



# Species Drift Without Decline: Avian Responses to Climate and Habitat

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**Abstract:** Birds are a faunal taxon that is highly sensitive to global climatic changes. Bird migration is one of the major bioindicators of habitat destruction and climate change. This study refers to bird species drift and migratory pattern changes due to habitat destruction and climate variation. The study was conducted at Jigani Lake Anekal Taluk, Bangalore, Karnataka, India (comparative analysis of 45 avian species was performed based on the available e-bird data and personal documentations (2020 to 2024). Out of 175 recorded species, considering the deviations that have occurred from the usual trend followed until 2020. Desertification, a decrease in water-holding capacity, rising temperatures, and altered precipitation patterns have affected migratory timing and vulnerability during long migrations, distribution ranges, egg-laying timing, clutch size, and the mismatch between behavior and the environment, causing a drift in avian species and populations. These changes have not caused a decrease in avian species numbers but have led to considerable species drift. These changes have led to an increased reproductive success in avian species like *Pavo cristatus*, *Vanellinae sp.* Etc. Conversely, many species have altered their migratory patterns. Many of the water birds, which were the regular migrants to the lake, have become passage migrants, whereas the migratory birds that prefer dry habitats like *Coracias garrulus* (European Roller) are observed. Introduction to invasive plantations, pollution, constructions, and other anthropogenic disturbances has caused degradation to the actual ecosystem. This can be considered as an epitome of climate change and ecosystem changes occurring in Bangalore. The paper emphasises the importance of wetland conservation, the need to restore and maintain biodiversity.

**Keywords:** Avian species drift, Migratory pattern shifts, Wetland conservation, Anthropogenic disturbance.

## 1. INTRODUCTION

Bird migration is one of the bioindicators of climate change (George et al., 2024)]. Wetlands (and lakes) are among the most productive ecosystems, serving as life support systems and habitats for rich and diverse biodiversity. Wetland bird diversity greatly depends on the quality, quantity, and local water cycle of the lake (Pant et al., 2024)]. The bird species diversity and population index reflect the relationship with seasons (Rai and Sharma, 2024). Reports suggest that large green patches always host larger bird diversity than small patches (Zhu et al., 2024). Urbanisation has led to loss of wetlands, floods, a decline in the groundwater table, urban heat island effects, and elevated carbon footprints (Ramachandra et al., 2015). Approximately 389 avian species have been found in urban Bangalore (<https://ebird.org/region/IN-KA-BN/bird-list>). Among these, around 50% of birds are migratory. Winter migration, which ranges from early October to March, is more prevalent in Bangalore compared to the summer migration. This lake hosts 190 species of birds

(<https://ebird.org/hotspot/L5174545/bird-list?rank=lrec>), including key species such as *Buteo buteo* (Buzzards), *Scolopacidae sp.* (Sandpipers), *Alaudidae sp.* (Larks), and *Passeri sp.* (Warblers). Many avian species exhibit migration, the seasonal habitual movement, and these birds are sensitive to climate change and specific habitats. They can be considered as bioindicators of environmental change (Arya et al., 2019).

The city has an approximate of 1,350 lakes spread across Bengaluru (Kulranjan and Palur, 2022), with around 850 active lakes in Bangalore Urban County, out of which some of the lakes are hotspots of avian biodiversity in the Bangalore urban county. The 98% of the lakes are encroached, and 90% of the lakes are sewage-fed (Ramachandra et al., 2015). 167 lakes have been protected by the BBMP (Government of Karnataka), which has caused improvements as well as destruction for the well-being and biodiversity of the lakes. The current storage capacity of Bengaluru's lakes is about 5 TMC (5,000,000,000 cubic feet), but due to siltation and other polluting factors, the

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actual storage capacity is only about 1.2 TMC (thousand million cubic feet). Lake-filling as part of industrialization has led to great destruction of the lakes and the biodiversity around them. These lakes host more than 1000 species of biodiversity, which greatly depend on these lake ecosystems. These include numerous species of fish, amphibians, birds, insects, phytoplankton, and zooplankton. Lakes play a critical role in controlling soil erosion, floods, microclimate variations, and biogeological cycles (Naem, 2024). E-bird is a platform hosted by the Cornell Lab that helps to collect and compile bird data. The study is based on the eBird data uploaded by 90 birdwatchers over the years 2020-2024. Every week for the past 2 years, the field work was done to record the biodiversity and to study the destruction and changes in and around the lake. The changes in habitat and climate conditions have caused a great change in migratory patterns of birds, and there is a hike in the number of bird species and population that prefer dry habitats in and around the lake (Scridel et al., 2024) indicating decline in water levels of the lake.

