Species Assemblage of Birds' Community in Protected Areas of Delhi-NCR

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Abstract

Green spaces in cities especially in the capital city of India provide necessary recreational, social and psychological benefits to stressing residents of the city. Cities and towns depict the extreme human-modified environments with only remnants of the original habitats present. Study undertaken to know the abundance, diversity and species richness of avian fauna in urban protected landscapes of Delhi, NCR. In the following paper, the methods include data is extracted from e-Bird of past 40 years to illustrate the changing trend of bird species from 1980-2019 from 7 greenspaces of Delhi-NCR which are Aravalli Biodiversity Park, Asola Bhatti Wildlife Sanctuary, Deer Park, Dheerpur Wetland, National Zoological Park, Northern Ridge, Okhla Bird Sanctuary, Sanjay Van, Yamuna Biodiversity Park and analysed as box plots using PAST. The result showed a varied trend from 1980-2019, which included the usage of e-Bird by the period. The result indicated that the recent decade is well updated with data on e-Bird, hence several birds' individual is maximumly observed from 2011-2019. The study has shown the wavy trend from 1980-2019 in species composition in the capital city of India. This also suggest that people have started recording observation on a single platform and shown interest in last decade. This study will lead to taking the necessary step to maintain the avian biodiversity in the green spaces of the capital city- Delhi-NCR.

Introduction

Green spaces in urban areas include urban parks, remnants of natural forested areas, streetscape plantations that act as important conservation areas in the urban setting. Green spaces in urban areas comprise largely small and large neighbourhood parks, pocket gardens in residential colonies, green enclaves in public institutional grounds, avenue trees, urban forests, cemeteries and vacant lots. Parks and gardens are the major publicly usable land safeguarding urban green spaces and they are maintained primarily for the recreation of urban inhabitants (Schipperijn et al. 2010; Paul 2016). Urban green spaces can increase resilience and reduce vulnerabilities to urbanization. Vegetation in urban areas contributes positively towards ecological heath in an urban system (Paul and Nagendra 2017). Green spaces in urban areas provide ecosystem services and recreational venues for diverse users. Moreover, urban green spaces provide various ecosystem services including social, economic and ecological benefits such as regulation of micro-climatic conditions, carbon sequestration, recreational and spiritual value and so on along with habitat for urban wildlife and platform for conservation easements and community development potential (Miller 1997; Hague and Siegel 2002; Milton 2002; Khera et al. 2009).

Urbanisation is the development and involvement of human activities; urbanisation is an alteration of the environment according to human needs which negatively affect the native biota. Aves are considered to be the potential umbrella group of species for biodiversity conservation. However, these days the research on avian biodiversity depicts the effects of urbanisation on the bird communities and in many other facets of biodiversity conservation. Urbanisation is one of the most prominent phenomena and its negative effect on biodiversity especially in the term of habitat fragmentation and loss (Rajashekara and Venkatesha 2015). The changes in land use such as agricultural development and urbanisation have

harmed the environment and its components by varied processes. These processes include degradation, fragmentation and loss of habitat, alteration of disturbance regimes and introduction of native and non-native species (La Sorte et al. 2014). Due to the increase in human population continuing to grow in density and extent (UN 2011) and the effect of anthropogenic activities the viability of many species is likely to reduce. As birds are considered to be excellent bioindicators, their communities attract several species, these are ideal for avifaunal studies which are mentioned later in the paper (Tippetts 2018). Birds have a significant role in the functioning and balancing of ecosystems. Avian Fauna is also considered as an agent of nutrient cycle, plant gene flow through pollination, seed dispersal and helps in environmental sanitation through scavenging of carrion. Aves are also used as food resources, artistic and spiritual inspiration by many folks (Kiros et al. 2018).

The national capital of India has undergone rapid urbanisation in the last few decades. It is also seen that with proper city planning green spaces and streetscapes of the city has increased (Khera et al. 2009). The current study was carried out to research the status of biodiversity in protected areas and recreational parks of Delhi-NCR by extracting data from the citizen science platform- “e-Bird” of the last 40 years i.e., from 1980–2019.

