

Research Article

AVIAN SPECIES DIVERSITY AND POPULATION IN AND AROUND AN URBAN LAKE IN BANGLADESH

Habibon Naher^{1*}, Shawkat Imam Khan², Noor Jahan Sarker³ and Mursida Parvin⁴

1Department of Zoology, Jagannath University, Dhaka-1100, Bangladesh

2Department of Natural History, Bangladesh National Museum, Dhaka 1000, Bangladesh

3Department of Zoology, University of Dhaka, Dhaka-1000, Bangladesh

4Upazila Resource Centre, Directorate of Primary Education, Sadar, Sirajganj

Received: 11 October 2020, Accepted: 25 June 2021

ABSTRACT

Species diversity and population of birds were studied in an urban lake under Dhaka North City Corporation (DNCC) of Bangladesh by direct field observation from January 2010 to December 2010 with the aim to enlist the status and diversity of urban birds. A total of 39 species of birds belonging to 13 orders, 30 families and 36 genera were recorded, of which, 21 (53.8%) species were passerines and 18 (46.2%) non-passerines. Resident status showed that 35 (89.7%) species were resident and 4 (10.3%) winter migrants. The species diversity was the highest (26 species, 66.7% of total recorded species) in September but the highest population was recorded in October (375 individuals, 24.1% of total recorded birds). The value of Shannon Diversity Index ($H' = 2.96$), Simpson Diversity Index ($D = 0.9$) and Evenness ($E = 0.8$) indicated the species richness of avifauna in this area. Wetland degradation was the main threat to birds in this area. Conservation initiatives should be strictly implemented as this area supported some important bird species throughout the area.

Key words: *Species diversity, population, Nikunja-1, Bangladesh*

Introduction

Birds are used in bioassays as they are highly susceptible to any changes in the habitat they live in (Ahsan and Khanom 2005). They play a vital role in both the structure and function of ecosystems by providing numerous ecological benefits, such as seed dispersal, the facilitation of forest restoration (Lozada *et al.*, 2007), the pollination of many plant species, and pest control services through the consumption of insects (Philpott *et al.*, 2009; Sekercioglu 2012) and small rodents, which can devastate hectares of agricultural products. Thus, birds are an ideal study group for the valuation of ecosystem services (Wenny *et al.*, 2011). They are integral part of food chain and food web (Singh *et al.*, 2018). Richness, abundance and community composition of birds are often used by ecologists to understand the diversity of species in natural occurrence (Joshi 2001). The environmental impacts on birds are typically assessed by recording changes in the population

***Correspondence:** *Habibon Naher, E-mail: habibon.naher@zool.jnu.ac.bd*

density, abundance or distribution of species in different habitat types (Temple and Wiens 1989). The major factor affecting the bird diversity is habitat destruction. Therefore, the majority of avian species are unknowingly enters to inhabit the urban area. The quantity and quality of habitat depended on the vegetation composition which could further affect the diversity, abundance and distribution of birds (Aggrawal *et al.*, 1998; Abdar 2013).

Several works on avifauna have been done sporadically in various parts of the country (Husain 1975; Husain and Haque 1976, 1977; Khan 1980; Husain *et al.*, 1983, Husain *et al.*, 1990; Harvey 1990; Thompson and Johnson 2003; Khan 2005; Khan and Naher 2009; Jaman *et al.*, 2011; Khan *et al.*, 2014) including the capital city of Dhaka (Sarker *et al.*, 2009; Akash *et al.*, 2013; Islam *et al.*, 2014; Razia *et al.*, 2015; Chowdhury *et al.*, 2014). Few works has been conducted on food, feeding behaviour and breeding of kingfishers at Nikunja-1 (Naher and Sarker 2015, 2016, 2018, 2019), but no work has yet been done on species diversity and number of birds in and around the lakes of Nikunja-1. Two lakes with diverse aquatic habitats attract a large number of birds. To explore these bird species and population we aimed to conduct a scientific study. The objective of this study was to determine the present study of birds, species assemblage in and around the lakes and the threats.

Material and Methods

Study Area

The study has been conducted at Nikunja-1 (23.82500°N, 90.42002°E) residential area (0.19 sq. km) under Dhaka North City Corporation between January 2010 and December 2010. The study area is located on the west side of Dhaka Airport highway. There are two Lakes, one at the east (17,469 sq.m) and another one at the west side (20,474 sq.m) of the Nikunja-1 residential area (Fig. 1). In between the lakes, there are several residential buildings. The northern and southern side of Nikunja-1 is bounded by Nikunja-2 residential area and Dhaka Cantonment Golf field respectively. The area is dominated with Koroi (*Albizia procera*), Shisham (*Dalbergia sissoo*) associated with other plant species such as, Acacia (*Acacia moniliformes*), Sodom Apple (*Calotropis procera*), Mango (*Mangifera indica*), Indian Jujube (*Zizyphus mauritiana*), Fig (*Ficus* spp.) Rain Tree (*Samanea saman*), Mahogany (*Swietenia mahagoni*), Coconut (*Cocos nucifera*), Indian Lilac (*Azadirachta indica*), Lemon Bottlebrush (*Callistemon citrinus*), China Berry (*Melia azedarach*), Black Berry (*Syzygium cumini*), Common Bur-flower (*Anthocephalus chinensis*), Guava (*Psidium guajava*), Bush Morning Glory (*Ipomoea fistulosa*), Water Morning Glory (*Ipomoea aquatica*), Banana (*Musa paradisiaca*) and Papaya (*Carica papaya*).

