J. Mountain Res. P-ISSN: 0974-3030, E-ISSN: 2582-5011 DOI: https://doi.org/10.51220/jmr.v16i3.24
Vol. 16(3), (2021), 229-240

Avian Diversity of Oak Mixed Forest in Pauri Garhwal, Uttarakhand, India

Jarnail Singh[1] • Sunil Bhandari[1*] • M S Bisht[1]
[1]*Department of Zoology, HNB Garhwal University (A Central University), BGR Campus Pauri Garhwal-246001*

*Corresponding author: sunilbhandari83@yahoo.in

Received: 24.102921; Revised: 14.11.2021; Accepted: 28.11.2021

Abstract: The avian diversity of Oak mixed forest in Pauri Garhwal district of Uttarakhand was studied during October 2019 to March 2020. Two strands of oak mixed forest located at different sites at 29º 22'-29º 75' North and 78º, 10' -78º,80' East (1750 masl) were selected. Regular field survey was carried out during the morning and evening hours at each site. A total of 63 species of birds belonging to 07 orders and 31 families were recorded. The average bird diversity index H ¯was 3.202. The species richness was observed around 7.27 and species evenness was 0.72. The highest number of species was recorded at Ransi Oak mixed forest (63) and lowest number of bird species were recorded in Teka Oak mixed forest (60).

Key words: Avian diversity, Diversity index, Species richness, Evenness, Oak mixed forest

Introduction

Birds are one of the best known and highly valued groups of species. They are a group of feathered, biped, warm blooded animals whose body temperature remains more or less constant and independent of surrounding temperature. The birdlife in India is truly amazing that contributes an important part to biodiversity. These are found in all the continents, seas and inlands penetrating the arctic beyond 30^0 North and over 6400m altitude on Mount Everest (Singh and Bhasker, 2003). The wide occurrence is due to their power of flight, which enable them to reach in accessible area. There are about 10,000 species of birds in the world and out of these India contributes nearly 1250 species (12.5%) of the world total avian diversity (Gill and Dhonsker, 2019). Garhwal Himalaya as a part of Western Himalaya is rich for its habitat diversity and bird species richness due to its unique position between indo-Chinese and Paleacritic lines and great altitudinal variation from 400m to 7817m (Nanda Devi Peak II). Therefore, present study was aimed to record avian diversity of Oak mixed forest of district Pauri Garhwal. Oak mixed forest are the habitats of wild animals including birds and provide various essential services such as medicine, food, timber, shelter, grasses, fresh oxygen and promotion of ecotourism.

Material and Methods

The present study was conducted in district Pauri Garhwal Uttarakhand which lies in the Western Himalaya between 29° 22′-29° 75'North and 78°, 10′ to 78°, 80′ East and at an altitude of 1750masl. Two sites of Oak mixed forest were selected constituted by *Quercus*, *Rhododendron*, *Myrica*, *Cedrus*, *Pinus* etc. at

Ransi and Teka (Table 1). The survey was carried out from October 2019 to March 2020; both sites were visited in each month. Following the Line transect and Point count methods (Javed and Kaul, 2002; Bibby et al., 2000), the birds were recorded at each site. With the help of field binocular (2 x 40X) and pocket field guides (Gremmitt et. al., 2011, Ali and Replay 2002), each bird was identified and photographed by digital Camera (21.1 mp x 63X zoom). The diversity index, species richness and evenness of birds were calculated by using (Shannon and Weaver diversity index 1949), Margalef index (1968). Field survey conducted during the harsh weather conditions and rainy seasons were not considered in the results.