Study Area

The geophysical area of Delhi is 1,483 sq. km and located at 28.7041° N, 77.1025° E, also showcasing two significant features i.e., Yamuna floodplains and Delhi Ridge. Delhi is known to be the largest metropolis by area and the second-largest metropolis in terms of the population of the country. According to the census 2011, the population of the capital city has reached 1.67 Crores, the wherein urban population is 97.50% and rural population is 2.50% (http://forest.delhigovt.nic.in/wps/wcm/connect/doit_forest/Forest/Home/Delhi+State).

The climate of Delhi is quite varying from extremely hot to chill. The capital becomes extremely hot in June and July followed by the monsoon. The annual temperature in Delhi varies from 3 degrees to 45 degrees Celsius and the precipitation is between 400mm to 600mm (http://forest.delhigovt.nic.in/wps/wcm/connect/doit_forest/Forest/Home/Delhi+State).

Methods

Data were extracted from the e-Bird from 1980–2019. There are various locations within Delhi from where the complete checklist has been updated by the enthusiastic birders (http://cornelllanofornithology.github.io/e-Bird-best-practices/e-Bird.html). There are 480 birding areas used by birders out of which 18 are listed (Table 1), according to the e-Bird checklist.

Table 1
Popular Birding hotspots In Delhi, NCR

District	Birding hotspots (RA-Recreational areas; PA- protected area
South Delhi	National Zoological Park, New Delhi (PA)
Central Delhi	Sanjay Van (PA)
New Delhi	Lodhi Gardens (PA)
South Delhi	Presidential Gardens (RA)
New Delhi	Najafgarh Jheel Area (PA)
Central Delhi	Hauz Khas–Deer Park (PA)
East Delhi	Tughlaqabad (RA)
East Delhi	Garden of Five Senses (RA)
North Delhi	Jawaharlal Nehru University Campus (PA)
South Delhi	Aravalli Biodiversity Park (PA)
South Delhi	Mehrauli Archaeological Park (RA)
New Delhi	Shankar Vihar Wetland (PA)
Central Delhi	Pusa Campus, New Delhi (PA)
North Delhi	Asola Bhatti WS, Delhi (PA)
South Delhi	Yamuna Biodiversity Park (PA)
South Delhi	Indian Agricultural Research Institute, New Delhi (PA)
Central Delhi	Okhla Bird Sanctuary (PA)
Central Delhi	TERI University Campus (RA)

To carry out this temporal analysis a simple procedure has been followed. The literature is searched using publish and perish. Later the data collection was done using e-Bird and extracted in Microsoft Excel, use of pivot table and graphs analysis has been done. QGIS is used to generate maps.

Data Analysis

Total number of bird species and percentile of bird species in the study period (1980–2019) was calculated using Microsoft Excel v.2010. To estimate the number of bird species in each year as well as the number of bird species in five-year study interval, boxplots were analysed using PAST software v.4.0 (Hammer et al. 2001), and individual bird species in various reserve parks of the study area were also analysed using boxplots by PAST software v.4.0 (Hammer et al. 2001). Total number of the bird species in each reserve park was calculated using Microsoft Excel v.2010.

Results

Urbanisation has altered richness, evenness and diversity composition in the region through it showed almost the same throughout the decade but there were a lot of alterations and changes seen in the region due to urbanisation. Data analysis of first quarter of year i.e., January to April has been analysed and following are the results. Bird species data was collected from e-bird from 1980–2019 in different protected areas and recreational parks. In 1980, the total number bird species were observed more, and gradually the bird species were decreased, but in 1988, we observed more bird species after onwards, the bird species were drastically decreased. Since 2011 to 2019, the highest number of the bird species was observed.

In Fig. 1 the highest number (66367) of bird species were observed in the 2015–2019-time interval (5 years' time interval), followed by 4142, 877 in 2010–2014 and 1986–1990 respectively in the study area. The lease number (180) of bird species were observed in 1997–2003 in the targeted study area (Fig. 1).

The percentage of birds was observed in each 5 years of time interval (Fig. 2). The 91.32% of birds were observed in during 2015–2019 time period, followed by 5.70%, 1.21%, 0.59%, 0.57%, 0.37%, and 0.25% of birds in 2010–2014, 1986–1990, 2004–2009, 1980–1985, 1991–1996, and 1997–2003 time periods respectively (Fig. 2). The boxplot showed the individual bird species, observed in the study area in each year (Fig. 3). The individual bird species were drastically increased in the year of 2014 to 2019 in the study area, but in the rest of the years there is no drastic change in the number of individual bird species (Fig. 3).

