



Research Article

COMMUNITY STRUCTURE OF BIRDS, RELATIVE ABUNDANCE AND HABITAT USE ALONG WITH SPECIES DIVERSITY IN LESSER HIMALAYAS OF JAMMU, JAMMU AND KASHMIR

***Ajaz Ahmed Wani**

Department of Zoology, Government Degree College, Doda -182201, Jammu and Kashmir, India.

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ABSTRACT

The present study dealt with the diversity, resident/migratory status, abundance, diversity indices and habitat used by the bird communities within five different habitats Cultivated Area (CA), Coniferous Forests (CF), Mixed Deciduous Forests (MDF) scrubby areas (SA) and Urban Areas (UA) of Udhampur of Jammu and Kashmir. During study a total of 3884 birds were counted belonging to 66 species, 11 orders and 27 families with annual abundance 946, 287, 928, 819 and 904 at CA, CF, MDF, SA and UA respectively. Mixed Deciduous forests were found to support maximum number of bird species (58) because of food and nesting sites availability. Order Passeriformes dominated among the four bird communities with 37 species. Shannon weaver index, Marglef richness Index and Reciprocal Simpson Index were found maximum at Mixed Deciduous Forest (MDE). Simpson diversity index was found maximum at Urban areas. Cultivated area and Scrubby Area were found more similar with highest value of Sorenson's Quotient of similarity (Q/S) (86.95%). The dominant species of CA, MDF, CF, SA and UA were House Sparrow, White-rumped Vulture, White-Cheeked Bulbul, Indian Blue Rock Pigeon and Common Myna respectively. 80.33 % of species were resident, 3.03% were winter migrant and 13.63% were summer migrant. Of the total 66 species reported, 51.51% were insectivorous, 22.72% carnivorous, 12.12% grainivorous, 7.5% omnivorous, 4.5% frugivorous and 1.5% bark feeders.

Keywords: Udhampur, Diversity, Avifauna, Mixed Deciduous Forests, Scrubby area, Bird Community.

INTRODUCTION

Indian subcontinent is known for diverse and rich bird species whose taxonomy, distribution and their general habitat characteristics are well documented in India (Ali & Ripley, 1983; Jerdon, 1862; Ripley, 1952). Bird community evaluation has become an important tool in biodiversity conservation and for identifying conservation actions in areas of high human pressure (Kremen, 1992; Shafiq *et al.*, 1997). Bird communities have been studied fairly well both in temperate and tropical forests (Blake, 2007; Latta *et al.*, 2003; MacArthur & MacArthur, 1961; Terborgh *et al.*, 1990; Thiollay, 1994; Wiens, 1989; Willson & Comet, 1996). However, only a very little is known about bird community structure and their dynamics in India (Acharya, 2008; Chettri *et al.*, 2001; Daniels, 1989; Das, 2008; Javed, 1996; Jayson & Mathew, 2002; Johnsingh & Joshua, 1994; Khah *et al.*, 2012; Khan *et al.*, 1993; Price *et al.*, 2003;

Raman *et al.*, 1998; Shafiq *et al.*, 1997; Rajan Singh *et al.*, 2013a; Sultana *et al.*, 2007; Sultana & Khan, 1999; Sultana & Khan, 2000). Large scale habitat changes are occurring globally for fulfilling human needs that have caused habitat destruction, fragmentation and degradation, so there is necessity for assessment on the impacts of such change on birds (Khan *et al.*, 1993). Understanding the diversity and structure of bird communities is essential to delineate the importance of regional or local landscapes for avian conservation (Kattan & Franco, 2004). Determinations of bird population in different habitats are central to understanding the community structure and niche relationships, as well as for intelligent management of populations. Moreover seasonal monitoring is equally important to trace the dynamic movement of birds in such habitats (Green & Catterall, 1998).

*Corresponding Author: Dr. Ajaz Ahmed Wani, Sr. Assistant Professor and Head, Department of Zoology, Government Degree College, Doda -182201, Jammu and Kashmir, India, Email: aahilajaz@gmail.com, Mobile: +91 9797588390

MATERIALS AND METHOD

Study area

The present study was conducted in District Udhampur of Jammu and Kashmir, which is a part of the Northwest Lower Himalayas (Figure 1). The geographical location of the town Udhampur lies between 32° 55' 08" N and 75° 07' 52" E with an elevation is 745 m from mean sea level. The climate of the study area is sub tropical and the temperature

ranges between 40°C during summer while in winter drops up to 22°C or even sometimes to 0°C with annual rainfall is 130 cm mainly in monsoons and winters due to Western disturbances. However due to changing climate patterns snowfall has been experienced in some years. Heavy hailstorms with piles of hail can be experienced in February and March of 2012. The forest is of temperate type. The pre-dominant tree species comprises of *Pinus roxburghii*, *Cedrus deodara* and *Quercus* sps. Mixed deciduous forests and scrubby areas are also found.



Figure 1. Map showing Study Area (Tehsil Udhampur).

