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Quantitative Assessment and Spatial Distribution of Avian Fauna of Okhla Bird Sanctuary of Delhi NCR

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Abstract

The present study was conducted to quantitatively assess the avian fauna of Okhla Bird Sanctuary (OBS) of Delhi NCR and their spatial distribution. Point count method was applied for the study from selected 25 locations covering the entire OBS. Total number of 22 species of 10 families in 8 orders were recorded during the study, out of which 10 are migratory in nature. Two species each have been listed as vulnerable (*Aythya ferina* and *Clanga clanga*) while one species was found as near threatened (*Mycteria leucocephala*) from the total recorded species. The fully water dependant species counted was 15, partly water dependant 6 and one species was terrestrial origin. The maximum relative diversity of families was found for Anatidae (22.74) followed by Phalacrocoracidae (13.63), and Ciconiidae (9.09). The spatial distribution of total species was depicted using geospatial technology where diverse distribution was found mostly in the areas bordering Uttar Pradesh state. The area touching the NCT of Delhi side had low diverse distribution of the species.

Introduction

Wetlands are unique productive ecosystem comprising elements of both terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. Wetlands should support few important attributes like: (a) hydrophytes should be the predominant vegetation; (b) the soil should be hydric in nature; and (c) the underlying layer should be saturated with water or covered by shallow water at least during the growing season of each year (Cowardin *et al*., 1979). According to Ramsar Convention (1971) wetlands shall include marsh, fen, peatland which may natural or artificial, with water may be flowing or stagnant in nature. Moreover, water can be fresh or salty including marine water bodies where depth of low tide should not be higher than 6 meter in height. Wetlands support diverse range of flora and fauna and waterbirds are one of them. Waterbirds are defined as species of birds that are

ecologically dependent on wetlands. These birds are considered to be an important health indicator of wetlands and are key parts of wetland ecosystem. Their presence, numbers and trends at a site can tell a lot about the health and quality of a wetland. Waterbirds have an important social function, providing food, recreation and tourism opportunities. Wetlands provide habitat, foods and also breeding ground for these birds (Wetland International, 2018). Waterbirds help in pest control, pollination, seed dispersal and good indicator of climate change due to their sensitive nature and thus rightly termed as bio-indicator (Harisha and Hosetti, 2009).

The study relating birds, its ecological role and need for conservation and its associated habitats, have been extensively studied all over the globe (Sidney, 1996, Tryjanowski *et al*., 2005, Robinson, *et al.,* 2010, Figuerola and Green, 2002, Wiacek *et al.,* 2015, Rappole and Hubalek, 2003). In India, Bhat *et al*. (2009), Dar and Dar (2009), Rajashekara and Venkatesha (2010), Kumar and Gupta (2009), Thakur *et al*. (2010), Gupta *et al.* (2010), Datta (2011), Chopra and Sharma (2012), Prasad *et al*., (2012), Gupta *et al.* (2012), Kumar and Gupta (2013), Singh *et al.* (2013), Garg *et al*. (2013), Puri and Virani (2016) have made significant contribution towards studying avian fauna migration, its conservation along with habitat and its associate wetland conservation. In the context of Okhla Bird Sanctuary significant studies have been made by Urfi (2003), *Manral et al. (2012),* Mukherjee and Sarma (2014) and Mazumdar (2017). Very few studies related to the aspects of birds have been done using geospatial technology (Swatantran *et al*., 2012, Somveille *et al.,* 2013, Bouten *et al.,* 2013). In India Chopra *et al.* (2001) and Yadav *et al*. (2013) have made significant contributions in studying bird migration pattern with the help of geospatial tools.