This study focuses on the anthropogenic destruction that has caused a change in the overall drift in the bird diversity and population without a decline in the total species count in Jigani Lake, Anekal Taluk, which is situated in the South of Urban Bengaluru (about 5 km from Bannerghatta National Park (air distance).

## 2. MATERIALS AND METHODS

### 2.1. Study Area

Bangalore - located at 12°59' north latitude and 77°57' east longitude, is nearly equidistant from both the eastern and western coasts of the South Indian peninsula. Situated at an altitude of 920 m above the mean sea level [Nölke (2021)]. The city experiences a tropical climate, with the monsoon extending from June to October and the dry season from November to April. In the first half of the monsoon (June-July), the rains are not abundant. The September and October bring peak rainfall, with monthly precipitation reaching up to 194 mm (Rainwater Harvesting. (n.d.). *Rainwater harvesting in India*. Retrieved November 03, 2025, from <http://www.rainwaterharvesting.org>). From mid-October, the north-east winds begin to result in reduced rainfall (Climates to Travel. (n.d.). *Bangalore climate: Weather by month, temperature and rainfall*. Retrieved November 06, 2025, from <https://www.climatestotravel.com>). In winter, from November to February, nights are cool, other for occasional falls in temperature to 10/12 °C (50/54 °F). In terms of precipitation, winter is the driest season. (Seasons Year. (n.d.). *Seasons in Bangalore:*

*Weather and climate*. Retrieved November 12, 2025, from <https://seasonsyear.com>).

Jigani Kere (Jigani Lake) is a water body covering an area of 2 hectares in the urban county of Bangalore city. The lake is at the coordinates - 12.7944° N, 77.6346° E, Anekal taluk, Bangalore, Karnataka, India. The lake can be considered a wetland as it has a large area with shallow water-filled grassland. During the summer, these areas dry up, whereas the major water body of the lake retains the water. The lake is surrounded by agricultural sites, plantations, mango county, plant nurseries, residential areas, temples, industrial areas, automobile workshops, and granite industries. Agricultural sites include paddy, groundnut, mustard, and vegetables. Plantations include eucalyptus (*Eucalyptus globulus*), mango (*Mangifera indica*), and coconut palms (*Cocos nucifera*). The industrial area hosts many large-scale and small-scale industries, including Cipla Ltd. (<https://www.cipla.com>), Aragen Life Science (<https://www.aragen.com>), Yazaki India Pvt. Ltd. (<https://www.yazaki-group.com>), and SAAB Engineering Pvt. Ltd. (<https://saabengg.com>). The East side of the lake has a rubberised road. Bannerghatta Anekal road runs along the lake, whereas other parts of the lake are encircled with a walking track. The lake also has many water holes around the main water body, which become a part of the lake when the lake overflows. The main water body has an island in the middle housing nesting perches for cormorants, raptors, and other water birds. The lake is facilitated with a canal, which gets active when the main water body overflows.

### 2.2. Bird Sampling and Data Collection

Field visits were done for a minimum period of 3 hours at least once a month in person for the past 4 years, i.e., 2020, 2021, 2022, 2023, and the bird data were updated in eBird. The available data is divided into Spring Migration (March - May), Breeding Season (June - July), Fall Migration (August - November), and Winter migration (December - February). E-bird is an online platform that collects and compiles the bird data uploaded and updated by the bird watchers and ornithologists who visit the field (<https://ebird.org/home>). This platform was launched and is maintained by the Cornell Lab of Ornithology. Jigani Lake is recognised as a hot spot by eBird (<https://ebird.org/hotspot/L5174545>). The observations were made with Binoculars and photographed with cameras. 190 species of birds have been recorded by 90 birders from this location, out of which 120 species of birds are recorded in person (<https://ebird.org/lifelists/L5174545>). 45 species among the above-mentioned birds are selected depending on their

impact on the study. These 45 species of birds are selected based on the changes in migratory patterns or because of the emergence of a new species in the location. Other geographical details and observations were recorded during the visit to the work field. E-bird events like the backyard bird count and big day counts were also conducted to record the species.

**3. RESULTS AND DISCUSSION**

Birds spotted for the 1<sup>st</sup> time during the observation periods includes avian species Cotton pygmy goose, Garganey, Northern pin tail, Baillon's crake (Figure 1.3), Osprey, Indian spotted eagle, Common buzzard (Figure 1.2), Large cuckoo shrike, Spot-breasted fantail (Figure 1.4), Thick-billed warbler, Paddy field warbler, Palla's grasshopper warbler, Lesser white throat, Asian brown flycatcher, Siberian stonechat, Oriental skylark and European roller (Figure 1.1). These 17 species of birds showed difference in population and migratory pattern in the years observed.

