

COMPARISON OF BIODIVERSITY OF BIRDS IN RURAL AND URBAN AREAS OF ISLAMABAD, THE CAPITAL OF PAKISTAN

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ABSTRACT

In the present study, the diversity of birds was calculated in the sub urban areas of Islamabad like Humuk, Ara, Burji and Saraieen (relatively more disturbed area), Talhar, Gokina and Saidpur Village (relatively undisturbed areas). All the selected areas were visited for three times in each season and vantage point technique and line transect of variable size were used. At Humuk and its adjacent areas, 1269 birds belonging to 30 species, 8 orders and 17 families were observed. At Humuk, Ara, Saraieen and Burji, Shanans-Weiner diversity index (H) was calculated as 3.05 and evenness was 0.89. While at Talhar, Gokina and Saidpur although a lot of development had happened but as the thick vegetation was not disturbed and a lot of patches were still intact that support the bird life, 1353 birds were observed here belonging to 36 species, 10 orders and 22 families. At these three highly thick vegetated areas, the Shanans-Weiner index (H) was 3.23 and the evenness was 0.90. In conclusion, the bird diversity in these areas is due to the Sawan River, so the quality of water must be ensured to support life. These areas are proving to be a second home land for the migratory birds.

Key words: Biodiversity, Distribution, Relative abundance, Diversity index, Evenness, Maximum number

INTRODUCTION

Birds are the beauty of the nature. Beside a scientist, even a common man is really interested to know about the birds. Most people want to know that how the birds feed, how they breed, how they make their homes, how they help each other, how they fight with predators and how certain factors affect the survival of these birds. To know about the birds and have a survey on them is really an interesting work. If we need to have an estimate of the population of any species, then surveys are required. The surveys may be conducted due to other reasons. The reasons may be just to find out the living member so for new particular species, or the basic information of a particular area supporting the survival of that species. One person can also get an idea that what measurements can be taken for the safety of that particular species (Bibby and Burges, 1992).

Monitoring can be called a step of survey technique. In monitoring, we specifically focus on a particular species and then find out the population trend of that particular species. By estimating the trend of a population, we get an idea that whether the species is flourishing or being disturbed. So by having a survey, we can achieve this indirect purpose too. By finding out the number of a particular species, one can point out that which species needs more conservation (Carter *et al.*, 2000; Gregory *et al.*, 2002).

Birds are considered to be the best barometers and indicators of a particular environment. The population of birds will give an idea about the environmental conditions there. Greater the number of bird species in an area, greater will be the tree number and greater the tree number better will be the living conditions. So bird survey also gives an idea about the population of trees there. The greater number of birds also depicts that particular area will be very much pollution free (Gilbert *et al.*, 1998).

The long term persistence and composition of many birds population depends upon the precise habitat requirements, abundance and dispersal strategies. The diversity of birds not only depends upon the size and structure of the land patch but also the surroundings of that patch have a major effect. The heterogeneity of natural environment is considered to be directly proportional to the diversity. The urban development has reduced the diversity of birds due to the transformation of natural environment into agricultural, industrial and commercial area. Thus, urban development has played a very important role in reducing the natural habitat area (Foster, 1996)

Birds play a major role in their ecosystem. They are involved in the seed dispersal, pollination and in breaking seed dormancy. They are also a very good indicator confirming the state of environment e.g. wetland, desert or forest. Birds during migration also play a role in dispersing the spore (Niemi *et al.*, 1997).

The urban ecosystems are considered the prime location for the distribution of invasive species. It has been found that human activities, species introduction and habitat fragmentation supported the invasive species and did

not favor the native one (Bigirimana *et al.*, 2012; Zhang *et al.*, 2011). Biodiversity is not evenly distributed in the world, some areas are rich and some are deficient. Mountain ecosystem proves a hotspot for the bird diversity. Infact, the bird diversity decreases with increase in the elevation.

The local environmental factors, site productivity, vegetation, competition and habitat structure directly or indirectly affect the diversity of birds (Begon *et al.*, 1990). The heterogeneity of environment plays an important role in the biodiversity of animals. Although a lot of efforts have been taken to sustain the natural habitat but conversion of natural habitat into pastures, industrial zone, agricultural area and housings chemes has severely affected biodiversity (Foster, 1996).