Okhla Bird Sanctuary (OBS) is known as the home of migratory birds located within the territory of the Indian national capital, Delhi. The sanctuary is providing excellent contribution in terms of groundwater recharge for the city dwellers. It is also a rich source of fresh water storage for Delhi region, helps in flood control, provides groundwater recharge and livelihood for fishing community of the nearby villages. Besides the diverse aquatic plants and animals, the OBS is the home of many terrestrial plants (*Leucaena leucocephala*, *Ficus benghalensis* and *Prosopis juliflora*) and animals (*Canis aureus*, *Boselaphus tragocamelus*, and *Funambulus palmarum*), located in the heart of the city. The most attractive feature of OBS is the presence of huge flocks of beautiful winter birds which gather in huge number for resting during their non-breeding periods. These colourful birds attract a lots of nature lover during the winter season. OBS gives shelters to 302 species of birds, out of which 3 species are listed as critically endangered (*Gyps bengalensis*, *Gyps indicus* and *Aythya baeri*), 8 species are vulnerable (*Anas formosa*, *Grus antigone*, *Vanellus gregarious*, *Rynchops albicollis*, *Haliaeetus leucoryphus*, *Leptoptilos javanicus*, *Chaetornis striata* and *Ploceus megarhynchus*) and 7 species are found to be near threatened (Urfi, 2003). The Okhla Bird Sanctuary is under threat from different anthropogenic activities. An attempt has been made in the present

study to do a quantitative assessment and spatial distribution of avian fauna within Okhla Bird Sanctuary.

Materials and Methods

Study Area: Okhla Bird Sanctuary is located between 28°32′43.5″N and 28°32′56.3″N latitudes and 77°18′41.7″E and 77°18′56.6″E longitudes with altitude of 200 m above mean sea level (Mukherjee and Sarma, 2014) (Figure 1). The sanctuary falls in the districts of South West of Delhi state and Gautam Buddh Nagar district of Uttar Pradesh state. After the construction of Okhla barrage in 1987, Government of Uttar Pradesh declared it as protected area in 1990, under Wildlife protection act of 1972 (Urfi, 2003).

The study for quantifying the avian fauna of Okhla Bird Sanctuary was conducted in the month of February, 2019. Point count method (Bibby *et al*., 2000) has been adopted for assessing the avian fauna diversity taking 25 locations covering the entire bird sanctuary. For species identification Ali (1943) has been extensively used while for assessing different status of birds, the works of Kumar *et al*., (2013) and Mazumdar (2017) have been utilised. For calculating the relative diversity (RDi) of family the method given by Kohli (2014) is adopted.

$$RDi = \frac{\text{Number of bird species in a family}}{\text{Total number of species}} \text{ x100}$$

For preparing the bird distribution map GCPs (ground control point) of 25 locations have been inserted in the OBS map and are linked to the field data. The total birds count in each point has been interpolated using spatial interpolation technique (kriging) in ArcGIS environment to prepare the bird distribution map.

Results and Discussion

During the present study a total number of 22 species of 10 families and 8 orders were recorded out of which 10 are migratory in nature. Two species each have been listed as vulnerable (*Aythya ferina* and *Clanga clanga*) and one near threatened (*Mycteria leucocephala*) from the total recorded species. The fully water dependant species counted was 15, partly water dependant 6 and one species was terrestrial origin (Table 1). The maximum relative diversity of families was found for Anatidae (22.74) followed by Phalacroracidae (13.63) and Ciconiidae (9.09) (Table 2). The spatial distribution of total species depicted diverse distribution pattern within OBS. Dense distributions of bird are found in the northeast, east and southeast parts of the sanctuary that border the Uttar Pradesh state. These sides of the bird sanctuary are comparatively less affected by the anthropogenic activities. The portion touching the Delhi state had low distribution of the

bird species due to various developmental activities taking place in this area (Figure 2). It was found from the analysis of bird distribution that about 3 percent (0.13 sq.km) of OBS area enjoys birds more than 130 numbers, located in the extreme northeast corner of the sanctuary where there are minimum human disturbances. Adjacent to this area where number of birds ranges from 116 to 130 occupies about 4 percent (0.16 sq.km) area. In the western part of the sanctuary bordering Delhi state where bird distribution was found to be scattered (below 25 species) covers more than 27 percent (1.14 sq.km) of the total sanctuary area (Table 3).

