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Assessing Avian Diversity and the Impact of Air Pollution on Ecological Communities in Western Haryana, India

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***Abstract*:** Understanding the structure and diversity of avian communities is crucial for elucidating the ecosystem's significance in conservation efforts. Birds, as rapid responders to environmental changes, serve as valuable 'bioindicators' reflecting ecosystem conditions. This study was conducted to explore the avifaunal diversity in the districts of Fatehabad and Hisar in western Haryana. The total of 115 bird species belonging to 18 orders and 46 families were recorded. Passeriformes emerged as the dominant order with 49 species, while families, Muscicapidae & Anatidae were prevalent, each comprising eight species. Examining the impact of fluctuating air quality on avian diversity from 2019 to 2022, including the COVID-19 pandemic period. Negative correlation was observed between the air quality index (AQI) and diversity indices. Elevated AQI values were associated with reduced avifaunal diversity, a trend that was particularly mitigated during the pandemic period due to enforced lockdown measures and decreased vehicular pollution. Of the species recorded, two species- Woolly-necked Stork and Alexandrine Parakeet are as Near Threatened in the IUCN Red List.

***Keywords*:** Avifaunal diversity, Air quality index, Simpson's diversity index, Shannon-Weiner diversity index, Air pollution

Biodiversity is the variety and variability of life in the ecosystem or ecological complex, in which the living organisms are a part. Birds are one of the most diversified creatures living on the earth, having a great diversity of size, form, color and behaviour. The total of 1353 Species of birds are found in India, and 1426 in Indian subcontinent (Praveen and Jayapal 2023). Bird species respond rapidly to any changes in the environment. The avian species diversity, richness, and abundance are determined by various factors such as migration, natality, mortality, and availability of food and niches. Birds are considered the valuable bio-indicators of the environment because they are involved in various essential processes like pollination, scavenging, seed dispersal, pest control and ecosystem engineering (Raj et al 2024).

Air pollution poses a significant threat to biodiversity worldwide, with avian species being particularly vulnerable to its adverse effects. Sanderfoot and Holloway (2017) mentioned birds exhibit heightened sensitivity to air pollutants compared to mammalian species. The ramifications of pollution on biodiversity are profound, contributing to the rapid decline in species populations globally. The interplay between environmental quality and ecological niches shapes the interactions between organisms and their abiotic surroundings. Any alteration in ecosystem structure and function inevitably leads to changes in biodiversity statistics (Bhowmick 2022). Among the myriad impacts of air pollution on wildlife, birds experience direct mortality, physiological stress, and bioaccumulation of toxins. In light of these observations, it becomes imperative to conduct comprehensive surveys of avian faunal diversity to assess the impact of air pollution on bird populations. This paper presents findings from a diversity survey conducted in the districts of Hisar and Fatehabad in the state of Haryana, India.

MATERIAL AND METHODS

Study area: The present study was conducted across various locations in Fatehabad and Hisar districts of Haryana. In Fatehabad district study sites included village Bhodia, Badopal, Dhangar and Chilli Lake. In Hisar district, two locations were studied: Sisai village and Chaudhary Charan Singh Haryana Agricultural University, Hisar.

Data collection: Weekly bird surveys were conducted from June 2019 to May 2022, adopting the line transect method (Gaston 1975; Sales and Berkmuller 1988). The total of 50 transects were studied that covered almost all of the study area. Transect length remained constant i.e. 500m, but the width varied according to survey area and visibility: in forests, 15m; in agricultural fields, 20m; and in other open fields, 50m. The field surveys were conducted in the morning (between 06:00 hours and 10:00 hours) and in the evening (from 16:00 hours to19:00 hours), when birds were found to be most active. Birds were photographed and identified using standard reference books (Grimmet et al 1998). Classification of the recorded bird species residential,

abundance and International Union for Conservation of nature (IUCN) status) was done (Praveen and Jayapal 2023). Nikon™ D3300 DSLR camera having 24.2 megapixels sensor along with a Nikkor zoom lens of focal range 70-300 mm and aperture range f/4.5-6.3, was used to photograph the bird species. Nikon™ Aculon A211 binocular was used for bird watching.