Results and Discussions

During the survey, a total of 63 species of birds belonging to 07 orders and 31 families were recorded (Table 2). The highest numbers of species were recorded under the order Passeriformes (75% species composition) and lowest in the order Galliformes and Strigiformes (Table 2 and Fig. 1). Among families, the highest species of birds were recorded in family Muscipidae (20% species composition) and the lowest were recorded in the family Phasinaidae, Strigidae, Dicruridae, Rhipiduridae, Timalidae, Sittidae, Fringillidae, Eberzidae, Zoosterpidae and Tichodromidae (Table-3 and Fig. 2). Therefore, the strong positive correlation between total number of species and total number of orders and families was observed (Fig. 3 and 4). From out of the total observed birds, 07 species were identified as summer visitors and 05 species as winter visitors (Table-4 and 5).

The highest numbers of bird species (63) was recorded at Ransi and Lowest was recorded at Teka (60). The overall diversity index of birds in Oak mixed forest of Pauri Garhwal was found (H^{-}=3.202), species richness (7.27) and species evenness 0.72 (Table 6). Out of the total birds recorded in the study area, one species Steppe eagle was endangered, four species Emerald dove Tickells leaf warbler, Greater yellownape and Indian nuthatch are rare, two species Black headed jay and White napped tit are vulnerable (IUCN, 2015, 2018, 2019) (Fig. 5). Besides this, five species Emerald dove, White crested kalij, Black headed jay, Himalayan bulbul are endemic to Western Himalaya.

Table 1. Bird species recorded at different sites in oak mixed forests of Pauri Garhwal, Himalaya.

S. N	Site Names	Altitude	TO	TF	TS
1	Ransi Oak mixed Forest	1890 m	07	32	63
2	Teka Oak mixed Forest	1750 m	07	29	60

Abbreviations: TO*- Total Order,* ***TF****- Total Families,* ***TS****- Total Species*

Table 2. Check list of bird fauna of the Oak mixed forest of Pauri town Garhwal Western Himalaya

S. No.	Name of Bird/Order /Family	Zoological Name	Relative abundance	Distribution Range
I	**GALLIFORMES**			
a)	**Phasinaidae**			
1	White crested Kalij	*Lophura leucomelones*	0.037	Up to 3700
II	**COLUMBIFORMES**			
a)	**Columbidae**			
2	Oriental turtle dove	*Stigmatopelia orgnatalis*	0.027	Up to 4000
3	Spotted dove	*Stigmatopelia chinensis*	0.012	Up to 4000
4	Emerald dove	*Chalcophaps indica*	0.014	<1800
5	Blue rock pigeon	*Columba livia*	0.015	<3300
III	**PSITACIFORMES**			
a)	**Psititidae**			
6	Slaty headed parakeet	*Psittacula himalayana*	0.049	600t0 2500
7	Plum headed parakeet	*Pisttacula cypnonephala*	0.038	<1500
8	Grey headed parakeet	*Pisttacula finschii*	0.025	<1500
IV	**STRIGIFORMES**			
a)	**Strigidae**			
9	Jungle owlet	*Glaucidium radiatum*	0.0033	<2000
V	**PICIFORMES**			
a)	**Captonidae**			
10	Great barbet	*Magalaima virens*	0.021	1000 to 3000
11	Blue throated barbet	*Megalaima asiatica*	0.066	1000 to 3000
b)	**Piccidae**			
12	Grey capped pygmy woodpecker	*Dendronopos canicapillus*	0.016	<1700
13	Brown fronted woodpecker	*Dendronopos auricops*	0.019	1000 to 3100
14	Greater yellow nap	*Picus chlorolopes*	0.02	<2100
15	Rufous bellied woodpecker	*Dendronopos hyperythrus*	0.028	<1500
VI	**PASSERIFORMES**			
a)	**Hirundunidae**			
16	Red rumped swallow	*Cecropis daurica*	0.0078	Upto 3000
17	Barn swallow	*Hirundo rustica*	0.051	Upto 3000
b)	**Dicruridae**			
18	Black drongo	*Dicrurus macrocercus*	0.0091	<2100
c)	**Sturnidae**			
19	Common myna	*Acridotheres tristis*	0.031	<3050
20	Jungle myna	*Aeridotheres fuscus*	0.013	<2400

