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Review Article

Migratory Birds' Diversity at Different National Parks in India

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ABSTRACT

The historical and ecological context of India's environmental protection laws and the establishment of regulatory agencies. It highlights the pivotal role played by the United Nations Conference on Human Environment in Stockholm in 1972, which catalysed the development of environmental governance in India. The emergence of the National Council of Environment Policy and Planning and the subsequent evolution into the Ministry of Environment, Forest, and Climate Change, reflects the growing recognition of environmental protection and management in India. The concept of wetlands and their significance as critical habitats for avian species, emphasises their role in foraging, breeding, and roosting. The ongoing study at Sultanpur National Park is briefly mentioned, focusing on the comprehensive documentation of wetland bird species and their conservation value. The term "migration" is defined in the context of avian behavior, highlighting its importance as a response to environmental factors and its seasonal nature. The challenges presented by the variability of bird diversity and the impact of anthropogenic interventions and climate change on avifauna are also acknowledged. Finally, the role of designated areas in India, such as wildlife sanctuaries, biosphere reserves, and national parks, in safeguarding biodiversity and ecosystems. It emphasizes the differences in scale and purpose between these protected areas, with a focus on their vital roles in conserving diverse species.

Key words: National Parks; Diversity; Migratory birds; Bird Sanctuary.

INTRODUCTION

The inception of India's Environmental Protection Laws and the establishment of regulatory agencies governing environmental matters can be attributed to the landmark United Nations Conference on Human Environment held in Stockholm in 1972. Prior to this pivotal event, despite the conspicuous inclusion of the phrase "Protection and Improvement of Environment" within the bold confines of Directive Principles of State Policy outlined in Part IV of the Indian Constitution, substantive actions remained conspicuously absent.

In response to the pressing need for an organized approach to environmental concerns, the National Council of Environment Policy and Planning was established, functioning under the aegis of the Department of Science and Technology, which served as its overseeing ministry. Subsequently, recognizing the growing significance of environmental protection, a dedicated Ministry of Environment and Forest emerged as a distinct entity. This ministry has since evolved and expanded its scope to encompass the complex issue of climate change, and thus, it is now known as the Ministry of Environment, Forest, and Climate Change (MOEFCC).

When the water table is close to the surface or the land is submerged in shallow water, an area is said to be a wetland because it is a transitional area between terrestrial and aquatic ecology. Wetlands provide optimal habitat conditions that cater to the essential requirements of avian species, encompassing favourable foraging opportunities, reproductive activities such as breeding, nesting, and roosting, and serving as a nurturing environment for their offspring. Wetlands provide indispensable resources for avian species, serving as pivotal sites for foraging, breeding, and roosting activities. These avifauna are commonly categorised as "water birds," known specifically as waterfowl and waders in ornithological classification. A meticulous survey conducted during the ongoing study at Sultanpur National Park yielded a comprehensive checklist documenting the presence of wetland and wetland-dependent or associated bird species. The investigation prioritised the significance of wetland ecosystems in bird conservation, guiding the systematic approach employed for data collection and analysis. Due to human-caused habitat damage and climate change, some birds are changing the timing and paths of their migratory flights. The most well-known wetlands in northern India are those in Sultanpur National Park. The present study involved systematic efforts to compile a comprehensive checklist of wetland and wetland-dependent or associated bird species inhabiting Sultanpur National Park. Throughout the research, particular emphasis was placed on recognising the conservation value of wetland birds. These considerations informed the methodical approach undertaken for data collection, ensuring the inclusion of pertinent species in the checklist (Chopra et al., 2013).

The Latin term "migrare," which means to migrate from one spatial unit to another, is where the word "migration" first appeared. The spatial unit is thought to be any position that an organism is in at a given time. Migration of avians is the process through which "regular, seasonal, large-scale, long-distance movement of a population twice a year between a fixed breeding and a fixed non-breeding area" occurs and is a versatile, adaptable behaviour that develops in response to

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In the context of India, designated areas such as wildlife sanctuaries, biosphere reserves, and national parks serve as crucial bastions for the safeguarding of both botanical and zoological components, as well as their native habitats. Wildlife sanctuaries, specifically earmarked for the protection of various species of flora and fauna, encompass both public and private lands, wherein the conservation efforts extend either throughout the entire year or for specific periods thereof.

National Parks, occupying expansive tracts of land, are primarily conceived as expansive sanctuaries aimed at shielding indigenous flora and fauna from the encroachment of industrialization, human exploitation, and pollution. At present, India boasts a total of 106 National Parks and 18 biosphere reserves, each playing a pivotal role in the broader mission of biodiversity conservation and ecosystem protection.

