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Annual Variation In Avifaunal Diversity In A Riverine Habitat: A Case Study Of The Yamuna River, Hodal

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Abstract
Study of avian diversity in riverine habitat aids in better planning and management of the structure, type, growth and overall conservation of the region. The study conducted in the Yamuna River basin near Hodal recorded 61 species of wetland birds spanning 23 families and 11 orders, with the greatest species diversity observed in Passeriformes (16 species), Charadriiformes (13 species) and Anseriformes (11 species). Species diversity varied seasonally, 30 in summer, 32 in monsoon, and 59 in winter. This variation in avian diversity is driven by habitat type, water availability, vegetation, and food resources. Of the total number of species, 40% were resident, 49% were winter migratory, 3% were summer migratory, and 8% were local migratory, underscoring the area's role as a key wintering ground for migrants from Central Asia and Siberia. Summer saw reduced diversity due to low water levels and heat stress; on the other hand, monsoon brought a slight increase in productivity, and winter peaked with favourable conditions supporting waterfowl, waders, and passerines. These findings highlight the ecological importance and conservation value of riverine wetlands as seasonal refuges. The birds of this area have not been researched and remain unexplored, despite their potentially rich diversity. This study will provide baseline information on the diversity of avian species for future studies and in the preparation of a comprehensive list of bird species in the riverine area. This study will further provide insights into awareness, conservation and sustainable management of riverine habitats.

Key Words: *Avian Diversity, Seasonal Diversity, Winter Migratory*

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I. Introduction

Monitoring animal populations across different seasons is essential for understanding animal ecology and plays a vital role in effective conservation and management efforts (Webster, 2002). Nearly all bird species rely on wetlands at some stage of their life cycle, making these ecosystems indispensable to avian survival. As wetlands provide good habitat for birds for roosting, breeding, pre-migratory requirements, migration and protection from predators, they form a very important part in the life cycle of birds. Owing to their high productivity, wetlands sustain an exceptional richness and diversity of bird and animal life.

The abundance and diversity of wetland birds exhibit pronounced seasonal variation, closely aligned with changing ecological conditions. Notably, the highest turnover in bird density, diversity, and species richness occurs during migratory periods, when species movement significantly reshapes community composition. (Nagarajan & Thiyagesan, 1996; Pandiyan et al., 2010). Avian communities are largely affected by seasonal variations. Changes in temperature, water availability, vegetation, and food resources influence species diversity and abundance throughout the year. During winter, many migratory species from Central Asia and other regions move in different directions, while in summer and monsoon seasons, resident and local migratory birds dominate the assemblage. Understanding these seasonal patterns is essential for assessing ecosystem health and planning effective conservation strategies. By researching the seasonal dynamics and diversity of wetland birds, we can better understand their movement ecology in the larger context of the migratory ecology. Regional studies examining species diversity and seasonal occurrences are necessary to understand their habitats, which in turn will contribute to conservation efforts (Vaithianathan, 2022).

Seasonal Migration of birds is a periodic, two-directional movement between their breeding and wintering grounds. Food availability, climatic fluctuations and changes in the inclination of the Earth's axis drive migration (Alerstam, 1990; Kumar & Alam, 2023). India lies within the Central Asian Flyway (CAF), one of the four principal global migratory bird flyways, linking breeding grounds in the Arctic and Eurasian regions with wintering areas across South Asia and the Indian Ocean basin. The CAF serves as a critical migratory corridor for more than 180 species of migratory birds, many of which are threatened with extinction. These species are highly dependent on wetlands, rivers, reservoirs, and other inland water bodies that provide essential stopover, resting, and wintering habitats along their migratory route. (Kumar & Alam, 2023; Vaithianathan, 2022).

The Yamuna River is one of the most important river systems in northern India, supporting a wide range of ecological habitats and biodiversity. Its floodplains, wetlands, and riparian zones provide crucial feeding,

