



## *Annual Research & Review in Biology*

Volume 39, Issue 6, Page 71-86, 2024; Article no.ARRB.118011

ISSN: 2347-565X, NLM ID: 101632869

(Past name: Annual Review & Research in Biology, Past ISSN: 2231-4776)

# Diversity of Avian Fauna in Karaivetti Bird Sanctuary, Ariyalur District, Tamil Nadu, India

Satheesh N <sup>a\*</sup>, K.Baranidharan <sup>b</sup>, S.Krishnamoorthi <sup>b</sup>,  
M.Vijayabhama <sup>b</sup> and S.Mugilan <sup>b</sup>

<sup>a</sup> Tamil Nadu Forest Department, Trichy, India.

<sup>b</sup> Tamil Nadu Agricultural University, Coimbatore, India.

### **Authors' contributions**

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

### **Article Information**

DOI: <https://doi.org/10.9734/arrb/2024/v39i62090>

### **Open Peer Review History:**

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/118011>

**Original Research Article**

**Received: 26/03/2024**

**Accepted: 31/05/2024**

**Published: 07/06/2024**

## **ABSTRACT**

Birds serve as key indicators of environmental health, helping to monitor and maintain ecological balance. The study conducted from 2021 to 2024 in the Karaivetti Bird Sanctuary, located in the Ariyalur district, aimed to assess year-wise species diversity, richness, relative diversity, evenness, density, and relative abundance of wetland birds. The total count method was employed to estimate the population of wetland birds. The study at Karaivetti Bird Sanctuary recorded 97 bird species over four years, with 30 migrant and 67 resident species. Among these, five species were Near Threatened viz., Black-tailed Godwit (*Limosa limosa*), Woolly-necked Stork (*Ciconia episcopus*), Spot-billed Pelican (*Pelecanus philippensis*), Black-headed Ibis (*Threskiornis melanocephalus*) and Oriental Darter (*Anhinga melanogaster*) and two were Vulnerable viz., Greater Spotted Eagle

\*Corresponding author: E-mail: [baranidharan.k@tnau.ac.in](mailto:baranidharan.k@tnau.ac.in);

**Cite as:** N, Satheesh, K.Baranidharan, S.Krishnamoorthi, M.Vijayabhama, and S.Mugilan. 2024. "Diversity of Avian Fauna in Karaivetti Bird Sanctuary, Ariyalur District, Tamil Nadu, India". *Annual Research & Review in Biology* 39 (6):71-86. <https://doi.org/10.9734/arrb/2024/v39i62090>.

(*Clanga clanga*) and Common Pochard (*Aythya ferina*). Comparative studies in other sanctuaries revealed similar patterns in species diversity and abundance. The highest species diversity at Karaivetti was in 2021, while the highest richness occurred in 2022. Total bird density was highest in 2021 and lowest in 2024, with the Little Cormorant showing the highest relative abundance in recent years.

**Keywords:** Wetland; water birds; karaivetti bird sanctuary; year-wise variations.

## 1. INTRODUCTION

Wetlands are transitional zones between permanently aquatic and dry terrestrial ecosystems. Covering roughly 6% of the Earth's land area, wetlands encompass various types including marshes, lagoons, bogs, fens, open water bodies, and mangroves [1]. According to the Ramsar Convention of the IUCN held in Iran in 1981, a wetland is defined as an "area of marsh, fen, peatland or water whether natural or artificial, permanent or temporary with water, that is static or flowing, fresh, brackish or salt including areas of marine water, the depth of which does not exceed 6 meters" – [2,3]. Wetlands are the second most productive ecosystems after tropical rainforests [4] and support migratory and resident avian species, enhancing biodiversity and ecosystem productivity [5,6]. They serve as crucial bird habitats, providing essential areas for feeding, roosting, and breeding. However, wetlands face numerous threats, primarily from human activities such as urbanization, agricultural expansion, pollution, drainage for development, and climate change. These activities significantly impact wildlife populations, water quality, hydrological cycles, and other vital wetland functions.

Migratory species are particularly vulnerable because they rely on different sites and habitats during breeding and non-breeding seasons; a threat to any one of these areas can have substantial consequences [7]. Habitat destruction is a primary cause of bird population decline, with over 90% of globally threatened birds and 86% of other bird species facing serious threats mainly due to habitat degradation [8,9]. Information on the status and distribution of threatened and endemic birds is crucial for predicting disturbance levels and implementing conservation measures at potential sites. In 2000, the 'Threatened Birds of the World' listed 1,186 species worldwide, including 123 species in India [10]. Preserving wetlands is therefore critical to protecting endangered and threatened species [11]. The Karaivetti Bird Sanctuary is a vital habitat for numerous wetland birds,

including threatened and migratory species. Despite its significance, there has been a noticeable lack of systematic studies focusing on wetland birds, particularly regarding yearly patterns, diversity, evenness, richness, and density. Therefore, this study aims to conduct an inventory of wetland birds within the Karaivetti Bird Sanctuary.

## 2. MATERIALS AND METHODS

### 2.1 Study Area

The Karaivetti Bird Sanctuary, located in the Ariyalur District of Tamil Nadu, India, was designated as a protected area in 1999. Spanning approximately 4.52 km<sup>2</sup>, this sanctuary is a crucial habitat for a diverse range of bird species. It is situated at coordinates 10.8741° N latitude and 79.1892° E longitude. The site is one of the largest inland freshwater lakes in the state of Tamil Nadu. It serves as a crucial stopover and foraging ground for birds migrating along the Central Asian Flyway. Approximately 10,000 individuals of 14 colonial waterbird species have been found nesting here. The gum Arabic tree (*Acacia nilotica*) provides essential roosting and nesting grounds for threatened species such as the spotted eagle (*Aquila clanga*), tawny eagle (*Aquila rapax*), and Indian darter (*Anhinga melanogaster*). When the water level starts receding after January, larger birds such as the painted stork (*Mycteria leucocephala*) flock to the site, which has recorded one of the largest congregations of waterbirds among all lakes in Tamil Nadu. The site also provides a breeding habitat for the vulnerable Indian flap-shelled turtle (*Lissemys punctata*). The water level of the site is maintained with water from the Mettur Dam. The lake water is also used to irrigate about 4,000 hectares of surrounding farmland.

### 2.2 Bird Survey Method

The field survey was conducted over the past four years, from 2021 to 2024, utilizing the total count method. Researchers walked within and

around the wetlands or stationed themselves at specific vantage points to observe and count all birds whenever feasible [12]. Surveys were conducted every month during the dawn and dusk periods, from 6:30 am to 10:00 am and 4:00 pm to 6:30 pm. Binoculars (Nikon 7x50) were used for observations, and bird photography was facilitated with a Nikon P900 camera. Bird identification was corroborated with the assistance of reference books such as "Birds of the Indian Subcontinent" [13] and "The Book of Indian Birds" by Salim Ali [14].

### 2.3 Data Analysis

Shannon-Weiner index of diversity [15] was used to assess the bird species diversity in Karaivetti Bird Sanctuary.

The formula for calculating the Shannon diversity index is

$$H' = - \sum P_i \ln P_i$$

Where  $H'$  = Shannon index of diversity,  $P_i$  = the proportion of the  $i^{\text{th}}$  species in the landscape element and  $\ln P_i$  = Natural logarithm of the proportion of each species.

Richness was calculated by counting the number of species observed in a particular season and particular place [16].

Species richness = Number of species recorded

Pielou's evenness index was utilized to estimate the species' evenness within the Karaivetti Bird Sanctuary. This index provides a measure of how evenly distributed the individuals are among different species, indicating the level of evenness in the community [4].

Evenness/Equitability =  $H'/H'_{\text{max}}$

Where,  $H'$  = Value recorded from Shannon-Weiner diversity index and  $H'_{\text{max}}$  = Maximum possible value of  $H'$ .

