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A preliminary survey of bird communities of South Sikkim, India

John Bhutia[1], Pamina Chettri[2], Bishnu K Sharma[3]
[1, 2] Department of Zoology, Namchi Government College, Kamrang South Sikkim, India
[3] Department of Botany, Namchi Government College, Kamrang South Sikkim, India

Abstract
Sikkim ($27^0$03'-$28^0$07'N & $88^0$03'-$88^0$57'E), a small state lies on the foothills of Himalayas, comprising only of 7096 sq km, having a varied climatic condition and vegetation, ranging from cold desert in the north to the lowland forest in south. The study of avian faunal diversity is an essential ecological tool, which acts as an indicator to evaluated different habitats both qualitatively and quantitatively The present day study was carried out to documents the avian diversity in South District of Sikkim. A total of 100 species of birds belonging to 35 families were recorded. In terms of familial richness, muscicapidae dominates in the field of study areas, comprising 16 species followed by turdidae with 8 species, corvdae with 6 species. The present day study adds some valuable information on avian diversity in the study area.

Keywords: avian fauna, birds, community, sikkim and conservation

1. Introduction
Birds are prominent species of global biodiversity (Olechnowski, 2009) [19] and key indicators of ecosystem health and stress as well as very appropriate bio-indicators (Taper *et al*., 1995) [24] (Newton, 1995 [18]; Urfi, 2011) [25]. The composition of bird communities is important to resolve the ecology and health of the local ecosystem or regional landscapes (Nagya *et al*., 2017) [16]. But the Himalayan avian diversity for a wider range remains relatively least investigated (Chettri *et al*., 2001 [7]; Price *et al*., 2003 [21]; Sultana *et al*., 2007) [22]. But in recent years some important studies on Himalayan context of bird diversity and community structure have been made (Laiolo, 2003; Chettri *et al*., 2001) [7]. Eastern Himalayan region (EHR), including Sikkim, is the part of one of the two biodiversity hotspots in India (Mittermeier *et al*., 2005) [15]. It is also identified as an endemic bird area (Birdlife International, 2001) [6]. Of the 19 endemic bird species of the Eastern Himalaya, 10 are found in Sikkim (India) alone. Sikkim also represents a relatively high number of threatened bird species: Of the 78 threatened birds on the Indian Sub-continent, 17 (one endangered, three critically endangered and 13 vulnerable) occur in Sikkim (Acharya and Vijayan 2010) [2]. Sikkim (27003'-28007'N & 88003'-88057'E), being a part of eastern Himalayas, having an altitudinal range varying from 300 m to 8586 m above sea level with annual rainfall ranging from less than 5 mm to nearly 3500 mm. Sikkim only has 9076 km^2 geographical area with large percentage of state's land area is under protection with more than 568 plus species of birds. Sikkim also contains many wetlands which is a critical water birds habitat. Therefore in recent years Sikkim has become haven for many researcher, birders and hobbyists. However Sikkim including other north east states of eastern Himalayas is facing immense depletion of their natural habitats due to many factors. That result in increase in the number of threatened species.

The increase on the number of threatened species is mainly because of habitat destruction and other anthropogenic factors. Degradation of the forests at the present pace is likely to wipe out over 90% of the Himalayan forests by the year 2100, leading to the extinction of many valuable species (Pandit *et al*., 2007) [20].

2. Materials and methods
2.1. Study areas
The south district of Sikkim lies at an altitude of 400 mtr to 2000 mtr with terraced slopes interrupted by spring patched forest. The district also comprises two sanctuaries (Kitam bird sanctuary and Maenam wildlife sanctuary). For the study, the two different areas were selected, that are Perbing and Kewzing. These areas are becoming popular among many local and non-local bird watcher because of its ecosystem and faunal diversity. Both the study area harbor variety of vegetation, with untouched forest areas that provides a great habitat for wild birds. The two study areas differ slightly in elevation and vegetation which provides different habitats for birds. Because the change in vegetation composition could impact the quantity and quality of habitat for birds in terms of food, water and cover, which can further affect diversity, abundance and distribution of birds Aggrawal and Tiwari (1998) [3], Abdar (2013) [1].
Kewzing village is at an altitude of 1404 meters above the sea level in the landscape with highest point the Maenam hill which is a protected area (the Maenam wildlife sanctuary). The Kewzing is located 8 km away from Ravangla and about 9 km from the Maenam wildlife sanctuary. The Maenam wildlife sanctuary is a home for about 200 different species of birds. Perbing is a small village located near Namchi, south district of Sikkim. Perbing lies 1677 meter above sea level and is mainly famous for its organic farming and untouched forest areas, thus attracts many species of bird particularly insectivorous birds. The location of study areas is given in figure 1.