breeding, and resting grounds for numerous bird species. The present study will focus on the avian diversity of the Yamuna River basin at Hodal in Palwal district, which has a variety of habitat types that could serve as feeding and nesting grounds for many bird species, including migratory visitors. Earlier, workers who have studied birds in the Yamuna include Hutson (1954), Ganguli (1975), Singh (1983), Urfi (1998; 2003). Despite the ecological significance of the Yamuna River, studies on migratory birds along its course remain limited, with most research concentrated in the Yamuna Nagar region near Hathnikund Barrage and Tajewala Dam, as well as in the Delhi region around Okhla Barrage. Only a few studies have been conducted in other areas of the river. Earlier investigations (Kalsi, 1998; Bahuguna et al., 2008; Gupta and Kaushik, 2011; Gupta et al., 2012; Chandna, 2015, 2018) largely focused on the Hathnikund Barrage area, while (Singh, 1983; Urfi, 1998, 2003; Chandna, 2015) centred on the Delhi region, and (Gupta et al., 2012; Chandna, 2021) addressed the Faridabad and Palwal region. Therefore, comprehensive studies on wetland bird diversity are still needed in other parts of the river. The Hodal stretch of the river, located in Haryana, represents one such underexplored area. In this context, the present study aims to investigate the seasonal variation of avian diversity along the Yamuna River in Hodal. By documenting species diversity across different seasons, the study seeks to provide baseline data for this relatively unexplored stretch and contribute to a broader understanding of avian ecology in riverine ecosystems. The findings are expected to aid in identifying key habitats, understanding temporal patterns, and informing conservation and management efforts for bird populations in the region.

II. Materials And Methods

The present study primarily examined seasonal variations in avian diversity along the Yamuna River near Hodal in the Palwal district. The river basin was surveyed in flowing water, and the sandy area along its banks. A major segment of the studies aims to understand the seasonal variations of wetland birds, including migratory and resident ones. The nomenclature adopted was that of Manakadan and Pittie (2001). The observations were taken with a camera (Sony Cybershot with 15X zoom and 8.1-megapixel clarity) and Nikon Action 10x50 mm binoculars. Enough photographic evidence was generated to analyse avian diversity. The visits were conducted from September 2023 to April 2024. Surveys were conducted from 6:30 a.m. to 10:00 a.m., and field data were collected using standardised ornithological survey methods, the Line Transect Method (Sale and Berkmuller, 1998) and the Point Count Method (Blondel *et al.,* 1981). A field notebook was used for keeping a systematic record of bird species and habitat parameters. Identifications of birds were carried out with the help of various books like "Guide to the Birds of the Indian Subcontinent" by Grimmet *et al.* (1996) and "The Book of Indian Birds" by Ali (2002). The birds observed at the study site have been categorised on their Residential status: Resident species, Local migratory species, Summer migratory species and Winter migratory species. To observe seasonal diversity, seasons were classified as Summer, Monsoon and Winter.

Table 1: List of Birds categorised order-wise and family-wise observed at the study site with their Residential status

S. No.	Order	Family	Common name	Zoological Name	Status
1	**Podicipediformes**	Podicipedidae	Little Grebe	*Tachybaptus ruficolis*	R
2	**Pelecaniformes**	Phalacrocoracidae	Little Cormorant	*Phalacrocorax niger*	R
3			Great Cormorant	*Phalacrocorax carbo*	LM
4	**Ciconiiformes**	Ardeidae	Grey Heron	*Ardea cinerea*	WM
5			Purple Heron	*Ardea purpurea*	LM
6			Indian Pond Heron	*Ardeola grayii*	R
7			Little Egret	*Egretta garzeta*	LM
8			Cattle Egret	*Bubulcus ibis*	R
9		Ciconiidae	Painted Stork	*Mycteria leucocephala*	R
10			Open-billed Stork	*Anastomus oscitans*	R
11		Threskiornithidae	Black ibis	*Pseudibis papillosa*	R
12	**Anseriformes**	Anatidae	Greylag goose	*Anser anser*	WM
13			Bar-headed goose	*Anser indicus*	WM
14			Spot-billed duck	*Anas poecilorhyncha*	WM
15			Common pochard	*Aythya ferina*	WM
16			Red crested pochard	*Rhodonessa rufina*	WM
17			Northern pintail	*Anas acuta*	WM
18			Ruddy shelduck	*Tadorna ferruginea*	WM
19			Common Teal	*Anas crecca*	WM
20			Mallard	*Anas platyrhynchos*	WM
21			Gadwall	*Anas strepera*	WM
22			Lesser Whistling duck	*Dendrocygna javanica*	SM
23	**Gruiiformes**	Rallidae	Common coot	*Fulica atra*	WM
24			Common Moorhen	*Gallinula chloropus*	LM
25			White breasted Waterhen	*Amaurornis phoenicurus*	R
26	**Charadriiformes**	Charadriidae	Little ringed plover	*Charadrius dubius*	WM