The Humuk, Ara, Burji, Saraian, Talhar, Gokina, Saidpur village, new developing housing schemes and orchard around the roads are some of the important sub-urban areas of Islamabad. Similarly, natural patches of vegetation among different new housing schemes also provide refuge to variety of bird species. Such areas were focused with following objectives:

- a) To find out the diversity of birds in sub-urban areas of Islamabad
- b) To examine the seasonal variations of the birds species

MATERIALS AND METHODS

STUDYSITE

Islamabad is the study area, the capital of Pakistan established on 1962 (33°43'N and 73° 04'E). In 1998, the population of Islamabad was 529,180. August is the most humid month for Islamabad. The highest temperature is 42°C (108 °F) and lowest temperature measured in Islamabad is 17 °C (63 °F). The average rainfall is 105.4/ml. *Broussonetia papyrifera* *Parthenium hysterophorus*, *Cannabis sativa* and *Ficus religiosa* are the most abundant vegetation. The robins, sparrows, kites, crows, larks are the most abundant birds in Islamabad and its surroundings Roberts (1991).

EXPERIMENTALDESIGN

Three techniques were used for data collection depending upon the survey area. Point count technique was used in hilly patches for accurate counting of birds by standing at a single place and just counting the birds. The line transect technique was used in plain areas by just moving straight and counting all the birds being seen along the selected path. The vintage point technique was also used in the hilly areas by hiding under a cave and observing the birds.

DATA COLLECTION

The suburban areas were focused for the present study. The left over patches of natural vegetation were identified like around Islamabad Highway, Humuk, Ara, Burji, Saraian, Talhar, Gokina, Saidpur village, new developing housing schemes and orchard around the roads. At the selected site, the birds were observed through walking transacts of variable size, point count method and vintage point technique by Bibby and Burges, (1999), Sutherland, (1996) from dawn to dusk. In hilly patches vantage points at suitable and accessible sites were selected to observe the species with the help of spotting scope (15×60) and binocular (12×50). The birds were identified by following Roberts (1991), Mirza and Wasiq (2007) and Grimm *et al.* (2008). The care was taken that sun should be on the back, so that the plumage patterns of the birds could be distinguished. Data were recorded on pre-designed sheets.

STATISTICAL ANALYSIS

The data was analyzed by using Shannon-wiener index (Shannon and Weaver, 1963) to calculate the diversity index:

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

$$H = H/H_{\max}$$

Whereas,

H' = Diversity Index

P_i =Relative abundance

H=Evenness

RESULTS AND DISCUSSION

To measure accurately the population size of a species in a particular area, and then a population index is insufficient for this purpose. If, for example, we want to measure the global population of the Raso Lark

Alaudarazae on its tiny island home or the numbers of Sharpe's Long claw *Macronyx sharpei*, particular grassland, then we must consider a method that yields an absolute measure of population size and where error can also be estimated. If, however we are not interested in measuring population size per hectare, only whether a population is increasing, decreasing or stable then a population index is enough to meet our objectives (Zheng *et al.*, 2005).

Bird diversity is very low in the urban areas due to some common factors, which directly or indirectly affect it. The present study will explore the diversity and seasonal variations in those areas where no previous record is available. As it is very obvious that in the urban areas birds get very less chances to have nesting or brooding sites (Emlen, 1974), the urban areas always proved the disturbed areas (Donald 1921) worked on the prey of birds in the Punjab region. The birds of Jhelum and Jhang districts were observed and their diversity was recorded by Whistler (1914) while birds of Salt Range were explored by the Waite (1948). Ali and Ripley (1974) covered the areas adjacent to Gujranwala for providing a record of the bird species found there.

In the winter season, the migratory birds generally migrate from Central Asia and Europe to the wetlands of Pakistan. A lot of these bird species pass that particular seasonal period in Chitral and in its adjacent areas (Ali, 2005). Birds and human being have a prehistoric relationship since the beginning of mankind. The birds always fascinate human and human kept them for this fascination (Bonney and Ronald, 2004).

