STUDY ON AVIFAUNAL DIVERSITY AND SPECIES RICHNESS IN FOOT HILLS OF NILGIRIS, TAMILNADU, INDIA

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ABSTRACT

A total of 87 bird species belonging to 13 orders and 31 families of terrestrial and semi-aquatic birds were identified and recorded during the study. The highest population of bird species recorded during the month of January followed by December. The maximum number of birds was observed of the corvidae family (11 species) followed by columbidae (6 species) and passeridae (6 species). The highest diversity of 4.19 was observed in the month of January followed by 4.17 in the month of February and 4.15 in the month of April. Species richness was highest in the month of January followed by February and least in April. This study illustrated useful information on bird diversity in the study region which serves as a baseline for future monitoring programs.

Key words: Birds diversity, Species richness, Nilgiris, Bird community.

Introduction

Birds are ideal bio indicators and useful models for studying a variety of environmental problems. Hence, the condition of local landscape must be investigated to identify crucial determinants of the bird community structure for avian conservation (Kattan and Franco, 2004). Describing and explaining spatial patterns in species diversity are crucial steps in conserving global biodiversity (Lee *et al.*, 2004) as the number of bird species inhabiting various altitudinal belts or 'life zones' (Ali, 1949) depend on climatic changes accompanied by corresponding changes in vegetation. Studies on species distribution along elevational gradients are essential to understand principles of community organisation and species conservation. Birds occupy a wide range of ecological positions (Sekercioglu and Hakki, 2006), depending on the taxonomic viewpoint, the number of known living bird species varies anywhere from 9,800 to 10,050 (Clements, 2007). The Indian subcontinent has diverse avifauna with 1300 bird species and highly varied climatic conditions, unique habitats, long stretch of inland, forest and coastal areas which attracts and supports a unique group of avian species round the year (Grimmett *et al.*, 1999). In many biodiversity, both present and past, is better understood for birds than for any other major group of organisms. On the other hand dominant trend of bird-count exercised in India has been focused on endangered birds, wetland birds, heronries and birds found in protected habitats such as national parks, sanctuaries and IBA (Important Bird Area), (Urfi, 2005). Obviously complete details of common birds and the utilization pattern in several rural areas and in some forest habitats such as sub-tropical thorn forest of India are scanty till date (Sandilyan, 2009; Sandilyan *et al.*, 2010).

Interestingly in recent days there is an increasing awareness about the birds in the remote pockets of India. Noticeably the availability of checklist of birds in those areas is highly helpful to get the complete picture about the birds in India for future studies and to assess the status of the species *i.e.* IUCN. The present climatic change also has adverse effects in bird life and ecological balance. The ornithological data is used to indicate the effects of environmental change on biodiversity. Already ample attempts are being made in some remote areas such as university campuses, institutes (Praveen and Joseph, 2006), and atomic power station (Hussain *et al.*, 2011). On that way the current study is the first attempt to explore the distribution and diversity of avifauna around the foot hills of Nilgiris with the objectives of identification, documentation and to study the species diversity and species richness in Jakkanari beat.

Material and Methods

The study was carried out from December 2012 to April 2013, in Jakkanari beat along the foot hills of Nilgiris. Data was collected at every weekend (Saturday and Sunday) during the above-mentioned months. The birds were identified and recorded during the morning (0730 to 1100 h) and afternoon (1500 to 1730 h) by direct field observation. Bird count was made by walking inside the forest area. Two parallel 500 m. transects with the distance of 300 m. between them were laid. The maximum visibility on either side of transect was about 100 meters and covered an area of 500 x 200 m. A 100 m gap was left between the two transects to avoid overlap

It was observed that highest diversity was 4.19 in the month of January followed by 4.57 in the month of February and 4.15 in the month of April.

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of birds while counting. The visibility on either side of the transect differed/ varied from 10 m to 100 m depending upon the structure of the vegetation. The birds were identified using Olympus binoculars (10x50) and field guides of Ali (2002); Ali and Ripley (1983); Grimmett *et al.* (1999) and Kazmierczak and Perlo (2000).

The number of birds in each species, percent occurrence was calculated using the following formula

$$Per\,cent\,occurence = \frac{No\ of\ species\ of\ each\ family}{Total\ no\ of\ different\ species\ observed} \times 100$$

And the species richness and diversity of species by Shannon-wiener Index (1949) method

$$H' = -\Sigma\,Pi\,\ln\,Pi$$

Where the *Pi*= the proportion of individuals of species *i*

Study area

The present study was carried out in the Jakkanari beat of Coimbatore forest division, Tamil Nadu, India. Covering of 1358 ha and located at the foothills of Nilgiris. The beat is perched at an altitude of 300 m with latitude of 11°23'N to 11°33'S, longitude of 76°02' E to 76°94'W and enjoys an annual rainfall of 830 mm. The mean maximum and minimum temperature are 32.2°C and 23.2°C respectively. The forest type present over here is sub-tropical thorn forest. Moreover the entire stretch supports good diversity of trees. The predominant tree species were Acacias, *Ferronium elephantum,* Neem, *Zizyphus glabrata* and *Carissa carandas* which are used by the birds for nesting, resting and roosting. Most of the birds recorded in the study area are categorised under 5 ecological groups (Granivores, Insectivores, Carnivores, Frugivores, and Omnivores). Naturally the forest land fulfills all requirements of the birds throughout the year.

