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Distribution Pattern of Avian Species in Sultanpur National Park, Haryana, India with Special Reference to Residential and Migratory

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

From September 2021 to March 2023, we embarked on a journey to document the avian wealth of Sultanpur National Park in Haryana, India. Our survey revealed a stunning tapestry of 105 bird species, representing 16 orders and 40 families. While 108 species held Least Concern status, two precious residents, the Saras Crane (Grus antigone) and White-necked Stork (Ciconia episcopus), teetered on the edge of vulnerability, facing mounting threats. The Indian Silverbill, Scaly-breasted Munia, Plain Martin, Wire-Tailled Swallow, and Bay-backed Shrike joined their ranks, listed as vulnerable in the IUCN Red Data Book. Our research suggests that Sultanpur National Park holds the potential to become a haven for these at-risk species. With dedicated efforts to ensure year-round water availability and the strategic planting of native trees like Ficus religiosa, Ficus bengalensis, Azadirachta indica, Acasia nilotica, and Mangifera indica, we can create a sanctuary for Painted Storks, White-necked Storks, and Black-necked Storks. Additional platforms could further encourage the proliferation of Saras Cranes and White-necked Storks, giving them the perfect stage to raise their young.

This study serves as a call to action, both for the public and the state government to up their game in the area of conservation of wildlife species. By understanding the park's rich avian tapestry and the dangers it faces, we can mobilize support for its conservation. Protecting Sultanpur National Park and its irreplaceable birdlife is not just a responsibility, but a privilege. Let us join hands to ensure the skies above this national treasure remain forever filled with the songs and wings of its feathered residents.

Keywords: Distribution pattern; Saras Crane; avian species; white-necked stork.

1. INTRODUCTION

Encompassing 142.52 hectares just off the Gurugram-Farrukhnagar road, Sultanpur National Park in Haryana serves as a vital haven for diverse life forms. Its heart lies in a shallow wetland, nourished by a confluence of neighboring canals, agricultural runoff, and even saline groundwater. This watery sanctuary attracts both resident and migratory birds, offering respite from harsh winters and arduous journeys. Seasonal aquatic plants and open grasslands paint a vibrant picture of the wetland, occasionally interrupted by man-made islands adorned with Acacia nilotica. A sturdy perimeter wall now safeguards the park's borders, effectively separating it from cultivated lands beyond. Pockets of Typha and Phragmites fringe the wetland, while its core embraces emergent vegetation. Lush marshes teeming with sedges sprawl north of the main wetland, creating a captivating mosaic with dry grasslands. While semi-arid scrubland defines the region's natural character, a significant 78% of the buffer zone thrives under cultivation. Recognizing its ecological significance, the MoEF and Climate Change designated a 5km eco-sensitive zone surrounding the park in 2010. From over 150 plant species to diverse insects, reptiles, amphibians, and mammals, Sultanpur National Park shelters a thriving tapestry of life. Beyond mere species count, the park boasts rich biodiversity, a testament to the variety and utilization of ecological resources within its boundaries. This biodiversity underscores the crucial role environmental resources play in shaping the lives of countless organisms that call this place home [1]. Ultimately, the delicate interplay between environmental resources and biological communities dictates species diversity and survival. Different habitats, with their unique offerings, cater to the specific needs of diverse species, ensuring their continued existence and evolution [2-4].

Evaluating bird communities has become a crucial tool for safeguarding biodiversity, especially in areas facing high human impact [5]. Understanding the makeup and variety of bird populations is essential for designing effective conservation strategies. Both resident and migratory birds play vital roles in shaping ecological niches, making their protection vital for the sustainability of any avian community. Natural habitats like lakes, forests, farms, and national parks offer essential resources for birds, providing them with vital nesting and feeding grounds. Therefore, conserving these areas, particularly vulnerable forest patches, is crucial for maintaining diverse and healthy bird populations [6]. Haryana, with its two national parks, 10 wildlife sanctuaries, and vast agricultural lands, serves as a haven for numerous bird species. Among these, Sultanpur

National Park, a renowned freshwater wetland and the state's oldest national park, stands out [7]. However, it faces increasing threats from habitat fragmentation, disturbance, and degradation. Agricultural activities in its vicinity, pollution, and the expansion of the National Capital Region (NCR) all contribute to these challenges. Our study aims to document the composition, conservation status, distribution, and habitat use of Sultanpur National Park's avian community. This information will inform the development of long-term government conservation plans and contribute to understanding changes in local and migratory bird populations. By protecting this vital refuge, we can ensure the future of Sultanpur's diverse and irreplaceable avian community.

2. MATERIALS AND METHODS

2.1 Study Area

Located approximately 32 kilometers southwest of Delhi in India's northern state of Haryana, Sultanpur National Park (28.46'71"N, 76.89'90"E to 28.45'46"N, 76.88'15"E) offers a tapestry of diverse habitats (Fig 1). From the core wetland to the surrounding marshes, scrubland, and parkland, the park pulsates with life. Between September 2021 and March 2023, a study delved into this vibrant web, investigating bird migration patterns, species diversity, and feeding guilds across these habitats. Observations employed the line transect method, with variable widths but consistent length, as described by Shekhawat & Bhatnagar (2014).

