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Avian Diversity and Their Feeding Guild Structure in Temperate Forests of Garhwal Himalaya, Uttarakhand, India

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Abstract: The study on avian diversity and their feeding guild structure with relation to their habitat use in temperate forest of district Pauri Garhwal was carried out between April 2015 to March 2017. Lines transect and direct visual methods were used to record the bird species diversity, their feeding habit and habitats. Frequent surveys were made in the study area and birds were counted. During the study period, a total of 152 species of birds belonging to 9 order and 43 families were recorded. The highest diversity index was recorded at Kandoliya (H^-= 3.98±0.06) and Adwani was recorded with minimum diversity (H^-= 3.34±0.08). The average bird diversity index at all sites was recorded as (H^-= 3.57±0.11). Further, on the basis of their feeding guilds the recorded birds were categorized into the six major categories such as insectivore (55.92%), omnivore (13.81%), grainivores (5.92%), carnivore (9.21%), nectarivorous (1.31), frugivore (5.92%) and 7.91% species remained unidentified. The insectivore guild was dominant in all the guild structures.

Keywords: Avian diversity, Feeding guild structure, Temperate forest, Pauri Garhwal, Bird diversity index

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Introduction

Birds are prominent species of global biodiversity and are found everywhere in the ecosystem. They are also known as essential indicators of the ecosystem health (Taper *et al*., 1995). They form an important component of the ecosystem and play key role in the control of insect pests of agricultural crops, as predators of rodents, pollinating agents and as scavengers. But, the wildlife resource, like other resources is being exploited at a greater pace. This overexploitation has endangered many species, various species already became extinct and many more are losing their number at an alarming rate. Wildlife conservation takes precedence in World natural resource agenda; for conservation measures to be implemented, it becomes necessary to know the

species diversity, type of the habitat they live in and local abundance of fauna of an ecosystem

Food and shelter are the two basic necessities for all the living organisms that they get from their habitats. Every living organism requires considerable amount of energy for its survival and reproduction. Therefore, a feeding guild structure can be important for every species that exploits the same class of environmental resources in the same way (Root, 1967). In bird's life feeding is an essential activity which is indispensable for its survival. However, the demands of food acquisition impose significant challenges to both physiology and behavior of the birds. Seasonal variation in food abundance often influences habitat use pattern, such as rainfall pattern changes availability of food for birds. It is long established fact that availability of food affects the population size. The community structure of birds may be determined by the several variables such as the quality and the availability of food, vegetation structure, floristic diversity and the nest predation. Avian feeding guild structures have previously been suggested as a suitable indicator (Rizki *et al*., 2020). Few studies are conducted on the food and feeding guild structure of birds of the Himalayan region and other parts of India (Joshi and Bhatt, 2011, 2014). Guilds have been viewed as natural ecological units which are the building blocks of ecological communities as well as a group of species that have similar feeding or foraging habitats. The studies on feeding guild structure are valuable to identify the resources that determine the feeding structure of animal communities. The avifaunal guilds have been widely studied specially in tropical and sub-tropical habitats by some researchers (Ali, 1996; Aggarwal, 2008; Kait, 2011; Singh *et al.*, 2013; Namrata, 2019; Asha and Sharma, 2020; Lemuel, 2020). But information on feeding habits of birds of the temperate forests are still lacking. Only few studies are conducted on Kalij pheasant (Bisht *et al*., 2002), Cheer pheasant (Bisht *et al*., 2005), and birds of temperate forests of Garhwal Himalaya (Bisht *et al*., 2004; Kumar *et al*., 2016, 2019, 2021).

Materials and Methods

The field study was conducted at different study sites to record the species diversity of birds and their feeding habits in temperate forests of district Pauri Garhwal Uttarakhand which lies between 29° 22'- 29° 75' N 70° 10'-78° 80' E along with the altitude of 1750 m asl. Lines transect and direct visual observation methods were used to record the avian diversity and their feeding guild structure. During the morning hours between 6:00 am to 10:00 am and in the evening hours between 4:30 pm to 7:00 pm, frequent field surveys were made at each site and birds were counted and each bird was identified with the help of field guides (Kazmeirczak, 2000; Grimmett, 2011). Keen observation was made on feeding habits of the birds. Therefore, the feeding guild structure of birds was defined based on the type of food birds used to feed on. With the help of binocular (2 x 40X) and digital camera (21mp x 63x zoom) observations were made in such a way to minimize the chance that the observer's presence did not alter their foraging behaviour. Observation periods were of 15 to 30 min duration for common species of birds and were measured by a stopwatch and alarm. The habitats of birds were identified as trees, ground and aerial. Depending on the feeding habits, the birds were classified into different guilds and the birds were identified.

