Study of the Avian Diversity in Jasder Dham, Barmer, Rajasthan

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Abstract— *Jasder Dham is a unique site in Barmer, Rajasthan. Despite being located in an arid region, the presence of a pond supports a significant diversity of aquatic birds. This research study aims to investigate the avian diversity within Jasder Dham, driven by the need to understand the ecological significance of this unique habitat and its role in supporting avian populations.*

Avian diversity studies in the arid zones of Rajasthan have been relatively limited. This research seeks to fill this gap by providing valuable insights into the bird species of various families inhabiting Jasder Dham.

The findings of this study will contribute to our understanding of the avian community structure in arid ecosystems, particularly in the context of Barmer, Rajasthan. Furthermore, the results may have implications for conservation efforts, as the identification of key bird species and their ecological requirements can guide conservation strategies aimed at preserving biodiversity in this unique habitat. Overall, this research serves as a valuable addition to the knowledge base on avian diversity in arid regions, emphasizing the importance of holistic conservation approaches for sustaining ecological balance.

Keywords— Jasder Dham, Avian, Diversity, Barmer, Birds, Desert.

I. INTRODUCTION

Rajasthan, situated in northwestern India, is a state renowned for its rich birdlife despite facing water scarcity. Remarkably, this state, comprising only 10% of India's geographical area, is home to approximately 40% of the country's avifauna (1224 species). This high avian diversity can be attributed to the region's diverse habitats and its location within a major migratory bird flyway.

An estimated 510 bird species are believed to occur in Rajasthan (Grimmett and Inskipp 2003), with 496 species recorded to date (Devarshi, D. 2004), representing around 40% of the Indian avifauna.

Our understanding of Barmer's avian fauna has been enriched by several studies. Rahmani (1997) conducted a comprehensive survey, documenting 213 species, including 35 in Barmer, highlighting the presence of diverse avian populations, even in this arid region. Subsequent studies, such as those by Sivaperuman et al. (2005) and Kumar et al. (2006), further expanded our knowledge. Kumar et al. (2006), focusing on wetland birds, listed 53 species from Barmer in their 'Geo-spatial Atlas for the wetland birds of GITD.'

More recently, as part of the Zoological Survey of India's assessment of the impact of proposed lignite mining in the Kapurdi and Jalipa Blocks and the surrounding 10-kilometer radius of Barmer district, "General Faunistic Surveys" were conducted. These surveys, covering approximately 850 square kilometers, meticulously recorded avian species, resulting in a comprehensive bird checklist for the Barmer district. This checklist encompasses a total of 153 species, representing 103 genera and 46 families (Tak et al., 2009).

II. MATERIALS AND METHODS

This study was conducted from July 2022 to January 2024 at and around Jasder Dham (25.773069, 71.425928), located in Barmer district, Rajasthan, India. Barmer, situated in the westernmost part of Rajasthan, forms a significant portion of the Great Indian Thar Desert (GITD). The study area exhibits an arid climate with an average annual rainfall of 150-280 mm and extreme pre-monsoon temperatures ranging between 44 and 52 degrees Celsius. High wind speeds, averaging 10-40 km/hour during summers, contribute to high rates of evaporation and transpiration (1000-1200 mm annually).

