

Research Article

RELATIVE ABUNDANCE, DIVERSITY AND THREATS OF AVIAN FAUNA AT DHANMONDI LAKE IN DHAKA, BANGLADESH

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ABSTRACT

A study was conducted on the relative abundance, diversity, and threats of avifauna in Dhanmondi Lake, Dhaka, Bangladesh from March to December 2021. Data was collected by following the line transect sampling method and direct field observations, where four days were spent every month in the study area. A total of 34 species of birds were observed, belonging to 9 orders and 20 families. Out of 34 species of birds, 94% were residents and 6% were migrants; of them, 55% were non-passerines and 45% were passerines. The relative abundance of avifauna was also estimated as 29% of species being very common, 15% being fairly common, 27% being common, and 29% being few. The highest number of individuals was observed in December (209 individuals), followed by 199 individuals in April, 189 individuals in March, 187 individuals in October, 178 in November, 177 in August, and 170 in June. The Shannon-Weiner index was estimated to be at its maximum ($H' = 2.98$) in March-21, and its minimum value was obtained ($H' = 2.62$) in June-21. Similarly, the value of Simpson's index of diversity was obtained to be maximum ($D = 0.09$) in June-21 and minimum ($D = 0.06$) in December-21. Human activities such as large gatherings, random assemblies, festivals, dumping of waste, throwing of papers, polythene, and plastics here and there, and finally, noises from the different vehicles, were identified as major threats to avian species.

Keywords: *Birds, Dhanmondi Lake, Diversity, Relative Abundance*

Introduction

Biodiversity or biological diversity is the collective amounts of whole life forms existing on universe including the millions of animals, plants, and microorganisms. Biodiversity characterized by the species richness in an area that started from the lower living being up to the climax species (Khan, 2008). Nature itself maintains its biodiversity with its concurrent variable

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factors that suddenly can change the harmony among the biotic entity or provide strength to cope with hazard situation (Odum, 1993). It provides enormous dimension of different values such as production of food, medicine, wood, timber, economic services and ecological foundations (Mukul, 2007). Biodiversity act as an indicator of the environmental health condition as high abundance of different biological community bears the indication of good health whereas less abundance indicates unhealthy condition (Das *et al.*, 2020).

A total of 690 species of birds are observed in Bangladesh. Among them, 380 species of birds are residents, 209 species are winter visitors, 90 species are vagrants and 11 species are summer visitors (Khan, 2008). It has been reported that the total number of avian species in Bangladesh is more or less same as all the avian species of Europe (Khan, 2008). Community structure and species richness of birds differ from region to region because of the variation of biotic and abiotic factors that differ from habitat to habitat (Johnsingh and Joshua, 1994).

Birds play an important role in ecosystem. Some striking activities like pollination, seed dispersal, create sound environment and pest control are executed by avian species (Jaman *et al.*, 1999). The importance of birds is immense for human being as well as for our nature (Jaman *et al.* 1999). But this avian diversity is diminishing because of mainly human activities. Pollution of environment, climate change unplanned urbanization and uncontrolled chopping of trees are the vital causes to circumscribe the feeding, foraging, and resting sites of avian species. During the process of urbanization some bird species altered their native habitat or disperse other different areas in search of shelter and food or sometimes birds can be disappeared from the nature because of it.

Natural or artificial lake with huge plantations within urban centers is fascinating to bird species like other wildlife species (Das *et al.*, 2020). Dhanmondi Lake is a large urban lake that is situated in the center of Dhaka city with diverse plant species constructing various habitats for avian species as well as creates a beautiful and modern venue for the relaxation of people and makes a suitable place for birds. In this study, we tried to find out the diversity and relative abundance of avian species with their density per hectare in Dhanmondi Lake and we also identified the possible problems and threats to avifauna in Lake Area.

Materials and Methods

Study Area: The study was conducted at Dhanmondi Lake which is situated (between 23°43'N latitude and 90°26'E longitude) in the center of Dhaka City (Fig.1) to be exact at the vicinity of Dhanmondi residential area which covers nearly 16% of the total area of Dhanmondi and was considered as an abandoned channel of the 'Karwan Bazar '. It is started from Jigatola and extends up to road Dhanmondi 27 and surrounded by Satmasjid Road in the west in the north is bounded by Mohammadpur- Lalmatia, BDR Gate in the south and in the east by Kalabagan. It is 3 km in length and width is between 35-100m. The overall water surface area is around 37.37 ha. There is a culvert box near the Sukrabad area in the lake, which is used as an outlet of the lake. Excess floodwater passes through this outlet during rainy season. So water level in the lake remains stable in all weather conditions.