Results and Discussion

During the study period, a total of 152 species of birds belonging to 9 orders, 43 families and 54786 individuals were recorded from April 2015 to March 2017 (Table 1). Out of 152 species of birds, the maximum species were recorded from order Passeriformes (110), followed by order Piciformes (13), Falconiformes (12), Columbiformes (7), Psittaciformes and Galliformes (4), Strigiformes (2) and the minimum species were recorded from order Apodiformes and Upupiformes (1). In the families wise, the maximum species were recorded from family Muscicapidae (14) followed by Accipitiridae (13), and the minimum were recorded from family Apodidae, Ploceidae,

Oriolidae, Upupidae, Zostropidae, Rhipiduridae and Pemizidae (1). The highest diversity index was recorded at Kandoliya (H^-= 3.98±0.06) and Adwani was recorded with minimum diversity (H^-= 3.34±0.08). The average of bird diversity index at all sites was recorded as (H^-= 3.57±0.11). Further, the feeding habits of 140 species of birds were monitored in the study area. All the species were categorized into six major feeding categories or feeding guilds as based on their preferable feeding niches (Tables 2, 3; Fig. 1). Out of total birds, the feeding habits of twelve (12) species could not be determined as they were sighted rarely. Fifteen (15) species of bird were identified as carnivorous because of their feeding habits on animals like invertebrates, reptiles, mammals etc. (Tables 2, 3). Nine (9) species were identified as frugivore feeding on the fruits of *Myrica esculenta*, *Berberis asiatica*, *Rubus nivens*, *Rubus ellipticus* etc. (Tables 2, 3). The included species were primarily feeding on grains and seeds (Tables 2, 3). The total nine (9) species of birds (5.92%) were noticed in the grainivores guild structure (Tables 2, 3). The species of this guild were observed feeding in the gardens, homes and other buildings where seeds and grains were easy available. Only two (2) species of birds namely, Purple sunbird *Nectarinia asiatica* and Green tailed sunbird *Aethopyga nipalensis* (1.31%) were observed in the nectarivorous guild structure (Table 2 and 3). These birds mainly feed on nectar from the flowering plants such as Hedge bind weed *Calystegia sepium,* Burans *Rhododendron arboretum* etc. Further, twenty one (21) species of birds were recorded under the omnivore feeding guild. The birds of this guild were observed feeding on insects, seeds, grains, waste garbage from the homes, institutes, hotels etc. The percentage of these birds under this guild was observed as 13.81%. The insectivore feeding guild has larger number of birds constituting 85 species (55.92%) of total population (Tables 2, 3).

Furthermore, the study based on the birds feeding habitats, 41 species (26.97% species composition) were observed feeding at ground and trees, 35 species (23.02%) were feeding only at trees, 23 species (15.13%) were feeding at ground, 22 species (15.47%) were feeding at trees and are also aerial feeders, 12 species (7.89%) were recorded feeding at all type of habitats such as at ground, trees, and aerial feeders and 7 species of birds (4.60%) were observed as aerial feeders. Among, all the birds recorded during the study period, the feeding habits of 12 species of birds (7.89%) remains unidentified (Tables 1, 3; Fig. 2). Efforts were made to know the feeding behavior of these birds during field study but these birds were seen very rare and whenever seen they were not feeding at that time.

The temperate forests of District Pauri Garhwal mark ecotonal habitats harboring a characteristically diverse faunal assemblage, especially birds that also use these habitats as pathways crucial for their movement. Increasingly, the climatic fluctuations and anthropogenic activities are the main cause of the declining birds. Therefore, it is important to understand that, the broad scale community patterns for conservation planning and prioritization for these ecotone habitats. Food is the important source of nutrients and energy. The nutrients present in the food helps in the growth, development and maintenance of body structure of the organism (Bolen and Robinson, 1989).

The feeding guild structure of the birds recorded in the present study highlighted that there is efficient distribution of all kinds of food resources in the habitat viz. temperate forests for different species in a community. Moreover, the previous research shows that the diversity of birds in the periphery is higher than in the forest and settlement areas. Further, results of the study showed that food availability has influence on the bird species relative abundance and distributions. Because availability of food in good quality and quantity constitutes one of the prime requisites of birds, which in turn attracts them in large numbers to the surplus area. The diverse vegetation such as *Myrica*, *Rhododendron, Qurecus, Cedrus, Berberis,*

Table 1: Feeding guild status and avian diversity in temperate forests of Garhwal Himalaya