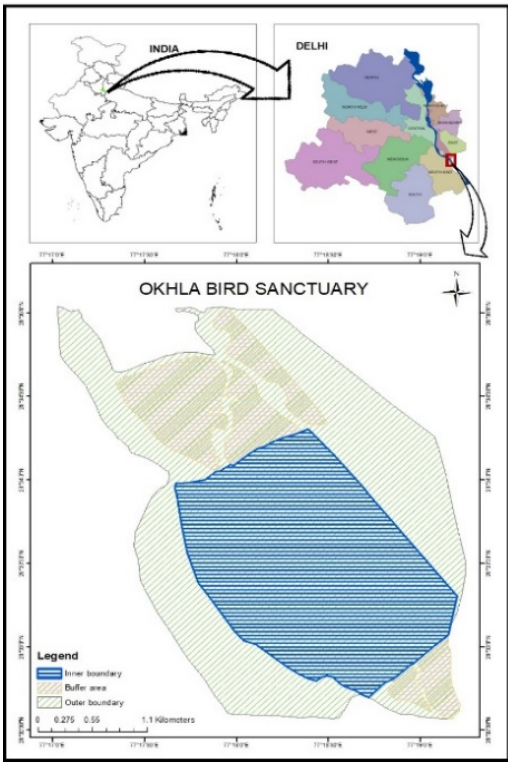

Figure 1 Location of the Okhla Bird Sanctuary

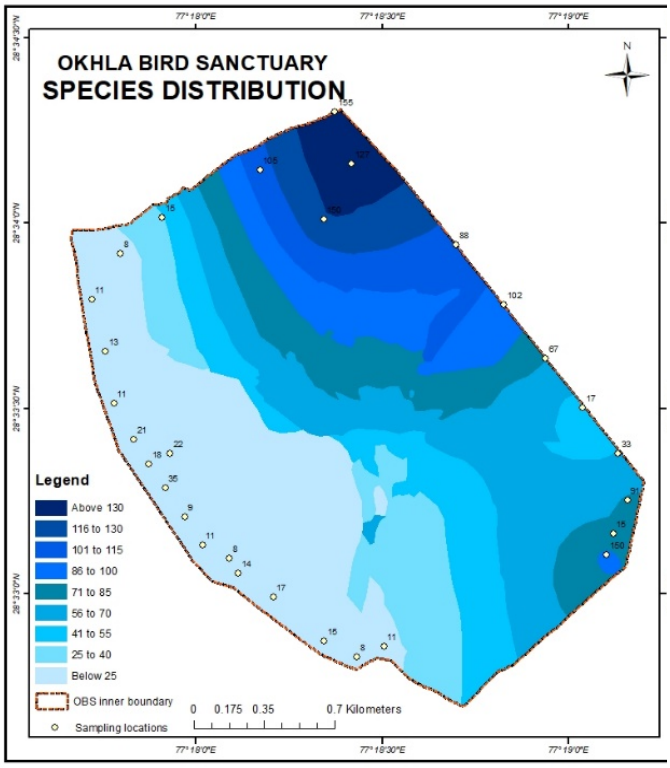

Figure 2 Distribution of avian fauna within Okhla Bird Sanctuary

Anatidae, Phalacroracidae and Rallidae to be found most diverse avian family in OBS. This result is the evident from other studies in wetland habitats (Urfi, 2003; Mazumdar, 2017; Vijayan *et al.,* 2006; Vyas *et al.*, 2009; Zakaria *et al.*, 2009; Ali *et al.*, 2011; Datta, 2011; Dal and Vaghela 2015; Tulasi *et al.*, 2016). The most abundant trees of the sanctuary i.e., *Leucaena leucocephala, Ficus benghalensis* and *prosopis juliflora* where resident birds like Cormonants and Herons use to rest for nesting purpose, and the grasses like *Typha angustifolia, T. Elephantina, Arundo donax* for feeding and for shelter (Mukherjee and Sarma, 2014). Similar results were depicted by Manral, *et al.* (2012) to support the results of this study. The course of the river Yamuna in Delhi sector is facing tremendous anthropogenic pressure leading to deteriorating water quality and changing

water regime (Rawat *et al.*, 2003; Aleem and Malik, 2005; Sengupta 2006; Trisal *et al.*, 2008). The area of OBS bordering Delhi state has been severely affected due to various development activities and other anthropogenic pressure (Manral *et al.*, 2012). Such excessive anthropogenic pressure on the riparian habitat and high load of pollutants make this stretch of Yamuna one of the most threatened riverine habitats of the world (Kumar, 2001). Observations of these factors support the results derived in the present study.