Many open ground-nesting birds lay and bury their eggs in sand or mud, which gives a long dry gestation period and provides camouflage to protect them from predators [Vishwa Jagati et al. (2023)]. Jigini lake is now occupied by *dry ground birds* as a breeding ground since it has dried up. The lake provides sand and dried grass, making it a suitable breeding ground (Figure 2).

Birds which prefer dry habitats, increased in population when compared to other places, indicating the rapid drying up of the Jigani lake. The above-mentioned reasons have also attracted Oriental skylark during the migratory track. These birds have started migrating here because the drying of the lake and flora has made it a suitable habitat (Dinda et

al., 2020; Scridel et al., 2024; Barik et al., 2021; Nath et al., 2022).

**3.1. Paddy-Field PIPIT**

Raptors like bird Short-toed Snake Eagle (Cauli et al., 2022) and bird Common buzzard (Sidorovich et al., 2016), which prefer dry grasslands with a good population of rodents and herps for their diet, were spotted for the first time during the study period. This shows that the lake is drying up. The decrease in water level helps the raptors catch fish and has caused an increase in the prey population. Insectivorous birds like bird Spot-breasted fantail (Sharma et al., 2024) and Bay-backed shrike, prefer shrub patches along small water bodies or streams, find great diversity and population of arthropods suitable for their diet (Figure 3). Invasive plants like *Bougainvillea spectabilis* (Bougainvillea) and *Lantana camara* have made a suitable habitat for them. Bird Thick-billed warbler, Paddy field warbler, Palla's grasshopper warbler, Lesser white throat, Yellow-eyed babbler, Siberian stonechat (Figure. 3.2), *Muscicapa latirostris* (Asian brown flycatcher), and Taiga flycatcher prefer dried flora as their habitat. The dried grass, shrubs, herbs, and trees support their habitat. All these birds, except bird Yellow-eyed babbler, are migrants to the lake. These birds were spotted for the first time during the study period. The eucalyptus plantations have made their habitat prosperous.

Larger waders like bird Asian openbill (Greeshma and Jayson 2018) and Yellow bittern have increased in population. Bird 79 has increased in population because of the excess availability of food materials like molluscs and fish. As the average water levels have come down in the lake



**Figure 1.** New bird species that have visited the place during the study period; 1.1: European Roller, Figure 1.2: Common Buzzard and 1.3 : Ballion Crake and Figure 1.4: Spot-breasted Fantail



**Figure 2.** Birds that have increased population due to availability of better breeding grounds; 2.1(R): Red wattled Lapwings, 2.1 (L): Yellow Wattled Lapwings; 2.2: Jerdon's Bush Lark and 2.3 : Zitting Cisticola and Figure

through the years, these waders are able to feed more easily with their specialized bills. Other waders like bird Yellow bittern have increased their populations due to shallow water grounds to build their nest in the grass. Warblers like bird, Booted warbler, *Acrocephalus dumetorum* (Blyth's reed warbler), and Clamorous reed warbler have become more common during their migratory seasons. These birds have started spending more time in the lake compared to previous years. This could be due to the exposure of grass and herbs of the lake above the water levels (Varga et al., 2023). These birds are usually found on short, dense patches of herbs above the water. During the observations, was found that the grass and shrubs on the mainland of the lakes started to get exposed.

Birds like *Coracina macei* (Large Cuckoo shrikes), Common Cuckoo [Puswal et al. (2024)], Chestnut-headed bee-eater and Ashy drongo have become winter visitors to the lakes, as there is an increase in deciduous habitat, and bird species are more common in places with more deciduous and arid habitats. Bird 66 is a passage winter migrant to Bangalore's rural areas. However, the bird was spotted for the first time in the lake in 2024, which is on the urban side of Bangalore (Figure 1.1). The bird was seen in the fields and barren lands around the lake. According to the studies, bird 66 prefer warmer and arid habitats (Kiss et al., 2020).

Smaller waders like *Tringa stagnatilis* (Marsh sandpiper), Wood sandpiper were observed to change their migratory patterns (Rischette et al., 2024). Baillon's crane, a migratory bird seen in the same habitats, was spotted for the 1<sup>st</sup> time in the lake during the observation period. These changes in migratory patterns may be due to the filling of the lake. It is noted that the depth of the lake has decreased largely because of the waste dumping and silt sedimentation. These shallow waters are preferred by these small waders (Figure 4). Late winters have also caused these birds' migratory patterns.