2.2 Methods

Sharp Nikon 22x10 binoculars aided bird observations during mornings (7 AM to noon) and evenings (4 PM to 7 PM). Opportunistic sightings throughout the study were also documented. To ensure accurate identification, photographs were captured with a Canon 500D camera and cross-referenced with Grimmett et al.'s 2016 field guide. Feeding habits and preferred habitats were recorded based on direct field observations. For seasonal migration patterns, we identified species within specific time spans and categorized them as summer migratory (March to August), winter migratory (October to March), passage migratory (August to October), or resident (present year-round). Species richness, threat status, and nomenclature followed the 2019.3 IUCN Red Data List, while bird identification relied on resources like Ali and Ripley (1987), Ali (1996), and Grimmet et al. (1998). The relative diversity (RDi) of bird families present was deduced by the follow formula (Torre- cuadros et al., [8].

$$RD = \frac{Total\ number\ of\ species\ in\ a\ family}{Total\ number\ of\ species} \times 100$$

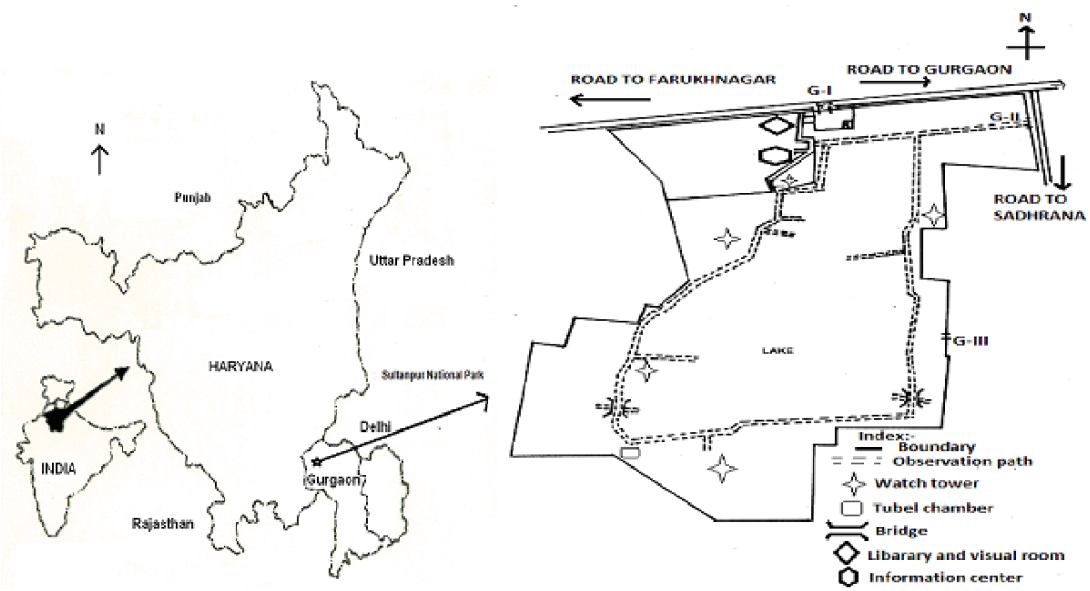


Fig. 1. Sultanpur National Park, Haryana, India

3. RESULTS AND DISCUSSION

A survey of Sultanpur National Park in Haryana revealed a vibrant avian community. We observed 105 bird species belonging to 16 orders and 40 families. Most, 80 species, were permanent residents, with 19 visiting in winter, 1 venturing on local migrations, and 7 arriving for the summer. (Table 2). It is evident from the Table 1, that family Acciptridae 4.76%, Anatidae 9.52%, Bucerotidae 0.95%, Upupidae 0.95%, Jacanidae 0.95%, Recurvirostridae 0.95%, Scolopacidae 3.81%, Ciconiidae 3.81%, Columbidae 3.81%, Alcedinidae 1.90%, Coraciidae 0.95%, Meropidae 0.95%, Cuculidae 3.81%, Phasianidae2.86% , Rallidae 3.81%, Alaudidae 0.95%, Cisticolidae 2.86%, Corvidae 2.86%, Dicruridae 0.95%, Estrildidae 1.90%, Hirundidae 1.90%, Laniidae 0.95%, Leiotrichidae 0.95%, Motacillidae 3.81%, Muscicapidae 5.71%, Nectariniidae 0.95%, Oriolidae 0.95%, Passeridae 1.90%, Phylloscopidae 0.95%, Ploceidae 1.90%, Pycnonotidae 1.90%, Stenostridae 0.95%, Sturnidae 5.71%, Ardeidae 7.62%, Threskiornithidae 2.86%, Megalaimidae 2.86%, Podicipedidae 0.95%, Psittlacidae 1.90%, Strigidae 0.95% and Anhingidae 0.95% reported respectively. In so far as, feeding guilds are concerned, most were Omnivorous (66 spp.) followed by Insectivorous (50 spp.), Carnivorous (32 Spp.), Granivorous (6 spp.), Frugivorous (6 spp.) and Nectivorous (1 Spp.). Of the 105 species of birds observed from the study area, two species – Asian woolly-neck Stork (Ciconia episcopus) and Saras Crane (*Grus antigone*) are vulnerable, 04 species - Painted Stork (*Mycteria leucocephala*), Black-necked Stork (*Ephippiorhynchus asiaticus*), Oriental White Ibis (*Threskiornis melanocephalus*) and Darter (*Anhinga melanogaster*) are Near Threatened (NT) and 98 species of birds are categorize as LC as per IUCN Red Data book (Birdlife International, 2014, IUCN Red Data Book, 2014). Saras Crane and Black-necked Stork were observed only twice during the study period i.e. from 2009 to 2013. In Sultanpur, mudflats are few and far between and hence the area does not support species like Redshank and White-tailed Lapwing. The Pheasant-tailed Jacana (Hydrophasianus chirurgus) and Bronze-winged Jacana (Metopidius indicus) depend heavily on water lilies and lotus for both food and shelter. Unfortunately, Sultanpur National Park's lake currently suffers from a significant decline in these vital plants. This scarcity of their preferred habitat severely impacts the Jacanas, potentially affecting their nesting and feeding behaviors. The need of the hour is thus for the management to identify its objectives, its target species and work towards maximizing these by appropriate habitat and water management.