Table 1: The bird species observed in Okhla Bird Sanctuary with their respective taxonomic positions, dispersal and IUCN status and habitat

Common name	**Scientific name**	**Family**	**Residential status**	**IUCN status**	**Habitat**
Eurasian Marsh Harrier	*Circus aeruginosus*	Accipitridae	M	LC	W
Greater Spotted eagle	*Clanga clanga*	Accipitridae	M	VU	T
Northern shoveler	*Spatula clypeata*	Anatidae	M	LC	W
Gadwall	*Mareca strepera*	Anatidae	M	LC	W
Bar- headed goose	*Anser indicus*	Anatidae	M	LC	W
Greylag goose	*Anser anser*	Anatidae	M	LC	W
Common Pochard	*Aythya ferina*	Anatidae	M	VU	W
Indian pond heron	*Ardeola grayii*	Ardeidae	R	LC	WA
Cattle egret	*Bubulcus ibis*	Ardeidae	R	LC	WA
Great white egret	*Ardea alba*	Ardeidae	R	LC	WA
Black stork	*Ciconia nigra*	Ciconiidae	M	LC	WA
Painted stork	*Mycteria leucocephala*	Ciconiidae	R	NT	WA
Great white pelican	*Pelecanus onocrotalus*	Pelecanidae	M	LC	W
Great cormorant	*Phalacrocorax carbo*	Phalacroracidae	R	LC	W
Little cormorant	*Microcarbo niger*	Phalacroracidae	R	LC	W
Indian cormorant	*Phalacrocorax fuscicollis*	Phalacroracidae	R	LC	W
Greater flamingo	*Phoenicopterus roseus*	Phoenicopteridae	M	LC	W
Little grebe	*Tachybaptus ruficollis*	Podicipedidae	R	LC	W
Purple swamphen	*Porphyrio porphyrio*.	Rallidae	R	LC	W
Common Coot	*Fulica atra*	Rallidae	R	LC	W
Eurasian Spoonbill	*Platalea leucorodia*	Threskiornithidae	R	LC	W
Black ibis	*Pseudibis papillosa*	Threskiornithidae	R	LC	WA

M: Migratory, R: Resident, LC: Least concern, NT: Near threaten, VU: Vulnerable, W: Water dependent, WA: Water associate, T: Terrestrial

Table 2: Relative diversity index (RDi) of avian family of Okhla Bird Sanctuary

Sl. No.	**Family**	**Rdi**	**Sl. No.**	**Family**	**Rdi**
1.	Anatidae	22.72	6.	Threskiornithidae	9.09
2.	Phalacroracidae	13.63	7.	Phoenicopteridae	4.54
3.	Rallidae	13.63	8.	Pelecanidae	4.54
4.	Ardeidae	13.63	9.	Podicipedidae	4.54
5.	Ciconiidae	9.09	10.	Accipitridae	4.54

Table 3: Spatial distribution of avian fauna in Okhla Bird Sanctuary

Sl. No.	Number of species	Area (Sq.km)	Percentage
1.	Above 130	0.13	3.15
2.	116 to 130	0.16	4.12
3.	101 to 115	0.24	6.05
4.	86 to 100	0.30	7.51
5.	71 to 85	0.45	11.14
6.	56 to 70	0.71	17.67
7.	41 to 55	0.48	12.11
8.	25 to 40	0.41	10.41
9.	Below 25	1.11	27.85
	Total	**4.00**	**100.00**

Conclusions

Okhla Bird Sanctuary is one of the few remaining wetlands of Delhi NCR. This wetland plays a vital role in providing shelter to avian fauna, attracts huge flock of migratory birds and also provides irrigation water via Agra canal to the neighbouring state of Uttar Pradesh. The OBS is under tremendous anthropogenic pressure like, urbanization, land encroachment, degradation, water and noise pollutions and so on. Noise pollution created by heavy vehicular movements, high rise buildings and electric poles and wires above OBS is affecting the avian ecosystem of the sanctuary. Moreover, Delhi side of the sanctuary is not covered under the Protected Area Network and as a result, most of the disturbing activities are prevailing in these parts. For effective conservation of avian fauna along with its associated ecosystem there should be proper management and protection in all sides of the sanctuary.

Authors Contribution: *H.S. Harma (M.Sc. NRM) performed the research work, data collection and writing of the manuscript; Kiranmay Sarma (Associate Professor) has contributed in GIS part and its interpretation including the editing of manuscript and also the corresponding author.*

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