



## Impact of anthropogenic activities on abundance and distribution of birds in and around Kayalana Lake

Ronak Barmera<sup>1</sup>, Dr. GR Parihar<sup>2</sup>

<sup>1-2</sup> Department of Zoology, Faculty of Science, Jai Narain Vyas University, Jodhpur, Rajasthan, India

### Abstract

A study of avian species abundance and distribution was conducted during July 2018 to September 2018 in the Kayalana lake. It is a major hotspot of Jodhpur (Raj.) as it is the major source of drinking water for city and provides habitat to the many floral and faunal species. However conservation to this area is challenging due to the increase in habitat destruction by man-made activities. Increased anthropogenic effect is the major threat to the environment. We examined the effects of these anthropogenic activities on avian diversity and highlights the potential conservation value of the unprotected area in and near Kayalana lake. Birds were assessed in 4 selected patches out of which 2 chosen was under unprotected region and other 2 was in the protected region. By using point count method we recorded total of 78 species in study area. Applying statistical analysis highest abundance and evenness was observed in protected area. This suggests that unprotected area with major anthropogenic effect needs helps or to be undertaken by management for conservation to minimise the loss.

**Keywords:** Kayalana lake, avian diversity, point count, abundance, anthropogenic effect, conservation.

### 1. Introduction

Birds occupy many levels of trophic webs, from mid-level consumer to top predators as with other native organisms, birds help maintain sustainable population levels of their prey and predator species and, after death, provide food for scavengers and decomposers. They are considered keystone species as their presence or absence from ecosystem affects other species indirectly. Birds appear in ancient art and mythology worldwide. Bird indicators are likely to form an important component of sets of indicator for biodiversity and habitat. The present condition of man-made pollution had an adverse effect on bird diversity as well as ecological balance. So it is the high time to save birds and maintain the biodiversity. Rapid increase in human population has adversely affected diversity around the globe <sup>[1]</sup>. Abundances of many bird species adapted to disturbance-mediated habitat have declined as well <sup>[2]</sup>.

Asia was considered among the most diversity rich continents; however increase in human population has adversely affected the diversity of the region. Due to increased urbanisation the birds are adversely affected as their count decreasing in response to the pollution caused by human population. Birds are considered to be biodiversity and environmental indicator. Birds are excellent bio indicators for the health of environment. The cause-and-effect link between an environment and birds are direct and simple one <sup>[3]</sup>. Biodiversity conservation in urban areas has become significant not only because of increasing human population in urban centre's but also it is one of the innovative ways to conserve biodiversity as suggested by various global environmental conceptions <sup>[4]</sup>. So a study was done to know the anthropogenic effect on the abundance and diversity of birds in Kayalana.

### 2. Past Scenario

Kayalana, A perennial water body with rocky areas is the

major source of potable water for the Jodhpur population. Several migratory birds are common visitors to these water bodies, Kayalana lake with 156 species of 51 families and 70 wetland dependent species of 20 families is reported. In contrast to the Kayalana in its vicinity the birds species and its diversity are reportedly noted by several workers including Agramoorthy, S.M. Mohnot (1986, 1989); HC Bohra, SP Goyal - Pavo(1992); S.Dookia (2002);C Sivaperuman, S Kumar, NS Rathore (2004). Species richness in Jodhpur amounted to 73 species reported in the vicinity of Sardarsamand Lake (1987), and 123 species of 38 families in the Machia Safari Park area [5]. Bird diversity was 100–125 species <sup>[5]</sup>, and included endemic species adapted to xeric environments—the lark, peafowl, wheatear, pigeon, partridge, sand grouse, courser, demoiselle crane, and rare birds like the great Indian bustard, lesser florican and houbara <sup>[6]</sup>.