FIGURE 1: The study area

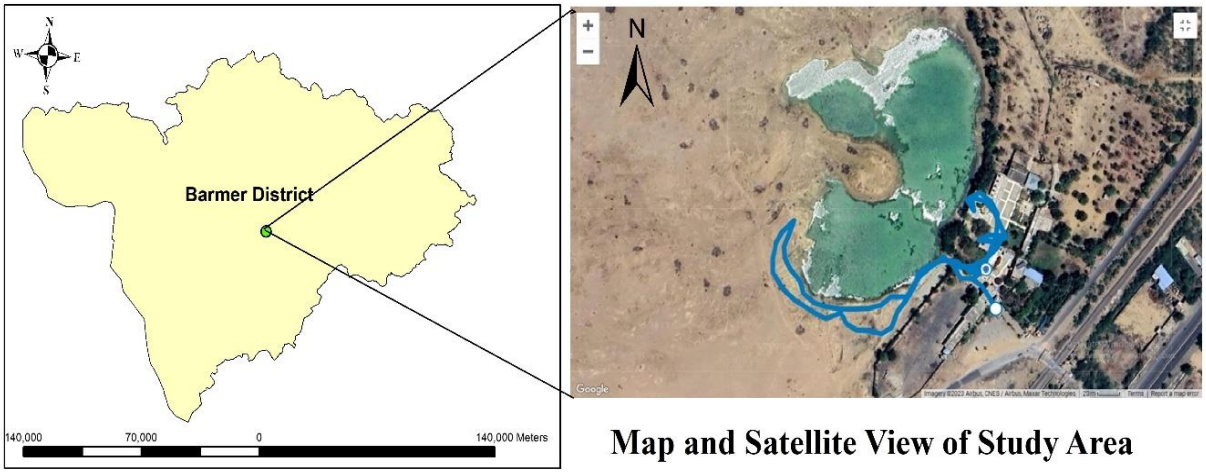

FIGURE 2: Map and Satellite View of Study Area (Jasder Dham, Barmer) (Map Source- ArcGIS and Google Map)

Field surveys were conducted regularly during all seasons, with morning sessions (05:00 AM to 10:00 AM) and evening sessions (04:00 PM to 07:00 PM). Each visit involved a 1-2 km transect within and around Jasder Dham. Data was collected seasonally to compare avian diversity across different periods.

2.1 Data Collection Techniques:

- **Bird Observation:** Bird sightings were recorded using 10x50 DPS I binoculars (Olympus).
- **Photography:** Canon B600 cameras were used to photograph observed bird species.

- **Location Tracking:** A Garmin eTrex GPS device and the eBird app were used to record the location of bird sightings.
- **Bird Identification:** Bird species were identified using the field guide "The Book of Indian Birds" by Dr. Salim Ali.

2.2 Data Analysis:

- **Point-Count Surveys (PCS):** The Point-Count Survey method was employed to assess avian biodiversity at fixed locations within the study area for a predetermined time period. This method is suitable for year-round surveys and allows for the recording of both seen and heard birds (Kumar, 2018).
- **Seasonal Analysis:** Seasonal grand totals were calculated, and a Seasonal Index (SI) was determined for each species by dividing the seasonal total of individual species by the seasonal grand total of all species and multiplying by 100.
- **Relative Diversity Index (RDi):** The RDi of each bird order was calculated using the following formula:

RDi = (Number of bird species in an order / Total number of bird species) x 100 (1)

III. OBSERVATIONS

Extensive field surveys were conducted within a 2.11 km² area encompassing Jasder Dham and its surroundings. These surveys involved systematic observations along transects, covering approximately 6 km around the pond circumference. Observations were conducted regularly during all seasons, with morning sessions (05:00 AM to 10:00 AM) and evening sessions (04:00 PM to 07:00 PM).

A total of 65 bird species belonging to 35 families were documented within the study area. The relative diversity of avian fauna is presented in Table 1 and Figure 4. A complete checklist of the documented avian fauna is provided in Appendix 1.

Notably, 19 species (7 families) were identified as waterbirds, highlighting the importance of the pond as a crucial habitat for aquatic avifauna. White-throated Kingfishers and Pied Kingfishers were commonly observed. The presence of a diverse small bird community attracted a variety of raptors, including hawks, kites, eagles, and vultures. Figure 3 showcases photographs of some of the bird species observed within the study area.