27			Red-wattled Lapwing	*Vanellus indicus*	R
28			River Lapwing	*Vanellus duvaucelli*	R
29		Scolopocidae	Common redshank	*Tringa totanus*	WM
30			Spotted redshank	*Tringa erythropus*	WM
31			Common sandpiper	*Actitis hypoleucos*	WM
32			Wood sandpiper	*Tringa glareola*	WM
33			Green sandpiper	*Tringa ochropus*	WM
34			Marsh sandpiper	*Tringa stagnatilis*	WM
35			Ruff	*Philomachus Pugnax*	WM
36		Recurvirostridae	Pied avocet	*Recurvirostra avocetta*	WM
37			Black-winged Stilt	*Himanotopus himanotopus*	R
38		Lariidae	Black-headed gull	*Larus ridibundus*	WM
39	**Columbiformes**	Columbidae	Spotted Dove	*Spilopelia chinensis*	R
40	**Psittaciformes**	Psittacidae	Rose ringed Parakeet	*Psittacula krameri*	R
41	**Cuculiformes**	Cuculidae	Greater coucal	*Centropus sinensis*	R
42	**Coraciiformes**	Alcedinidae	White-throated Kingfisher	*Halcyon smyrnensis*	R
43			Pied Kingfisher	*Ceryle rudis*	R
44		Meropidae	Blue-cheeked Bee-eater	*Merops persicus*	SM
45			Green Bee-eater	*Merops oriantalis*	R
46	**Passeriformes**	Hirundinidae	Red-rumped swallow	*Hirundo daurica*	WM
47			Common swallow	*Hirundo rustica*	LM
48		Laniidae	Brown shrike	*Lanius cristatus*	WM
49		Sturnidae	Asian Pied Starling	*Sturnus contra*	R
50		Pycnonotidae	Red vented Bulbul	*Pycnonotus cafer*	R
51		Muscicapidae	Common Babbler	*Turdoides caudatus*	R
52			Common Tailorbird	*Orthotomus sutorius*	R
53			Pied Bushchat	*Saxicola caprata*	R
54		Motacillidae	White wagtail	*Motacilla alba*	WM
55			Large pied wagtail	*Motacilla maderaspatensis*	WM
56			Yellow wagtail	*Motacilla flava*	WM
57			Grey wagtail	*Motacilla cinerea*	WM
58			Citrine wagtail	*Motacilla citreola*	WM
59			Forest wagtail	*Dendronanthus indicus*	WM
60		Ploceidae	Baya Weaver	*Ploceus phillipinus*	R
61			Streaked Weaver	*Ploceus manyar*	R

R- Resident; WM- Winter migratory; LM- Local migratory; SM- Summer Migratory

Table 2: List of Birds observed in the three different seasons at the study site

COMMON NAME	ZOOLOGICAL NAME	Summer	Monsoon	Winter
Little Grebe	*Tachybaptus ruficolis*	+	+	+
Little Cormorant	*Phalacrocorax niger*	+	+	+
Great Cormorant	*Phalacrocorax carbo*	+	+	+
Grey Heron	*Ardea cinerea*			+
Purple Heron	*Ardea purpurea*	+	+	+
Indian Pond Heron	*Ardeola grayii*	+	+	+
Little Egret	*Egretta garzeta*		+	+
Cattle Egret	*Bubulcus ibis*	+	+	+
Painted Stork	*Mycteria leucocephala*	+	+	+
Open-billed Stork	*Anastomus oscitans*	+	+	+
Black Ibis	*Pseudibis papillosa*	+	+	+
Greylag goose	*Anser anser*			+
Bar-headed goose	*Anser indicus*			+
Spot-billed duck	*Anas poecilorhyncha*			+
Common pochard	*Aythya ferina*			+
Red crested pochard	*Rhodonessa rufina*			+
Lesser Whistling Duck	*Dendrocygna javanica*	+	+	
Ruddy shelduck	*Tadorna ferruginea*			+
Northern pintail	*Anas acuta*			+
Mallard	*Anas platyrhynchos*			+
Gadwall	*Anas strepera*			+
Common Teal	*Anas crecca*			+
Common coot	*Fulica atra*			+
Common Moorhen	*Gallinula chloropus*	+	+	+
White-breasted Waterhen	*Amaurornis phoenicurus*	+	+	+
Little ringed plover	*Charadrius dubius*			+
Red-wattled Lapwing	*Vanellus indicus*	+	+	+
River Lapwing	*Vanellus duvaucelli*	+	+	+
Common redshank	*Tringa totanus*			+
Spotted redshank	*Tringa erythropus*			+
Common sandpiper	*Actitis hypoleucos*			+

