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Study on avifaunal diversity and species richness in and around upper lake, Bhopal, India

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Abstract

A total of 49 bird species belonging to 5 orders and 11 families of terrestrial and semi-aquatic birds were identified and recorded during the study. The highest population of bird species recorded during the month of May followed by June. The maximum number of birds was observed from Corvidae family (11 species) followed by Columbidae (6 species) and Passeridae (6 species). The highest percent occurrence was shown by Corvidae 22.44%. The highest diversity of 3.59 was observed in the month of May followed by 3.58 in the month of July and 3.57 in the month of April. Species richness was highest in the month of May followed by July and least in April.

Keywords: birds diversity, species richness, upper lake, Shannon-wiener index

Introduction

Birds are ideal bio indicators and valuable models for concentrating on an assortment of ecological issues. Thus, the state of neighborhood scene should be examined to distinguish urgent determinants of the bird local area structure for avian preservation^[10]. Portraying and clarifying spatial examples in species variety are essential strides in moderating worldwide biodiversity^[12] as the quantity of bird species possessing different altitudinal belts or 'life zones'^[11] rely upon climatic changes joined by comparing changes in vegetation. Studies on species circulation along elevational angles are fundamental to comprehend standards of local area association and species protection. Birds possess a wide scope of natural positions^[24], contingent upon the ordered perspective, the quantity of known living bird species fluctuates somewhere in the range of 9,800 to 10,050^[4]. The Indian subcontinent has different avifauna with 1300 bird species and profoundly shifted climatic conditions, novel territories, significant length of inland, timberland and waterfront regions which draws in and upholds an extraordinary gathering of avian species round the year^[7]. In numerous biodiversity, both present and past, is preferable perceived for birds over for some other significant gathering of organic entities. Then again predominant pattern of bird-include practiced in India has been centered around jeopardized birds, wetland birds, heronries and birds found in ensured living spaces like public parks, asylums and IBA (Important Bird Area),^[25]. Clearly complete subtleties of normal birds and the use design in a few provincial regions and in a few backwoods environments, for example, sub-tropical thorn forests of India are inadequate till date^[22]. Curiously as of late there is an expanding mindfulness about the birds in the remote pockets of India. Recognizably the accessibility of agenda of birds in those areas is profoundly useful to get the total picture about the birds in India for future examinations and to evaluate the situation with the species for example IUCN. The present climatic change additionally has antagonistic impacts in bird life and natural equilibrium. The ornithological information is utilized to show the impacts of natural change on biodiversity. Currently plentiful endeavors are being made in a few faroff regions, for example, college grounds, foundations^[16] and nuclear power station^[8].

Material and Methods

The study was carried out from April 2020 to July 2020, in Upper Lake of Bhopal. Data was collected at every weekend (Saturday and Sunday) during the above-mentioned months. The birds were identified and recorded during the morning (0630 to 1100 h) and evening (1600 to 1830 h) by direct field observation. Bird count was made by walking inside the forest area.

Two parallel 500 m transects with the distance of 300 m between them were laid. The maximum visibility on either side of transect was about 100 meters and covered an area of 500 x 200 m. A 100 m gap was left between the two transects to avoid overlap of birds while counting. The visibility on either side of the transect differed/ varied from 10 m to 100 m depending upon the structure of the vegetation. The birds were identified using Olympus binoculars (10x50) and field guides of ^[1, 2, 7].

The number of birds in each species, percent occurrence was calculated using the following formula

$$\text{Percent occurrence} = \frac{\text{No of species of each family}}{\text{Total no of different species observed}} \times 100$$

And the species richness and diversity of species by ^[23] method.

$$H' = - \sum P_i \ln P_i$$

Where the P_i = the proportion of individuals of species i .

Study Area

Upper Lake (Bhojtaal) was created by Raja Bhoj (King of Parmar dynasty and ruler of Malwa region) during 1005-1055 AD. The lake was known as the Upper Lake or Bada

Talab (Big Pond) until March (2011). It was renamed as Bhojtaal in honour of the Great King Raja Bhoj who built it. The lake was created by constructing an earthen dam across the Kolans river, formerly a tributary of the Halali river. Bhadbhada dam constructed in 1965 at the southeast corner of the Bhojtaal controls the outflow of the upper lake to the Kaliasot river. The Bhojtaal spans an area of 31 km², and drains a catchment of 361 km². Being a source of portable water, Upper Lake meets the demand of drinking water for nearly 40% (30 million gallons per day) for the growing population of the Bhopal city. Being wetland in nature it is a hotspot of biodiversity. Besides this it provides economic benefit to number of riparian owners in terms of fish production (Fig.1).