Data Collection

The area was surveyed every after two weeks usually from morning (06:30h to 09:00h) and afternoon (16:30h to 1900h or till dusk), as the birds are most active during these time periods (Fujita *et al.*, 2010; Akash *et al.*, 2013). The time schedule fluctuated depending on the seasonal variation. Data were collected through direct field observations along the transects which were placed on walkways or around the lakes and predefined road in between the residential buildings in the study area. Total transect length was 2923 m (2.9 km) ranged from 256m to 778m (417.6 ± 178.8 , $n=7$) (Table 1). Each transect was repeated twice in a day. In this method, the observer slowly walks on a straight line and observed the birds from both sides. During population count,

‘point count’ method was followed while the observer fixed a point at the middle of the small-length transects (transect no 2-6) and in case of long-length transects (transect no 1 and 7) the points were fixed at every 160 m from the starting and ending point. The observer stood at the point for 10 minutes and recorded all the birds seen and heard. The birds flying over the head were also count. The birds were carefully seen to avoid repeated count.



Fig. 1. Map of the study area.

Table 1. Transect line with lengths (m) at Nikunja-1 in Dhaka.

Transect No	Length of (m)	Location	Vegetation Characteristics
1.	778	Along the walkway of Lake-1	Acacia, Sodom Apple, Mango, Indian Jujube, Fig, Rain Tree, Lemon Bottlebrush, Black Berry, China Berry, Common Bur-flower, Mahogany, Coconut, Indian Lilac, grass and aquatic vegetation along both side of the lake
2.	256	Between the pre-defined roads	Grass around the residential buildings
3.	331	Between the pre-defined roads	Grass around the residential buildings
4.	311	Between the pre-defined roads	Grass around the residential buildings
5.	443	Between the pre-defined roads	Grass around the residential buildings
6.	313	Between the pre-defined roads	Grass around the residential buildings
7.	491	Along the walkway of Lake-2	Water Morning Glory, Banana, Guava, Touch-me-not, Papaya, Bush Morning Glory, grass and aquatic vegetation along both side of the lake,

All bird species were identified following Ali and Ripley (1996) and Grimmett *et al.* (1998). For clear observation a pair of binoculars (Bushnell 20 × 280 mm with multicoated lens) was used whenever necessary. The local status of each species was assessed based on the percentage of

occurrence during observations following several parameters (Khan 1982; Khan and Naher 2009; Khan *et al.*, 2014): Very Common (VC)-a species seen during 76 to 100% of the visits; Common (C)-a species seen during 51 to 75% of the visits; Fairly Common (FC)- a species seen during 26 to 50% of the visits; and Rare or Occasional (O)-a species seen single or in small number of occasions, i.e., up to 25% of the visits.

Data Analysis

Shannon-Wiener Index (1949), Simpson's index (1949) of diversity and evenness (quantifies how numerically equal the community is) of species in the study area were calculated according to the months.

Results and Discussion

Species Composition

A total of 39 species of birds were recorded (Table 2) belonging to 13 orders (Fig. 2) and 31 families (Fig. 3). Lower than the present study was recorded in Uttara in Dhaka (Sarker *et al.*, 2009), while they reported 27 species of birds under 8 orders and 14 families (25 species from Uttara 7 and 18 species from Uttara 9). More species were found in Uttara 7 as the vegetation types of this area included lakes, vegetable gardens and 53 species of trees and bushes. On the other hand, Uttara 9 supported a lake but vegetation types are poorer than Uttara 7, constituted 40 species of trees and bushes. Bird diversity was also recorded by several researchers in Ramna Park which contained 71 species of flowering trees including shrubs, perennials, and annuals, of which thirty-six were fruit bearing plants, 33 were medicinal plants and 41 were forest trees (Rajia *et al.*, 2015). Altogether 50 species of birds belonging to 11 orders and 28 families were recorded by Rajia *et al.* (2015), 65 species belonging to 11 orders and 28 families and 53 genera recorded by Islam *et al.* (2014) and 37 species were recorded by Das (1975) in Ramna Park. Shovon *et al.* (2014) recorded 60 species of birds from the Sher-e-Bangla Agricultural University Campus in Dhaka, which had a diverse ecological habitats and vegetation types, consisting of wetlands, grasslands, crop fields, forest areas, bushes, woodlands and human settlements and sheltered various kinds of wild life, fishes and innumerable number of insects. Dhaka University campus is other biodiversity rich area in Dhaka city which contained 541 species of plants including, herbs, trees, shrubs, climbers, epiphytes and parasites (Uddin and Hassan 2016). Akash *et al.* (2013) recorded 50 species from the Curzon hall premises and Chowdhury *et al.* (2014) reported 78 species under 11 orders, 39 families and 64 genera from Dhaka University campus. From this study it is revealed that the diversity of habitats of an area influenced the species assemblage of birds.

Migratory and Resident Status

The present study recorded 89.7% (35 species) of resident birds (Table 2) which was more than other findings reported by Sarker *et al.* (2009) at Uttara (88.9%), Rajia *et al.* (2015) at Ramna park (84%) and Akash *et al.* (2013) at Curzon hall premises (58%) and Shovon *et al.* (2014) in Sher-e-Bangla Agricultural University campus (72%) in Dhaka. The vegetation in Sher-e-Bangla Agricultural University, Ramna Park, Curzon Hall premises and Dhaka University campus providing resting, nesting and feeding sites of many wild animals (Sarker *et al.*, 2009; Shovon *et al.*, 2014; Rajia *et al.*, 2015; Akash *et al.*, 2013; Uddin and Hassan 2016) which influenced the resident

bird diversity. The dominant resident birds were Jungle Crow (13.2% of total population), followed by Asian Pied Starling (9.4%), Black Kite (8.5%), House Sparrow (8.4%), Black Drongo (7.3%) and House Crow (6.9%) in the present study. House Crow and House Sparrow were the dominant resident birds both in Ramna Park (Rajia *et al.*, 2015) and Uttara (Sarker *et al.*, 2009).

