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Research Article

AVIAN DIVERSITY AND CONSERVATION SIGNIFICANCE OF GATEHARA BIRD FIELD IN KALOL, GANDHINAGAR, GUJARAT: AN ASSESSMENT OF SPECIES DIVERSITY, POPULATION STATUS AND BIODIVERSITY INDICES

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ABSTRACT

Wetlands are a cornerstone habitat for avian biodiversity, especially in current landscapes where concrete jungles are ever-expanding and replacing other natural habitats. Gatehara Bird field is one such wetland located in Kalol, Gandhinagar, that supports a healthy population and diversity of birds, showing its importance for avian conservation and ecological health. A systematic survey recorded 173 species of birds belonging to 54 different families, with an estimated total abundance of around 29,036 individuals. The wetland supports significant populations of 13 species of high conservation priority as mentioned in the State of India's Bird Report 2023. The avian community exhibits a value of 0.9594 on Simpson's Index 1-D and a Shannon-Weiner diversity Index (H) value of 3.704, showing high avian diversity and richness, along with Evenness (e^H/S) of 0.2347. The site is critical for migratory waterbirds, with winter migrants forming a substantial portion of the community dependent on the wetland for food, nesting and as a stop/satellite wetland during their migration journey. The site supports a significant population and diversity of species facing global decline in their numbers, 43.4% of species found here are facing a global decline in population trends. The site acts as a crucial node within the Central Asian Flyway, supporting a massive congregation of waders like Bar-tailed Godwit, Black-winged stilt, Sandpipers, Shanks etc. The study establishes Gatehara bird-field as a wetland of state and national importance when compared to Ramsar sites like Thol Lake Sanctuary and Nal Sarovar Bird Sanctuary, and other stop-over sites Like Pariyej, Chhari Dhandh, Chhaya Rann wetlands in Gujarat. This study and comparison with other wetlands highlight the importance of Gatehara for the rich local as well as migratory avifauna critical need for its immediate formal protection and safeguard of its rich biodiversity against escalating anthropogenic pollution and threats.

Keywords: Avian Diversity, Population Guild, IUCN Red List, Population trend, Biodiversity Indices.

INTRODUCTION

Wetlands as defined by Article 1.1 of the Ramsar convention are "areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salty, including areas of marine water the depth of which at low tide doesn't exceed six meters" (Rahmani *et al.,* 2004). Wetlands are 'lands transitional between terrestrial and aquatic eco-systems where the water table is usually at or near the surface or the land is covered by shallow water' (Dodman *et al.,* 2007). In India, wetlands are defined under the Wetlands (Conservation and Management) Rules, 2017, notified by the Ministry of Environment, Forest and Climate Change (MoEFCC), which has adopted the same definition as mentioned in Article 1.1 of the Ramsar Convention (Ramsar Regional Centre – East Asia, 2017). At present, in India and globally, the study of wetlands and its biodiversity is mostly focused to Ramsar sites, but the global climate change and anthropogenic influence on nature are forcing different species to shift their habitats and birds are no exception to it, Water birds are highly mobile, with many species conducting long-distance movements of hundreds or thousands of kilometres in days

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or weeks (Dodman *et al.,* 2007; Donnelly *et al.,* 2019; Pedler *et al.,* 2014). Understanding these movements is key to effective management of waterbird populations (Haig *et al.,* 1998), particularly since rates of wetland habitat loss are increasing. Many waterbird species are highly mobile and move across jurisdictional boundaries and at continental scales, which makes strategic conservation management challenging (Jia *et al.,* 2016). Closer examination of 'non-listed' sites for which tracked birds have shown site fidelity may reveal areas worthy of additional conservation management (Singh M. 2022). Therefore, it becomes crucial to study the wetlands which are unprotected and not studied in detail, so that a holistic understanding of these complex ecosystems and their biodiversity can be done along with the well-protected and studied wetlands**.** (Singh, 2022). Wetlands are considered cradles of biological diversity that provide the water and habitat upon which countless species of animals and plants depend for survival (Unesco.org). The avifauna of a wetland serves as a sensitive bio-indicator of its ecological health. (Sebastián-González *et al.,* 2016). Gujarat is home to 4 Ramsar sites and is speckled by numerous locally and nationally important wetlands that are home, breeding sites, feeding sites and stop over points for a plethora of avifauna within the Central Asian Flyways (Mundkur *et al.,* 2017) (Asian Waterbirds Report by Wetlands International). Gujarat is home to 549 bird species, including both resident and migratory species (eBird). This study amplifies species inventory by integrating abundance data, regional conservation priorities (State of India's Birds 2023), global IUCN status, national protection schedules, and population trends to present a holistic conservation assessment. The present study highlights the importance of Gatehara bird field as a "Satellite/stop-over" wetland supporting a rich diversity of 173 avian species from 54 families, and how it despite facing anthropogenic pollution and threats continues to support a large number of birds both resident and migratory throughout the year. The site was investigated to quantify the taxonomic and functional diversity of its avian community. Evaluate its conservation significance by identifying key species based on IUCN Red List, Wildlife Protection Act schedules, and the priority list of the State of India Bird's 2023. An analysis of guild structures (migratory) was also conducted to understand the wetland's ecological functionality, along with the assessment of the population trend patterns to identify potential warning signs of ecosystem stress. An effort was also made to provide robust, data-driven recommendations for conservation policy and management. Gatehara Bird-field has also been compared with Ramsar sites i.e., Thol Lake Sanctuary and Nal Sarovar Bird Sanctuary, as these three wetlands are present in the same vicinity, topographic and geoclimatic region. This is the first formal research conducted for Gatehara Bird-field and the first detailed study and listing of its avifauna, which earlier had been mentioned only in checklists of birdwatchers in eBird. The study highlights the importance of such Satellite wetlands which are crucial in sustaining and conserving the species dependent upon them for various aspects like foraging, nesting, or as a stopover site, and why they should be brought under monitoring and protection, especially in a state like Gujarat which has the highest are under wetland in India therefore known as 'Land of Wetlands'. (Shan *et al.,* 2021).