The area receives rains from the western Arabian Sea monsoon which commences by mid June, July and August are the peak rainy months. December and January are the coldest months, while November and February are less cold. By March it begins to grow warmer and the summer season commences from April with May being the hottest month when the temperature usually exceeds 40°C. Thereafter, from mid June to mid August monsoon season is observed which in turn is followed by post monsoon season experiencing rise in temperature again which drops with the advancement of months till winter season sets in from mid November upto February.



Fig 1: Map showing study area.

Results

Identification of bird species

It was observed that a total of 49 bird species belonging to 5 orders and 11 families of terrestrial and semi-aquatic birds were identified and recorded during the study period (Table-1).

Classification of bird species

Among the 49 bird species 4 migratory species were also recorded which were:

1. Pompadour Green- Pigeon (*Treron pompadora*)
2. Blue- Winged Parakeet (*Psittacula columboides*)
3. Plum-headed Parakeet (*Psittacula cyanocephala*)
4. Indian Hanging Parrot (*Loriculus vernalis*)

The highest population of bird species occurred during the month of May followed by June (Table 2). The observations from table 3 showed that the maximum number of bird

families were observed in the Corvidae (11 species) and least number (2 species and 1 species) in families *viz.*, Sturnidae and Charadriidae. The least occurrence of the bird species of 2 families (Table-3) may be due to non-availability of feed, change in climate pattern etc.

Species diversity and species richness

Species diversity and species richness was calculated for the avifaunal species observed in the study period. Species diversity was an expression of community structure and it was a characteristic unique to the community level of organization. A community demonstrates a high species diversity if many species are equally abundant or nearly equally abundant species are present. If a community is composed of only a few species, or if only a few species are abundant, then species diversity is low. High species diversity indicates a complex community in which a high degree of species interaction is possible. Communities with

higher diversities typically have higher levels of energy transfer, predation, competition and niche availability. The theory of species diversity takes into account three different ecological phenomena viz., species richness, relative abundance and community evenness. It was observed that highest diversity was 3.59 in the month of May followed by 3.58 in the month of July and 3.57 in the month of April (Table 4). There was no much significant difference between the highest value and it indicates a complex community in which a high degree of species interaction is possible. It does not take into account the number of individuals per species, but it indicates the health of the habitat and structure of an environment. The observation from the (Table 3) showed that species richness was highest in the month of May followed by July and least in April. The highest value indicates the health of the community or habitat of the study area. Non-significant difference of species diversity and species richness indicate the uniform weather pattern and feeding material available during the study period. Nests of various avifaunal species were identified, which indicated the breeding season for certain bird species.

Discussion

Protection of worldwide biodiversity has turned into the issue of prime significance in late many years [5]. Protectionists all over the planet are fighting with preservation challenges under the steadily speeding up dangers of anthropogenic unsettling influences to biodiversity. Birds involve practically all living space types and variety of birds regularly fills in as a decent sign of generally variety of a given region [6]. Birds are additionally known to be receptive to any sort of changes to their surrounding conditions subsequently can be utilized as bioindicator [14]. Since comprehensive stock of variety needs unthinkable degrees of time and exertion [11] researchers all over the planet most as of late have stressed on performing quick inventories and biodiversity assessment turning out to

be ever well known and in such manner planning of agendas of birds on a more extensive scale has been given a lot of significance [21]. From the review it was seen that the movement of birds begins from November and it nonstop up to April. These transitory bird species moved from higher height to the review region during the long stretches of December, January, February, March, April. The event of these birds was reliably found in the time of study. This event might be because of progress in the environment and furthermore accessibility of its feed viz., Especially natural product bearing trees bushes and spices in the above months. 39 bird species from Buxa Tiger Reserve directed during the period of February [13]. Author had detailed 87 types of birds having a place with 13 orders and 31 families from Foot Hills of Nilgiris, Tamilnadu, India [15]. From Bhoj Wetland, Bhopal author had revealed 70 types of birds having a place with 16 orders and 35 families [17]. Species lavishness for the most part diminishes with expanding height [3]. Bird dispersion and overflow fluctuates with territory [19], climatic condition, food asset and developmental history of the area [9]. The species lavishness recorded was high in the review region. This was presumably the review region has more deciduous and clean wilderness which might uphold high food accessibility. Along these lines, in this heterogeneous grid of environment it is fundamental to keep up with and save unblemished woods in Kalakad-Mundanthurai Tiger Reserve. The uncovered bird local area piece altogether connected with rise and tree species synthesis of destinations, demonstrating the impact of deterministic variables on bird local area structure [18]. Asset overflow and accessibility are portrayed as the main component in deciding the local area structure [20]. Author announced most noteworthy variety in the period of January followed by February from foot Hills of Nilgiris, Tamilnadu India [15]. The current review which recorded 49 bird species mirrors a respectably solid in general biodiversity of the current review area.

