumar & Sharma (2018). Ardeidae was the most dominant family with 8 species and the highest RD_i value (10.26) (Table 2). This finding conforms to that of Vyas et al. (2010) in Bhoj wetland, Madhya Pradesh, but is in contrast to the results of Karikar et al (2019) in Solapur, Maharashtra and Kumar and Gupta (2009) in Kurukshetra, Haryana, who reported Anatidae to be the most dominant family. This was followed by Scolopacidae with 7 species (Table 2). According to the residential status of the birds recorded, 53 species (68%) were resident and 25 species (32%) were winter visitors. Similar results were reported by Ahmed et al (2019) in Haripura-Baur reservoir, Uttarakhand and Karikar et al (2019) in wetlands of Solapur, Maharashtra. The occurrence of higher number of winter migrants must be due to the fact that this study area is a part of the Central Asian Flyway and therefore may act as a wintering and stop over site for the winter migrants that breed in the Palearctic zone (Kumar et al 2016). The winter birds started arriving from October and reached peak in December and January and slowly started moving out from February. The other resident birds stayed in the wetland throughout but their populations fluctuated.

Out of the four major feeding guilds identified, carnivore guild was the most dominant with 36 species (46%), followed by omnivore (40%), insectivore (13%) and frugivore (1%). The food quality and quantity are the major factors that attracts bird population towards a habitat (Jha 2013). The higher representation of carnivores and omnivores suggests the presence of diverse food resources in the jheel. Due to their specialized feeding structure, the frugivores were the least represented. Many of the wetland associated birds such as ducks, jacanas, kingfishers, storks, herons, egrets etc. fed on aquatic creatures namely, worms, amphibians, crustaceans, fish and insects at various depths of wetlands, adjacent marshy areas and agricultural fields. Apart from food, the wetland and its surrounding habitats also provide shelter, breeding and nesting sites to the wetland associated birds. The birds such as lapwings, thick-knees, Sarus cranes have been observed nesting in the habitats adjacent to this jheel.

The unprotected but perennial Jagdishpur Jheel supported three vulnerable species viz., *Antigone antigone*, *Aquila rapax* and *Sterna aurantia* and four near threatened species viz., *Anhinga melanogaster*, *Esacus recurvirostris*, *Mycteria leucocephala*, and *Vanellus duvaucellii* as per the IUCN Red List (IUCN 2021) (Table 1). Moreover, eight species were included in the Appendix-II of CITES (CITES 2012) (Table 1). Six species came under Schedule I of the Indian Wildlife (Protection) Act (1972) (Table 1). In addition to this, the wetland supported 26

