ORIGINAL ARTICLE

Avifauna Species Diversity and their Abundance in Tilyar Lake, Rohtak, Haryana (India)

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ABSTRACT

The species diversity, density and status of avifauna in Tilyar Lake (28º 52' 52.77" N and 76º 38' 12.05" E), Rohtak, Haryana (India) was investigated to determine the current ecological status and establish bird species checklist. Following the identification of three stations in the lake, census of avifauna was conducted for one year (July 2008 to June 2009) adopting point count method. A total of 3448 bird individuals were recorded belonging to 34 bird species of 24 families. On the basis of relative abundance, 68.65% individuals with 13 species were common, 26.16% with 15 species were fairly common, 4.87% with 5 species were occasional and 0.32% with single specie was reported in scarce condition. Maximum Shannon index (3.337), Simpson's index (0.9597) and Margalef's index (4.503) with 34 bird species was observed at station 3 while minimum Shannon index (3.095), Simpson's index (0.9490) and Margalef's index (3.725) having 26 bird species at station 1. Anthropogenic disturbances were presumed to be responsible for decreasing species richness and diversity, increasing density and favoring dominance by human commensals bird species.
Keywords: Anthropogenic disturbances, Migratory bird, Native Birds, Tilyar Lake.

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INTRODUCTION

A direct link occurs between biological diversity, ecosystem function, and sustainability of natural and managed ecosystems. Lakes are highly complex, land interactive, most productive and fertile ecosystems in the world, constituting a treasury of biodiversity [1,2]. Due to inadequate attention and ignorance, these ecosystems are referred as wastelands which lead to their disappearance by the process of urbanization and development. Owing to fast urbanization native species tends to become rare and become extinct in a specific region [3]. Birds are one of the common fauna of all habitat types because their diversity and abundance can reflect ecological trends in other biodiversity [4]. Birds cannot tolerate even slight ecological disturbance because of their highly specific habitat requirements [5]. The birds are very sensitive towards human disturbances. There is a close relationship between the distances to human built structure and bird habitats. Closer the human structures to bird habitats, fewer will be the abundance of different bird species [6]. It cause a negative effect on biodiversity, especially in term of irrecoverable habitat fragmentation and loss, extermination of native and migratory bird species [7]. Bird species play a significant role in many food webs of aquatic system nutrient cycles. But the increase of human disturbances towards these ecosystems causes threats to bird diversity. An assessment of abundance and diversity of bird species in any ecosystem serve as a good indication of the health of the environment in and around the ecosystem [8,9].

The Ramsar convention, which came into force in December 1973, demands an urgent need to develop the conservation strategies and management plan by inventorying, monitoring and documenting the diversity and density of biodiversity. Water bodies serve as stop-over sites for winged visitors like the migratory water fowls from central Asia and some parts of India [10].

STUDY AREA

Tilyar Lake is situated 5 km away from Rohtak city, on Rohtak-Delhi road. Geographically it is located at the latitude of 28º 52' 52.77" N and longitude of 76º 38' 12.05" E. Tilyar Lake conserves a very wide range of biodiversity and has a crucial importance from the point of native and immigrant bird species. It

harbors a large number of [1] bird [2] animal and [3] plant species. It has 53.42 hectare of area including riparian area and water logged area. There are three small islands with high plant density which act as attraction point for bird species and tourists (Fig.1). It is visited by a very large number of tourists which is detrimental for the lake. The study was carried out to obtain bird species composition, density, diversity indexes and bird species similarity within the lake. This information is required for proper planning and management for sustainability of the ecosystem as a whole. The lake was divided into three blocks based on anthropogenic disturbances, station1 (high anthropogenic disturbance), station 2 (medial disturbances) and station 3 (minimal disturbances) where station 1 was found to have high tourist disturbances due to boating spot, tourist resort, amusement park and community center while station 2 and 3 was observed to show less disturbances and close to agricultural fields.

