

Uniqueness of avifauna on islands in some lakes in Hanoi city

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Abstract. Hanoi is a city characterized by many lakes and rivers. Some lakes have small islands separated from the shore or have bridges across them. The islands are unique ecological niches that contribute to maintaining biodiversity for the city. This is the habitat, shelter, feeding and nesting place of many species of birds. Research on the island avifauna in 4 lakes of Hanoi city in 2024-2025 recorded 63 bird species belonging to 10 orders, 28 families, 41 genera. Among them, there are 4 bird species that were listed in Decree 84/2021/ND-CP. The Ardeidae and Muscicapidae (7 species, Rdi = 11.11) being the most diverse families. There is one species that colonial nesting, the Chinese Pond-heron. Most of the species are resident birds (43 species, accounting for 68% of total species), the rest are winter visitor and passage migrant species. The area of the island, the structure of the vegetation on the island, the separation of the island from the shore, the impact of human activities on the island or around the island are factors affecting the diversity of bird species on the island. Islands on lakes play an important role in maintaining the diversity and abundance of bird species in the city.

Keywords: Avifauna, diversity, species, unique, island, lake, Hanoi

1 Introduction

Along with rivers, lagoons, lakes are a unique feature of Hanoi with a long history of development. Currently, Hanoi has about 301 lakes, of which there are about 56 lakes in the inner-city districts and about 245 lakes in the suburban districts [1]. A large part of the lakes in Hanoi are natural lakes, relics of ancient river bends, formed when the river changes its course and the lakes are low-lying areas that have not been filled in by alluvium. The process of urbanization, infrastructure construction and traffic system renovation has significantly changed the natural landscape and especially the water surface of many lakes and lagoons in Hanoi. Many lakes and lagoons have been filled in and their purpose of use has been changed. However, most of the lakes have now been renovated, dredged, embanked and landscaped

around the lakes. Lakes and rivers in Hanoi play an important role in regulating the climate, regulating rainwater, wastewater, tourism and some are also used for aquaculture. However, due to the population explosion, rapid urbanization and industrialization, most of the untreated wastewater has been discharged directly into rivers and lakes in Hanoi, causing pollution. The phenomenon of mass fish deaths has become common in some lakes when the water becomes heavily polluted.

Some recent studies show that the ecological landscape around rivers and lakes in Hanoi is a place with high biodiversity, especially the diversity of bird species. However, there is a special type of habitat that some large lakes in Hanoi have not been studied, which is the small islands in the lake. This is a unique feature of the lakes in Hanoi that needs to be studied. The role of islands with constructions and green cover for

birds, especially water birds, is what this study focuses on to have a satisfactory answer as a basis for sustainable development planning of Hanoi city.

2 Materials and methods

Study area

The project was carried out from February 2024 to March 2025 with 12 research periods. The total number of field survey days was 20 days. The research was carried out on islands in 4 lakes in Hanoi city, specifically in the following areas: Ngoc Island (Hoan Kiem Lake), Thuy Trung Tien Island (Truc Bach Lake), Thong Nhat Island and Hoa Binh Island (Bay Mau Lake), Egret Island (Linh Dam Lake). Ngoc Island is in Hoan Kiem Lake or Ho Guom, a natural lake located in Hoan Kiem ward with an area of 10.5 hectares. On the island there is Ngoc Son Temple and the famous The Huc bridge that leads tourists to the island to visit the Temple. Thuy Trung Tien Island is in Truc Bach Lake located in Truc Bach ward, about 30 m from Thanh Nien Street, connected by a stone bridge. On the island there is Thuy Trung Tien Temple and a green tree system that creates conditions for bird's colonial nesting. In Thong Nhat Park located in Hai Ba Trung ward, there are two islands: Thong Nhat Island and Hoa Binh Island. Thong Nhat Island is connected to the shore by a bridge, on the island are planted flowers to create scenery, along with a system of shady green trees and a large statue. Hoa Binh Island is separate from the shore, on the island there is also a shrine, tourists who want to go to the island must go by canoe. Stork Island in Linh Dam Lake located in Hoang Liet ward was originally an island where storks came to nest in large groups until 2009 - 2010 when the lake had not been renovated into a deep lake. Later, when the lake was renovated, the water birds also flew

away and did not return to nest in groups on the island anymore.

Methods

Bird species were recorded in the field through direct observation at close range or with Steiner SkyHawk Pro 10x42 binoculars at long range. Birds were photographed with a 125X Nikon Coolpix P1000 super zoom camera (24 - 3000mm). Reference books [2, 3, 4] were used to quickly identify birds in the wild. Scientific names of species and bird lists are arranged according to the classification systems of HBW and Birdlife International (ver.9, 2024) [5]; Common names according to documents by Nguyen Lan Hung Son, Nguyen Thanh Van [6].