Table 1. Checklist and status of bird species recorded in Jagdishpur jheel

Order/Family/Common name	Scientific name	Residential status	Feeding guild	Conservation status			
				IUCN list (2021)	CITES (2012)	IWPA (1972)	Global status
Accipitriformes Accipitridae (5)							
Black Kite	<i>Milvus migrans</i> (Boddaert 1783)	R	C	LC	II	I	?
Black-winged Kite	<i>Elanus caeruleus</i> (Desfontaines 1789)	R	C	LC	II	I	→
Indian Spotted Eagle	<i>Clanga hastata</i> (Lesson 1831)	R	C	LC	II	I	↓
Shikra	<i>Accipiter badius</i> (Gmelin 1788)	R	C	LC	II	I	→
Tawny Eagle	<i>Aquila rapax</i> (Temminck 1828)	R	C	VU	II	I	↓
Pandionidae (1)							
Osprey	<i>Pandion haliaetus</i> (Linnaeus 1758)	WV	C	LC	II	I	↑
Anseriformes Anatidae (6)							
Bar-headed Goose	<i>Anser indicus</i> (Latham 1790)	WV	O	LC	-	IV	↓
Cotton Pygmy-goose	<i>Nettapus coromandelianus</i> (Gmelin 1789)	R	O	LC	-	IV	→
Garganey	<i>Spatula querquedula</i> (Linnaeus 1758)	WV	O	LC	-	IV	↓
Indian Spot-billed Duck	<i>Anas poecilorhyncha</i> (Forster 1781)	R	O	LC	-	IV	↓
Lesser Whistling Duck	<i>Dendrocygna javanica</i> (Horsfield 1821)	R	O	LC	-	IV	↓
Northern Pintail	<i>Anas acuta</i> (Linnaeus 1758)	WV	O	LC	-	IV	↓
Charadriiformes Burhinidae (2)							
Great Thick-knee	<i>Esacus recurvirostris</i> (Cuvier 1829)	R	C	NT	-	IV	↓
Eurasian Thick-knee	<i>Burhinus ioedicnemus</i> (Linnaeus 1758)	R	O	LC	-	IV	↓
Charadriidae (5)							
Kentish Plover	<i>Charadrius alexandrinus</i> (Linnaeus 1758)	WV	C	LC	-	IV	↓
Little Ringed Plover	<i>Charadrius dubius</i> (Scopoli 1786)	R	O	LC	-	IV	→
Red-wattled Lapwing	<i>Vanellus indicus</i> (Boddaert 1783)	R	O	LC	-	IV	?
River Lapwing	<i>Vanellus duvaucelii</i> (Lesson 1826)	R	C	NT	-	IV	↓
Yellow-wattled Lapwing	<i>Vanellus malabaricus</i> (Boddaert 1783)	R	C	LC	-	IV	→
Jacanidae (1)							
Bronze-winged Jacana	<i>Metopidius indicus</i> (Latham 1790)	R	O	LC	-	IV	?
Laridae (1)							
River Tern	<i>Sterna aurantia</i> (Gray 1831)	R	C	VU	-	IV	↓
Recurvirostridae (1)							
Black-winged Stilt	<i>Himantopus himantopus</i> (Linnaeus 1758)	WV	C	LC	-	IV	↑
Rostratulidae (1)							
Greater Painted-snipe	<i>Rostratula benghalensis</i> (Linnaeus 1758)	R	O	LC	-	IV	↓
Scolopacidae (7)							
Common Greenshank	<i>Tringa nebularia</i> (Gunnerus 1767)	WV	C	LC	-	IV	→
Common Redshank	<i>Tringa totanus</i> (Linnaeus 1758)	WV	C	LC	-	IV	?
Common Sandpiper	<i>Actitis hypoleucos</i> (Linnaeus 1758)	WV	C	LC	-	IV	↓
Green Sandpiper	<i>Tringa ochropus</i> (Linnaeus 1758)	WV	O	LC	-	IV	↑
Little Stint	<i>Calidris minuta</i> (Leisler 1812)	WV	O	LC	-	IV	↑
Temminck's Stint	<i>Calidris temminckii</i> (Leisler 1812)	WV	O	LC	-	IV	?
Wood Sandpiper	<i>Tringa glareola</i> (Linnaeus 1758)	WV	O	LC	-	IV	→
Pelecaniformes Ciconiidae (2)							
Asian Openbill	<i>Anastomus oscitans</i> (Boddaert 1783)	R	C	LC	-	IV	?