d)	**Coraciidae**			
21	Black headed jay	*Garrulus lanceolatus*	0.038	900 t0 2500
22	Euration jay	*Garrulus glandarius*	0.03	1500 to 3000
e)	**Corvidae**			
23	Grey treepie	*Deudrocitta formorae*	0.016	600 to 2100
24	Red billed blue magpie	*Urocissa erythrohyncha*	0.026	Up to 2000
25	Yellow billed blue magpie	*Urocissa flauisostris*	0.033	1000
26	Jungle crow	*Corvus macrohynchos*	0.023	1600
f)	**Campehagidae**			
27	Scarlet minivet	*Pericrocotus flammesns*	0.006	2700
g)	**Pycnonotidae**			
28	Black bulbul	*Hypsipetes leucocephalus*	0.022	3000
29	Himalayan bulbul	*Pycmotus leucogenys*	0.062	300 to 2400
30	Red vented bulbul	*Pycmotus cafer*	0.049	1500
h)	**Muscicapidae**			
31	Verditer flycatcher	*Eumfias thalassium*	0.0057	1200 t0 2700
32	Dull blue flycatcher	*Eumfias rordidus*	0.002	900 to 2100
33	Grey headed canary flycatcher	*Culicipa ceylonensis*	0.0067	<2700
34	Yellow rumped flycatcher	*Ficedula zanthropygia*	0.0033	<400
35	Common stone chat	*Saxicola torquatus*	0.008	<1800
36	Grey bush chat	*Saxicola ferreus*	0.01	1200 t0 3000
i)	**Turdidae**			
37	Blue whistling thrush	*Myophonus caerulous*	0.027	1500 t0 2400
38	Grey winged black bird	*Turdus boulboul*	0.034	1800 to 2700
j)	**Rhipiduridae**			
39	White throated fantail	*Rhipidura albicollis*	0.009	<1700
k)	**Timilidae**			
40	Rusty checked scimitar bubbler	*Pomatorhimiseythronemis*	0.0033	750 to 1800
l)	**Sittidae**			
41	Chest nut bellied nuthatch	*Sitta castanea*	0.0072	1200 to 2800
m)	**Certhiidae**			
42	Brown throated tree creeper	*Certhia discolor*	0.012	700 to 3200
43	Bar tailed tree creeper	*Certhia himalayana*	0.013	<1500
n)	**Paridae**			
44	Black lored tit	*Parus xanthogenys*	0.0057	<2400
45	White napped tit	*Parus muchalis*	0.0042	<1200
46	Yellow checked tit	*Parus aplontus*	0.0028	1200 to 2400
47	Black throated tit	*Aegitholos concinnus*	0.0072	1200 to 2400
o)	**Pemizidae**			

48	Fire capped tit	*Cephalopyrus flammicepus*	0.01	2000 to 3500
p)	**Cisticolidae**			
49	Tickle's leaf warbler	*Phyllocopes affinis*	0.0038	3300 t0 4500
50	Grey hooded warbler	*Phyllocopes xanthosohistos*	0.0057	1000 t0 2300
51	Blyth's leaf warbler	*Phyllocopes reguloids*	0.0058	<1200
52	Greenish warbler	*Phyllorgales trochiloids*	0.0056	2600 t0 4000
q)	**Silividae**			
53	Streaked laughing thrush	*Garrulax lincatus*	0.061	<1200
54	White laughing thrush	*Garrulax albogulasis*	0.022	1800 t0 3300
r)	**Passeridae**			
55	House sparrow	*Passer domestians*	0.066	<4000
56	Russet sparrow	*Passer rutilans*	0.023	500 to 2700
s)	**Motacilliadae**			
57	Grey wagtail	*Moticilla cinerea*	0.0017	<1800
t)	**Fringillidae**			
58	Yellow breasted green finch	*Carduelis spinodes*	0.0033	900 to 4400
v)	**Embrizidae**			
59	Rock bunting	*Emberizacia*	0.0057	600 to 4600
u)	**Zosteropidae**			
60	Oriented white eye	*Zosterops palpebrosus*	0.0097	<1800
v)	**Tichodromidae**			
61	Wall creeper	*Tricodroma murasia*	0.0055	<3300
VII	**FALCONIFORMS**			
a)	**Accipitiridae**			
62	Himalayan vulture	*Gyps himalayensis*	0.0037	900 to 4000
63	Steppe eagle	*Aquila nipalensis*	0.0034	<1500