### 3. Material and methods

**3.1 Study area:** The study of anthropogenic effects on avian diversity was carried out in and nearby Kayalana lake located in Jodhpur (Raj.). Jodhpur, the second largest city in the state of Rajasthan, India. It is the gateway to the Thar, as it is literally on the edge of the Thar Desert. Kayalana lake is located 8 km west of Jodhpur (Raj.). It is an artificial lake made in 1872 by Pratap Singh. It receives its water from Hati Nahar, which is further connected to the Indira Gandhi Canal. The drinking water needs of Jodhpur and nearby villages is fulfilled by this lake. It's surface area is 84 km<sup>2</sup> (32 sq in) with an average depth of approximately 35 to 40 feet (11 to 12 m). It's coordinate 26017' N 720 58' E. It is hot and semi-arid during dry season. Temperature varies from 490 in summer to 10 in winters. Average rainfall is 302 mm/yr. The soil is sandy, with a natural vegetation of trees and shrubs comprising of *Prosopis cineraria*, *Capparis deciduas*, *Caligonum polygonides*, *Acacia senegal*, *Zizipus*

nummularia, S.persica, Euphorbia caducifolia, Calotropis procera, Dactyloctenium aegyptium. The fauna of this area mainly include Mangoose, Jackal, Nilgai, Desert hair, Cobra, Cat, Dog, etc.

**3.2 Materials:** Binocular(8X42) was used to study the avian species and observations. For identification of species ‘The book of Indian Bird’s by Salim Ali and websites was considered. The digital camera Nikon D 3400 was used for photography.

**3.3 Methods:** In the present study observations were made throughout the study area. Point count method were used to record birds within study area [7,8]. This method allows the observer to travel within the area and to stop at particular point, allows the birds to settle and then record the bird’s diversity. Thereby recording birds at predefined area within Kayalana lake and hills nearby. A recent map was used to evaluate the landscape along with Google Earth. GPS was used to mark the points by moving along the site. Total of 4 patches, with an area of 500 square hectares for each was carried out across the lake. Out of which two patches (i.e. point 1 and 2) were taken in the area that were not as intensively protected by any management body or government (referred to as unprotected site) and the other two patches (i.e. point 3 and 4) for comparison chosen were thus in heavily managed and protected parts of the area. Each point was given the time of 20 min with a time gap of 5 min between each point. The radial distance from the point to detected birds was recorded. As the distance increased the probability of observing birds decreased [8]. The data regarding diversity and distribution was collected from July 2018 to September 2018. Time schedule chosen was from 6:00h to 9:00 h in morning and 16:00h to 18:00h in the evening. At each site an area of 400 square hectares

was selected and marked. Anthropogenic activity such as Aquatic vegetation, Ethical activities, Boating, Dumping of wastes, Domestic uses in and around the lake were recorded using visual observation.

**3.4 Statistical analysis:** The data of all observations was pooled and community characteristics were calculated to quantify the bird’s abundance and distribution at selected locations. Species diversity was calculated by Shannon-Weiner Index;  $H = -\sum P_i \log P_i$ , where  $P_i$  is the proportion of the  $i$ th species of birds. ‘H’ is referred as ‘Shannon’s index’. This formula is known as Shannon- Wiener index of bird’s diversity. Simpson’s index may be defined as it is the probability that two individuals drawn at random from an assemblage will belong to the same species [9]. It is calculated as  $D = 1 / \sum P_i^2$ , where is the proportion of the  $i$ th species. Species evenness is about how well distributed abundance or biomass is among species within a community [10]. Species evenness is also known as equitability and denoted as E (which ranges between 0-1).

**4. Result and Discussion**

During the present study, total of 78 birds species were identified for the points along Kayalana lake (Table 1). From the given table 2 of computed statistical analysis shows Species richness was highest at point 4 followed by point 3, 2 and lowest richness was recorded from point 1(Table 2). Computed statistical data show that Shannon’s index (H) provides a quantitative report of diversity which was highest at point4 followed by point 3,2 and least in point 1. Similarly, Simpson’s index shows diversity measure for avian fauna. Bigger the value of D, lower the diversity and vice versa. The lowest value of point 4 followed by point 3, 2 and highest in point 1 (Table 2).