Methodology

Variable width line transects method adopted by Burnham *et al.*, (1980) was used in which observer walks through a fixed path counting the birds seen or heard on both sides of the path. Line Transect Method and Visual Count Method were applied for the record of avian diversity. Census was carried out twice in a month starting from April 2011 to April 2012. During the census a distance of 4 km was covered with a fixed duration of 120 minutes, thus covering 2 km/hour and this census was maintained throughout census. The transect were selected of the representative habitats of the area namely Scrubby Area, Mixed Deciduous Forest, Coniferous Forest, Cultivated Areas and Urban areas. 24 samples of line transects were collected from the study area during 12 months period. In order to maintain uniformity, all surveys were conducted from 6:30 am to 10:30 am in the morning and 4:30 pm to 6:30 pm in the evening during summer and 7:30 am to 11:30 am in the morning and 3:30 pm to 5:30 pm in the evening during winter. Binoculars (Bushnell 750 USA made) were used to record the observation from a distance to avoid any disturbance to the birds and photography was done by making use of Cannon T-70 camera with 210 mm and 300 mm lens. Whenever a bird was spotted, it was identified and details like number of birds and habitat were noted. The birds were identified with the help of colourful plates of (Ali & Ripley, 1983; Grimmett *et al.*, 2016). For recording the abundance of the avifauna during the survey,

the terminology used by Ahmed & Sahi, (2005) was applied.

C = common: means it can be invariably be seen in that habitat where it occurs with the proviso of course that the reason is also appropriate.

F= Frequent: means that visiting appropriate habitat it will not be seen or heard invariably, perhaps only in one visit out of three.

O= Occasional: means seen or heard only in one visit out of six.

R= rare: means even less likelihood of occurrence

The five habitats surveyed were:

1. Scrub forest Habitat (SF)
2. Deciduous forest habitat (DF)
3. Coniferous Forest Habitat (CF)
4. Cultivated Areas habitat (CA)
5. Urban areas(UA)

Statistical analysis

To compare bird community, various indices calculated at each station. Species diversity was determined by applying Shannon-Weaver Diversity Index (Shannon and Weaver, 1949), $H' = - \sum_{i=1}^S p_i \ln(p_i)$, in which H' is the information content of sample (bits/individuals), S is the

number of species and p_i is the proportion of total species belonging to its species. Simpson's Index of dominance (C) was calculated by formula $C = \sum_{i=1}^s p_i^2$ (Stone & Pence, 1978) where p_i is the proportion of total number of individuals of each species. Species richness was determined applying Marglef's Index (Marglef, 1968), $d' = S - 1/\log n$ (N), in which S is the total number of species, N is the total number of individuals in sample and $\log n$ is the Natural log. Evenness was calculated using the Pielou Index, $E = H'/\ln S$ (Pielou, 1969), where H' is the Index of diversity of Shannon-Weaver, $\ln$ is the Natural log and S is the total number of species. Percentage similarity of the bird communities at different stations was calculated by Sorenson's Quotient of Similarity (Sorensen, 1948), $Q/S = (2j/a+b) 100$, where j is the number of species common to both samples, as is the total number of species in sample 1 and b is the total number of species in sample 2. The relative dominance of each bird species in different habitats was calculated by determining the Dominance Index. The formula $D = n_i * 100/N$ was used for calculating the Dominance index (D) where n_i is number of individuals of the species, N is total number of individuals of all the species seen during the study period.

RESULTS AND DISCUSSION

A total of 3884 birds were counted belonging to 66 species, 11 orders and 27 families with annual abundance 946, 287, 928, 819 and 904 at CA, CF, MDF, SA and UA respectively. The systematic list of 66 species belonging to 11 orders and 27 families along with their migratory status, abundance and feeding guild is presented in Table 1. Annual abundance of birds was observed to be 946, 287, 928, 819 and 904 respectively at Cultivated Areas (CA), Coniferous forest (CF), Mixed deciduous forest (MDF), Scrubby Areas (SA) and Urban Areas respectively (Table 2). Approximately proportions of species fell into each of the four abundance categories common (30.43%), occasional (27.53%), frequent (24.63%) and rare (17.39%). Out of 11 orders, order Passeriformes dominated the bird community (56.06%) followed by Piciformes (10.14%), Falconiformes (7.57%), Upupiformes (7.54%), Columbiformes (6.06%), Cicconiformes (6.06%), Galliformes (4.54%), Stringiiformes (4.54%), Psittaciformes (3.03%), Cuculiformes (1.5%) and Coraciiformes (1.5%) (Figure 2).

Table 1. Checklist of Birds of Udhampur with migratory status, abundance and feeding guild.