Data analysis: Standard biodiversity indices were applied to calculate the species diversity, evenness and richness (Simpson 1949; Shannon Weaver 1963). The diversity indices were calculated using PAST 3.14 software. Each survey was analyzed for relative abundance on the basis of frequency of sightings (Mackinnon and Phillipp 1993): very common- sighted >10times; common- sighted from seven to nine times; uncommon-sighted from three to six times; rare-sighted once or twice. Air Quality Index (AQI) data were collected from the Central Pollution Control Board (CPCB) official website on every single day during the study period (AQI = max ($AQI_{PM2.5}$, AQI_{PM10}, AQI_{O3}). The correlation between AQI and diversity indices was statistically analyzed using Pearson's correlation coefficient in IBM SPSS Statistics 21 and figures were generated using Microsoft Excel.

RESULTS AND DISCUSSION

The total of 115 bird species were identified, representing 18 orders and 46 families (Table 2). Analysis of species distribution by order revealed the dominance of the Passeriformes order, encompassing 49 bird species. Family-wise distribution highlighted the prevalence of the Muscicapidae and Anatidae families, each comprising eight bird species (Fig. 4). Among the recorded avifauna, two species, the Wooly-necked Stork (*Ciconia episcopus*) and Alexandrine Parakeet (*Psittacula eupatria*), are classified as "Near Threatened" (Fig. 2, 3). All other recorded species are categorized as "Least Concern." Among 115 species, 76 species were residents, 28 species were winter visitors, 8 species were summer visitors and four species were

Table 1. Location of selected study sites

Site no.	Name	Co-ordinates
Site 1	Bhodia village pond, Fatehabad	29.491485°N, 75.422804°E
Site 2	Chilli Lake, Fatehabad	29.517824°N, 75.459927°E
Site 3	Dhangar village, Fatehabad	29.470820°N, 75.515744°E
Site 4	Badopal village, Fatehabad	29.427654°N, 75.539440°E
Site 5	Sisai village, Hisar	29.175187°N, 76.009799°E
Site 6	C.C.S. Haryana Agricultural University, Hisar	29.144649°N, 75.707255°E

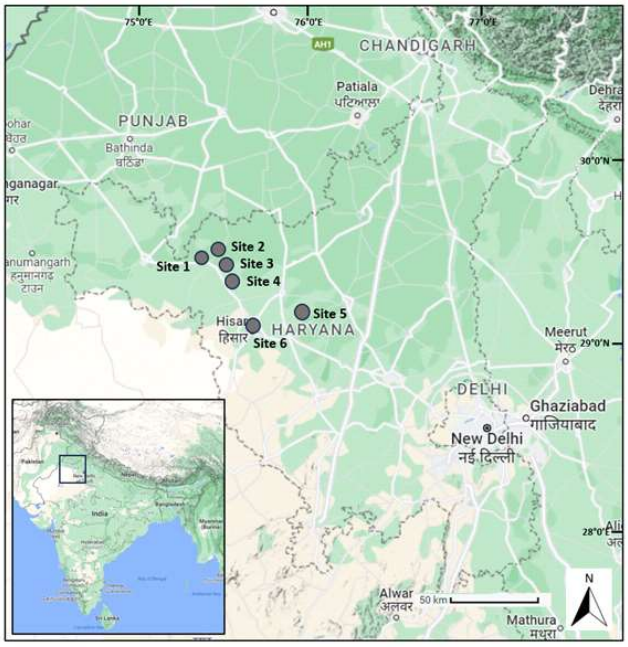

Fig. 1. Location of study sites

2. Alexandrine Parakeet, *Psittacula eupatria*

3. Wooly-Necked Stork, *Ciconia episcopus*

Fig. 2, 3. Recorded bird species with IUCN status of Near-Threatened (NT)

Table 2. List of bird species recorded from selected study sites in the Fatebabad and Hisar districts of Haryana