The study uses the bird data as a scale for climate change (Copernicus Climate Change Service. 2021). *Bird migration and climate indicators*. ECMWF. Retrieved November 14, 2025, from <https://climate.copernicus.eu>. Industrialization has caused great destruction to the lake, which has affected the birds. Plantation of invasive species like eucalyptus has caused water levels to go down (Kabir et al., 2023). Dumping of construction waste or solid waste has caused silting and filling of lakes. Pollution and dumping of waste and chemicals have caused the water quality to decline.

### 3.3. NDVI (Normalized Difference Vegetation Index)

NDVI (Normalized Difference Vegetation Index) is an indicator of vegetative health, controlled by satellites, where darker green areas indicate healthy, dense vegetation, and white or pale areas represent less or no vegetation, such as bare soil, dry grassland, or buildings (Janani et al., 2017). NDVI maps are generated using the Google Earth Engine tool (<https://earthengine.google.com/platform/>) for the spring migration season (March–May) across five years (2020–2024) to understand the habitat transformation around Jigani Lake and its influence on migratory bird patterns (Zeng et al., 2022).

Moderate vegetation coverage was observed around Jigani Lake, indicating balanced wetland-grassland ecosystems that supported both wetland birds and seasonal migrants (Figure 1) (NASA Earth Observatory. (n.d.). *Measuring vegetation (NDVI & EVI)*. Retrieved November 20, 2025, from <https://earthobservatory.nasa.gov/features/MeasuringVegetation>].



**Figure 3.** Birds that have prospered due to the emergence of shrub habitat- **3.1:** Indian White -eye and **3.2:** Siberian Stone-chat



**Figure 4.** Birds that are reported throughout the year which were once visitors- Black Winged Stilt

**Table 1.** Presence of various birds in different seasons during 2020 to 2024

Common name	Scientific name	Spring	Breeding	Fall	Winter	Iucn status	Residential status
Cotton pygmy goose	<i>Nettapus coromandelianus</i>	-	-	-	+	LC	Resident
Garganey	<i>Spatula querquedula</i>	+	-	-	+	LC	Winter migrant
Northern pintail	<i>Anas acuta</i>	-	-	-	+	LC	Winter migrant
Eurasian collared dove	<i>Streptopelia decaocto</i>	+	-	-	-	LC	Resident & winter migrant
Laughing dove	<i>Spilopelia senegalensis</i>	+	+	+	+	LC	Resident
Baillon's crane	<i>Zapornia pusilla</i>	-	-	-	+	LC	Winter migrant
Watercock	<i>Gallinix cinerea</i>	-	-	+	-	LC	Resident & Within-India Migrant
Rudy breasted crane	<i>Zapornia fusca</i>	+	+	+	2020-21	LC	Resident
					-		
		+	-	-	2023-24		
					+		
Striated heron	<i>Butorides striata</i>	+	-	+	+	LC	Resident
Spot-billed pelican	<i>Pelecanus philippensis</i>	-	-	+	2020-21	NT	Resident
					-		
		+	+	+	2023-24		
					+		
Yellow bittern	<i>Botaurus sinensis</i>	+	+	+	2020-21	LC	Resident & Local Migrant
					-		
		+	-	-	2023-24		
					+		
Eurasian spoonbill	<i>Platalea leucorodia</i>	-	-	-	+	LC	Resident & Local Migrant
Black crowned night heron	<i>Nycticorax nycticorax</i>	-	+	+	2020-21	LC	Resident
					+		
		+	+	+	2023-24		
					+		
Osprey	<i>Pandion haliaetus</i>	-	-	-	+	LC	Winter migrant
Indian spotted eagle	<i>Clanga hastata</i>	-	-	-	+	VU	Resident & Within-India Migrant
Common buzzard	<i>Buteo buteo</i>	+	-	-	+	LC	Winter migrant
Short-toed Snake Eagle	<i>Circaetus gallicus</i>	-	-	-	+	LC	Resident
Booted eagle	<i>Hieraaetus pennatus</i>	-	-	+	2020-21	LC	Winter migrant
					+		
		-	+	+	2023-24		
					+		
Oriental honey buzzard	<i>Pernis ptilorhynchus</i>	-	+	+	2020-21	LC	Resident & Winter Migrant
					-		
		+	+	+	2023-24		
					+		
Crested serpent eagle	<i>Spilornis cheela</i>	-	-	+	-	LC	Resident
Greater spotted eagle	<i>Clanga clanga</i>	-	-	+	2020-21	VU	Winter migrant
					+		
		+	-	+	2023-24		
					+		
Indian pitta	<i>Pitta brachyura</i>	-	-	-	+	LC	Within-India Migrant

Cont..