S. No.	Name of Bird/Order/Family	Zoological Name	Feeding habitat			Feeding habits
			Ground	Tree	Arial	
A)	**FALCONIFORMES**					
i)	**Accipitiridae**					
1)	Steppe eagle	*Aquila rapax nipalensis*	G	T	-	Carnivore
2)	Merlin	*Falco columbarius*	G	T	-	Carnivore
3)	Egyptian vulture	*Neophron percnopterus*	G	T	-	Carnivore
4)	Mountain hawk eagle	*Nisaetus nipalensis*	-	T	-	Carnivore
5)	Crested serpent eagle	*Spilornis cheela*	-	T	-	Carnivore
6)	Eastern imperial eagle	*Aquila heliacal*	G	T	-	Carnivore
7)	Black kite	*Milvus migrans*	-	T	-	Carnivore
8)	Eurasian sparrow hawk	*Accipiter nisus*	-	T	-	Carnivore
9)	Griffon vulture	*Gyps himalayensis*	G		-	Carnivore
10)	Shikra	*Accipiter badius*	-	T	-	Carnivore
11)	Jerdons baaza	*Zviceda jerdoni*	-	T	-	Carnivore
12)	Crested goshawk	*Accipiter trivirgatus*	-	T	-	Carnivore
B)	**GALLIFORMES**					
i)	**Phasinaidae**					
13)	Kalij pheasant	*Lophura leucomelanos hamiltoni*	G	-	-	Omnivore
14)	Hill partridge	*Arboroehila torqueola*	G	-	-	Omnivore
15)	Black francolin	*Francolinus francolinus*	G	-	-	Omnivore
16)	Himalayan monal	*Lophophorus impejanus*	G	-	-	Omnivore
C)	**COLUMBIFORMES**					
i)	**Columbidae**					
17)	Common pigeon	*Columba livia*	G	-	-	Grainivore
18)	Wedge tailed green pigeon	*Treron sphenura*	-	T	-	Frugivore
19)	Common wood pigeon	*Columba palumbus*	G	T	-	Grainivore
20)	Spotted dove	*Streptopelia chinensis*	G	-	-	Grainivore
21)	Oriental turtle dove	*Streptopelia orientalis*	G	-	-	Grainivore
22)	Emerald dove	*Chalcophaps indica*	G	T		Unidentified
23)	Eurasian collard dove	*Streptopelia dacaocto*	G	-		Grainivore
D)	**PSITTACIFORMES**					
i)	**Psittidae**					
24)	Grey headed parakeet	*Psittacula finschii*	-	T	-	Frugivore
25)	Slaty headed parakeet	*Psittacula himalayana*	-	T	-	Frugivore
26)	Plum headed parakeet	*Psittacula cyanocephala*	-	T	-	Frugivore
27)	Red breasted parakeet	*Psittacula alexandri*	-	T	-	Frugivore
E)	**STRIGIFORMES**					
i)	**Strigidae**					
28)	Asian barred owlet	*Glaucidium cuculoides*	-	T	-	Carnivore
29)	Jungle owlet	*Glaucidium radiatum*	-	T	-	Carnivore
F)	**APODIFORMES**					
i)	**Apodidae**				-	
30)	House swift	*Apus affinis*	-	-	A	Insectivore
G)	**UPUPIFORMES**					
i)	**Upupidae**					
31)	Common hoopoe	*Upupa epops*	G	-	-	Insectivore
H)	**PICIFORMES**					
i)	**Captonidae**					
32)	Great barbet	*Megalaima virens*	-	T	-	Frugivore
33)	Blue throated barbet	*Megalaima asiatica*	-	T	-	Frugivore