In Fig. 4 showed the individual bird species were high in the 2015–2019 time period compared to other time periods in the targeted study area. In Asola Bhatti Wildlife Sanctuary (ABWS), the highest number (26362) of birds was observed, whereas the lower number (213) of birds was observed in Dheerpur Wetland (DW) (Fig. 5). In Fig. 6 showed the individual bird species in each protected area. Aravalli Biodiversity Park (ABP) was observed highest individual bird species, followed by Asola Bhatti Wildlife Sanctuary (ABWS) respectively whereas remaining protected areas showed very low number of individual bird species (Fig. 6). In the supplementary file, all the collected data on bird species from e-Bird was provided.

Discussion

Conservation & monitoring

The intense and human activities creating pressure around the metropolitan landscapes which have made a negative impression on the avian community composition of urbanisation (Rajashekara and Venkatesha 2015). Conserving vegetation in the urban areas supports bird species to dwell in urban regions. As technology has increased and the awareness of keeping and maintaining the e-Bird checklist and this also helped the scientist and research to easily approach the data of a certain region and less manual power and expenses. Complexity and the nature of habitats and microhabitats constitute a

valuable factor that determines the species composition and diversity in a particular area. Thereby several bird species tend to find their own suitable habitats where they have access and resources to feed and breed (Begon et al. 1986). Highly complex habitats provide a wide array of opportunities to a higher number of bird species as they are enriched with a wide range of foods and other resources to sustain lives. This parameter governs the variation of avifaunal species composition and diversity in large scale. Parameters such as abundance and relative abundance of bird species might be associated with nature of habitat, abundance of food, and breeding season of the species (Bellanthudawa et al. 2019).

According to Sethy et al. (2015) assessment of the bird community is a necessary tool in biodiversity conservation and identifications of conservation actions. Gaining/ having knowledge on diversity and composition of bird communities is also important to determine the health status of the local ecosystem or regional landscapes. Moreover, identifying the existing threats in a particular area is also essential for developing effective conservation efforts and management actions.

Birds are a group of faunal species that are greatly influenced by human attention. Therefore, there are some incidences which lead to reduction in insectivorous birds and total birds' richness as a result of anthropogenic disturbances. In more human-modified urban land uses, less development-sensitive bird species can be seen while there are larger numbers of individuals of birds in recreational trails in forest and grassland ecosystems. Reduction and control of human-modified urban land uses in a greener area will facilitate habitat for sensitive species for rapid development activities with large scale disturbances. When constructions and developments are taken place, vegetation and plants are cleared and removed from the sites which creates canopy gaps. This narrows down and separates habitat connectivity of habitats, making more sensitive species vulnerable and decreasing their population size. Conservation and management efforts should be oriented toward protecting habitat and resources for development sensitive species, such as migrants, insectivores, and forest specialists, during the modification of available land uses. Most birds residing in these areas are vulnerable to habitat degradation due to loopholes in existing legal protection. In addition, community knowledge enhancements also should be strengthened for a sustainable conservation of bird species while maintaining their ecological interactions in urban areas.

Conclusion

The results extracted from greenspaces of urban areas like Delhi, species composition has fluctuated over the years. However, the maximum number of observations were recorded from past decade. This is due to the reason that birders have gradually increased their interest in avian fauna and maintaining the record on e-Bird to help other people and scientists and researchers to carry out their work.

Declarations

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Conflict of Interest

The authors declare that they have no conflict of interest and the paper was communicated with consent of all the authors.

Availability of data and material: The data that support the findings of this study are available from the corresponding authors upon reasonable request.

Code availability: Not applicable

Author Contributions

Deepali Chatrath and Janmejay Sethy have designed and wrote the manuscript. Janmejay Sethy and Deepali have analyzed, interpreted and edited the manuscript. Lipakshi Bhatt and Meesala K. Murthy represents the analysis and infographics in the paper. He has come up with the analysis to be undertake with the collected data. He has also helped in drafting the context and gave necessary review to the writeup wherever necessary. All the authors have read and approved the manuscript.