Order	Family	Common name	Zoological name	IUCN status	Residential status	Abundance status
Colombiformes	Columbidae	Rock Dove	*Columba livia*	LC(DEC)	Resident	Very Common
		Laughing Dove	*Stigmatopelia senegalensis*	LC(STABLE)	Resident	Common
		Eurasian Collared Dove	*Streptopelia decaocto*	LC(INC)	Resident	Very Common
		Yellow-Footed Green Pigeon	*Treron phoenicoptera*	LC(INC)	Resident	Common
		Spotted Dove	*Spilopelia chinensis*	LC(INC)	Resident	Less Common
Charadriformes	Recurvirostridae	Black-Winged Stilt	*Himantopus himantopus*	LC(INC)	Resident	Very Common
	Jacanidae	Pheasant-tailed Jacana	*Hydrophasianus chirurgus*	LC(DEC)	Summer Visitor	Less Common
	Charadriidae	Red-wattled Lapwing	*Vanellus indicus*	LC(UNKNOWN)	Winter Visitor	Very Common
	Scolopacidae	Common Redshank	*Tringa tetanus*	LC(UNKNOWN)	Winter Visitor	Very Common
		Ruff Bird	*Calidris pugnax*	LC(DEC)	Winter Visitor	Very Common
		Common Sandpiper	*Actitis hypoleucos*	LC(DEC)	Winter Visitor	Very Common
		Little Stint	*Calidris minuta*	LC(INC)	Summer Visitor	Very Common
	Burhinidae	Eurasian stone curlew	*Burhinus oedicnemus*	LC(DEC)	Resident	Common
Psittaciformes	Psittacidae	Rose-Ringed Parakeet	*Psittacula krameri*	LC(INC)	Resident	Very Common
		Alexandrine Parakeet	*Psittacula eupatria*	NT(DEC)	Resident	Common
		Plum-headed Parakeet	*Psittacula cyanocepala*	LC(DEC)	Resident	Less Common
Anseriformes	Anatidae	Indian Spot-billed Duck	*Anas poecilorhyncha*	LC(DEC)	Resident	Very Common
		Northern Pintail	*Anas acuta*	LC(DEC)	Winter Visitor	Common
		Northern Shoveler	*Spatula clypeata*	LC(DEC)	Winter Visitor	Common
		Eurasian Green-Winged Teal	*Anas crecca*	LC(UNKNOWN)	Winter Visitor	Less Common
		Gadwall	*Mareca strepera*	LC(INC)	Winter Visitor	Common
		Knob-billed Duck	*Sarkidiornis melanotos*	LC(DEC)	Resident	Less Common
		Lesser Whistling Duck	*Dendrocygnajavanica*	LC(DEC)	Summer Visitor	Common
		Red-crested Pochard	*Netta ruffina*	LC(UNKNOWN)	Winter Visitor	Common
	Podicipedidae	Little Grebe	*Tachybaptus ruficollis*	LC(DEC)	Winter Visitor	Common
Suliformes	Phalacrocorcidae	Little Cormorant	*Microcarboniger*	LC(UNKNOWN)	Resident	Very Common
		Indian Cormorant	*Phalacrocorax fuscicollis*	LC(UNKNOWN)	Winter Visitor	Common
		Great Cormorant	*Phalacrocorax carbo*	LC(INC)	Passage Migrant	Less Common
Galliformes	Phasianidae	Indian Peafowl	*Pavo cristatus*	LC(STABLE)	Resident	Common
		Black Francolin	*Francolinus francolinus*	LC(STABLE)	Resident	Common
		Grey Francolin	*Francolinus pondicerianus*	LC(STABLE)	Resident	Very Common
Ciconiiformes	Ardeidae	Indian Pond-heron	*Ardeolagrayii*	LC(STABLE)	Resident	Common
		Cattle Egret	*Bubulcus ibis*	LC(INC)	Resident	Very Common
		Little Egret	*Egrettagarzetta*	LC(INC)	Resident	Less Common

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Table 2. List of bird species recorded from selected study sites in the Fatebabad and Hisar districts of Haryana