Wood sandpiper	*Tringa glareola*	_	_	+
Green sandpiper	*Tringa ochropus*	_	_	+
Marsh sandpiper	*Tringa stagnatilis*	_	_	+
Ruff	*Philomachus Pugnax*	_	_	+
Pied avocet	*Recurvirostra avocetta*	_	_	+
Black-winged Stilt	*Himanotopus himanotopus*	+	+	+
Black-headed gull	*Larus ridibundus*			+
Spotted Dove	*Spilopelia chinensis*	+	+	+
Rose ringed Parakeet	*Psittacula krameri*	+	+	+
Greater coucal	*Centropus sinensis*	+	+	+
White-throated Kingfisher	*Halcyon smyrnensis*	+	+	+
Pied Kingfisher	*Ceryle rudis*	+	+	+
Blue-cheeked Bee-eater	*Merops persicus*	+	+	_
Green Bee-eater	*Merops oriantalis*	+	+	+
Red-rumped swallow	*Hirundo daurica*	_		+
Common swallow	*Hirundo rustica*	_	+	+
Brown shrike	*Lanius cristatus*			+
Asian Pied starling	*Sturnus contra*	+	+	+
Red vented Bulbul	*Pycnonotus Cafer*	+	+	+
Common Babbler	*Turdoides caudatus*	+	+	+
Common Tailorbird	*Orthotomus sutorius*	+	+	+
Pied Bushchat	*Saxicola caprata*	+	+	+
White wagtail	*Motacilla alba*	+	+	+
Large pied wagtail	*Motacilla maderaspatensis*			+
Yellow wagtail	*Motacilla flava*	_	_	+
Grey wagtail	*Motacilla cinerea*	_	_	+
Citrine wagtail	*Motacilla citreola*	_	_	+
Forest wagtail	*Dendronanthus indicus*			+
Baya Weaver	*Ploceus phillipinus*	+	+	+
Streaked Weaver	*Ploceus manyar*	+	+	+

Figure 1: Depiction of avian diversity in an order-wise manner at the study site

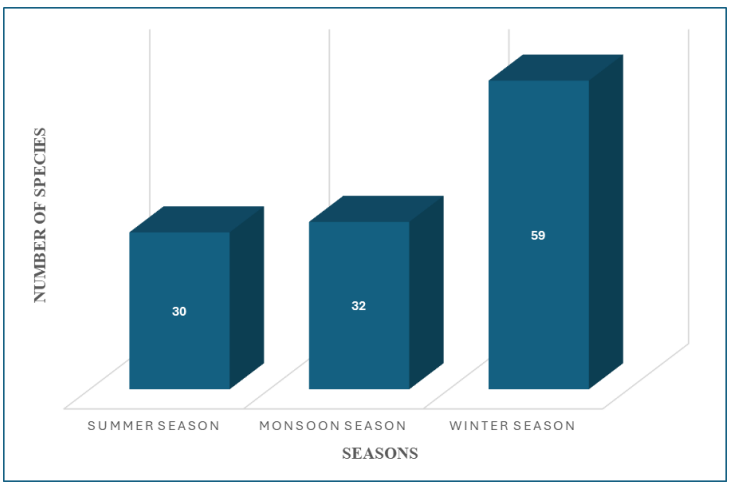

Figure 2: Season-wise Diversity of Avian Fauna at Study Site

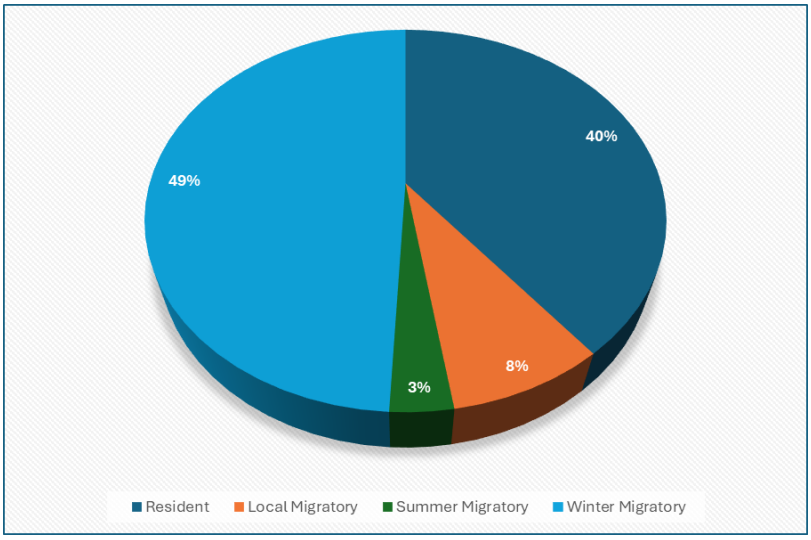

Figure 3: Per cent Composition of Avian Fauna according to their Residential Status