Ethics approval: The authors states and confirms that no animals model were used or capture from the wild in the process of the study.

Consent to participate: The authors have permitted to involve in research and have agreed to the roles and responsibilities towards one another throughout the whole of the research process.

Consent for publication: The authors have permitted the publication permission.

References

Begon M, Harper JL, Townsend CR (1986) Ecology. Individuals, populations and communities. *Blackwell scientific publications*.

Bellanthudawa BKA, Nawalage NMSK, Subanky S, Panagoda PABG, Weerasinghe HWGAS, Tharaka LKDN, Abeywickrama MSJ (2019) Composition and Diversity Variation of Avifauna, along Different Vegetative Habitat Types in a Human-Modified Area. University of Kelaniya, Sri Lanka. *International Journal of Zoology*, 2019.

Hague M, Siegel N (2002) Municipal parks in New York City: Olmsted, Riis, and the transformation of the urban landscape: 1858–1897. In: Backhaus, G., Murungi, J. (Eds.). Transformations of Urban and Suburban Landscapes: Perspectives from Philosophy, Geography, and Architecture. *Lexington Books, Lanham*, MD, pp. 153–191.

Hammer O, Harper DA, Ryan PD (2001) PAST: Paleontological statistics software package for education and data analysis. *Palaeontologia electronica*, 4(1), 9.

Khera N, Mehta V, Sabata BC (2009) Interrelationship of birds and habitat features in urban greenspaces in Delhi, India. *Urban Forestry & urban greening*, 8(3), 187-196.

Kiros S, Afework B, Legese K (2018) A preliminary study on bird diversity and abundance from Wabe fragmented forests around Gubre subcity and Wolkite town, southwestern Ethiopia. *International Journal of Avian & Wildlife Biology*, 3(5), 333-340.

La Sorte FA, Tingley MW, Hurlbert AH (2014) The role of urban and agricultural areas during avian migration: an assessment of within-year temporal turnover. *Global ecology and biogeography*, 23(11), 1225-1234.

Miller RW (1997) Urban Forestry: Planning and Managing Urban Greenspaces. Prentice-Hall, Upper Saddle River, NJ.

Milton K (2002) Loving Nature: Towards an Ecology of Emotion. Routledge, New York.

Paul S, Nagendra H (2017) Factors influencing perceptions and use of urban nature: Surveys of park visitors in Delhi. Land, 6(2), 27.

Paul S (2016) Mapping the Impact of Urbanization on Green Spaces: The Human Drivers of Land Use/Land Cover Change in Delhi. Doctoral dissertation, Manipal University, *Ashoka Trust for Research in Ecology and the Environment* (ATREE).

Rajashekara S, Venkatesha MG (2015) Temporal and spatial avian community composition in urban landscapes of the Bengaluru region, India. *Journal of Environmental Biology*, 36(3).

Schipperijn J, Ekholm O, Stigsdotter UK, Toftager M, Bentsen P, Kamper-Jørgensen F, Randrup TB (2010) Factors influencing the use of green space: Results from a Danish national representative survey. *Landsc. Urban Plan*. 2010, 95, 130–137.

Sethy J, Samal D, Sethi S, Baral B, Jena S, Payra A, Sahu HK (2015) Species diversity and abundance of birds in and around North Orissa University, Takatpur, Baripada, Mayurbhanj, Odisha. *Species Diversity*, 4(2).

Tippetts JJ (2018) Analysis of avian diversity and richness in relation to urban park size using e-Bird.