Data analysis

The relative diversity index (RDi) of birds' families was calculated following La Torre Cuadros et al. [7] using the formula below:

$$RDi = \frac{\text{Number of bird species in a family}}{\text{Total number of species}} \times 100$$

3 Results and discussion

3.1 Species diversity

Research results in 2024 - 2025 and inheriting some previous research results in the area recorded on the islands in 4 lakes in Hanoi city, there are 63 bird species belonging to 41 genera, 28 families, 10 orders (Table 1). Of the total 63 species identified, 35 were recorded through photos taken in the field, 18 direct observations or hearing the sound. Ten species were recorded only referred to from previous documents [8, 9, 10]. Most of the species are resident birds (43 species, accounting for 68% of total species), the rest are winter visitor (18 species) and passage migrant (2 species). This suggests that islands in urban lakes are also important destinations for

migratory birds due to their safe habitat, isolation, and food supply. 4 species were recorded in this study and were listed in Decree 84/2021/ND-CP

on the management of endangered, precious, and rare forest plants and animals [11].

Table 1. List of bird species recorded on islands in four lakes in Hanoi city

No	Common name	Scientific name	Status	Place recorded				Notes
				(a)	(b)	(c)	(d)	
	I. COLUMBIFORMES							
	1. Columbidae							
1	Red Collared-Dove	<i>Streptopelia tranquebarica</i> (Hermann, 1804)	R			+		O
2	Eastern Spotted Dove	<i>Streptopelia chinensis</i> (Scopoli, 1768)	R	+		+	+	P
	II. CAPRIMULGIFORMES							
	2. <i>Caprimulgidae</i>							
3	Grey Nightjar	<i>Caprimulgus jotaka</i> Temminck & Schlegel, 1845	Wv			+		O
	3. <i>Apodidea</i>							
4	Asian Palm-swift	<i>Cypsiurus balasiensis</i> (J.E. Gray, 1829)	R	+		+	+	P
	III. CUCULIFORMES							
	4. <i>Cuculidae</i>							
5	Plantive Cuckoo	<i>Cacomantis merulinus</i> (Scopoli, 1768)	R	+		+	+	P
6	Greater Coucal	<i>Centropus sinensis</i> (Stephens, 1815)	R	+		+	+	P
	IV. GRUIFORMES							
	5. <i>Rallidae</i>							
7	White-breasted Waterhen	<i>Amaurornis phoenicurus</i> (Pennant, 1769)	R		+	+	+	P
	V. PELECANIFORMES							
	6. <i>Ardeidae</i>							
8	Yellow Bittern	<i>Botaurus sinensis</i> (Gmelin, JF, 1789)	R			+	+	P
9	Cinnamon-bittern	<i>Botaurus cinnamomeus</i> (Gmelin, JF, 1789)	R				+	P
10	Black-crowned Night-heron	<i>Nycticorax nycticorax</i> (Linnaeus, 1758)	R	+	+	+	+	P
11	Green-backed Heron	<i>Butorides striata</i>	R	+	+	+	+	P

No	Common name	Scientific name	Status	Place recorded				Notes
				(a)	(b)	(c)	(d)	
		(Linnaeus, 1758)						
12	Chinese Pond-heron	<i>Ardeola bacchus</i> (Bonaparte, 1855)	R	+	+	+	+	P
13	Western cattle Egret	<i>Ardea ibis</i> Linnaeus, 1758	Wv	+		+	+	P
14	Little Egret	<i>Egretta garzetta</i> (Linnaeus, 1766)	Wv			+	+	O
	VI. STRIGIFORMES							
	7. Tytonidae							
15	Barn Owl	<i>Tyto alba</i> (Scopoli, 1769)	R			+		[8]
	VII. ACCIPITRIFORMES							
	8. Accipitridae							
16	Besra	<i>Accipiter virgatus</i> (Temminck, 1822)	R			+		P
	VIII. CORACIIFORMES							
	9. Alcedininae							
17	Common Kingfisher	<i>Alcedo atthis</i> (Linnaeus, 1758)	R	+		+	+	P
18	Pied Kingfisher	<i>Ceryle rudis</i> (Linnaeus, 1758)	R	+				O
	IX. FALCONIFORMES							
	10. Falconidae							
19	Common Kestrel	<i>Falco tinnunculus</i> (Linnaeus, 1758)	Wv			+		P
20	Peregrine Falcon	<i>Falco peregrinus</i> (Tunstall, 1771)	Wv		+			O
	X. PASSERIFORMES							
	11. Campephagidae							
21	Ashy Minivet	<i>Pericrocotus divaricatus</i> (Rafflet, 1822)	Wv			+		O
	12. Rhipiduridae							
22	White-throated Fantail	<i>Rhipidura albicollis</i> (Violeillot, 1818)	R	+	+	+	+	P
	13. Laniidae							
23	Brown Shrike	<i>Lanius cristatus</i>	Wv	+				[9]