Sultanpur National Park boasts a diverse avian community, with a mix of conservation priorities. One endangered species, the majestic Egyptian vulture (*Neophron percnopterus*), soars through the skies, while the vulnerable Asian woollyneck (*Ciconia episcopus*) wades gracefully through the wetlands. Six near-threatened species, including the ferruginous duck (*Aythya nyroca*) and the vibrant painted stork (*Mycteria leucocephala*), add to the park's ecological tapestry. The remaining 72 recorded species are classified as Least Concern, highlighting the park's role in protecting a wide range of birdlife (Picture 1 to11). As a feeding guilds, Omnivores dominate (40 species), followed by carnivores (29), insectivores (24), granivores (9), and frugivores (6). Nectarivores (2) are least common. Analysis reveals mixed population trends within each guild, with some species stable, increasing, or decreasing. This diversity reflects the varied food availability in the habitat. The existence of 32 species with declining or unknown population trends highlights the need for further research and conservation efforts for the park's avian community. This guild diversity reflects varied food availability in the habitat. Analysis highlights the ecological balance and resource interdependence.

Analyzing the global population trends of the 105 bird species in Sultanpur National Park revealed a mixed picture. Notably, 35 species had stable populations, while 32 faced worrying declines. Encouragingly, 25 species showed increasing populations, with 19 species requiring further research due to unclear trends (Graph 1-4). Seasonal migration patterns added another layer of complexity. 75% of the species were resident, while 29 were migratory. Winter visitors dominated, with 21 species identified, compared to 7 summer visitors and only 1 true migratory species. The reasons for this are likely linked to the park's diverse wetland habitats, providing abundant food and nesting opportunities for wintering birds [9] loser examination of population trends among migratory birds revealed further nuances. Among winter visitors, 8 species saw increasing populations, while 6 declined. Notably, 5 species lacked sufficient data, highlighting the need for further research. Summer visitors displayed a similar pattern, with

Table 1. Family Distribution pattern during study (RDi)

Order	Family	Genus	RDi
Accipitriformes	Acciptridae	5	4.76
Anseriformes	Anatidae	10	9.52
Bucerotiformes	Bucerotidae	1	0.95
	Upupidae	1	0.95
	Jacanidae	1	0.95
	Recurvirostridae	1	0.95
	Scolopacidae	4	3.81
Ciconiiformes	Ciconiidae	4	3.81
Columbiformes	Columbidae	4	3.81
Coraciformes	Alcedinidae	2	1.90
	Coraciidae	1	0.95
	Meropidae	1	0.95
Cuculiformes	Cuculidae	4	3.81
Galliformes	Phasianidae	3	2.86
Gruiformes	Rallidae	4	3.81
Passeriformes	Alaudidae	1	0.95
	Cisticolidae	3	2.86
	Corvidae	3	2.86
	Dicruridae	1	0.95
	Estrildidae	2	1.90
	Hirundidae	2	1.90
	Laniidae	1	0.95
	Leiotrichidae	1	0.95
	Motacillidae	4	3.81
	Muscicapidae	6	5.71
	Nectariniidae	1	0.95
	Oriolidae	1	0.95
	Passeridae	2	1.90
	Phylloscopidae	1	0.95
	Ploceidae	2	1.90
	Pycnonotidae	2	1.90
	Stenostridae	1	0.95
	Sturnidae	6	5.71
Pelecaniformes	Ardeidae	8	7.62
	Threskiornithidae	3	2.86
Piciformes	Megalaimidae	3	2.86
Podicipediformes	Podicipedidae	1	0.95
Psittlaciformes	Psittlacidae	2	1.90
Strigiformes	Strigidae	1	0.95
Suliformes	Anhingidae	1	0.95

2 species increasing, 2 with unknown trends, and 3 remaining stable. Resident species, however, presented a different picture. 30 species had stable populations, but 26 faced declines, a worrying trend. Thankfully, 15 species showed encouraging increases, and 11 remained uncertain. The lone migratory species' population trend remained unclear. With 32 species in decline and 19 with unknown trends, the research underscores the need for increased attention and conservation efforts for Sultanpur's avian community. Protecting and restoring the park's vital habitats is crucial for the long- term survival of these diverse birds. Sultanpur National Park's rich avian tapestry has been documented by several studies. Chopra et al. [10] identified 105 bird species, with 49 migratory and 64 residents. Focusing on wetland birds, Chopra et al. [11] found 79 species, 20 resident and 59 migratory. Kaushik & Gupta (2016) further expanded the list to 161 species, with 62 migrants and 99 residents. Notably, Banerjee & Singh [12] recorded 37 globally threatened species in the park between 1970 and 2000. Our current study identified 105 species, with a surprising 75%

resident and only 15% migratory. Worryingly, both the number and count of migratory species have declined compared to previous research. Nevertheless, all studies highlight Sultanpur's significance as a haven for avian diversity [13,14].

