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Diversity and Conservation of Avian Fauna in Daphar Forest Sanctuary, Mandi Bahauddin, Pakistan

Original Article

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Biodiversity is representative of a healthy ecosystem. Anthropogenic activities, including habitat degradation, hunting, and fragmentation, are major circumstances which results in species extinction. The present study was conducted to explore avian fauna and role of Daphar Forest Sanctuary, Mandi Bahauddin, Pakistan, in its conservation. Study was carried out for 12 months, and 12 visits were made during 1st January 2020 – 31st December 2020. The visits were paused during periods of rain or high wind. Sampling was done by direct count method. A total of 2999 avian population were observed during the study. An overall population was composed of 12 orders, 20 families, 28 genera, and 32 species. Relative Abundance was calculated highest for family Sturnidae, 12.94% (N = 388) of birds, and order Passerine 54.95% (N = 1648). Simpson Diversity index (SDI) value was 0.95, Shannon Weiner Diversity Index value was 3.224 that, showed high diversity of avian fauna. However, evenness was 0.78, which showed an even distribution was found among birds population. It was noticed that Sanctuary faces drastic pollution which results in complications for the native wildlife. It was concluded scientific activities and researches were legalized in the respective wildlife sanctuary so that more information is gathered about the wildlife thriving in these areas.

Keywords: Avian Fauna, Biodiversity, Daphar Forest Sanctuary, Pollution, Poaching

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Authors contributed equally in conducting research and writing manuscript.

INTRODUCTION

Avian biodiversity plays a key role in identifying the health of a native ecosystem [1]. Birds provide their key services as scavengers, pollinators, and insect's predators and play a significant role in agro-ecosystems as some species are insectivorous and act as biological regulator by consuming detrimental insects of crops, and some species also support pollination moreover, birds are seed eater, and in this way, they cause the dispersal of seeds consequently affecting the agricultural sector and human health in a positive manner [2]. Birds may be proving appropriate biological indicators because they are very sensitive towards ecological changes and are highly effective to observe the ecological health [3].

Pakistan occupies lies between 24° and 37° in North and 61° and 75° in East. Wildlife Diversity in Pakistan is distinctive and unique as the country occupies 3 biogeographic realms i.e., Palearctic, Ethiopian, and Oriental. More or less 2/3 of the state is rocky and abrupt distinctions in altitude results in varied biodiversity within small spaces. But numerous natural habitat zones are being altered to make distinct agro-ecosystems for cultivation processes [4]. Rapid growth of population, communities having low literacy rate (35 %), and poverty effects the natural resources and exploits its productivity to meet their basic needs [5].

Reduction and extinction in bird's populations at an alarming level throughout the 21st century may possibly disrupt ecological progressions [6]. Loss of bird's population might reduce the level of pollination and seed dispersal of some plant species that, could lead to overall enhanced extinction rate of plant species and also results in ecosystem collapse [7]. According to the data of IUCN, nearly 12% of avian diversity is under the risk of extinction [8]. Scientific research and education both are playing a significant role in conservation of wildlife species and protection of natural environment [9][10].

A small effort for conserving genetic recourses globally is done through construction of protected areas particularly when the natural resources are being increasingly manipulated [11]. The sites which are concerned with wildlife conservation are designated as Wildlife Sanctuaries (WLS), these sites are perfectly aimed to conserve animal fauna, and all sort of activities such as hunting and shooting is strictly controlled in these sites. Therefore, they are called as reservoirs for conservation of local environment and species [12], [13] and are always a great source of natural resources like fuel, fodder, medicinal plants, edible seed, and fruits [14], along with genetic combination of endangered populations in west Himalaya [15]. Ecological deviation inside a narrow geographical zone makes altitudinal gradients appropriate for inspecting numerous environmental and biogeographical theories [16].

Conservation of the biodiversity is becoming significant issue since the onset of 21st century due to severe challenges like wildlife deterioration, habitat and ecological degradation, ineffective awareness about wildlife importance [17]. Anthropogenic effects result in destruction, collapse, and contamination of natural resources. Lack of effective governance along with over harvesting and poor administrative activities is the basic factors that results in abolishing the diversity [18]. Heterogeneity in a habitat is much more favorable as it carries more diversity and provides ecosystem services more effectively than a homogenous one [19], [20].