Only 4 species of birds (10.9% of total) were migratory in present study which is in line with the findings of Sarker *et al.* (2009) who recorded only 3 species (11.1% of total) at Uttara. Several studies in different sites also recorded few number of migratory species, such as, Islam *et al.* (2014) recorded 9 species (13.8% of total) in Botanical Garden, Akash *et al.* (2013) recorded 12 species in Curzon hall premises and Rajia *et al.* (2015) recorded 8 species (16% of total) in Ramna park and Shovon *et al.* (2014) recorded 17 species (28% of total) in Sher-e-Bangla Agricultural University campus. The dominant migratory bird in the present study was Barn Swallow and White Wagtail. Rajia *et al.* (2015) recorded White Wagtail as dominant migratory bird in Ramna Park. From this finding, it is evident that the habitat of study area does not suitable for migratory birds although few migratory birds used this area as stopover during their local movement.

Passerine and Non-Passerine Birds

Passerines were dominant (21 species, 53.8%) in the present study (Table 2) as found in other studies in Dhaka (14 species and 51.85% in Uttara, Sarker *et al.*, 2009 and 27 spp. and 54% at Curzon Hall premises, Akash *et al.*, 2013; 41 spp. and 52.6% at Dhaka University Campus, Chowdhury *et al.*, 2014) but fifty percent of recorded birds were passerines in Botanical Garden (total species 65, Islam *et al.*, 2014) and Ramna park (total species 50, Rajia *et al.*, 2015) in Dhaka. Resident birds were dominant among both passerine (18 species, 85.7%) and non-passerine birds (17 species, 94.4%) in comparison to migratory (passerines: 3 species, 14.3%; non-passerines: 1 species, 5.6%) in the present study.

Less than fifty percent non-passerines (18 species, 46.2%) (Table 2) were recorded in the present study. Studies in other urban areas also revealed the same (Sarker *et al.*, 2009; Akash *et al.*, 2013; Chowdhury *et al.*, 2014) but fifty percent non-passerines were recorded at Botanical Garden (Islam *et al.*, 2014) and Ramna park (Rajia *et al.*, 2015) in Dhaka. Black Kite was dominant among non-passerines and House Crow among passerines in the present study whereas Rose-ringed Parakeet was dominant among non-passerines and House Crow among passerines in Ramna Park (Rajia *et al.*, 2015).

Resident birds were dominant among both passerine (18 species, 85.7%) and non-passerine birds (17 species, 94.4%) in comparison to migratory (passerines: 3 species, 14.3%; non-passerines: 1 species, 5.6%) in the present study. The highest number of bird species (21 i.e., 48.7%) belonged to number to the Order Passeriformes (Table 2) and lowest number of the species (1 i.e., 2.6%) to each of the Orders Anseriformes, Columbiformes, Cuculiformes, Suliformes, Bucerotiformes, Piciformes and Psittaciformes (Table 2). Family Corvidae and Sturnidae comprised the highest number of species (3 of each i.e., 7.7% of the total and 14.3% of the passerines). Twenty-five (12 non-passerines and 13 passerines) of the 36 recorded families contained single species (Table 3).

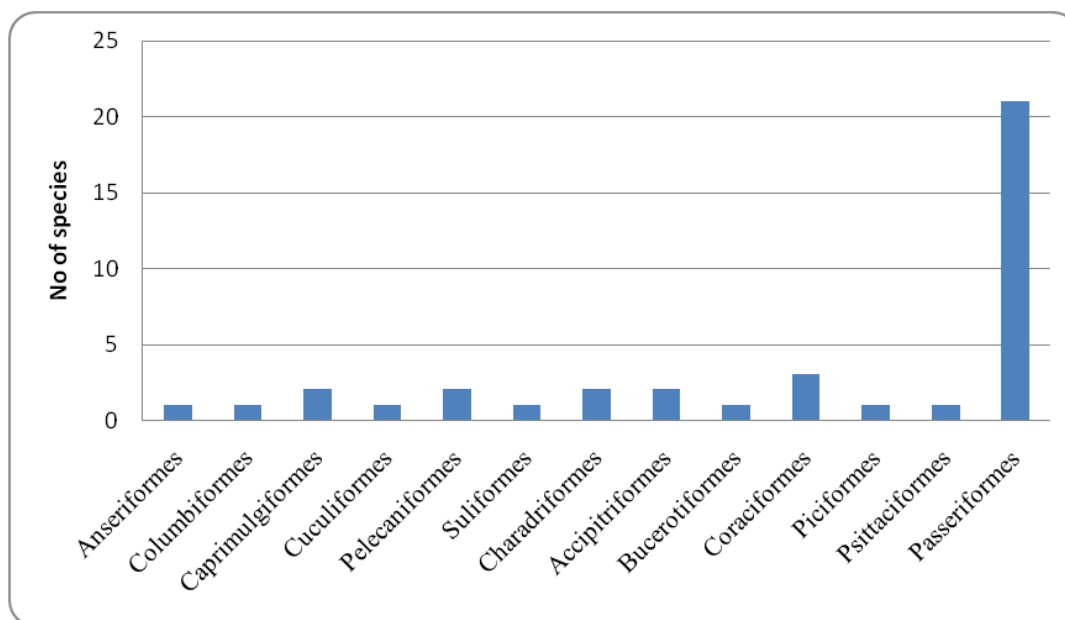


Fig. 2. Species diversity of recorded birds according to orders.