MATERIALS AND METHODS

Study Area

The study was carried out at Gatehara Bird field, which is a shallow lentic wetland located near the village of Laxmipura in Kalol taluka of the Gandhinagar district, India. It is a low-lying semi-natural habitat formed by water accumulation from natural sources and industrial wastewater, the fluctuation in water levels thus creates ephemeral wetland conditions. Its approximate coordinates are 23.214919°N, 72.496682°E. Dense bushes and scrub vegetation, along with the farm land around the water body, provide cover and nesting sites for birds. Despite its artificial/ semi-natural origin, it supports a plethora of avifauna, ranging from waterfowls like flamingos, teals, spoonbills, etc, to waders like snipes, sandpipers and godwits, along with passerines, raptors and many more. During monsoon and post-monsoon, the wetland spans approximately 60,000 to 80,000 square meters, whereas during the dry season it shrinks to 40,000 square meters or less.

Figure 1. Satellite map of Gatehara Bird-Field.

Research timeline

The study was conducted from June 2022 to September 2025, covering all four seasons for three years. The bird counting was done using primarily the point count method and the Look-See method (used by Wetland Bird Survey and British Trust for Ornithology), other methods used included Transect counts (walks on fixed path, i.e., transect to record observation within a defined distance), Photographic and videographic assisted bird counts. A pair of Nikon Action (8×40) binoculars, Canan EOS 1300d camera and Nikon Coolpix P900 camera were the equipment used for the methods mentioned earlier, a field guide i.e., Birds of the Indian Subcontinent (by Richard Grimmett, Carol Inskipp and Tim Inskipp) and e-bird, along with State of India's Birds 2023 were used to identify the species and verify and confirm with data submitted by other birdwatchers, field notebook/ datasheet . Monthly observations were taken, therefore covering all 12 months. In a month, 10 days were selected for the study, in which two time slots were selected for the study in a day: a. morning from sunrise till 11 AM and b. evening from 4 pm till dark (7:30-8 pm).

Statistical Analysis

For the statistical analysis, PAST (Paleontological Statistical) 4.03 software and formula application in Excel 2021 were used to find values for Diversity indices, i.e. Simpson diversity index (1-D), Shannon Weiner diversity index (H), and Evenness (e^H/S). The avian diversity was quantified using Simpson's Diversity Index (D), whose values ranged from 0 to 1, where values approaching 1 indicate low diversity and high dominance, while values approaching 0 indicate high diversity within the sample (Cambridge, 2018). The species diversity was also assessed using the Shannon-Weiner Diversity Index (H′), which measures both taxonomic richness and the evenness of individuals distributed among taxa. The resulting H′ values were interpreted using standard ecological thresholds, where $H' > 3.5$ indicates high diversity, values between 1.5 and 3.5 indicate moderate diversity, and $H' < 1.5$ indicates low diversity (Dinh *et al.,* 2018). Evenness (e^H/S) quantifies how evenly individuals are distributed amongst the present species. The resulting E values range from 0 to 1, where a value of 1 indicates complete evenness with uniform distribution across all categories, while values approaching 0 signify strong dominance by one or a few categories (Honggang *et al.,* 2012). For Conservation priority analysis: IUCN Red List, Wildlife (Protection) Act, 1972 and State of India Birds (SoIB) 2023 priority list were used as a reference to classify different avian species into conservation status, schedule and high priority list, respectively. A guild structure analysis was done, which encompassed the migratory status and the population trend based on the data provided in the State of India Birds (SoIB) 2023 as a reference.

RESULTS AND DISCUSSION

The study recorded a presence of 173 species of avifauna from 54 families with an estimated abundance of 29,036 individuals. The study highlighted that the families having the most species are Scolopacidae, i.e., waders having 18 species (58.1% of total species abundance), followed by Ardeidae, i.e., herons having 11 species, and Accipitridae, i.e. raptors having 9 species, which along with other families are mentioned in Figure 5. The community was predominated by species belonging to Least Concern status of the IUCN Red List forming 95.4% of the avian community i.e., 165 species. Six belonged to Near Threatened species representing 3.5% of the community, i.e., Painted Stork, Oriental Darter, Alexandrine Parakeet, Lesser Flamingo, Bar-tailed Godwit, Black-tailed Godwit, and Black-headed Ibis, whose individuals were numbered at 4,334 individual birds, while one species belonged to the Vulnerable category i.e., Sarus Crane, and 1 species has not been yet assessed by the IUCN, which is mentioned in Figure 4. A significant 8.67% species, i.e., 15 species, are provided legal protection under Schedule I of the Wildlife Protection Act. 88.43% of species, i.e., 153 species, are listed under Schedule II, 3 species are listed under Schedule IV, and 2 species are not protected, as mentioned in Figure 3. The Population trend showed 21 species facing rapid decline, which accounts for 12.14% of the species in the total community, while 37 species showed a decline in their population trend, forming 21.39% of the population. A total decline in population trend was estimated at 33.53% of the community, representing 58 species. There were 47 species (27.17%) whose population trends were inconclusive/data insufficient, based on the data provided in the State of India Birds (SoIB) 2023 as reference. 5 species showed a rapid increase (2.89%), and 13 showed an increase in their population trend (7.51%), as mentioned in Figure 1. There are 21 species flagged as "High" priority for conservation action within India as per the State of India Birds (SoIB) 2023 report, while 152 species belonged to Not listed/Moderate/ Low priority. The study of Guild Composition and Functional Role showed a dominance of Resident species which are 89 in number and constituted 51.4% of the community, followed by the Winter Migrants, which comprised 26.6% of all species i.e., 46 species in number, 20 species belonged to Resident and Local migration guild forming 11.6%, followed by 9 species belonging to Winter and Localised Summer migration guild, 6 species belonged to Intra-India migratory guild, and 3 belonging to Resident and Summer migrant guild, as mentioned in Figure 2. A vast majority of the migratory species and their significant total abundance highlights Gatehara Bird-Field's critical role in the Central Asian Flyway. The Simpson's Index (1-D) showed a high diversity value of 0.9594 (close to 1). The value of the Shannon-Wiener diversity Index (H) at 3.704 indicated high diversity (typically between 1.5 and 3.5), incorporating both richness and evenness. A value for Evenness (e^H/S) at 0.2347 indicates low species evenness, i.e., the community is dominated by a few species, while others are comparatively less in number. All the details of the Result can be studied in Table 1 (Checklist).