S.No.	Name	Status	Abundance	Feeding Guild
Order 1: Passeriformes				
Family 1: Passeridae				
1.	White Wagtail <i>Motacilla alba</i>	SM	F	Inst.
2.	Large Pied Wagtail <i>Montacilla maderaspatens</i>	Rst	O	Inst.
3.	Yellow Waigtail <i>Montacilla flava</i>	SM	R	Inst.
Family 2 : Nectarinidae				
4.	Purple Sunbird <i>Nectarinia asiatica asiatica</i>	Rst	O	Inst.
5.	Yellow backed Sunbird <i>Aethopyga siparaja</i>	Rst	O	Inst.
Family 3: Musciciapidae				
6.	Jungle Babbler <i>Turdoides striatus somervillei</i>	Rst	C	Inst.
7.	Common Babbler <i>Turdoides caudatus caudatus</i>	Rst	C	Inst.
8.	Paradise Flycatcher <i>Terpsiphone paradise paradise</i>	SM	O	Inst.
9.	Indian Tailor Bird <i>Orthotomus sutorius guzuratus</i>	Rst	C	Inst.
10.	Indian Magpie Robin <i>Copsychus saularis saularis</i>	WM	O	Inst.
11.	Pied Bush Chat <i>Saxicola caprata bicolour</i>	Rst	O	Inst.
12.	Indian Robin <i>Saxicoloides fulicata cambaiensis</i>	Rst	F	Inst.
13.	Brown Rock Chat <i>Cercomela fusca</i>	Rst	R	Inst.
14.	Pied Bush Chat <i>Saxicola caprata bicolour</i>	Rst	C	Inst.
Family 4: Lanidae				
15.	Rufous- backed Shrike <i>Lanius scahach erythronotus</i>	Rst	F	Car.
Family 5: Oriolidae				
16.	Indian Golden Oriole <i>Oriolus oriolus kundoo</i>	SM	O	Inst.
Family 6: Dicruridae				
17.	Black Drongo <i>Dicrurus adsimilus</i>	Rst	C	Inst.
Family 7: Sturnidae				
18.	Indian Myna <i>Acridotheres tristis tristis</i>	Rst	C	Inst.
19.	Brahminy Myna <i>Sturnus pagodarum</i>	Rst	O	Inst.
20.	Bank Myna <i>A.ginginnianus</i>	Rst	C	Inst.

Family 8: Corvidae

21.	House Crow <i>Corvus splendens splendens</i>	Rst	C	Omn.
22.	Jungle Crow <i>C. macrorhynchos culminates</i>	Rst	F	Omn.
23.	North Eastern Treepie <i>Dendrocitta vagabunda</i>	Rst	O	Omn.
24.	Yellow Billed Blue Magpie <i>Cissa flavirostris</i>	Rst	F	Omn.
25.	Himalayan Whistling Thrush <i>Myiophonus caeruleus</i>	Rst	F	Inst.
26.	Long Tailed Minivet <i>Pericrocotus ethologus</i>	Rst	R	Inst.

Family 9: Pycnonotidae

27.	Red-vented Bulbul <i>Pycnonotus cafer cafer</i>	Rst	C	Inst.
28.	White-cheeked Bulbul <i>P. leucogenys leucogenys</i>	Rst	C	Inst.

Family 10: Hirundinidae

29.	Red-rumped Swallow <i>Hirundo daurica</i>	Rst	C	Inst.
30.	Wire Tailed Swallow <i>Hirundo smithii</i>	Rst	O	Inst.

Family 11: Monarchinae

31.	Verdicator Flycatcher <i>Muscicapa thalassaina thalassaina</i>	SM	O	Inst.
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Family 12: Turnidae

32.	White Capped Redstart <i>Chaimarrornis leucocephalus</i>	Rst	O	Inst.
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Family 13: Ploceidae

33.	Indian House Sparrow <i>Passer domesticus indicus</i>	Rst	C	Grn.
34.	Spotted Munia <i>Lunchura punctulata</i>	SM	C	Grn.

Family 14: Paridae

35.	Grey Tit <i>Parus major</i>	Rst	F	Frg.
36.	Green Backed Tit <i>Parsus monticolus</i>	Rst	R	BF

Family 15 : Emberizinae

Family 16: Phylloscopidae

37.	Grey-Hooded Warbler <i>Phylloscopus xanthoschistos</i>	Rst	C	Inst.
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Order 2: Falconiformes

Family 17: Accipitridae

38.	Long-Billed Vulture <i>Gypus indicus</i>	Rst	C	Car.
39.	White-Rumped Vulture <i>Gypus bengalensis</i>	Rst	F	Car.
40.	Pariah Kite <i>Milvus migrans govinda</i>	Rst	C	Car.
41.	Steppe Eagle <i>Aquila nepalensis</i>	WM	R	Car.
42.	Indian Shikra <i>Accipiter badius dussumieri</i>	Rst	C	Car.

Order 3: Galliformes

Family 18: Phasianidae

43.	Indian Red Jungle Fowl <i>Gallus gallus murghi</i>	Rst	R	Inst.
44.	Grey Partridge <i>Francolinus pondiecirianus</i>	Rst	R	Grn.
45.	Black Partridge <i>Francolinus francolinus</i>	Rst	O	Grn.

Order 4: Columbiformes

Family 19: Columbidae

46.	Indian Blue Rock Pigeon <i>Columbia livia</i>	Rst	F	Grn.
47.	Indian Spotted Dove <i>Streptopelia decaocta decaocta</i>	Rst	F	Grn.
48.	Rufous Turtle Dove <i>S. orientalis orientalis</i>	SM	O	Grn.
49.	Indian Ring Dove <i>Streptopelia chinensis suratensis</i>	Rst	C	Grn.

Order 5 : Psittaciformes

Family 20: Psittacidae

50.	Rose Ringed Parakeet <i>Psittacula krameri manillensis</i>	SM	C	Frg.
51.	Blossom Headed Parakeet <i>P. cyanocephali</i>	SM	C	Frg.