The Relative Abundance [17], (Ayenalem & Bekele, 2008) was analyzed from the collected data during the study period using the following formula:

Relative Abundance =

$$\frac{\text{Number of individual species}}{\text{Number of individuals of all species}} \times 100$$

The density is an utterance of the numerical strength of a particular species where the total number of individuals of each species in a particular season is divided by the total area of the wetland [1].

### 3. RESULTS AND DISCUSSION

The current study recorded a total of 97 bird species from 15 orders and 36 families over the last four years in Karaivetti Bird Sanctuary. Of these, 30 species were migrants, and the remaining 67 were residents. Five species were classified as Near Threatened: the Black-tailed Godwit (*Limosa limosa*), Woolly-necked Stork (*Ciconia episcopus*), Spot-billed Pelican (*Pelecanus philippensis*), Black-headed Ibis (*Threskiornis melanocephalus*), and Oriental Darter (*Anhinga melanogaster*). Additionally, two species were categorized as Vulnerable: the Greater Spotted Eagle (*Clanga clanga*) and Common Pochard (*Aythya ferina*). Ninety species were listed as Least Concern. A previous study was conducted by Baranidharan et al. [18] who recorded 36 species of wetland birds belonging to 13 families and 4 orders in Karaivetti Bird Sanctuary. Among these, six Near Threatened species were observed, including the Oriental Darter (*A. melanogaster*), Painted Stork (*M. leucocephala*), Spot-billed Pelican (*P. philippensis*), Woolly-necked Stork (*C. episcopus*), Black-headed Ibis (*T. melanocephalus*), and Black-tailed Godwit (*L. limosa*), as well as one Vulnerable species, the River Tern (*Sterna aurantia*). A similar study by Krishnamoorthi et al. [19] in the Vellode Bird Sanctuary found 72 bird species across 38 families and 17 orders, with three Near Threatened species: the Oriental Darter (*A. melanogaster*), Painted Stork (*M. leucocephala*), and Spot-billed Pelican (*P. philippensis*). Furthermore, Vas et al. [20] analyzed Neyveli Lignite Corporation India Limited (NLCIL) in Neyveli, Tamil Nadu, identifying 107 different bird species comprising 21 orders and 45 families, with three Near Threatened species.

**Table 1. Year-wise avian species diversity, total density richness and evenness of Karaivetti bird sanctuary**

| Year | Total density | Richness | Diversity | Evenness |
|------|---------------|----------|-----------|----------|
| 2021 | 4991.41       | 58       | 2.75      | 0.27     |
| 2022 | 4773.35       | 78       | 2.12      | 0.21     |
| 2023 | 4859.25       | 51       | 2.72      | 0.27     |
| 2024 | 1820.04       | 34       | 2.21      | 0.24     |

### 3.1 Species Diversity

Regarding the species diversity in the Karaivetti bird sanctuary during different years, the highest species diversity was recorded in 2021 (2.75) followed by 2023 (2.72) and 2024 (2.21) while the lowest species diversity was obtained in 2022 (2.12). Similar findings were reported by Satheesh et al. [21] in their analysis of species diversity in the Udhayamarthandapuram Bird Sanctuary, Tamil Nadu. They noted that the maximum diversity was observed in 2021 (2.75), while the minimum diversity was recorded in 2024 (1.64). From the current study, the maximum richness was observed in 2022 (78) followed by 2021 (58) and 2023 (51) while the minimum species richness was recorded in 2024 (34). A similar finding was found by Manohara et al. [22] in the Magadi bird sanctuary, Karnataka with maximum species richness observed in 2012-13 (33) and minimum in 2015-16 (27). Concerning the evenness of the Karaivetti bird sanctuary the highest evenness was obtained during 2021 and 2023 (0.27) followed by 2024 (0.24) whereas the lowest evenness was recorded during 2022 (0.21) (Table 1 & Figs. 1 & 2). The results were consistent with the findings of Satheesh et al. [21], who observed maximum evenness in 2024 (0.37) and minimum evenness in 2023 (0.21) in Vaduvor Bird Sanctuary [23].

### 3.2 Total Density

The current investigation revealed that the highest total bird density in Karaivetti Bird Sanctuary was recorded in 2021 (4991.41/km<sup>2</sup>), followed by 2023 (4773.35/km<sup>2</sup>) and 2022 (4773.35/km<sup>2</sup>), with the lowest density observed in 2024 (1820.04/km<sup>2</sup>) (Table 1 & Fig. 2). This result aligns with the findings of Krishnamoorthi et al. [19], who noted that the maximum total density was observed during the monsoon season (1556.99/km<sup>2</sup>), while the lowest density was recorded during the winter season (948.18/km<sup>2</sup>). In 2021, the maximum species density was for the Glossy Ibis (866.079/km<sup>2</sup>), followed by the Little Cormorant (851.762/km<sup>2</sup>),

Little Egret (621.366/km<sup>2</sup>), White Ibis (424.449/km<sup>2</sup>), and Cattle Egret (401.762/km<sup>2</sup>). In 2022, the highest species density was observed for the Little Cormorant (1753.30/km<sup>2</sup>), followed by the Little Egret (1228.85/km<sup>2</sup>), Glossy Ibis (496.92/km<sup>2</sup>), and Eurasian Coot (179.30/km<sup>2</sup>). In 2023, the maximum species density was found in the Little Cormorant (1148.68/km<sup>2</sup>), followed by the Little Egret (840.31/km<sup>2</sup>), Cattle Egret (267.84/km<sup>2</sup>), and White Ibis (246.92/km<sup>2</sup>). In 2024, the highest species density was registered for the Little Cormorant (696.04/km<sup>2</sup>), followed by the Glossy Ibis (253.30/km<sup>2</sup>), Little Egret (246.70/km<sup>2</sup>), White Ibis (171.8/km<sup>2</sup>), and Open Bill Stork (90.31/km<sup>2</sup>) (Tables 2, 3, 4 & 5). These findings are consistent with the previous study of Baranidharan et al. [18], who stated that the maximum density in the Karaivetti Bird Sanctuary was recorded for the Large Egret (57/km<sup>2</sup>), followed by the Cattle Egret (56/km<sup>2</sup>), Little Cormorant (50/km<sup>2</sup>), and Spot-billed Duck (32/km<sup>2</sup>), with the lowest densities observed for the Darter, Purple Heron, Eurasian Spoonbill, and Common Teal (1.5/km<sup>2</sup>) [24,25].

### 3.3 Relative Abundance

From this study, the highest relative abundance in 2021 was observed in the Glossy Ibis (17.35%), followed by the Little Cormorant (17.06%), Little Egret (12.45%), White Ibis (8.50%), and Cattle Egret (8.049%). In 2022, the maximum relative abundance was recorded in the Little Cormorant (36.73%), followed by the Little Egret (25.74%), Glossy Ibis (10.41%), and Eurasian Coot (3.76%). In 2023, the highest relative abundance was noted in the Little Cormorant (23.64%), followed by the Little Egret (17.29%), Cattle Egret (5.51%), and White Ibis (5.08%). In 2024, the maximum relative abundance was observed in the Little Cormorant (38.24%), followed by the Glossy Ibis (13.92%), Little Egret (13.55%), White Ibis (9.44%), and Open Bill Stork (4.96%) (Tables 2, 3, 4, & 5). Similar findings were recorded by Satheesh et al. (2024) in Vaduvor Bird Sanctuary, where the

maximum relative abundance was noted in the Black-headed Ibis (43.32%), while the minimum (0.004%) was observed for the Cinnamon Bittern, Wood Sandpiper, Glossy Ibis, Yellow Bittern, Ruff, Indian Paradise Flycatcher, Crested Serpent Eagle, Indian Pitta, Western Marsh Harrier, and Jerdon’s Bushlark in 2022. Bibi et al.