Data Collection:

The research was started from March to December 2021. Line transects sampling method was used to estimate the density of avian species. Observations were conducted in morning at 06.00 - 10.00 a.m. with duration of 3-4hour, and in the afternoon at 04.00 – 07.00 p.m. with duration of 2-3hour, because those times are considered as the peak activity period of birds.

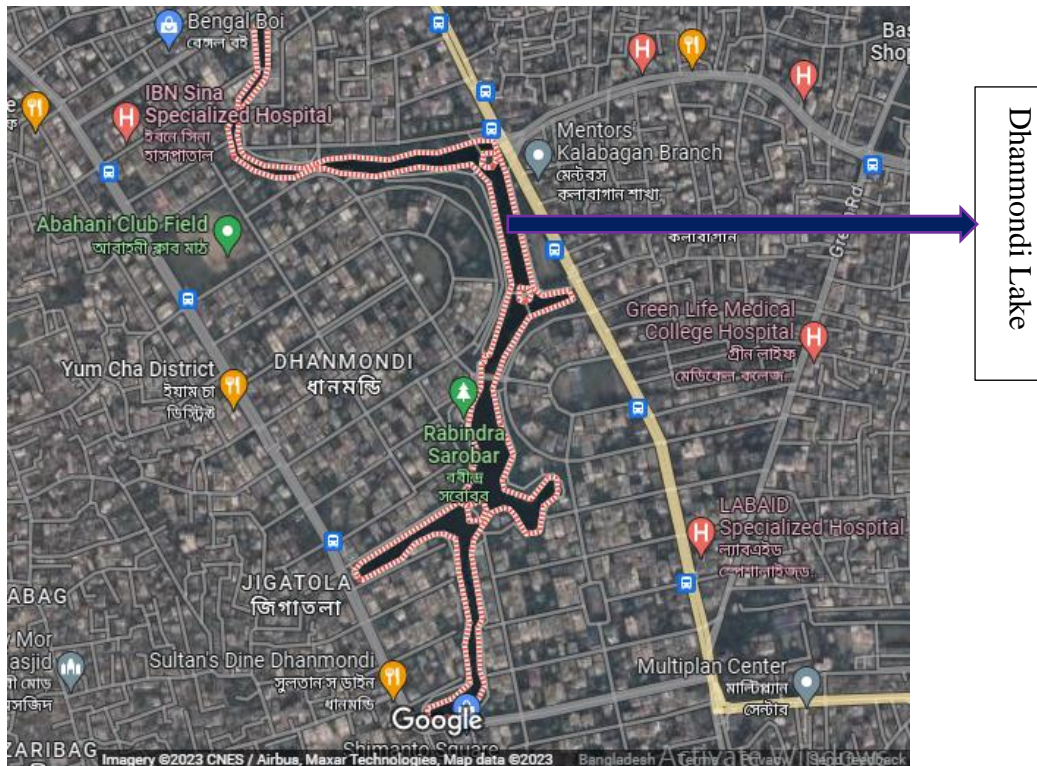


Fig. 1 Map of Dhanmondi Lake (Source- Google, and Maps of Bangladesh).

Five transects were selected. Starting and ending coordination's of selected transects were taken by a Garmin eTrex GPS machine. Transects length were varied from 230-260m in length and the width of each transect were varied from 25-35m. In total, 150 line samples were conducted during the whole study period. Four days were spent on selected transects in every month. Surveillance was carried out on foot at a speed of 1.6 km per hour with frequent stops for counting and observing the avian species. In total, 40 days were spent for data collection during study period.

Observation methodology: During the study period, direct observation was used to observe the avian species. Sometimes, a binocular was used to observe the remote species clearly which was not visible with naked eyes. A digital camera was also used to capture the photographs of birds.

Species identification: Avian species were identified by photographs which was taken during field observation and two popular books by (Hussain, 2008) and (Ali, 1996) were also used for the

identification of species. The scientific name, common English, and local names of the birds was taken from Khan (2008a, b), (Grewal *et al.*, 2002) and (Ali, 1996), and the following three features were applied for prescribing the avian species.