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Painted Stork	<i>Mycteria leucocephala</i> (Pennant 1769)	WV	C	NT	-	IV	↓
Columbiformes Columbidae (1)							
Yellow-footed Green-pigeon	<i>Treron phoenicopterus</i> (Latham 1790)	R	F	LC	-	IV	↑
Coraciiformes Alcedinidae (3)							
Common Kingfisher	<i>Alcedo atthis</i> (Linnaeus 1758)	R	C	LC	-	IV	?
Pied Kingfisher	<i>Ceryle rudis</i> (Linnaeus 1758)	R	C	LC	-	IV	?
White-throated Kingfisher	<i>Halcyon smyrnensis</i> (Linnaeus 1758)	R	C	LC	-	IV	↑
Falconiformes Falconidae (1)							
Common Kestrel	<i>Falco tinnunculus</i> (Linnaeus 1758)	WV	C	LC	II	IV	↓
Gruiformes Gruidae (1)							
Sarus Crane	<i>Antigone</i> (Linnaeus 1758)	R	O	VU	-	IV	↓
Rallidae (5)							
Common Coot	<i>Fulica atra</i> (Linnaeus 1758)	R	O	LC	-	IV	↑
Common Moorhen	<i>Gallinula chloropus</i> (Linnaeus 1758)	R	O	LC	-	IV	→
Purple Swampphen	<i>Porphyrio</i> (Linnaeus 1758)	R	O	LC	-	IV	?
Watercock	<i>Gallicrex cinerea</i> (Gmelin 1789)	R	C	LC	-	IV	↓
White-breasted Waterhen	<i>Amauornis phoenicurus</i> (Pennant 1769)	R	O	LC	-	IV	?
Passeriformes Acrocephalidae (1)							
Blyth's Reed Warbler	<i>Acrocephalus dumetorum</i> (Blyth 1849)	WV	O	LC	-	IV	↑
Alaudidae (1)							
Sand Lark	<i>Alaudala raytal</i> (Blyth 1845)	R	O	LC	-	IV	→
Cisticolidae (2)							
Ashy Prinia	<i>Prinia socialis</i> (Sykes 1832)	R	I	LC	-	IV	→
Plain Prinia	<i>Prinia inornata</i> (Sykes 1832)	R	I	LC	-	IV	→
Dicruridae (1)							
Black Drongo	<i>Dicrurus macrocercus</i> (Vieillot 1817)	R	C	LC	-	IV	?
Estrildidae (1)							
Scaly-breasted Munia	<i>Lonchura punctulata</i> (Linnaeus 1758)	R	O	LC	-	IV	→
Hirundinidae (3)							
Barn Swallow	<i>Hirundo rustica</i> (Linnaeus 1758)	WV	I	LC	-	IV	↓
Streak-throated Swallow	<i>Petrochelidon fluvicola</i> (Blyth 1855)	R	I	LC	-	IV	↑
Wire-tailed Swallow	<i>Hirundo smithii</i> (Leach 1818)	R	I	LC	-	IV	↑
Leiothrichidae (1)							
Common Babbler	<i>Argya caudata</i> (Dumont 1823)	R	O	LC	-	IV	→
Motacillidae (4)							
Citrine Wagtail	<i>Motacilla citreola</i> (Pallas 1776)	WV	I	LC	-	IV	↑
Grey Wagtail	<i>Motacilla cinerea</i> (Tunstall 1771)	WV	I	LC	-	IV	→
Western Yellow Wagtail	<i>Motacilla flava</i> (Linnaeus 1758)	WV	I	LC	-	IV	↓
White-browed Wagtail	<i>Motacilla maderaspatensis</i> (Gmelin 1789)	R	I	LC	-	IV	→
Muscicapidae (1)							
Black Redstart	<i>Phoenicurus ochruros</i> (Gmelin 1774)	WV	I	LC	-	IV	↑

Cont...