Table 3. Composition of bird species under different order

S.N	Order	No. of Species	Species Composition %
1	Galliformes	01	1.59%
2	Columbiformes	04	6.35%
3	Psittaciformes	03	4.76%
4	Strigiformes	01	1.58%
5	Passeriformes	45	71.43%
6	Piciformes	06	9.52%
7	Falconiformes	03	4.76%

Among families, the highest species of birds were recorded in family Muscipidae (20% species composition) and the lowest were recorded in the family Phasinaidae, Strigidae, Dicruridae, Rhipiduridae, Timalidae, Sittidae, Fringillidae, Eberzidae, Zoosterpidae and Tichodromidae (Table-4 and Fig. 2). Therefore, the strong positive correlation between total number of species and total number of orders and families was observed (Fig. 3 and 4). From out of the total observed birds, 07 species were identified as summer visitors and 05 species as winter visitors (Table- 5 and 6).

Table 4. Composition of bird species under different families

S.N	Family	No. of Species	Species Composition (%)
1	Phasinaidae	01	1.59%
2	Columbidae	04	6.35%
3	Psititidae	03	4.76%
4	Strigidae	01	1.59%
5	Captonidae	02	3.17%
6	Piccidae	04	6.35%
7	Hirundunidae	02	3.17%
8	Dicruridae	01	1.59%
9	Sturnidae	02	3.17%
10	Coraciidae	02	3.17%
11	Corvidae	04	6.35%
12	Campehagidae	01	1.59%
13	Pycnonotidae	03	4.76%
14	Muscicapidae	06	9.52%
15	Turdidae	02	3.17%
16	Rhipiduridae	01	1.59%
17	Timilidae	01	1.59%
18	Sittidae	01	1.59%
19	Certhiidae	02	3.17%
20	Paridae	04	6.35%
21	Pemizidae	01	1.59%
22	Cisticolidae	04	6.35%
23	Silividae	02	3.17%
24	Leiothrichidae	01	1.59%
25	Passeridae	02	3.17%
26	Motacilliadae	01	1.59%
27	Fringillidae	01	1.59%
28	Embrizidae	01	1.59%
29	Zosteropidae	01	1.59%
30	Accipiteridae	01	1.59%
31	Tichodromidae	01	1.59%

Table 5. Summer visitor birds recorded in the Oak mixed forest of Pauri Garhwal

S. No	Name Of Bird Species	Zoological Name
1	Plum headed parakeet	*Psittacula cyanocephala*
2	Black drongo	*Dicrurus leucophaeus*
3	Oriental turtle dove	*Streptopelia*
4	Ultramarine flycatcher	*Orientalis*
5	Common myna	*Acridotheres triestis*
6	Dull blue fly catcher	*Eumyias sordidus*
7	Mountain tailor bird	*Phyllegates cuculatus*

Table 6. Winter visitor birds recorded in the Oak mixed forest of Pauri Garhwal

S. N.	Name of Bird Species	Zoological Name
1	Lesser yellow nape	*Picus chlorolophus*
2	Rock bunting	*Emberiza cia*
3	White checked tit	*Aegithalos leucogenys*
4	Wall creeper	*Tichodroma muraria*
5	White throated laughing thrush	*Garrulax albogularis*

Table 7. Monthly average records of bird species in oak mixed forest at Pauri Garhwal.