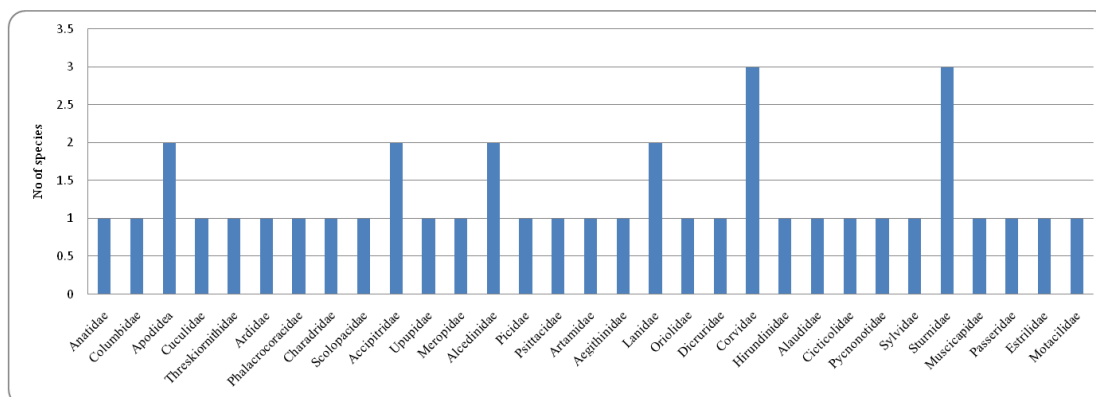


Fig. 3. Species diversity of recorded birds according to families.

Relative Abundance of the Local Status of Birds

During this study, the highest number of species ($n=22$; 56.4%) were Occasional and the number of Common species ($n=8$; 20.5%) was very close to the number of Fairly Common species ($n=7$; 17.9%). Sarker *et al.* (2009) recorded the highest number of species was Very Common (Uttar 7: 11 species, 44%; Uttara 9: 7 species, 38.9%), followed by Rare (Uttar 7: 6 species, 24%; Uttara 9: 6 species, 33.3%) and Fairly Common (Uttar 7: 8 species, 32%; Uttara 9: 5 species, 27.8%). Rajia *et al.* (2015) recorded 18% birds were Very Common, 30% Common, 16% Fairly Common and 36% Few in Ramna Park. Eleven species (25.6%) were recorded for only once throughout the year (Table 3). A large flock of Scaly-breasted Munia was seen in feeding on grasses and Jungle

Crow was seen in a large flock in October (Table 3). Asian Pied Starling and House Sparrow were Very Common species which were regularly seen throughout the area (Table 3), this finding is in line with the findings in Ramna Park and Curzon Hall campus (Rajia *et al.*, 2015, Akash *et al.*, 2013). Sarker *et al.* (2009) recorded the highest number of House Crow, Jungle Crow and House Sparrow at Uttara in Dhaka.

Country Status and Global Status of the Recorded Birds

Most of the recorded species were Least Concern (97.4%) according to IUCN Bangladesh (2015). Black-headed Ibis, *Threskiornis melanocephalus* was recorded only once in the month of November which is globally Near Threatened and Vulnerable in Bangladesh (Table 3), twenty-eight individuals of this species were seen to fly over the study area in November.

Monthly and Seasonal Variation of Species Diversity of Recorded Birds

The highest species diversity was recorded in September (n=26 species; 67%) and lowest in February and July (n=5 in each month; 13%) (Fig. 4, Table 3). Shannon-Wiener index (H') revealed the highest diversity in January, May, August, November and December but Simpson's index of diversity (D) showed the rich diversity in May, June, September, November and December (Table 3). Regarding seasonal variation, the species diversity was the highest in monsoon and winter (n=29 in each season, i.e. 74.4%) but the lowest in summer (n=16; 41%) (Fig. 5). During winter, due to presence of migratory birds the diversity was increased. In summer, most of the birds may be busy for breeding activities while less species of birds were seen (Rajia *et al.*, 2015).

On the other hand, the highest number of individuals of different species of birds was recorded in winter including migratory birds (789 individuals, i.e. 50.8% of total) and the lowest in monsoon (183 individuals, i.e. 11.8% of total species recorded).

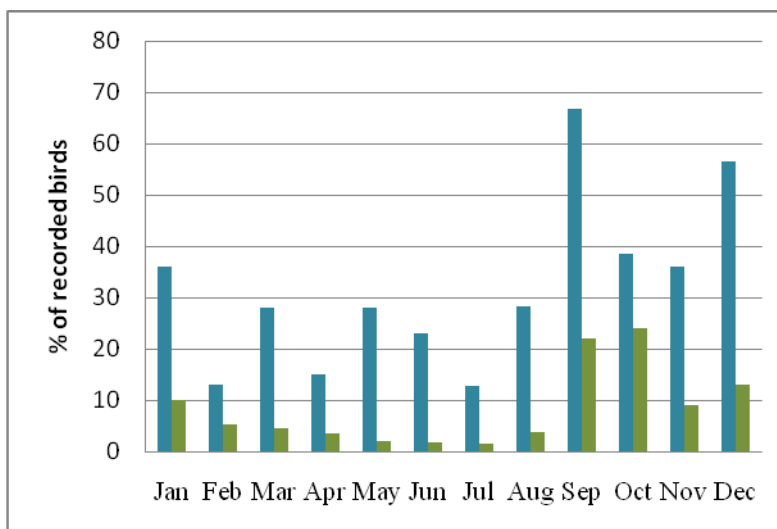


Fig. 4. Monthly variation of relative abundance (%) of species diversity and number of individuals in study area.