No	Common name	Scientific name	Status	Place recorded				Notes
				(a)	(b)	(c)	(d)	
		(Linnaeus, 1758)						
24	Burmese Shrike	<i>Lanius collurioides</i> (Leson, 1834)	R			+		O
25	Long-tailed Shrike	<i>Lanius schach</i> (Linnaeus, 1758)	R			+	+	P
26	Gray-backed Shrike	<i>Lanius tephronotus</i> (Vigors, 1831)	Wv			+		[9]
	14. Paridae							
27	Great Tit	<i>Parus major</i> (Linnaeus, 1758)	R	+	+	+	+	P
	15. Cisticolidae							
28	Rufescent Prinia	<i>Prinia rufescens</i> (Blyth, 1847)	R	+		+		O
29	Yellow-bellied Prinia	<i>Prinia flaviventris</i> (Delessert, 1840)	R	+		+		[9]
30	Prinia inornata	<i>Prinia inornata</i> (Sykes, 1832)	R	+		+	+	O
31	Common Tailorbird	<i>Orthotomus sutorius</i> (Pennant, 1769)	R	+	+	+	+	P
32	Dark-necked Tailorbird	<i>Orthotomus atrogularis</i> (Temminck, 1836)	R	+		+		O
	16. Hirundinidae							
33	Red-rumped Swallow	<i>Hirundo daurica</i> (Linnaeus, 1771)	Wv		+			O
34	Barn Swallow	<i>Hirundo rustica</i> (Linnaeus, 1758)	R	+	+	+	+	P
	17. Pycnonotidae							
35	Red-whiskered Bulbul	<i>Pycnonotus jocosus</i> (Linnaeus, 1758)	R	+	+	+	+	P
36	Light-vented Bulbul	<i>Pycnonotus sisnensis</i> (Gmelin, 1789)	R			+		O
37	Sooty-headed Bulbul	<i>Pycnonotus aurigaster</i> (Vieillot, 1818)	R	+		+	+	P
	18. Phylloscopidae							
38	Yellow-browed Warbler	<i>Phylloscopus inornatus</i> (Blyth, 1842)	Wv			+		P

No	Common name	Scientific name	Status	Place recorded				Notes
				(a)	(b)	(c)	(d)	
39	Dusky Warbler	<i>Phylloscopus fuscatus</i> (Blyth, 1842)	Wv	+				O
40	Bianchi's Warbler	<i>Phylloscopus valentini</i> (E. Hartert, 1907)	Wv			+		O
41	Eastern Crowed Warbler	<i>Phylloscopus coronatus</i> (Temminck & Schlegel, 1847)	Wv			+		P
	19. Sturnidae							
42	Common Myna	<i>Acridotheres tristis</i> (Linnaeus, 1766)	R	+				P
	20. Turdidae							
43	Chinese Blackbird	<i>Turdus Mandarinus</i> (Bonaparte, 1850)	Wv	+				O
	21. Muscicapidae							
44	Oriental Magpie-robin	<i>Copsychus saularis</i> (Linnaeus, 1758)	R	+		+		P
45	White-rumped Shama	<i>Copsychus malabaricus</i> (Scopoli, 1788)	R			+		[8]
46	Brown-breasted Flycatcher	<i>Muscicapa muttui</i> (Layard, 1854)	Pm				+	O
47	Asian Brown-Flycatcher	<i>Muscicapa dauurica</i> (Pallas, 1811)	Wv			+		P
48	Yellow-rumped Flycatcher	<i>Ficedula zanthopygia</i> (Hay, 1845)	Pm			+		[10]
49	Snowy-browed Flycatcher	<i>Ficedula hyperythra</i> (Muller, 1835)	R			+		[8]
50	Tibetan Stonechat	<i>Saxicola torquatus</i> (Linnaeus, 1766)	R	+		+	+	P
	22. Zosteropidae							
51	Swinhoe's White-eye	<i>Zosterops japonicus</i> (Temminck and Schelegel, 1847)	R	+	+	+	+	P
	23. Dicaeum							
52	Scarlet-backed flowerpecker	<i>Dicaeum cruentatum</i> (Linnaeus, 1758)	R			+		P
53	Plain Flowerpecker	<i>Dicaeum minullum</i> (Jerdon, 1840)	R	+				[8]