FIGURE 3: Photographs of some birds taken during field work (Upper Row- from Left→Right: White wagtail, Indian Rollar, Black naped ibis, Lesser Cormorant; Middle Row→ Black drongo, White throated kingfisher, Common sandpiper, Shikra; Lower Row→ Black-Winged Stilt, Eurasian coot, House crow, Indian Pond Heron)

TABLE 1
RELATIVE DIVERSITY (RDI) OF VARIOUS AVIAN FAMILIES AT JASDER DHAM, BARMER

S.N.	Avian Family	No. of Species	RDi
1	Accipitridae	6	9.2
2	Alaudidae	1	1.5
3	Alcedinidae	2	3.1
4	Anatidae	5	7.7
5	Anhingidae	1	1.5
6	Ardeidae	5	7.7
7	Burhinidae	1	1.5
8	Caprimulgidae	1	1.5
9	Charadriidae	1	1.5
10	Ciconiidae	1	1.5
11	Columbidae	4	6.2
12	Coraciidae	1	1.5
13	Corvidae	2	3.1
14	Cuculidae	3	4.6
15	Dicruridae	1	1.5
16	Falconidae	1	1.5
17	Laniidae	1	1.5
18	Laridae	1	1.5
19	Leiothrichidae	1	1.5
20	Meropidae	1	1.5
21	Motacillidae	2	3.1
22	Muscicapidae	4	6.2
23	Passeridae	1	1.5
24	Phalacrocoracidae	2	3.1
25	Phasianidae	2	3.1
26	Psittacidae	1	1.5
27	Pteroclididae	1	1.5
28	Pycnonotidae	2	3.1
29	Rallidae	2	3.1
30	Recurvirostridae	1	1.5
31	Scolopacidae	1	1.5
32	Strigidae	1	1.5
33	Sturnidae	2	3.1
34	Threskiornithidae	2	3.1
35	Upupidae	1	1.5

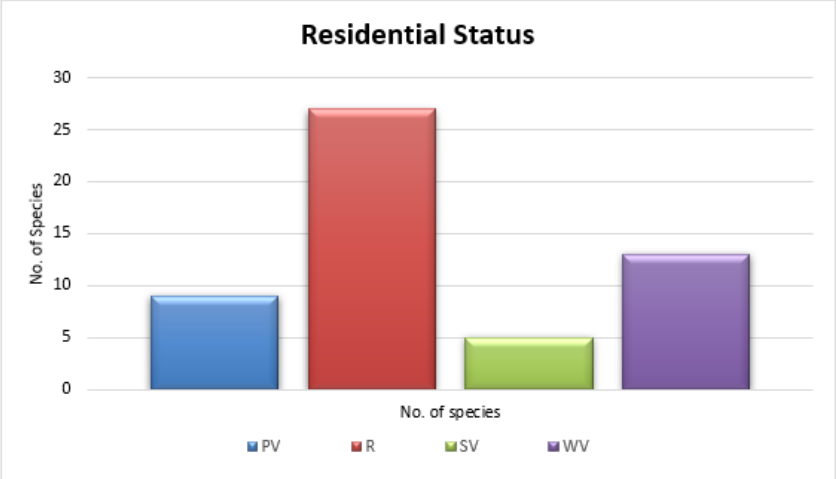

FIGURE 4: Chart showing comparative residential status of avian diversity at study area.
(Note: Residential Status- (R=Resident: PV= Passage visitor: SV= Summer visitor WV= Winter visitor)

3.1 Threats and Challenges:

The study also investigated the threats and challenges faced by avian fauna in and around the study area. Ongoing development activities pose a significant risk to avian populations by leading to habitat loss and fragmentation.

3.2 Seasonal Variation in Bird Abundance:

The frequency of bird species sightings was recorded for each season: summer (April-June), monsoon (July-October), and winter (November-March). The seasonal grand totals were 343, 418, and 603, respectively.

A Seasonal Index (SI) was calculated for each species to assess its relative abundance in each season. SI values greater than 1 indicate higher abundance in that season compared to the average across all seasons. Conversely, SI values less than 1 indicate lower abundance. The SI values for each species were plotted to understand seasonal patterns of occurrence.