Seasonality of Number of Individuals

Regarding population of the birds, a total of 1553 individuals of 39 species of birds were recorded (Table 3). The highest individuals was recorded in October (375 individuals, i.e. 24% of total) and the lowest in July (22 individuals, i.e. 1.4% of total). Sarker *et al.* (2009) recorded the highest diversity in June-July and the lowest in December at Uttara in Dhaka. Rajia *et al.* (2015) reported the highest individuals in December and the lowest in July in Ramna Park.

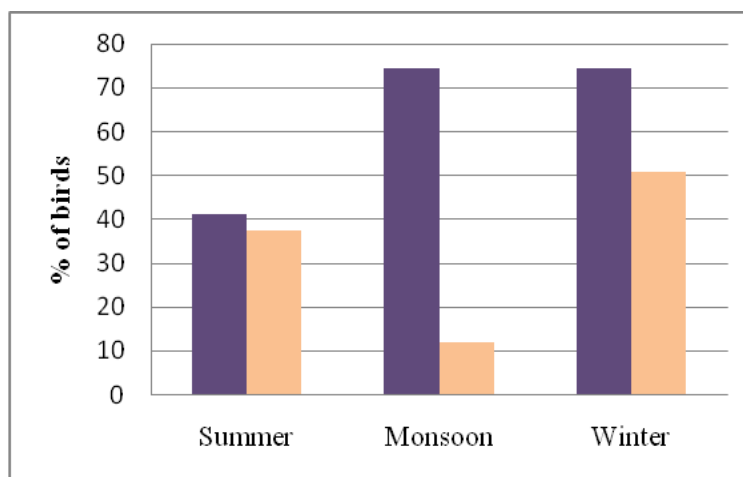


Fig. 5. Seasonal variation of relative abundance (%) of species diversity and number of individuals in study area.

Table 2. Status and diversity of different species including transect no at Nikunja-1 in Dhaka, Bangladesh.

Common name	Scientific name	Order	Family	CS	GS	LS	R/M	Transect no
Lesser Whistling Duck	<i>Dendrocygna javanica</i>	Anseriformes	Anatidae	LC	LC	O	R	7
Eastern Spotted Dove	<i>Spilopelia chinensis</i>	Columbiformes	Columbidae	LC	LC	O	R	6
Asian Palm Swift	<i>Cypsiurus balasiensis</i>	Caprimulgiformes	Apodidea	LC	LC	C	R	7
House Swift	<i>Apus nipalensis</i>	Caprimulgiformes	Apodidea	LC	LC	FC	R	1,2,3,4,5,6,7
Western Koel	<i>Eudynamis scolopaceus</i>	Cuculiformes	Cuculidae	LC	LC	O	R	7
Black-headed Ibis	<i>Threskiornis melanocephalus</i>	Pelecaniformes	Threskiornithidae	VU	NT	O	R	1,2,3,4,5,6,7
Indian Pond Heron	<i>Ardeola grayii</i>	Pelecaniformes	Ardidae	LC	LC	C	R	1,7
Little Cormorant	<i>Microcarbo niger</i>	Suliformes	Phalacrocoracidae	LC	LC	O	R	1,7
Red-wattled Lapwing	<i>Vanellus indicus</i>	Charadriiformes	Charadriidae	LC	LC	O	R	7
Common Sandpiper	<i>Actitis hypoleucos</i>	Charadriiformes	Scolopacidae	LC	LC	FC	M	7
Black Kite	<i>Milvus migrans</i>	Accipitriformes	Accipitridae	LC	LC	C	R	1,2,3,4,5,6,7

Brahminy Kite	<i>Haliastur indus</i>	Accipitriformes	Accipitridae	LC	LC	FC	R	1,2,3,4,5,6,7
Common Hoopoe	<i>Upupa epops</i>	Bucerotiformes	Upupidae	LC	LC	O	R	7
Asian Green Bee-eater	<i>Merops orientalis</i>	Coraciiformes	Meropidae	LC	LC	O	R	7
Common Kingfisher	<i>Alcedo atthis</i>	Coraciiformes	Alcedinidae	LC	LC	C	R	1, 7
White-breasted Kingfisher	<i>Halcyon smyrnensis</i>	Coraciiformes	Alcedinidae	LC	LC	C	R	1, 7
Black-rumped Flameback	<i>Dinopium benghalense</i>	Piciformes	Picidae	LC	LC	O	R	1.7
Rose-ringed Parakeet	<i>Psittacula krameri</i>	Psittaciformes	Psittacidae	LC	LC	O	R	7
Ashy Wood Swallow	<i>Artamus fuscus</i>	Passeriformes	Artamidae	LC	LC	O	R	7
Common Iora	<i>Aegithina tiphia</i>	Passeriformes	Aegithinidae	LC	LC	O	R	7, 1
Brown Shrike	<i>Lanius cristatus</i>	Passeriformes	Lanidae	LC	LC	FC	M	7,
Long-tailed Shrike	<i>Lanius schach</i>	Passeriformes	Lanidae	LC	LC	O	R	7,
Black-hooded Oriole	<i>Oriolous xanthornus</i>	Passeriformes	Oriolidae	LC	LC	O	R	7,
Black Drongo	<i>Dicrurus macrocercus</i>	Passeriformes	Dicruridae	LC	LC	C	R	1,2,3,4,5,6,7
Rufous Tree Pie	<i>Dendrocitta vagabunda</i>	Passeriformes	Corvidae	LC	LC	O	R	1,7
House Crow	<i>Corvus splendens</i>	Passeriformes	Corvidae	LC	LC	C	R	1,2,3,4,5,6,7
Jungle Crow	<i>Corvus leuallantii</i>	Passeriformes	Corvidae	LC	LC	O	R	1,2,3,4,5,6,7
Barn Swallow	<i>Hirundo rustica</i>	Passeriformes	Hirundinidae	LC	LC	O	M	1,2,3,4,5,6,7,
Indian Short-toed (Sand) Lark	<i>Calandrella raytal</i>	Passeriformes	Alaudidae	LC	LC	O	R	7
Zitting Cisticola	<i>Cisticola juncidis</i>	Passeriformes	Cisticolidae	LC	LC	O	R	7
Red -vented Bulbul	<i>Pycnonotus cafer</i>	Passeriformes	Pycnonotidae	LC	LC	C	R	1,2,3,4,5,6,7,
Common Tailorbird	<i>Orthotomus sutorius</i>	Passeriformes	Sylviidae	LC	LC	O	R	1,7
Jungle Myna	<i>Acridotheres fuscus</i>	Passeriformes	Sturnidae	LC	LC	O	R	1,2,3,4,5,6,7,
Common Myna	<i>Acridotheres tristis</i>	Passeriformes	Sturnidae	LC	LC	FC	R	1,2,3,4,5,6,7,
Asian Pied Starling	<i>Sturnus contra</i>	Passeriformes	Sturnidae	LC	LC	VC	R	1,2,3,4,5,6,7,
Oriental Magpie-robin	<i>Copsychus saularis</i>	Passeriformes	Muscicapidae	LC	LC	FC	R	
House Sparrow	<i>Passer domesticus</i>	Passeriformes	Passeridae	LC	LC	VC	R	1,2,3,4,5,6,7,
Scaly-breasted Munia	<i>Lonchura punctulata</i>	Passeriformes	Estrilidae	LC	LC	O	R	6
White Wagtail	<i>Motacilla alba</i>	Passeriformes	Motacilidae	LC	LC	FC	M	7