S.N	Months	TO	TF	TS	DI	SR	Evenness	Simpson index (1-D)
1	October	07	31	57	1.8	4.41	0.44	0.96
2	November	05	27	41	1.7	2.08	0.45	0.95
3	December	06	29	54	1.7		0.48	0.97
4	January	06	28	45	1.3	2.34	0.34	0.97
5	February	07	31	61	1.6	3.57	0.47	0.99
6	March	07	31	63	1.9	3.39	0.49	0.98

Abbreviations: **TO**- Total orders, **TF**- Total families, **TS**- Total Species, **DI**- Diversity index, **SR**- Species richness

The highest numbers of bird species (63) was recorded at Ransi and Lowest was recorded at Teka (60). The overall diversity index of birds in Oak mixed forest of Pauri Garhwal was found ($\bar{H}$=3.202), species richness (7.27) and species evenness 0.72 (Table 7). Out of the total birds recorded in the study area, one species Steppe eagle was endangered, four species Emerald dove Tickells leaf warbler, Greater yellownape and Indian nuthatch are rare, two species Black headed jay and White napped tit are

vulnerable (IUCN, 2015, 2018, 2019) (Fig. 5). Besides this, five species Emerald dove, White crested kalij, Black headed jay, Himalayan bulbul are endemic to Western Himalaya.

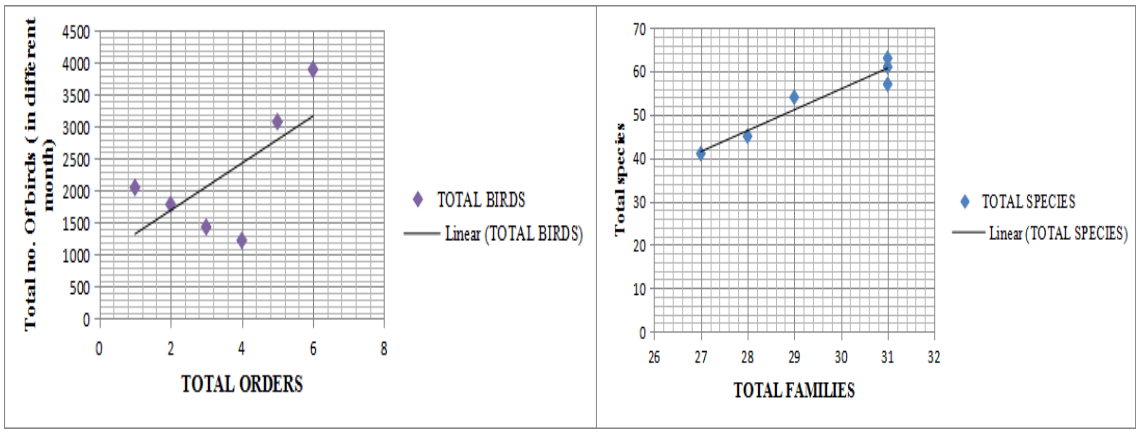

Fig. 3. Correlation between number of species and orders

Fig. 4. Correlation between number of species and families.