ii)	**Picidae**					
34)	Grey headed woodpecker	*Picus canus*	G	T	-	Insectivore
35)	Scaly bellied woodpecker	*Picus squamatus*	-	T	-	Insectivore
36)	Brown fronted woodpecker	*Dendrocopos auriceps*	-	T	-	Insectivore
37)	Grey headed pygmy woodpecker	*Dendrocopos canicapillus*	-	T	-	Insectivore
38)	Himalayan woodpecker	*Dendrocopos himalayensis*	-	T	-	Insectivore
39)	Crimson breasted woodpecker	*Dendrocopos cathpharius*	-	T	-	Insectivore
40)	Rufous bellied woodpecker	*Dendrocopos hyperythrus*	-	T	-	Insectivore
41)	Darjeeling woodpecker	*Dendrocopos darjellensis*	-	T	-	Insectivore
42)	Speckled piculet	*Picumnus innominatus*	--	T	--	Unidentified
43)	Greater yellow nape	*Picus flavinucha*	-	T	-	Insectivore
44)	Lesser yellow nape	*Picus chlorolophus*	-	T	-	Insectivore
I)	**PASSERIFORMES**					
i)	**Alaudidae**					
45)	Oriental skylark	*Alauda gulgula*	G	-	-	Unidentified
46)	Humes short toed lark	*Calandrell acutirostris*	G	-	-	Unidentified
ii)	**Hirundunidae**					
47)	Barn swallow	*Hirundo rustica*	-	-	A	Insectivore
48)	Red rumped swallow	*Hirundo daurica*	-	-	A	Insectivore
iii)	**Laniidae**					
49)	Grey backed shrike	*Lanius tephronotus*	-	T	-	Unidentified
iv)	**Dicruridae**					
50)	Black drongo	*Dicrurus macrocercus*	-	-	A	Insectivore
51)	Ashy drongo	*Dicrurus leucophaeus*	-	-	A	Insectivore
v)	**Sturnidae**					
52)	Common myna	*Acredotheres tristis*	G	T	-	Omnivore
53)	Jungle myna	*Acredotheres fuscus*	G	T	-	Omnivore
vi)	**Oriolidae**					
54)	Maroon oriole	*Oriolus traillii*	-	T	-	Frugivore
vii)	**Coraciidae**					
55)	Black headed jay	*Garrulus lanceolatus*	G	T	A	Omnivore
56)	Eurasian jay	*Garrulus glandarius*	G	T	A	Omnivore
viii)	**Corvidae**					
57)	Grey treepie	*Dendrocitta formosae*	G	T	-	Omnivore
58)	Rufous treepie	*Dendrocitta vagabunda*	G	T	-	Omnivore
59)	Red billed blue magpie	*Urocissa erythrorhyncha*	G	T	-	Omnivore
60)	Yellow billed blue magpie	*Urocissa flavirstris*	G	T	-	Omnivore
61)	Large billed crow	*Corvus macrorhynchas*	G	T	-	Omnivore
62)	House crow	*Corvus splendens*	G	T	-	Omnivore
ix)	**Campehagidae**					
63)	Scarlet minivet	*Pericrocotus flammeus*	-	-	A	Insectivore
64)	Small tailed minivet	*Pericrocotus cinnamomeus*	-	-	A	Insectivore
x)	**Pycnonotidae**					
65)	Black bulbul	*Hypsipetes leucocephalus*	G	T	A	Omnivore
66)	Himalayan bulbul	*Pycnonotus leucogenys*	G	T	A	Omnivore
67)	Red vented bulbul	*Pycnenotus cafer*	G	T	A	Omnivore
xi)	**Muscicapidae**					
68)	Verditer flycatcher	*Eumyias thalassina*	-	T	A	Insectivore
69)	Little pied flycatcher	*Ficedula westermanni*	-	T	A	Insectivore
70)	Ultramarine flycatcher	*Ficedula superciliaris*	-	T	A	Insectivore
71)	Dull blue flycatcher	*Eumyias sordidus*	-	T	A	Insectivore
72)	Grey headed canary flycatcher	*Culicicapa ceylonensis*	-	T	A	Insectivore
73)	Yellow rumped flycatcher	*Ficedula zanthopygia*	-	T	A	Insectivore