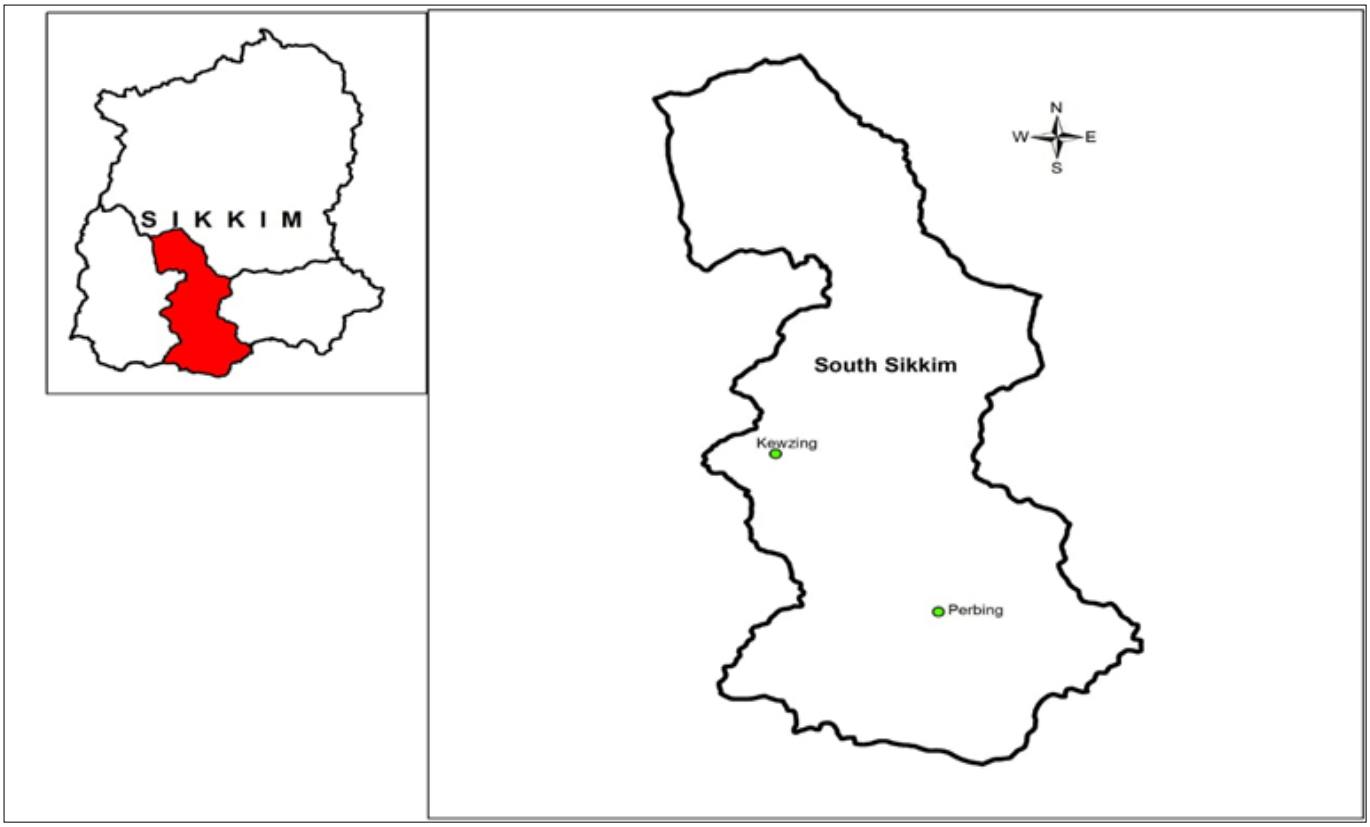

Fig 1: map of Sikkim and study area (a. Kewzing and b. Perbing)