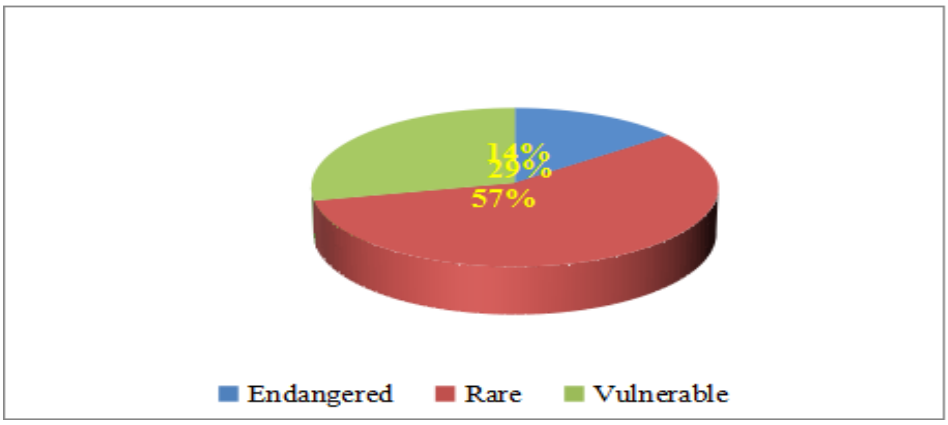

Fig.5. Birds under different IUCN Category

Findings of the present study suggest that the bird community structure of the oak mixed forest of Garhwal Himalaya also exhibit variations in time and is a function of the food as reported by (Sabo and Holmes, 1983; Mac Arthur, 1958, Holmes et al., 1986). Ecologically, birds have tremendous importance as they are important pollinators,

scavengers and play a key role in seed dispersal. These are good indicators, as their presence is an indication of healthy ecosystem in habitats. The previous systematic studies on avian diversity, abundance and resistant status has been conducted on Kalij pheasant (Chandola-Saklani et al., 1988; Kumar et al., 2013,2016,2019), Himalayan monal (Bisht et al., 1989), Chukur partridge (Kukreti et al., 2005), Cheer pheasant (Bisht et al., 2005 and Phaurailatpum, 2005), avian diversity (Bisht et al., 2004; Bhandari and Bisht 2012, Bhandari et al., 2015, 2018). The birds of Himalayan region (Shafiq et al, 2000) and pioneering investigations to Ali, S.(1981) authoritative handbook of Himalayan region.

This study indicates the current status of community composition (abundance, richness, evenness, and diversity), status of endangered, rare and vulnerable bird species in oak mixed forest constituted by the dominant species of *Quercus, Rhododendron, Myrica, Cedrus, Pinus*, are under heavy anthropogenic pressure near human habitation which directly or indirectly effect the avian diversity. Despite, various anthropogenic activities, oak mixed forest still have good number of birds but some pheasants (Cheer pheasant and Partridges) were common in the past have not seen in the study area. Habitat destruction by deforestation, unusual forest fire, and invasive weeds like *Eupatorium* and *Lantana* camera are the main threats to biodiversity in the study area (Kumar et al., 2019). Therefore, the forest department and local people should properly look after the natural forests and necessary steps must be taken to ensure the well being of forests and associated bird diversity to be conserved in the future.

Acknowledgement

The authors are thankful to Prof. A. K. Dobriyal, Dean of Life Sciences, HNB Garhwal Central University and Head department of Zoology, BGR Campus Pauri Garhwal for his continuous support and encouragement.

References

Ali, S. and Ripley, S. D. (2002). *Handbook of Bird of India and Pakistan*. Compact edition, Oxford University Press, New Delhi.

Ali, S., (1981). *The Himalaya in Indian Ornithology*. In the Himalaya aspect

of change. Oxford University Press, New Delhi.16-31.

Bhandari S, Kumar S and Bisht M S (2015). Avian Diversity of the Western Nayar Valley (Pauri Garhwal) Uttarakhand. J. Mountain Res. Vol. (10): Pp13-19.

Bhandari S, Kumar S and Bisht M S (2018). Status of Faunal Diversity In Nanda Devi National Park (NDNP): Chamoli, Uttarakhand India. J. Mountain Res. Vol. (13): Pp59-67.

Bhandari, S and Bisht, M. S. (2012). Studies on the community structure of avian fauna in relation to distribution of invasive vegetation in Garhwal Himalaya, Ph.D. thesis submitted to HNB Garhwal University Srinagar: 158

Bibby, C. J, Burgess N. D, Hill D. A. and Mustoe S. H. (2000). *Birds census techniques*. London: Academic Press: 302.