Order 6: Stringiiformes

Family 21: Strigidae

52.	Northern Spotted Owlet <i>Athene brama indica</i>	Rst	O	Car.
53.	Barred Jungle Owlet <i>Glaucidium radiatum radiatum</i>	Rst	R	Car.

54. Great Horned Owl <i>Bubo bubo bengalensis</i>	Rst	C	Car.
Order 7: Coraciiformes			
Family 22: Alcedinidae			
55. White Breasted Kingfisher <i>Halcyon smyrnensis smyrnensis</i>	Rst	C	Car.
Order 8: Upupiformes			
Family 23: Upupidae			
56. European Hoopoe <i>Upupa epops epops</i>	Rst	C	Inst.
Family 24: Picidae			
57. Maharatta Woodpecker <i>Picoides maharathensis maharathensis</i>	Rst	O	Inst.
58. Lesser Golden Backed Woodpecker <i>Dinopium benghalense benghalense</i>	Rst	R	Inst.
59. Brown-fronted woodpecker <i>Dendrocopos auriceps</i>	Rst	O	Inst.
60. Blue-throated Barbet <i>Megalaima asiatica</i>	Rst.	F	Omn.
Order 9: Cuculiformes			
Family 25: Cuculidae			
61. Indian Koel <i>Eudynamis scolopacea scolopacea</i>	Rst	C	Inst.
Order 10: Cicconiformes			
Family 26: Ardeidae			
62. Cattle Egret <i>Bubulcus ibis</i>	Rst	C	Car.
63. Indian Pond Heron <i>Ardeola grayii grayii</i>	Rst.	C	Car.
64. Little Egret <i>Egretta garzetta</i>	Rst	R	Car.
65. Cattle Egret <i>Bubulcus ibis coromandus</i>	Rst	C	Car.
Order 11: Gruiformes			
Family 27: Rallidae			
66. White Breasted Waterhen <i>Amaurornis phoenicurus phoenocurus</i>	Rst	C	Car.

SM= Summer Migrant, WM= Winter Migrant, Rst. =Resident, Inst.= Insectivores, Omn.=Omnivorous, Car.= Carnivorous, Frg.= Frugivorous, Grn.= Granivores BF=Bark feeder.

Table 2. Site wise population of birds at five different habitats.

Name	Cultivated areas	Coniferous forests	Mixed forests	Deciduous	Scrub by Areas	Urban areas	Total
Bank Myna	9	0	0		0	74	83
White Capped Redstart	0	6	6		0	0	12
Great Horned Owl	4	1	1		0	0	6
Maharatta Woodpecker	3	3	7		0	0	13
Lesser Golden Backed Woodpecker	8	9	11		0	0	28
Brown-fronted woodpecker	5	7	12		0	0	24
Indian Koel	15	0	16		0	0	31
Indian Pond Heron	6	0	0		0	0	6
White breasted waterhen	5	0	0		0	0	5
Northern Spotted Owlet	3	3	4		1	0	11
Yellow Waihtail	1	4	3		2	0	10
Yellow Billed Blue Magpie	2	9	6		2	0	19
Long Tailed Minivet	3	5	8		2	0	18
Verdicator Flycatcher	0	4	7		2	0	13
Steppe Eagle	0	8	7		2	0	17
Barred Jungle Owlet	3	6	3		2	0	14
White Breasted Kingfisher	8	0	5		2	7	22
Yellow backed Sunbird	3	0	9		4	0	16
Paradise Flycatcher	3	6	7		4	0	20
House Crow	34	0	0		4	65	103

North Eastern Treepie	6	7	16	4	0	33
Indian Red Jungle Fowl	0	21	7	4	0	32
Blue-throated Barbet	9	0	17	4	0	30
Indian Shikra	6	6	9	5	0	26
Indian Golden Oriole	15	3	29	6	0	53
Lon Billed Vulture	0	7	9	6	0	22
Rose Ringed Parakeet	33	0	46	6	19	104
Purple Sunbird	16	2	0	7	0	25
Pariah Kite	0	14	4	7	26	51
Rufous Turtle Dove	11	0	9	7	0	27
Cattle egret	13		0	7	2	22
Brahminy Myna	7	0	9	8	4	28
Wire Tailed Swallow	18	0	6	8	48	80
Little egret	9	0	0	8	0	17
Indian Robin	12	3	8	9	4	36
Jungle Crow	25	21	17	9	132	204
Red-rumped Swallow	15	0	6	9	102	132
Spotted Munia	23	0	13	9	0	45
Cattle Egret	16	0	7	9	0	32
Grey Partridge	2	4	6	11	0	23
Black Partridge	9	7	17	11	0	44
Large Pied Wagtail	2	7	11	12	0	32
White-rumped vulture	0	26	7	13	0	46
White Wagtail	4	6	13	14	0	37
European Hoopoe	5	7	17	14	0	43
Indian Tailor Bird	8	0	2	17	0	27
Indian Myna	41	0	26	17	235	319
Green Backed Tit	9	0	31	17	0	57
Indian Magpie Robin	4	2	14	18	0	38
Rufous- backed Shrike	17	0	19	18	7	61
Grey Tit	36	0	37	18	0	91
Himalayan Whistling Thrush	6	15	18	19	0	58
Indian Spotted Dove	17	0	8	19	0	44
Brown Rock Chat	0	5	19	21	0	45
Indian Ring Dove	29	0	31	22	0	82
Red- vented Bulbul	24	0	56	23	9	112
Blossom Headed Parakeet	27	0	16	24	4	71
Black Drongo	17	0	25	27	5	74
Indian House Sparrow	173	0	0	31	86	290
Indian Magpie Robin	5	13	21	32	4	75
Jungle Babbler	15	19	47	35	0	116
White-cheeked Bulbul	46	0	76	37	21	180
Grey-hooded Warbler	36	0	24	37	0	97
Pied Bush Chat	18	2	23	45	0	88
Common Babbler	16	4	31	46	3	100
Indian Blue Rock Pigeon	31	15	9	62	47	164
Total	946	287	928	819	904	3884