No	Common name	Scientific name	Status	Place recorded				Notes
				(a)	(b)	(c)	(d)	
	24. Nectariniidae							
54	Olive-backed Sunbird	<i>Cinnyris jugularis</i> (Linnaeus, 1766)	R			+		O
54	Crimson Sunbird	<i>Aethopyga siparaja</i> (Raffles, 1822)	R		+	+		P
56	Fork-tailed Sunbird	<i>Aethopyga christinae</i> R. Swinhoe, 1869	R		+			P
	25. Estrildidae							
57	Scaly-breasted Munia	<i>Lonchura punctulata</i> (Linnaeus, 1758)	R			+	+	P
	26. Passeridae							
58	Eurasian Tree Sparrow	<i>Passer montanus</i> (Linnaeus, 1758)	R	+	+	+	+	P
	27. Motacillidae							
59	Olive-backed Pipit	<i>Anthus hodgsoni</i> (Richmond, 1907)	Wv			+		[8]
60	Paddyfield Pipit	<i>Anthus rufulus</i> (Vieillot, 1818)	R	+				[9]
61	Grey Wagtail	<i>Motacilla cinerea</i> (Tunstall, 1771)	Wv			+		P
62	White Wagtail	<i>Motacilla alba</i> (Linnaeus, 1758)	Wv	+	+	+	+	P
	28. Fringillidae							
63	Grey-capped Greenfinch	<i>Chloris sinica</i> (Linnaeus, 1766)	R	+		+		O
Total:				32	16	51	27	

Status: R- resident; Pm- passage migrant; Wv- winter visitor.

Places recorded: (a)- island in Hoan Kiem lake; (b)- island in Truc Bach lake; (c)- islands in Bay Mau lake; (d)- island in Linh Dam lake.

Notes: P- species recorded with photo; O- species recorded by observation; [8]- Son N.L.H. et al.; [9]- Son N.L.H. et al.; [10]- Son N.L.H. et al.

Comparison of bird species recorded between lakes shows difference (Figure 1). Bay Mau Lake recorded the most species (51 species), followed by Hoan Kiem Lake, Linh Dam Lake and the least in Truc Bach Lake (16 species). Analysis of the characteristics of the 4 lakes shows that there are a number of ecological factors affecting the diversity of bird species including: island area, level of human influence on the island, distance between the island and the shore, diversity of vegetation on the island and canopy closure, lake area, location of the lake in relation to the Red River and activities and traffic around the lake.

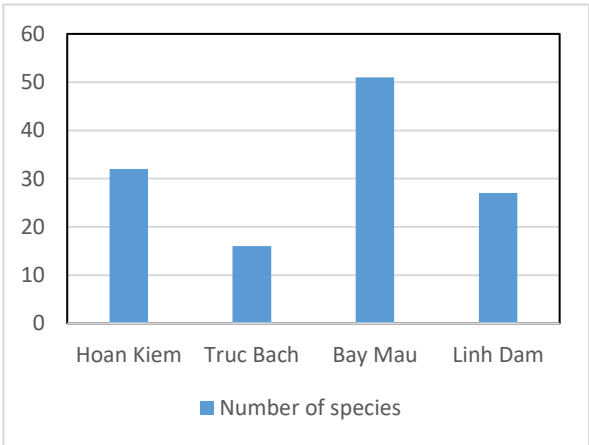


Fig. 1. Number of bird species recorded on islands in 4 lakes in Hanoi city.

Research by Son et al. in 2010 [8] showed that before Linh Dam Lake was dredged and converted into a deep lake, the egret island here attracted a lot of water birds to roost and colonial nesting. After the lake was renovated, water birds no longer came to nest in groups on the island. Currently, around the islands in the four lakes, there are rafts for planting umbrella papyrus (*Cyperus alternifolius*) which aim to clean the lake water. These plant rafts are coincidentally the places for water birds belonging to Rallidae and Ardeidae to roost and feed. The aquatic plants

rafts play an important role as small satellite islands for water birds to use.

3.2 Species composition

Assessment of the diversity in species composition shows that among the 10 orders recorded in the study area, the Passeriformes order has the most diversity in species composition, followed by the Pelecaniformes order, the remaining orders have only 1-2 species represented. The presence of representatives of all 3 orders (Strigiformes, Accipitriformes, Falconiformes) in the raptor group shows the diversity in species composition of bird communities on islands in lakes in urban ecosystems. Because raptors often stand at the top of the ecological pyramid, playing the role of umbrella species.

