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**Research Article** 

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

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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).

#### 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<sup>o</sup> 55' 08" N and 75<sup>o</sup> 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 rouxbergii*, *Cedrus deodara* and *Quercus* sps. Mixed deciduous forests and scrubby areas are also found.

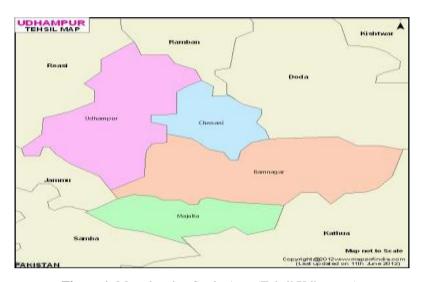


Figure 1. Map showing Study Area (Tehsil Udhampur).

#### 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),  $H' = -\sum_{i=1}^{s} \operatorname{pi.ln}(\operatorname{pi})$ , in which H' is the information content of sample (bits/individuals), S is the

number of species and pi is the proportion of total species belonging to its species. Simpson's Index of dominance (C) was calculated by formula  $C = \sum_{i=1}^{s} pi^2$  (Stone & Pence, 1978) where pi 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, In 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), O/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<sub>i</sub> \*100/N was used for calculating the Dominance index (D) where n<sub>i</sub> 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%), (7.57%),Upupiformes Falconiformes (7.54%). Cicconiformes Columbiformes (6.06%),(6.06%),Galliformes Stringiiformes (4.54%),(4.54%),Cuculiformes Psittaciformes (3.03%),(1.5%)and Coraciiformes (1.5%) (Figure 2).

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

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

Family 8	: Corvidae			
21.	House Crow Corvus splendens splendens	Rst	C	Omn.
22.	Jungle Crow C.macrorhynchos culminates	Rst	F	Omn.
23.	North Eastern Treepie Dendrocitta vagabunda	Rst	O	Omn.
24.	Yellow Billed Blue Magpie Cissa flavirostris	Rst	F	Omn.
25.	Himalayan Whistling Thrush Myiophonus caeruleus	Rst	F	Inst.
26.	Long Tailed Minivet Pericrocotus ethologus	Rst	R	Inst.
Family 9	: Pycnonotidae			
27.	Red- vented Bulbul Pycnonotus cafer cafer	Rst	C	Inst.
28.	White-cheeked Bulbul P. leucogenys leucogenys	Rst	C	Inst.
Family 1	0: Hirundinidae			
29.	Red-rumped Swallow Hirundo daurica	Rst	C	Inst.
30.	Wire Tailed Swallow Hirundo smithii	Rst	O	Inst.
Family 1	1: Monarchinae			
31.	Verdicator Flycatcher Muscicapa thalassaina thalassina	SM	O	Inst.
Family 1	2: Turnidae			
32.	White Capped Redstart Chaimarrornis leucocephalus	Rst	O	Inst.
Family 1	3: Ploceidae			
33.	Indian House Sparrow Passer domesticus indicus	Rst	C	Grn.
34.	Spotted Munia Lunchura punctulata	SM	C	Grn.
Family 1	4: Paridae			
35.	Grey Tit Parus major	Rst	F	Frg.
36.	Green Backed Tit Parsus monticolus	Rst	R	BF
Family 1	5 : Emberizinae			
Family16	5:Phylloscopidae			
37.	Grey-Hooded Warbler Phylloscopus xanthoschistos	Rst	C	Inst.
Order 2:	Falconiformes			
Family 1	7: Accipitridae			
38.	Long–Billed Vulture Gypus indicus	Rst	C	Car.
39.	White–Rumped Vulture Gypus bengalensis	Rst	F	Car.
40.	Pariah Kite Milvus migrans govinda	Rst	C	Car.
41.	Steppe Eagle Aquila nepalensis	WM	R	Car.
42.	Indian Shikra Accipiter badius dussumieri	Rst	C	Car.
Order 3:	Galliformes			
Family 1	8: Phasianidae			
43.	Indian Red Jungle Fowl Gallus gallus murghi	Rst	R	Inst.
44.	Grey Patridge Francolinus pondiecirianus	Rst	R	Grn.
45.	Black Patridge Francolinus francolinus	Rst	O	Grn.
Order 4:	Columbiformes			
Family 1	9: Columbibidae			
46.	Indian Blue Rock Pigeon Columbia livia	Rst	F	Grn.
47.	Indian Spotted Dove Streptopelia decaocta decaocta	Rst	F	Grn.
48.	Rufous Turtle Dove S. orientalis orientalis	SM	O	Grn.
49.	Indian Ring Dove Streptopelia chinensis suratensis	Rst	C	Grn.
Order 5:	Psittaciformes			
Family 2	0: Psittacidae			
50.	Rose Ringed Parakeet Psittacula krameri manillensis	SM	C	Frg.
51.	Blossom Headed Parakeet P. cynocephali	SM	C	Frg.
Order 6:	Stringiiformes			Č
	1: Strigidae			
52.	Northern Spotted Owlet Athene brama indica	Rst	O	Car.
53.	Barred Jungle Owlet Glaucidium radiatum radiatum	Rst	R	Car.