Comprehensive avian surveys were conducted in the study area for one year from April 2019 to March 2020 by employing the following standard methods i.e. Point count method. Point count method: In this method, the observer will stand in a haphazardly chosen point and record bird species seen and heard in a 50 m radius for 5 minutes. This observation is repeated in another point at least 300 m off from the first point. In addition to this, opportunistic bird sightings were made, while traveling within the study region (Emlen *et al*., 1974 [8]; Hill *et al*., 2015 [11]; Sutherland *et al*., 2006 [23]; Nautiyal *et al*., 2015.) [15]. Survey and observations were made twice a day when avifauna was usually most active (05:00 am to 10 am and 03:00 pm to 06:00 pm). Birds were observed with the help of an Olympus Binocular (8X42) and photographs taken using a Nikon D5300 and D3400. Sometimes, birds were identified by listening to bird calls. Identification of birds was done by using standard field guides (Ali S. *et al*., 1983 [4], Manakadan R, et at., 2001 [14], Arlott N. *et al* [5]., 2014, Grewal, 2010 [9] and Grimmett *et al*., 2011) [10].

3. Result and Discussion

A total of 100 birds belonging to 35 families were recorded from the study areas. In terms of familial richness, muscicapidae dominates in the field of study areas, comprising 16 species followed by turdidae with 8 species, corvdae with 6 species. This suggests that the study area is highly diverse and harbors many avian fauna. Detailed checklist of avian fauna of the study areas is given below in Table 1 and Fig. 3.

Table 1: Checklist of Avian fauna with their distribution

Sl. No	Common name	Scientific name	Family	Distribution
1	Black eagle	*Ictinaetus malayensis*	Accipitridae	Himalayas, hills of India, Bangladesh and Sri Lanka
2	Crested serpent eagle	*Spilornis cheela*	Accipitridae	Widespread resident; unrecorded in most of NW and NE subcontinent
3	Moutain hawk eagle	*Nisaetus nipalensis*	Accipitridae	Himalayas, hills of NE India
4	Besra	*Accipiter virgatus*	Accipitridae	The Besra species are distributed in India, Pakistan, Nepal, Central and South China, Southeast Asia, Indonesia and Phillipines
5	Himalayan Buzzard	*Buteo (buteo) burmanicus*	Accipitridae	Resident and winter visitor to Himalayas; also winter visitor to NE India
6	Scarlet minivet	*Pericrocotus (flammeus) speciosus*	Campephagidae	Himalayas, hills of C and E India, Eastern Ghats of N Andhra, Andamans and Bangladesh
7	Sikkim treecreeper	*Certhia discolor*	Certhiidae	Himalayas
8	Chestnut headed tesia	*Oligura castaneocoronata*	Cettiidae	Himalayas and NE Indian hills
9	Orange bellied leafbird	*Chloropsis hardwickii*	Chloropseidae	Himalayas, NE India and Bangladesh
10	Commom tailor bird	*Orthotomus sutorius*	CistIcolidae	Widespread resident. Only tailorbird throughout most of range
11	Rock pigeon/ Rock Dove	*Columba livia*	Columbidae	Widespread resident; unrecorded in parts of NW and NE subcontinent