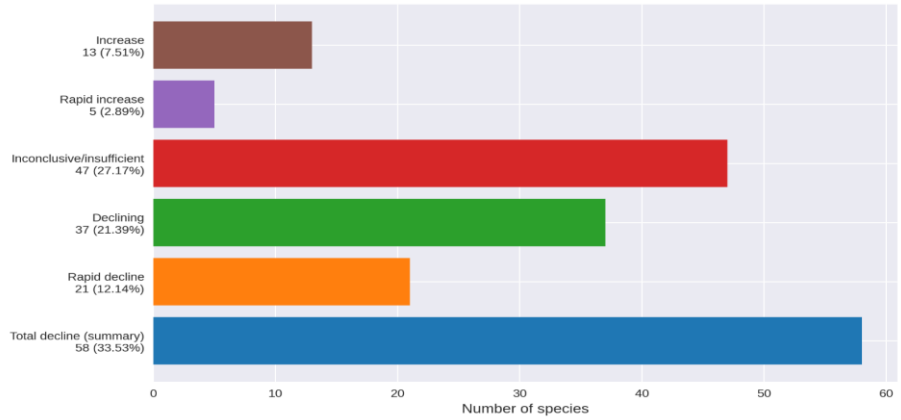

Figure 1. Population Trend (species counts and percentages).

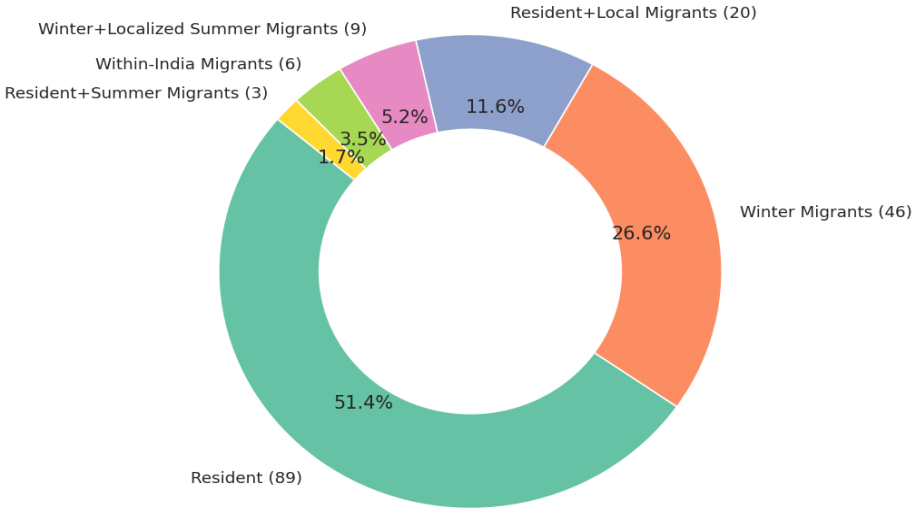

Figure 2. Population Guild (species counts and percentages).

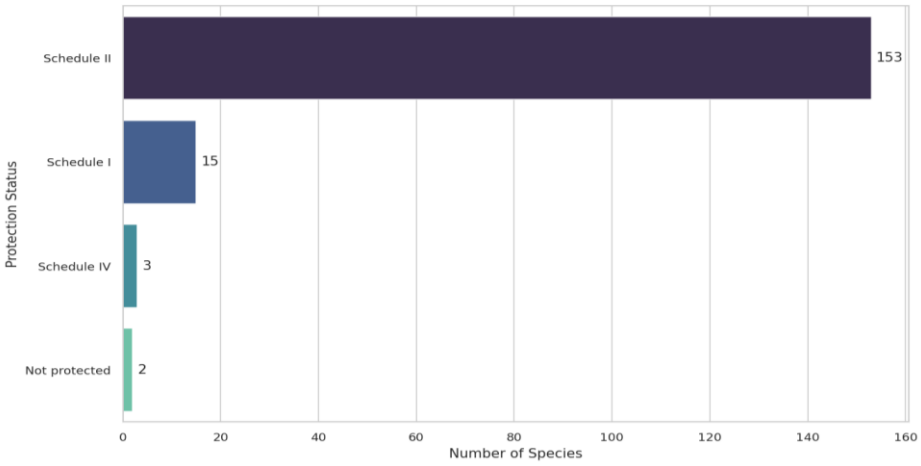

Figure 3. Protection status of species as per the Wildlife Protection Act (1972).

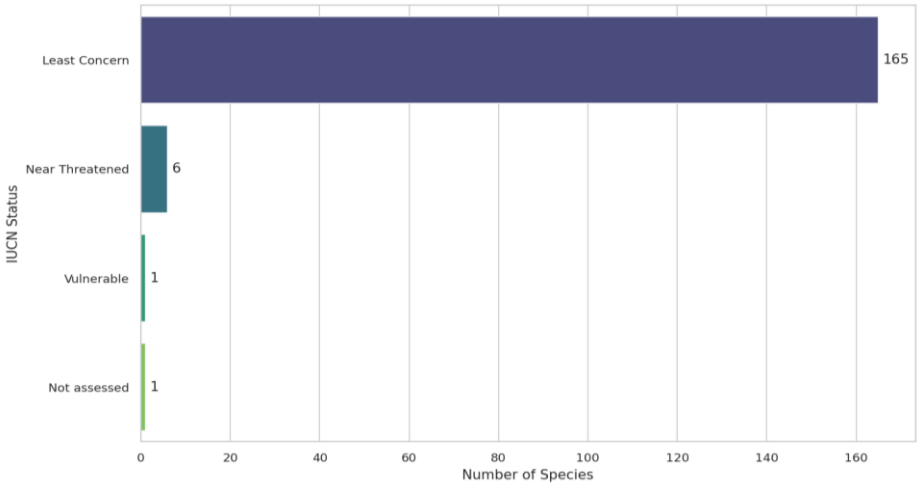

Figure 4. IUCN conservation status by the total number of species.