(2003) reported comparable findings in the Taunsa Barrage Wildlife Sanctuary, Pakistan, where they observed the Eurasian Coot as the most abundant species (13.3%), followed by the Cattle Egret (12.3%), Little Egret (11.5%), Common Pochard (8.9%), and House Crow (5.8%).

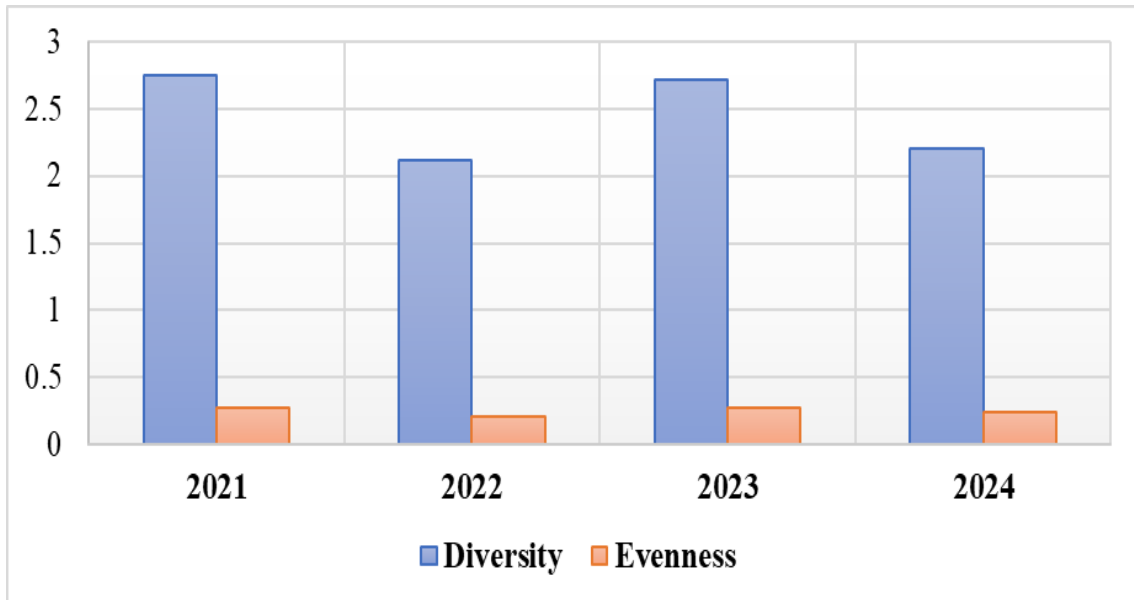


Fig. 1. Year-wise avian diversity and evenness of Karaivetti bird sanctuary

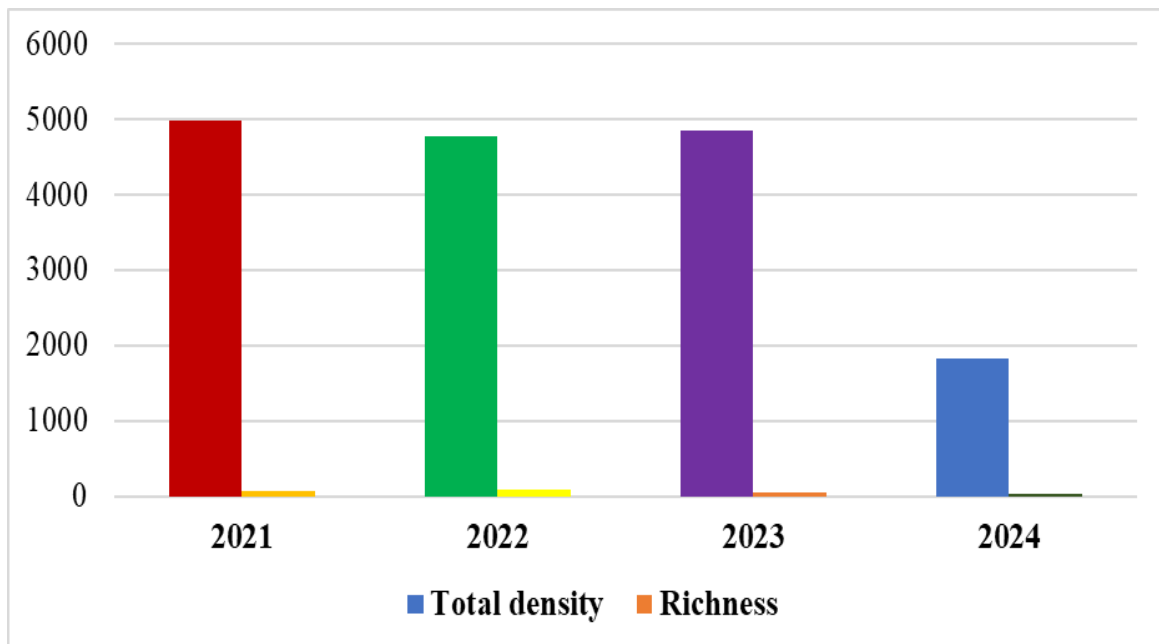


Fig. 2. Year-wise avian density and richness of Karaivetti bird sanctuary

**Table 2. Avian density and relative abundance during 2021 of Karaivetti Bird Sanctuary**

| <b>S.No.</b> | <b>Species Name</b>     | <b>Density (km<sup>2</sup>)</b> | <b>Relative Abundance (%)</b> |
|--------------|-------------------------|---------------------------------|-------------------------------|
| 1.           | Little grebe            | 46.256                          | 0.927                         |
| 2.           | Grey Pelican            | 3.965                           | 0.079                         |
| 3.           | Little cormorant        | 851.762                         | 17.065                        |
| 4.           | Great cormorant         | 2.863                           | 0.057                         |
| 5.           | Oriental Darter         | 27.974                          | 0.560                         |
| 6.           | Little egret            | 621.366                         | 12.449                        |
| 7.           | Grey heron              | 7.048                           | 0.141                         |
| 8.           | Purple heron            | 25.991                          | 0.521                         |
| 9.           | Large egret             | 51.322                          | 1.028                         |
| 10.          | Median egret            | 42.291                          | 0.847                         |
| 11.          | Cattle egret            | 401.762                         | 8.049                         |
| 12.          | Pond heron              | 51.101                          | 1.024                         |
| 13.          | Little Green heron      | 0.220                           | 0.004                         |
| 14.          | Night heron             | 28.194                          | 0.565                         |
| 15.          | Chestnut bittern        | 0.661                           | 0.013                         |
| 16.          | Painted stork           | 26.872                          | 0.538                         |
| 17.          | Open bill stork         | 67.621                          | 1.355                         |
| 18.          | White necked stork      | 2.423                           | 0.049                         |
| 19.          | White ibis              | 424.449                         | 8.504                         |
| 20.          | Spoonbill               | 4.626                           | 0.093                         |
| 21.          | Glossy ibis             | 866.079                         | 17.351                        |
| 22.          | Bar Headed Goose        | 55.947                          | 1.121                         |
| 23.          | Comb duck               | 0.220                           | 0.004                         |
| 24.          | Cotton teal             | 49.119                          | 0.984                         |
| 25.          | Spot –bill duck         | 194.053                         | 3.888                         |
| 26.          | Shoveller               | 49.339                          | 0.988                         |
| 27.          | Pintail Duck            | 272.907                         | 5.468                         |
| 28.          | Garganey                | 5.947                           | 0.119                         |
| 29.          | Common teal             | 182.599                         | 3.658                         |
| 30.          | Lesser whistling teal   | 48.238                          | 0.966                         |
| 31.          | Common pochard          | 1.982                           | 0.040                         |
| 32.          | Wigeon                  | 0.220                           | 0.004                         |
| 33.          | White breasted waterhen | 7.709                           | 0.154                         |
| 34.          | Purple moorhen          | 28.414                          | 0.569                         |
| 35.          | Common moorhen          | 5.507                           | 0.110                         |
| 36.          | Common coot             | 160.132                         | 3.208                         |
| 37.          | Pheasant-tailed jacana  | 4.846                           | 0.097                         |
| 38.          | Bronze-winged jacana    | 1.762                           | 0.035                         |
| 39.          | Greater painted -snipe  | 2.643                           | 0.053                         |
| 40.          | Plover                  | 3.304                           | 0.066                         |
| 41.          | Yellow-wattled lapwing  | 2.863                           | 0.057                         |
| 42.          | Red- wattled lapwing    | 13.436                          | 0.269                         |
| 43.          | Grey-Headed Lapwing     | 0.220                           | 0.004                         |
| 44.          | Black tailed godwit     | 1.322                           | 0.026                         |
| 45.          | Whimbrel                | 2.643                           | 0.053                         |
| 46.          | Redshank                | 4.626                           | 0.093                         |
| 47.          | Greenshank              | 4.185                           | 0.084                         |
| 48.          | Marsh sandpiper         | 29.075                          | 0.582                         |
| 49.          | Wood sandpiper          | 0.220                           | 0.004                         |
| 50.          | Common Sandpiper        | 8.150                           | 0.163                         |
| 51.          | Little stint            | 116.300                         | 2.330                         |
| 52.          | Black winged stilt      | 115.859                         | 2.321                         |
| 53.          | Black-headed gull       | 0.220                           | 0.004                         |
| 54.          | Little tern             | 47.137                          | 0.944                         |