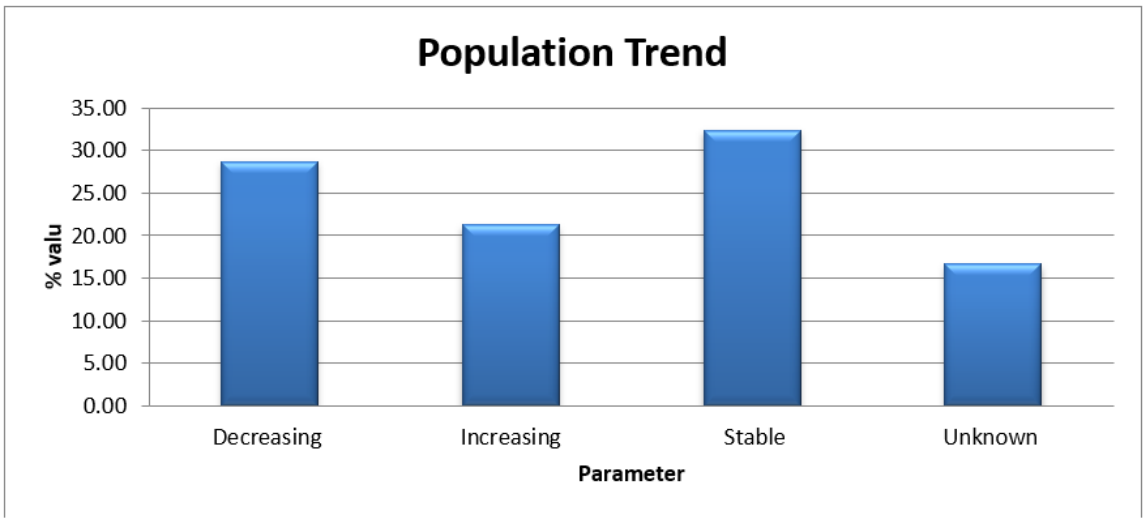
Table 2. Avian species distribution pattern in Sultanpur N. P., Haryana

Order	Family	Common Name	Scientific names	PT	FG	R S
Accipitriformes	Acciptridae	Besra	*Accipiter virgatus*	D	CV	R
		Black Kite	*Milvus migrans*	U	CV	R
		Black Shouldered Kite	*Elanus axillaris*	I	CV	R
		Egyptian Vulture	*Neophron percnopterus*	D	CV	R
		Shikra	*Accipiter badius*	S	CV	R
Anseriformes	Anatidae	African Comb Duck	*Sarkidiornis melanotos*	D	OV	R
		Bar Headed Goose	*Anser indicus*	D	OV	R
		Common Teal	*Anas crecca*	U	OV	WM
		Ferruginous Duck	*Aythya nyroca*	D	OV	WM
		Gadwall	*Mareca strepera*	I	OV	WM
		Garganey	*Spatula querquedula*	D	OV	WM
		Indian Spot-billed Duck	*Anas poecilorhyncha*	D	OV	R
		Mallard	*Anas platyrhynchos*	I	OV	WM
		Northern Pintail	*Anas acuta*	D	OV	WM
		Northern Shoveler	*Spatula clypeata*	D	OV	WM
Bucerotiformes	Bucerotidae	Indian Grey Hornbill	*Ocyceros birostris*	S	FV	R
	Upupidae	Common Hoopoe	*Upupa epops*	D	IV	R
	Jacanidae	Bronze-winged Jacana	*Metopidius indicus*	U	OV	SM
	Recurvirostridae	Black Stilt	*Himantopus no-vaezelandiae*	I	CV	R
	Scolopacidae	Common Redshank	*Tringa tetanus*	U	CV	WM
		Common Sandpiper	*Actitis hypoleucos*	U	CV	WM
		Green Sandpiper	*Tringa ochropus*	I	IV	WM
		Ruff	*Calidris pugnax*	D	CV	WM
Ciconiiformes	Ciconiidae	Asian Openbill	*Anastomus oscitans*	U	CV	R
		Asian Wollyneck	*Ciconia episcopus*	D	CV	R
		Black Necked Stork	*Ephippiorhynchus asi- aticus*	D	CV	R
		Painted Stork	*Mycteria leucocephala*	D	CV	R
Columbiformes	Columbidae	Eurasian Collard Dove	*Streptopelia decaocto*	I	GV	R
		Laughing Dove	*Spilopelia senegalensis*	S	GV	R
		Rock Dove	*Columba livia*	D	GV	R
		Yellow Footed		I	GV	R