MATERIALS AND METHODS

The lake was surveyed for the period of one year (July 2008 to June 2009). A monthly census was done to know the residing status and occurrence of bird species. The survey was conducted between 7 am to 10 am. Point survey method was adopted to count the bird population. Birds were censused four times in a month [11,12,13]. Birds were counted at their point of first detection and care was taken to ensure that same bird was not counted again. Bird species in the area were observed through naked eyes and with the aid of binocular. The photographs were taken using a digital camera for closer identification. The birds were identified by referring the classical literatures and text books authored by [14,15,16].

Residential status of different species like resident, resident migrant, winter visitor and summer visitor have assigned strictly with reference to the study area on the basis of sightings during study period. Occurrence status was worked out as common (above 3), fairly common (1-2) and scarce (0-1) on the basis of relative abundance.

$$\text{Relative Abundance} = \frac{\text{No. of individuals of the species}}{\text{No. of individuals of all species}} \times 100$$

Data was analyzed for species diversity by Shannon diversity index (i), Simpson's diversity index (ii) and Margalef's diversity index (iii) as follow:

$$(i) \qquad H' = -\sum_{i=1}^{s} (pi)(\ln pi)$$

$$(ii) \qquad 1 - D = 1 - \sum_{i=1}^{s} \frac{ni(ni-1)}{N(N-1)}$$

$$(iii) \qquad Dmg = \frac{S-1}{\ln N}$$

Where H'= Shannon diversity index, p_i= proportion of population in species i to the total sample, I-D is Simpson diversity index, n_i = No. of species i in the sample, N= Total no. of population in sample, S= Total no. of species, D_{Mg}= Margalef's diversity index. The obtained information was analyzed via using PAST software.

RESULTS AND DISCUSSION

Relative Abundance

The bird species checklist showing residential and occurrence status and relative abundance are given in table 1. 34 bird species were recorded belonging to 22 families during the study. Analysis of data revealed that out of 34 bird species, 19 bird species were resident (inhabitant the lake throughout the year), 10 bird species were resident migrant (bird that breed in one part of area in one season and move to other part within the state or country in a different season) and 5 bird species were found to be fall in migratory bird category in which 2 bird species were winter visitors and 3 were summer visitors. White Wagtail and Long-billed Pipit were found to visit the lake in winter season. These birds migrate from Europe and hilly areas of North Asia to pass the winter and in search of food. They stay five months from mid November to mid March. In summer season three migratory birds were observed including Asian Koel, Black crowned Night Heron and Blue-tailed Bee-eater. They migrate from South India, Sri Lanka, North Africa and South Asia for breeding and food. They arrive in the month of May and inhabitant the lake till the beginning of August.

A total of 3448 individual birds were counted during the study. On the basis of relative abundance 2367 (68.65%) individual birds belonging 13 bird species were common, 902 (26.16%) individuals of 15 bird species were fairly common, 168 (4.87%) individuals of 5 bird species were occasional and 11 (0.32%)