| S.No. | Species Name              | Density (km <sup>2</sup> ) | Relative Abundance (%) |
|-------|---------------------------|----------------------------|------------------------|
| 55.   | Whisked tern              | 0.220                      | 0.004                  |
| 56.   | Small blue kingfisher     | 3.744                      | 0.075                  |
| 57.   | Pied Kingfisher           | 6.388                      | 0.128                  |
| 58.   | White-breasted Kingfisher | 5.066                      | 0.101                  |

**Table 3. Avian density and relative abundance during 2022 of Karaivetti Bird Sanctuary**

| S.No. | Species Name              | Density (km <sup>2</sup> ) | Relative Abundance (%) |
|-------|---------------------------|----------------------------|------------------------|
| 1.    | Spot billed Pelican       | 3.30                       | 0.07                   |
| 2.    | Bar Headed Goose          | 18.06                      | 0.38                   |
| 3.    | Eurasian Wigeon           | 16.74                      | 0.35                   |
| 4.    | Indian Spot billed Duck   | 69.38                      | 1.45                   |
| 5.    | Lesser Whistling Duck     | 29.74                      | 0.62                   |
| 6.    | Fulvous whistling duck    | 10.35                      | 0.22                   |
| 7.    | Northern Pintail          | 85.02                      | 1.78                   |
| 8.    | Garganey                  | 24.23                      | 0.51                   |
| 9.    | Northern Shoveller        | 92.73                      | 1.94                   |
| 10.   | Common Teal               | 72.03                      | 1.51                   |
| 11.   | Little Grebe              | 27.97                      | 0.59                   |
| 12.   | Little Cormorant          | 1753.30                    | 36.73                  |
| 13.   | Large cormorant           | 5.51                       | 0.12                   |
| 14.   | Indian Cormorant          | 18.06                      | 0.38                   |
| 15.   | Oriental Darter           | 19.38                      | 0.41                   |
| 16.   | Indian Pond Heron         | 25.33                      | 0.53                   |
| 17.   | Black-crowned Night Heron | 7.71                       | 0.16                   |
| 18.   | Cattle Egret              | 77.53                      | 1.62                   |
| 19.   | Little Egret              | 1228.85                    | 25.74                  |
| 20.   | Intermediate Egret        | 42.95                      | 0.90                   |
| 21.   | Great Egret               | 5.51                       | 0.12                   |
| 22.   | Purple Heron              | 2.20                       | 0.05                   |
| 23.   | Grey Heron                | 7.05                       | 0.15                   |
| 24.   | Black-headed Ibis         | 272.03                     | 5.70                   |
| 25.   | Spoonbill                 | 18.72                      | 0.39                   |
| 26.   | Glossy Ibis               | 496.92                     | 10.41                  |
| 27.   | Painted Stork             | 1.32                       | 0.03                   |
| 28.   | Asian Openbill            | 40.75                      | 0.85                   |
| 29.   | Woolly-necked Stork       | 0.44                       | 0.01                   |
| 30.   | White-breasted Waterhen   | 1.76                       | 0.04                   |
| 31.   | Common Sandpiper          | 1.54                       | 0.03                   |
| 32.   | Green Sandpiper           | 1.32                       | 0.03                   |
| 33.   | Wood Sandpiper            | 0.66                       | 0.01                   |
| 34.   | Little Ringed Plover      | 0.88                       | 0.02                   |
| 35.   | Red Wattled Lapwing       | 7.93                       | 0.17                   |
| 36.   | Pheasant-tailed Jacana    | 1.76                       | 0.04                   |
| 37.   | Purple Swamphen           | 0.88                       | 0.02                   |
| 38.   | Common Moorhen            | 0.44                       | 0.01                   |
| 39.   | Eurasian Coot             | 179.30                     | 3.76                   |
| 40.   | Black-winged Stilt        | 25.33                      | 0.53                   |
| 41.   | Gull-Billed Tern          | 0.88                       | 0.02                   |
| 42.   | Greater Spotted Eagle     | 0.44                       | 0.01                   |
| 43.   | Osprey                    | 0.44                       | 0.01                   |
| 44.   | Black Kite                | 0.66                       | 0.01                   |
| 45.   | Brahminy Kite             | 1.10                       | 0.02                   |
| 46.   | Eurasian Marsh Harrier    | 0.66                       | 0.01                   |
| 47.   | Shikra                    | 0.66                       | 0.01                   |
| 48.   | Spotted Dove              | 1.10                       | 0.02                   |

| S.No. | Species Name              | Density (km <sup>2</sup> ) | Relative Abundance (%) |
|-------|---------------------------|----------------------------|------------------------|
| 49.   | Rock Pigeon               | 1.54                       | 0.03                   |
| 50.   | Rose-ringed Parakeet      | 1.32                       | 0.03                   |
| 51.   | Common Hawk Cuckoo        | 0.66                       | 0.01                   |
| 52.   | Jacobin Cuckoo            | 0.44                       | 0.01                   |
| 53.   | Greater Coucal            | 0.66                       | 0.01                   |
| 54.   | Grey Francolin            | 0.66                       | 0.01                   |
| 55.   | Indian Peafowl            | 0.66                       | 0.01                   |
| 56.   | Ashy-crowned Sparrow Lark | 1.10                       | 0.02                   |
| 57.   | Paddyfield Pipit          | 1.10                       | 0.02                   |
| 58.   | Blyth's Reed Warbler      | 0.66                       | 0.01                   |
| 59.   | Clamorous Reed Warbler    | 0.44                       | 0.01                   |
| 60.   | Asian Palm Swift          | 7.49                       | 0.16                   |
| 61.   | Barn Swallow              | 16.74                      | 0.35                   |
| 62.   | White-throated Kingfisher | 1.54                       | 0.03                   |
| 63.   | Common Kingfisher         | 1.10                       | 0.02                   |
| 64.   | Pied Kingfisher           | 1.10                       | 0.02                   |
| 65.   | Green Bee-eater           | 8.37                       | 0.18                   |
| 66.   | Blue-tailed Bee-eater     | 3.08                       | 0.06                   |
| 67.   | Indian Roller             | 0.88                       | 0.02                   |
| 68.   | Black Drongo              | 3.08                       | 0.06                   |
| 69.   | Common Myna               | 3.30                       | 0.07                   |
| 70.   | Rufous Treepie            | 0.66                       | 0.01                   |
| 71.   | House Crow                | 4.41                       | 0.09                   |
| 72.   | Indian Jungle Crow        | 2.20                       | 0.05                   |
| 73.   | Yellow-billed Babbler     | 3.30                       | 0.07                   |
| 74.   | Ashy Prinia               | 0.66                       | 0.01                   |
| 75.   | Plain Prinia              | 0.22                       | 0.00                   |
| 76.   | White-browed Wagtail      | 1.10                       | 0.02                   |
| 77.   | Purple-rumped Sunbird     | 0.66                       | 0.01                   |
| 78.   | Baya Weaver               | 3.30                       | 0.07                   |