Statistical analysis revealed that the mean and median number of reported birds were highest in summer. The standard deviation was also highest in summer, indicating greater variability in bird abundance during this season. Boxplots (Figure 5) were used to visualize the distribution of bird species frequencies across different seasons. Figure 6 presents the seasonal variation in the total number of bird species reported, demonstrating that winter had the highest species diversity (65 species) while summer had the lowest (52 species).

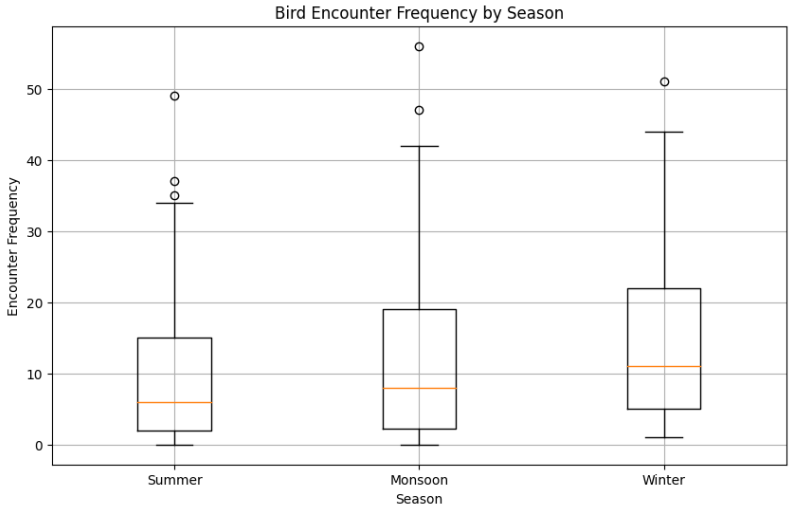

FIGURE 5: Boxplot showing bird encounter frequency in summer, monsoon and rainy season at Jasder Dham

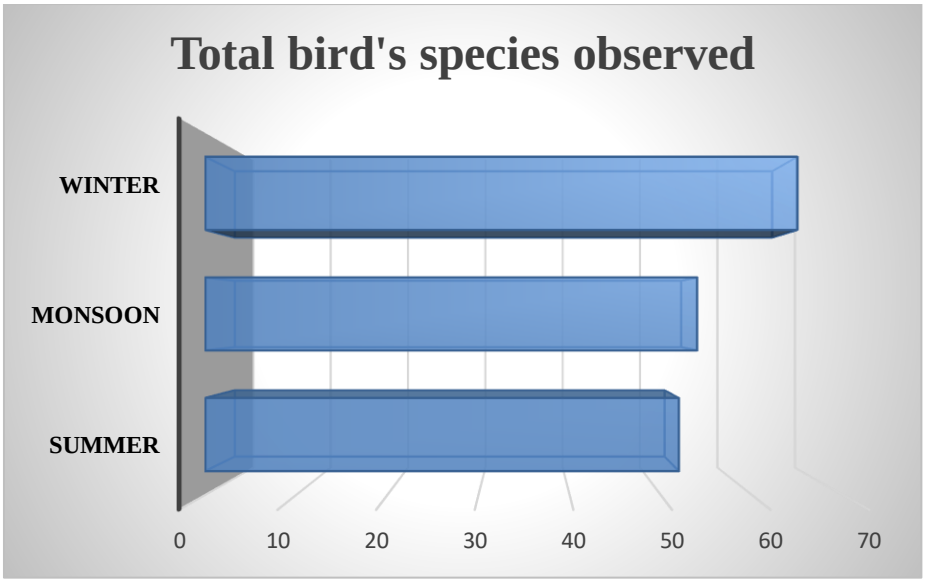

FIGURE 6: 3-D Clustered bar graph showing total bird species recorded in each seasons

3.3 Observations on Endangered Species:

The study area provides suitable habitat for endangered vulture species, particularly the Egyptian Vulture (*Neophron percnopterus*). The presence of carcass dumping sites near the wetland provides a reliable food source for these scavengers. Egyptian Vultures were frequently observed resting on Khejri trees (*Prosopis cineraria*) and actively feeding on carcasses. This suggests that the study area plays a crucial role in supporting the conservation of endangered vulture species, including the Egyptian Vulture, White-rumped Vulture (*Gyps bengalensis*), and Indian Vulture (*Gyps indicus*).