Figures

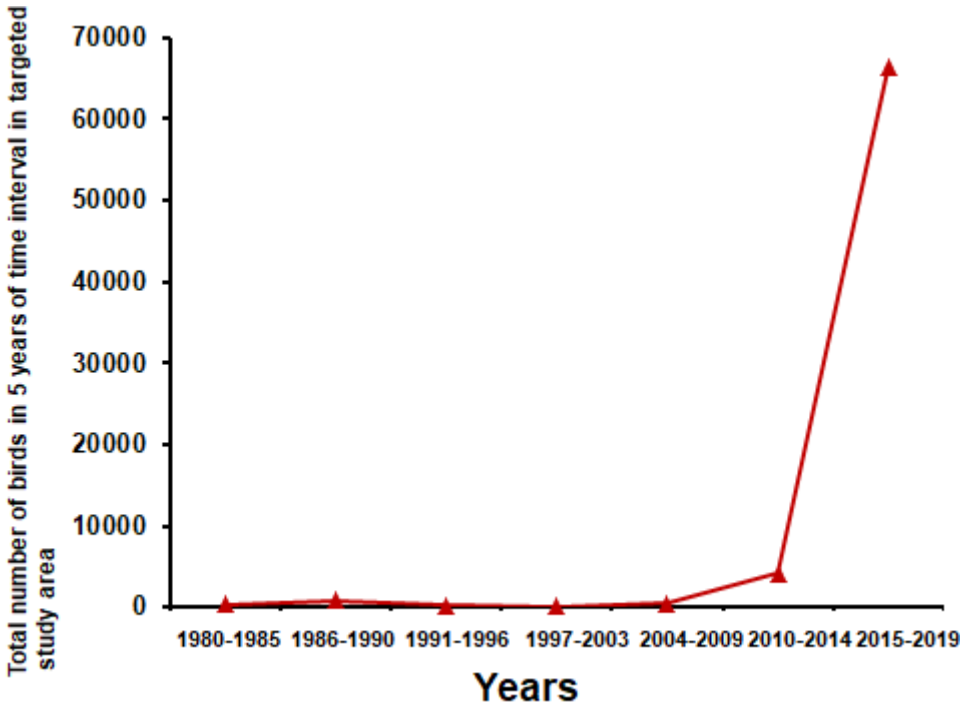

Figure 1

Number of birds' individuals present in the study area during 5 years of time interval