At Humuk, Ara, Burji and Saraian, a total of 30 species were counted during the whole study period. The most common bird species, which were found, were Little Swift, House Crows, Myna, Larks and Common House Sparrows. The total number of that bird count at morning and evening visits is given in the table. The Shannon-Weiner diversity index was calculated and was given in the Table 1. At Humuk, Ara, Burji and Saraian different birds of 8 orders and 7 families were observed. The bulbuls, especially the red vented and black bulbul were observed resting on the tree patches along the main road side. The white cheeked bulbul were seen moving here and there even inside the houses. It was told by the local community that once a lot of doves were found in this area but due to a lot of disturbance those doves shifted. A lot of water birds are also permanently residing there. A lot of thick vegetation plots are still in the Humuk, which supports the bird species.

At Humuk and it's by areas, a lot of construction is under process. It is the industrial area. Sihala slaughter house is nearer to Humuk that's why a lot of kites and crows were seen there. The number of Little Swift is increasing day by day in the areas where old bridges are present or where agricultural land is available. Terns were also observed at the bank of Sawan River. The wild pigeon species was observed having nest in the over-head bridge. Once the White-cheeked Bulbul was very abundant but now due to change in the weather pattern and deforestation their number has decreased. Humuk is an industrial area. The industries of flour, cement and tiles are flourishing there. Once the areas were just like a forest with almost no human community but now these areas are densely populated and for their easy living all the facilities are provided to them. The heavy traffic passes through Kahuta Road, which disturbs the bird's life. The road also caused the fragmentation of habitat, which ultimately affects the bird diversity. Although a lot of model houses are being constructed there but still a lot of bird diversity is found both in winter and summer season.

It is a very good census that the biodiversity loss is directly or indirectly driven by the human activities such as introduction of invasive species, over exploitation of native species, climate changes and fragmentation of habitat (Sala *et al.*, 2000). All these stressors are very lethal and can lead to extinction of any species.

Talhar like areas are the gift of God. These are the natural areas remained almost undisturbed. Although, in the past this area was very backward and the Government paid no attention to raise the status of this beautiful natural resort but in the last two decade a lot of investment has been done to groom this area. At this time, a fully paved road is available for easy travelling but a lot of work has to be done to attract the visitors and to generate the income. As compared to Humuk there is still a natural environment. The White Cheek Bulbul, Black Drongo, Carrion Crow, Common Manya and House Sparrows are very common. The Chukar Partridge is also reported in this area by the local community. Three visits were conducted in this area in the morning and in the evening. Point Count, Line Transect both method and Vintage Point were used according to situation.

Talhar, Gokina and on the mountains of Saidpur a total of 36 species, 10 orders and 22 families of birds were observed. It means that a lot of bird species just prefer this area as a suitable resort for passing the harsh conditions of their home land. The Pine trees are the dominant plant species in these areas and hills are covered with the thick bushy vegetation. The presence of a lot of water springs indicates that the nature is very kind on the local community as well as on the birds. The data is shown in the Table 2

Talhar, Gokina and Saidpur village have common boundaries. Saidpur has now become the Model village. In the past, a lot of mango orchards were there and a great variety of Parrots was there but now the situation has changed. The mango orchards are reduced, a lot of area is owned by the army and a lot of developing projects are going on. The Government of Pakistan has decided to keep these areas intact and to conserve the heritage, that's why new constructions are now banned and Capital Developmental Authority is working well.

Table 1. Relative Abundance and Diversity Index at Humuk, Ara, Saraien and Burji.