Table 1: List of Birds observed in and around Upper Lake Bhopal.

S. No	Common name	Scientific name	Habitat	IUCN status
Phasianidae				
1	Common Quail	<i>Coturnix coturnix</i>	R	LC
2	Jungle Bush-Quail	<i>Perdica asiatica</i>	R	LC
3	Grey Francolin	<i>Francolinus pondicerianus</i>	R	LC
4	Grey Jungle Fowl	<i>Gallus sonneratii</i>	R	LC
5	Indian Peafowl	<i>Pavo Cristatus</i>	R	LC
Corvidae				
6	Indian Treepie	<i>Dendrocitta vagabunda</i>	R	LC
7	House Crow	<i>Corvus splendens</i>	R	LC
8	Jungle Crow	<i>Corvus macrorhynchos</i>	R	LC
9	Small Minivet	<i>Pericrocotus erythropygus</i>	R	LC
10	Common Wood Shrike	<i>Tephrodornis pondicerianus</i>	R	LC
11	Black Drongo	<i>Dicrurus macroceres</i>	R	LC
12	White-Bellied Drongo	<i>Dicrurus caerulescens</i>	R	LC
13	Black-Headed Oriole	<i>Oriolus xanthornus</i>	R	LC
14	Asian paradise Flycatcher	<i>Terpsiphone paradise</i>	R	LC
15	Common Iora	<i>Aegithina tiphia</i>	R	LC
16	Black-Headed Cuckoo-shrike	<i>Coracina melanoptera</i>	R	LC
Muscicapidae				
17	Asian Brown Flycatcher	<i>Muscicapa dauurica</i>	R	LC
18	Oriental Magpie-robin	<i>Copsychus saularis</i>	R	LC
19	Pied Bushchat	<i>Saxicola caprata</i>	R	LC
20	Indian Robin	<i>Saxicoloides fulicata</i>	R	LC
Sturnidae				

21	Brahminy Starling	<i>Sternus pagodarum</i>	M	LC
22	Common Myna	<i>Acridotherus tristis</i>	R	LC
Hirundinidae				
23	Common Swallow	<i>Hirundo rustica</i>	R	LC
24	House Swallow	<i>Hirundo tahitica</i>	R	LC
25	Streak-Throated Swallow	<i>Hirundo flavicola</i>	R	LC
Nectarinidae				
26	Tickell's Flowerpecker	<i>Dicaeum erythrorhynchos</i>	R	LC
27	Purple -Rumped Sunbird	<i>Nectarinia zeylonica</i>	R	LC
28	Small Sunbird	<i>Nectarinia minima</i>	R	LC
29	Purple Sunbird	<i>Nectarinia asiatica</i>	R	LC
Passeridae				
30	House Sparrow	<i>Passer domesticus</i>	R	LC
31	Paddy field Pipit	<i>Anthus rufulus</i>	R	LC
32	Brown Rock Pipit	<i>Anthus similis</i>	R	LC
33	Forest Wagtail	<i>Dendronanthus indicus</i>	R	LC
34	Spotted Munia	<i>Lonchura punctulata</i>	R	LC
35	Black-Headed Munia	<i>Lonchura Malacca</i>	R	LC
Cisticolidae				
36	Jungle Prinia	<i>Prinia sylvatica</i>	R	LC
37	Common Tailor Bird	<i>Orthotomus sutorius</i>	R	LC
38	Paddyfield Warbler	<i>Acrocephalus agricola</i>	R	LC
Charadriidae				
39	Red-Wattled Lapwing	<i>Vanellus indicus</i>	R	LC
Columbidae				
40	Pompadour Green- Pigeon	<i>Treron pompadora</i>	M	LC
41	Blue Rock Pigeon	<i>Coloba livia</i>	R	LC
42	Eurasian Coloured- Dove	<i>Streptopelia decaocto</i>	R	LC
43	Spotted Dove	<i>Streptopelia chinensis</i>	R	LC
44	Red Collared Dove	<i>Streptopelia tranquebarica</i>	R	LC
45	Little Brown Dove	<i>Streptopelia senegalensis</i>	R	LC
Psittacidae				
46	Rose -Ringed Parakeet	<i>Psittacula krameri</i>	R	LC
47	Blue- Winged Parakeet	<i>Psittacula columboides</i>	M	LC
48	Plum-headed Parakeet	<i>Psittacula cyanocephala</i>	M	LC
49	Indian Hanging -Parrot	<i>Loriculus vernalis</i>	M	LC

LC= Least Concern, R=Resident and M=Migrant.