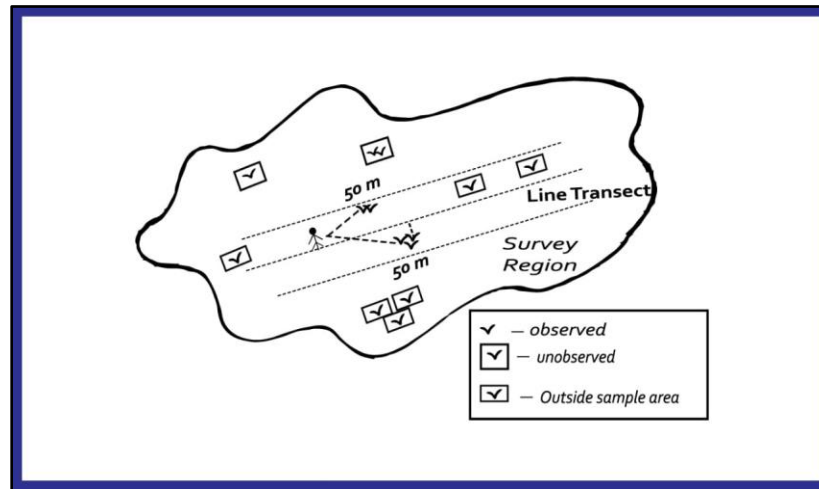


Fig. 2 Showing how the line transect method was used for data collection

External morphology: Size, shape, color, beak or bill type, leg and tail patterns of the birds were the most striking characters to identify the species.

Song and calls: Species identification was also done by observing the songs or/and calls of birds.

Habitats: Sometimes birds were also identified by observing the residence of the birds that were categorized into five habitats as follows: 1. Open area 2. Bush 3. Human habitations 4. Trees and 5. Water bodies.

Status justification: Status of birds was also justified following a standard method used by (Khan, 1982).

Data analysis:

Species richness, diversity index, abundance, relative abundance and species status were calculated. Species richness expresses the number of species, while abundance shows the total number of individuals. Following formulas were used for data analysis:

$$\text{Relative abundance} = \frac{(\text{Number of individual of a species})}{(\text{Total number of individuals of all species})} \times 100$$

$$\text{Simpson's Index, } D = \frac{\sum n(n-1)}{N(N-1)}$$

$$\text{Simpson's index of diversity} = (1 - D)$$

$$\text{Shannon-Wiener index, } H = -\sum [(p_i) \times \ln(p_i)]$$

(Where, n = the total number of organisms of a particular species

N = the total number of organisms of all species)

P_i = number of individuals of a species/ total number of individuals of all species from the same group.)

The species diversity was estimated by following the Shannon-Wiener index (1949) and Simpson's index (1949) of diversity. All data were organized and tabulated in excel spreadsheet. Data analysis was carried out by using the Microsoft excels.

Results and Discussion

Species composition and density of avifauna

A total of 34 species of avifauna were observed belonging to 09 orders and 20 families. Passeriformes was the highest number (15 species) of birds followed by Coraciformes (5 species), Columbiformes (3 species), Cuculiformes (3 species), Piciformes (3 species), Acciptriformes (2 species), Suliformes (1 species) Psittaciformes (1 species), and Strigiformes (1 species) (Fig-3). (Sarker *et al.*, 2007) reported that a total of 27 species of birds were observed from 2 different urban areas in Dhaka. On the other hand, (Akash *et al.*, 2013) accomplished a study on avian fauna at Curzon Hall premises at Dhaka University and he observed in total 50 species of birds from Curzon hall. (Chowdhury *et al.*, 2014) estimated a total of 78 avian species from the Dhaka university campus. We found 34 species of birds and estimated bird density of per hectore was 50.19 individuals in Dhanmondi Lake. So, these data show that the study area can be a better ground to avian species for living as it supports many edible trees, fruiting and flowering plants, large trees for sheltering, and a large lake.