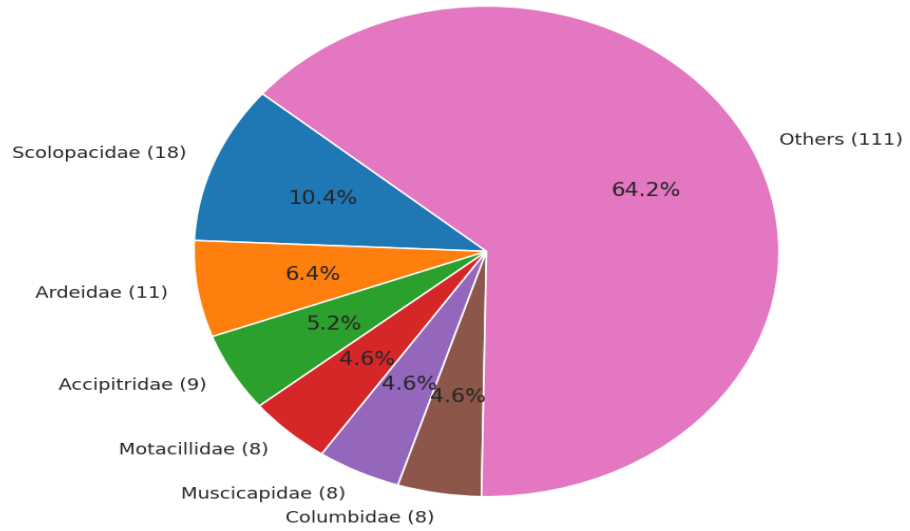

Figure 5. Avian Family Distribution (number of species).

The species richness, coupled with the massive congregation of avifauna at Gatehara Bird-field, meets the criteria for designation as a Key Biodiversity Area, which can be categorized into a category of smaller yet highly productive and biologically diverse form of wetlands called "Satellite wetlands", wetlands like Gatehara also act as key breeding, foraging and stoppage sites for resident birds as well as migratory birds. The data and results unequivocally show that Gatehara Bird-field is a crucial wetland for avian migrants of the Central Asian Flyway. The Scolopacidae family, which has an overwhelming dominance in terms of abundance (58.1%), is driven by massive congregations of wintering shorebirds like the Bar-tailed Godwit (n=2,600), Spotted Redshank (n=2,200), and Common Sandpiper (n=1,560). Further substantiates and underscores the wetland's critical role as a stopover and foraging site within the Central Asian Flyway. The 21 'High priority' species as per the State of India Birds (SoIB) 2023 and the alarming population trends of the rapidly-declining and declining species, reveal the critical insight and threats faced by the wetland as well as its avifauna.

The Simpson's Index (1-D) of Gatehara Bird-Field showed a high diversity value of 0.9594 (close to 1), indicating a well-balanced community, where despite some dominating species, the community is overall diverse, with many species contributing meaningfully to the community and the wetland's niche ecosystem itself, when compared with the Simpson's index value of Ramsar sites like Thol Lake Sanctuary and Nal Sarovar Bird Sanctuary which are present in its nearby district of Mehsana and Ahmedabad respectively, the importance and value of Gatehara Bird-Field in supporting and conserving avifauna is highlighted further, enhancing the need to protect and rejuvenate this

wetland. Compared to Nal Sarovar, which has a Simpson's index value of 0.968 (Joshi *et al.,* 2020). Gatehara Bird-Field has a slightly lower but on par range with a value of 0.9594, putting both these wetlands into high diversity wetland categories. In contrast Gatehara has a higher Simpson's diversity index value as compared to Thol Lake sanctuary, which has a value of 0.942 (Patel *et al.,* 2021). The value of the Shannon-Weiner diversity Index (H) at 3.704 indicated high diversity (typically between 1.5-3.5), incorporating both richness and evenness. Gatehara has a higher Shannon-Weiner diversity Index (H) value than Thol Lake Sanctuary, which has a value of 3.52 (Patel *et al.,* 2021), and compared to Nal Sarovar, which has a Shannon-Weiner diversity Index (H) value of 3.89 (Joshi *et al.,* 2020). Gatehara has a slightly lower value than Nal Sarovar, but both are in the same high diversity and richness range. Though this trend of diversity is not the same when the value for Evenness (e^H/S) is calculated as Gatehara has lower value of Evenness (e^H/S) at 0.234, compared to Thol at 0.271 and Nal Sarovar at 0.295 (GEMI, 2024), which indicates low species evenness, i.e., the community is dominated by a few species, while others are comparatively less in number. This could suggest environmental stress or habitat disturbance, or seasonal or migratory patterns affecting species distribution, resulting in a slightly less even community. Figure 7 highlights the comparative evaluation of Biodiversity indices for all three wetlands. The combined evaluation and comparison of these values of Simpson's Index (1-D), Shannon-Weiner diversity Index (H), and Evenness (e^H/S) with Thol Lake Sanctuary and Nal Sarovar Bird Sanctuary shows how Gatehara Bird-field is a rich and diverse Satellite/stop-over wetland for the avifauna, which is ecologically productive and supports a wide range of bird species, including both the residents and migratory species along the Central Asian Flyway, but faces a constant threat from Anthropogenic pressures like pollution, land reclamation and release of untreated sewage water, which affects its evenness, thus making it mandatory to carry out conservation efforts to protect and rejuvenate this deteriorating micro-haven for birds. There are very few similar such studies on unprotected yet crucial wetlands have been done in other parts of Gujarat which have been termed as Stop-over wetland sites, these studies are: Avian diversity studied at Pariyej Community Reserve, which is a wetland of National importance, where 116 species from 51 families have been recorded (Chaudhary *et al.,* 2023), another such wetland is Chhari Dhandh in Kachchh where 66 species belonging to 14 families were recorded in a study conducted by Joshi et al.,. in 2016-17. A study conducted at Chhaya Rann wetland complex reported 70 species from 21 families (Vargiya *et al.,* 2019). Comparing the species diversity of these stopover sites with Gatehara Bird-field 173 species from 54 families clearly shows how it is rich in its biodiversity and why it should be considered as a wetland of National importance and be brought under protection to enhance its conservation and rejuvenation efforts. Conserving and rejuvenating a deteriorating wetland requires a multidisciplinary integrated effort from various.

Table 1. Checklist of Birds in Gatehara Bird-Field.