**Table 4. Avian density and relative abundance during 2023 of Karaivetti Bird Sanctuary**

| S.No. | Species Name       | Density (km <sup>2</sup> ) | Relative Abundance (%) |
|-------|--------------------|----------------------------|------------------------|
| 1.    | Little grebe       | 45.15                      | 0.93                   |
| 2.    | Grey Pelican       | 2.64                       | 0.05                   |
| 3.    | Little cormorant   | 1148.68                    | 23.64                  |
| 4.    | Great cormorant    | 1.76                       | 0.04                   |
| 5.    | Darter             | 26.65                      | 0.55                   |
| 6.    | Little egret       | 840.31                     | 17.29                  |
| 7.    | Grey heron         | 138.33                     | 2.85                   |
| 8.    | Purple heron       | 68.72                      | 1.41                   |
| 9.    | Large egret        | 138.33                     | 2.85                   |
| 10.   | Median egret       | 40.97                      | 0.84                   |
| 11.   | Cattle egret       | 267.84                     | 5.51                   |
| 12.   | Pond heron         | 47.36                      | 0.97                   |
| 13.   | Little Green heron | 0.22                       | 0.00                   |
| 14.   | Night heron        | 26.65                      | 0.55                   |
| 15.   | Chestnut bittern   | 0.22                       | 0.00                   |
| 16.   | Painted stork      | 25.99                      | 0.53                   |
| 17.   | Open bill stork    | 65.64                      | 1.35                   |
| 18.   | White necked stork | 1.32                       | 0.03                   |
| 19.   | White ibis         | 246.92                     | 5.08                   |
| 20.   | Spoonbill          | 3.96                       | 0.08                   |
| 21.   | Glossy ibis        | 424.01                     | 8.73                   |
| 22.   | Bar Headed Goose   | 57.71                      | 1.19                   |



| S.No. | Species Name            | Density (km <sup>2</sup> ) | Relative Abundance (%) |
|-------|-------------------------|----------------------------|------------------------|
| 23.   | Comb duck               | 0.22                       | 0.00                   |
| 24.   | Cotton teal             | 47.58                      | 0.98                   |
| 25.   | Spot-billed duck        | 192.29                     | 3.96                   |
| 26.   | Shoveller               | 47.36                      | 0.97                   |
| 27.   | Pintail Duck            | 272.03                     | 5.60                   |
| 28.   | Garganey                | 5.07                       | 0.10                   |
| 29.   | common teal             | 181.28                     | 3.73                   |
| 30.   | Lesser whistling teal   | 47.58                      | 0.98                   |
| 31.   | Common pochard          | 1.32                       | 0.03                   |
| 32.   | Wigeons                 | 0.22                       | 0.00                   |
| 33.   | White-breasted Waterhen | 6.17                       | 0.13                   |
| 34.   | Purple moorhen          | 26.65                      | 0.55                   |
| 35.   | Common moorhen          | 4.63                       | 0.10                   |
| 36.   | Common coot             | 158.81                     | 3.27                   |
| 37.   | Pheasant-tailed jacana  | 3.96                       | 0.08                   |
| 38.   | Bronze-winged jacana    | 0.66                       | 0.01                   |
| 39.   | Greater painted-snipe   | 1.76                       | 0.04                   |
| 40.   | Little Ringed Plover    | 2.20                       | 0.05                   |
| 41.   | Yellow-wattled lapwing  | 1.76                       | 0.04                   |
| 42.   | Red-wattled lapwing     | 12.11                      | 0.25                   |
| 43.   | Grey-Headed Lapwing     | 0.22                       | 0.00                   |
| 44.   | Black-tailed godwit     | 0.66                       | 0.01                   |
| 45.   | Whimbrel                | 1.76                       | 0.04                   |
| 46.   | Redshank                | 3.96                       | 0.08                   |
| 47.   | Greenshank              | 3.30                       | 0.07                   |
| 48.   | Marsh sandpiper         | 26.65                      | 0.55                   |
| 49.   | Wood sandpiper          | 0.22                       | 0.00                   |
| 50.   | Common Sandpiper        | 7.27                       | 0.15                   |
| 51.   | Little stint            | 77.31                      | 1.59                   |

**Table 5. Avian density and relative abundance during 2024 of Karaivetti Bird Sanctuary**

| S.No. | Species Name           | Density (km <sup>2</sup> ) | Relative Abundance (%) |
|-------|------------------------|----------------------------|------------------------|
| 1.    | Large Egret            | 39.65                      | 2.18                   |
| 2.    | Cattle Egret           | 48.46                      | 2.66                   |
| 3.    | Little Egret           | 246.70                     | 13.55                  |
| 4.    | Little Grebe           | 14.76                      | 0.81                   |
| 5.    | Little Cormorant       | 696.04                     | 38.24                  |
| 6.    | Grey Heron             | 37.44                      | 2.06                   |
| 7.    | Pond Heron             | 17.62                      | 0.97                   |
| 8.    | White Necked Stork     | 0.44                       | 0.02                   |
| 9.    | Open Bill Stork        | 90.31                      | 4.96                   |
| 10.   | Painted Stork          | 6.61                       | 0.36                   |
| 11.   | White Headed Ibis      | 171.81                     | 9.44                   |
| 12.   | Glossy Ibis            | 253.30                     | 13.92                  |
| 13.   | Darter                 | 13.00                      | 0.71                   |
| 14.   | Red Wattled Lapwing    | 15.20                      | 0.84                   |
| 15.   | Spoon Bill             | 5.51                       | 0.30                   |
| 16.   | Wigeon                 | 3.30                       | 0.18                   |
| 17.   | Common Sand Piper      | 3.30                       | 0.18                   |
| 18.   | Purple Heron           | 5.51                       | 0.30                   |
| 19.   | Common Coot            | 10.79                      | 0.59                   |
| 20.   | Spot Bill Duck         | 17.62                      | 0.97                   |
| 21.   | Pheasant Tailed Jacana | 4.41                       | 0.24                   |
| 22.   | River Term             | 13.22                      | 0.73                   |
| 23.   | Wood Sandpiper         | 5.29                       | 0.29                   |

| S.No. | Species Name             | Density (km <sup>2</sup> ) | Relative Abundance (%) |
|-------|--------------------------|----------------------------|------------------------|
| 24.   | Black Winged Stilt       | 16.52                      | 0.91                   |
| 25.   | Yellow Wattled Lapwing   | 1.10                       | 0.06                   |
| 26.   | Spot Billed Pelican      | 6.61                       | 0.36                   |
| 27.   | Garganey                 | 18.72                      | 1.03                   |
| 28.   | Purple Moorhen           | 7.71                       | 0.42                   |
| 29.   | Common Teal              | 9.91                       | 0.54                   |
| 30.   | Cottan Teal              | 4.41                       | 0.24                   |
| 31.   | Lesser Whistling Duck    | 10.35                      | 0.57                   |
| 32.   | White Breasted Water Hen | 3.30                       | 0.18                   |
| 33.   | Northern Shoveller       | 14.54                      | 0.80                   |
| 34.   | Bar Headed Goose         | 6.61                       | 0.36                   |

#### 4. CONCLUSION

The study conducted over four years in Karaivetti Bird Sanctuary recorded 97 bird species, including migrant and resident species. Five species were Near Threatened, and two were Vulnerable according to the IUCN Red List. It serves as a foundational reference for understanding population dynamics, habitat preferences, and conservation priorities within the sanctuary and potentially informs broader conservation strategies for wetland ecosystems. Comparison with previous studies highlighted the sanctuary's regional importance for avian diversity. Fluctuations in species diversity, richness, and evenness across years emphasized the need for ongoing conservation efforts. Overall, these findings not only contribute to the scientific understanding of avian ecology but also have implications for the conservation and management of Karaivetti Bird Sanctuary and similar habitats. Continued research and monitoring efforts are essential for ensuring the preservation of biodiversity in the face of environmental challenges.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

#### REFERENCES

- Ramamurthy V, Rajakumar R. A study of avifaunal diversity and influences of water quality in the Udhayamarthandapuram Bird Sanctuary, Tiruvarur District, Tamil Nadu, India. *International Journal of Innovative Research in Science, Engineering and Technology*. 2014;3(1).
- Ramsar C. The list of wetlands of international importance. *RAMSAR Secretariat: Gland, Switzerland*; 2004.