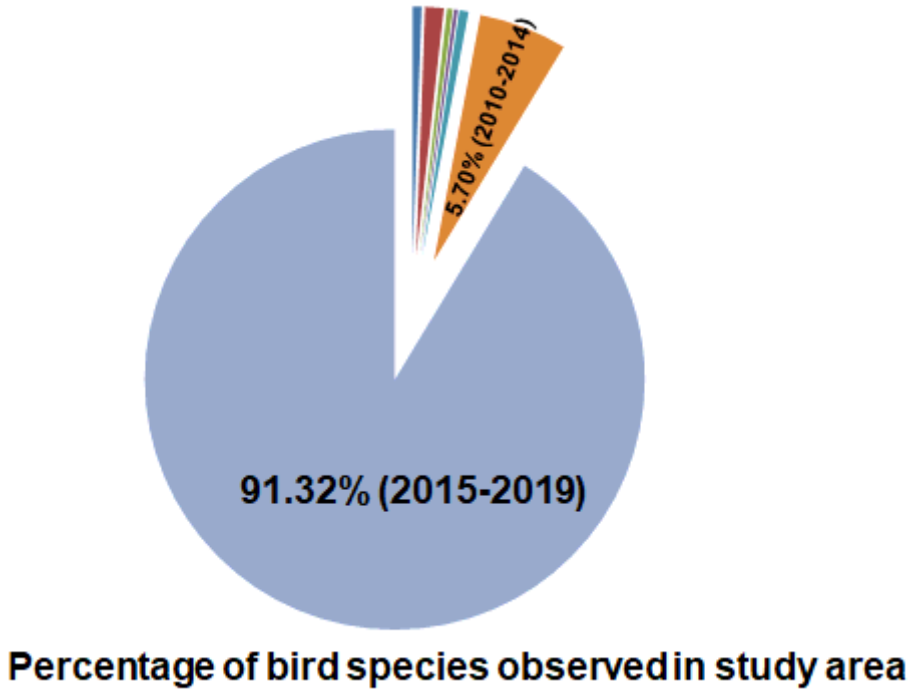

Figure 2

Percentage of bird species observed in the study area

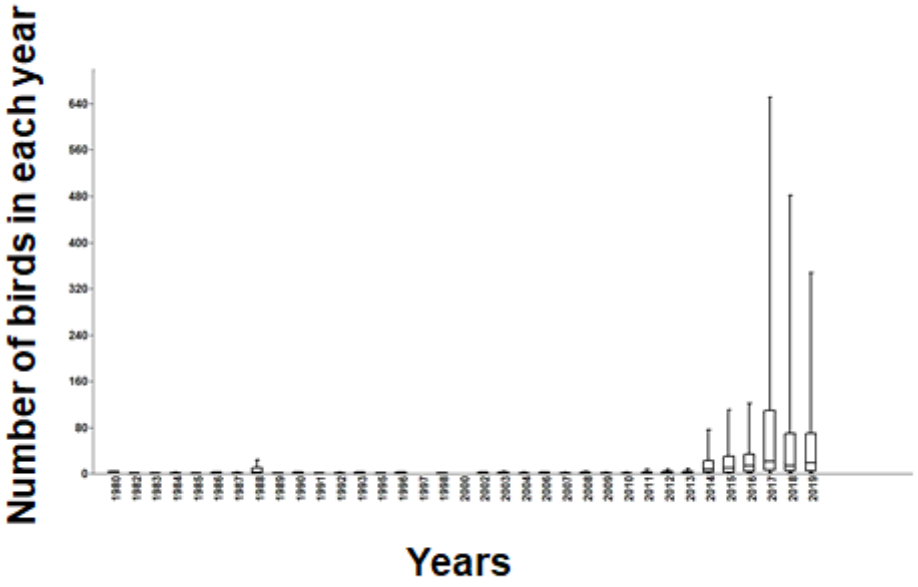

Figure 3

Number of birds in each individual year during study period 1980-2019

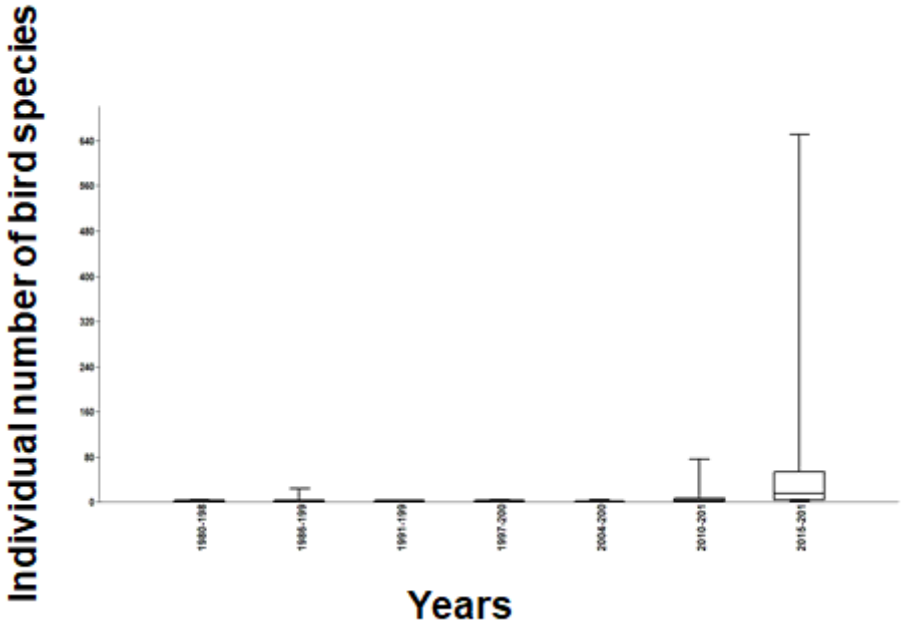

Figure 4

Individual number of bird species in 5 years of time interval during study period 1980-2019