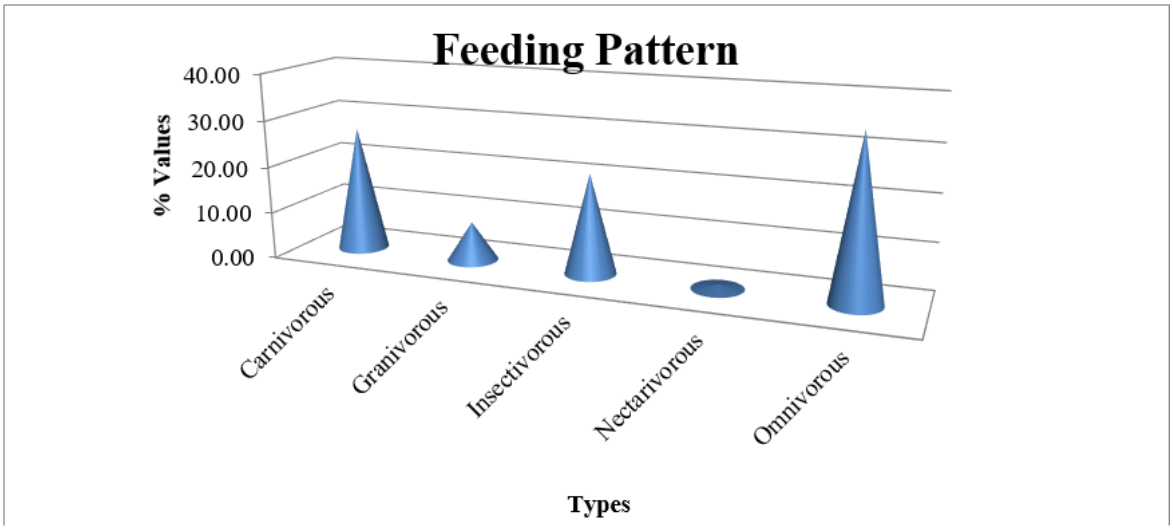
Order	Family	Common Name	Scientific names	PT	FG	R S
		Green Pigeon				
Coraciformes	Alcedinidae	Pied Kingfisher	*Ceryle rudis*	U	CV	R
		White Breasted Kingfisher	*Halcyon smyrnensis*	I	OM	R
	Coraciidae	Indian Roller	*Coracias benghalensis*	I	OM	R
	Meropidae	Blue Tailed Bee Eater	*Merops philippinus*	S	IV	SM
		Green Bee Eater	*Merops orientalis*	I	IV	SM
Cuculiformes	Cuculidae	Greater Coucal	*Centropus sinensis*	S	OV	R
		Grey-bellied Cuck-oo	*Cacomantis passerines*	S	IV	SM
		Jacobin Cuckoo	*Clamator jacobinus*	S	OV	SM
		Western Koel	*Eudynamys scolopaceus*	S	FV	R
Galliformes	Phasianidae	Black Francolin	*Francolinus francolinus*	S	OV	R
		Grey Francolin	*Francolinus pondicerianus*	S	OV	R
		Indian Peafowl	*Pavo cristatus*	S	OV	R
Gruiformes	Rallidae	Common Coot	*Fulica atra*	I	OV	R
		Common Moorhen	*Gallinula chloropus*	S	OV	R
		Purple Swamphen	*Porphyrio porphyrio*	U	OV	R
		White Breasted Wa- terhen	*Amaurornis phoe-nicurus*	U	OV	R
Passeriformes	Alaudidae	Crested Lark	*Galerida cristata*	D	GV	R
	Cisticolidae	Ashy Prinia	*Prinia socialis*	S	IV	R
		Plain Prinia	*Prinia inornata*	S	IV	R
		Tailor Bird	*Orthotomus sutorius*	S	IV	R
	Corvidae	House Crow	*Corvus splendens*	S	OV	R
		Large Billed Crow	*Corvus macrorhynchos*	S	OV	R
		Rufous Treepie	*Dendrocitta vagabunda*	D	CV	R
	Dicruridae	Black Drongo	*Dicrurus macrocercus*	U	CV	R
	Estrildidae	Indian Silverbill	*Euodice malabarica*	S	GV	R
		Scaly-breasted Munia	*Lonchura punctulata*	S	GV	R
	Hirundidae	Plain Martin	*Riparia chinensis*	D	IV	R
		Wire-Tailled Swallow	*Hirundo smithii*	I	IV	SM
	Laniidae	Bay-backed Shrike	*Lanius vittatus*	S	CV	R
	Leiotrichidae	Common Babbler	*Argya caudate*	S	OV	R
		Jungle Babbler	*Turdoides striata*	S	OV	R
	Motacillidae	Grey Wagtail	*Motacilla cinerea*	S	IV	WM
		Tree Pipet	*Anthus trivialis*	D	IV	R
		White Wagtail	*Motacilla alba*	S	IV	WM
		Yellow Wagtail	*Motacilla tschutschensis*	D	IV	WM
	Muscicapidae	Black Redstart	*Phoenicurus ochruros*	I	IV	WM