12	Ashy wood pigeon	*Columba pulchricollis*	Columbidae	Himalayas and NE Indian Hills
13	Spotted dove	Stigmatopelia chinensis	Columbidae	Widespread resident; unrecorded in most of northwest and N Himalayas.
14	Oriental turtle dove	*Streptopelia orientalis*	Columbidae	Himalayas, NE India and Bangladesh south to C peninsular India and Sri Lanka
15	Wedge tailed green pigeon	*Treron sphenurus*	Columbidae	Himalayas, NE India and Bangladesh
16	Common green magpie	*Cissa chinensis*	Corvidae	Himalayas, NE India and Bangladesh
17	Grey treepie	*Dendrocitta formosae*	Corvidae	Himalayas, NE India, Eastern Ghats and Bangladesh
18	House crow	*Corvus splendens*	Corvidae	Widespread resident
19	Large Billed Crow	Corvus macrorhynchos	Corvidae	Mountains of N Baluchistan and Himalayas from N Pakistan east to Arunachal
20	Indian Jungle Crow	*Corvus (macrorhynchos) culminatus*	Corvidae	Base of Himalayas to Sri Lanka, absent from NW
21	Common Raven/ Northern Raven	*Corvus corax*	Corvidae	High himalayas
22	Eurasian cuckoo	*Cuculus canorus*	Cuculidae	Himalayas and NE Indian hills
23	Indian cuckoo	*Cuculus micropterus*	Cuculidae	Breeds in Himalayas and E subcontinent
24	Asian koel	*Eudynamys scolopaceus*	Cuculidae	Widespread
25	Himalayan Cuckoo/ Oriental Cuckoo	*Cuculus saturatus*	Cuculidae	Breeds in Himalayas and NE India; winter Visitor to Andamans and Nicobars
26	Fire breasted flower pecker	*Dicaeum ignipectus*	Dicaeidae	Himalayas and NE Indian hills
27	Common drongo	*Dicrurus adsimilis*	Dicruridae	
28	Spangled drongo	*Dicrurus hottentottus*	Dicruridae	Himalayan foothills, NE India, Bangladesh and Eastern and Western Ghats
29	White Rumped Munia	*Lonchura striata*	Estrildidae	Widespread in subcontinent except NW
30	Common kestral	*Falco tinnunculus*	Falconidae	Resident in mountains of Pakistan, Himalayas and Western Ghats and Sri Lanka; widespread winter visitor
31	Yellow breasted greenfinch	*Carduelis spinoides*	Fringillidae	Himalayas and NE India
32	Common-rose Finch	*Carpodacus erythrinus*	Fringillidae	Breeds in Baluchistan and Himalayas; widespread in winter; unrecorded in Sri Lanka
33	Nepal house martin	*Delichon nipalense*	Hirundinidae	Himalayas
34	Grey backed shrike	*Lanius tephronotus*	Laniidae	Breeds in Himalayas; winters in Himalayas and on adjacent plains in N and NE India and in Bangladesh
35	Long tailed shrike	*Lanius schach*	Laniidae	Widespread resident