3.4 Threats to Avian Diversity:

Several threats are impacting avian diversity in and around Jasder Dham:

- **Water Pollution:** The immersion of Lord Ganesha idols, often made of harmful chemicals, during the festival of Ganesh Chaturthi contaminates the pond water. This pollution can lead to the depletion of dissolved oxygen and the accumulation of toxic sediments, posing a serious threat to aquatic life, including birds.
- **Kite Flying Hazards:** The use of thin but sharp threads during Makar Sankranti (kite flying festival) poses a significant threat to birds. These threads can entangle and injure birds, often resulting in fatalities.
- **Improper Waste Disposal:** The dumping of domestic and commercial waste, along with the improper disposal of dead animals, can contaminate the environment and pose health risks to birds.
- **Human Disturbance:** Increased human activity in the area, such as recreational activities and urbanization, can disrupt bird breeding, feeding, and roosting behaviors.
- **Electrocution:** Power lines and transmission towers pose a significant threat to birds, particularly large raptors, through electrocution.
- **Predation by Feral Dogs:** Feral dog populations can prey on ground-nesting birds and their eggs, impacting avian populations.

IV. RESULTS AND DISCUSSION

This study documented 65 bird species belonging to 35 families within and around Jasder Dham, demonstrating a rich avian diversity that includes resident, resident-migratory, and migratory species. Despite the presence of human settlements, the study area supports a significant avian population.

4.1 Seasonal Variation:

Bird species encounters varied across seasons. Summer exhibited the highest activity, followed by winter and monsoon. The highest variability in sightings was observed during summer, suggesting a wider range of species observed during this period.

- **Summer:** Average Bird Count (ABC) was approximately 10.54. Red-wattled Lapwing was the most frequently sighted species, while Eurasian Griffon Vulture, Black-shouldered Kite, Long-legged Buzzard, Comb Duck, Northern Pintail, Common Pochard, Great Cormorant, and Common Kestrel were observed less frequently.
- **Monsoon:** ABC was approximately 12.37. India Pigeons and Doves were the most frequently sighted, while Common Pochard, Common Kestrel, Great Cormorant, Common Sandpiper, and Red-naped Ibis were less frequent.
- **Winter:** ABC was approximately 10.11. Pigeons, doves, vultures, and kites were frequently observed, while Oriental White Ibis, Northern Pintail, Eurasian Griffon, Common Pochard, Great Cormorant, Common Kestrel, and Red-naped Ibis were less frequent.

  This quantitative seasonal analysis indicates significant variations in bird species encounter frequencies across different seasons. Notably, winter exhibited the highest diversity of migratory bird species.

4.2 Community Composition:

Analysis of the species checklist (Appendix 1) revealed that resident birds dominate the avifauna. Carnivorous birds comprise a significant portion of the resident population, suggesting a diverse prey base within the habitat. Passage visitors, primarily carnivorous birds, likely utilize the area as a foraging ground during their migration.

4.3 Conservation Status:

The majority of bird species observed were classified as "Least Concern" by the IUCN Red List, indicating relatively stable populations. However, the presence of endangered (E) species like the Egyptian Vulture and near-threatened (NT) species like the Indian Thick-knee highlights the need for focused conservation efforts.

4.4 Ecological Significance:

The presence of diverse bird families, such as Accipitridae, Ardeidae, and Columbidae, indicates a diverse habitat supporting various ecological niches.