Order	Family	Common name	Zoological name	IUCN status	Residential status	Abundance status
		Black-crowned Night Heron	*Nycticorax nycticorax*	LC(DEC)	Resident	Less Common
	Ciconiidae	Wooly-Necked Stork	*Ciconia episcopus*	NT(DEC)	Resident	Rare
Strigiformes	Strigidae	Spotted owlet	*Athene brama*	LC(STABLE)	Resident	Common
Pelecaniformes	Threskiornithidae	Red-Naped Ibis	*Pseudibis papillosa*	LC(DEC)	Resident	Common
Gruiformes	Rallidae	Common Coot	*Fulicaatra*	LC(INC)	Resident	Common
		Common Moorhen	*Gallinula chloropus*	LC(STABLE)	Resident	Common
		White-Breasted Waterhen	*Amaurornis phoenicurus*	LC(UNKNOWN)	Resident	Common
Culculiformes	Cuculidae	Jacobin Cuckoo	*Clamator jacobinus*	LC(STABLE)	Passage Migrant	Less Common
		Asian Koel	*Eudynamys scolopaceus*	LC(STABLE)	Resident	Common
		Common Hawk Cuckoo	*Hierococcyx varius*	LC(STABLE)	Resident	Less Common
	Centropodidae	Greater Coucal	*Centropus sinensis*	LC(STABLE)	Resident	Common
Piciformes	Megalaimidae	Brown-headed Barbet	*Psilopogon zeylanicus*	LC(STABLE)	Resident	Less Common
		Copper Smith Barbet	*Psilopogon haemacephalus*	LC(INC)	Resident	Rare
	Picidae	Black-rumpedFlameback	*Dinopium benghalense*	LC(STABLE)	Resident	Common
		Yellow-crowned Woodpecker	*Leiopicus mahrattensis*	LC(STABLE)	Resident	Less Common
		Eurasian Wryneck	*Jynx torquilla*	LC(DEC)	Winter Visitor	Rare
Upupiformes	Upupidae	Common Hoopoe	*Upupa epops*	LC(DEC)	Resident	Common
Burcerotiformes	Burcerotidae	Indian Grey Hornbill	*Ocyceros birostris*	LC(STABLE)	Resident	Common
		Oriental Pied Hornbill	*Anthracoceros albirostris*	LC(STABLE)	Summer Visitor	Rare
Coraciformes	Coraciidae	Indian Roller	*Coracias benghalensis*	LC(INC)	Resident	Less Common
	Halcyonidae	White-Breasted Kingfisher	*Halcyon smyrnensis*	LC(INC)	Resident	Common
	Meropidae	Green Bee-eater	*Merops orientalis*	LC(INC)	Summer Visitor	Less Common
		Blue-tailed Bee-eater	*Merops philippinus*	LC(STABLE)	Passage migrant	Less Common
Accipitriformes	Accipitiridae	Shikra	*Accipiter badius*	LC(STABLE)	Winter Visitor	Less Common
		Besra Sparrowhawk	*Accipiter virgatus*	LC(DEC)	Resident	Common
		Crested Honey Buzzard	*Pernis ptilorhynchus*	LC(DEC)	Resident	Common
		Black-Shouldered Kite	*Elanus axillaris*	LC(INC)	Winter Visitor	Less Common
		Brahminy Kite	*Haliasturindus*	LC(DEC)	Resident	Common
		Changeable Hawk Eagle	*Nisaetus cirrhatus*	LC(DEC)	Winter Visitor	Less Common
		Booted Eagle	*Hieraaetus pennatus*	LC(UNKNOWN)	Winter Visitor	Less Common
Passeriformes	Muscicapidae	Brown Rockchat	*Oenanthe fusca*	LC(STABLE)	Summer Visitor	Less Common
		Oriental Magpie Robin	*Copsychus saularis*	LC(STABLE)	Winter Visitor	Less Common
		Black Redstart	*Phoenicurus ochruros*	LC(INC)	Resident	Common
		Pied Bushchat	*Saxicola caprata*	LC(STABLE)	Winter Visitor	Less Common

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Table 2. List of bird species recorded from selected study sites in the Fatebabad and Hisar districts of Haryana