A wildlife Sanctuary is an area set aside as an undisturbed breeding ground, primarily for protection of all natural resources to which public access is restricted or regulated. Settlement and grazing by domestic livestock are prohibited in Wildlife Sanctuaries [21]. At present, there are 99 Wildlife Sanctuaries in Pakistan. Daphar wildlife forest sanctuary, also called as Rakh forest, is assigned as the 2nd largest forest of Punjab. Thus, the soil of forest has

some composition of sand and clay, and plantation is irrigated with the river water. The height of trees is diverse, and it varies from 15-30 feet [22].

The present study was designed to explore the avian fauna diversity in Daphar plantation reserved forest. The study highlights the importance of this ignored wildlife sanctuary and to find the major problems and threats to avian species in this study area.

MATERIALS AND METHODS

Study Site

The selected study area was Daphar wildlife forest sanctuary, that is commonly named as Daphar plantation reserved forest. It covers an area of 7135 acres. It is situated at intersection of latitude 32-25'30" degree north, and longitude 73-10'59.98" degree east in Tehsil Malakwal, of district Mandi Bahauddin and is almost 9.6 Km to south course of Pakhowal Railway Station (Figure 1).

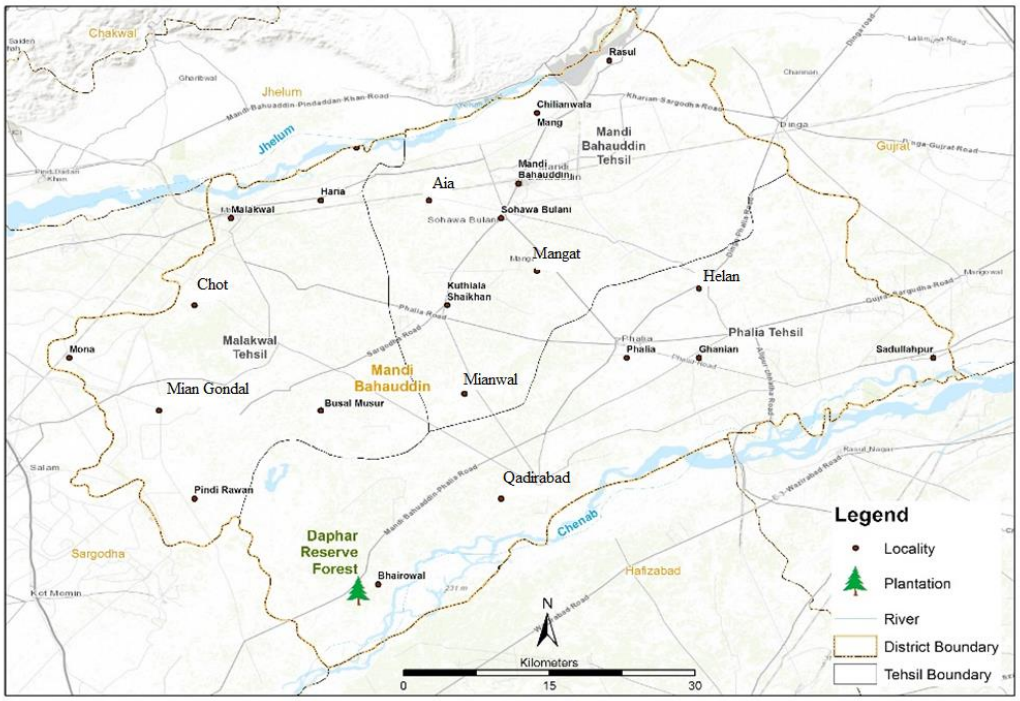

Figure. 1. Location of Daphar Wildlife Forest Sanctuary

Number of Sampling Surveys

Study area Daphar Forest Sanctuary was divided into twelve zones, and it was visited 12 times for the avifauna collection. Each study was carried out at early in the morning, at 5:00 am to 08:00 am, and at evening 3:00 pm to 7:00 pm in summer and at 6:00 am to 09:00 am and at evening 3:00 pm to 6:00 pm in winter. Survey stopped duringrain or high winds. The study was conducted from 1st January 2020 – 31st December 2020 under the natural ecological conditions of district Mandi Bahauddin.

Methodology for Data Collection

Census Method and Direct count method, meeting with local communities and expert opinion of concerned Department was adopted for data collection.

Proposed Analysis of Collected Data

Various sorts of analysis were conducted to establish the diversity index, such as Specie Richness was found as described by Jost (2006) [23].