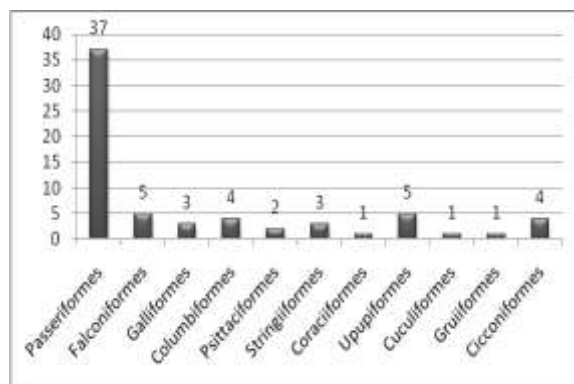


Figure 2. Bar diagram showing the distribution of Bird species of different orders.

Table 3. Diversity indices of bird community in five different habitats of study area.

Diversity indices	Cultivated Area	Coniferous Forests	Mixed Deciduous Forests	Scrubby area	Urban areas
Shanon-Weaver Index	3.52	3.33	3.75	3.69	2.35
Marglef Richness Index	6.5	6.4	9.8	8.4	3.4
Abundance	946	287	928	819	904
Simpson Diversity Index	0.051	0.042	0.030	0.034	0.130
Reciprocal Simpson Index	18.86	22.89	32.68	31.56	7.69
Pielos Evenness index	0.868	0.930	0.920	0.913	0.773

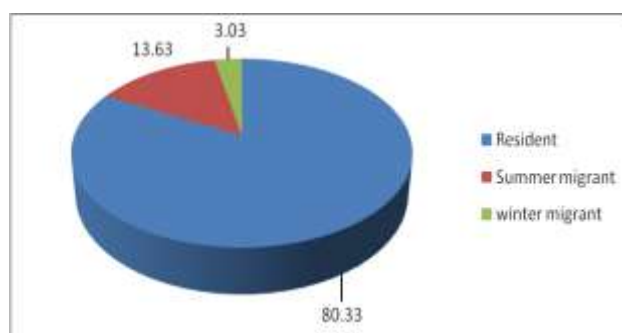


Figure 3. Pie diagram showing relative percentage of migratory status of avifauna of the study area.

Table 4. Dominance index of selected species at five different habitats.

Cultivated areas			Mixed Deciduous Forests	Coniferous Forests	Scrubby Areas	Urban areas	
Indian House Sparrow (0.18)			White-rumped vulture (0.081)	White-cheeked Bulbul (0.099)	Indian Blue Rock Pigeon (0.075)	Indian Myna (0.3528)	
White-Cheeked Bulbul (0.045)			Jungle Crow (0.060)	Red-vented Bulbul (0.073)	Common Babbler (0.056)	Jungle Crow (0.146)	
Indian Myna(0.043)			Indian Red Jungle Fowl (0.050)	Jungle Babbler (0.073)	Pied Bush Chat (0.054)	Red-rumped Swallow (0.112)	
Grey-Hooded Warbler (0.038)			Jungle Babbler (0.049)	Rose Ringed Parakeet (0.066)	Grey-hooded Warbler (0.054)	Indian House Sparrow (0.095)	
Grey Tit (0.038)			Indian Blue Rock Pigeon (0.048)	Grey Tit (0.052)	White-cheeked Bulbul (0.045)	Bank Myna (0.081)	

Table 5. Sorenson's similarity indices to compare the community structure of five types of habitats.

Compared habitats	No. of species			Sorenson's Quotient
A vs B	A	B	Common	
CA vs CF	58	36	28	59.57%
CA vs MDF	58	58	50	86.20%
CA vs SA	58	57	50	86.95%
CF vs MDF	36	58	34	72.34%
CF vs SA	36	57	31	66.66%
MDF vs SA	58	57	52	82.05%
CA vs UA	58	21	20	50.63%
CF vs UA	36	21	6	21.05%
MDF vs UA	58	21	17	43.03%
SA vs UA	57	21	20	51.28%