Order	Family	Common name	Zoological name	IUCN status	Residential status	Abundance status
		Red-breasted Flycatcher	*Ficedula parva*	LC(INC)	Resident	Very Common
		European Stonechat	*Saxicola rubicola*	LC(DEC)	Summer Visitor	Common
		Verditer Flycatcher	*Eumyias thalassinus*	LC(STABLE)	Resident	Common
		Blue-Throat	*Luscinia svecica*	LC(STABLE)	Resident	Very Common
	Dicruridae	Black Drongo	*Dicrurus macrocercus*	LC(UNKNOWN)	Resident	Common
		Ashy Drongo	*Dicrurus leucophaeus*	LC(UNKNOWN)	Passage Migrant	Common
	Pycnonotidae	Red-Vented Bulbul	*Pycnonotus cafer*	LC(INC)	Resident	Common
	Hirundinidae	Wire-tailed Swallow	*Hirundo smithii*	LC(INC)	Resident	Common
		Streak-throated Swallow	*Petrochelidon fluvicola*	LC(INC)	Resident	Common
	Sturnidae	Common Myna	*Acridotheres tristis*	LC(INC)	Resident	Common
		Brahminy Starling	*Sturnia pagodarum*	LC(UNKNOWN)	Summer Visitor	Rare
		Rosy Starling	*Pastor roseus*	LC(UNKNOWN)	Winter Visitor	Common
		Asian Pied Starling	*Gracupica contra*	LC(INC)	Resident	Common
	Corvidae	House Crow	*Corvus splendens*	LC(STABLE)	Resident	Common
		Large-Billed Crow	*Corvus macrorhynchos*	LC(STABLE)	Resident	Less Common
		Rufous Treepie	*Dendrocitta vagabunda*	LC(DEC)	Resident	Less Common
	Oriolidae	Indian Golden Oriole	*Oriolus kundoo*	LC(UNKNOWN)	Winter Visitor	Common
	Acrocephalidae	Clamorous Reed-warbler	*Acrocephalus stentoreus*	LC(STABLE)	Winter Visitor	Less Common
	Estrildidae	Scaly breasted Munia	*Lonchura punctulata*	LC(STABLE)	Resident	Common
		Indian Silverbill	*Euodice malabarica*	LC(STABLE)	Winter Visitor	Less Common
	Laniidae	Long-Tailed Shrike	*Lanius schach*	LC(UNKNOWN)	Winter Visitor	Less Common
		Bay-backed Shrike	*Lanius vittatus*	LC(STABLE)	Winter Visitor	Common
	Motacillidae	White Wagtail	*Motacilla alba*	LC(STABLE)	Resident	Common
		GreyWagtail	*Motacilla cinerea*	LC(STABLE)	Resident	Common
		White-browed Wagtail	*Motacilla maderaspatensis*	LC(STABLE)	Resident	Common
		Yellow Wagtail	*Motacilla flava*	LC(DEC)	Resident	Common
		Citrine Wagtail	*Motacilla citreola*	LC(INC)	Resident	Common
		Tree Pipit	*Anthus trivialis*	LC(DEC)	Resident	Common
		Paddyfield Pipit	*Anthus rufulus*	LC(STABLE)	Resident	Common
	Nectariniidae	Purple Sunbird	*Cinnyris asiaticus*	LC(STABLE)	Resident	Common
	Cisticolidae	Ashy Prinia	*Prinia socialis*	LC(STABLE)	Resident	Very Common
		Rufous-Fronted Prinia	*Prinia buchanani*	LC(STABLE)	Resident	Less Common
		Graceful Prinia	*Prinia gracilis*	LC(STABLE)	Resident	Very Common
		Striated Prinia	*Prinia crinigera*	LC(STABLE)	Resident	Very Common
		Plain Prinia	*Prinia inornata*	LC(STABLE)	Resident	Common
		Common Tailor bird	*Orthotomus sutorius*	LC(STABLE)	Resident	Less Common
	Passeridae	House Sparrow	*Passer domesticus*	LC(DEC)	Winter Visitor	Common

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Passage migrants. Regarding abundance status, 19 species were classified as very common, 58 species as common, 33 species as less common and 5 species as rare.