54.	Great Horned Owl Bubo bubo bengalensis	Rst	C	Car.			
Order 7: Coraciiformes							
Family 22	2: Alcedinidae						
55.	White Breasted Kingfisher Halcyon smyrnensis smyrensis	Rst	C	Car.			
Order 8: 1	Upupiformes						
Family 23	3: Upupidae						
56.	European Hoopoe Upupa epops epops	Rst	C	Inst.			
Family 24							
57.	Maharatta Woodpecker Picoides maharathensis maharathensis	Rst	O	Inst.			
58.	Lesser Golden Backed Woodpecker Dinopium benghalense	Rst	R	Inst.			
	benghalense						
59.	Brown-fronted woodpecker Dendrocopos auriceps	Rst	O	Inst.			
60.	Blue-throated Barbet Megalaima asiatica	Rst.	F	Omn.			
	Cuculiformes						
Family 25	5: Cuculidae						
61.	Indian Koel Eudynamys scolopacea scolopacea	Rst	C	Inst.			
	Cicconiformes						
Family 26	6: Ardeidae						
62.	Cattle Egret Bubulcus ibis	Rst	C	Car.			
63.	Indian Pond Heron Ardeola grayii grayii	Rst.	C	Car.			
64.	Little Egret Egretta garzetta	Rst	R	Car.			
65. Cattle Egret Bubulcus ibis coromandus Rst C Car.							
Order 11: Gruiiformes							
Family 27	7: Rallidae						
66.	White Breasted Waterhen Amaurornis phoenicurus phoenocurus	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	Coniferous	Mixed Deciduous	Scrub by	Urban	Total
	areas	forests	forests	Areas	areas	
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 Waigtail	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

Note   Part   Part	North Eastern Transic	6	7	16	4	0	33
Blue-throated Barbet   9	North Eastern Treepie	6				0	
Indian Shikra	_						
Indian Golden Oriole		-					
Lon Billed Vulture							
Rose Ringed Parakeet			_				
Purple Sunbird			•				
Pariah Kite	=						
Rufous Turtle Dove							
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         204           Red-rumped Swallow         15         0         6         9         102         132         204         6         9         102         132         204         6         11         0         24         6         111         0         23         204         14         6         11         0         23         24         6         11         0         24         4         14         6         13         14         0         32         24         14         14 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>							
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Indian Robin							
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 Patridge   2   4   6   11   0   23     Black Patridge   9   7   17   11   12   0   32     Black Patridge   9   7   17   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   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   99   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   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   16   4   31   46   3   100     Indian Blue Rock Pigeon   31   15   9   62   47   164							
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 Patridge         2         4         6         11         0         23           Black Patridge         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 Magpie Robin         4         1         0         26         17         235         319           Green Backed Tit         9         0         31         17         0         57 </td <td></td> <td></td> <td></td> <td></td> <td>-</td> <td></td> <td></td>					-		
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Black Patridge         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         34           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         44							
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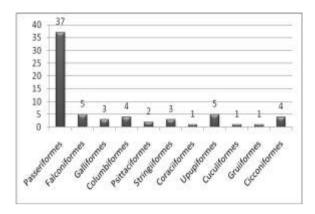


Figure 2. Bar diagram showing the distribution of Bird species of different orders.

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

Diversity indices	Cultivated Area	Coniferous	Mixed Deciduous	Scrubby	Urban
		Forests	Forests	area	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

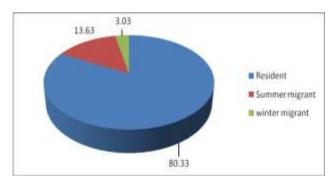


Figure 3. Pie diagram showing relative percentage of migratory status of avifauna of the study area.

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

Cultivated areas		Mixed Deciduous		Coniferous	Scrubby		Urban areas	
		Forests		Forests	Areas			
Indian House Sp	arrow	White-ru	ımped	White-cheeked Bulbul	Indian Blue	e Rock	Indian	Myna
(0.18)		vulture (0	0.081)	(0.099)	Pigeon (0.075	5)	(0.3528)	
White-Cheeked Bul	lbul (	Jungle	Crow	Red- vented Bulbul (	Common	Babbler	Jungle Crov	w (0.146)
0.045)		(0.060)		0.073)	(0.056)			
Indian Myna(0.043)		Indian Re	ed Jungle	Jungle Babbler (0.073)	Pied Bus	sh Chat	Red-rumped	d
		Fowl (0.0	050)		(0.054)		Swallow (0	.112)
Grey-Hooded W	'arbler	Jungle	Babbler	Rose Ringed Parakeet	Grey-hooded	Warbler	Indian	House
(0.038)		(0.049)		(0.066)	(0.054)		Sparrow (0.	095)
Grey Tit (0.038)		Indian B	lue Rock	Grey Tit ( 0.052)	White-cheeke	ed	Bank Myna	(0.081)
		Pigeon (0	0.048)		Bulbul (0.045	5)		

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

Compared habitats		No. of spo	ecies	Sorenson's Quotient
A vs B	A	В	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, 5 species were omnivorous, frugivorous were 3 species and 1 species were Bark Feeder (Figure 4). The data depicts that the overall highest proportion is of insectivores birds followed by carnivorous.

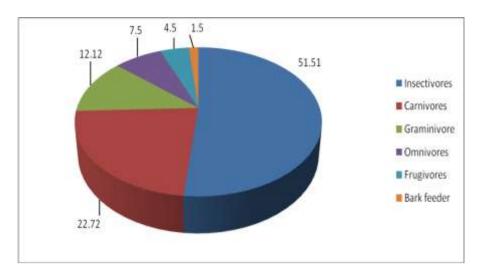


Figure 4. Pie diagram showing relative percent of feeding guild used by bird communities in the study area.

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 Passeriniformes 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 Udhumpur 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.

#### ACKNOWLEDGEMENTS

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