Note: LC =Least Concern, VU = Vulnerable, NT = Near Threatened, R = Resident, M = Migratory, O= Occasional, FC=Fairly Common, C= Common, VC= Very Common, CS= Country status, GS= Global status, LS= Local status

The present study reveals that the number of Jungle Crow was the highest (205 individuals, i.e. 13.2%) followed by Asian Pied Starling (146 individuals, i.e. 9.4%), Black Kite (132 individuals, i.e. 8.5%), House Sparrow (130 individuals, i.e. 8.4%), Black Drongo (113 individuals, i.e. 7.3%) and House Crow (108 individuals, i.e. 7%) (Table 2). According to Akash *et al.* (2013) and Rajia *et al.* (2015), House Crow, House Sparrow and Common Myna were dominant both in Ramna Park and Curzon Hall premises.

The study area supported varieties of avifauna as the sites supported different habitats. Two large lakes supported wetland birds and grasslands in and around the lakes supported granivorous birds. The area also supported insectivorous birds as the site consisted of many aquatic plants such as Water lettuce *Pistia stratiotes*, Water hyacinth *Eichhornia crassipes*, Morning glory *Ipomoea carnea*, Taro root *Colocasia esculenta*, Water spinach *Ipomoea aquatic* which were the good habitats for insects. Overall, the value of Shannon Diversity Index ($H' = 2.96$), Simpson Diversity Index ($D = 0.9$) and Evenness ($E = 0.8$) indicated the richness of avifauna.

Table 3. Monthly variation in number of individuals of different species at Nikunja-1 in Dhaka of Bangladesh.

Common name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Lesser Whistling Duck*	-	-	-	-	-	-	-	-	-	-	-	58	58
Eastern Spotted Dove*	-	-	-	-	-	-	-	-	1	-	-	-	1
Asian Palm Swift	-	-	20	12	7	-	-	20	10	12	10	3	94
House Swift	40	-	2	-	2	-	-	-	40	-	-	-	84
Western Koel*	-	-	2	-	-	-	-	-	-	-	-	-	2
Black-headed Ibis*	-	-	-	-	-	-	-	-	-	-	28	-	28
Indian Pond Heron	16	-	-	3	2	-	-	7	-	1	5	4	38
Little Cormorant	-	-	-	-	-	-	-	-	2	-	-	2	4
Red-wattled Lapwing	-	5	5	-	-	-	-	-	-	-	-	-	10
Common Sandpiper	1	-	-	-	-	-	-	-	1	-	1	1	4
Black Kite	2	75	-	-	2	2	-	-	41	4	5	1	132
Brahminy Kite	11	1	1	-	-	-	-	-	-	-	2	3	18
Common Hoopoe*	-	-	-	-	-	-	-	-	1	-	-	-	1
Asian Green Bee-eater	-	-	-	-	-	-	-	-	3	23	-	-	26
Common Kingfisher	1	-	-	-	1	1	1	1	3	-	1	1	10
White-breasted Kingfisher	2	-	1	-	2	2	2	2	3	1	-	1	16
Black-rumped Flameback*	-	-	-	-	-	-	-	-	-	-	-	1	1
Rose-ringed Parakeet*	-	-	-	-	-	-	-	-	1	-	-	-	1
Ashy-wood Swallow*	-	-	-	-	-	-	-	-	4	-	-	-	4
Common Iora	-	-	-	-	-	-	-	-	-	4	-	1	5
Brown Shrike	-	1	-	-	-	-	-	-	6	-	1	4	12
Long-tailed Shrike	-	-	-	-	-	-	-	-	2	5	-	-	7