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Passeridae (1)							
House Sparrow	<i>Passer domesticus</i> (Linnaeus 1758)	R	O	LC	-	IV	↓
Sturnidae (4)							
Asian Pied Starling	<i>Gracupica contra</i> (Linnaeus 1758)	R	O	LC	-	IV	↑
Bank Myna	<i>Acridotheres ginginianus</i> (Latham 1790)	R	O	LC	-	IV	↑
Brahminy Starling	<i>Sturnia pagodarum</i> (Gmelin 1789)	R	O	LC	-	IV	?
Common Myna	<i>Acridotheres tristis</i> (Linnaeus 1766)	R	O	LC	-	IV	↑
Pelecaniformes Ardeidae (8)							
Black-crowned Night Heron	<i>Nycticorax nycticorax</i> (Linnaeus 1758)	R	O	LC	-	IV	↓
Cattle Egret	<i>Bubulcus ibis</i> (Linnaeus 1758)	R	C	LC	-	IV	↑
Great Egret	<i>Ardea alba</i> (Linnaeus 1758)	R	C	LC	-	IV	?
Grey Heron	<i>Ardea cinerea</i> (Linnaeus 1758)	WV	C	LC	-	IV	?
Indian Pond Heron	<i>Ardeola grayii</i> (Sykes 1832)	R	C	LC	-	IV	?
Intermediate Egret	<i>Ardea intermedia</i> (Wagler 1829)	R	C	LC	-	IV	?
Little Egret	<i>Egretta garzetta</i> (Linnaeus 1766)	R	C	LC	-	IV	↑
Purple Heron	<i>Ardea purpurea</i> (Linnaeus 1766)	R	C	LC	-	IV	↓
Threskiornithidae (1)							
Red-naped Ibis	<i>Pseudibis papillosa</i> (Temminck 1824)	WV	C	LC	-	IV	↓
Phoenicopteriformes Podicipedidae (1)							
Little Grebe	<i>Tachybaptus ruficollis</i> (Pallas 1764)	R	C	LC	-	IV	↓
Strigiformes Strigidae (2)							
Jungle Owlet	<i>Glaucidium radiatum</i> (Tickell 1833)	R	C	LC	-	IV	→
Spotted Owlet	<i>Athene brama</i> (Temminck 1821)	R	C	LC	II	IV	→
Pelecaniformes Anhingidae (1)							
Oriental Darter	<i>Anhinga melanogaster</i> (Pennant 1769)	WV	O	NT	-	IV	↓
Phalacrocoracidae (2)							
Indian Cormorant	<i>Phalacrocorax fuscicollis</i> (Stephens 1826)	WV	C	LC	-	IV	?
Little Cormorant	<i>Microcarbo niger</i> (Vieillot 1817)	R	C	LC	-	IV	?

IUCN: International Union for Conservation of Nature and Natural Resources; CITES: Convention on International Trade in Endangered Species of Wild Fauna and Flora; IPWA: Indian Wildlife Protection Act; R: Resident, WV: Winter Visitor; C: Carnivorous; O: Omnivorous; I: Insectivorous; F: Frugivorous; LC: Least Concern; VU: Vulnerable; NT: Near Threatened; CITES II: Schedule-II species of CITES are the ones that are not necessarily threatened now with extinction but may become so unless trade is closely controlled; IWPA I: Schedule - I species of IWPA (high priority species); IV: Schedule - IV species of IWPA (relatively low priority species); ?: Unknown; -: Stable; ↑: Increasing; ↓: Decreasing

Table 2. Relative diversity (Rdi) of various bird families in Jagdishpur jheel

Avian family	Number of species recorded	Rdi value
Ardeidae	8	10.26
Scolopacidae	7	8.97
Anatidae	6	7.69
Accipitridae	5	6.41
Charadriidae	5	6.41
Rallidae	5	6.41
Motacillidae	4	5.13
Sturnidae	4	5.13
Alcedinidae	3	3.85
Hirundinidae	3	3.85
Burhinidae	2	2.56
Ciconiidae	2	2.56
Cisticolidae	2	2.56
Strigidae	2	2.56
Phalacrocoracidae	2	2.56
Pandionidae	1	1.28
Jacaniidae	1	1.28
Laridae	1	1.28
Recurvirostridae	1	1.28
Rostratulidae	1	1.28
Columbidae	1	1.28
Falconidae	1	1.28
Gruidae	1	1.28
Acrocephalidae	1	1.28
Alaudidae	1	1.28
Dicruridae	1	1.28
Estrildidae	1	1.28
Leiothrichidae	1	1.28
Muscicapidae	1	1.28
Passeridae	1	1.28
Threskiornithidae	1	1.28
Podicipedidae	1	1.28
Anhingidae	1	1.28

species (33%) of birds having a declining population trend globally. This result highlights the conservation importance of a wetland which is totally exposed to human interference but yet has the potential to conserve globally threatened, migratory and population declining bird species. The wetland due to its variation in water depth and surrounding habitat such as grasses, agriculture and scattered trees attract the resident as well as migratory species. It provides the birds with permanent and temporary refuge sites, foraging, nesting and breeding sites.