It is noteworthy that wildlife sanctuaries, while vital in their own right, generally encompass smaller areas in comparison to the more expansive biosphere reserves and national parks. These sanctuaries, by design, fulfill a dual purpose: safeguarding and facilitating the proliferation of diverse species within their confines.

STUDY SITES

Sultanpur National Park

It is the oldest national park in the state and is a well-known freshwater low-lying marsh (Singh et al., 2021). Sultanpur National Park is renowned as a highly favourable destination for birdwatching enthusiasts due to its exceptional avian diversity. The park is particularly notable for attracting both migratory and resident bird species, further enhancing its appeal for bird observation and study. In September, migratory birds begin to arrive in the park. Birds use the park as a rest stop until March or April of the following year. Sultanpur National Park plays a vital role in offering essential feeding, roosting, and breeding grounds for a significant population of water birds. However, the park faces grave peril due to the detrimental impacts of human activities, which pose a severe threat to its ecological integrity and the associated avian species. The escalating expansion of residential and commercial infrastructure in the vicinity, coupled with the construction of tall buildings, amplified transportation activities, and the development of nearby road and rail networks, collectively exert a substantial impact on the avian population of Sultanpur National Park (Banerjee et al., 2018). The current study was conducted in Sultanpur National Park, it is located at 28°28′ N latitude and 76°53′ E longitude in the district Gurugram of the state of Haryana. The distance of the park is around 50 km from Delhi and 15 km from Gurugram. Around 13727 hectares area are covered by the park, with a core area of 143 hectares dedicated to low-lying marsh vegetation. The average minimum and maximum temperatures in January May and June were 5°C and 30°C, respectively, whereas the average annual rainfall, in the studied region, was 450 mm. The seasonal freshwater marsh known as Jheel has uneven boundaries with constantly changing water levels. The Sultanpur Jheel inside the park has designated a sanctuary in April 1971 under Section 8 of the Punjab Wildlife Protection Act of 1959. The park is a bird paradise for bird watchers. The national park is a major habitat for aquatic birds, including migratory and resident birds. Migratory birds start arriving in the park in September. It is well-known for its migratory and permanent birds. It was notified as a Ramsar site, a wetland of international importance, in 2021. Up until the next March–April, birds utilise the park as a resting area. The migratory birds, which have their hometowns in Europe, Siberia and Central Asia, reach here after covering incredible distances due to cold weather, snow-covered areas and frozen lakes.

Keoladeo National Park

Keoladeo Ghana National Park attained the prestigious designation of a World Heritage Site in the year 1985, under the specific criterion denoted as "iv." The rationale behind this recognition was based on the park's status as a wetland area of global significance, particularly notable for its role as a crucial migratory destination for waterfowl. It emerged as a vital wintering habitat for the exceedingly rare Siberian crane and also served as a dwelling for substantial populations of indigenous nesting avian species.

Subsequently, in the year 2005, during the revision of the World Heritage criteria, Keoladeo Ghana National Park was reclassified under Criterion (x). This classification asserts that sites eligible for World Heritage status must encompass the foremost and most noteworthy natural environments essential for the on-site preservation of biodiversity. This includes areas that harbor endangered species possessing extraordinary universal value from both scientific and conservation perspectives.

Keoladeo National Park (27º8' to 27º12'N and 77º30' to 77º34' E), with an area of 28 km2, is located in Bharatpur district, Rajasthan, on the extreme western end of the Gangetic Basin, where the Gambhir and Banganga rivers originally met. With a large diversity of migrating birds throughout the winter, there are more than 350 species of birds known to exist Given that it is situated in the Asia Pacific Global Migratory Flyway's Central Asian Flyway, Keoladeo National Park is renowned as "Birders Paradise". The park has served as the only wintering location for the majority of the critically endangered Siberian Cranes (*Grus leucogeranus*). The park is located in an area that is primarily agricultural and is crisscrossed by irrigation canals, earning it designation as both a Ramsar site and a World Heritage Site for its high significance for bird life.

Bhindawas Bird Sanctuary

On July 5, 1985, the Haryana government's Forests Department formally designated this 411.55-hectare tract as a wildlife sanctuary. The Bhindawas Bird Sanctuary is situated 25 Km south of Jhajjar (28º37′N, 76º40′E). It is located 80 kilometres north of Delhi and 15 Km from the administrative centre of the Jhajjar district. This Sanctuary covers a total of 1016.94 acres. On May 7, 1986, it received notification that it was a wildlife sanctuary. A lake with a 12 km radius is also present in the area. Kanwah, Bilochpura, Nawada, Redhuwas, Shanjabanpur, Kunjah, and Chadwana are the seven villages that surround the sanctuary. The average minimum and maximum temperatures in January and May and June were 7°C and 40.5°C, respectively, whereas the average annual rainfall, in the studied region, was 444 mm. Birds are the main attraction of the wetland complex. Migratory birds start arriving in the park in October. Throughout the year, over 30,000 different migratory and resident birds from over 250 species visit the wetlands throughout the year. Migratory. Until the following March–April, birds utilise the park as a resting area. The Bird Sanctuary is a major habitat for aquatic birds, including migratory and resident birds.