Black-hooded Oriole	-	-	-	-	-	-	-	-	12	1	-	1	14
Black Drongo	15	-	-	-	4	6		3	41		14	30	113
Rufous Tree pie	5	-	-	-	-	-	-	-	-	-	-	10	15
House Crow	-		25	25	2	2	6	3	20	-	15	10	108
Jungle Crow	-								5	200	-	-	205
Barn Swallow	37	-	-	-	-	-	-	-	-	-	-	10	47
Indian Short-toed (Sand)Lark*	-	-	-	-	-	-	-	-	1	-	-	-	1
ZittingCisticola*	-	-	-	-	-	-	-	-	-	-	-	1	1
Red-vented Bulbul	-	-	4		1	1	-	3	1			1	11
Common Tailorbird*	-	-	1	-	-	-	-	-	-	-	-	-	1
Jungle Myna	-	1							7	-	7	-	15
Common Myna	-	-	-	3	-	1	-	-	25	35	25	-	89
Asian Pied Starling	3		5	5	4	5	5	5	82	2	20	10	146
Oriental Magpie-robin	4	-	-	-	-	-	-	1	5	2	-	-	12
House Sparrow	5	-	6	5	5	6	8	5	20	8	12	50	130
Scaly-breasted Munia	-	-	-	-	-	-	-	-	4	70	-	-	74
White Wagtail	11	-	-	-	-	-	-	-	1	-	1	2	15
Total	153	83	72	53	32	26	22	57	335	375	140	205	1553
% of total	9.9	5.3	4.6	3.4	2.1	1.7	1.4	3.7	21.6	24.1	9.0	13.2	100
Sp. Diversity (no)	14	5	11	6	11	9	5	11	26	15	14	22	39
% of sp. diversity	35.9	13	28	15	28.2	23	12.8	28.2	66.7	38.5	35.9	56.4	
Shannon-Wiener index (<i>H'</i>)	2.1	0.4	1.8	1.6	2.2	1.9	1.3	2.8	0.99	1.6	2.2	2.2	
Simpson's index of diversity (<i>D</i>)	0.8	0.2	0.8	0.7	0.9	0.9	0.8	0.8	0.9	0.7	0.9	0.9	

Note: *= found only once in the study period.

Conclusion

Species diversity and population of avifauna in this area indicated the suitability of habitat. The presence of lakes enhanced its attraction to many diversified bird species. The migratory birds or some wetland birds used this area as temporary roosting site during their local movement. This area is facing serious threats due to wetland degradation, illegal hunting and trapping by the fish farmers. The study may consider as a baseline for further detailed works on avifauna and this area should be conserved strictly as it sheltered some important species of birds throughout the year.

Acknowledgements

The authors are grateful to the Ministry of Science, Information and Communication Technology for funding the research. The authors would like to express their heartiest gratitude to local people who helped in different ways during data collection.

References

- Abdar, M.R. (2013). Diversity and Richness of bird species in newly formed habitats of Chandoli National Park in Western Ghats, Maharashtra State, India. *Biodiversity Journal*, 4: 235-242.
- Aggrawal, A., Tiwari, G. and Harsh, S.A. (1998). Diversity and Density Estimation of Birds of the Indian Institute of Forest Management Campus, Bhopal, India. *Journal of Threatened Taxa*, 7: 2-12.
- Ahsan, M.F. and Khanom, N. (2005). Birds of the Chittagong University Campus, Chittagong. *Chittagong University Journal of Science*, 15(1): 77-88.
- Akash, M., Hossain, M.A., Chowdhury, G.W., Mahmud, H. and Islam, M.A. (2013). Status of avifauna in Curzon Hall premises University of Dhaka, Bangladesh. *Ecoprint*, 20: 1-8.
- Ali, S. and Ripley, S.D. (1996). The book of Indian birds. Bombay Natural History Society. *Oxford University Press*, Mumbai.
- Chowdhury, S., Aich, U. and Shahadat, O. (2014). Checklist of avian fauna of Dhaka University Campus, Bangladesh. *International Journal of Fauna and Biological Studies*, 1(5): 56-60.
- Das, A.K. (1975). *A study on birds of Curzon Hall and Ramna Park*. M.S. thesis, Department of Zoology, University of Dhaka.
- Fujita, M.S., Yoshimura, M., Iqbal, M., WijaMukti, S., Mulyawati, D., Novarino, W., Lestari, Y., Supriadi, B., Gunawan, R. and Prawiradilaga, D.M. (2010). *Inventory of birds in Acacia plantation in PT. MusihutanPersada, Indonesia*. Kyoto Working papers on Area Studies no-110. Kyoto University.
- Grimmett, R., Inskipp, C. and Inskipp, T. (1998). Pocket guide to the birds of the Indian Subcontinent. *Oxford University Press*, Delhi. 384.
- Harvey, W.G. (1990). Birds in Bangladesh. *University Press Limited*, Dhaka, viii+188.
- Husain, K.Z. (1975). Birds of the Pablakhali Wildlife Sanctuary. *Bangladesh Journal of Zoology*, 3(2): 155-157.
- Husain, K.Z. and Haque, M.N. (1976). Further addition to the list of Birds of Pablakhali Wildlife Sanctuary. *Bangladesh Journal of Zoology*, 4(2): 131-132.
- Husain, K.Z. and Haque, M.N. (1977). The avifauna of the Madhupur Forest. *Proceeding of the First Bangladesh National Conference of Forestry*, 381-392.
- Husain, K.Z., Sarker, S.U. and Rahman, M. (1983). Summer birds of the Sundarbans Nilkamal Sanctuary. *Bangladesh Journal of Zoology*, 11(1): 48-51.
- Husain, K.Z., Sarker, S.U., Rahman, M. and Haque, M.N. (1990). Birds of the Dulahazara deer breeding centre (Cox's Bazar Forest Division). *Bangladesh Journal of Zoology*, 18(1): 107-114.
- Islam, M.S., Shahadat, O., Kabir, M.M., Rashid, M.A., Al-Razi, H., Kamruzzaman, M., Alam, S.M.I., Mustafa, T. and Islam, M.S. (2014). Avifauna of the National Botanical garden of Bangladesh. *Journal of Taxonomy and Biodiversity Research*, 6: 17-20.