4.5 Threats and Conservation:

The study identified several threats to avian populations, including:

- Water pollution from idol immersions during festivals.
- Bird fatalities due to kite flying with sharp threads during Makar Sankranti.
- Improper waste disposal and habitat degradation.
- Electrocution from power lines.
- Predation by feral dogs.

To mitigate these threats, it is crucial to implement conservation measures and raise awareness among local communities about the importance of environmental protection and habitat conservation.

V. CONCLUSION

This study provides valuable insights into the avian community composition, ecological interactions, and conservation needs within the Jasder Dham region. Conservation strategies should prioritize the protection of critical habitats, maintaining ecological connectivity, and mitigating threats such as habitat loss, pollution, and climate change.

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APPENDIX I

List of avian diversity observed in and around Jasder Dham, Barmer, Rajasthan, India.

S.N.	Name of Bird	Scientific Name	Family	Residential Status	IUCN STATUS	Feeding Status
1.	Egyptian Vulture	*Neophron percnopterus*	Accipitridae	PV	E	Carnivores
2.	Eurasian Griffon	*Gyps fulvus*		PV	LC	Carnivores
3.	Black Kite	*Milvus migrans*		R	LC	Carnivores
4.	Black Shouldered Kite	*Elanus caeruleus*		PV	LC	Carnivores
5.	Shikra	*Accipiter badius*		R	LC	Carnivores
6.	Long Legged buzzard	*Buteo rufinus*		PV	LC	Carnivores
7.	Black-crowned Sparrow-Lark	*Eremopterix nigriceps*	Alaudidae	SV	LC	Omnivores
8.	White-throated Kingfisher	*Halcyon smyrnensis*	Alcedinidae	R	LC	Carnivores
9.	Lesser Pied Kingfisher	*Ceryle rudis*		R	LC	Carnivores
10.	Comb Duck	*Sarkidiornis melanotos*	Anatidae	WV	LC	Herbivores.
11.	Nothern Pintail	*Anas acuta*		WV	LC	Omnivores
12.	Spot-Billed Duck	*Anas poecilorhyncha*		WV	LC	Omnivores
13.	Common Pochard	*Aythya ferina*		WV	LC	Omnivores
14.	Domestic goose sp. (Domestic type)	*Anser sp. (Domestic type)*		R	NE	Herbivores.
15.	Darter	*Anhinga melanogaster*	Anhingidae	R	LC	Carnivores
16.	Indian Pond-Heron	*Ardeola grayii*	Ardeidae	R	LC	Carnivores
17.	Grey Heron	*Ardea cineria*		WV	LC	Carnivores
18.	Little Egret	*Egretta garzetta*		PV	LC	Carnivores
19.	Purple Heron	*Ardea purpurea*		WV	LC	Carnivores
20.	Cattle Egret	*Bubulcus ibis*		PV	LC	Opportunistic feeders
21.	Indian Thick-knee	*Burhinus indicus*	Burhinidae	R	NT	Carnivores.
22.	Indian Jungle Nightjar	*Caprimulgus indicus*	Caprimulgidae	R	LC	Insectivores
23.	Red-Wattled Lapwing	*Vanellus indicus*	Charadriidae	R	LC	Omnivores
24.	Painted Stork	*Mycteria leucocephala*	Ciconiidae	WV	NT	Carnivores.
25.	Eurasian Collared-Dove	*Streptopelia decaocto*	Columbidae	R	LC	Omnivores
26.	Rock Pigeon	*Columba livia*		R	LC	Granivores
27.	Red Collared-Dove	*Streptopelia tranquebarica*		R	LC	Granivores
28.	Laughing Dove	*Spilopelia senegalensis*		R	LC	Granivores
29.	Indian Roller	*Coracias benghalensis*	Coraciidae	PV	LC	Insectivores.
30.	House Crow	*Corvus splendens*	Corvidae	R	LC	Omnivores
31.	Common Raven	*Corvus corax*		R	LC	Omnivores

Continue. . . . . .