The impact of fluctuating air quality on avian faunal diversity was investigated throughout the study period from 2019 to 2022, including the Covid-19 pandemic. Month-wise AQI data for the study areas were analyzed (Table 3) revealing a negative correlation between AQI and avian diversity indices., Specifically, the correlation coefficients between AQI and Simpson's Diversity, as well as Shannon-Weiner diversity index, were -0.677 and -0.796, respectively (Table 4). AQI peaked in November, and was lowest in August. Notably, AQI decreased significantly during the pandemic due to lockdown measures and reduced vehicular pollution (Fig. 5, 6). The negative correlation coefficients indicate that species diversity, richness, and evenness

Table 2. List of bird species recorded from selected study sites in the Fatebabad and Hisar districts of Haryana

Order	Family	Common name	Zoological name	IUCN status	Residential status	Abundance status
		Sind Sparrow	*Passer pyrrhonotus*	LC(STABLE)	Winter Visitor	Less Common
	Ploceidae	Baya Weaver	*Ploceus philippinus*	LC(STABLE)	Resident	Common
	Leiothrichidae	Jungle Babbler	*Turdoides striata*	LC(STABLE)	Resident	Very Common
		Large Grey Babbler	*Turdoide smalcomi*	LC(STABLE)	Resident	Common
		Striated Babbler	*Turdoide searlei*	LC(DEC)	Winter Visitor	Less Common
	Sylviidae	Lesser Whitethroat	*Sylvia curruca*	LC(STABLE)	Resident	Common
	Phylloscopidae	Hume's Leaf Warbler	*Phylloscopus humei*	LC(STABLE)	Winter Visitor	Less Common
	Zosteropidae	Oriental white-eye	*Zosterops palpebrosus*	LC(DEC)	Resident	Less Common
Apodiformes	Apodidae	Little Swift	*Apus affinis*	LC(STABLE)	Resident	Common
		Common Swift	*Apus apus*	LC(STABLE)	Resident	Common

IUCN-International Union for Conservation of Nature; LC-Least Concern; NT-Near Threatened; DEC-Declining; INC-Increasing