Simpson Diversity Index (SDI) = **$D = 1 - \sum n\,(n-1) / N\,(N-1)$** was calculated.

n = total number of birds of a particular species

N = the entire number of birds of all species

Shannon-Wiener Index was measured by using formulae $H' = -\sum pi \log pi$.

Evenness was completed using formulae **(Shannon Weiner Diversity Index /ln (log natural) of Total Population)**.

STATISTICAL ANALYSIS

Data was statistically analyzed by using SPSS version 25- and one-way ANOVA was applied to see the significance of avian data.

RESULTS AND DISCUSSION

The study was conducted on twelve distinct sites of Daphar Forest Sanctuary. Each site was visited once in each month to check the **"Diversity and Conservation of Avian Fauna in Daphar Forest Sanctuary"**, Punjab, Pakistan. It was noticed that overall population of 2999 bird species were found in Daphar Forest Sanctuary that belongs to 12 orders, 20 families, 28 genera, and 32 species, and maximum population was recorded among dense forestation in sanctuary. Statistical analysis was carried out by ANOVA, which showed a value of 0.038 ($P > 0.05$), and significant differences were found in different bird species.

Simpson Diversity index **(SDI)** value was calculated along with Shannon Weiner Diversity Index and Evennes; the resulted values werer 0.95, 3.224, and 0.78, respectively (Table 1).

Table 1. Diversity Indexes of Avian Fauna

Aves	Diversity Indexes
Taxa_S	32
Individuals	2999
Dominance_D	0.04962
Simpson_1-D	0.9504
Shannon_H	3.224
Evenness_e^H/S	0.7853

Species Abundance

It was noticed that during the study, 5 species were recorded high in the study besides their counts and relative abundance these were *Corvus splendens* (Passeriformes: corvidae) N=296 (R.A, 9.8699*), Acridotheras tristis* (Passeriformes: Stumidae) N=278 (R.A, 9.2697), *Passer domesticus* (Passeriformes: Passeridae) N=250 (R.A, 8.3361), *Dicrurus macrocerus* (Passeriformes: Dicuridae), N=208 (R.A, 6.9356), *Gymnoric xanthocollis* (Passeriformes: Passeridae), N=181 (R.A, 6.0353) and average value among 5 most observed birds species were 242.6. Least counted species were *Spilopelia senegalensis* (Columbiformes: Columbidae), N=24 (R.A, 0.8002), *Athene brama* (Strigiformes: Striglde), N=31 (R.A, 1.0336), *Accipiter nisus* (Accipitriformes: Accipitridae), N=32 (R.A 1.0670*), Francolinus francolinus* (Galliformes: Phasinaidae), N=33 (R.A, 1.1003), *Columba livia* (Columbiformes: Columbidae), N=36 (R.A 1.2004) and the average value for the most frequent observed species was 31.2 (Table 2).

Relative abundance of Avian Fauna upto Family and Order Level

20 bird's families were observed among which highest R.A was calculated for family Sturnidae 12.94% (N = 388) succeeded by Pycnonotidae 11.07% (N = 332). However, minimum was calculated for families including Strigldae, Upupidae, and Pycnonotidae. 12 orders were documented and highest R.A was recognized for order Passerine 54.95% (N = 1648) succeeded by Cuculiformes 9.87% (N = 296) and Charadriiformes7.20% (N = 216). However, minimum R.A was measured for orders Bucerotiformes, Strigiformes, Piciformes, Columbiformes, Psittaciformes, and Pelecaniformes (Table 2).

It was revealed that Daphar wildlife sanctuary faces drastic pollution, which results in complications for the native wildlife. Adil et.al [24] also reported that the people who visited these areas polluted the water resources, which is one of biggest human interruption that causes decrease in diversity of this sanctury. Moreover, an increased level of toxic chemicals in various environmental media such as air, water, soil, and non-degradable wastage from urban, agricultural, and rural areas are considered as important factor which affects the forest plantation [24]. Similarly, hunting, human-driven fragmentation, habitat destruction, poaching, and chopping down forests are among biggest drivers of degradation of species. Poaching was perhaps one of the biggest threats to wildlife, particularly to few species, especially the ones that were almost endangered and heavily poached for their economic value [25]–[27].