Sr. No.	Species	Scientific name	Family	IUCN status	Priority status (SoIB 2023)	Schedule	Population trend	Resident/Local migrant/ migratory
1.	Black-winged Kite	*Elanus caeruleus*	Accipitridae	Least Concern		II	Decline	Resident
2.	Black Kite	*Milvus migrans*	Accipitridae	Least Concern		II	Inconclusive	Resident and Winter Migration
3.	Oriental Honey Buzzard	*Pernis ptilorhynchus*	Accipitridae	Least Concern		I	Stable	Resident and Winter Migration
4.	White-eyed Buzzard	*Butastur tessa*	Accipitridae	Least Concern		I	Decline	Resident and Local Migration
5.	Common Buzzard	*Buteo buteo*	Accipitridae	Least Concern		II	Decline	Winter Migration
6.	Shikra	*Accipiter badius*	Accipitridae	Least Concern		I	Stable	Resident
7.	Booted Eagle	*Hieraaetus pennatus*	Accipitridae	Least Concern		I	Inconclusive	Winter Migration
8.	Short-toed Snake Eagle	*Circaetus gallicus*	Accipitridae	Least Concern	High	I	Rapid Decline	Resident
9.	Western Marsh Harrier	*Circus aeruginosus*	Accipitridae	Least Concern	High	I	Rapid Decline	Winter Migration
10.	Syke's warbler	*Iduna rama*	Acrocephalidae	Least Concern		II	Inconclusive	Winter Migration
11.	Booted Warbler	*Iduna caligata*	Acrocephalidae	Least Concern		II	Stable	Winter Migration

12.	Blyth's Reed Warbler	*Acrocephalus dumetorum*	Acrocephalidae	Least Concern		II	Stable	Winter Migration and Local Summer Migration
13.	Hume's Warbler	*Phylloscopus humei*	Acrocephalidae	Least Concern		II	Inconclusive	Winter Migration and Local Summer Migration
14.	Common Iora	*Aegithina tiphia*	Aegithinidae	Least Concern		II	Increase	Resident
15.	Indian Bushlark	*Mirafra erythroptera*	Alaudidae	Least Concern		II	Decline	Resident
16.	Oriental Skylark	*Alauda gulgula*	Alaudidae	Least Concern	High	II	Rapid Decline	Resident and Local Migration
17.	Crested Lark	*Galerida cristata*	Alaudidae	Least Concern		II	Decline	Resident
18.	Common Kingfisher	*Alcedo atthis*	Alcedinidae	Least Concern		II	Stable	Resident
19.	White-throated Kingfisher	*Halcyon smyrnensis*	Alcedinidae	Least Concern		II	Inconclusive	Resident
20.	Pied Kingfisher	*Ceryle rudis*	Alcedinidae	Least Concern		II	Decline	Resident
21.	Lesser Whistling-Duck	*Dendrocygna javanica*	Anatidae	Least Concern		II	Decline	Resident
22.	Knob-billed Duck	*Sarkidiornis melanotos*	Anatidae	Least Concern		II	Decline	Resident
23.	Indian Spot-billed Duck	*Anas poecilorhyncha*	Anatidae	Least Concern		II	Inconclusive	Resident
24.	Oriental Darter	*Anhinga melanogaster*	Anhingidae	Near Threatened		II	Inconclusive	Resident and Local Migration
25.	Little Swift	*Apus affinis*	Apodidae	Least Concern		II	Stable	Resident
26.	Purple Heron	*Ardea purpurea*	Ardeidae	Least Concern		II	Stable	Resident
27.	Grey Heron	*Ardea cinerea*	Ardeidae	Least Concern		II	Inconclusive	Resident
28.	Black-crowned Night Heron	*Nycticorax nycticorax*	Ardeidae	Least Concern		II	Stable	Resident
29.	Indian Pond Heron	*Ardeola grayii*	Ardeidae	Least Concern		II	Stable	Resident
30.	Striated Heron	*Butorides striata*	Ardeidae	Least Concern		II	Decline	Resident
31.	Little Egret	*Egretta garzetta*	Ardeidae	Least Concern		II	Stable	Resident
32.	Intermediate Egret	*Ardea intermedia*	Ardeidae	Least Concern		II	Stable	Resident
33.	Cattle Egret	*Bubulcus ibis*	Ardeidae	Least Concern		II	Stable	Resident
34.	Greater Egret	*Ardea alba*	Ardeidae	Least Concern		II	Decline	Resident
35.	Black Bittern	*Ixobrychus flavicollis*	Ardeidae	Least Concern		II	Inconclusive	Resident and Local Migration
36.	Yellow Bittern	*Ixobrychus sinensis*	Ardeidae	Least Concern		II	Inconclusive	Resident and Local Migration
37.	Cinnamon Bittern	*Ixobrychus cinnamomeus*	Ardeidae	Least Concern		I	Decline	Resident and Local Migration
38.	Indian Grey Hornbill	*Ocyceros birostris*	Bucerotidae	Least Concern		II	Stable	Resident
39.	Indian Thick-	*Burhinus indicus*	Burhinidae	Least Concern		II	Insufficient data	Resident

	knee							
40.	Yellow-wattled Lapwing	*Vanellus malabaricus*	Charadriidae	Least Concern		II	Decline	Resident
41.	Red-wattled Lapwing	*Vanellus indicus*	Charadriidae	Least Concern		II	Inconclusive	Resident
42.	Kentish Plover	*Charadrius alexandrinus*	Charadriidae	Least Concern	High	II	Rapid Decline	Resident and Winter Migration
43.	Little Ringed Plover	*Charadrius dubius*	Charadriidae	Least Concern	High	II	Rapid Decline	Resident and Winter Migration
44.	Painted Stork	*Mycteria leucocephala*	Ciconiidae	Near Threatened		II	Decline	Resident
45.	Common Tailorbird	*Orthotomus sutorius*	Cisticolidae	Least Concern		II	Increase	Resident
46.	Grey-breasted Prinia	*Prinia hodgsonii*	Cisticolidae	Least Concern		II	Inconclusive	Resident
47.	Ashy Prinia	*Prinia socialis*	Cisticolidae	Least Concern		II	Increase	Resident
48.	Plain Prinia	*Prinia inornata*	Cisticolidae	Least Concern		II	Increase	Resident
49.	Zitting Cisticola	*Cisticola juncidis*	Cisticolidae	Least Concern		II	Stable	Resident
50.	Red Collared Dove	*Streptopelia tranquebarica*	Columbidae	Least Concern		II	Stable	Resident and Local Migration
51.	Eurasian Collared Dove	*Streptopelia decaocto*	Columbidae	Least Concern		II	Increase	Resident
52.	Rock Pigeon	*Columba livia*	Columbidae	Least Concern		Not protected	Increase	Resident
53.	Red Collared Dove	*Streptopelia tranquebarica*	Columbidae	Least Concern		II	Stable	Resident and Local Migration
54.	Eurasian Collared Dove	*Streptopelia decaocto*	Columbidae	Least Concern		II	Increase	Resident
55.	Spotted Dove	*Spilopelia chinensis*	Columbidae	Least Concern		II	Increase	Resident
56.	Laughing Dove	*Spilopelia senegalensis*	Columbidae	Least Concern		II	Inconclusive	Resident
57.	Yellow-footed Green Pigeon	*Treron phoenicopterus*	Columbidae	Least Concern		II	Increase	Resident
58.	Indian Roller	*Coracias benghalensis*	Coraciidae	Least Concern		II	Decline	Resident
59.	Rufous Treepie	*Dendrocitta vagabunda*	Corvidae	Least Concern		II	Stable	Resident
60.	House Crow	*Corvus splendens*	Corvidae	Least Concern		Not protected	Inconclusive	Resident
61.	Large-billed Crow	*Corvus macrorhynchos*	Corvidae	Least Concern		II	Decline	Resident
62.	Pied Cuckoo	*Clamator jacobinus*	Cuculidae	Least Concern	High	II	Stable	Resident and Summer Migration
63.	Asian Koel	*Eudynamys scolopaceus*	Cuculidae	Least Concern		II	Increase	Resident
64.	Common Hawk Cuckoo	*Hierococcyx varius*	Cuculidae	Least Concern		I	Rapid increase	Resident and Local Migration