- Guptha MB, Vijayan L, Sandaliyan S, Sridharan N. Status of Wetlands and Wetland Birds in Coimbatore, Trichy, Peramballore and Thiruvavur Districts in Tamil Nadu, India. *World Journal of Zoology*. 2021;6(2):154-158.
- Ekhande A, Patil J, Padate G. Study of birds of Yashawant Lake with respect to densities, species richness and Shannon-Weiner indices and its correlation with lake dynamics. *European Journal of Zoological Research*. 2012;1(1):6-15.
- Gibbs JP. Importance of small wetlands for the persistence of local populations of wetland-associated animals. *Wetlands*. 1993;13:25-31.
- Paracuellos M. How can habitat selection affect the use of a wetland complex by waterbirds?. *Biodiversity & Conservation*. 2006;15(14):4569-4582.
- Salathe T. (ed.) *Conserving Migratory Birds*. Technical publication no. 12. International Council for Bird Preservation, Cambridge, England. 1991;393.
- Kauzeni AS, Kiwasila HL. Serengeti regional conservation strategy: A socioeconomic study. Dar Es Salaam, Tanzania: Institute of Resource Assessment University of Dar Es Salaam; 1994.
- Kideghesho JR, Nyahongo JW, Hassan SN, Tarimo TC, Mbije NE. Factors and ecological impacts of wildlife habitat destruction in the Serengeti ecosystem in northern Tanzania. *African Journal of Environmental Assessment and Management*. 2006;11:17-32.
- Kaur R, Braich OS. Abundance and diversity of threatened birds in Nangal Wetland, Punjab, India. *Journal of Threatened Taxa*. 2021;13(12):19733-19742.
- Abir S. Seasonal variations in physico-chemical characteristics of Rudrasagar

- wetland-a Ramsar Site, Tripura, North East, India. Research Journal of Chemical Sciences; 2014. ISSN, 2231, 606X.
12. Gupta D, Ranjan RK, Parthasarathy P, Ansari A. Spatial and seasonal variability in the water chemistry of Kabar Tal wetland (Ramsar site), Bihar, India: multivariate statistical techniques and GIS approach. Water Science and Technology. 2021; 83(9):2100-2117.
  13. Grimmett R, Inskipp C, Inskipp T, Byers C. Pocket guide to the birds of the Indian subcontinent; 1999.
  14. Ali S, Ali S. The book of Indian birds. Oxford University Press, USA; 1996.
  15. Shannon CE, Wiener. The mathematical theory of communications, University of Illinois, Chicago. Urbana. 1963;117.
  16. Harisha MN, Hosetti BB. Diversity and distribution of avifauna of Lakkavalli range forest, Bhadra wildlife sanctuary, western ghat, India. Ecoprint: An International Journal of Ecology. 2009;16:21-27.
  17. Anjos LD. Species richness and relative abundance of birds in natural and anthropogenic fragments of Brazilian Atlantic forest. Anais da Academia Brasileira de Ciências. 2004;76(2):429-434.
  18. Baranidharan K, Vijayabhama M, Sathish N, Vigneswaran S. Study on seasonal variations of wetland birds in Karaivetti Bird Sanctuary, Ariyalur, Tamil Nadu, India. Agriculture Association of Textile Chemical and Critical Reviews Journal. 2022;92-97.
  19. Krishnamoorthi S, Shivaa MK, Baranidharan K, Prasanthrajan M. Study on seasonal variations of wetland birds in Vellode bird sanctuary, Erode, Tamil Nadu, India. Journal of Entomology and Zoology Studies. 2020;8:333-337.
  20. Vas AM, Baranidharan K, Vigneswara S, Tilak M, Vijayabhama M. Seasonal dynamics of avian diversity in mine spoil afforested areas: A study in and around NLCIL, Neyveli. The Pharma Innovation Journal. 2023;12(8):1357-1364.
  21. Satheesh N, Baranidharan K, Krishnamoorthi S, Vijayabhama M, Mugilan S. Diversity and Abundance of Wetland Birds in Udayamarthandapuram Bird Sanctuary, Tiruvarur District, Tamil Nadu, India. Asian Journal of Environment & Ecology. 2024;23(6):80-90.
  22. Manohara G, Harisha MN, Hosetti BB. Status, diversity and conservation threats of migratory wetland birds in Magadi Bird Sanctuary, Gadag district, Karnataka, India. Journal of Entomology and Zoology studies. 2016;4(4):265-269.
  23. Anika T, Parasharya BM. Importance of sewage treatment ponds for water- birds in semi-arid zone of Gujarat, India. International Journal of Research in BioSciences. 2013;2(4):17-25.
  24. Baranidharan K, Krishnamoorthi S, Vijayabhama M. Study on seasonal variation of wetland birds in Coimbatore District in Tamil Nadu, India. Journal of Wildlife Research. 2020;8(2):20-23.
  25. Baranidharan K, Krishnamoorthi S, Vijayabhama M, Mugilan S. Status, diversity and species composition of wetland birds on Vaduvor Bird Sanctuary, Tiruvarur District, Tamil Nadu, India. Journal of Agriculture and Ecology Research International. 2024;25(3):99-106.