74)	Indian blue robin	*Saxicoloides fulicata*	G	-	-	Insectivore
75)	Common stone chat	*Saxicola torquatus*	G	-	-	Insectivore
76)	Black redstart	*Phoenicurus ochuros*	G	T	-	Insectivore
77)	Grey bush chat	*Saxicola ferrea*	G	-	-	Insectivore
78)	Pied bush chat	*Saxicola caprata*	G	T	-	Insectivore
79)	Jordon's bush chat	*Saxicola jerdoni*	G	-	-	Insectivore
80)	White capped redstart	*Chaimarrornis leucocephalus*	G	-	-	Insectivore
81)	Blue capped redstart	*Phoenicurus caeruleocephalus*	G	-	-	Insectivore
xii)	**Sylviinae**					
82)	Ashy prinia	*Prinia sylvatica*	-	T	-	Insectivore
83)	Striated prinia	*Prinia criniger*	-	T	-	Insectivore
xiii)	**Trochilidae**					
84)	White tailed ruby throat	*Luscinia pectoralis*	-	T	A	Unidentified
85)	Lesser white throat	*Sylvia curruca*	-	T	A	Unidentified
xiv)	**Turdidae**					
86)	Blue capped rock thrush	*Monticola cinclorhynchus*	G	T	-	Insectivore
87)	Chestnut bellied rock thrush	*Monticola rufiventris*	G	T	-	Insectivore
88)	Blue whistling thrush	*Myiophonus caeruleus*	G	T	-	Insectivore
89)	Grey winged black bird	*Turdus boulboul*	G	T	-	Insectivore
90)	White collard black bird	*Turdus albocinctus*	G	T	-	Omnivore
91)	Tibetan black bird	*Turdus merula/maximus*	G	T	-	Insectivore
92)	Long billed thrush	*Zoothera monticola*	G	T	-	Insectivore
93)	Himalayan blue tail	*Parsiger rufilatus/cyanurus*	-	-	-	Insectivore
xv)	**Rhipiduridae**					
94)	White throated fantail	*Rhipidura albicollis*		T		Unidentified
xvi)	**Timalidae**					
95)	Spot breasted scimitar babbler	*Pomatorhinus erythrocnemis*	G	T	A	Insectivore
96)	Jungle babbler	*Turdaoiedes striatus*	G	T	A	Omnivore
97)	White browed shrike babbler	*Pteruthius flaviscapis*	G	T	A	Insectivore
xvii)	**Sittidae**					
98)	Chest nut bellied nuthatch	*Sitta/cinnamoventris, castanea*	-	T	A	Insectivore
99)	Indian nuthatch	*Sitta castanea*	-	T	A	Insectivore
xviii)	**Certhiidae**					
100)	Hudgson tree creeper	*Certhia hodgsonii*	G	T	-	Insectivore
101)	Humes tree creeper	*Certhia manipurensis*	G	T	-	Insectivore
102)	Bar tailed tree creeper	*Certhia himalayana*	G	T	-	Insectivore
xix)	**Paridae**					
103)	Black lored tit	*Parus xanthogenys*	G	T	A	Insectivore
104)	Black throated tit	*Aegitholos concinnus*	-	T	A	Insectivore
105)	Green backed tit	*Parus monticolus*	G	T	A	Insectivore
106)	Great tit	*Parus major*	G	T	A	Insectivore
107)	White napped tit	*Parus nuchalis*	-	T	A	Insectivore
108)	Yellow cheeked tit	*Parus spilonotus*	-	T	A	Insectivore
109)	Indian yellow tit	*Parus aplonotus*	-	T	A	Insectivore
110)	Yellow browed tit	*Sylviparus modestus*	-	T	A	Insectivore
111)	Rufous napped tit	*Periparus rufonuchalis*	-	T	A	Insectivore
112)	Coal tit	*Periparus ater*	-	T	A	Insectivore
113)	White cheeked tit	*Aegithalos leucogenys*	-	T		Insectivore
xx)	**Pemizidae**					
114)	Fire capped tit	*Cephalopyrus flammiceps*	-	T	A	Insectivore
xxi)	**Cisticolidae**					
115)	Tickells leaf warbler	*Phyllascopus affinis*	-	T	A	Insectivore
116)	Grey hooded warbler	*Seicercus xanthoschistos*	-	T	A	Insectivore