36	Bar throated minla/ bar throated siva	*Siva strigula*	Leiothrichidae	Himalayas and NE Indian hills
37	Red billed leiothrix	*Leiothrix lutea*	Leiothrichidae	Himalayas and NE Indian hills
38	Red tailed minla	*Minla ignotincta*	Leiothrichidae	Himalayas and NE Indian hills
39	Rufous sibia	*Malacias capistratus*	Leiothrichidae	Himalayas
40	Olive backed pipit	*Anthus hodgsoni*	Motacillidae	Breeds in Himalayas; widespread in winter,except NW and SE.
41	Asian brown flycatcher	*Muscicapa dauurica*	Muscicapidae	Breeds in Himlayan foothills and hills of C and W India; winters in S, C and E India and Sri Lanka
42	Blue fronted redstart	*Phoenicurus frontali*	Muscicapidae	Breeds in Himalayas; winters in Himalayan foothills
43	Grey bush chat	*Saxicola ferreus*	Muscicapidae	Breeds in Himalayas and NE Indian hills, winters south to N Indian plains.
44	Rufous-gorgeted Fly catcher	*Ficedula strophiata*	Muscicapidae	Resident. Himalayas and NE India
45	Large niltava	*Niltava grandis*	Muscicapidae	Himalayas and NE India
46	Oriental magpie robin	*Copsychus saularis*	Muscicapidae	Widespread resident; unrecorded in most of the northwest
47	Rufous bellied niltava	*Niltava sundara*	Muscicapidae	Himalayas and NE India
48	Small niltava	*Niltava macgrigoriae*	Muscicapidae	Himalayas and NE India
49	Verditer flycatcher	*Eumyias thalassinus*	Muscicapidae	Summer visitor to Himalayas and NE India; widespread in winter
50	White capped water redstart	*Chaimarrornis leucocephalus*	Muscicapidae	Breeds in Himalayas and NE Indian hills; winters south to Baluchistan and Bangladesh
51	Grey-hooded Warbler	*Phylloscopus xanthoschistos*	Muscicapidae	Himalayas and NE Indian hills
52	Lemon-rumped Warbler	*Phylloscopus chloronotus*	Muscicapidae	Breeds in himalayas; winters lower down and in NE Indian Hills
53	Yellow-browed Warbler	*Phylloscopus inornatus*	Muscicapidae	Winter visitor, Mainly E Himalayas, NE India andf Bangladesh
54	Yellow-bellied Warbler	*Abroscopus superciliaris*	Muscicapidae	Himalayas. Hills of NE India and Bangladesh
55	Blue Throated Blue Flycatcher	*Cyornis rubeculoides*	Muscicapidae	Summer visitor to Himalayas and resident in NE India; winters in E Himalayan foothills and South to Bangladesh, SW India and Sri Lanka
56	Rufous Bellied Rock thrush/ Chestnut-Bellied Rock Thrush	*Monticola rufiventris*	Muscicapidae	Himalayas and NE India