Order	Family	Common Name	Scientific names	PT	FG	R S
		Brown Rockchat	*Oenanthe fusca*	S	IV	R
		Indian Robin	*Saxicoloides fulicatus*	S	IV	R
		Oriental Magpie Robin	*Copsychus saularis*	S	IV	R
		Pied Bushchat	*Saxicola caprata*	S	IV	R
		Red Breasted Flycatcher	*Ficedula parva*	I	IV	WM
	Nectariniidae	Purple Sunbird	*Nectarinia asiatica*	S	NV	R
	Oriolidae	Indian Golden Oriole	*Oriolus kundoo*	U	OV	SM
	Passeridae	Chestnut-Shouldered BushSparrow	*Gymnoris xanthocollis*	S	GV	R
	Phylloscopidae	House Sparrow	*Passer domesticus*	D	GV	R
		Common Chiffchaff	*Phylloscopus collybita*	I	IV	WM
	Ploceidae	Baya Weaver	*Ploceus philippinus*	S	OV	R
		Black-Breasted Weaver	*Ploceus benghalensis*	S	OV	R
	Pycnonotidae	Red-Vented Bulbul	*Pycnonotus cafer*	I	OV	R
		White-Eared Bulbul	*Pycnonotus leucotis*	D	OV	R
	Stenostridae	Grey-headed Canary- flycatcher	*Culicicapa ceylonensis*	U	IV	WM
	Sturnidae	Asian Pied Starling	*Gracupica contra*	I	OV	R
		Bank Myna	*Acridotheres gingini- anus*	I	OV	R
		Brahminy Starling	*Sturnia pagodarum*	U	OV	R
		Common Myna	*Acridotheres tristis*	I	OV	R
		Common Starling	*Sturnus vulgaris*	D	OV	R
		Rosy Starling	*Pastor roseus*	U	OV	PM
Pelecaniformes	Ardeidae	Black-Crowned Night -Heron	*Nycticorax nycticorax*	D	CV	R
		Cattle Egret	*Bubulcus ibis*	I	CV	R
		Great White Egret	*Ardea alba*	U	CV	R
		Grey Heron	*Ardea cinerea*	U	CV	WM
		Indian Pond-Heron	*Ardeola grayii*	U	CV	R
		Intermediate Egret	*Ardea intermedia*	D	CV	R
		Purple Heron	*Ardea purpurea*	D	CV	R
		Small Egret	*Egretta garzetta*	I	CV	R
	Threskiornithidae	Black Headed Ibis	*Threskiornis melancephalus*	D	CV	R
		Eurasian Sponbill	*Platalea leucorodia*	U	CV	R
		Red-Naped Ibis	*Pseudibis papillosa*	D	OV	R
Piciformes	Megalaimidae	Brown-Headed Barbet	*Psilopogon zeylanicus*	S	FV	R
		Black-Rumped Flameback	*Dinopium benghalense*	S	IV	R
		Coppersmith Barbet	*Psilopogon haemacephalus*	I	FV	R

Order	Family	Common Name	Scientific names	PT	FG	R S
Podicipediformes	Podicipedidae	Little Grebe	*Tachybaptus ruficollis*	D	OV	R
Psittlaciformes	Psittlacidae	Alexandrine parakeet	*Psittacula eupatria*	D	FV	R
		Rose Ringed Parakeet	*Psittacula krameri*	I	FV	R
Strigiformes	Strigidae	Spotted Owlet	*Athene brama*	S	CV	R
Suliformes	Anhingidae	Oriental Darter	*Anhinga melanogaster*	D	CV	R



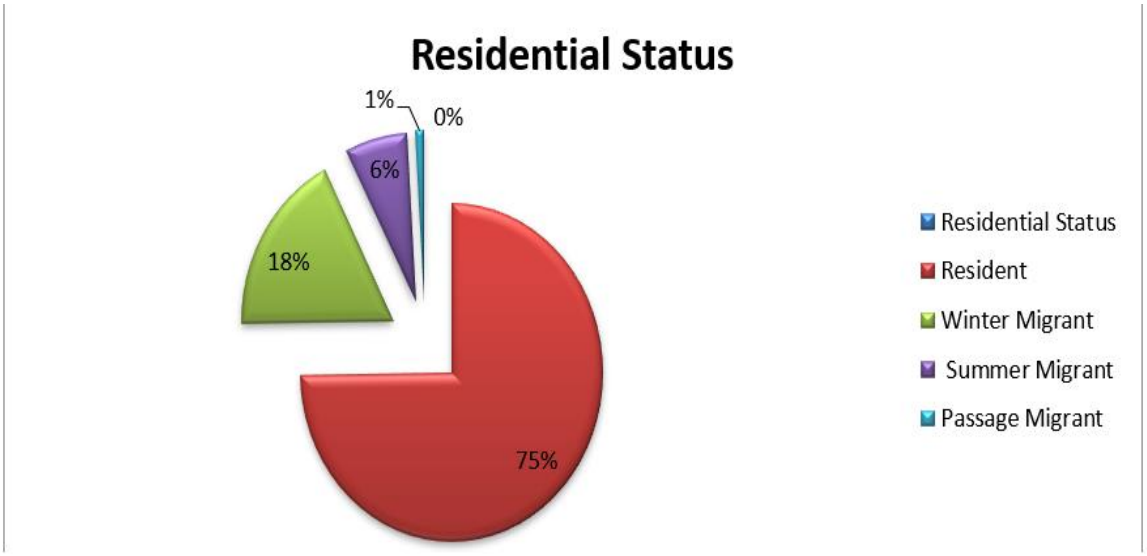
Graph 1. Population trend of birds in Sultanpur National Park, Haryana, India