- IUCN, Bangladesh. (2015). Red List of Bangladesh. Volume 3: Birds. *IUCN, International Union for Conservation of Nature, Bangladesh Country Office*, Dhaka, Bangladesh. xvi+676.
- Jamam M.F., Rahman M.S. and Haque M.E. (2011). Diversity of avifauna at the Bangladesh Academy for Rural Development (BARD), Kotbari, Comilla. *University Journal of Zoology. Rajshahi University*, 30: 41-44.
- Joshi, P.P. (2001). Assessment of avian population in different habitat around Amolakch and Mahavidyalaya Campus, Yavatmal, Maharashtra, India. *Journal of Bioscience*, 4: 11.
- Khan, M.A.R. (1982). Wildlife of Bangladesh-a checklist. *University of Dhaka*, Dhaka, Bangladesh. iv+174.
- Khan, M.M.H. (2005). Species diversity, relative abundance and habitat use of the birds in the Sundarbans East Wildlife Sanctuary of Bangladesh. *Forktail*, 21: 79-86.
- Khan, S.I. and Naher, H. (2009). Birds in Kurigram district of Bangladesh. *Journal of Threatened Taxa*, 1(4): 245-250.
- Khan, S.I., Naher, H. and Islam, M.S. (2014). Avifauna of Pashukhali and Gajdhar village in Netrokona district, Bangladesh. *Bangladesh Journal of Zoology*, 42(2): 141-152.
- Khan, M.A.R. (1980). A comparative account of the avifauna of the shoals and neighbouring plantation in the Nilgiri. *Journal of the Bombay Natural History Society*, 75(3): 1028-1035.
- Lozada, T, De Koning, G.H.J, Marché, R., Klein, A.M. and Tschardtke, T. (2007). Tree recovery and seed dispersal by birds: comparing forest, agroforestry and abandoned agroforestry in coastal Ecuador. *Perspectives in Plant Ecology, Evolution and Systematics*, 8(3): 131-140.
- Philpott, S.M., Soong, O., Lowenstein, J.H., Pulido, A.L., Lopez, D.T., Flynn, D.F and DeClerck, F. (2009). Functional richness and ecosystem services: Bird predation on arthropods in tropical agro-ecosystems. *Ecological Applications*, 19(7): 1858-1867.
- Naher, H. and Sarker, N.J. (2015). Feeding techniques of Common Kingfisher (*Alcedo atthis*). *Jagannath University Journal of Science*, 4(II): 67-75.
- Naher, H. and Sarker, N.J. (2016). Nest and nest characteristics of Common (*Alcedo atthis*) and White-throated Kingfisher (*Halcyon smyrnensis*). *Bangladesh Journal of Zoology*, 44(1): 99-110.
- Naher, H. and Sarker, N. J. (2018). Provisioned food to the nestlings of common kingfisher (*Alcedo atthis*) and white-throated kingfisher (*Halcyon smyrnensis*) by their parents. *Jagannath University Journal of Life and Earth Sciences*, 4(2): 176-186.
- Naher, H. and Sarker, N.J. (2019). Food items and feeding activities of Common Kingfisher (*Alcedo atthis*) in Bangladesh. *Jagannath University Journal of Science*, 6(1&2): 11-24.
- Rajia, S., Alam, M.M., Chowdhury, G.W., Akash, M. and Islam, M. A. (2015). Status and diversity of birds of Ramna Park, Dhaka, Bangladesh. *Bangladesh Journal of Zoology*, 43(2): 291-301.
- Sarker, N.J., Sultana, D., Jaman, M.F. and Rahman, M.K. (2009). Diversity and population of avifauna of two urban sites in Dhaka, Bangladesh. *Ecoprint*, 16: 1-7.

- Sekercioglu, C.H. (2012). Bird functional diversity and ecosystem services in tropical forests, agroforests and agricultural areas. *Journal of Ornithology*, 153(1): 153-161.
- Shovon, S.C., Islam, M.S., Al-Mahmud J., Chowdhury M.S.N., Alam, M.N., Sultana, T. and Islam M.M. (2014). Diversity of Avifauna in Sher-E-Bangla Agricultural University Campus. *International Journal of Business, Social and Scientific research*, 2(1): 58-63.
- Singh, R., Jaiswal, A., Singh, J., Singh, N., Bhaskar, S.K., Kumar, N., Singh, V.K. and Singh, D.K. (2018). Study of Bird Diversity in Gorakhpur University Campus. *Journal of Biodiversity and Endangered Species*, 6: 002.
- Tompson, P.M. and Johnson, D.L. (2003). Further notable bird records from Bangladesh. *Forktail*, 19: 85-102.
- Temple, S.A. and Wiens, J.A. (1989). Bird populations and environmental changes: Can birds be bio-indicators? *American Birds*, 43(2): 260-270.
- Uddin, M.Z and Hassan, M.A. (2016). Plant diversity of Dhaka University Campus, Bangladesh. *Journal of Asiatic Society of Bangladesh, Science*, 42(1): 49-68.
- Wenny, D.G., Devault, T.L., Johnson, M.D., Kelly, D., Sekercioglu, C.H., Tomback, D.F. and Whelan, C.J.(2011). The need to quantify ecosystem services provided by birds. *The Auk*, 128(1): 1-14.