**Table 1.** Presence of various birds in different seasons during 2020 to 2024

Common name	Scientific name	Spring	Breeding	Fall	Winter	Iucn status	Residential status
Large cuckoo shrike	<i>Coracina macei</i>	+	-	-	+	LC	Resident
Spot-breasted fantail	<i>Rhipidura albogularis</i>	+	-	-	+	LC	Resident
Bay-backed shrike	<i>Lanius vittatus</i>	+	-	+	+	LC	Resident & Local Migrant
Thick-billed warbler	<i>Arundinax aedon</i>	+	-	-	-	LC	Winter migrant
Paddyfield warbler	<i>Acrocephalus agricola</i>	-	-	-	+	LC	Winter migrant
Palla's grasshopper warbler	<i>Helopsaltes certhiola</i>	-	-	-	+	LC	Winter migrant
Streak-throated swallow	<i>Petrochelidon fluvicola</i>	+	-	-	-	LC	Local Migrant
Lesser white throat	<i>Curruca curruca</i>	+	-	-	+	LC	Winter Migrant & Localized Summer Migrant
Yellow-eyed babbler	<i>Chrysomma sinense</i>	+	-	-	-	LC	Resident
Asian brown flycatcher	<i>Muscicapa dauurica</i>	+	-	-	+	LC	Within-India Migrant & Winter Migrant
Tickell's blue flycatcher	<i>Cyornis tickelliae</i>	+	-	-	+	LC	Resident
Taiga flycatcher	<i>Ficedula albicilla</i>	+	-	-	+	LC	Winter migrant
Siberian stonechat	<i>Saxicola maurus</i>	-	-	+	-	NR	Winter Migrant & Localized Summer Migrant
Streaked weaver	<i>Ploceus manyar</i>	+	-	-	-	LC	Resident
Black-headed cuckooshrike	<i>Lalage melanoptera</i>	-	-	+	2020-21	LC	Within-India Migrant
					2023-24		
					+		
Ashy drongo	<i>Dicrurus leucophaeus</i>	-	-	-	2020-21	LC	Within-India Migrant
					+		
					2023-24		
					+		
Oriental skylark	<i>Alauda gulgula</i>	-	+	-	2020-21	LC	Resident & Local Migrant
					2023-24		
					+		
Booted warbler	<i>Iduna caligata</i>	+	-	-	2020-21	LC	Winter migrant
					2023-24		
					+		
Clamorous reed warbler	<i>Acrocephalus stentoreus</i>	+	-	-	2020-21	LC	Resident & Winter Migrant
					+		
					2023-24		
					+		
Rosy starling	<i>Pastor roseus</i>	-	-	+	2020-21	LC	Winter migrant
					2023-24		
					+		
Chestnut-tailed starling	<i>Sturnia malabarica</i>	-	-	-	2020-21	LC	Resident & Within-India Migrant
					+		
					2023-24		
					+		
Indian cuckooshrike	<i>Coracina macei</i>	+	-	-	+	LC	Resident & Local Migrant

Cont..