## APPENDIX

## Appendix 1. Species composition of wetland birds and wetland-associated birds of Karaivetti Bird Sanctuary

| S.No | Order            | Family       | Species                 | Scientific name                 | IUCN status              | Migratory status | 2021 | 2022 | 2023 | 2024 |   |
|------|------------------|--------------|-------------------------|---------------------------------|--------------------------|------------------|------|------|------|------|---|
| 1.   | Accipitriformes  | Accipitridae | Black Kite              | <i>Milvus migrans</i>           | LC                       | R                |      | ✓    |      |      |   |
| 2.   |                  |              | Brahminy Kite           | <i>Haliastur Indus</i>          | LC                       | R                |      | ✓    |      |      |   |
| 3.   |                  |              | Eurasian Marsh Harrier  | <i>Circus aeroginosus</i>       | LC                       | M                |      | ✓    |      |      |   |
| 4.   |                  |              | Greater Spotted Eagle   | <i>Aquila clanga</i>            | VU                       | M                |      | ✓    |      |      |   |
| 5.   |                  |              | Shikra                  | <i>Accipiter badius</i>         | LC                       | R                |      | ✓    |      |      |   |
| 6.   |                  |              | Pandionidae             | Osprey                          | <i>Pandion haliaetus</i> | LC               | M    |      | ✓    |      |   |
| 7.   | Anseriformes     | Anatidae     | Bar Headed Goose        | <i>Anser indicus</i>            | LC                       | M                | ✓    | ✓    | ✓    | ✓    |   |
| 8.   |                  |              | Comb duck               | <i>Sarkidiornis melanatos</i>   | LC                       | R                | ✓    | ✓    | ✓    |      |   |
| 9.   |                  |              | Common pochard          | <i>Aythya farina</i>            | VU                       | M                | ✓    | ✓    | ✓    |      |   |
| 10.  |                  |              | Common Teal             | <i>Anas crecca</i>              | LC                       | M                | ✓    | ✓    | ✓    | ✓    |   |
| 11.  |                  |              | Cotton teal             | <i>Nattapus coromandelianus</i> | LC                       | R                | ✓    | ✓    | ✓    |      |   |
| 12.  |                  |              | Eurasian Wigeon         | <i>Anas Penelope</i>            | LC                       | M                |      |      |      |      | ✓ |
| 13.  |                  |              | Fulvous whistling duck  | <i>Dendrocygna bicolor</i>      | LC                       | R                |      |      |      |      | ✓ |
| 14.  |                  |              | Garganey                | <i>Anas querquedula</i>         | LC                       | M                | ✓    | ✓    | ✓    | ✓    |   |
| 15.  |                  |              | Indian Spot billed Duck | <i>Anas poecilorhyncha</i>      | LC                       | R                | ✓    | ✓    | ✓    | ✓    |   |
| 16.  |                  |              | Lesser Whistling Duck   | <i>Dendrocygna javanica</i>     | LC                       | R                | ✓    | ✓    | ✓    | ✓    |   |
| 17.  |                  |              | Northern Pintail        | <i>Anas acuta</i>               | LC                       | M                | ✓    | ✓    | ✓    | ✓    |   |
| 18.  | Anseriformes     | Anatidae     | Northern Shoveller      | <i>Anas clypeata</i>            | LC                       | M                | ✓    | ✓    | ✓    | ✓    |   |
| 19.  |                  |              | Wegion                  | <i>Mareca penelope</i>          | LC                       | M                | ✓    | ✓    | ✓    |      |   |
| 20.  | Caprimulgiformes | Apodidae     | Asian Palm Swift        | <i>Cypsiurus balasiensis</i>    | LC                       | R                |      |      |      | ✓    |   |
| 21.  |                  |              | Grey-Headed             | <i>Vanellus cinereus</i>        | LC                       | M                | ✓    | ✓    | ✓    |      |   |

| S.No | Order           | Family           | Species                | Scientific name                 | IUCN status                       | Migratory status | 2021 | 2022 | 2023 | 2024 |   |
|------|-----------------|------------------|------------------------|---------------------------------|-----------------------------------|------------------|------|------|------|------|---|
| 22.  |                 |                  | Lapwing                |                                 |                                   |                  |      |      |      |      |   |
| 23.  |                 | Charadriidae     | Little Ringed Plover   | <i>Charadrius dubius</i>        | LC                                | R                | ✓    | ✓    | ✓    | ✓    |   |
| 24.  |                 |                  | Red Wattled Lapwing    | <i>Vanellus indicus</i>         | LC                                | R                | ✓    | ✓    | ✓    | ✓    |   |
| 25.  |                 | Jacanidae        | Yellow-wattled lapwing | <i>Vanellus malabaricus</i>     | LC                                | R                | ✓    | ✓    | ✓    |      |   |
| 26.  |                 |                  | Bronze winged jacana   | <i>Metopidius indicus</i>       | LC                                | R                | ✓    | ✓    | ✓    |      |   |
| 27.  | Charadriiformes | Laridae          | Pheasant-tailed Jacana | <i>Hydrophasianus chirurgus</i> | LC                                | R                | ✓    | ✓    | ✓    | ✓    |   |
| 28.  |                 |                  |                        | Black headed gull               | <i>Chroicocephalus ridibundus</i> | LC               | M    | ✓    |      | ✓    |   |
| 29.  |                 |                  |                        | Gull-billed tern                | <i>Gelochelidon nilotica</i>      | LC               | M    |      |      |      | ✓ |
| 30.  |                 |                  |                        | Little tern                     | <i>Sternula albifrons</i>         | LC               | R    | ✓    |      | ✓    |   |
| 31.  |                 | Recurvirostridae | Whisked tern           | <i>Childonias hybrida</i>       | LC                                | M                | ✓    |      | ✓    |      |   |
| 32.  |                 |                  | Black-winged Stilt     | <i>Himantopus himantopus</i>    | LC                                | M                | ✓    | ✓    | ✓    | ✓    |   |
| 33.  |                 | Rostratulidae    | Greater painted snipe  | <i>Rostratula benghalensis</i>  | LC                                | R                | ✓    | ✓    | ✓    |      |   |
| 34.  | Charadriiformes | Scolopacidae     | Black tailed godwit    | <i>Limosa limosa</i>            | NT                                | M                | ✓    | ✓    | ✓    |      |   |
| 35.  |                 |                  | Common Sandpiper       | <i>Actitis hypoleucos</i>       | LC                                | M                | ✓    | ✓    | ✓    | ✓    |   |
| 36.  |                 |                  | Green Sandpiper        | <i>Tringa ocropus</i>           | LC                                | M                |      |      |      | ✓    |   |
| 37.  |                 |                  | Greenshank             | <i>Tringa nebularia</i>         | LC                                | M                | ✓    | ✓    | ✓    |      |   |
| 38.  |                 |                  | Little stint           | <i>Calidris minuta</i>          | LC                                | M                | ✓    | ✓    | ✓    |      |   |
| 39.  |                 |                  | Marsh sandpiper        | <i>Tringa stagnatilis</i>       | LC                                | M                | ✓    | ✓    | ✓    |      |   |
| 40.  |                 |                  | Redshank               | <i>Tringa totanus</i>           | LC                                | M                | ✓    | ✓    | ✓    |      |   |
| 41.  |                 |                  | Whimbrel               | <i>Numenius phaeopus</i>        | LC                                | M                | ✓    | ✓    | ✓    |      |   |
| 42.  | Ciconiiformes   | Ciconiidae       | Wood Sandpiper         | <i>Tringa glareola</i>          | LC                                | M                | ✓    | ✓    | ✓    | ✓    |   |
| 43.  |                 |                  |                        | Asian Openbill                  | <i>Anastomus oscitans</i>         | LC               | R    | ✓    | ✓    | ✓    | ✓ |
| 44.  |                 |                  |                        | Painted Stork                   | <i>Mycteria leucocephala</i>      | LC               | R    | ✓    | ✓    | ✓    | ✓ |
| 44.  |                 |                  |                        | Woolly-necked Stork             | <i>Ciconia episcopus</i>          | NT               | R    | ✓    | ✓    | ✓    | ✓ |