S.N.	Name of Bird	Scientific Name	Family	Residential Status	IUCN STATUS	Feeding Status
32.	Asian Koel	*Eudynamys scolopacea*	Cuculidae	PV	LC	Frugivores
33.	Lesser Coucal	*Centropus bengalensis*		R	LC	Insectivores.
34.	Greater Coucal	*Centropus sinensis*		R	LC	Omnivores
35.	Black Drongo	*Dicrurus macrocercus*	Dicruridae	R	LC	Insectivores.
36.	Common Kestral	*Falco tinnunculus*	Falconidae	R	LC	Carnivores
37.	Great Grey Shrike	*Lanius excubitor*	Laniidae	R	LC	Carnivores
38.	River Tern	*Sterna hirundo*	Laridae	WV	LC	Piscivores
39.	Common Babler	*Turdoides caudatus*	Leiothrichidae	R	LC	Omnivores
40.	Small Bee-Eater	*Merops orientalis*	Meropidae	R	LC	Insectivores
41.	White Wagtail	*Motacilla alba*	Motacillidae	R	LC	Insectivores
42.	Large Pied Wagtail	*Motacilla maderaspatensis*		R	LC	Insectivores
43.	Oriental Magpie Robin	*Copsychus malabaricus*	Muscicapidae	SV	LC	Insectivores
44.	Brown Rock Chat Indian Chat	*Cercomela fusca*		SV	LC	Omnivores
45.	Desert Wheater	*Oenanthe deserti*		SV	LC	Insectivores
46.	Indian Robin	*Saxicoloides fulicata*		R	LC	Insectivores
47.	House Sparrow	*Passer domesticus*	Passeridae	R	LC	Granivores
48.	Little Cormorant	*Phalacrocorax niger*	Phalacrocoracidae	WV	LC	Piscivores
49.	Great Cormorant	*Phalacrocorax fusca*		WV	LC	Piscivores
50.	Indian Peacock	*Pavo cristatus*	Phasianidae	R	LC	Omnivores
51.	Grey Francolin	*Francolinus pondicerianus*		R	LC	Omnivores
52.	Alexandrine Parakeet	*Psittacula eupatria*	Psittacidae	R	LC	Granivores
53.	Chestnut Bellied Sandgrouse	*Pterocles exustus*	Pteroclididae	R	LC	Granivores
54.	White-Eared Bulbul	*Pycnonotus leucotis*	Pycnonotidae	R	LC	Omnivores
55.	Red-Vented Bulbul	*Pycnonotus cafer*		R	LC	Omnivores
56.	White Breasted Waterhen	*Amaurornis phoenicurus*	Rallidae	R	LC	Omnivores.
57.	Eurasian Coot	*Fulica atra*		WV	LC	Herbivores
58.	Black-Winged Stilt	*Himantopus himantopus*	Recurvirostridae	WV	LC	Omnivores.
59.	Common Sandpiper	*Actitis hypoleucos*	Scolopacidae	WV	LC	Insectivores
60.	Spotted Owlet	*Athene brama*	Strigidae	R	LC	Carnivores
61.	Brahminy Starling	*Sturnus pagodarum*	Sturnidae	PV	LC	Omnivores
62.	Common Myna	*Acridotheres tristis*		R	LC	Omnivores
63.	Red-Naped Ibis	*Pseudibis papillosa*	Threskiornithidae	WV	LC	Omnivores
64.	Oriental White Ibis	*Threskiornis melanocephalus*		WV	LC	Omnivores
65.	Common Hoopoe	*Upupa epops*	Upupidae	SV	LC	Insectivores

Note: PV= Passage visitor: R=Resident: SV=Summer visitor: WV=Winter Visitor: LC=Least concern: E=Endangered: NE=Not evaluated: NT= Near threatened