**Table 1.** Presence of various birds in different seasons during 2020 to 2024

Common name	Scientific name	Spring	Breeding	Fall	Winter	Iucn status	Residential status
Black-headed oriole	<i>Oriolus larvatus</i>	-	-	-	+	LC	Resident & Local Migrant
White-bellied drongo	<i>Dicrurus caeruleus</i>	+	+	-	-	LC	Resident
Indian paradise-Flycatcher	<i>Terpsiphone paradisi</i>	-	-	+	2020-21	LC	Resident & Within-India Migrant
		+	-	-	2023-24		
					+		
Rufous treepie	<i>Dendrocitta vagabunda</i>	+	-	+	+	LC	Resident
Ashy-crowned sparrow-Lark	<i>Eremopterix griseus</i>	+	-	-	-	LC	Resident
Jungle prinia	<i>Prinia sylvatica</i>	+	-	+	-	LC	Resident
Sykes's warbler	<i>Iduna rama</i>	-	-	-	+	LC	Winter migrant
Green warbler	<i>Phylloscopus nitidus</i>	-	-	+	+	LC	Summer Migrant & Localized Winter Migrant
Greenish warbler	<i>Phylloscopus trochiloides</i>	+	-	+	+	LC	Winter Migrant & Localized Summer Migrant
Tawny-bellied babbler	<i>Dumetia hyperythra</i>	-	-	+	+	LC	Resident
Puff-throated babbler	<i>Pellorneum ruficeps</i>	+	-	-	+	LC	Resident
Loten's sunbird	<i>Cinnyris lotenius</i>	+	-	+	+	LC	Resident
Jerdon's leafbird	<i>Chloropsis jerdoni</i>	-	-	+	2020-21	LC	Resident
		-	-	-	2023-24		
					+		
Western yellow wagtail	<i>Motacilla flava</i>	-	-	+	+	LC	Winter migrant
Brown shrike	<i>Lanius cristatus</i>	+	-	+	2020-21	LC	Winter migrant
		-	-	+	2023-24		
					+		
Common Cuckoo	<i>Cuculus canorus</i>	-	-	+	2020-21	LC	Summer Migrant & Passage Migrant
		-	-	+	2023-24		
					-		
Grey-bellied cuckoo	<i>Cacomantis passerinus</i>	+	+	+	2020-21	LC	Resident & Local Migrant
		+	-	-	23-24		
					+		
Pied cuckoo	<i>Clamator jacobinus</i>	+	+	+	2020-21	LC	Resident & Summer Migrant
		+	-	+	2023-24		
					+		
Common hawk-Cuckoo	<i>Hierococcyx varius</i>	-	+	+	2020-21	LC	Resident & Local Migrant
		+	+	+	2023-24		
					+		
Indian scops-owl	<i>Otus bakkamoena</i>	-	-	+	2020-21	LC	Resident
					-		
Mottled wood owl	<i>Strix ocellata</i>	-	-	+	+	LC	Resident

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**Table 1.** Presence of various birds in different seasons during 2020 to 2024

Common name	Scientific name	Spring	Breeding	Fall	Winter	Iucn status	Residential status
European roller	<i>Coracias garrulus</i>	-	-	+	-	LC	Passage Migrant & Localised Summer Migrant
Chestnut-headed bee-eater	<i>Merops leschenaulti</i>	-	-	-	+	LC	Resident & Within-India Migrant
Green sandpiper	<i>Tringa ochropus</i>	-	-	-	2020-21 +	LC	Winter migrant
		+	-	-	2023-24 +		
Wood sandpiper	<i>Tringa glareola</i>	-	+	+	2020-21 -	LC	Winter migrant
		+	-	+	2023-24 +		
Yellow wattled lapwing	<i>Vanellus malabaricus</i>	-	-	-	+	LC	Resident
Black-winged slit	<i>Himantopus himantopus</i>	-	-	+	2020-21 -	LC	Winter migrant
		+	+	-	2023-24 +		
Little ringed plover	<i>Charadrius dubius</i>	-	-	-	+	LC	Resident & Winter Migrant
Common snipe	<i>Gallinago gallinago</i>	+	-	-	+	LC	Winter migrant
Common sandpiper	<i>Actitis hypoleucos</i>	+	-	+	+	LC	Winter migrant
Whiskered tern	<i>Chlidonias hybrida</i>	+	-	+	2020-21 -	LC	Winter Migrant & Localized Summer Migrant
		+	-	+	2023-24 +		
River tern	<i>Sterna aurantia</i>	-	-	+	2020-21 +	VU	Resident & Local Migrant
		+	-	+	2023-24 +		
Greater painted snipe	<i>Rostratula benghalensis</i>	+	+	+	2020-21 -	LC	Resident
		+	-	+	2023-24 +		
Pheasant-tailed jacana	<i>Hydrophasianus chirurgus</i>	-	+	+	2020-21 -	LC	Resident
		+	-	+	2023-24 +		
Asian openbill	<i>Anastomus oscitans</i>	-	-	+	2020-21 +	LC	Resident
		+	-	+	2023-24 +		
Painted stork	<i>Mycteria leucocephala</i>	-	+	+	2020-21 -	LC	Resident
		+	+	+	2023-24 +		
Eurassian hoopoe	<i>Upupa epops</i>	-	-	+	2020-21 - 2023-24	LC	Resident
		+	-	-	+		

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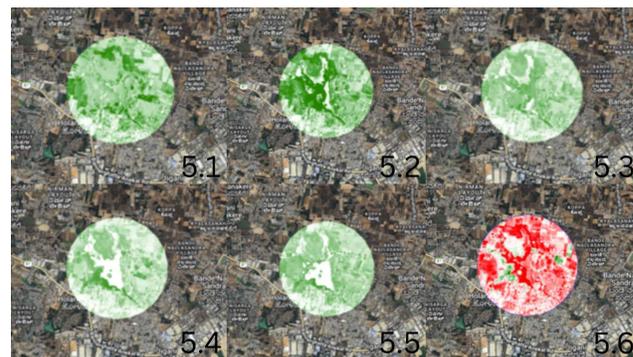
**Table 1.** Presence of various birds in different seasons during 2020 to 2024