Table 2: Bird population in different months

S. No	Common Name	April 2020	May 2020	June 2020	July 2020
1	Common Quail	15	12	9	8
2	Jungle Bush-Quail	17	17	17	17
3	Grey Francolin	16	15	14	16
4	Grey Jungle Fowl	6	7	5	8
5	Indian Peafowl	10	8	10	15
6	Indian Treepie	6	7	8	7
7	House Crow	30	35	38	42
8	Jungle Crow	32	34	36	35
9	Small Minivet	3	5	2	4
10	Common Wood Shrike	4	5	2	5
11	Black Drongo	6	6	2	4
12	White-Bellied Drongo	6	6	6	4
13	Black-Headed Oriole	2	1	2	3
14	Asian paradise Flycatcher	2	2	0	3
15	Common Iora	4	2	4	5
16	Black-Headed Cuckoo-shrike	6	5	3	4
17	Asian Brown Flycatcher	0	2	2	3
18	Oriental Magpie-robin	5	6	4	7
19	Pied Bushchat	6	6	5	2
20	Indian Robin	5	5	5	7
21	Brahminy Starling	18	10	15	14
22	Common Myna	28	36	14	10
23	Common Swallow	26	20	12	15
24	House Swallow	25	29	21	31
25	Streak-Throated Swallow	30	25	21	26
26	Tickell's Flowerpecker	15	12	14	17
27	Purple -Rumped Sunbird	9	8	7	4
28	Small Sunbird	8	8	5	6

29	Purple Sunbird	8	5	6	4
30	House Sparrow	14	40	35	19
31	Paddy field Pipit	8	10	0	4
32	Brown Rock Pipit	0	2	2	0
33	Forest Wagtail	3	2	5	1
34	Spotted Munia	19	21	15	18
35	Black-Headed Munia	16	25	14	11
36	Jungle Prinia	2	0	1	4
37	Common Tailor Bird	4	4	5	3
38	Paddyfield Warbler	15	12	14	10
39	Red-Wattled Lapwing	10	8	12	15
40	Pompadour Green- Pigeon	30	25	35	40
41	Blue Rock Pigeon	25	22	41	30
42	Eurasian Coloured- Dove	6	6	6	6
43	Spotted Dove	10	20	20	15
44	Red Collared Dove	10	10	10	10
45	Little Brown Dove	12	12	10	13
46	Rose -Ringed Parakeet	15	10	22	16
47	Blue- Winged Parakeet	0	12	15	13
48	Plum-headed Parakeet	22	23	25	28
49	Indian Hanging -Parrot	0	10	15	0

Table 3: Percent Occurrence of bird Families

S. No	Family	Percent Occurrence
1	Phasinidae	10.20%
2	Corvidae	22.44%
3	Muscicapidae	8.16%
4	Sturnidae	4.08%
5	Hirundinidae	6.12%
6	Nectarinidae	8.16%
7	Passeridae	12.24%
8	Cisticolidae	6.12%
9	Charadriidae	2.04%
10	Columbidae	12.24%
11	Psittacidae	8.16%

Table 4: Species diversity and species richness Shannon-wiener Index

Month	Species diversity	Species richness
April 2020	3.57	45
May 2020	3.59	48
June 2020	3.53	47
July 2020	3.58	49

Conclusion

To close it very well might be noticed that a couple or chose patches in and around the Upper Lake were read up for more limited periods of time, a more concentrated review would doubtlessly bring about recognizing numerous more avifaunal species. The effect of anthropogenic tension in adjustment of the habitats in and around the current review is the need of hour.