Table 1: Showing total transect area and bird density in Dhanmondi Lake

Transect no	Length(m)	Width(m)	Total Transect Area(A)	Total Observed Birds(N)	Density (D=N/A)
01	230	35	36 Hectors	1807 Birds	50.19 Birds /Per Hector
02	240	25			
03	260	30			
04	220	25			
05	250	35			
Total	1200m	150m			

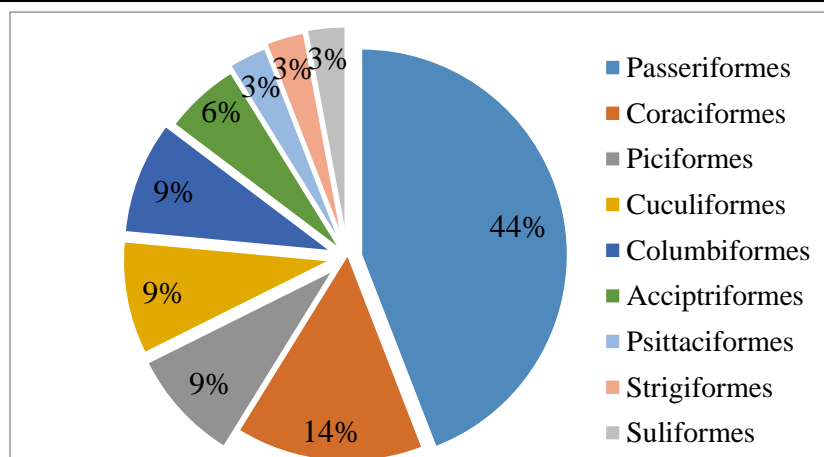


Fig. 3 Pie chart showing the comparison of abundance of species in order basis.

Status and relative abundance of avian species

Overall relative abundance showed that 29% birds were very common, 27% common, 15% fairly common and 29% few (Fig-4). In a study conducted by Banu *et al.*, (2016), it was observed that a significant proportion of birds in Dhaka University Campus were categorized as very common (26%), common (13%), uncommon (19%), and rare (43%). Similarly, (Rajia *et al.*, 2015) found that a portion of birds in Ramna Park were identified as very common (18%), common (30%), fairly common (16%), and few (36%). Another study by (Sarker *et al.*, 2009) reported that the obtaining maximum percentage of bird were considered as very common (44%), followed by fairly common (32%), and rare (24%). *Passer domesticus* was the most noticeable species followed by *Corvus splendens* and *Sturnus contra* amongst the observed avifauna in the Dhanmondi Lake. Only *Centropus sinensis* were observed in the month of March-21, *Otus lettia*, *Cuculus micropterus*, *Haliastur indus* were observed in the month of April-21, *Halcyon capensis*, *Columba livia* were observed in the month of July-21. *Corvus splendens* was a dominant species at dhanmondi lake and mostly scavenger bird usually feeds on garbage products. So, the huge population of house crow indicates that the environments of Dhanmondi Lake and its vicinity are not so clean in compared to the other areas of Dhaka. Some insectivorous birds was also observed such as *Dicrurus macrocercus* which played as pest control agent especially insect pests. (Jaman *et al.*, 1999) reported that birds exterminate a large number of detrimental insects and mosquitoes from the nature, so they are considered as effective friends of human beings.

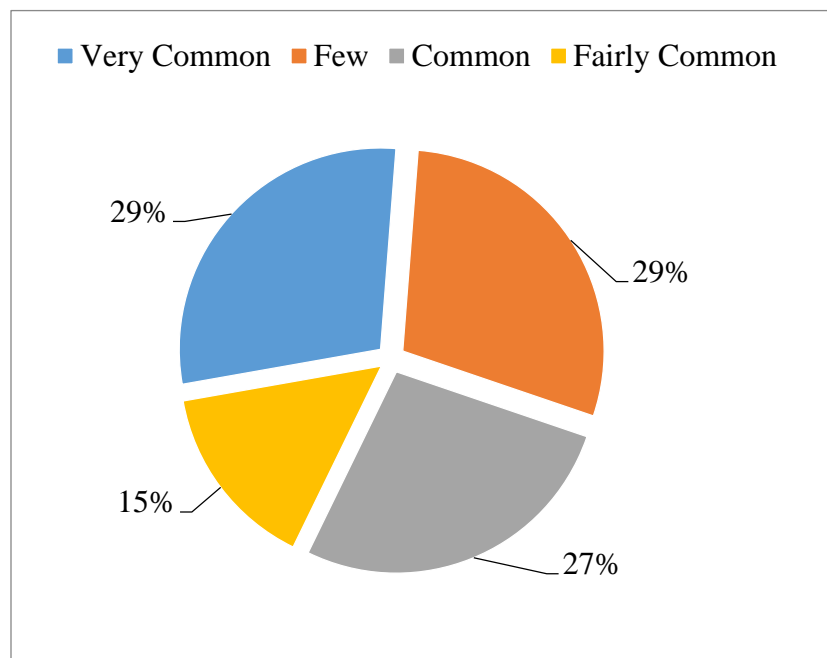


Fig. 4. Relative abundance of avian species in Dhanmondi Lake.