**Table 1:** Scientific name, common name and number of birds in points studies from study area during the study period.

Scientific name	Common name	Point 1	Point 2	Point 3	Point 4
<i>Pavo cristatus</i>	Indian Peafowl	0	1	5	7
<i>Anastomus oscitans</i>	Asian Openbill	1	0	6	9
<i>Francolinus pondicerians</i>	Gray Francolin	1	0	1	5
<i>Trachybaptus ruficollis</i>	Little Grebe	4	8	22	15
<i>Appus affinis</i>	Little Swift	6	0	7	3
<i>Microcarbo niger</i>	Little cormorant	3	5	16	20
<i>Phalacrocorax carbo</i>	Great Cormorant	4	2	6	9
<i>Phalacrocorax fuscicollis</i>	Indian Cormorant	5	10	20	21
<i>Neophron percnopterus</i>	Egyptian Vulture	0	0	1	0
<i>Aquila nipalensis</i>	Steppe Eagle	1	0	0	1
<i>Milvus migrans</i>	Black Kite	2	0	2	7
<i>Phylloscopus humei</i>	Hume's Warbler	0	0	3	5
<i>Aythya farina</i>	Common Pochard	9	11	28	21
<i>Aythya fuligula</i>	Tufted Duck	7	15	21	15
<i>Streptopelia decaocta</i>	Eurasian Collard Duck	5	3	11	14
<i>Gallinula chloropus</i>	Eurasian Moorhen	5	0	4	2
<i>Fulica atra</i>	Eurasian Coot	8	5	12	10
<i>Porphyrio poliocephalus</i>	Gray-headed Swamphen	0	1	4	3
<i>Sterna aurantia</i>	River Tern	0	0	1	0
<i>Mycteria leucocephala</i>	Painted Stork	0	0	0	1
<i>Ardea purpurea</i>	Purple Heron	2	1	1	0
<i>Egretta garzetta</i>	Little Egret	0	0	0	1
<i>Bubulcus ibis</i>	Cattle Egrte	2	0	1	1
<i>Threskiornis melanocephalus</i>	Black-headed ibis	0	1	0	0
<i>Buteo rufinus</i>	Long legged Buzzard	1	0	4	6
<i>Ceryle rudis</i>	Pied Kingfisher	0	0	0	1
<i>Gracupica contra</i>	Asian Pied Starling	0	0	0	0
<i>Acridotheres ginginianus</i>	Bank Myna	1	0	3	4