117)	Thick billed warbler	*Phragamaticola aedon*	-	T	A	Insectivore
118)	Blyths leaf warbler	*Phyllascopus reguloides*	-	T	A	Insectivore
119)	Greenish warbler	*Phyllascopus trochiloides*	-	T	A	Insectivore
120)	Mountain tailor bird	*Phyllergates cuculatus*	-	T	A	Insectivore
121)	White browed tit warbler	*Leptopoecile sophiae*	-	T	A	Insectivore
xxii)	**Silvidae**					
122)	Streaked laughing thrush	*Garrulax lineatus*	G	-	-	Insectivore
123)	White throated laughing thrush	*Garrulax albogularis*	G	T	-	Insectivore
124)	Rufous chinned laughing thrush	*Garrulax rufogularis*	-	T	-	Insectivore
125)	Spot breasted scimitar babbler	*Pomatorhinus erythrocnemis*	G	T	-	Insectivore
126)	White browed shrike babbler	*Pomatorhinus schisticeps*	G	T	-	Insectivore
127)	White breasted scimitar babbler	*Pomatorhinus schisticeps*	-	T	-	Insectivore
128)	Tickells thrush	*Turdus unicolor*	G	T	-	Insectivore
129)	Mistle thrush	*Turdus viscivorus*	G	T	-	Insectivore
130)	Chestnut thrush	*Turdus rubrocanus*	-	T	-	Insectivore
131)	Black throated thrush	*Turdus atrogularis*	G	T	-	Insectivore
xxiii)	**Leiothrichidae**					
132)	Rufous sibia	*Heterophasia capistrata*	-	T	-	Insectivore
133)	Bar throated sivia	*Siva strigula*	G	T	-	Omnivore
134)	Blue winged sibia	*Siva cyanouroptera*	-	T	-	Unidentified
xxiv)	**Necterinidae**				-	
135)	Purple sunbird	*Nectarinia asiatica*	-	T	-	Nectarivore
136)	Green tailed sunbird	*Aethopyga nipalensis*	-	T	-	Nectarivore
xxv)	**Passeridae**				-	
137)	House sparrow	*Passer domsticus*	G	T	-	Omnivore
138)	Russet sparrow	*Passer rutilanis*	G	T	-	Insectivore
xxvi)	**Prunellidae**					
139)	Black throated accentor	*Prunella atrogularis*	G	T	-	Unidentified
xxvii)	**Motacilliadae**			-	-	
140)	Citrine wagtail	*Motacilla citreola*	G	-	-	Insectivore
141)	Grey wagtail	*Moticilla cinerea*	G	-	-	Insectivore
142)	White wagtail	*Motacilla alba*	G	-	-	Insectivore
xxviii)	**Ploceidae**			-	-	
143)	Scaly breasted munia	*Lonchura punctulata*	G	T	-	Grainivore
xxix)	**Fringillidae**					
144)	Common rose finch	*Cardueles erythrinus*	G	T	-	Grainivore
145)	Yellow breasted green finch	*Cardueles spinoides*	G	T	-	Grainivore
xxx)	**Emberizidae**					
146)	Rock bunting	*Emberiza cia*	G	-	-	Grainivore
147)	Crested bunting	*Melophus lathami*	G	-	-	Insectivore
xxxi)	**Zosteropidae**					
148)	Oriental white eye	*Zosterops palpebrosus*	G	T	-	Insectivore
xxxii)	**Dicaeidae**					
149)	Fire breasted flower pecker	*Dicaeum ignipectus*	-	T	-	Frugivore
xxxiii)	**Pittidae**					
150)	Blyths pipit	*Anthus godlewskii*	G	T	-	Unidentified
xxxiv)	**Pachycephalidae**					
151)	Mangroov whistler	*Pachycephala cinerea*	G	T	-	Unidentified
xxxv)	**Tichodromidae**					
152)	Wall creeper	*Tichodroma muraria*	G	-	-	Insectivore

G- Feeding on the ground**, T-** Feeding on the trees**, A-** Aerial feeders

Table 2: Avian diversity of temperate forests of district Pauri Garhwal

Sites	Line Transect method			
	T.O.	T.F.	T.S.	D.I.
Nagdev (Pauri)	08	34	81	3.35±0.07
Kandoilya	07	33	90	3.98±0.06
Ransi	07	30	82	3.56±0.05
Khirsu	06	24	75	3.41±0.06
Adwani	07	26	71	3.34±0.08
Lansdowne	07	26	73	3.76±0.13
Average	-	-	-	3.57±0.11

T.O.- Total order, T.F. - Total family, T.S. - Total species, D.I. - Diversity index

Table 3: Per cent composition of temperate forest birds under different feeding guilds

S. No.	Feeding habit/guild	Total species	Per cent composition
1.	Carnivorous	14	9.21%
2.	Frugivorous	09	5.92%
3.	Grainivorous	09	5.92%
4.	Nectarivorous	02	1.31%
5.	Omnivorous	21	13.81%
6.	Insectivorous	85	55.92%
7.	Unidentified	12	7.89%

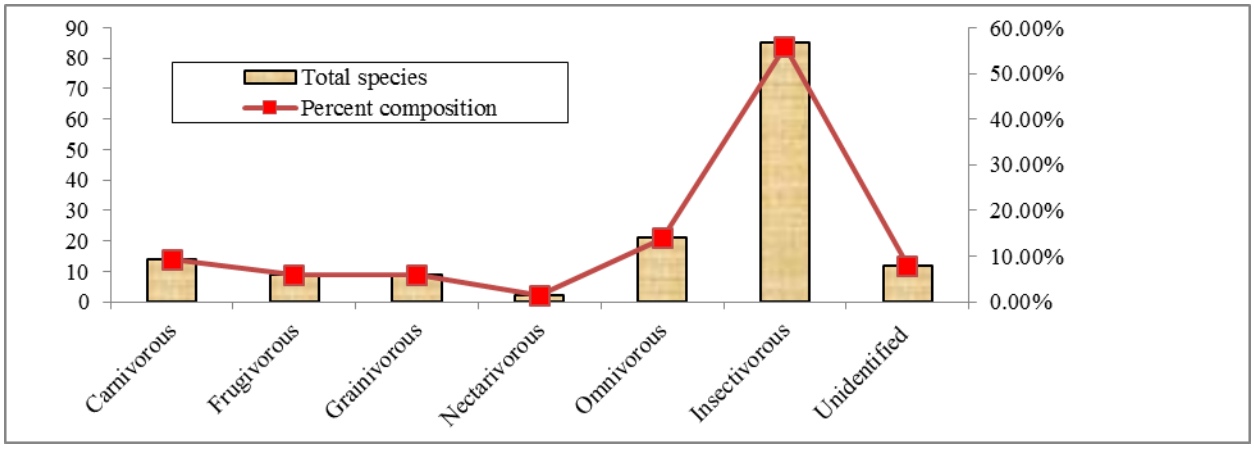

Fig. 1: Composition of temperate forest birds under different guilds.