Table 1. Comparative study of the different areas' climatic conditions.

Sl. No.	Topic	Sultanpur	Bhindawas	Keoladeo National Park
1.	Location	Gurugram (Haryana)	Jhajjar (Haryana)	Bharatpur (Rajasthan)
2	Area	13727 hectares	412 hectares	2912 hectares
3.	Temperature (Jan-Feb)	18-22 °C	20-24 °C	21-25 °C
	High	5.0-7.0 °C	8.0-11 °C	8-12 °C
	Low			
4	Rainfall	16.9-26.9 mm	12.4-17.5 mm	9.6-10.6 mm
5.	Wind Speed	2.4-2.7 m/s	2.8-3.0 m/s	2.5-2.8 m/s

Identification

Identification of birds was conducted following a structured methodology that combines field observation, photographic documentation, and reference to a comprehensive field guide (Grimmet et al., 2016). The process adhered to the guidelines established by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram to ensure transparency and reproducibility.

1. Field Observation:

Birds were initially identified through field observation using binoculars, allowing for close examination of their size, coloration, and behavior. This step involved carefully noting distinctive features such as plumage, markings, and any unique behaviors exhibited by the birds in their natural habitat.

2. Photographic Documentation:

Following initial identification, photographs of the observed birds were captured using a Sony DCX 400V camera. This photographic documentation served as a valuable reference for subsequent analysis. The use of a high-quality camera ensured clarity and detail in the images, facilitating accurate identification during later stages of the process.

3. Comparison with Field Guide:

The field guide by Grimmet et al., (2016) was utilized as the primary reference for bird identification. Each photograph taken in the field was systematically compared with the images in the field guide to identify key characteristics and confirm the species.

4. Visual Identification Method:

The combination of size and form was employed as an effective method for visual identification of birds. This involved assessing the relative size of the bird and observing its overall form, including features such as beak shape, wing morphology, and tail structure. The visual identification method was applied during field observation and cross-referenced with the field guide for confirmation.

PRISMA Flow Diagram:

A PRISMA flow diagram (Figure 1) detailing the step-by-step process of bird identification, from initial observation to the final confirmation using the field guide, is provided to ensure clarity and transparency in reporting the methodology.

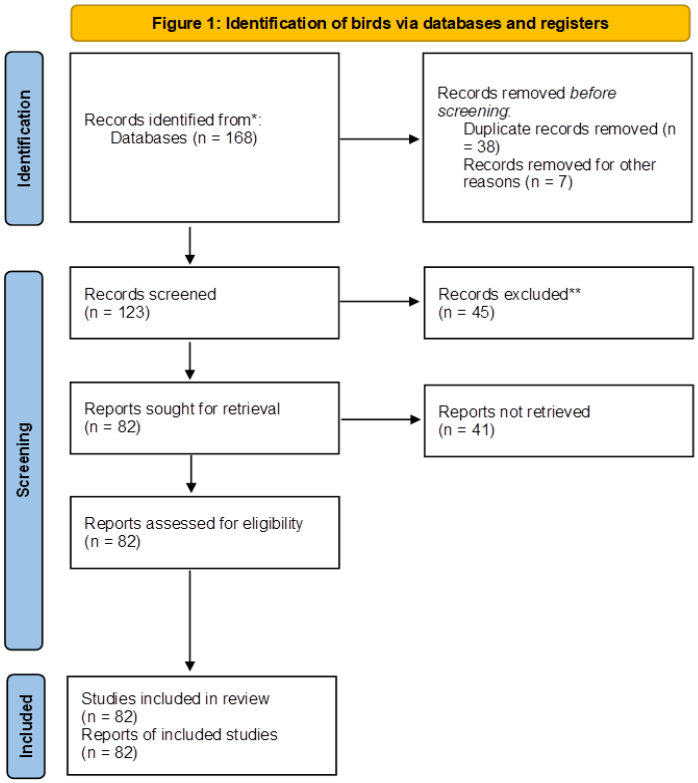


Figure 1. Identification of birds via database and registers

Table 2. Data Table of birds spotted at Bhindawas Bird Sanctuary, Sultanpur National Park and Keolade National Park.