Sr. No	Common Name	Scientific Name	Maximum number (n)	Distribution	Relative abundance (Pi)	In Pi	Pi (InPi)
1	Black- belied Tern	<i>Sterna acuticauda</i>	21	Resident	0.016548	-4.10	-0.068
2	Common Gul	<i>Larus canus</i>	5	Winter visitor	0.00394	-5.53	-0.022
3	Brown wingedTern	<i>Sterna anaethetus</i>	25	Summer visitor	0.019701	-3.92	-0.077
4	BlackStork	<i>Ciconia nigra</i>	6	Winter visitor	0.004728	-5.35	-0.025
5	Blue Rock Pigeon	<i>Columba livia</i>	19	Resident	0.014972	-4.20	-0.063
6	Eastern Stock Pigeon	<i>Columba eversmanni</i>	13	Resident	0.010244	-4.58	-0.047
7	IndianRing Dove	<i>Streptopelia decaocto</i>	31	Resident	0.024429	-4.58	-0.047
8	Common Crow Pheasant	<i>Centropus sinensis</i>	6	Winter visitor	0.004728	-5.35	-0.025
9	LittleSwift	<i>Apus affinis</i>	113	Resident	0.089046	-2.41	-0.215
10	Indus Sand Rock	<i>Calandrella raytal</i>	23	Resident	0.018125	-4.01	-0.073
11	Collard sand Martin	<i>Riparia benghalense</i>	25	Resident	0.019701	-3.92	-0.077
12	Brown Rock-chat	<i>Cercomela fusca</i>	17	Winter visitor	0.013396	-4.31	-0.058
13	Common Wood Shrike	<i>Tephrodornis pondicerianus</i>	19	Resident	0.014972	-4.20	-0.063
14	Pied Crusted Cuckoo	<i>Clamator jacobinus</i>	7	Summer visitor	0.005516	-5.20	-0.029
15	White Cheeked Bulbul	<i>Pycnonotus leucogenys</i>	64	Resident	0.050433	-2.98	-0.151
16	Red Vented Bulbul	<i>Pycnonotus cafer</i>	73	Resident	0.057526	-2.85	-0.164
17	Black Bulbul	<i>Hypsipetes madagascariensis</i>	47	Winter visitor	0.037037	-3.29	-0.122
18	Eurasian Wren	<i>Troglodytes troglodytes</i>	31	Resident	0.024429	-3.71	-0.091
19	Black Drongo	<i>Dicrurus macrocercus</i>	17	Resident	0.013396	-4.31	-0.058
20	Indian Tree Pie	<i>Dendrocitta vagabunda</i>	24	Resident	0.018913	-3.96	-0.075
21	House Crow	<i>Corvus splendens</i>	135	Resident	0.106383	-2.24	-0.238
22	Carrion Crow	<i>Corvus corone</i>	54	Winter visitor	0.042553	-3.15	-0.134
23	Common Myna	<i>Acredotheres tristis</i>	123	Resident	0.096927	-2.33	-0.226
24	Bank Myna	<i>Acridotheres ginginianus</i>	95	Resident	0.074862	-2.59	-0.194
25	Jungle Myna	<i>Acridotheres fuscus</i>	47	Resident	0.037037	-3.28	-0.122
26	House sparrow	<i>Passer domesticus</i>	123	Resident	0.096927	-2.33	-0.226
27	Black kite	<i>Milvus migrans</i>	23	Resident	0.018125	-4.01	-0.073
28	Crested Bunting	<i>Melophus lathamii</i>	46	Resident	0.036249	-3.31	-0.12
29	Grey headed Flycatcher Warbler	<i>Seicercus xanthoschistos</i>	17	-----	0.013396	-4.31	-0.058
30	Indian Magpie Robin	<i>Copsychus saularis</i>	20	Resident	0.01576	-4.15	-0.065
TOTAL CAPTURED			1269	Shannon Weiner Diversity Index (H)			3.05
						H_{max}	3.40
						Evenness	0.89

Data was analyzed by using Shannon-wiener index

Table 2. Relative Abundance and Diversity Index at Talhar, Saidpur and Gokina.