Rubus, Rosa, Pyrocantha etc. produce leafy buds, fruits, nectar and also attract insects during different seasons. Birds of each guild are important to maintain balance of the ecosystem as the frugivorous birds that feed primarily on fruits for their survival have basic mechanism of seed dispersal that allows birds to carry seeds from the parent plants to the new environment for their successful germination (Levey *et al*., 2002).

In temperate forests, fruit eating birds like parakeets, Wedge tailed green pigeon, Barbets; Maroon oriole and Fire breasted flower pecker are particularly important seed dispersers, because most of tree species such as *Myrica*, *Quercus,* and *Pyrocantha* etc. produce fruits which are further eaten by birds (Herrera *et al*., 1994). The insectivorous guild was found dominant in temperate forests, indicating rich abundance and availability of insects. Similar observations have been reported in Indian subcontinents and observed that the insectivorous feeding guild is dominant in the tropical forest habitats (Singh,

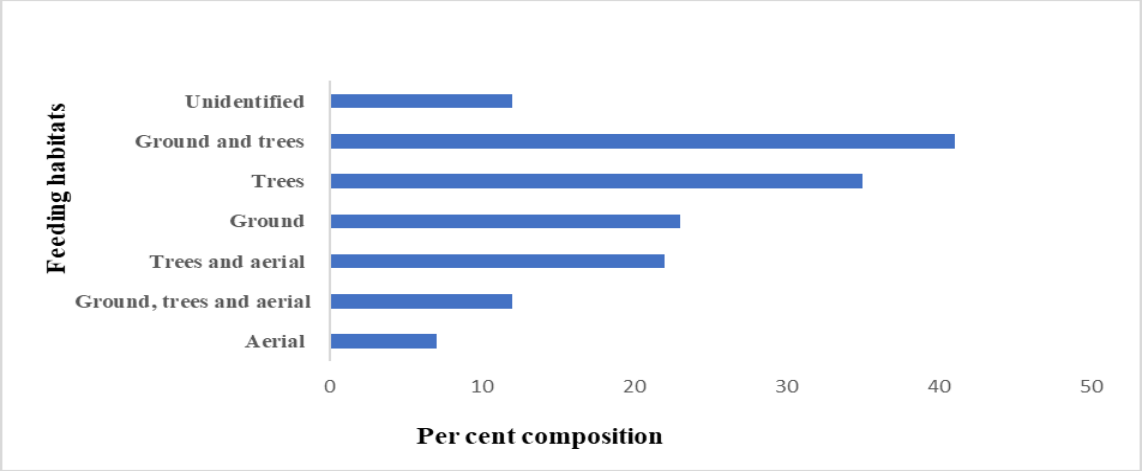

Fig. 2: Percentage of temperate forest birds under different feeding habitat.

2000). During the study period, it was observed that winter is a critical period for the bird population because of decreased food availability in comparison to other seasons and the birds feed mostly on roots and tubers of the plants. Similar observations were reported by Lathi (1998). Thus, the food availability has a considerable impact on the survival and reproductive output of individuals within a population. Birds are potential predictors of the integrity and function of habitats (Mukhopadhyay and Mazumdar, 2019).

Conclusion

The wealth of diverse vegetations in the temperate forests of Garhwal Himalaya provides a wide variety of food resources to the birds. Feeding is an important activity in the life of the bird which is indispensible for their survival. The insectivorous and carnivorous species of birds are considered to be useful to agriculture since they keep a very potent check on population of insects and rodent pests. The particular temperate forest bird species have their own feeding guilds and technique, so all the niches of habitat were utilized more perfectly but due to the high anthropogenic pressure birds are declining at an alarming rate. Therefore, there is urgent need to protect the habitats of the birds for the maintenance of ecosystem.

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References

Aggarwal S, Sahi DN and Wani A. (2008) Feeding guilds of avifauna of Nandani Wildlife Sanctuary, Jammu (Jammu and Kashmir). The Ecoscan 2(2): 157-160.

Ali S. (1996) The Book of Indian Birds. 12th edition, The Bombay Natural History Society, India.

Asha S and Sharma N. (2020) Assessing the bird guild patterns in heterogeneous land use types around Jammu, Jammu and Kashmir, India. Ecol Process. 9: 49.