57	Black throated sunbird	*Aethopyga saturata*	Nectariniidae	Himalayas and NE India
58	Crimson sunbird	*Aethopyga siparaja*	Nectariniidae	Himalayas, hills of NE and E India and Bangladesh; also N and NE plains in winter
59	Fire tailed sunbird	*Aethopyga ignicauda*	Nectariniidae	Himalayas and NE Indian hills
60	Green tailed sunbird	*Aethopyga nipalensis*	Nectariniidae	Himalayas and NE India
61	Maroon oriole	*Oriolus traillii*	Oriolidae	Himalayas, NE India and Bangladesh
62	Green backed tit	*Parus monticolus*	Paridae	Himalayas and NE Indian hills
63	Sultan tit	*Melanochlora sultanea*	Paridae	C and E Himalayas and NE Indian hills
64	House sparrow	*Passer domesticus*	Passeridae	Widespread resident, except in parts of NE and NW subcontinent
65	Russet sparrow	*Passer rutilans*	Passeridae	Himalayas and NE Indian hills
66	Eurasian tree sparrow	*Passer montanus*	Passeridae	Baluchistan, Himalayas, NE India, Eastern Ghats and Bangladesh
67	Kalij pheasent	*Lophura leucomelanos*	Phasianidae	Himalayas, NE India and Bangladesh
68	Greater flameback/ greater goldenback	*Chrysocolaptes lucidus*	Picidae	Himalayas, hills of India and Bangladesh
69	Greater yellownape woodpecker	*Picus flavinucha*	Picidae	Himalayas, NE and E India and Bangladesh
70	Grey headed woodpecker	*Picus canus*	Picidae	Himalayas, NE and E India, and Bangladesh
71	Black bulbul	*Hypsipetes leucocephalus*	Pycnonotidae	Himalayas and NE India
72	Himalayan bulbul	*Pycnonotus leucogenys*	Pycnonotidae	N Pakistan hills and Himalayas
73	Black crested bulbul	*Pycnonotus (melanicterus) flaviventris*	Pycnonotidae	Himalayas, NE India and Bangladesh
74	Mountain bulbul	*Ixos mcclellandii*	Pycnonotidae	Himalayas and NE India
75	Red vented bulbul	*Pycnonotus cafer*	Pycnonotidae	Widespread resident
76	Blue throated barbet	*Megalaima asiatica*	Ramphastidae	Himalayas, NE India and Bangladesh
77	Golden throated barbet	*Megalaima franklinii*	Ramphastidae	Himalayas, NE India and Bngladesh
78	Great barbet	*Megalaima virens*	Ramphastidae	Himalayas, NE India and Bangladesh
79	Velvet-fronted nuthatch	*Sitta frontalis*	Sittidae	Himalayas, Indian hills, Bangladesh and Sri Lanka
80	White tailed nuthatch	*Sitta himalayensis*	Sittidae	Himalayas and NE Indian hills
81	Grey headed canary flycatcher	*Culicicapa ceylonensis*	Stenostiridae	Breeds in Himalayas, hills of India, Bangladesh and Sri Lanka; winters in Himalayan foothills, and plains in Pakistan and N, E and NE India
82	Common myna	*Acridotheres tristis*	Sturnidae	Widespread resident; unrecorded in parts of NW and NE subcontinent
83	Grey throated babbler	*Stachyris nigriceps*	Timaliidae	Himalayas, NE and E India, and Bangladesh
84	Puff throated babbler	*Pellorneum ruficeps*	Timaliidae	Himalayan foothills, hills of India and Bangladesh
85	White browed shrike babbler	*Pied shrike babbler*	Timaliidae	
86	Blue Winged Siva/ Blue Winged Minla	*Siva cyanouroptera*	Timaliidae	Himalayas and NE Indian Hills
87	Grey winged black bird	*Turdus boulboul*	Turdidae	Resident in Himalayas and winters South to NE India
88	Blue whistling thrush	*Myophonus caeruleus*	Turdidae	N Baluchistan, Himalayas and NE India
89	Orange headed thrush	*Zoothera citrina*	Turdidae	Summer visitor to Himalayas; resident in NE, C and W India; winter visitor to E India and Sri Lanka
90	Blue capped rock thrush	*Monticola cinclorhynchus*	Turdidae	Summer visitor to Himalayas; winters mainly in Western Ghats3
91	Striated laughing thrush	*Garrulax striatus*	Turdidae	Himalayas and NE India
92	Tickell's thrush	*Turdus unicolor*	Turdidae	Summers in Himalayas; winters mainly farther east and south in India
93	White crested laughing thrush	*Garrulax leucolophus*	Turdidae	Himalayas, NE India and Bangladesh
94	White throated laughing thrush	*Garrulax albogularis*	Turdidae	Himalayas
95	Jungle owlet	*Glaucidium radiatum*	Tytonidae	Widespread resident; unrecorded in most of NW and NE
96	Bar Winged Flycatcher Shrike	*Hemipus picatus*	Vangidae	Himalayas, hills of India, Bangladesh and Sri Lanka
97	Stripe-throated yuhina	*Yuhina gularis*	Zosteropidae	Himalayas and NE Indian hills
98	Oriental white eye	*Zosterops palpebrosus*	Zosteropidae	Widespread resident; unrecorded in parts of the northwest.
99	Whiskered yuhina	*Yuhina flavicollis*	Zosteropidae	Himalayas and NE Indian hills
100	White naped Yuhina	*Yuhina bakeri*	Zosteropidae	E Himalayas and NE Indian hills