Monthly variations of avian species

Maximum number of individuals were observed in the month of December (209 individuals) followed by 199 individuals in April, 189 individuals in March, 187 individuals in October, 178 individuals in November, 170 individuals in June, 169 individuals in May and minimum numbers of individuals were estimated in the month of July (160 individuals) (Fig-5). (Sarker *et al.*, 2009) estimated the maximum individuals from June to July and the minimum was in December in Uttara of Dhaka. (Rajia *et al.*, 2015) found the highest number of individuals in December and the lowest in July at Ramna Park. (Naher *et al.*, 2021) reported that the highest avian diversity was observed in September and lowest diversity was estimated in February and July. Eventually, no significant variation in the number of avian species was observed throughout the months at Dhanmondi Lake. But, the present study revealed that in December had highest avian species and the month of July showed the lowest species. This might be due to the presence of migrant species, availability of food sources, a large water body and less human disturbance because of winter. Nabaneta (2019) reported that type of habitats, the availability of foods, and vegetation types all have a consequence on the diversity and abundance of avian species. A large number of nesting and foraging plants and different vegetation was also observed in the vicinity of lake area that increases the variety of birds species. Soka (2013) depicted that avian diversity may increase as a result of the variety of foraging and nesting opportunities given by different vegetation.

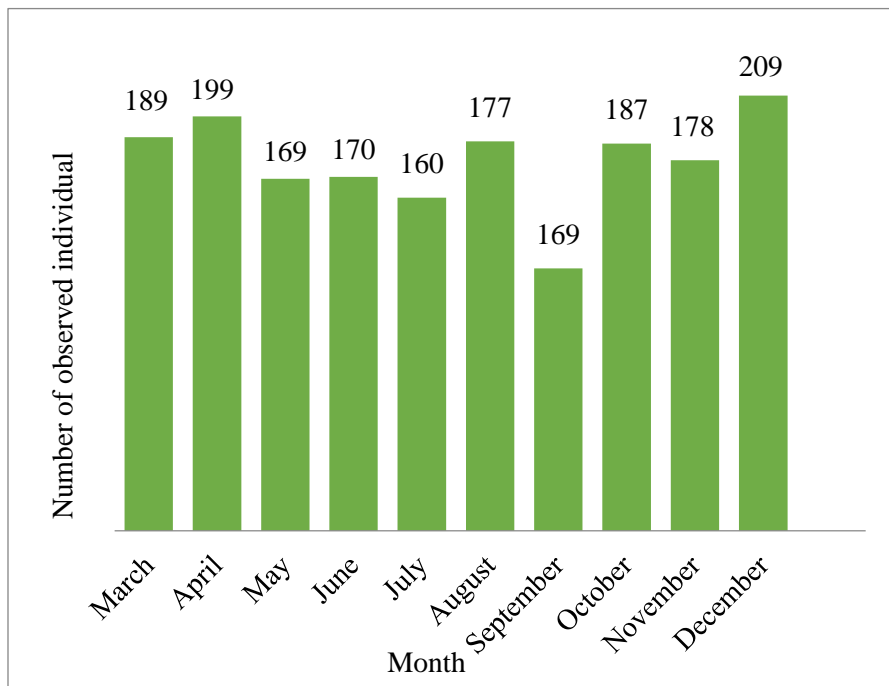


Fig. 5. Month wise variation of avian species at Dhanmondi Lake.

Resident and migrant status of birds

Among 34 species of birds, 94% birds were considered as residents and 6% was winter migrants' species. 45% birds were passerines and 55% was non-passerines (Table 2). (Rajia *et al.* 2015) reported that, among 50 species of birds, 84% birds were identified as residents and 16% birds were migrant's species including winter migrant and summer migrant, 50% birds were passerines and 50% avian species were non-passerines at Ramna Park. (Jaman *et al.*, 2009) showed that 24 species (88.89%) were residents and 3(11.11%) were migratory in Uttara, Dhaka. Jaman *et al.*, (2009) also observed that 22 (88%) were residents and 3 (12%) were migrants in Uttara. Among migratory birds, only *Merops leschenaulti* and *Merops orientalis* was the winter migrant. The migrant and resident status of these birds show that the study area still has a good opportunity for feeding, breeding, and roosting sites for avian species.