SL No.	Order	Family	Common Name	Scientific Name	Status
1.	Podicipediformes	Podicipedidae	Little Grebe	Tachybaptus ruficollis	R
			Great Created Grebe	Podiceps cristatus	M
			Black Necked Grebe	Podiceps nigricollis	M
2.	Ciconiiformes	Ardeidae	Grey Heron	Ardea cinera	M
			Cattle Egret	Bulbulcus ibis	R
		Ciconiidae	Painted stork	Mycteria leucocephala	R
		Ardeidae	Purple Heron	Ardea purpurea	M
			Little egret	Egretta garzetta	M
		Ciconiidae	White Stork	Ciconia ciconia	R
			Black Necked Stork	Ephippiorhyncus asiaticus	M
			Open Bill Stork	Anastomus oscitans	M
3.	Anseriformes	Anatidae	Grey Leg Goose	Anser anser	M
			Common Teal	Anas crecca	M
			Mallard	Anas platyrhynchos	M
		Threskiornithidae	Black Headed Ibis	Threskiornis melanocephalus	M
			Bar headed Goose	Anser indicus	M
			Spot- billed Duck	Anas poecilorhyncha	R
			Cotton Teal	Nettapus coromandelianus	M
			Comb Duck	Sarkidiornis melanotoss	M
			Red Crested Pochard	Netta rufina	M
			Marbled Duck	Marmaronetta angustirostris	M
			Common Shelduck	Tadorna tadorna	M
			Cotton Pygmy Goose	Nettapus coromandelianus	M
			Indian Spot-billed Duck	Anas poecilorhyncha	R
			Gadwell	Mareca strepera	M
		Anseridae	White Fronted Goose	Anser albifrons	M
		Anatidae	Northern Pintail	Anas acuta	M
			African comb duck	Sarkidiornis melanotos	M
4.	Falconiformes	Accipitridae	Black Shoulder Kite	Elanus caeruleus	R
			Tawny Eagle	Aquila rapax	M
5.	Galliformes	Phasianidae	Grey Francolin	Francolinus pondicerianus	R

Continued

6.	Charadriiformes	Scolopacidae	Common Sandpiper	*Actitis hypoleucos*	M
		Jacanidae	Bronze-Winged Jacana	*Metopidius indicus*	M
		Scolopacidae	Marsh Sandpiper	*Tringa stagnatilis*	M
			Common green shank	*Tringa nebularia*	M
		Recurvirostridae	Pied Avocet	*Recurvirosta avosetta*	M
		Scolopacidae	Sanderling	*Calidris alba*	M
		Jacanidae	Lesser Jacana	*Microparra capensis*	M
		Scolopacidae	Curlew Sandpiper	*Numenius hudsonicus*	M
7.	Columbiformes	Columbidae	Red Collared Dove	*Streptopelia tranquebarica*	R
		Columbidae	Eurasian Collard Dove	*Streptopelia decaocto*	R
8,	Coraciformes	Alcedinidae	White Throated King Fisher	*Halcyon smyrenensis*	R
		Meropidae	Blue Cheeked Bee-Eater	*Merops persicus*	M
		Alcedinidae	Pied King Fisher	*Ceryle rudis*	M
9.	Gruiformes	Rallidae	Common Moorhen	*Gallinule chloropus*	M
			Purple Swamphen	*Porphyrio porphyria*	R
		Scolopacidae	Common Red Shank	*Tringa totanus*	M
		Rallidae	Common Coot	*Fulica atra*	M
		Scolopacidae	Spotted Sandpiper	*Tringa erythropus*	M
		Gruidae	Sarus Crane	*Grus antigone*	R
		Rallidae	Purple Moorhen	*Porphyrio porphyrio*	M
		Rallidae	White Breasted Waterhen	*Amaurornis phoenicurus*	M
10.	Pelecaniformes	Threskiornithidae	Spoonbill	*Platalea ajaja*	R
		Ardeidae	Indian Pond Heron	*Ardeola grayii*	R
			Great White Egret	*Ardea alba*	R
		Phalacrocoracidae	Indian Cormorant	*Phalacrocorax fusicollis*	M
		Threskiornithidae	Eurasian spoonbill	*Platalea leucorodia*	M
		Ardeidae	Black-crowned Night-Heron	*Nycticorax nycticorax*	R
			Small Egret	*Egretta garzetta*	R
11.	Suliformes	Anhingidae	Oriental Darter	*Anhinga melanogaster*	R
			Anhinga	*Anhinga anhinga*	M
12.	Accipitriformes	Accipitridae	Honey Buzzard	*Pernis ptilorhynchus*	R
			European honey buzzard	*Pernis apivorus*	M
			Shikra	*Accipiter virgatus*	R
			Egyptian Vulture	*Neophron percnopterus*	R
			Black Kite	*Milvus migrans*	R