CONCLUSION

It is evident from the present study that though the Jagdishpur jheel does not enjoy any protection status, it serves as a good site for habouring and nurturing avifauna especially of threatened and migratory category. This study has helped develop a baseline data of the wetland based on which further long-term monitoring studies can be taken up emphasising on the importance of the wetland in terms of breeding and nesting sites. Conservation measures can also be implemented with the help of the local people of the study area.

REFERENCES

- Ahmed T, Bargali HS, Bisht D, Mehra GS and Khan A 2019. Status of waterbirds in Haripura-Baur reservoir, Western Terai-Arc landscape, Uttarakhand, India. *Journal of Threatened Taxa* **11**(9): 14158-14165.
- Ali S and Ripley SD 1987. *Compact handbook of the birds of India and Pakistan together with those of Bangladesh, Nepal, Bhutan and Sri Lanka*. Oxford University Press, Delhi, p 737.
- Bibby CJ, Hill DA, Burgess ND and Mustoe S 2000. *Bird census techniques*. Academic Press, London, p. 302.
- CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) 2012. *Checklist of Convention on International Trade in Endangered Species of Wild Fauna and Flora*. CITES, Geneva, Switzerland. <http://www.cites.org>. Accessed on 04 September 2021.
- Crisman TL 2001. Wetlands of East Africa: Biodiversity, exploitation, and policy perspectives. *Biodiversity and Wetlands* **2**: 101-131.
- Grimmett R, Inskipp C and Inskipp T 2011. *Birds of the Indian Subcontinent*. Oxford University Press and Christopher Helm, London, p. 480.
- Gupta RC, Parashar M and Kaushik TK 2012. Documentation of avian diversity of Khaparwas Bird Sanctuary in Jhajjar district in Haryana, India. *International Journal of Life Sciences* **6**(1): 20-30.
- IUCN (International Union for Conservation of Nature) 2021. *The IUCN Red List of threatened species, v. 2017.1*. Bird Life International, Gland, Switzerland. <http://www.iucnredlist.org>. Accessed on 04 September 2021.
- IWPA (Indian Wildlife Protection Act) 1972. *The Indian Wildlife (Protection) Act, 1972 (as amended up to 1993)*. Ministry of Environment, Forest and Climate Change, Govt. of India, Delhi. <http://www.envfor.nic.in/legis/wildlife/wildlife1.html> Accessed on 04 September 2021.
- Jha K 2013. Aquatic food plants and their consumer birds at Sandi Bird Sanctuary, Hardoi, Northern India. *Asian Journal of Conservation Biology* **2**(1): 30-43.
- Kanaujia A, Kumar A, Kushwaha S and Kumar A 2013. Diversity of waterbirds in Lucknow district, Uttar Pradesh, India. *International Journal of Science and Research* **4**(1): 862-866.
- Karikar SP, Mali SV, Prasad K and Priti A 2019. An assessment of bird communities across Ujjani and its five satellite wetlands in Solapur district of Maharashtra, India. *Journal of Threatened Taxa* **11**(15): 14989-14997.
- Kumar A and Kanaujia A 2015. Waterbird diversity of Samaspur Bird Sanctuary, Rae Bareilly district, Uttar Pradesh. *Discovery Nature* **9**(23): 48-57.
- Kumar A and Srivastava M 2013. The Biodiversity at Sandi Bird Sanctuary, Hardoi with special reference to Migratory Birds. *Journal of Environmental Research* **1**(3): 187-196.
- Kumar A, Kanaujia A, Kushwaha S and Kumar A 2015. A preliminary assessment of avifaunal diversity of Nawabganj Bird Sanctuary, Unnao, Uttar Pradesh. *Journal of Environmental Science*,