In terms of species composition in families, among the 28 families recorded in the study area, the Ardeidae and Muscapidae are the most diverse in species composition with 7 species recorded (Relative Diversity index, $RDi = 11.11$). Cisticolidae followed with 5 species ($RDi = 9.52$). However, there are also 14 families that were poorly represented with only 1 recorded species ($RDi = 1.59$) (Table 2). This suggests that the island is an important habitat for waterbirds, especially some species with colonial nesting behavior. Research has identified large numbers of Black-crowned Night-heron (*Nycticorax nycticorax*) nesting in colonies on Thuy Trung Tien Island in Truc Bach Lake. The vegetation on the island plays an important role as a shelter and nesting place for waterbirds. The depth of the lake also affects the shallow water feeding behavior of waterbirds. The aquatic food source affects the abundance of waterbirds, especially during the breeding season of the species. Insectivorous birds and scrub birds are common birds in urban areas. Therefore, the structure of urban vegetation,

which is associated with the food sources of birds, is a factor influencing the diversity of bird species composition.

The research results in Table 1 show that there are 11 bird species recorded on the islands in all 4 lakes, 10 species recorded in 3 lakes. However, there are up to 29 bird species recorded in only 1 of the 4 research lakes. The majority of the recorded bird species are small and medium sized species. Some large species with a small number of individuals recorded are mainly waterbird species belonging to Gruiformes, Pelecaniformes or raptors belonging to Strigiformes, Accipitriformes, Falconiformes. Domestic pigeons are quite popular in urban areas besides two wild dove species recorded in Columbiformes. Survey birds in 37 parks in Nanjing city, China were recorded 75 species and using RLQ analysis (including park environment variables - R, species traits - Q, species distribution - L) showed that body size and habitat specificity were correlated with distance to city center and connectivity of the parks, reflecting strong effects of trait-mediated environmental filters that selectively benefit species with smaller body mass and lower habitat specificity in urbanized landscape [12]. *Passer montanus*, *Pycnonotus jocosus* and *Zosterops*

japonicus are still the dominant birds in urban as well as on the island.

3.3 The role of lake islands in urban ecosystems

Many studies have shown that urban parks often act as “green islands” or fragmented urban habitats for wildlife [13]. Managing wildlife-friendly habitats in parks is an effective way to protect biodiversity in urban ecosystems [14]. As an important part of biodiversity, birds are important bioindicators of ecosystem health [15]. Theoretical and empirical evidence suggests that bird diversity in urban areas is largely determined by several key factors, including fragmentation, isolation, shape, habitat diversity, and human disturbance [13, 16]. Several studies on island biogeography have shown that the relationship between species and island area, park area and multi-layered vegetation are often the most important factors determining the diversity of bird species on islands [17, 18]. Research results in Hanoi show that lake islands in the city play an important role for wild birds, especially waterbirds and insectivorous birds. Maintaining green islands in lakes not only creates an ecological landscape for the city but also contributes to maintaining biodiversity for the city.

Table 2. Relative diversity index of bird families on islands in 4 lakes in Hanoi city

Bird families	Number of species	Relative diversity index (RDi)
Ardeidae, Muscipidae	7	11,11
Cisticolidae	5	7,94
Lanidae, Phylloscopidae, Motacillidae	4	6,35
Pycnonotidae, Nectariniidae	3	4,76
Columbidae, Cuculidae, Alcedinidae, Falconidae, Hirundinidae, Dicaeidae,	2	3,17
Caprimulgidae, Apodidae, Rallidae, Tytonidae, Accipitridae, Campephagidae, Rhipiduridae, Paridae, Sturnidae, Turdidae, Zosteropidae, Estrildidae, Passeridae, Fringillidae	1	1,59

4 Conclusion

Studies on the diversity of bird species on islands in 4 lakes in Hanoi city show the role and uniqueness of islands in the urban ecosystem. Islands are places that attract a lot of species of birds to roost, forage and even colonial nesting. In addition to the common resident birds, there are many seasonal migratory birds that visit the island. The structure of the island affects the diversity of bird species on the island. Green islands on lakes play an important role in maintaining the diversity of bird species and creates an ecological landscape for the city. The city needs to pay attention to the role of lake islands in urban planning and management for sustainable development. Attention should be paid to improving the embankment around the island with cornerstone to help birds easily perch and forage along the shore. At the same time, it is necessary to protect and care for increasing the canopy and diversity of plant species on the island. Limit negative impacts of humans on the island. The bird islands in the lake are a unique highlight of biodiversity for urban areas such as Hanoi city.

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