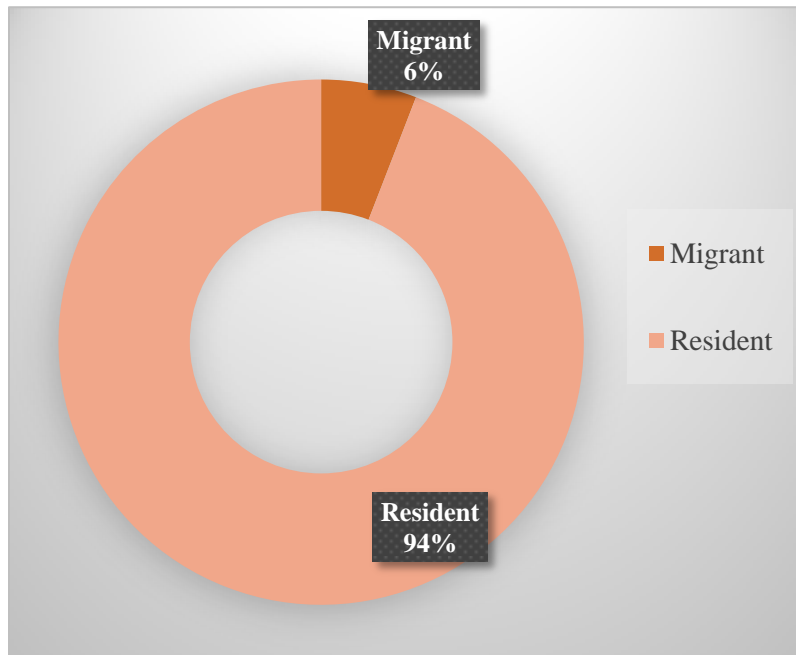


Fig. 6. Resident and migrant status of birds at Dhanmondi Lake.

Table 2. List of avifauna with their status in Dhanmondi Lake

Order	Family Name	Scientific Name	English Name	Common name	Number of Observed species	Pop ⁿ status, (Local*)	Pop ⁿ status, (Global*)	R/M	Group
Passeriformes	Ploceidae	<i>Ploceus philippinus</i>	Baya weaver	Babui	35	VC	LC	R	Pa
	Passeridae	<i>Passer domesticus</i>	House sparrow	Chorui	207	VC	LC	R	Pa
	Nectarinidae	<i>Cinnyris asiaticus</i>	Purple sunbird	Beguni moutushi	14	FC	LC	R	Pa
	Muscicapidae	<i>Copsychus saularis</i>	Oriental Magpie Robin	Doel	122	VC	LC	R	Pa
	Cisticolidae	<i>Orthotomus sutorius</i>	Common tailor bird	Tuntuni	75	C	LC	R	Pa
	Corvidae	<i>Dendrocitta vagabunda</i>	Rufous treepie	Khoiri Harichacha	7	C	LC	R	Pa
	Corvidae	<i>Corvus splendens</i>	House crow	Patikak	255	VC	LC	R	Pa
	Pycnonotidae	<i>Pycnonotus cafer</i>	Red vented bulbul	Bulbuli	48	VC	LC	R	Pa
	Corvidae	<i>Corvus macrorhynchos</i>	Large billed crow	Darkak	15	C	LC	R	Pa
	Sturnidae	<i>Sturnus malabaricus</i>	Chestnut tailed starling	Kath shalik	97	VC	LC	R	Pa
	Sturnidae	<i>Sturnus contra</i>	Asian pied starling	Gobrey shalik	210	VC	LC	R	Pa
	Orididae	<i>Oriolus xanthornus</i>	Black hooded oriole	Kalomatha benebou	14	C	LC	R	Pa
	Sturnidae	<i>Acridotheres tristis</i>	Common myna	Bhat shalik	140	VC	LC	R	Pa
	Dicruridae	<i>Dicrurus macrocercus</i>	Black drongo	Kalo fingeey	12	VC	LC	R	Pa
Sturnidae	<i>Acridotheres fuscus</i>	Jungle myna	Jhuti shalik	86	VC	LC	R	Pa	
Piciformes	Picidae	<i>Dinopium benghatense</i>	Black rumped flameback	Kalokomor kaththokra	10	C	LC	R	NP