Bisht, M. S., Phurailatpam, S. and Kathait, B. S. (2005). Breeding ecology of Cheer pheasant *Catreus wallichii* in Garhwal Himalaya. *Proceeding of 3rd International Galliformes symposium.* (Eds.) Fuller, R.A. and Browne, S. J. *Fordingbridge*, U.K. 188-191.

Bisht, M., Lakhera, P. and Chandola-Saklani, A. (1991). Himalayan monal pheasant: Current status and habitat utilization in the Kedarnath Sanctuary, Garhwal Himalaya. In (Eds.) Garson, P. J. and Jenkins, D. *Pheasant in Asia*. WPA, Reading U.K. 205-208.

Chandola-Saklani, A., Lakhera, P. and Bisht, M. S, (1988). Current status and distribution of some endangered and wide spread animals of the Garhwal Himalaya, *Proc. III International Range land Congress*, New Delhi, 2: 435:437.

Grimmett, R., Inskipp, C. and Inskipp, T. (2011). '*Birds of Indian subcontinents*", 2nd edition. Oxford University Press. New Delhi, 615.

Holmes, R.T., Shery, T. W. and Struges, F.W. (1986). Bird community dynamics in a temperate deciduous forest; long term trends at Hubbard brook. Ecol. Monogr. 56; 201-220.

IUCN (2015). IUCN *Red List of Threatened Species*. iucnredlist. org.

IUCN (2016). IUCN *Red List of Threatened Species*.www.iucnredlist.org.

IUCN (2018). IUCN *Red List of Threatened Species*.www.iucnredlist.org.

Javed, S. and Kaul, R., (2002). *Field Methods for Bird Surveys*. *Bomb. Nat. Hist. Soci*. and World Pheasant Association, New Delhi, 61.

Kukreti, M., Phurailatpam, S. and Bisht, M. S. (2005). Ecology of Chukar Partridge *Alectorischukar* in Garhwal Himalaya.*Proc. of 3rd Int. Galliformes Symp*. 4-7th April, Dehradun. Eds. Fuller, R.A. and Browne, S.J. World Pheasant Association, Fording bridge U.K. 195-198.

Kumar S, Bisht M.S. 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. Vol. (11): Pp 63-67.

Kumar S, Bisht M.S. and Bhandari S (2019). Bird Fauna of Temperate Forest of District Pauri Garhwal, Uttarakhand. Int. J. Res. Rew., Vol. 6 (1): Pp 1396-1404.

Kumar S. and Bhandari S. (2015). Survey of Bird Fauna of Nagdev Reserve Forest in District Pauri Garhwal, Uttarakhand, India J. Mountain Res. Vol. (10): Pp45-50.

Kumar, S., Bisht, M. S. and Kukreti. M. (2013). Social behavior of White crested Kalij pheasant *Lophura leucomelanos hamilitonii* (Grey) in Garhwal Himalaya. *Cheetal*, 51(1&2): 20-28.

Mac Arthur, R. H. (1958). Population ecology of some warblers of north eastern coniferous forests. Ecology. 76; 318-325.

Margalef, D. R. (1968). '*Perspective in ecological theory*". University of Chicago Press.Chicago.

Phurailatpam, S. (2005). Some aspects of biology and population ecology of the endangered Cheer pheasant *Catreus wallichii*in Garhwal Himalaya. Ph.D. Thesis submitted to

HNB Garhwal University Srinagar (Garhwal), Uttarakhand, India.

Sabo, S. R. and Holmes, R. T. (1983). Foraging niches and the structure of forest bird communities in contrasting montane habitat. *Condor*. 85; 121-138

Shafiq, T., Javed, S. and Kaul, R. (2000). Himalayan mountain quail in India: living or extinct. Annual Rev. *WPA*, 46-52.

Shannon C. E. and Weaver W. (1949). *The Mathematical Theory of Communication*. University of Illinois Press; *Urbana*, IL, USA.

Singh, G. and Bhaskar, H., (2003). An Introduction to Birds. Campus International Publication, 242.