Common name	Scientific name	Spring	Breeding	Fall	Winter	Iucn status	Residential status
Indian peafowl	<i>Pavo cristatus</i>	-	-	+	2020-21	LC	Resident
		+	+	+	2023-24		
Grey junglefowl	<i>Gallus sonneratii</i>	-	-	+	+	LC	Resident
Jungle bush quail	<i>Perdica asiatica</i>	+	-	+		LC	Resident
Indian nightjar	<i>Caprimulgus asiaticus</i>	-	-	-	+	LC	Resident
Little swift	<i>Apus affinis</i>	+	+	+	2020-21	LC	Resident
		+	+	+	2023-24		
Asian palm swift	<i>Cypsiurus balasiensis</i>	-	-	+	2020-21	LC	Resident
		+	-	+	2023-24		
Little grebe	<i>Tachybaptus ruficollis</i>	-	+	+	2020-21	LC	Resident
		+	+	+	2023-24		
White-naped woodpecker	<i>Chrysocolaptes festivus</i>	+	-	+	-	LC	Resident
Plum-headed parakeet	<i>Psittacula cyanocephala</i>	-	-	+	+	LC	Resident

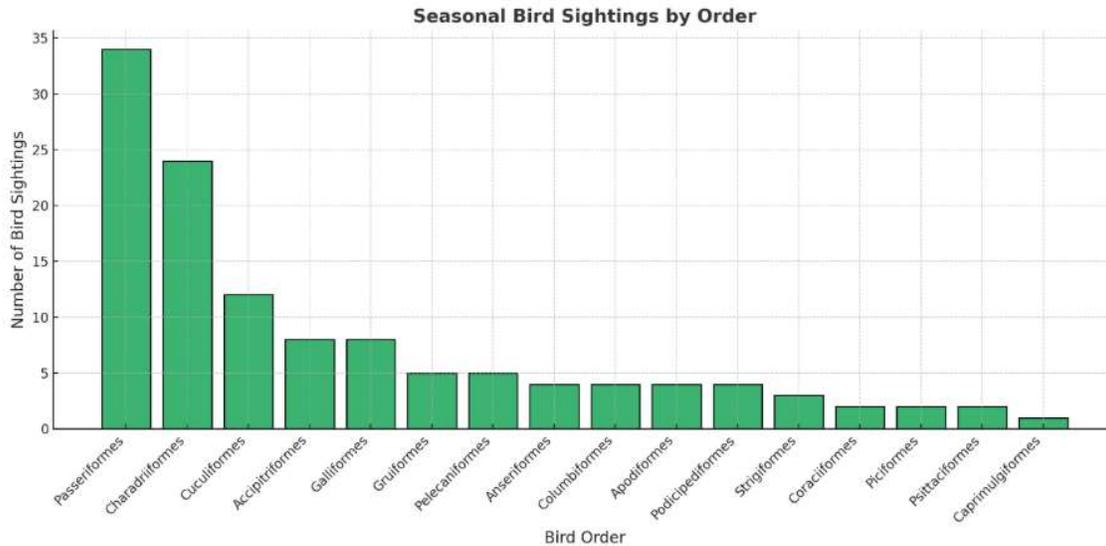
*Breeding Code - C- Carnivores, O-Omnivore, G-Granivore, N-Nectarivore, F Frugivore .[The SoIB Partnership. (2023). State of India's birds. Retrieved November 17, 2025, from https://stateofindiabirds.in/. The table consists IUCN- International Union for Conservation of Nature (https://iucn.org/) status birds were classified as The IUCN Red listing is done based on the database collected and analysed by the SIS committee (https://www.iucnredlist.org/assessment/process). The 43 birds come under the classification of LC (Least concern) except for the Indian Spotted Eagle, which is VU(Vulnerable), and the Spot-billed Pelican, which is NT (near threatened) (https://www.iucnredlist.org/) The table also consists of the residential status in which some birds are R(residential) and WM (winter migrant). This classification is done based on the presence of the individual in the study area in the chosen period. This data is mentioned based on the observation and analysis of the data available in e-bird (https://ebird.org/barchart?r=L5174545). The bird is considered resident if the bird is present throughout the year. Winter migrants are the birds that visit the study area during their migratory tracts or as migrants during the winter season.*