65.	Sirkeer Malkoha	*Taccocua leschenaultii*	Cuculidae	Least Concern		II	Rapid Decline	Resident
66.	Greater Coucal	*Centropus sinensis*	Cuculidae	Least Concern		II	Rapid Increase	Resident
67.	White-bellied Drongo	*Dicrurus caerulescens*	Dicruridae	Least Concern		II	Decline	Resident
68.	Black Drongo	*Dicrurus macrocercus*	Dicruridae	Least Concern		II	Inconclusive	Resident and Local Migration
69.	Red-headed Bunting	*Emberiza bruniceps*	Emberizidae	Least Concern		II	Inconclusive	Winter Migration
70.	Black-headed Bunting	*Emberiza melanocephala*	Emberizidae	Least Concern		II	Inconclusive	Winter Migration
71.	Indian Silverbill	*Euodice malabarica*	Estrildidae	Least Concern		II	Stable	Resident
72.	Scaly-breasted Munia	*Lonchura punctulata*	Estrildidae	Least Concern		II	Increase	Resident
73.	Red Munia	*Amandava amandava*	Estrildidae	Least Concern		II	Inconclusive	Resident
74.	Common Crane	*Grus grus*	Gruidae	Least Concern	High	I	Rapid Decline	Winter Migration
75.	Sarus Crane	*Antigone antigone*	Gruidae	Vulnerable		II	Rapid Decline	Resident
76.	Wire-tailed Swallow	*Hirundo smithii*	Hirundinidae	Least Concern		II	Stable	Resident
77.	Barn Swallow	*Hirundo rustica*	Hirundinidae	Least Concern		II	Inconclusive	Winter Migration and Local Migration
78.	Streak-throated Swallow	*Petrochelidon fluvicola*	Hirundinidae	Least Concern		II	Inconclusive	Local Migration
79.	Red-rumped Swallow	*Cecropis daurica*	Hirundinidae	Least Concern		II	Decline	Resident and Winter Migration
80.	Dusky Crag Martin	*Ptyonoprogne concolor*	Hirundinidae	Least Concern	High	II	Inconclusive	Resident
81.	Pheasant-tailed Jacana	*Hydrophasianus chirurgus*	Jacanidae	Least Concern		II	Inconclusive	Resident
82.	Brown-winged Jacana	*Metopidius indicus*	Jacanidae	Least Concern		II	Inconclusive	Resident
83.	Bay-backed Shrike	*Lanius vittatus*	Laniidae	Least Concern		II	Decline	Resident and Local Migration
84.	Long-tailed Shrike	*Lanius schach*	Laniidae	Least Concern		II	Stable	Resident and Within-India Migration
85.	Large Grey Babbler	*Argya malcolmi*	Leiothrichidae	Least Concern		II	Stable	Resident
86.	Jungle Babbler	*Argya striata*	Leiothrichidae	Least Concern		II	Stable	Resident
87.	Common Babbler	*Argya caudata*	Leiothrichidae	Least Concern		II	Decline	Resident
88.	Coppersmith Barbet	*Psilopogon haemacephalus*	Megalaimidae	Least Concern		II	Stable	Resident
89.	Green Bee-eater	*Merops orientalis*	Meropidae	Least Concern		II	Stable	Resident
90.	Blue-cheeked Bee-eater	*Merops persicus*	Meropidae	Least Concern		II	Inconclusive	Resident and Summer Migration