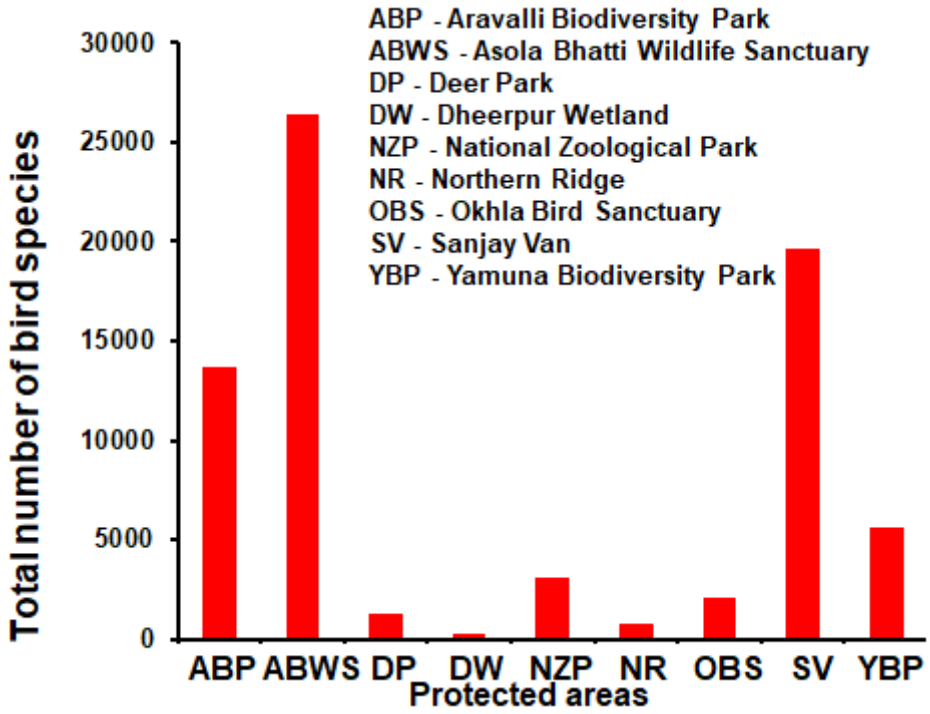

Figure 5

Total number of bird species in different protected areas of study site. ABP - Aravalli Biodiversity Park, ABWS - Asola Bhatti Wildlife Sanctuary, DP - Deer Park, DW - Dheerpur Wetland, NZP - National Zoological Park, NR - Northern Ridge, OBS - Okhla Bird Sanctuary, SV - Sanjay Van, YBP - Yamuna Biodiversity Park

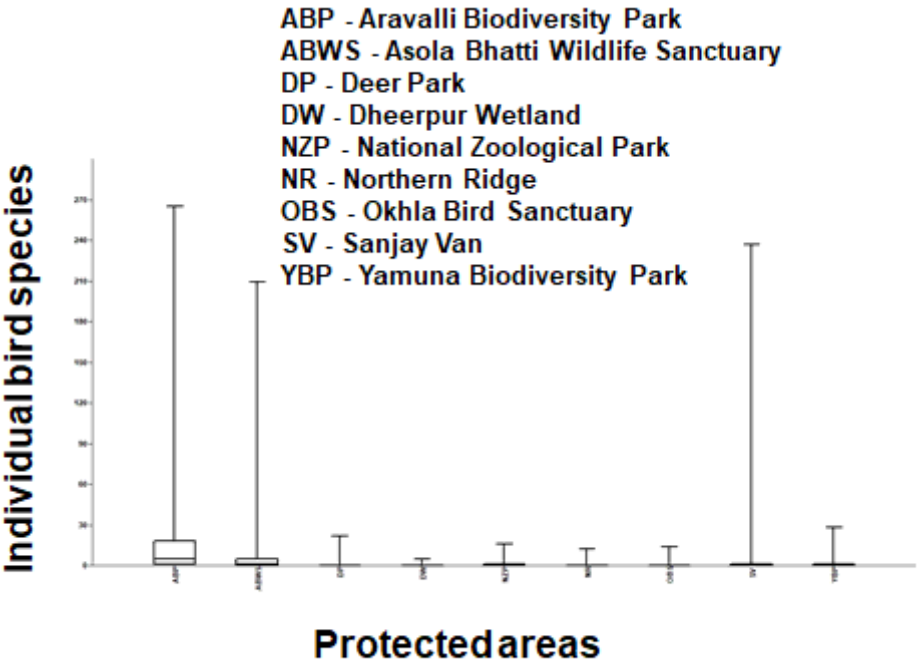

Figure 6

Individual bird species in different protected areas of study site ABP - Aravalli Biodiversity Park, ABWS - Asola Bhatti Wildlife Sanctuary, DP - Deer Park, DW - Dheerpur Wetland, NZP - National Zoological Park, NR - Northern Ridge, OBS - Okhla Bird Sanctuary, SV - Sanjay Van, YBP - Yamuna Biodiversity Park

Supplementary Files

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