Table (1): Residing and occurrence status of bird species found in Tilyar Lake

Common Name	Scientific Name	Family	Residing Status	Relative Abundance	Occurrence Status
Ashy Prinia	*Prinia socialis*	Cristicolidae	RM	1.16	FC
Asian Koel	*Eudynamys scolopaceus*	Cuculidae	SM	2.55	O
Bank Myna	*Acridotheres ginginianus*	Sturnidae	R	6.29	C
Black Drongo	*Dicrurus macrocercus*	Dicruridae	RM	1.10	FC
Black headed ibis	*Threskiornis melanocephalus*	Threskiornithidae	RM	1.97	FC
Black-crowned Night Heron	*Nycticorax nycticorax*	Ardeidae	SM	0.20	O
Blue-tailed Bee-eater	*Merops philippinus*	Meropidae	SM	0.17	O
Cattle Egret	*Bubulcus ibis*	Ardeidae	RM	2.00	FC
Common Coot	*Fulica atra*	Rallidae	RM	0.32	SC
Common hoopoe	*Upupa epops*	Upupidae	R	4.35	C
Common Myna	*Acridotheres tristis*	Sturnidae	R	5.94	C
Crow Pheasant	*Centropus sinensis*	Cuculidae	RM	1.65	FC
Euracian thick knee	*Burhinus oedicnemus*	Burhinidae	RM	1.94	FC
Eurasian Collared Dove	*Streptopelia decaocto*	Columbidae	R	1.68	FC
Green Bee-eater	*Merops orientalis*	Meropidae	RM	1.25	FC
Grey francolin	*Francolinus pondicerianus*	Phasianidae	R	2.58	FC
House Crow	*Corvus splendens*	Corvidae	R	6.53	C
House Sparrow	*Passer domesticus*	Passeridae	R	5.22	C
Indian Peafowl (Male)	*Pavo cristatus*	Phasianidae	R	3.01	C
Laughing Dove	*Spilopelia senegalensis*	Columbidae	R	5.45	C
Little cormorant	*Microcarbo niger*	Phalacrocoracidae	R	6.47	C
Little egret	*Egretta garzetta*	Ardeidae	R	5.45	C
Long-billed Pipit	*Anthus similis*	Motacillidae	WM	0.46	O
Magpie Robin	*Copsychus saularis*	Muscicapidae	R	1.51	FC
Paddyfield Pipit	*Anthus rufulus*	Motacillidae	R	3.74	C
Red-vented Bulbul	*Pycnonotus cafer*	Pycnonotidae	R	1.88	FC
Red-wattled Lapwing	*Vanellus indicus*	Charadriidae	R	3.68	C
Rock Pigeon	*Columba livia*	Columbidae	R	5.08	C
Rose-ringed Parakeet	*Psittacula krameri*	Psittacidae	R	3.92	C
Spot billed duck	*Anas poecilorhyncha*	Anatidae	R	6.53	C
Swan Goose	*Anser cygnoides*	Anatidae	R	1.25	FC
White Ibis	*Eudocimus albus*	Threskiornithidae	RM	1.36	FC
White Wagtail	*Motacilla alba*	Motacillidae	WM	1.48	O
White-throated Kingfisher	*Halcyon smyrnensis*	Halcyonidae	RM	1.80	FC

Total number of individual birds = 3448 birds
Relative abundance (RA), 0-1= SC (Scarce), 1-3= FC (Fairly Common), above 3= C (Common) and O= Occasional
WM= Winter Migrant, SM= Summer Migrant, R= Resident and RM= Resident migrant

bird individuals of single species were scarce or seen rarely (Table 1). During the study eight bird species were found highly common on the basis of relative abundance. The most abundant species in lake was Spot-billed duck (RA= 6.53) and House crow (RA= 6.53) followed by Bank myna (RA= 6.29), Common myna (RA= 5.49), Little egret (RA= 5.45), Laughing dove (RA= 5.45), House sparrow (RA= 5.22) and Rock pigeon (RA= 5.08) while Common coot (RA= 0.32) was recorded in scarce condition. There were seven such species which were recorded near to scarce condition. Blue-tailed bea eater (RA= 0.17) and Long-billed pipit (RA= 0.46) can't be include in scarce due to their migratory residential status. Black drongo (RA= 1.10), Ashy parina (RA= 1.16), Green-bea eater (RA= 1.25), Swan goose (RA= 1.25) and White ibis

(RA= 1.36) (Table 1). Bird species abundance was observed on island situated in the lake. This may be due to having least anthropogenic disturbances and high plant density.

The study showed population of water birds like common coot, Swan goose and White ibis is very low due to increase in population of human associated bird species like common myna, bank myna, house crow, house sparrow and rock pigeon. This is the result of urbanization and increase in anthropogenic disturbances. Urbanization and human interference makes natural succession recovery difficult or impossible, with long term effects on biodiversity. All these increase biological homogenization, causing the extirpation of native species and promoting the establishment of non-native, urban adaptable species that are becoming increasingly widespread and locally abundant across the area [17].