13.	Psittaciformes	Psittaculidae	Rose Ringed Parakeet	*Psittacula krameri*	**R**
			Alexandrine parakeet	*Psittacula eupatria*	R
14.	Passeriformes	Muscicapidae	Indian Robin	*Saxicoloides fulicuta*	R
		Motacillidae	White Wagtail	*Motacilla alba*	M
		Corvidae	Large Billed Crow	*Corvus macrorhychos*	R
		Laniidae	Brown Shrike	*Lanius cristatus*	M
		Sturnidae	Common Myna	*Acridotheres tristis*	R
		Timaliidae	Large Grey Babbler	*Argya malcolini*	R
		Corvidae	House Crow	*Corvus splendens*	R
			Large Billed Crow	*Corvus macrorhyncos*	R
		Phylloscopidae	Common Chiffchaff	*Phylloscopus collybita*	R
		Motacillidae	Grey wagtail	*Motacilla cinerea*	M
		Passeridae	House Sparrow	*Passer domesticus*	R
		Muscicapidae	Pied Bus Chat	*Saxicola caprata*	M
15	Piciformes	Megalaimidae	Brown-Headed Barbet	*Psilopogon zeylanicus*	R
			Coppersmith Barbet	*Psilopogon haemacephalus*	R

The present studies were carried out from January to March for the investigation of avian diversity of Bhindawas Birds Sanctuary, Sultanpur National Park and Keoladeo National Park.

In the present study, a total of 82 species of birds were identified in different places like Bhindawas Birds Sanctuary, Sultanpur National Park and Keoladeo National Park. Bird species were found in 15 orders. The study revealed that the maximum number of species belonged to the order Anseriformes followed by Passeriformes, Ciconiiformes, Charadriiformes, Gruiiformes, Pelecaniformes Accipitriformes, Coraciiformes, Podicipediformes, Falconiformes, Psittaciformes, Suliformes, Columbiformes, and Piciformes, Galliformes with least number of species. Earlier study by Girish Chopra (2013), in Sultanpur National Park, Gurugram had also reported that Passeriformes is the most dominant order representing a maximum number of species in the national park. The majority of the bird species in their investigation were migratory, while the remainder were resident species. The Bhindawas Bird Sanctuary showed a diverse distribution of birds in several sorts of habitats, including along the sides of highways, around lakes, and near agricultural fields. A total of 82 species were recorded from the Bhindawas Bird Sanctuary, Sultanpur National Park and Keoladeo National Park. Out of the total 82 species spotted, 48 species were winter migrants while 34 species were residents. Due to greater food availability and good climatic conditions for nesting and roosting in SNP and Keoladeo National Park, a maximum number of species were reported in earlier research studies during the winters (Priya et al., 2022; Bhadoria et al., 2012). Thousands of migratory birds come from different areas to find the best ecological conditions and habitats for feeding, breeding and raising their young. When conditions at breeding sites become unfavourable, it is time to fly to regions where conditions are better. Birds have played a unique role in the growth, protection and restoration of the natural environment and their importance and significance in the maintenance of a clean and healthy environment is of high order. The rich diversity of the birds, documented during the present study, may be because of the availability of varied habitats including forest patches, low-laying marshy areas as well as the availability of different sources of food.

The presence of diverse food sources, including fish, crustaceans, invertebrates, water plants, and plankton, within wetland habitats contributes significantly to the overall diversity of bird species. These varied food resources available in wetland ecosystems play a crucial role in supporting and sustaining a wide range of bird populations, thus enhancing the overall avian biodiversity within these habitats. During the winter season, water birds exhibit a need for aggregated platforms within water bodies, serving as designated areas for basking. These platforms play a crucial role in providing suitable perching sites for water birds, enabling them to engage in sunning behaviour and regulate their body temperature effectively. The availability of clustered platforms within water bodies is essential for facilitating the winter thermoregulation and overall well-being of water bird species. Out of 82 species, 34 species were resident while 48 were migrant species.

Table 3. Status of bird orders recorded in Bhindawas Bird Sanctuary, Sultanpur National Park and Keoladeo National Park.

S. No.	Order	No. of species	Percent occurrence
1.	Anseriformes	17	20
2.	Passeriformes	12	14.6
3.	Ciconiiformes	08	9.4
4.	Charadriiformes	08	9.4
5.	Gruiiformes	08	9.4
6.	Pelecaniformes	07	8.2
7.	Accipitriformes	05	5.8
8.	Coraciiformes	03	3.52
9.	Podicipediformes	03	3.52
10.	Falconiformes	02	2.35
11.	Psittaciformes	02	2.35
12.	Suliformes	02	2.35
13.	Columbiformes	02	2.35
14.	Piciformes	02	2.35
15.	Galliformes	01	1.17

The Keoladeo National Park exhibited the highest observed species richness, followed by Sultanpur National Park and Bhindawas Bird Sanctuary, in descending order.