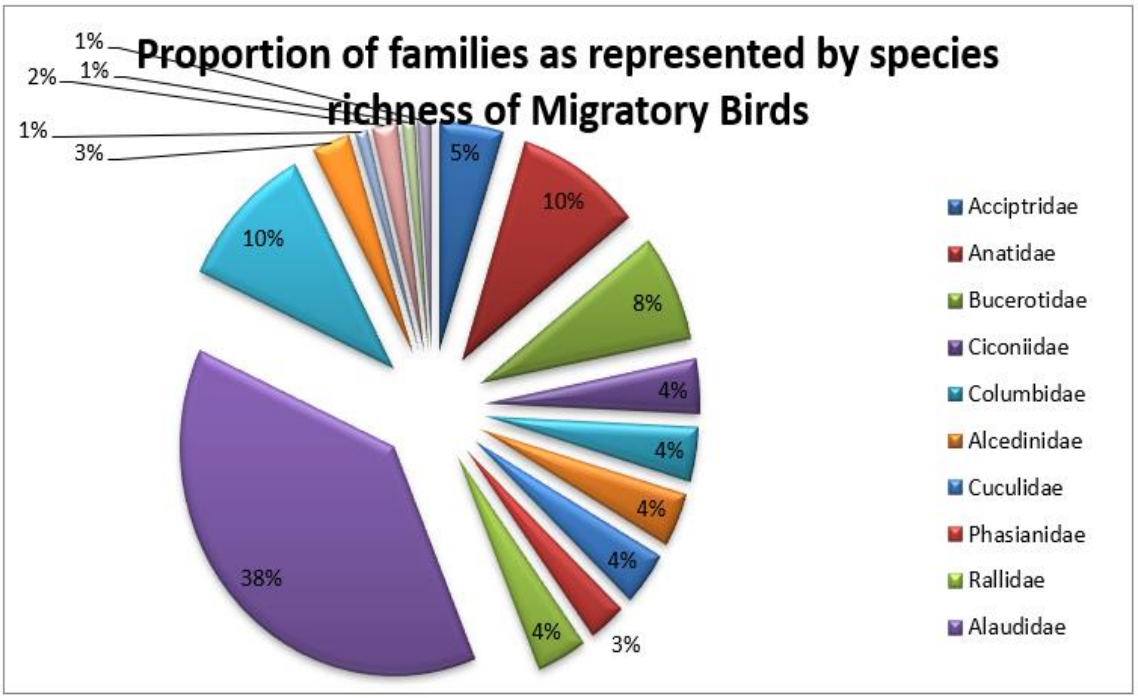
Graph 2. Feeding pattern of birds in Sultanpur National Park, Haryana, India

Despite its small size and urban surroundings, Sultanpur National Park teems with 105 bird species, including rare gems like one endangered, one vulnerable, and six near-threatened individuals. Notably, all threatened species in this study belonged to non-perching birds. This vulnerability stems from their narrow food choices, often limited to aquatic prey. In contrast, warblers thrive in diverse habitats, from agricultural fields to marshes, thanks to their

varied diets. This highlights the critical role of analyzing feeding guilds for understanding biodiversity composition and identifying key threats. The Egyptian vulture and Alexandrian parrot were exceptions - these near-threatened species weren't solely dependent on the shrinking wetland. However, for vulnerable and threatened waterfowl, the story was grim. Indiscriminate destruction of nesting and feeding sites due to habitat loss, shrinking water bodies (from 3.32 km² in 1995 to just 1.12 km² in 2015), and deforestation pose a major threat to their survival. Sultanpur National Park's avian diversity hangs in the balance. Conserving this vital oasis requires urgent action to protect dwindling water resources, curb deforestation, and create safe havens for these feathered residents [15].



Graph 3. Migrant status of birds in Sultanpur National Park, Haryana, India



Graph 4. Avian species distribution pattern in Sultanpur National Park, Haryana, India