Bird Species Diversity Indexes

Table 2 highlights the bird species diversity indexes various station in the lake. Diversity indexes indicate the species richness and abundance in an area. Higher values of diversity indexes indicate the higher species richness and abundance. The diversity indexes calculated for whole lake were Shannon diversity index (3.277), Simpson's diversity index (0.9565) and Margalef's diversity index (4.051). But when the bird diversity comparison was made between different stations, maximum diversity indexes were found at station 3 i.e. Shannon index (3.337), Simpson's index (0.9597) and Margalef's index (4.503) with 34 bird species and 1524 bird individuals while minimum diversity indexes i.e. Shannon index (3.095), Simpson's index (0.9490) and Margalef's index (3.725) with 26 bird species and 821 bird individuals was observed at station 1. This may be due to high anthropogenic disturbance and less plant diversity at station 1 as comparison to station 2 and 3 [17].

Table (2): Bird species diversity indexes of Tilyar Lake at different stations

Diversity Indexes	Station 1	Station 2	Station 3	Whole Lake
Taxa	26	31	34	34
Individuals	821	1103	1524	3448
Shannon index	3.095	3.249	3.337	3.277
Simpson index	0.949	0.9558	0.9597	0.9565
Margalef index	3.725	4.282	4.503	4.051

The reason for such differences in species richness and diversity indexes seems to be related with different anthropogenic activities. The lake is visited by a large number of tourists every day due to attachment of lake with small animal zoo. Station 1 and 2 are highly affected by tourist population due to presence of tourist resort, community center, amusement park and animal zoo. The birds are very sensitive towards human disturbances. Bird species richness has negative relationship with urbanization [7]. High plant density favors the bird population due to food availability, diversity of habitat or shelter or nesting place [18].

On monthly basis analysis, maximum bird species were observed from September to February with highest Shannon index (3.296), Simpson's index (0.9592) and Margalef's index (5.142) in the month of December. This may be due to the arrival of migrant and resident migrant bird species on lake for food and forage. Minimum bird species were observed from June- August with Shannon index (2.933), Simpson's index (0.9402) and Margalef's index (4.321) in the month of July (Fig. 2). This may be due to very high temperature, less availability of food and migration of local migrant species to nearby agricultural field for food [19].

The dendrogram shows similarity in the number of bird species between three stations in the lake (Fig. 3). Due to the case of single lake, all the three stations form a single cluster but species similarity varies from one station to another. Station 2 and 3 have high similarity (82.38%) followed by similarity between station 1 and 2 (67.67%) and station 1 and 3 (60.21%). High similarity between station 2 and station 3 may be due to less human disturbances on both the station while less species similarity between station 1 and station 3 may be the result of high anthropogenic disturbances at station 1 and less at station 3. The results of the present study reveal that the station 1 is highly affected by anthropogenic disturbances due to high tourist population, tourist resort, boating spot and community center.
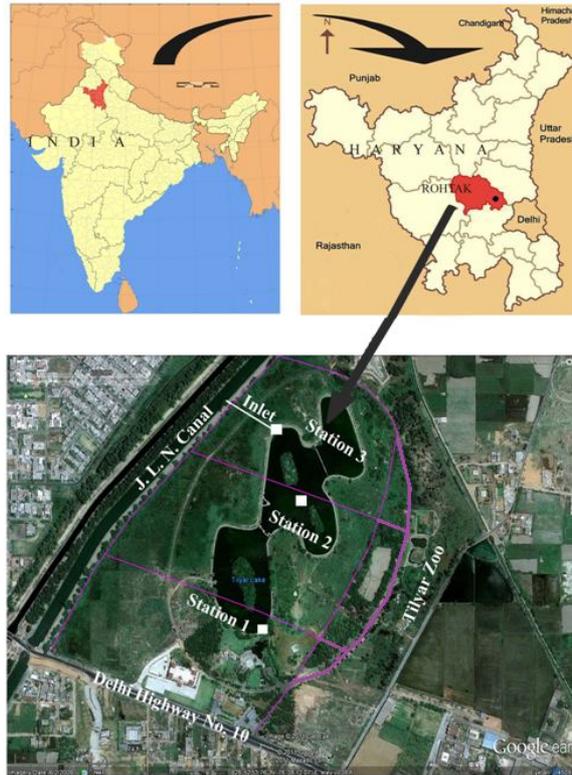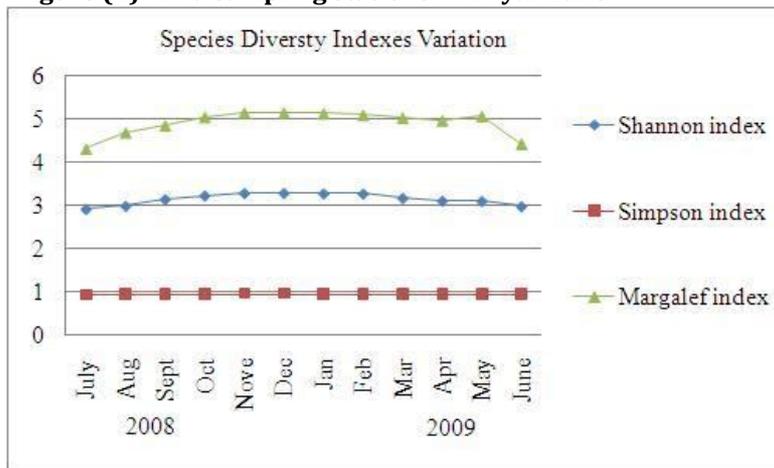
Figure (1): Bird sampling stations in Tilyar Lake