Habitat Diversity: Keoladeo National Park likely offers a greater diversity of habitats, including wetlands, woodlands, and grasslands. This diversity provides niches for a wider range of bird species, attracting both migratory and resident birds.

Geographical Location: Keoladeo National Park's geographical location may place it along important migratory routes, making it a preferred stopover for a variety of migratory birds. Its location could offer favourable conditions for birds travelling from northern breeding grounds to southern wintering areas.

Food Availability: The availability of food resources, such as aquatic plants, insects, and small vertebrates, may be abundant in Keoladeo National Park, which can attract a larger number of bird species.

Conservation Efforts: Effective conservation measures and habitat management within Keoladeo National Park may have contributed to its ability to support a diverse bird population.

Protection and Preservation: Keoladeo National Park's long history of protection and preservation as a designated wildlife sanctuary could have created a relatively undisturbed and safe environment for various bird species to thrive.

Historical Significance: Keoladeo National Park may have a longer history of attracting ornithologists, researchers, and conservationists, leading to a more comprehensive understanding of its avian biodiversity.

While the predominant proportion of documented avian species consisted of migratory taxa, a notable number of resident species were also documented. Within the observed species assemblage, the Anseriformes order demonstrated the highest species count, with a total of 17 species identified. Conversely, the Galliformes order represented the lowest species count, with only a single species documented (Figure 2).

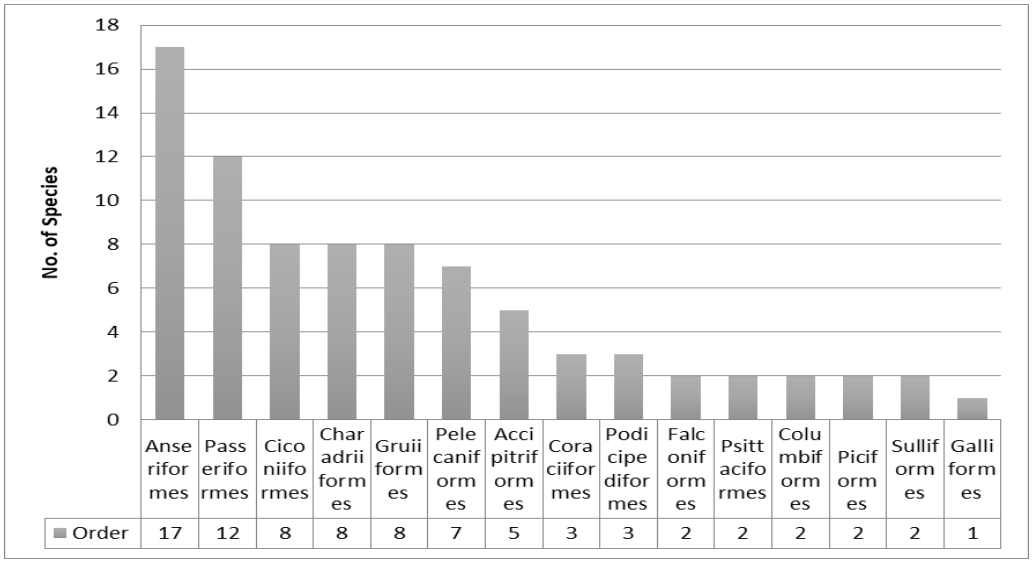


Figure 2. Graphical representation of the incidence of avian biodiversity spotted in Sultanpur

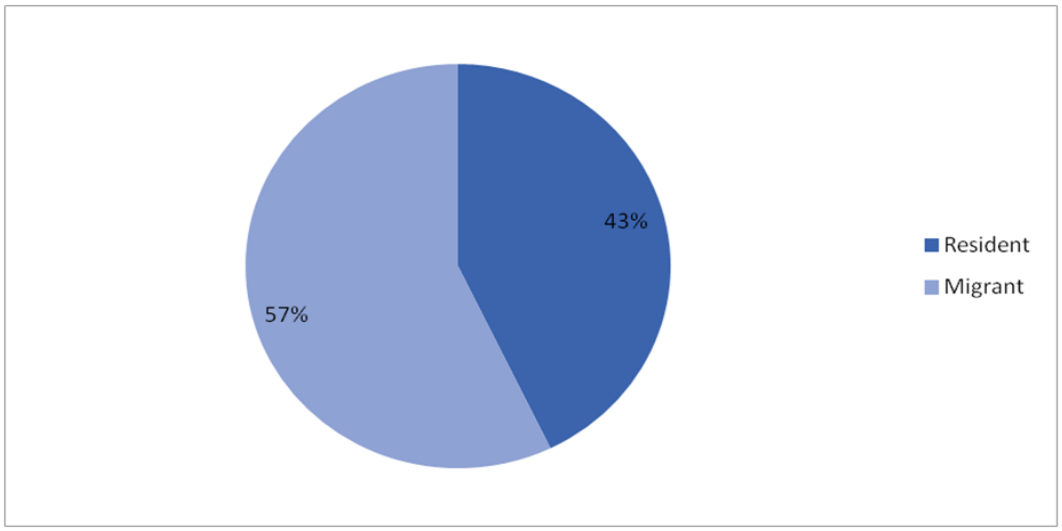


Figure 3. Overall percentage composition of resident and migratory bird of all the different study sites.