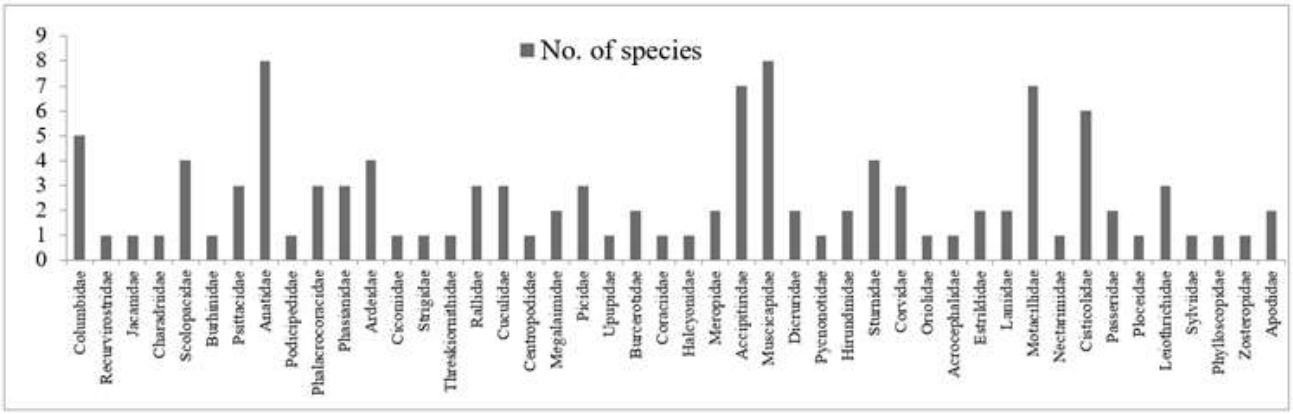

Fig. 4. Family-wise distribution of bird species in the study area

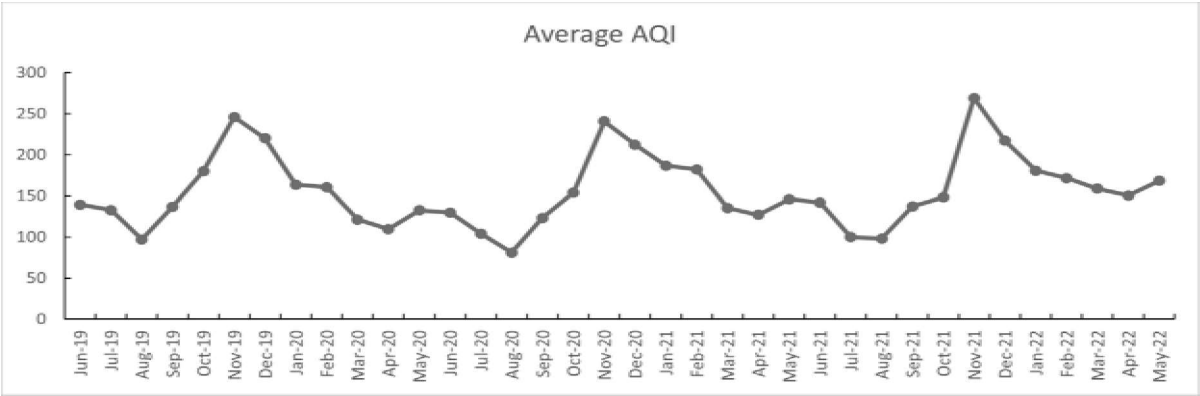

Fig. 5. Month-wise average AQI data during the study period

Table 3. Month-wise air quality index (AQI), bird diversity and species evenness of the study area

	Average AQI	Simpson Index of diversity	Species evenness index
2019			
June	139.6	0.711	2.198
July	133.1	0.814	2.291
August	97.3	0.821	2.313
September	136.9	0.734	2.211
October	180.2	0.648	2.124
November	246.1	0.883	2.440
December	220.1	0.951	2.501
2020			
January	163.7	0.629	2.103
February	160.5	0.640	2.119
March	121.4	0.751	2.224
April	109.7	0.799	2.256
May	132.7	0.699	2.136
June	129.9	0.819	2.212
July	104.4	0.856	2.411
August	81.3	0.887	2.450
September	123.4	0.821	2.242
October	154.0	0.781	2.140
November	240.8	0.950	2.512
December	212.2	1.110	2.663
2021			
January	186.6	0.723	2.089
February	182.1	0.746	2.136
March	135.5	0.833	2.356
April	127.1	0.842	2.399
May	146.1	0.802	2.198
June	141.9	0.804	2.223
July	100.1	0.842	2.312
August	98.2	0.864	2.397
September	137.5	0.811	2.236
October	148.2	0.759	2.189
November	269.2	0.822	2.429
December	217.5	0.919	2.333
2022			
January	180.8	0.710	2.091
February	171.8	0.721	2.113
March	158.9	0.821	2.291
April	150.5	0.836	2.302
May	168.3	0.786	2.219

decline with increasing AQI levels, suggesting birds' efficacy as bioindicators of air pollution. Furthermore site 2, Chilli Lake, 30 species of birds were recorded. This lake is shrinking at a very fast rate because of garbage dumping in it by the local people and use of land for agriculture practices nearby the lake.

Ther documentation of 115 bird species across 18 orders and 46 families aligns with similar studies conducted in various wetland habitats across India, and underscores the importance of these ecosystems for avian conservation. Muralikrishnan et al (2023) recorded 90 bird species belonging to 21 orders, 42 families in the Koonthankulam village pond in Tirunelveli district, southern Tamil Nadu. Similarly, Raj et al (2023) recorded 262 bird species from the Bharathapuzha River Basin, the second largest, west-flowing river in Kerala, Western Ghats. Kumar et al (2016) documented 69 wetland birds belonging to 20 families in the six rural ponds of District Kurukshetra, Haryana. Koli (2014) identified 150 bird species in the Todgarh-Raoli Wildlife Sanctuary, Rajasthan, India., Gupta et al (2009) reported 92 bird species at Kurukshetra University, Haryana. Yadav & Chauhan (2018) reported 181 bird species belongs to 22 orders in Jhalawar forest division, Rajasthan. Yadav et al (2023) reported 59 birds along Yamuna River, Haryana. Brraich et al (2023) observed 204 bird species in Patiala district, Punjab. Kumar (2021) reported 114 species of birds in Central University campus, Himachal Pradesh. Sharma & Tripathi (2023) found 102 species of avifauna in Bhilwara, Rajasthan. The variations in bird species composition across different regions can be attributed to factors such as habitat type, climate, and geographical location. The presence of 152 bird species in the Indian Institute of Technology - Guwahati campus highlights the importance of secondary growth and eco-forests in supporting avian diversity. Order Passeriformes emerged as the most dominant avian taxa with 49 species, indicating its ecological significance in the region. This finding is in line with, identifying Passeriformes as particularly species-rich across different habitats in India (Kohli 2014; Rai et al 2017; Singh et al 2021). The total of 40 points were laid and 140 species were recorded, with Passeriformes as the most dominating order (Rana and Khan 2024). Overall, 59 species of birds including 45 resident, 11 resident migratory and 3 migratory species were recorded (Sekhon et al 2023). A total of 506 nests were