III. Result and Discussion:

A total of 61 wetland bird species, belonging to 23 families across 11orders, were documented during the study along the Yamuna River basin in the Hodal region as depicted in **Table 1**. The diversity of birds was influenced by habitat type, water availability, vegetation cover, and, most importantly, the seasonal fluctuations. The species diversity among three seasons, namely summer, monsoon and winter, is depicted in **Table 2**. The checklist of bird species was prepared by the standardised common and scientific names outlined by Manakadan and Pittie (2001). Among the 11 recorded orders, *Passeriformes* exhibited the highest species richness with 16 species, followed by *Charadriiformes* with 13 species, *Anseriformes* with 11 species, *Ciconiiformes* with 8 species, *Coraciiformes* with 4 species, *Gruiformes* with 3 species, *Pelecaniformes* with 2 species and *Podicipediformes, Columbiformes, Psittaciformes and Cuculiformes each having 1 species*, as depicted in **Figure 1.** Within the 23 families, *Anatidae* represented the largest number with 11 species, followed by *Scolopacidae* (7 species), *Motacillidae* (6 species), *Ardeidae* (5 species), *Charadriidae, Rallidae, Ciconiidae* and *Muscicapidae* (3 species each), *Phalacrocoricidae, Recurvirostridae, Alcedinidae, Meropidae, Hirundinidae and Ploceidae* (2 species), *Podicipedidae, Lariidae, Columbidae, Psittacidae, Cuculidae, Laniidae*, *Sturnidae*, and *Pycnonotidae* were each represented by a single species. The present study recorded significant seasonal variation in avifaunal diversity along the Yamuna River at Hodal, reflecting changes in habitat conditions, water availability, and food resources across summer, monsoon, and winter seasons. As depicted in **Figure 3**, among the total 61 recorded species, 24 (40%) were resident, 2 (3%) were summer migratory, 30 (49%) were winter migratory, and 5 (8%) were local migratory, indicating the ecological importance of the riverine habitat.

During the summer season, a comparatively lower number of species (30) were recorded **Figure 2**, as water levels in the river were significantly reduced, exposing mudflats, reducing aquatic vegetation, and limiting prey availability. Resident and heat-tolerant species such as waders, herons, and some passerines dominate in summer as exposed mudflats support certain shorebirds and waders, utilising these areas for foraging. The decline in avifaunal diversity during summer can be attributed to high temperature stress, reduced water availability and decline in food resources.

During the monsoon season, 32 species **Figure 2** were recorded, showing a slight increase in diversity compared to summer, as water levels rise, aquatic vegetation expands, and insect populations increase. The monsoon season enhances habitat productivity due to nutrient influx, improved primary productivity and increased prey availability. However, excessive water flow and flooding may reduce nesting sites and disturb ground-feeding birds. Thus, while food availability increases, habitat instability limits maximum diversity.

The winter season recorded the highest avifaunal diversity, with 59 species **Figure 2**, including a significant number of migratory birds. Waterfowl, waders, and passerines dominate the site during the winter season. The increase in diversity during winter is primarily due to migration from colder regions (Central Asia, Siberia) and favourable climatic conditions. The Yamuna River at Hodal acts as an important wintering and foraging ground for migratory birds. Adequate water availability and rich food resources support a wide range of species.

This pattern aligns with ecological theories suggesting that riverine wetlands serve as critical seasonal refuges for migratory avifauna. The high diversity also indicates the study area's ecological health and conservation value.

IV. Conclusion

The observed seasonal variation highlights that the Yamuna River supports dynamic avifaunal communities. The study demonstrates that avifaunal diversity in the Yamuna River at Hodal is strongly season-dependent, with winter supporting maximum diversity due to migratory influx and favourable ecological conditions. As the present study reveals, the Yamuna serves as an important wintering ground for a wide variety of migratory bird species, offering suitable habitats supported by its moderate climate, abundant food, and diverse wetlands; thus, conservation strategies should prioritise maintaining water quality, habitat heterogeneity, and minimal disturbance, especially during the winter season, to protect migratory species.