<i>Passer domesticus</i>	House Sparrow	16	18	25	36
<i>Sarkidiornis melanotos</i>	Knob billed Duck	5	7	15	18
<i>Anas clypeata</i>	Northern Shoveler	2	4	8	5
<i>Anas poecilorhyncha</i>	Indian Spot billed Duck	5	10	16	17
<i>Anas carolinensis</i>	Green-winged Teal	0	0	2	0
<i>Columba livia</i>	Rock Pigeon	17	15	20	29
<i>Streptopelia orientalis</i>	Oriental Turtle Dove	0	0	2	5
<i>Spilopelia chinensis</i>	Spotted Dove	0	0	1	0
<i>Spilopelia senegalensis</i>	Laughing Dove	7	10	12	11
<i>Teron phoenicoptera</i>	Yellow footed Pigeon	0	0	0	0
<i>Himantopus himantopus</i>	Black-winged Slit	2	4	4	6
<i>Vanellus indicus</i>	Red-wattled Lapwing	9	11	13	17
<i>Charadrius dubius</i>	Little Ringed Plover	0	0	0	1
<i>Philomachus pugnax</i>	Ruff	0	0	0	0
<i>Actitis hypoleucos</i>	Common Sandpiper	5	8	12	19
<i>Tringa nebularia</i>	Common Greenshank	0	0	0	0
<i>Alcedo atthis</i>	Common Kingfisher	2	1	4	6
<i>Halcyon smyrnensis</i>	White-Throated Kingfisher	0	0	2	0
<i>Merops orientalis</i>	Green Bee Eater	0	0	4	6
<i>Falco tinnunculus</i>	Eurasian Kestrel	0	0	0	1
<i>Psittacula krameri</i>	Rose-ringed Parakeet	5	12	18	20
<i>Lanius isabellinus</i>	Isabelline Shrike	0	0	2	1
<i>Lanius excubitor</i>	Great Gray Shrike	0	0	0	0
<i>Dicrurus macrocercus</i>	Black Drongo	0	0	1	2
<i>Dendrociitta vagabunda</i>	Rufous Tree pie	0	0	0	0
<i>Corvus splendens</i>	House Crow	2	6	17	23
<i>Eremopterix griseus</i>	Ashy-crowned Sparrow- Lark	9	13	20	29
<i>Galerida cristata</i>	Crested Lark	1	0	2	0
<i>Cecropis daurica</i>	Red-rumped Swallow	0	0	0	0
<i>Pycnonotus cafer</i>	Red-vented Bulbul	3	0	8	12
<i>Pycnonotus leucotis</i>	Whited Eared bulbul	0	5	12	16
<i>Iduna caligata</i>	Booted Warbler	0	1	0	0
<i>Acrocephalus dumetorum</i>	Blyth's Reed Warbler	0	0	0	0
<i>Orthotomus sutorius</i>	Common Tailorbird	0	0	4	7
<i>Prinia socialis</i>	Ashy Prinia	0	0	0	1
<i>Sylvia curruca</i>	Lesser Whitethroat	0	0	1	3
<i>Zosterops palpebrosus</i>	Oriental White-eye	0	0	1	0
<i>Turdoides caudate</i>	Common Babbler	5	9	13	14
<i>Turdoides malcolmi</i>	Large Gray Babbler	8	1	10	13
<i>Saxicoloides falicatus</i>	Indian Robbin	19	17	29	35
<i>Copsychus saularis</i>	Oriental Magpie-Robin	0	0	0	0
<i>Phoenicurus ochruros</i>	Black Redstart	2	1	2	3
<i>Oenanthe isabellina</i>	Isabelline Wheatear	1	4	9	5
<i>Pastor roseus</i>	Rosy Starling	0	0	0	0
<i>Sturnia pagodarum</i>	Brahminy Starling	0	0	1	2
<i>Acridotheres tristis</i>	Common Myna	0	0	0	1
<i>Cimyrus asiaticus</i>	Purple sunbird	4	8	9	12
<i>Nettapus coromandelianus</i>	Cotton Pygmy goose	0	1	8	18
<i>Dendrocygna javanica</i>	Lesser Whistling Duck	8	11	21	19

**Table 2:** Statistical analysis of avifauna of study areas.

Statistical analysis	Point 1	Point 2	Point 3	Point4
Species no.	40	35	57	57
Individual no.	204	275	507	594
Simpson index(D)	0.04	0.031	0.03	0.028
Shannon index (H)	3.38	3.26	3.67	3.68
Evenness	0.91	0.918	0.908	0.910

Our results reveals that avian species that are mainly found in the study area are dependent on protected area with little human disturbance than in the unprotected region mainly due to the better habitat, vegetation composition, better availability of food, better environment for nesting. The research says that the birds use to prefer the area with least pollution, human interference and the area safe from anthropogenic activities. Many studies support the fact that vulnerable species require rich habitat <sup>[11]</sup>. There is the direct

role disturbance and successional processes in structuring avian habitats and community. Slightly disturbed areas have relatively high diversity and dominance of avian species. This result supports the findings of numerous studies around the globe that shows the avian diversity most susceptible to the human disturbance.

**5. Conclusion**

The anthropogenic activities are continuously affecting the Kayalana lake which in turn affecting the natural ecosystem and balance of nature, which is harmful for all the animals occupying that habitat as well as affecting the diversity and distribution of avian species. Changes in the natural habitat and vegetation structure and composition caused by human disturbance in our study area have led to considerable changes in bird abundance, richness and composition.as habitat destruction increases species are predicted to become

extinct. Moreover, the more fragmented a habitat is, the greater is the number of extinctions caused by added destructions [12]. Based on our statistical analysis we can predict the declining diversity of avian fauna in the given study area as compared to the area with the least disturbance. Avian species react rapidly to the anthropogenic activities. It is therefore foremost important to obtain a better understanding of conservation and management of unprotected area. Crucial steps should be taken for conservation of avian species and their habitat and problem should be brought to the eyes of the management. Our study highlights the proper protection of intact ecosystem to maximise the diversity.

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