NDVI values slightly increased in central zones, due to favorable monsoon conditions in the previous year during Spring 2021 (Fig 5.2) This corresponds with sightings of migratory ducks such as *Spatula querquedula*(Garganey) and *Anas acuta* (Northern Pintail) as regular visitors during the spring (Lu et al., 2025). There was patchy reduction in vegetation, especially at the lake margins spring 2022, indicating the start of the drying phase (Figure 5.3). This aligned with the spotting of (yellow-wattled lapwing) *Vanellus malabaricus* and (Oriental Skylark) *Alauda gulgula* as new nesting species in the area (Saikia et al. 2025). The vegetation reduced further, especially in shallow and peripheral areas of the lake. This shift in habitat favored birds adapted to dry and semi-open landscapes, such as (Indian Pitta) *Pitta brachyura*, (Bay-backed Shrike) *Lanius vittatus*, and various flycatchers and warblers (Figure 5.4) (Ramachandra and Aithal 2016). NDVI maps showed extensive vegetation in the middle of the lake, while peripheral areas show less vegetation during spring 2024

(Figure 5.5). This indicates the growth of invasive plant species like Lantana camara and Eucalyptus spp., which support insectivorous and shrub-eating birds (Figure 5) (Liu et al. 2024) Change detection NDVI map (Figure 2) shows the difference in vegetation over five years. Red zones represent loss in vegetation, possibly due to drying, deforestation, and construction of buildings (Figure 5.6).



**Figure 5.1.** NDVI Map of Jigani Lake - Spring 2020



**Figure 6.** Number of birds in each family according to taxonomy

Green zones indicate an increase in vegetation, due to the growth of seasonal crops and invasive plant species and white zones indicate little or no change, due to permanently dry areas. This satellite evidence confirms the findings of the study, i.e, climate change and drying up of the lake, indicated by a change in the migratory pattern of bird species around Jigani Lake.

The Order Passeriformes has the highest number of avian species, (22), followed by the order Accipitriformes (5 species). Anseriformes and Charadriiformes, (3 bird species) (Figure 6). The study indicate that number of Charadriiformes (the shore birds), which are supposed to be high in numbers in a lake ecosystem, is being overtaken by the Passeriformes (the perching birds). This drift in population can be considered an indication of the habitat drift happening in the ecosystem.

The study has shown that habitat destruction and climatic changes have affected the migratory patterns and relative population density of several affected species. The study results demonstrate that the bird data can be used for climate monitoring and observations and as a measure of habitat drift (Buriro and Lund, 2025). This supports the fact that birds are effective climate indicators (Liang, 2021). Rise in temperature, shift in monsoon patterns, and habitat alterations have led to a shift in migration timing, species distribution, and breeding behaviour (Lal et al., 2025). The reduction in water level and the expansion in dry habitat have resulted in an increase in birds preferring dry habitat and a decrease in water birds (Deomurari et al., 2023). The

observations of population and species drift of birds indicate the factors of depletion in the ecosystem and the affected habitat. Unregulated industrialization, pollution, and the introduction of invasive species have degraded the ecosystem, changing the natural balance of the wetland habitat (Buriro and Lund, 2025). Non-scientific and unethical developmental operations like concreting of lake banks, road construction around the lakes, waste dispersal and treatment plants around the lakes, non-scientific weeding in lakes, and introduction of Alien Invasive Species (fishes and plants) for commercial and aesthetic reasons by the government have also contributed a large percentage to the destruction of the wetland ecosystem (Prasanya et al., 2024). From the study area, it is also noted that the dumping of solid wastes, including construction wastes, cut wastes from granite industries, and plastic wastes, has played a major role in the depletion of the water holding capacity of the lake. (Buriro and Lund, 2025);

**4. CONCLUSION**

The study reveals that habitat destruction and climate change have caused changes in the bird population and visiting terns in the lake. The diversity of the bird species has shifted from wetland species to dry land species. Due to the shift, there is only a negligible decline in the total avian species considering the study duration. The observation shows that there is a slight positive deviation in the total number of species. The paper emphasizes the importance of wetland conservation, the need to restore and maintain biodiversity. Measures such as controlling pollution and

restoring native vegetation can help lessen the harmful effects of habitat shift and climate change on the bird populations. Bird migration patterns are bio-indicators of environmental changes. Protecting Jigani Lake and similar habitats is crucial for preserving biodiversity and moderating the long-term effects of climate change on migratory bird species.

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#### Authors' Contributions

Data collection, data analysis and content design: Abhijith S. Scientific writing: Steven S. Guidance and content design: Jincy George.

#### Disclosure statement

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

#### Data availability statement

Data is available and can be made available on demand.

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