On the basis of relative abundance in different habitat, the order of utilization was recorded CA>MDF> UA> SA > CF. But the maximum numbers of species (58 out of 66) were found in MDF. Out of total 66 species, 55 species were Resident and 11 species were migrant. Out of 15 migrant species, 9 species were summer migrant and 2 species were winter migrant (Figure 3). The variations in diversity indices of bird community at five different habitats of study area are given in Table 3. The Shannon Index of diversity found maximum (3.75) at MDF and minimum (3.33) at CA. Simpson Diversity Index was greatest at Cultivated Area (0.067) and lowest at Mixed Deciduous Forests (0.027). The highest Marglef's richness index value (9.8) was calculated at Mixed Deciduous Forests and lowest (3.4) at Urban Areas. Highest Marglef's species richness index (which considers both abundance and species number) at Mixed Deciduous Forests revealed that this site harboured a good number of bird taxa. Pielos Evenness Index showed maximum evenness at Coniferous Forest (0.930) and minimum at Urban Area (0.773). Highest Marglef's species richness index (which considers both abundance and species number) at Deciduous Forests revealed that this site harboured a good number of bird taxa. Simpson diversity index was found maximum (0.130) at Urban Areas and minimum (0.030) at Mixed Deciduous Forests. The relative dominance of species in different habitats is given in Table 4. House sparrow was found

dominant in rural habitation and Cultivated Areas because of lot of nesting sites available in mud houses present in the study area and food availability. White Rumped Vulture was found dominant in Coniferous forests. The dominant species of Mixed Deciduous Forests found was White Cheeked Bulbul. Scrubby Areas has Indian Rock Pigeon as dominant species. Common Myna was found as dominant species in Urban Areas.

Comparison between habitats was made by using qualitative presence-absence type and it was found that Cultivated Areas and Scrubby Area were found more similar with highest value of Sorenson's Quotient of similarity (Q/S) (86.95%) whereas lowest similarity (19.71%) was calculated between urban areas and coniferous forest habitats (Table 5). In order to study feeding biology of the birds in the study area 6 major feeding guilds were reported and divided into six categories viz. insectivorous, carnivorous, grainivorous, omnivorous, frugivorous and bark feeders. Of the total 66 species reported, 34 species were insectivores, 15species were carnivorous, 8 species were grainivorous, 5species were omnivorous, frugivorous were 3 species and 1species were Bark Feeder (Figure 4). The data depicts that the overall highest proportion is of insectivores birds followed by carnivorous.

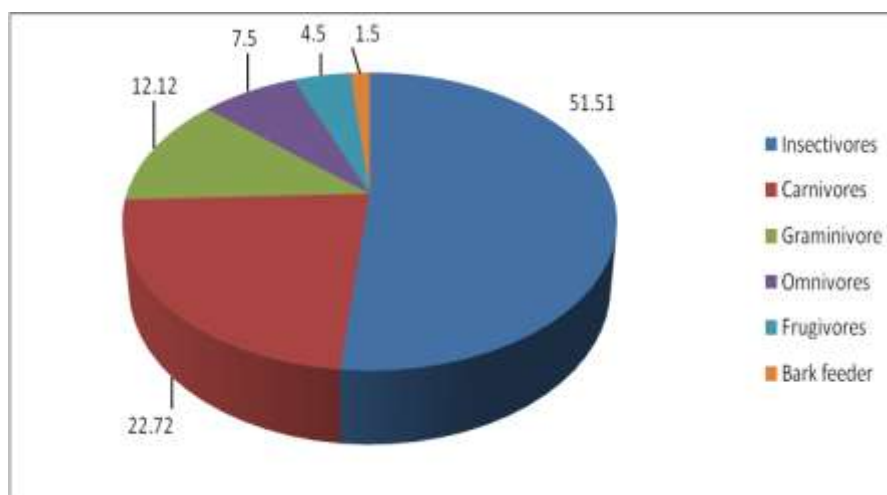


Figure 4. Pie diagram showing relative percent of feeding guild used by bird communities in the study area.

The species composition of bird association and guilds changed periodically. Availability of food resource appeared to be a very influential factor controlling seasonal fluctuation of bird communities, the other being changes of climatic conditions and consequent emigration and immigration. Ahmed & Sahi, (2005) have reported 41 species belonging to 6 orders and 22 families from Tehsil Doda which is about 106 km and is located in lower Himalayas. (Rajan Singh *et al.*, 2013b) has also reported 69 species, 11 orders and 29 families in Tehsil Chenani which is 24 km away from the Udhampur Town. During the course of study order Passer iniformes was found dominant. (Singh *et al.*, 2013b) and Ahmed and also reported order Passeriniiformes as dominant order in Tehsil Chenani and Tehsil Doda respectively. During study it was found that Jungle crow, Common Myna, Bank Myna and Pariah Kite number increases in urban areas because of their wide adjustably in different areas. The House Sparrow number was found to decreasing in urban areas because of lack of nesting sites, lack of roosting sites, competition for nesting sites with other birds etc. The number of House Sparrow was found to be less in Urban Areas than Rural Areas. (Singh *et al.*, 2013b) has also reported the lack of nesting sites, the lack of spiny shrubs and trees less than 7 ft. height, lack of animal diet in early stage of nestling diet and intense competition for nesting sites for birds like Common Myna, Red -Rumped Swallow etc. as cause of decline of House sparrow in urban areas of Jammu.