| S.No | Order         | Family         | Species                   | Scientific name                  | IUCN status | Migratory status | 2021 | 2022 | 2023 | 2024 |
|------|---------------|----------------|---------------------------|----------------------------------|-------------|------------------|------|------|------|------|
| 45.  | Columbiformes | Columbidae     | Rock Pigeon               | <i>Columba livia</i>             | LC          | R                |      | ✓    |      |      |
| 46.  |               |                | Spotted Dove              | <i>Streptopelia chinensis</i>    | LC          | R                |      | ✓    |      |      |
| 47.  | Coraciiformes |                | Common Kingfisher         | <i>Alcedo atthis</i>             | LC          | R                | ✓    |      | ✓    | ✓    |
| 48.  |               | Alcedinidae    | Pied Kingfisher           | <i>Ceryle rudis</i>              | LC          | R                | ✓    |      | ✓    | ✓    |
| 49.  |               |                | White-throated Kingfisher | <i>Halcyon smyrnensis</i>        | LC          | R                | ✓    |      | ✓    | ✓    |
| 50.  |               | Coraciidae     | Indian Roller             | <i>Coracias benghalensis</i>     | LC          | R                |      |      |      | ✓    |
| 51.  |               | Meropidae      | Blue-tailed Bee-eater     | <i>Merops philippinus</i>        | LC          | M                |      | ✓    |      |      |
| 52.  |               |                | Green Bee-eater           | <i>Merops orientalis</i>         | LC          | R                |      | ✓    |      |      |
| 53.  | Cuculiformes  | Cuculidae      | Common Hawk Cuckoo        | <i>Hierococcyx varius</i>        | LC          | R                |      | ✓    |      |      |
| 54.  |               |                | Greater Coucal            | <i>Centropus sinensis</i>        | LC          | R                |      | ✓    |      |      |
| 55.  |               |                | Jacobin Cuckoo            | <i>Clamator jacobinus</i>        | LC          | R                |      | ✓    |      |      |
| 56.  | Galliformes   | Phasianidae    | Grey Francolin            | <i>Francolinus pondicerianus</i> | LC          | R                |      |      |      | ✓    |
| 57.  |               |                | Indian Peafowl            | <i>Pavo cristatus</i>            | LC          | R                |      |      |      | ✓    |
| 58.  | Gruiformes    | Rallidae       | Common Moorhen            | <i>Gallinula chloropus</i>       | LC          | R                | ✓    | ✓    | ✓    | ✓    |
| 59.  |               |                | Eurasian Coot             | <i>Fulica atra</i>               | LC          | R                | ✓    | ✓    | ✓    | ✓    |
| 60.  |               |                | Purple Swamphen           | <i>Porphyrio porphyrio</i>       | LC          | R                | ✓    | ✓    | ✓    | ✓    |
| 61.  |               |                | White-breasted Waterhen   | <i>Amauornis phoenicurus</i>     | LC          | R                | ✓    | ✓    | ✓    | ✓    |
| 62.  |               | Acrocephalidae | Blyth's Reed Warbler      | <i>Acrocephalus dumetorum</i>    | LC          | M                |      |      |      |      |
| 63.  |               |                | Clamorous Reed Warbler    | <i>Acrocephalus stentoreus</i>   | LC          | M                |      |      | ✓    |      |
| 64.  | Passeriformes | Alaudidae      | Ashy-crowned Sparrow Lark | <i>Erymopterix griseus</i>       | LC          | R                |      |      | ✓    |      |
| 65.  |               | Cisticolidae   | Ashy Prinia               | <i>Prinia socialis</i>           | LC          | R                |      |      | ✓    |      |
| 66.  |               |                | Plain Prinia              | <i>Prinia inornata</i>           | LC          | R                |      |      | ✓    |      |
| 67.  |               |                | House Crow                | <i>Corvus splendens</i>          | LC          | R                |      |      | ✓    |      |
| 68.  |               | Corvidae       | Indian Jungle Crow        | <i>Corvus culminatus</i>         | LC          | R                |      |      | ✓    |      |

| S.No | Order            | Family            | Species                   | Scientific name                    | IUCN status | Migratory status | 2021 | 2022 | 2023 | 2024 |
|------|------------------|-------------------|---------------------------|------------------------------------|-------------|------------------|------|------|------|------|
| 69.  |                  |                   | Rufous Treepie            | <i>Dendrocitta vagabunda</i>       | LC          | R                |      |      | ✓    |      |
| 70.  |                  | Dicruridae        | Black Drongo              | <i>Dicrurus macrocercus</i>        | LC          | R                |      |      | ✓    |      |
| 71.  |                  | Hirundinidae      | Barn Swallow              | <i>Hirundo rustica</i>             | LC          | M                |      |      | ✓    |      |
| 72.  |                  | Leiothrichidae    | Yellow-billed Babbler     | <i>Argya affinis</i>               | LC          | R                |      |      | ✓    |      |
| 73.  |                  |                   | Paddyfield Pipit          | <i>Anthus rufulus</i>              | LC          | R                |      |      | ✓    |      |
| 74.  |                  | Motacillidae      | White-browed Wagtail      | <i>Motacilla maderaspatensis</i>   | LC          | R                |      |      | ✓    | ✓    |
| 75.  |                  | Nectariniidae     | Purple-rumped Sunbird     | <i>Leptocoma zeylonica</i>         | LC          | R                |      | ✓    |      |      |
| 76.  |                  | Ploceidae         | Baya Weaver               | <i>Ploceus philippensis</i>        | LC          | R                |      |      |      | ✓    |
| 77.  |                  | Sturnidae         | Common Myna               | <i>Acridotheres tritis</i>         | LC          | R                |      | ✓    |      |      |
| 78.  | Pelecaniformes   | Ardeidae          | Black-crowned Night Heron | <i>Nycticorax nycticorax</i>       | LC          | R                | ✓    | ✓    | ✓    | ✓    |
| 79.  |                  |                   | Cattle Egret              | <i>Bubulcus ibis</i>               | LC          | R                | ✓    | ✓    | ✓    | ✓    |
| 80.  |                  |                   | Cinnamon bittern          | <i>Ixobrychus cinnamomeus</i>      | LC          | R                | ✓    | ✓    | ✓    |      |
| 81.  |                  |                   | Great Egret               | <i>Ardea alba</i>                  | LC          | R                | ✓    | ✓    | ✓    | ✓    |
| 82.  |                  |                   | Grey Heron                | <i>Ardea cinerea</i>               | LC          | R                | ✓    | ✓    | ✓    | ✓    |
| 83.  |                  |                   | Indian Pond Heron         | <i>Ardeola grayii</i>              | LC          | R                | ✓    | ✓    | ✓    | ✓    |
| 84.  |                  |                   | Intermediate Egret        | <i>Ardea intermedia</i>            | LC          | R                | ✓    | ✓    | ✓    | ✓    |
| 85.  |                  |                   | Little Egret              | <i>Egretta garzetta</i>            | LC          | R                | ✓    | ✓    | ✓    | ✓    |
| 86.  |                  |                   | Little Green heron        | <i>Butorides virescens</i>         | LC          | M                | ✓    | ✓    | ✓    |      |
| 87.  |                  |                   | Purple Heron              | <i>Ardea purpurea</i>              | LC          | R                | ✓    | ✓    | ✓    | ✓    |
| 88.  |                  | Pelecanidae       | Spot billed Pelican       | <i>Pelecanus philippensis</i>      | NT          | R                | ✓    | ✓    | ✓    | ✓    |
| 89.  |                  | Threskiornithidae | Black-headed Ibis         | <i>Threskiornis melanocephalus</i> | NT          | R                | ✓    | ✓    | ✓    | ✓    |
| 90.  |                  |                   | Glossy Ibis               | <i>Plegadis falcinellus</i>        | LC          | R                | ✓    | ✓    | ✓    | ✓    |
| 91.  |                  |                   | Spoonbill                 | <i>Platalea leucorodia</i>         | LC          | R                | ✓    | ✓    | ✓    | ✓    |
| 92.  | Podicipediformes | Podicipedidae     | Little Grebe              | <i>Tachybaptus ruficollis</i>      | LC          | R                | ✓    | ✓    | ✓    | ✓    |

| S.No | Order          | Family            | Species              | Scientific name                  | IUCN status | Migratory status | 2021 | 2022 | 2023 | 2024 |
|------|----------------|-------------------|----------------------|----------------------------------|-------------|------------------|------|------|------|------|
| 93.  | Psittaciformes | Psittaculidae     | Rose-ringed Parakeet | <i>Psittacula krameri</i>        | LC          | R                |      |      |      | ✓    |
| 94.  |                | Anhingidae        | Darter               | <i>Anhinga melanogaster</i>      | NT          | R                | ✓    | ✓    | ✓    | ✓    |
| 95.  |                |                   | Indian Cormorant     | <i>Phalacrocorax fuscicollis</i> | LC          | R                |      |      |      | ✓    |
| 96.  | Suliformes     | Phalacrocoracidae | Large cormorant      | <i>Phalacrocorax carbo</i>       | LC          | R                | ✓    | ✓    | ✓    | ✓    |
| 97.  |                |                   | Little Cormorant     | <i>Microcarbo niger</i>          | LC          | R                | ✓    | ✓    | ✓    | ✓    |

© Copyright (2024): Author(s). The licensee is the journal publisher. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited

Peer-review history:  
 The peer review history for this paper can be accessed here:  
<https://www.sdiarticle5.com/review-history/118011>