Sr. No	Common Name	Scientific Name	Maximum number (n)	Distribution	Relative abundance (Pi)	In Pi	Pi (InPi)
1	Black- belied Tern	<i>Sterna acuticauda</i>	8	Summer visitor	0.00591	-5.13	-0.03
2	Blue Rock Pigeon	<i>Columba livia</i>	17	Resident	0.01256	-4.37	-0.055
3	Spotted Dove	<i>Streptopelia chinensis</i>	21	Resident	0.01552	-4.16	-0.065
4	Little Swift	<i>Apus affinis</i>	14	Resident	0.01035	-4.57	0.047
5	Eurasian Common KIngfisher	<i>Alcedo athis</i>	17	Resident	0.01256	-4.37	0.055
6	Orange Flanked Bush robin	<i>Tersiger cyanurus</i>	31	Summer visitor	0.022291	-3.77	-0.087
7	Black Drongo	<i>Dicurus leucophaeus</i>	31	Resident	0.02291	-3.77	-0.087
8	Ashy Drongo	<i>Dicurus leucophaeus</i>	35	Resident	0.02587	-3.65	-0.095
9	Lanceolated Jay	<i>Garrulus lanceolatus</i>	41	Resident	0.0303	-3.49	-0.106
10	Yellow-Billed Blue Magpie	<i>Urocissa flavirostris</i>	15	Resident	0.01109	-4.50	-0.05
11	Grey Tree Pie	<i>Dendrocitta formosae</i>	21	Resident	0.01552	-4.16	-0.065
12	House Crow	<i>Corvus Splenders</i>	125	Resident	0.09239	-2.38	-0.22
13	Carrion Crow	<i>Corvus Splenders</i>	110	Resident	0.0813	-2.50	-0.204
14	Himalayan Jungle Crow	<i>Corvus macrohynchos</i>	54	Resident	0.03991	-3.22	-0.129
15	Common Myna	<i>Acredo thestristis</i>	120	Resident	0.08869	-2.42	-0.215
16	Jungle Myna	<i>Acridotheres fuscus</i>	49	Resident	0.03622	-3.31	-0.12
17	House Sparrow	<i>Passer domesticus</i>	121	Resident	0.08943	-2.41	-0.216
18	Himalayan Green-Finch	<i>Carduelis spinoides</i>	24	Resident	0.01774	-4.03	-0.072
19	Verditer Flycathcher	<i>Muscica pathalassina</i>	15	Resident	0.01109	-4.50	-0.05
20	Dark-sided Flycathcher	<i>Muscicapa sibirica</i>	27	Summer Visitor	0.01996	-3.91	-0.078
21	Kaleej Pheasant	<i>Lophura leucomelana</i>	7	Resident	0.00517	-5.26	-0.027
22	Slaty-headed Parkeet	<i>Psittacula</i>	13	Resident	0.00961	-4.64	-0.045
23	Himalayan Cuckoo	<i>Cuculus Staturatus</i>	14	Summer Visitor	0.01035	-4.57	-0.047
24	Rufous-Bellied Pied woodpecker	<i>Dendrocopos Hyperythrus</i>	7	Resident	0.00517	-5.26	-0.027
25	Fairy Pitta	<i>Pitta brachyuran</i>	11	Summer Visitor	0.00813	-4.81	-0.039
26	Brown Rock Pipit	<i>Anthus Similis</i>	21	Resident	0.01552	-4.16	-0.065
27	White-cheeked Bulbul	<i>Pycnonotus leucogenys</i>	121	Resident	0.08943	-2.41	-0.216
28	Red-Vented Bulbul	<i>Pycnonotus cafer</i>	67	Resident	0.04952	-3.00	-0.149
29	Black Bulbul	<i>Hypsipetes madagascariensis</i>	41	Summer Visitor	0.0303	-3.49	-0.106
30	Brown Dipper	<i>Cinclus pallasii</i>	21	Resident	0.01552	-4.16	-0.065
31	Spotted Forktail	<i>Enicurus maculates</i>	29	Resident	0.02143	-3.84	-0.082
32	Plae Strong-Footed Bush-Warbler	<i>Cettia fortipes</i>	31	Summer visitor	0.02291	-3.77	-0.087
33	Blue Throated Flycathcher	<i>Cyornis Rubeculoides</i>	21	Summer Visitor	0.01552	-4.16	-0.065
34	Asian Paradise Flycathcher	<i>Terpsiphone paradise</i>	13	Summer Visitor	0.00961	-4.64	-0.045

35	Pecking Robin	<i>Leiothrix lutea</i>	21	Resident	0.01552	-4.16	-0.065
36	Water Rail	<i>Rallus aquaticus</i>	19	Summer Visitor	0.01404	-4.26	-0.06
TOTAL CAPTURED			1353	Shannon Weiner Diversity Index (H)			3.23
				H_{max}			3.58
				Evenness			0.90

Data was analyzed by using Shannon-wiener index

The one worst thing that was observed was the dump of waste in the running spring water which is likely to affect the health of the local community as well as the bird diversity there. The lush green hills are surrounding the whole village, which provide suitable condition for the fauna there. Although a lot of disturbances happened in Saidpur to make it a Model village but due to the presence of lush green hills a lot of bird species are still surviving.