The bird community composition is correlated to the species richness of trees and not to its abundance and also that the population size of bird species is unaffected by tree diversity (Das, 2008). The Mixed Deciduous Forest was found to support maximum species of birds in present study. The deciduous forests have variety of broadleaved, grasses and herbs and thus support a large population of birds. The deciduous forests also provide lot of nesting sites for birds. (Singh *et al.*, 2013b) found maximum abundance in MDF (instead of CA in present study) out of four different habitats studied (CA, MDF, SA and CF) but

maximum number of species (64 out of 69) were reported from MDF. (Das, 2008) has studied bird community structure in six habitats namely Evergreen with grassland (EGGL), Disturbed Evergreen (EGD), Evergreen (EG), Shola Forests (SHOLA) and Shola with Grassland (SHOLAG) and Broad-leaved hill forests (BLHF). The maximum species (59.2%) and individuals (27.2%) were in evergreen forest habitat which also has maximum species richness for plant species and minimum in BLHF (22.8 % and 5.73% respectively). Jayson & Mathew, (2002) compared bird community structure of two different habitats tropical evergreen and moist deciduous forests and found that the latter supported maximum number of species and it also had more species richness of vegetation. The variation in species diversity and species evenness at various habitats may be due to the availability of food to the birds, nesting sites, change of climatic conditions and consequent emigration and immigration (Singh *et al.*, 2013a).

In rural habitation and Cultivated Areas, the House Sparrow was found to be dominant because of lot of nesting sites available in mud houses present in the study area and food availability. The House Sparrow is primarily associated with human habitations e.g., agricultural land, villages and urban areas (Lowther & Cink, 1992). Order Insectivore was found to be dominant in present study. Insectivore feeding guild has also been reported as major feeding guild in Tehsil Doda (Ahmed & Sahi, 2005) and in Tehsil Chenani (Singh *et al.*, 2013b). Karr *et al.*, (1990) observed that the presence of food resources available to and exploited by birds in defining the trophic structure of the community. Similarities or difference among species in diet composition are especially relevant to the tests of niche or guild concept. The species composition of bird association and guilds changed periodically. Availability of food resource appeared to be a very influential factor controlling seasonal fluctuation of bird communities, the other being changes of climatic conditions and consequent emigration and immigration.

CONCLUSION

The results showed that there was a significant difference in the avian diversity among different habitats. The study depicted that the maximum bird diversity is directly linked with maximum plant diversity. Tehsil Udhampur represents 5% of the bird species out of the total birds species i.e. 1300 species recorded from Indian sub-continent (Grimmet *et al.*, 1998). Thus the study area supports an extremely rich and diverse bird community. The observed bird diversity in relatively small area underlines the importance of this area for biodiversity conservation. To conclude it can be said that the study area has a potential as a habitat for avian species. The need is to enlist the data and manage the habitat in consideration with various requirements of avian fauna. Our understanding of avifauna diversity is still insufficient to guarantee proper conservational strategies and only scientific research can through light on the improved methods of management and conservation.

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REFERENCES

- Acharya, B. (2008). *Bird communities and their distribution pattern along the elevation gradient of Teesta Valley, Sikkim*. Ph. D. Thesis. Bharathiar University, Coimbatore, India.
- Ahmed, A., & Sahi, D. (2005). Diversity and status of birds of Tehsil Doda. *Journal of Nature and Conservation*, 17(1), 135-143.
- Ali, S., & Ripley, S. D. (1983). *Handbook of the birds of India and Pakistan*. Compact edition. Oxford University Press and BNHS, Mumbai. Ali, S. and SD Ripley (1995). *The Pictorial Guide to the Birds of Indian Sub-continent*. Oxford University Press and BNHS, Mumbai. Baskaran, ST (1992). *Sighting of Dusky Horned Owl*. Newsletter for Birdwatchers, 32(9), 10.
- Blake, J. G. (2007). Neotropical forest bird communities: a comparison of species richness and composition at local and regional scales. *The Condor*, 109(2), 237-255.
- Burnham, K. P., Anderson, D. R., & Laake, J. L. (1980). Estimation of density from line transect sampling of biological populations. *Wildlife Monographs*(72), 3-202.
- Chettri, N., Sharma, E., & Deb, D. (2001). Bird community structure along a trekking corridor of Sikkim Himalaya: a conservation perspective. *Biological Conservation*, 102(1), 1-16.
- Daniels, R. R. (1989). *A conservation strategy for the birds of the Uttara Kannada District*. Indian Institute of Science, Bangalore.
- Das, K. (2008). *Bird community structure along the altitudinal gradient in Silent Valley National Park, Western Ghats, India*. PhD Thesis. Bharathiar University, Coimbatore. India.
- Green, R. J., & Catterall, C. P. (1998). The effects of forest clearing and regeneration on the fauna of Wivenhoe Park, south-east Queensland. *Wildlife Research*, 25(6), 677-690.
- Grimmett, R., Inskipp, C., & Inskipp, T. (2016). *Birds of the Indian Subcontinent: India, Pakistan, Sri Lanka, Nepal, Bhutan, Bangladesh and the Maldives*: Bloomsbury Publishing. Oxford University Press, Delhi.
- Javed, S. (1996). *Studies on Bird Community Structure of Terai Forest in Dudwa National Park*. Ph. D. Thesis, Centre for Wildlife and Ornithology, Aligarh Muslim University, India.
- Jayson, E., & Mathew, D. (2002). Structure and composition of two bird communities in the southern Western Ghats. *Journal-Bombay Natural History Society*, 99(1), 8-25.
- Jerdon, T. (1862). 1864. *The Birds of India*. Calcutta.(2 Vols).
- Johnsingh, A., & Joshua, J. (1994). Avifauna in three vegetation types on Mundanthurai Plateau, South India. *Journal of Tropical Ecology*, 323-335.
- Karr, J. R., Robinson, S. K., Blake, J. G., Bierregaard, R., & Gentry, A. H. (1990). Four neotropical rainforests. Yale university press, New Haven, C.T: 237-269.
- Kattan, G. H., & Franco, P. (2004). Bird diversity along elevational gradients in the Andes of Colombia: area and mass effects. *Global Ecology and Biogeography*, 13(5), 451-458.
- Khah, S., Rao, R., & Wani, K. (2012). Studies on bird diversity of Overa-Aru wildlife sanctuary of Jammu and Kashmir, India. *Journal of Threatened Taxa*, 3228-3232.
- Khan, J., Khan, D., & Ahmed, A. (1993). Preliminary investigations of bird community structure at Aligarh, India. *Tropical Ecology*, 34(2), 217-225.
- Kremen, C. (1992). Assessing the indicator properties of species assemblages for natural areas monitoring. *Ecological applications*, 2(2), 203-217.
- Latta, S. C., Rimmer, C. C., & McFarland, K. P. (2003). Winter bird communities in four habitats along an elevational gradient on Hispaniola. *The Condor*, 105(2), 179-197.
- Lowther, P., & Cink, C. (1992). House sparrow, no. 12. *Birds of North America*. Academy of Natural Sciences, Philadelphia Academy of Sciences, Philadelphia.