References

1. Ali S. The Book of Indian Birds (13th Revised Edition). Oxford University Press, New Delhi, 2002, pp 326.
2. Ali S, Ripley SD. Hand Book of Birds of India and Pakistan. Oxford university press, Delhi, 1983, pp. 110-112.
3. Begon M, Harper JL, Townsend CR. Ecology: individuals, populations, and communities. Blackwell Science, London, 1996, pp945.
4. Clements JF. Checklist of Birds of the World (6th ed.). Ithaca: Cornell University Press, 2007. ISBN 978-0-8014-4501-9.
5. Ehrlich PR, Wilson EO. Biodiversity studies: science and policy. Science. 1991;253:758-762.
6. Furness RW, Greenwood JJD. Birds as a Monitor of Environmental Change. Chapman and Hall, London, 1993.
7. Grimmet R, Inskipp C, Inskipp T. Pocket guide to the Birds of Indian Subcontinent. Oxford University Press, New Delhi, 1999, pp 384.
8. Hussain KJ, Ramesh T, Satpathy K, Selvanayagam M. A checklist of birds of Department of Atomic Energy Campus, Kalpakkam, Tamil Nadu. Zoo's Print., 2011;25(7):13-20.
9. Jayson EA. Synecology and behavioural studies on the forest birds of Kerala. PhD Thesis, University of Calicut, Calicut, 1994, pp314.
10. Kattan GH, Franco P. Bird diversity along elevational gradients in the Andes of Colombia: area and mass effects. Global Ecology and Biogeography. 2004;13:451-458.
11. Lawton JH, Bignell DE, Bolton B, Bloemers GF, Eggleton P, Hammond PM, *et al.* Biodiversity inventories, indicator taxa, and effects of habitat modification in tropical forest. Nature. 1998;391:72-76.
12. Lee PF, Ding TS, Hsu FH, Geng S. Breeding bird species richness in Taiwan: distribution on gradients of elevation, primary productivity and urbanization. Journal of Biogeography. 2004;31:307-314.
13. Naaz S, Das SK, Mukhopadhyay SK. Report on the ornithological visit to Terai for-ests of the Jalpaiguri district of West Bengal. India. J Natural History. 2005;1(1):79-85.
14. Padoa SE, Baietto M, Massa R, Bottoni L. Bird communities as bioindicators: The focal species concept in agricultural landscapes Ecological Indicators. 2006;6(1):83-93.
15. Peter JS, Revathi R, Jaisankar I, Rasu DP. Study on avifaunal diversity and species richness in foot hills of Nilgiris, Tamilnadu, India. Indian Forester. 2015;141(10):1067-1074.
16. Praveen J, Joseph JK. A checklist of birds of the National Institute Technology Campus, Kozhikode, Kerala. Zoos' Print Journal. 2006;21(6):2298-2300.

17. Rather HA, Shrivastava P. Status of avifaunal diversity in Bhoj Wetland Bhopal, Madhya Pradesh, India. *Journal of Entomology and Zoology Studies*. 2021;9(6):89-92. DOI: 10.13140/RG.2.2.15175.62883.
18. Raman TRS, Joshi NV, Sukumar R. Tropical rainforest bird community structure in relation to altitude, tree species composition, and null models in the Western Ghats, India. Centre for Ecological Sciences, Indian Institute of Science, 2005, 34pp.
19. Ramesh T, Sridharan N, Kalle R. Birds of Kuno Wildlife Sanctuary, Central India. *Zoo's Print*. 2011;26(12):25-29.
20. Recher HF, Davis WE. Foraging profile of a Salmon Gum woodland avifauna in Western Australia. *Journal of Royal Society of Western Australia*. 2002;85:103-111.
21. Roy US, Pal A, Banerjee P, Mukhopadhyay SK. Comparison of avifaunal diversity in and around Neora Valley National Park, West Bengal, India. *Journal of Threatened Taxa*. 2011;3(10):2136-2142.
22. Sandilyan S, Thiyagesan K, Nagarajan R. Major decline in species-richness of waterbirds in the Pichavaram mangrove wetlands, southern India. *Wader Study Group Bull*. 2010;117(2):91-98.
23. Shannon CE, Weaver. *The mathematical Theory of communication*. Urbana University, Illinois press, 1949, pp. 117.
24. Sekercioglu, Cagan Hakki. Handbook of Birds of the World. In Josepdel Hoyo, Andrew Elliott and David Christie (eds.), *Old World Flycatchers to Old World Warblers*. Barcelona: Lynx Edicions, ISBN 84-96553-06-X. 2006, 11.
25. Urfi AJ. Counting birds in India: Methodologies and Trends. *Cur. Sci*. 2005;89(12):(1997-2003).
26. Van Strien AJ. Biodiversity declining in the Netherlands: an indicator to describe the changes in the number of wild species. *Netherlands Official Statistics*, Winter, 1997, 45-49.