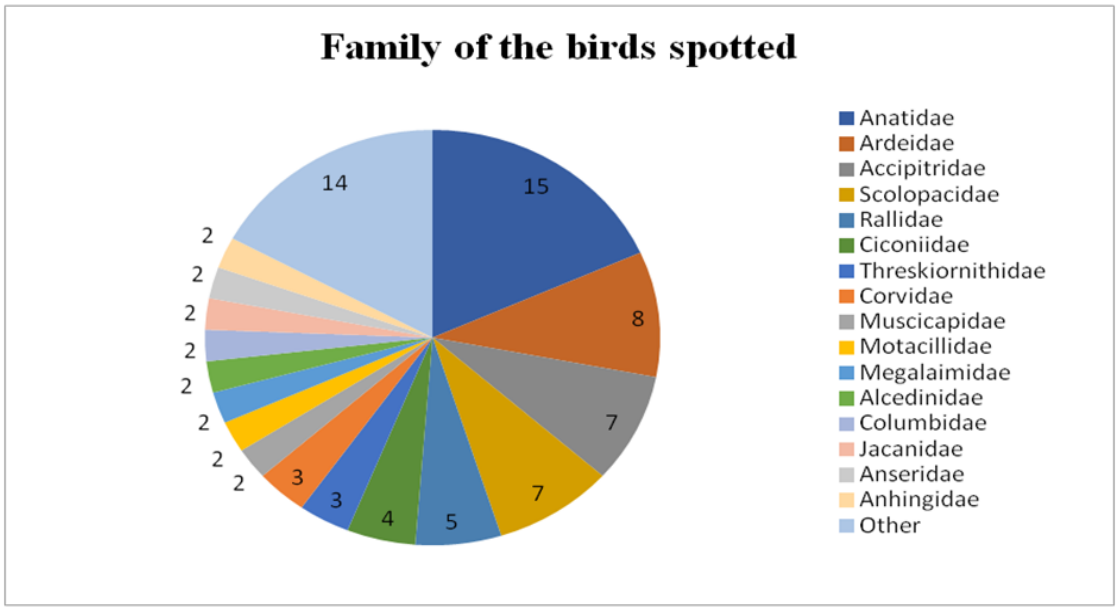


Figure 4. Overall percentage composition of resident and migratory bird of all the different sites.

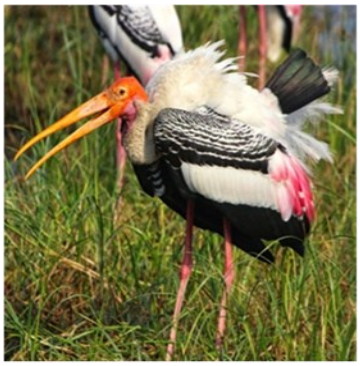
The Sultanpur National Park, Keoladeo National Park, and Bhindawas Bird Sanctuary all have different environments that support a broad variety of migratory as well as resident bird species. A wide variety of bird species can be found in the varied habitats created by the park island, lush trees, and nearby swampy regions. The migratory birds' diversity was found to be higher in winter seasons as compared to the residential bird species. We gave an updated and extended list of the bird species found in the Bhindawas Bird Sanctuary, Keoladeo National Park, and Sultanpur National Park. The bird species observed at the Sultanpur, Keoladeo National Park and Bhindawas bird sanctuary include both resident and migratory bird species. The Sultanpur, Keoladeo National Park is home to numerous species of birds ranging from small colorful birds to large size migratory birds. The count of migratory birds was small in the Bhindawas Bird Sanctuary as compared to the Sultanpur and Keoladeo National Park.

Bhindawas Bird Sanctuary, Sultanpur, and Keoladeo National Parks offer valuable educational opportunities for visitors. These natural reserves provide informative signage and conduct guided tours, greatly enhancing visitors' understanding of the diverse bird species that inhabit these areas. The presence of numerous avian fauna species highlights the need for further scientific investigation and increased fieldwork in both the national park and Bhindawas bird sanctuary.