Picture 1. Spotted Owlet

Picture 2. Shikra

Picture 3. Plain Martin

Picture 4. Painted Stork

Picture 5. Oriental Magpie Robin

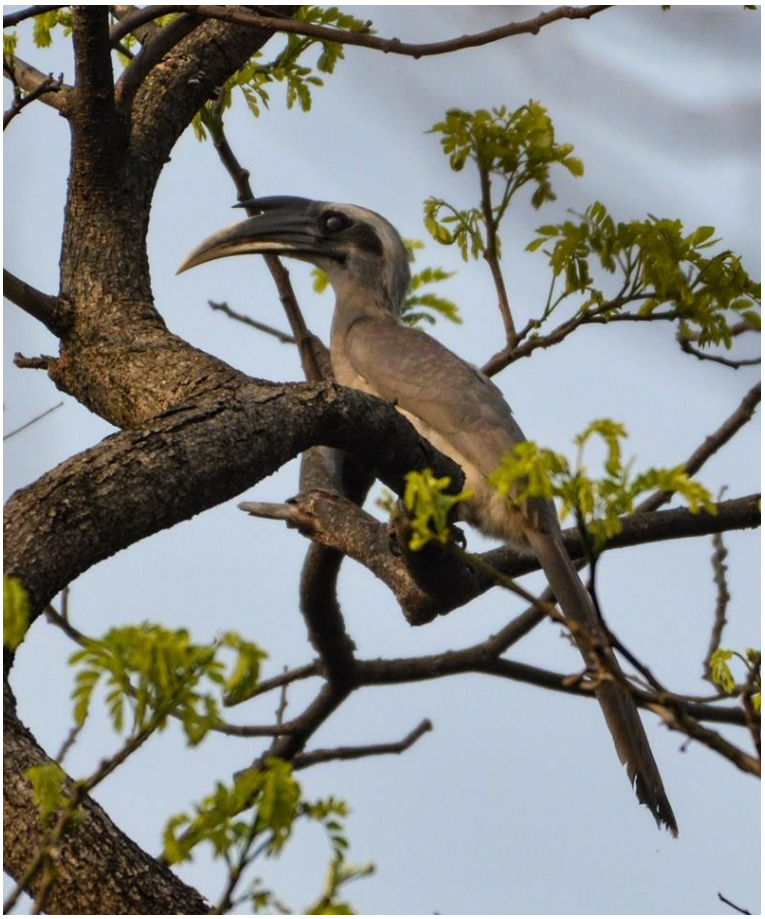
Picture 6. Mallard Flock

Picture 7. Common Teal

Picture 8. Common Redshank

Picture 9. Common Chiffchaff

Picture 10. Brahminy Starling



Picture 11. Indian Grey Hornbill

Picture 12. Black Shouldered Kite

Picture 13. Besra

While previous studies documented a significant presence of threatened bird species in Sultanpur National Park, our study revealed a concerning decreases. Earlier reports listed three critically endangered species (griffon vultures, long-billed vultures, and red-headed vultures), one endangered species (black-bellied tern), eight vulnerable species (including spotted pelicans, lesser adjutant storks, and sarus cranes), and twelve near-threatened species (comprising alexandrine parrots and European rollers). However, our study found no critically endangered species and only one endangered species, the Egyptian vulture, not previously documented in the park. Similarly, only the Asian wolf was recorded among the eight previously listed vulnerable species. Notably, six of the twelve previously documented near-threatened species were also absent. This decline in threatened species can be attributed to several factors, including reduced water availability, habitat destruction, and disturbance. Sultanpur National Park faces various threats: drying water bodies during droughts, expanding urbanization, highway construction, and industrial development in surrounding areas. Additionally, human activities within the buffer zone and tourism pose significant challenges to the park's avian diversity. To combat these threats and conserve Sultanpur National Park's unique ecosystem, awareness programs should educate local communities about the vital role bird play and the importance of preserving the wetland ecosystem for broader biodiversity. Such initiatives are crucial for the long-term survival of this national park and its valuable birdlife [16].

4. CONCLUSION

Sultanpur has the potential to be amongst good bird conservation areas but would need some good planning and management inputs. Foremost, is a sustained water supply to regulate as per needs Secondly, afforestation with varied varieties and species of trees likes Peepal, Banyan, Neem, Kikar and Mango. In addition bushes, herbs, scrubs, Beri and Mango trees be planted in hundreds each. Thirdly appropriate emergent and sub-mergent vegetation be sustained in water sheet as floating, rooted and sub-merged aquatic plants. In addition, several land flats be reconstructed in the centre and other places for water birds to roost and use. Watch towers and avenues for excursion be constructed on peripheral margins. These steps would generate good biodiversity in general and avian biodiversity in particular. Good bird life inside Sultanpur could also mean better livelihood to people especially youths living around the park by engaging them as guides. 62 bird families from 21 different bird orders were recorded during this observation (Table.1). This highlights a rich and diverse avian community, encompassing birds with varied ecological roles and life histories. Certain families stand out with higher RDi values, indicating they were encountered more frequently during the study. These include Ardeidae (herons and egrets) with an RDi of 7.62, Accipitridae (hawks and eagles) at 4.76, Sturnidae (starlings) at 5.71, and Muscicapidae (flycatchers) also at 5.71. This suggests these families have relatively higher abundance or detectability within the study area.

In Passeriformes (the largest order), families like Motacillidae (wagtails) and Sturnidae (starlings) show higher RDi compared to others like Alaudidae (larks) and Dicruridae (drongos). Similarly, within Ciconiiformes, Ardeidae (herons and egrets) have a significantly higher RDi than Ciconiidae (true storks). These variations could be due to habitat preferences, foraging strategies, or other ecological factors. Accipitriformes (hawks and eagles), Anseriformes (ducks and geese), Ciconiiformes (storks and herons), Cuculiformes (cuckoos), Passeriformes (perching birds), and Pelecaniformes (pelicans and herons). These orders contributed significantly to the overall species diversity, with each comprising several families and exhibiting RDi values ranging from 3.81 to 7.62. Several families have only one genus listed with an RDi of 0.95. This implies that these families were represented by just a single observed species during the study. Examples include Upupidae (hoopoes), Jacanidae (jacanas), and Leiotrichidae (scimitar-babblers). This could be due to their low abundance in the study area or their cryptic behaviour. By analyzing species-level data within each family, the study could provide further insights into specific factors influencing bird distribution, such as habitat utilization, breeding seasons, and resource availability. It's important to acknowledge that RDi may not accurately reflect absolute abundance, as it can be influenced by factors like bird detectability and observer bias. Combining RDi with other methods like point counts or transect surveys could provide a more comprehensive understanding of bird distribution. Several orders and families were represented by only one species, resulting in RDi values of 0.95. This might be due to limitations in the study's scope or specific habitat focus, potentially overlooking families with broader distributions. Overall, this table offers valuable information about the relative abundance and diversity of bird families within the study area. Further analysis, considering species-level data and potential limitations of RDi, can illuminate deeper ecological patterns and contribute to avian conservation efforts.

SUPPLYMENTARY MATERIALS

Supplymentary Materials is available in the following link:
https://www.youtube.com/watch?v=YBr7-9s3VNk&authuser=3

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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