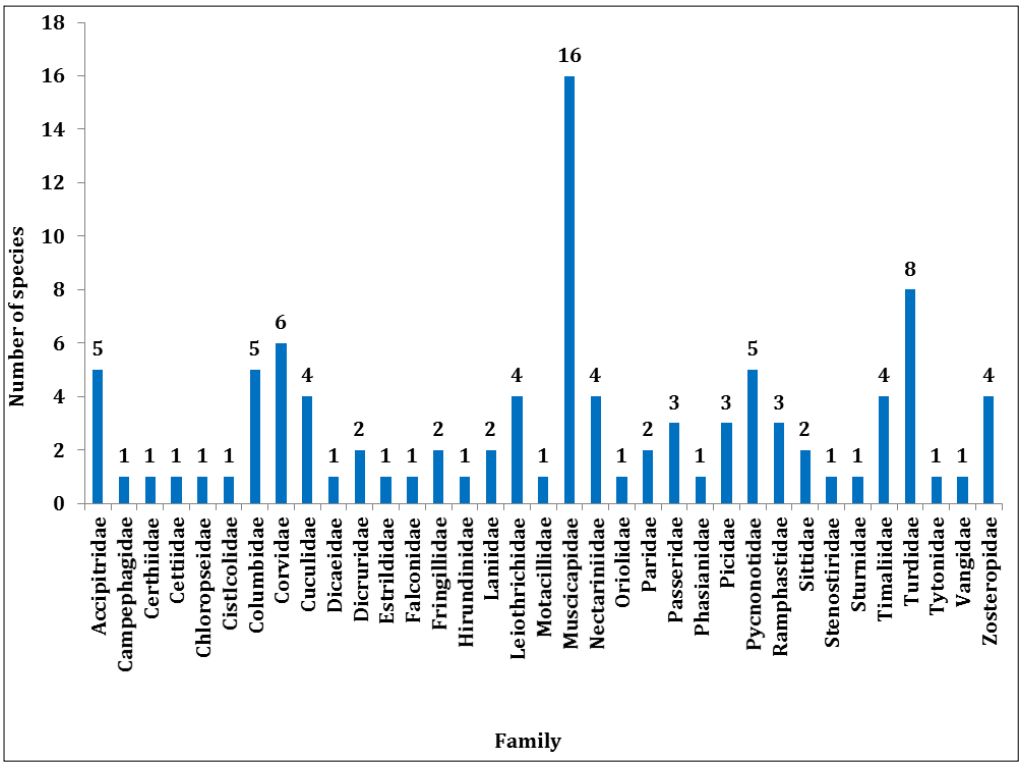

Fig 2: Number of Species in various Families

The most abundant species observed across the study area happen to be Rufous Sibia, warblers, flycatchers, The Great Barbet, Grey Treepie, Long tailed shrike, Oriental white-eye, blue whistling thrush, Common tailor bird, Green tailed sunbird, scarlet minivet, bulbuls, and doves.

The least abundant species includes common kestrel, Himalayan buzzard, mountain hawk eagle, chestnut headed tesia, jungle owlet, bar winged flycatcher shrike.

While some species like maroon oriole, asian koel, wedge tailed green pigeon were observed occasionally in the study areas.

4. Conclusion

The total of 100 bird species was found in the field of study area and there is great similarity in the avian community between two study areas. This finding provides small information about how diverse these areas are. Out of 78 threatened birds of Indian Sub-continent, 17 (1 Endangered, 3 Critically Endangered and 13 Vulnerable) occur in Sikkim (IUCN 2009) [12]. Similarly, 10 Near Threatened species of birds are also reported from Sikkim. But not these threatened bird species were recorded during the span of one year form the study area. The study area has diverse avian communities; therefore a serious survey is required for the documentation of bird species in these areas. The present work provides small information for future studies in this area and also this study will help to make decisions for conservation and management of avian fauna in this region.

Greater yellownape woodpecker

Green tailed sunbird

Grey headed woodpecker

Oriental magpie robin | Golden throated barbet | Mountain hawkle

Common green magpie

Fig 3: Photographs of some bird species from study area

5. Acknowledgements
The authors are grateful to local people for identified the selection of area. We also thank Central University Sikkim, India, for permitting to confirm the identification of Birds.