- Toxicology and Food Technology* **9**(4): 81-91.
- Kumar A, Sati JP, Tak PC and Alfred JRB 2005. *Handbook on Indian Wetland Birds and Their Conservation*. Zoological Survey of India, p. 472.
- Kumar P and Sharma A 2018. Diversity and status of avifauna in man-made sacred ponds of Kurukshetra, India. *Journal of Threatened Taxa* **10**(9): 12173-12193.
- Kumar P and Gupta SK 2009. Diversity and abundance of wetland birds around Kurukshetra, India. *Our Nature* **7**: 212-217.
- Kumar P, Rai D and Gupta SK 2016. Wetland bird assemblage in rural ponds of Kurukshetra, India. *Waterbirds* **39**(1): 86-98.
- Lagos NA, Paolini P, Jaramillo E, Lovengreen C, Duarte C and Contreras H 2008. Environmental processes, water quality degradation, and decline of waterbird populations in the Rio Cruces Wetland, Chile. *Wetlands* **28**: 938-950.
- Mitsch WJ, Gosselink JG, Zhang L and Anderson CJ 2009. *Wetland Ecosystems*. John Wiley and Sons, p. 256.
- NWA (National Wetland Atlas) 2010. Uttar Pradesh, SAC/RESA/AFEG/NWIA/ATLAS/12/2010, Space Applications Centre, ISRO, Ahmedabad, India, p. 372.
- Panigrahy S, Murthy TVR, Patel JG and Singh TS 2012. Wetlands of India: inventory and assessment at 1:50,000 scale using geospatial techniques. *Current Science* **102**(6): 852-856.
- Paracuellos M 2006. How Can Habitat Selection Affect the Use of a Wetland Complex by Waterbirds? *Biodiversity and Conservation* **15**: 4569-4582.
- Prasad SN, Ramachandra TV, Ahalya N, Sengupta T, Kumar A, Tiwari AK, Vijayan VS and Vijayan L 2002. Conservation of wetlands of India: A review. *Tropical Ecology* **43**(1): 173-186.
- Praveen J, Jayapal R and Pittie A 2020. Taxonomic updates to the checklists of birds of India, and the South Asian region. *Indian Birds* **16**(1): 12-19.
- Reginald LJ, Mahendran C, Kumar S and Pramod P 2007. Birds of Singanallur Lake, Coimbatore, Tamil Nadu. *Zoos' Print Journal* **22**(12): 2944-2948.
- Srivastava PK and Srivastava SJ 2012. Preliminary observations on avifauna of the Jai Prakash Narayan Bird Sanctuary (Suraha Tal Lake), Ballia, Uttar Pradesh, India. *Journal of Threatened Taxa* **4**(7): 2727-2732.
- Torre-Cuadros MDLAL, Herrando-Perez S and Young KR 2007. Diversity and structure patterns for tropical montane and premontane forests of central Peru, with an assessment of the use of higher-taxon surrogacy. *Biodiversity and Conservation* **16**: 2965-2988.
- Vargiya D and Chakraborty A 2019. The status of waterbird populations of Chhaya Rann Wetland complex in Porbandar, Gujarat, India. *Journal of Threatened Taxa* **11**(10): 14268-14278.
- Vyas V, Vishwakarma M and Dhar N 2010. Avian diversity of Bhoj Wetland: A Ramsar site of Central India. *Our Nature* **8**: 34-39.
- Yashmita-Ulman 2022a. Bird diversity in riverscapes of Ayodhya district, Uttar Pradesh. *Indian Journal of Ecology* **49**(1): 280-287.
- Yashmita-Ulman 2022b. Birds in agricultural fields of Ayodhya district, Uttar Pradesh. *Indian Journal of Ecology* **49**(5): 1647-1653.