References:

[1]. Ali, S. (2002). The Book Of Indian Birds. 13th Edition. Oxford University Press, Mumbai.
[2]. Alerstam, T. (1990). Bird Migration. Cambridge University Press, Cambridge.
[3]. Bahuguna, A., J. P. Sati And P. C. Tak (2008). Sighting Of Black Stork (Ciconia Nigra) In Kalesar National Park, Yamunanagar District, Haryana, India. Newsletter For Birdwatchers 48(4): 49-50.
[4]. Blondel, J., C. Ferry And B. Frochot (1981). Point Count With Unlimited Distance. Study Of Avian Biology 6: 414-420.
[5]. Chandna, P. (2015). Seasonal Diversity And Status Of Avifauna At Tajewala Dam In Yamunanagar District In Haryana, India. Airo International Research Journal 7(3): 42-50.
[6]. Chandna, P. (2015). A Review On Avian Diversity Of Okhla Barrage At Delhi. Airo International Research Journal 5(3): 322-327.
[7]. Chandna, P. (2018). Diversity And Status Of Wetland Birds In And Around Yamuna River At Hathnikund Barrage In Yamunanagar District In Haryana, India. Annals Of Biology 34(3): 317-319.
[8]. Chandna, P. (2021). Diversity And Residential Status Of Wader Birds At Hodal In Palwal District, In Haryana, India. Indian Journal Of Applied Research 11(9): 31-33.
[9]. Ganguli, U. (1975). A Guide To The Birds Of The Delhi Area. Indian Council Of Agricultural Research, New Delhi.
[10]. Grimmet, R., C. Inskipp And T. Inskipp (1996). Birds Of Indian Subcontinent. Oxford University Press, Mumbai.
[11]. Gupta, R. C. And T. K. Kaushik (2011). Insight Into Wetland Winter Migratory Avian Biodiversity In Hathnikund Barrage In Haryana State In India. International Journal Of Life Sciences 5(1): 39-43.
[12]. Gupta, R. C., P. Chandna And T. K. Kaushik (2012). An Analysis Of Avian Fauna Of Tajewala Reservoir In Yamunanagar District In Haryana, India. Nature Conservators 24(1): 13-18.
[13]. Gupta, R. C.; Chandna, P. And Kaushik, T. K. (2012). Analysis Of Wetland Birds As Seen Along Yamuna River At Okhla (Delhi), Faridabad And Palwal Districts In Haryana, India. Environment Conservation Journal 13(3): 7-14.
[14]. Hutson, H. P. W. (1954). The Birds About Delhi. Delhi Birdwatching Society, Delhi.
[15]. Kalsi, R. S. (1998). Birds Of Kalesar Wildlife Sanctuary, Haryana, India. Forktail 13: 29-32.
[16]. Kumar, A. And I. Alam (2023). Migration Of Birds And Their Flyways In India. Records Of The Zoological Survey Of India 123(1S): 25–35. Https://Doi.Org/10.26515/Rzsi/V123/I1s/2023/172454
[17]. Manakadan, R. And A. Pittie (2001). Standardised Common And Scientific Names Of The Birds Of The Indian Subcontinent. Buceros 6: 1–37.
[18]. Nagarajan, R. And K. Thiyagesan (1996). Waterbirds And Substrate Quality Of The Pichavaram Wetlands, Southern India. Ibis 138(4): 710–721.
[19]. Pandiyan, J., S. Asokan And R. Nagarajan (2010). Habitat Utilization And Assemblage Patterns Of Migratory Shorebirds At Stop-Over Sites In Southern India. Stilt 58: 36–44.
[20]. Sale, J. B. And K. Berkmuller (1998). Manual Of Wildlife Techniques In India. Field Document No. 11. FAO, United Nations, Dehradun, India. 243.
[21]. Singh, J. L. (1983). Birds In The Okhla Barrage. Newsletter For Birdwatchers 23: 18–19.
[22]. Urfi, A. J. (1998). A Monsoon Delivers Storks. Natural History 107: 32–39.
[23]. Urfi, A. J. (2003). The Birds Of Okhla Barrage Bird Sanctuary, Delhi, India. Forktail 19: 39–50.
[24]. Vaithianathan, P. (2022). Migratory Waterbirds Along The Central Asian Flyway: Conservation Priorities And Wetland Management In India. Current Science 122(4): 389-395.
[25]. Webster M.S. (2002). Links Between Worlds: Unravelling Migratory Connectivity. Trends In Ecology & Evolution. Https://Www.Sciencedirect.Com/Science/Article/Pii/S0169534701023801