Table 4. Correlation between AQI with diversity indices during the study period

Correlation coefficient value of Mean AQI with:	**r**
1. Simpson's Index of Diversity	-0.677
2. Shannon-Weiner Diversity Index	-0.796

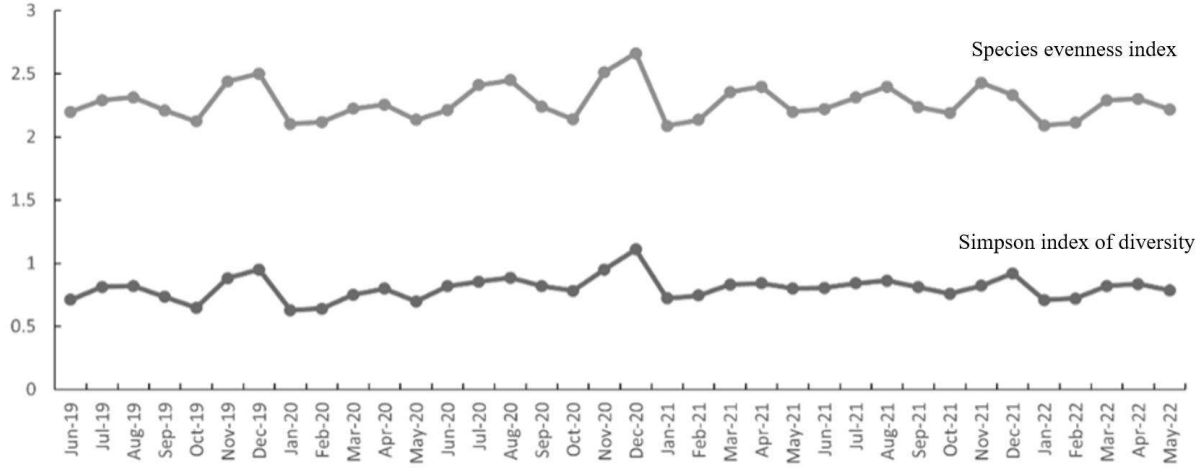

Fig. 6. Month-wise diversity indices during the study period

counted from the study areas which shows proximity to water bodies and among these 33% were observed from Krishnakumarsinhji Town Hall followed by 30% from Manila bag (Gohel et al 2021). A total of 201 species belonging to 44 families were recorded in the area. The family Muscicapidae was dominant followed by Corvidae (Kukreti 2021). The observed negative correlation between air quality index (AQI) and bird species diversity is an important finding, reflecting the interconnectedness of environmental factors and biodiversity. The improvement in air quality during the COVID-19 lockdown period coinciding with increased bird species diversity underscores the vulnerability of avian populations to anthropogenic activities, particularly those impacting air quality. Furthermore, studies such as Bhowmick (2021) emphasize the complex relationship between air pollution and biodiversity, suggesting that efforts to mitigate air pollution could have positive implications for biodiversity conservation. By elucidating the relationships between environmental factors, such as air quality, and bird species diversity, researchers can inform conservation efforts aimed at preserving ecosystems and safeguarding avian populations for future generations.

CONCLUSIONS

115 bird species were found comprising 18 orders and 46 families which shows that the study areas have a great diversity of birds. Rural ponds in the villages are preferred habitat of aquatic birds so, they should be protected. Order Passeriformes was dominant with 49 species. Family Muscicapidae & Anatidae were dominant, each comprising eight species. Two species were found Near Threatened - Woolly-necked Stork and Alexandrine Parakeet. Elevated AQI values were associated with reduced avifaunal diversity. It shows that birds are valuable bioindicators of the air quality.

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