6. References

1. Abdar MR. Diversity and Richness of bird species in newly formed habitats of Chandoli National Park in Western Ghats, Maharastra State. India. Biodiv J. 2013; 4:235-242.
2. Acharya BK, Vijayan L. Status and distribution of endemic and threatened birds of the eastern Himalaya in Sikkim, India. Journal of Threatened Taxa. 2010; 2:685-689.
3. Aggrawal A, Tiwari G, Harsh SA. Diversity and Density Estimation of Birds of the Indian Institute of Forest Management Campus, Bhopal, India. J. Threat. Taxa. 1998; 7:2-12. 4.
4. Ali S, Ripley SD, Dick JH. (Illustrator). A pictorial guide to the birds of the Indian subcontinent, Bombay natural History Society, Oxford University Press, India, 1983.
5. Arlott N. Collins Field Guide: Birds of India, Harper Collins Publisher, London, 2014, 400.
6. Birdlife International. Threatened bird of Asia: the Birdlife International Red Data Book. Cambridge, UK: Birdlife International, 2001.
7. Chettri N, Sharma E, Deb DC. Bird community structure along a trekking corridor of Sikkim Himalaya: a conservation perspective. Biological Conservation. 2001; 102:1-16.
8. Emlen JJ. An Urban Bird Community in Tucosan, Arizona: Diversity, Structure and Regualtion. Condor. 1974; 76:184-194.
9. Grewal Bikram. A photographic Guide to Birds of India and Nepal, Garfied House, Edgware Road, London (UK), 2010, 86-88.
10. Grimmett R, Inskipp C, Inskipp T. Birds of the Indian Subcontinent, Bloomsbury Publishing India Pvt. Ltd, 2011.
11. Hill D, Fasham M, Tucker G, Shewry M, Shaw P. Handbook of Biodiversity methods, Survey, Evaluation and Monitoring. Cambridge University Press, New York, 2005, 573.
12. IUCN. IUCN Red List of Threatened Species. <http:// www.iucnredlist.org.>. On-line version 2009.1 dated 14 June, 2009.
13. Laiolo P. Diversity and structure of the bird community overwintering in the Himalayan subalpine zone: is conservation compatible with tourism? Biological Conservation. 2003; 115:251-262
14. Manakadan, R.and Pittie, A. Standardised common and scientific names of the birds of the Indian subcontinent. Buceros (ENVIS Newsletter). 2001; 6(1):1-37.
15. Mittermeier RA, Gill PR, Hoffman M, Pilgrim J, Brooks CG, Mittermeier JL, *et al.* and da Fonseca,

G.A.B. Hotspots Revisited: Earth's Biologically Richest and Most Endangered Terrestrial Ecoregions. Mexico: CEMEX, 2005.
16. Nagya GG, Ladányib M, Aranyc I, Aszalósc R, Czúczca B. Birds and plants: Comparing biodiversity indicators in eight lowland agricultural mosaic landscapes in Hungary. Ecological Indicators. 2017; 7:566-573.
17. Nautiyal S, Bhaskar K, Khan YDI. Biodiversity of Semiarid Landscape: Baseline Study for Understanding the Impact of ISBN 978-3-319-15463-3.Human Development on Ecosystems. Springer International Publishing, 2015, 398.
18. Newton I. The contribution of some recent research on birds to ecological understanding. Journal of Animal Ecology. 1995; 64:675-696
19. Olechnowski BF. An examination of songbird avian diversity, abundance trends, and community composition in two endangered temperate ecosystems: riparian willow habitat of the Greater Yellowstone Ecosystem and a restored tallgrass prairie ecosystem, Neal Smith National Wildlife. RefugeIowa State University. Lowa State University, 2009.
20. Pandit MK, Sodhi S, Kob LP, Bhaskar A, Brook BN. Unreported yet massive deforestation during loss of biodiversity in Indian Himalaya. Biodiversity Conservation. 2007; 16:153-163
21. Price T, Zee J, Jamdar K, Jamdar N. Bird species diversity along the Himalaya: A comparison of Himachal Pradesh with Kashmir. Journal of Bombay Natural History Society. 2003; 100: 394-410.
22. Sultana A, Hussain MS, Khan JA. Bird communities of the proposed Naina and Pindari Wildlife Sanctuaries in the Kumaon Himalaya, Uttarakhand, India. Journal of Bombay Natural History Society. 2007; 104:19-29.
23. Sutherland WJ. Ecological census techniques - A hand book. Second edition, Cambridge university press, Cambridge, UK, 2006, 432.
24. Taper ML, Bohning-Gaese K, Brown JH. Individualistic responses of bird species to environmental change. Oecologia, 1995, 478-486.
25. Urfi AJ. Climate change and its impacts on Indian birds: monsoon phenology and monitoring heronry birds. Current Science. 2011; 101:1140-1142