Table 2. Avian Fauna Diversity and Relative Abundance in Daphar Forest Wildlife Sanctuary

Order	Family	Common Name	Scientific Name	IUCN Status	N	R.A
Accipitriformes	Accipitridae	Marsh Harier	*Circus aeruginosus*	LC	40	1.3337
Accipitriformes	Accipitridae	Black Kite	*Milvus migrans*	LC	54	1.8006
Accipitriformes	Accipitridae	Indian sparrow hawk	*Accipiter nisus*	LC	32	1.0670
Bucerotiformes	Upupidae	Hoopoe	*Upupa epops*	LC	46	1.5338
Charadriiformes	Charadridae	Red Walted Lapwing	*Vanellus indicus*	LC	83	2.7675
Columbiformes	Columbidae	Eurasian collared dove	*Streptopelia decaocto*	LC	63	2.1007
Columbiformes	Columbidae	Totrofakhta	*Spilopelia senegalensis*	LC	24	0.8002
Columbiformes	Columbidae	spotted Dove	*Spilopelia chinensis*	LC	46	1.5338
Columbiformes	Columbidae	Rock dove	*Columba livia*	LC	36	1.2004
Cuculiformes	Cuculidae	Great coucal	*Centropus sinensis*	LC	64	2.1340
Cuculiformes	Cuculidae	Asian koel	*Eudynamys scolopaceus*	LC	75	2.5008
Cuculiformes	Cuculidae	cuckoo bird	*Cuculus canorus*	LC	59	1.9673
Galliformes	Phasinaidae	Black francolin	*Francolinus francolinus*	LC	33	1.1003
Galliformes	Phasinaidae	Grey francolin	*Francolinus pondierianus*	LC	72	2.4008
Galliformes	Phasinaidae	Common Quail	*Coturnix coturnix*	LC	57	1.9006
Gruiformes	Rallaidae	White Breasted Water hen	*Amaurornis phoenicurus*	LC	49	1.6338

Passerine	Pycnonotidae	Red Vented Bulbul	*Pycnonotus cafer*	LC	72	2.4008
Passeriformes	Leiothrichidae	Jungle Babbler	*Argya striata*	LC	77	2.5677
Passeriformes	Sturnidae	Common Myna	*Acridotheras tristis*	LC	278	9.2697
Passeriformes	Pycnonotidae	Yellow vented bulbul	*Pycnonotus goiavier*	LC	110	3.6678
Passeriformes	Pycnonotidae	White cheeked bulbul	*Pycnonotus leucotis*	LC	82	2.7342
Passeriformes	Passeridae	House sparrow	*Passer domesticus*	LC	250	8.3361
Passeriformes	Passeridae	Yellow throated sparrow	*Gymnoric xanthocollis*	LC	181	6.0353
Passeriformes	Dicuridae	Black Drongo	*Dicrurus macrocerus*	LC	208	6.9356
Passeriformes	Corvidae	House Crow	*Corvus splendens*	LC	296	9.8699
Passeriformes	Phylloscopidae	Common chiffchaff	*Phylloscopus collybita*	LC	94	3.1343
Passeriformes	Estrildidae	Indian silverbill	*Euodice malabarica*	LC	56	1.8672
Pelecaniformes	Ardeidae	Intermediate Egret	*Ardea intermedia*	LC	158	5.2684
Pelecaniformes	Ardeidae	Pond Heron	*Ardeola grayii*	LC	114	3.8012
Piciformes	Picidae	Scaly Bellied woodpecker	*Picus squamatus*	LC	50	1.6672
Psittaciformes	Psittacidae	Rose Ringed Parakeet	*Psittacula krameri*	LC	109	3.6345
Strigiformes	Strigldae	Spotted Little owl	*Athene brama*	LC	31	1.0336

CONCLUSION

Overall, a very lesser number of species was recorded in Daphar forest Wildlife Sanctuary. Although the number of species can be enhanced by fulfilling the objective that were considered to establish Daphar forest Wildlife Sanctuary. The purpose was to protect particular species or group of species by providing space for reproduction and to protect them from extinction. However, study revealed that Daphar wildlife sanctuary shared a border with native community and it faces drastic pollution causing complications for the native wildlife. Moreover, hunting, habitat destruction, illegal killing or hunting, and cutting down of forests are different factors for the loss of few species, particularly those which are endangered and have high economic value. So, it was concluded that there is a need to enhance the importance of such protected areas by research to conserve wild bird species.

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