Bisht MS, Phurailatpam S and Kathait BS. (2005) Breeding ecology of Cheer pheasant *Catreus wallichii* in Garhwal Himalaya. Proc 3rd International Galliformes Symposium, (eds.) Fuller R.A. and Browne S. J., Fordingbridge, U.K., pp. 188-191.

Bisht MS, Kukreti M and Shanti B. (2004) Relative abundance and distribution of the bird fauna of Garhwal Himalaya. Ecol Environ Conserv. 10(4): 451- 460.

Bisht MS, Dobriyal AK and Bisht KL. (2002) Habitat utilization of White crested Kaleej pheasant (*Lophura leucomelana hamiltonii*) in Garhwal Himalaya. J Adv Biosci. 21 (1): 11-16.

Bolen EG and Robinson WL. (1989). Wildlife Ecology and Management. 2nd edition, Prentice Hall, Englewood Cliffs, New Jersey, pp. 574.

Grimmett R, Inskipp C and Inskipp T. (2011) Birds of Indian subcontinents, 2nd edition, Oxford University Press, New Delhi, pp. 615.

Herrera CM, Jordano P, Lopez-Soria L and Amat JA. (1994) Recruitment of a mast fruiting, bird dispersed tree: bridging frugivore activity and seedling establishment. Ecol Monograph 64: 315-344.

Joshi K and Bhatt D. (2011) Birds of three different forest habitats in Nainital district (Western Himalaya), Uttarakhand, India. Indian Birds 7(10): 33-37.

Joshi KK and Bhatt D. (2014) Birds of three different forest (Sal, Pine and Oak) habitats in Nainital District (Western Himalaya) of Uttarakhand, India. Rep Opinion 9: 59-67.

Kait R. (2011) Studies on avian and mammalian diversity of Trikuta hills. Ph.D. Thesis University of Jammu, Jammu and Kashmir, India.

Kazmeirczak K. (2000) A field guide to the birds of India. Om Book Service, New Delhi, pp. 352.

Kumar Sudesh, Bisht MS and Bhandari S. (2016) Record of species diversity and relative abundance of bird fauna in temperate forests of district Pauri Garhwal, Uttarakhand. J Mountain Res. 11: 63-67.

Kumar Sudesh, Bisht MS and Bhandari S. (2019) Bird fauna of temperate forest of district Pauri Garhwal, Uttarakhand. Int J Res Analytical Rev. 6(1): 1396-1404.

Kumar Sudesh, Bisht MS and Kumar R. (2021) Avian diversity and effect of anthropogenic activities on temperate forests of Garhwal Himalaya, Uttarakhand, India. Intern J Zool Invest. 7(2): 527-533.

Lahti K. (1998) Social dominance and survival in flocking passerines birds: a review with an emphasis on the Willow Tit *Parus montanus*. Ornis Fennica 75: 1-17.

Lemuel A, Pabico M, Duyal V and Fidelino JS. (2020) Bird feeding guild assemblage along a disturbance gradient in the Pantabangan-Carranglan Watershed and Forest Reserve, Central Luzon Island, Philippines. Philippine J Sci. 150(S1): 237-255.

Levey DJ, Silva WR and Galetti M. (2002) Seed dispersal and frugivory: Ecology, evolution and conservation. Ann Bot. 90(1): 155.

Mukhopadhyay S and Mazumdar S. (2019) Habitat wise composition and foraging guilds of avian community in a suburban landscape of lower Gangetic plains, West Bengal, India. Biologia 74: 1001-1010.

Namrata RU and Dholakia AH. (2019) Feeding guild structure of water birds at Gavier Lake, Surat, Gujarat. Int J Innov Res Sci Engineer Technol. 8(8): 8359-8364.

Rizki KT, Sitanggang FI and Sutiawan R. (2020) The diversity, distribution and feeding guild of mammals and birds in Institute of Technology Sumatera (ITERA) landscape. https://iopscience.iop.org/article/10.1088/1755-1315/537/1/012014.

Root RB. (1967) The niche exploitation pattern of the Blue-gray Gnatcatcher. Ecol Monograph: 37: 317-350.

Singh AP. (2000) Birds of lower Garhwal Himalayas: Dehra Dun valley and neighboring hills. Forktail (16): 101-123.

Singh R, Kour D, Ahmad N and Sahi DN. (2013) Species diversity, relative abundance and habitat use of the bird communities of Tehsil Chenani, District Udhampur, Jammu and Kashmir, India. Indian J Life Sci. 2(2): 81-90.

Taper ML, Bohning-Gaese K and Brown JH. (1995) Individualistic responses of bird species to environmental change. Oecologia 101: 478-486.