Order	Family Name	Scientific Name	English Name	Common name	Number of Observed species	Pop ⁿ status, (Local*)	Pop ⁿ status, (Global*)	R/ M	Group
	Megalaimidae	<i>Megalaima haemacephala</i>	Copper smith barbet	Choto basonto Bauri	11	F	LC	R	NP
	Picidae	<i>Dendrocopos macei</i>	Fulvous breasted wood pecker	Pakrabook kath thokra	11	F	LC	R	NP
Coraciiformes	Meropidae	<i>Merops leschenaulti</i>	Chestnut Headed Bee eater	Khoiya matha shuichor	48	F	LC	Mw	NP
	Alcedinidae	<i>Halcyon smyrnensis</i>	White throated kingfisher	Shadagola machranga	33	FC	LC	R	NP
	Alcedinidae	<i>Halcyon capensis</i>	Stork Billed kingfisher	Megh-hou machranga	3	F	LC	R	NP
	Meropidae	<i>Merops orientalis</i>	Green Bee Eater	Sabuj Shuichor	114	FC	LC	Mw	NP
	Alcedinidae	<i>Alcedoatthis</i>	Common kingfisher	Choto machranga	25	C	LC	R	NP
Psittaciformes	Psittaculidae	<i>Psittacula krameri</i>	Rose ringed parakeet	Shabuj tia	28	C	LC	R	NP
Cuculiformes	Cuculidae	<i>Centropus sinensis</i>	Greater coucal	Boro cuboo	5	F	LC	R	NP
	Cuculidae	<i>Cuculus micropterus</i>	Indian cuckoo	Bau-katha kao	2	F	LC	R	NP
	Cuculidae	<i>Eudynamys scolopaceus</i>	Asian koel	Kokil	8	FC	LC	R	NP
Strigiformes	Stigididae	<i>Otus lettia</i>	Collared scops owl	Konthi nimpecha	7	F	LC	R	NP
Columbiformes	Columbidae	<i>Columba livia</i>	Rock pigeon	Jalali kabutor	16	F	LC	R	NP
	Columbidae	<i>Streptopelia chinensis</i>	Spotted dove	Tila ghughu	23	C	LC	R	NP
	Columbidae	<i>Streptopelia tranquebarica</i>	Red collared dove	Lalkonthi ghughu	18	FC	LC	R	NP
Suliformes	Phalacrocoracidae	<i>Phalacrocorax niger</i>	Little cormorant	Choto pankouri	54	F	LC	R	NP
Accipitriformes	Accipitridae	<i>Milvus migrans</i>	Black kite	Bhubon chil	30	C	LC	R	NP
	Accipitridae	<i>Haliastur indus</i>	Brahminy kite	Shankha chil	24	F	LC	R	NP

Note: CS- Conservation Status, F-Few, C-Common, VC-Very common, FC-Fairly Common, LC-Least Concern, Pa- Passerine, NP- Non-Passerine, R- Resident Status, Mw- Winter Migrant, , , Local*-Study area and Global*- Version 2015-3. (www.iucnredlist.or)

Species diversity indices

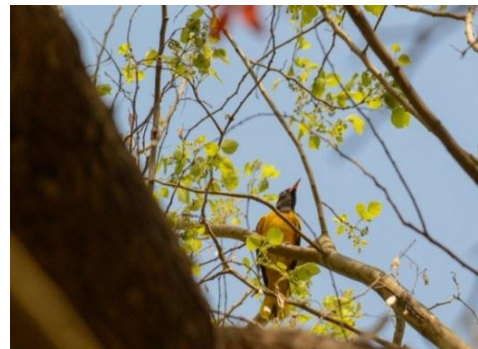
The value of Shannon-Weiner index was highest ($H'=2.98$) in March-21 and lowest ($H' = 2.62$) in the month of June-21. In addition, value of Simpson's index of diversity was highest ($D= 0.09$) in June-21 and lowest value ($D = 0.06$) in December-21. These estimated figures indicate that the species diversity was magnificent (31 species) in the month of December in comparison to July (20 species). Species evenness was also calculated where avian species were more evenly distributed ($E=0.886$) in September and were less distributed ($E=0.857$) in August (Table 3). (Rajia *et al.*, 2015) observed the maximum Shannon-Weiner index ($H'=3.209$) in December and lowest value ($H'=2.899$) was estimated in July. (Singh and Laura, 2013) stated that the highest values of diversity indices were observed in December and lowest indices value was observed in July at Tilyar Lake in Rohtak (Haryana, India). (Albores and Siguenza, 2011) obtained highest species diversity in December due to presence of migrant species. December is the winter month of when migratory birds travelled the country and constituted the highest species diversity along with local residents' birds. On the other hand, there were no migratory birds in July for being warmer environment (Albores and Siguenza, 2011). The richness of bird's species in Dhanmondi Lake, Dhaka might be due to availability of diversified habitats and availability of foods, but the numbers of the individuals were too little that might be due to huge disturbances by the visitors. In the middle part of the lake, there were huge numbers of alien plant species (e.g. *Eucalyptus*), the ground soil of which was dry and clean. We found only the Common Hawk Cuckoo in this part of lake. The current communication represents only basic information on avifaunal diversity that could be helpful for further works on avifauna of Dhanmondi Lake in Dhaka.