The study area serves as an ideal location for numerous migratory bird species, particularly during the winter season. Additionally, it provides a favorable habitat for resident bird species, offering essential roosting and nesting opportunities. The National Parks' remarkable range of habitats and diverse environments attract and support a significant number of avifaunal species.

Given the significance of these ecological sites, it is highly recommended to minimize or altogether avoid any developmental or human activities in and around the national park region. It is crucial to implement appropriate measures that prioritize the protection and preservation of the avian heritage within these National Parks and Sanctuaries. By doing so, we can ensure the long-term conservation of these invaluable ecosystems and safeguard the future of the avian populations that rely on them

Photo plate 1. Birds spotted at different sites



Painted Stork

Grey Heron

Grey Leg Goose

Purple Swamphen

Common Teal

White-Fronted Goose

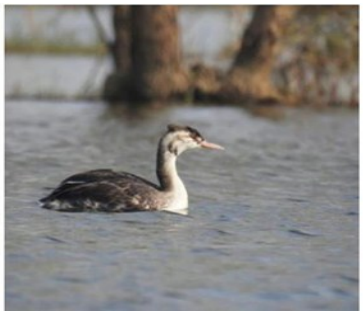
Black-Headed Ibis

Jacana Bird

Cattle Egret

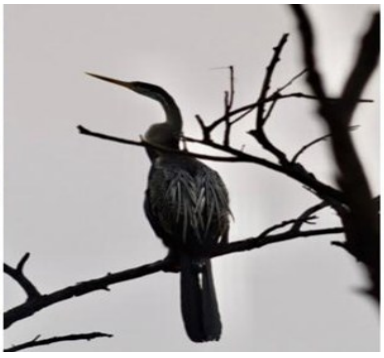
Eurasian Spoonbill

Gadwall



Great crested Grebe

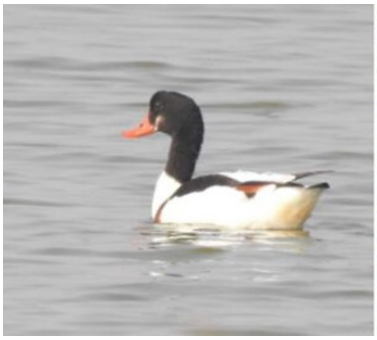
Curlew Sandpiper



Anhinga

Indian Pond Heron

Photo plate 2. Birds spotted at different sites



Common Shel Duck

Black Necked Grebe

Bar headed Goose

Snake Birds

Marsh Sandpiper

Common Moorhen

Shikara

Black Ibis

European Honey Buz-

Crested Honey Buzzard

Eurasian curlew

Common Red Shank

Eurasian Collard Dove

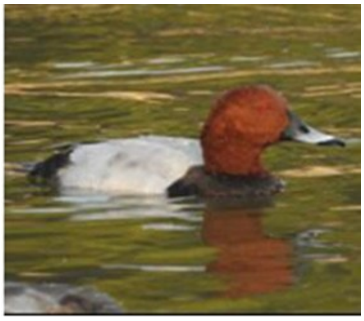
Sarus Crane

Tufted Duck

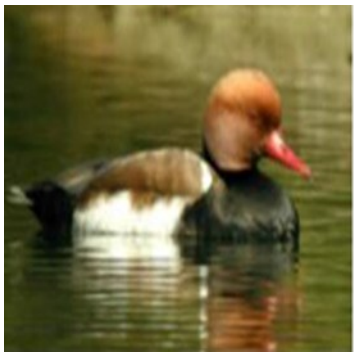
Photo plate 3. Birds spotted at different sites

Black Stork

Little Egret



Common Pochard



Red Crested

Common Kingfisher

Red Collared

CONCLUSION

Birds that migrate prominently during the winter were seen in Sultanpur National Park, Bhindawas Bird Sanctuary, and Keoladeo National Park. A total of 84 bird species were found in the study area, with the winter season having the maximum migratory bird diversity as compared to the resident birds. The study area contains diverse avian biodiversity, but it also supports several mammalian species such as Neelgai, Jungle Cat, Monkey, and Rabbit.

The avian biodiversity in the Bhindawas Bird Sanctuary, Sultanpur National Park, and Keoladeo National Park is under threat from an increase in anthropogenic influences, including habitat degradation and fragmentation, pressure from tourists, and improper management of food for birds. However, fewer migratory birds were sighted in the current survey than in past investigations, and there are fewer declining population trends for many documented bird species. It is a worrying indicator for the preservation of the avian diversity in this area. This calls for an urgent action plan for their conservation.

Additionally, it is suggested that regular research be done on the diversity, abundance, residency status, and migration patterns of birds to identify any declines in these characteristics as well as population sizes and their ecological causes. Therefore, necessary action must be taken to make it a more acceptable habitat for the various permanent and migratory bird species.

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