Figure 2: Bird species diversity indexes variation from July 2008 to June 2009
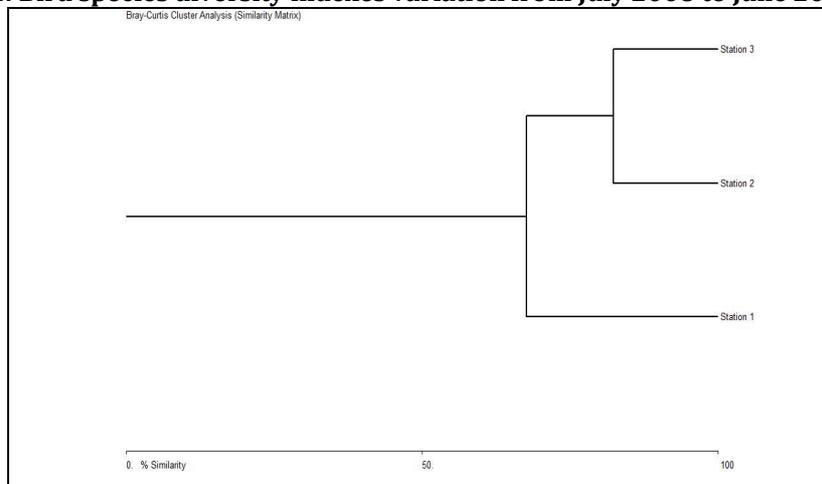

Figure 3: Dendrogram showing similarity in number of bird species on different stations

CONCLUSION

Bird diversity is an important aspect for maintaining a healthy and sustainable ecosystem. The present study represents the effect of human disturbances on bird species diversity and density. Abundance of human commensales like myna, house crow, house sparrow and rock pigeon are the signs of human activity around the lake. Further if the human disturbances increase in future, then there may be danger for bird species homogenization. Thus human interferences should be minimized to maintain species composition and abundance. It is also required to maintain natural plant species in and around the lake area. High tourist density cause harm to the lake biodiversity. Construction processes in the lake riparian area are destroying the plant diversity which is a home for the bird species. The lake water is completely changed after a fix period which causes a detrimental effect on biodiversity. All these processes badly affect the avian population both in water and in riparian area. The lake management authorities should be aware to maintain the ecological balance in the lake. There should be strict management rules for the tourists in relation to the biodiversity conservation in lake area. An alternate measure should adopt to keep clean the lake water except completely change, because the process destroys all the aquatic biodiversity. The ecological health of the lake and habitat quality for birds can be improved by zonation of the lake (wildlife and tourist's zone etc.), initiation of vegetation control program, strict check on land encroachment, regulated tourism practices, regular wildlife research and monitoring programs and formulation of species recovery plan for threatened species of the area

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