Table 3. Species diversity indices during study period at Dhanmondi Lake

Parameter	Marc	April	May	June	July	Augus	Sep.	Oct.	Nov.	Dec.
Shannon- Weiner Index	2.98	2.88	2.79	2.62	2.64	2.72	2.78	2.97	2.92	2.96
Simpson's Index Diversity	0.06	0.07	0.08	0.09	0.08	0.08	0.08	0.06	0.06	0.06
Evenness	0.885	0.865	0.877	0.859	0.88	0.857	0.886	0.873	0.868	0.861
Species Observed	29	28	24	21	20	24	23	30	29	31
Observed Individual	189	199	169	170	160	177	169	187	178	209



Merops orientalis



Oriolus xanthornus



Acridotheres fuscus



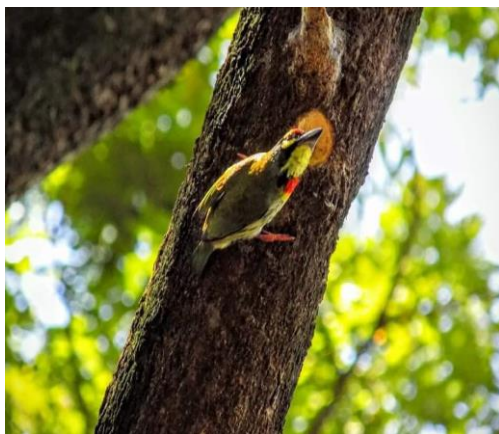
Dendrocopos macei



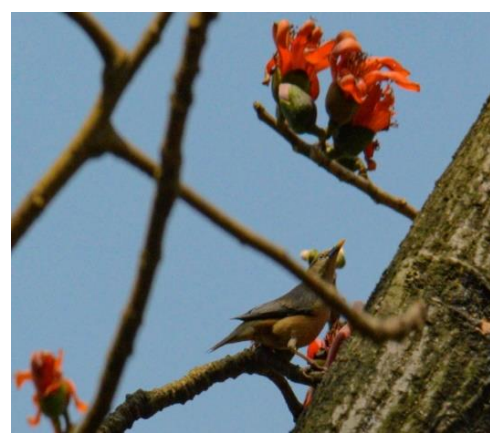
Centropus sinensis



Dicrurus macrocerus



Megalaima haemacephala



Sturnus contra

*Psittacula krameri**Eudynamys scolopaceus**Otus lettia**Passer domesticus**Copsychus saularis**Corvus macrorhynchos*

Plate1: Some notable bird images of Dhanmondi Lake

Problems and threats

Some problems and threats were observed inside the lake area through the study period. People dump and throw their waste materials for instances, household trash, plastics, chips packets, polythene and other unused papers etc. Restaurant inside the park, anthropogenic gatherings and movement, selling of different foods by hawkers, huge sound pollution from the outside vehicles and pollution of water body by careless dumping of garbage were considered as main problems. Moreover, people always use this lake area as an alternative route for their movement and to reach their destinations. (Rani and Chopra, 2015) stated that anthropogenic activities were the main threats to avian species at Chilli Lake in Fatehabad, Haryana, India. So, all in all owing to these problems and threats, the bird species might be affected in the Dhanmondi Lake in near future.

Conclusion

The good diversity of avian species and their relative abundance indicates the suitability of habitats in Dhanmondi Lake. The existence of water body inside the lake area with densely plant species increases its attraction to many diversified avian fauna. Some migrant species (mostly *Merops leschenaulti* and *Merops orientalis*) used this lake as transient roosting place during their local movement. However, some human creating threats and pollution was observed during study that affected the birds inside or the vicinity of lake area. Therefore, Lake should be conserved immediately by taking effective management plan and creating public awareness to conserve these avian species.

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