91.	White-browed Wagtail	*Motacilla maderaspatensis*	Motacillidae	Least Concern		II	Stable	Resident
92.	Citrine Wagtail	*Motacilla citreola*	Motacillidae	Least Concern		II	Inconclusive	Winter Migration and Local Summer Migration
93.	White Wagtail	*Motacilla alba*	Motacillidae	Least Concern		II	Rapid Decline	Resident and Winter Migration
94.	Western Yellow Wagtail	*Motacilla flava*	Motacillidae	Least Concern		II	Rapid Decline	Winter Migration and Local Summer Migration
95.	Grey Wagtail	*Motacilla cinerea*	Motacillidae	Least Concern		II	Rapid Decline	Winter Migration and Local Summer Migration
96.	Paddyfield Pipit	*Anthus rufulus*	Motacillidae	Least Concern		II	Decline	Resident
97.	Tree Pipit	*Anthus trivialis*	Motacillidae	Least Concern		II	Decline	Winter Migration
98.	Spotted Flycatcher	*Muscicapa striata*	Motacillidae	Least Concern		II	Decline	Winter Migration and Local Summer Migration
99.	Oriental Magpie Robin	*Copsychus saularis*	Muscicapidae	Least Concern		II	Stable	Resident
100.	Indian Robin	*Copsychus fulicatus*	Muscicapidae	Least Concern		II	Stable	Resident
101.	Pied Bushchat	*Saxicola caprata*	Muscicapidae	Least Concern		II	Stable	Resident and Within-India Migration
102.	Bluethroat	*Luscinia svecica*	Muscicapidae	Least Concern		II	Decline	Winter Migration and Local Summer Migration
103.	Red-breasted Flycatcher	*Ficedula parva*	Muscicapidae	Least Concern		II	Stable	Winter Migration
104.	Black Redstart	*Phoenicurus ochruros*	Muscicapidae	Least Concern		II	Decline	Winter Migration and Local Summer Migration
105.	Siberian Stonechat	*Saxicola maurus*	Muscicapidae	NA		II	Inconclusive	Winter Migration and Local Summer Migration
106.	Purple Sunbird	*Cinnyris asiaticus*	Nectariniidae	Least Concern		II	Increase	Resident and Local Migration
107.	Purple-rumped Sunbird	*Leptocoma zeylonica*	Nectariniidae	Least Concern		II	Inconclusive	Resident
108.	Indian Golden Oriole	*Oriolus kundoo*	Oriolidae	Least Concern		II	Stable	Within-India Migration
109.	Yellow-eyed Babbler	*Chrysomma sinense*	Paradoxornithidae	Least Concern		II	Stable	Resident
110.	Yellow-throated Sparrow	*Gymnoris xanthocollis*	Passeridae	Least Concern		II	Inconclusive	Resident
111.	House Sparrow	*Passer domesticus*	Passeridae	Least Concern		II	Decline	Resident and Winter Migration
112.	Little Cormorant	*Microcarbo niger*	Phalacrocoracidae	Least Concern		II	Stable	Resident
113.	Indian Cormorant	*Phalacrocorax fuscicollis*	Phalacrocoracidae	Least Concern		II	Inconclusive	Resident
114.	Great Cormorant	*Phalacrocorax carbo*	Phalacrocoracidae	Least Concern		II	Stable	Resident and Winter Migration
115.	Indian Peafowl	*Pavo cristatus*	Phasianidae	Least Concern		I	Rapid increase	Resident
116.	Barred Buttonquail	*Turnix suscitor*	Phasianidae	Least Concern		II	Insufficient data	Resident
117.	Grey Francolin	*Ortygornis pondicerianus*	Phasianidae	Least Concern		II	Increase	Resident

118.	Lesser Flamingo	*Phoeniconanias minor*	Phoenicopteridae	Near Threatened	High	II	Insufficient data	Within-India Migration
119.	Greater Flamingo	*Phoenicopterus roseus*	Phoenicopteridae	Least Concern	High	II	Rapid Decline	Within-India Migration
120.	Common Chiffchaff	*Phylloscopus collybita*	Phylloscopidae	Least Concern		II	Inconclusive	Winter Migration
121.	Greenish Warbler	*Phylloscopus trochiloides*	Phylloscopidae	Least Concern		II	Stable	Winter Migration and Local Summer Migration
122.	Sulphur-bellied Warbler	*Phylloscopus griseolus*	Phylloscopidae	Least Concern	High	II	Data insufficient	Within-India Migration
123.	Yellow-crowned Woodpecker	*Leiopicus mahrattensis*	Picidae	Least Concern		I	Decline	Resident
124.	White-naped Woodpecker	*Chrysocolaptes festivus*	Picidae	Least Concern		II	Insufficient data	Resident
125.	Black-rumped Flameback	*Dinopium benghalense*	Picidae	Least Concern		I	Inconclusive	Resident
126.	Eurasian Wryneck	*Jynx torquilla*	Picidae	Least Concern		II	Inconclusive	Winter Migration and Local Summer Migration
127.	Black-breasted Weaver	*Ploceus benghalensis*	Ploceidae	Least Concern		II	Stable	Resident
128.	Baya Weaver	*Ploceus philippinus*	Ploceidae	Least Concern		II	Stable	Resident
129.	Little Grebe	*Tachybaptus ruficollis*	Podicipedidae	Least Concern		II	Inconclusive	Resident
130.	Alexandrine Parakeet	*Psittacula eupatria*	Psittaculidae	Near Threatened		II	Rapid increase	Resident
131.	Rose-ringed Parakeet	*Psittacula krameri*	Psittaculidae	Least Concern		II	Stable	Resident
132.	White-browed Bulbul	*Pycnonotus luteolus*	Pycnonotidae	Least Concern		II	Rapid increase	Resident
133.	Red-vented Bulbul	*Pycnonotus cafer*	Pycnonotidae	Least Concern		II	Inconclusive	Resident
134.	White-eared Bulbul	*Pycnonotus leucotis*	Pycnonotidae	Least Concern		II	Stable	Resident
135.	Grey-headed Swamphen	*Porphyrio poliocephalus*	Rallidae	Least Concern		II	Stable	Resident
136.	Common Moorhen	*Gallinula chloropus*	Rallidae	Least Concern		II	Stable	Resident and Local Migration
137.	Eurasian Coot	*Fulica atra*	Rallidae	Least Concern		II	Decline	Resident and Winter Migration
138.	White-breasted Waterhen	*Amaurornis phoenicurus*	Rallidae	Least Concern		II	Stable	Resident
139.	Black-winged Stilt	*Himantopus himantopus*	Recurvirostridae	Least Concern		II	Inconclusive	Resident and Local Migration
140.	Spot-breasted Fantail	*Rhipidura albogularis*	Rhipiduridae	Least Concern		II	Inconclusive	Resident
141.	White-browed	*Rhipidura aureola*	Rhipiduridae	Least Concern		II	Decline	Resident and Summer Migration