- MacArthur, R. H., & MacArthur, J. W. (1961). On bird species diversity. *Ecology*, 42(3), 594-598.
- Pielou, E. (1969). An introduction to mathematical ecology John Wiley & Sons. New York.
- Price, T., Zee, J., Jamdar, K., & Jamdar, N. (2003). Bird species diversity along the Himalaya: a comparison of Himachal Pradesh with Kashmir. *Journal of the Bombay Natural History Society*, 100(2&3), 394â.
- Raman, T. S., Rawat, G., & Johnsingh, A. (1998). Recovery of tropical rainforest avifauna in relation to vegetation succession following shifting cultivation in Mizoram, North-East India. *Journal of Applied Ecology*, 35(2), 214-231.
- Ripley, S. D. (1952). Breeding birds of Kashmir: List of Books in the Josselyn Van Tyne Memorial Library, the Wilson Ornithological Society. *The Wilson Bulletin*, 94(3), 393-429.
- Shafiq, T., Javed, S., & Khan, J. (1997). Bird community structure of middle altitude oak forest in Kumaon Himalayas, India: a preliminary investigation. *International Journal of Ecology and Environmental Sciences*, 23, 389-400.
- Singh, R., Kour, D. N., Ahmad, F., & Sahi, D. (2013a). The causes of decline of House Sparrow (*Passer domesticus*, Linnaeus 1758) in urban and suburban areas of Jammu region, J & K. *Munis Journal of Entomology and Zoology*, 8, 803-811.
- Singh, R., Kour, D. N., Ahmad, F., & Sahi, D. (2013b). Species diversity, relative abundance and habitat use of the bird communities of Tehsil Chenani, District Udhampur, Jammu and Kashmir, India. *Indian Journal of Life Sciences*, 2(2), 74-84.
- Sorensen, T. A. (1948). A method of establishing groups of equal amplitude in plant sociology based on similarity of species content and its application to analyses of the vegetation on Danish commons. *Kongelige Danske Videnskabernes Selskab Biologiske Skrifter.*, 5, 1-34.
- Stone, J. E., & Pence, D. B. (1978). Ecology of helminth parasitism in the bobcat from West Texas. *The Journal of Parasitology*, 295-302.
- Sultana, A., Hussain, M. S., & Khan, J. A. (2007). Bird communities of the proposed Naina and Pindari wildlife sanctuaries in the Kumaon Himalaya, Uttarakhand, India. *Journal-Bombay Natural History Society*, 104(1), 19.
- Sultana, A., & Khan, J. (1999). Avian community in the Kumaon Himalaya, India-a preliminary study. *International Journal of Ecology and Environmental Sciences*, 25, 167-176.
- Sultana, A., & Khan, J. A. (2000). Birds of oak forests in the Kumaon Himalaya, Uttar Pradesh, India. *Forktail*, 131-146.
- Terborgh, J., Robinson, S. K., Parker III, T. A., Munn, C. A., & Pierpont, N. (1990). Structure and organization of an Amazonian forest bird community. *Ecological Monographs*, 60(2), 213-238.
- Thiollay, J.-M. (1994). Structure, density and rarity in an Amazonian rainforest bird community. *Journal of Tropical Ecology*, 449-481.
- Wiens, J. A. (1989). Spatial scaling in ecology. *Functional Ecology*, 3(4), 385-397.
- Willson, M. F., & Comet, T. A. (1996). Bird communities of northern forests: patterns of diversity and abundance. *The Condor*, 98(2), 337-349.