The hills of Gokina and Talhar sub urban areas are almost totally undisturbed so offering a lot of rare bird species to have a nest there. These lush green hills provide the best environment and a very supportive habitat for these bird species. The white cheeked bulbuls are common in these regions. The Black Drongo is also very common being observed while sitting on the electric wires. The bird of prey is scarce in the area and it reduces the predation pressure on small bird species. The weather also suit the birds that is why the local community reported that Magpie species were not found there in the past but now they are very common in number. The Magpies are so quick in travelling from one tree to another that taking a snap shot becomes impossible. The collared birds like Gold finch and Orange flanked bush robin were observed along the water body in the bushes.

Now a day, the population of birds has severely declined worldwide (Birdlife International, 2007). The major threats, which directly effects the bird diversity are the overhunting, habitat destruction, accidental mortality due to bio geographical changes, catching of aquatic birds, pollution in water (oil spills or industrial waste deposit), use of pesticides and the competition between the native and invasive species (Blackburn *et al.*, 2004).

Pakistan has a pan tropic variety of environment and birds generally love and prefer to live in these types of regions. The previous data showed that more than 650 species of bird are found in three zoo geographical zones (Oriental, Pale arctic and Ethiopian region) and it is a very unique case (Grimmett *et al.*, 2001; Mirza and Wasiq, 2007).

It has been observed that protected or conserved areas always provided a room for flourishing the biodiversity especially avian diversity. Pakistan has 235 protected or conserved sites including 24 National parks, Ninety nine wildlife sanctuaries, 100 game reserves and 14 un-classified areas (Khan 2004). The distinctive color pattern and the changing behavior of birds provide us a clear view of the nature and their natural habitat among of all other fauna there. The species richness data of an area give us a clear view of the ecosystem. The bird species, which prefer to live in the scrub habitat are severely affected by the deforestation followed by the urbanization (Mehboob *et al.*, 2013).

CONCLUSION

The present study revealed that the Little Swift, Red-Vented Bulbul, Common Myna, Common Crow and Carrion Crow were the most common birds of these areas. On the other hand, Common Crow Pheasant, Common Gull, Black Stork and Pied-Crusted Cuckoo were relatively rare bird species. It is also revealed that the Common Gull, Black Stork, Common Crow Pheasant, Brown Rock-chat, Black Bulbul and Carrion Crow were the winter visitors while Brown winged Tern, Pied Crusted Cuckoo were the summer visitor of Sawan area. At this location, the bird diversity was due to the Sawan River, so the quality of water must be ensured to support life. A lot of dung was disposed off near the bank of Sawan River, which was really annoying for any responsible citizen. A lot of developing housing schemes and industrial set up was being in the process, which did not allow the birds to make some permanent nesting.

The White Cheeked Bulbul, Black Drongo, Red-Vented Bulbul, Orange Flanked Bush Robin, Common Crow and Carrion Crow were the most common species while Black Bellied Tern and Kaleej Pheasant were rare ones. The Little Swift were also very less in number. The Black-bellied Tern, Orange flanked Bush Robin, Verditer Flycatcher, Dark-sided Flycatcher, Himalayan Cuckoo, Fairy Pitta, Black Bulbul, Pale Strong-footed Bush-Warbler, Blue-throated Flycatcher, Asian Paradise Flycatcher and Water Rail were the summer visitor while no winter visitor bird was observed except the resident birds, due to severe cold weather. So these areas were proving to be a second home land for the migratory birds. There is need that the process of deforestation should be minimized to conserve the existing bird species.

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