	Fantail							
142.	Green Sandpiper	*Tringa ochropus*	Scolopacidae	Least Concern		II	Decline	Winter Migration
143.	Common Sandpiper	*Actitis hypoleucos*	Scolopacidae	Least Concern		II	Decline	Winter Migration
144.	Wood Sandpiper	*Tringa glareola*	Scolopacidae	Least Concern		II	Decline	Winter Migration
145.	Marsh Sandpiper	*Tringa stagnatilis*	Scolopacidae	Least Concern	High	II	Rapid Decline	Winter Migration
146.	Ruff	*Calidris pugnax*	Scolopacidae	Least Concern	High	II	Decline	Winter Migration
147.	Common Greenshank	*Tringa nebularia*	Scolopacidae	Least Concern	High	I	Rapid Decline	Winter Migration
148.	Spotted Redshank	*Tringa erythropus*	Scolopacidae	Least Concern	High	II	Rapid Decline	Winter Migration
149.	Common Redshank	*Tringa totanus*	Scolopacidae	Least Concern	High	II	Rapid Decline	Winter Migration
150.	Bar-tailed Godwit	*Limosa lapponica*	Scolopacidae	Near Threatened		II	Insufficient data	Winter Migration
151.	Black-tailed Godwit	*Limosa limosa*	Scolopacidae	Near Threatened	High	II	Rapid Decline	Winter Migration
152.	Temminck's Stint	*Calidris temminckii*	Scolopacidae	Least Concern		II	Decline	Winter Migration
153.	Little Stint	*Calidris minuta*	Scolopacidae	Least Concern	High	I	Rapid Decline	Winter Migration
154.	Common Snipe	*Gallinago gallinago*	Scolopacidae	Least Concern		II	Decline	Winter Migration and Local Summer Migration
155.	Pintail Snipe	*Gallinago stenura*	Scolopacidae	Least Concern	High	II	Decline	Winter Migration and Local Summer Migration
156.	Greater Painted-snipe	*Rostratula benghalensis*	Scolopacidae	Least Concern		II	Inconclusive	Resident
157.	Spotted Owlet	*Athene brama*	Strigidae	Least Concern		IV	Insufficient data	Resident
158.	Mottled Owl	*Strix virgata*	Strigidae	Least Concern		IV	Stable	Resident
159.	Rosy Starling	*Pastor roseus*	Sturnidae	Least Concern		II	Rapid Decline	Winter Migration
160.	Brahminy Starling	*Sturnia pagodarum*	Sturnidae	Least Concern		II	Inconclusive	Resident
161.	Common Myna	*Acridotheres tristis*	Sturnidae	Least Concern		II	Stable	Resident
162.	Bank Myna	*Acridotheres ginginianus*	Sturnidae	Least Concern	High	II	Rapid Decline	Resident
163.	Lesser Whitethroat	*Curruca curruca*	Sylviidae	Least Concern		II	Stable	Winter Migration and Local Summer Migration
164.	Eastern Orphean Warbler	*Curruca crassirostris*	Sylviidae	Least Concern		II	Insufficient data	Winter Migration
165.	Common Woodshrike	*Tephrodornis pondicerianus*	Tephrodornithidae	Least Concern		II	Decline	Resident
166.	Red-naped Ibis	*Pseudibis papillosa*	Threskiornithidae	Least Concern		II	Stable	Resident
167.	Black-headed Ibis	*Threskiornis melanocephalus*	Threskiornithidae	Near Threatened		II	Stable	Resident
168.	Glossy Ibis	*Plegadis falcinellus*	Threskiornithidae	Least Concern		II	Stable	Resident
169.	Eurasian Spoonbill	*Platalea leucorodia*	Threskiornithidae	Least Concern	High	I	Rapid Decline	Resident and Local Migration
170.	Tawny-	*Dumetia*	Timaliida	Least		II	Stable	Resident

	bellied Babbler	*hyperythra*	e	Concern				
171.	Asian Barn Owl	*Tyto javanica*	Tytonidae	Least Concern		IV	Insufficient data	Resident
172.	Eurasian Hoopoe	*Upupa epops*	Upupidae	Least Concern		II	Decline	Winter Migration and Within-India Migration
173.	Indian White-eye	*Zosterops palpebrosus*	Zosteropidae	Least Concern		II	Stable	Resident

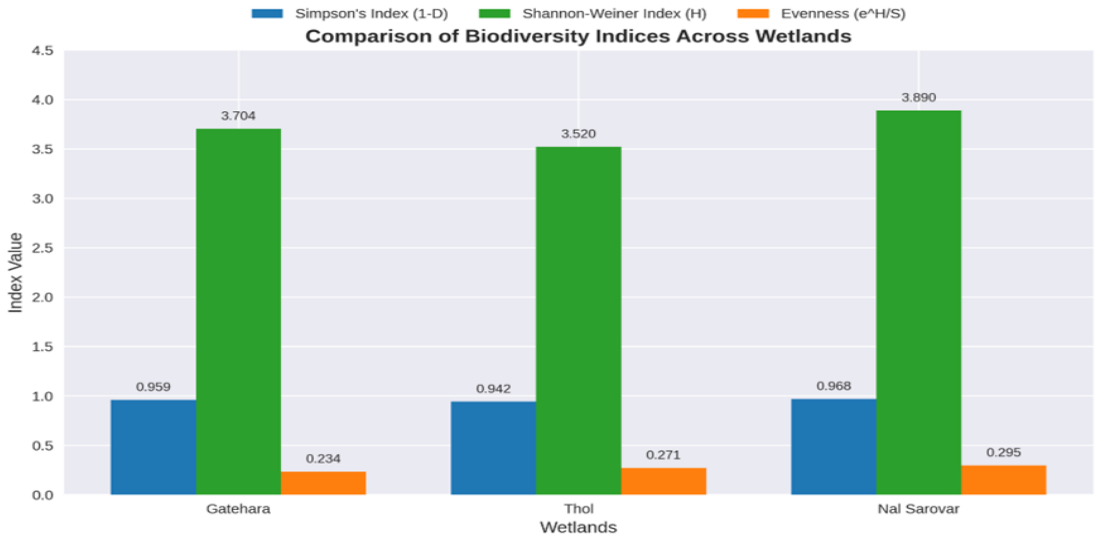

Figure 6. Comparison of Biodiversity Indices across Gatehara, Thol and Nal Sarovar Wetland.

CONCLUSION

This is the first detailed study conducted at Gatehara Bird-field. The study puts forward a detailed listing of 173 species of birds belonging to 54 families found here, along with their high abundance, especially of the migratory birds of the Central Asian Flyway. The high biodiversity and richness are indicated through the values of 0.9594 on Simpson's Diversity Index and a value of 3.704 on Shannon-Weiner Index, highlighting its importance as a 'Satellite Wetland', which acts as an important feeding, breeding and stop-over site for both residential and migratory species. But the future and further rejuvenation of this Wetland as a 'Nationally important wetland' depends on the conservation and protection efforts of a species whose various stakeholders could make all the difference, i.e. us Humans.

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CONFLICT OF INTERESTS

The authors declare no conflict of interest

ETHICS APPROVAL

Not applicable

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AI TOOL DECLARATION

The authors declares that no AI and related tools are used to write the scientific content of this manuscript.

DATA AVAILABILITY

Data will be available on request

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