Results

Identification of bird species

It was observed that a total of 87 bird species belonging to 13 orders and 31 families of terrestrial and semi-aquatic birds were identified and recorded during the study period (Table 1).

Classification of bird species

Among the 87 species 6 migratory species were also recorded which were :

1. Blue- Winged Parakeet (*Psittaculacolumboides*)
2. Plum-Headed Parakeet (*Psittaculacyanocephala*)
3. Indian Hanging –Parrot (*Loriculusvernalis*)
4. Brahminy Starling (*Sternuspagodarum*)
5. Pompadour Green- Pigeon (*Treronpompadora*)
6. Indian Grey Hornbill (*Ocycerousbirostris*)

The highest population of bird species occurred during the month of January followed by December (Table 2). The observation from table 3 showed that the maximum number of bird families were observed in the Corvidae (11 species) followed by Columbidae (6 species) and Passeridae (6 species) and least number (1 number) in families viz., Picidae, Bucerotidae, Hemiprocridae, Strigidae, Charadriidae, Irenidae and Alandidae. The least occurrence of the bird species of 11 families (Table 3.) may be due to the non-availability of feed, change in climate pattern etc.

Species diversity and species richness

Species diversity and species richness was calculated for the avifaunal species observed in the study period. Species diversity was an expression of community structure and it was a characteristic unique to the community level of organization. A community demonstrates a high species diversity if many species are equally abundant or nearly equally abundant species are present. If a community is composed of only a few species, or if only a few species are abundant, then species diversity is low. High species diversity indicates a complex community in which a high degree of species interaction is possible. Communities with higher diversities typically have higher levels of energy transfer, predation, competition and niche availability. The theory of species diversity takes into account three different ecological phenomena viz. species richness, relative abundance and community evenness. It was observed that highest diversity was 4.19 in the month of January followed by 4.17 in the month of February and 4.15 in the month of April (Table 4).

There was no much significant difference between the highest value and it indicates a complex community in which a high degree of species interaction is possible. It does not take into account the number of individuals per species, but it indicates the health of the habitat and structure of an environment. The observation from the table 3 showed that species richness was highest in the month of January followed by February and least in April. The highest value indicates the health of the community or habitat of the study area. Non-significant difference of species diversity and species richness indicate the uniform weather pattern and feeding material available during the study period. Nests of various avifaunal species were identified, which indicated the breeding season for certain bird species.

Discussion

Conservation of global biodiversity has become the issue of prime importance in recent decades (Ehrlich and Wilson, 1991). Conservationists around the globe

Table 1 : List of Birds observed in Jakkanari beat, foot hills of Nilgiris

S.no	Common name	Scientific name	Habitat	IUCN status
	Phasianidae			
1.	Common Quail	*Coturnix coturnix*	R	LC
2.	Jungle Bush-Quail	*Perdicula asiatica*	R	LC
3.	Grey Francolin	*Francolinus pondicerianus*	R	LC
4.	Grey Jungle Fowl	*Gallus sonneratii*	R	LC
5.	Indian Peafowl	*Pavo cristatus*	R	LC
	Picidae			
6.	Lesser golden-Backed Woodpecker	*Dinopium benghalense*	R	LC
	Megalaimidae			
7.	Blue -Throated Barbet	*Megalaima asiatica*	R	LC
8.	Crimson-Throated Barbet	*Megalaima rubricapilla*	R	LC
	Bucerotidae			
9.	Indian Grey Hornbill	*Ocycerous birostris*	M	LC
	Upupidae			
10.	Common Hoopoe	*Upupa epops*	R	LC
	Coraciidae			
11.	Indian Roller	*Coracias benghalensis*	R	LC
	Dacelonidae			
12.	White-Breasted Kingfisher	*Halcyon smyrensis*	R	LC
	Meropidae			
13.	Chestnut -Headed Bee-Eater	*Merops leschenaulti*	R	LC
14.	Small bee-eater	*Merops orientalis*	R	LC
15.	Blue-Bearded Bee -Eater	*Nyctyornis athertoni*	R	LC
	Cuculidae			
16.	Common Cuckoo	*Cuculus canorus*	R	LC
17.	Indian Cuckoo	*Cluculus micropterus*	R	LC
18.	Pied Crested Cuckoo	*Clamator jacobinus*	R	LC
19.	Asian Koel	*Eudynamus scolopacea*	R	LC
20.	Small Green- Billed Malkoha	*Phaenicophaeus viridirostris*	R	LC
	Centropodidae			
21.	Lesser Coucal	*Centropus benalensis*	R	LC
	Psittacidae			
22.	Rose -Ringed Parakeet	*Psittacula krameri*	R	LC
23.	Blue- Winged Parakeet	*Psittacula columboides*	M	LC
24.	Plum-headed Parakeet	*Psittacula cyanocephala*	M	LC
25.	Indian Hanging -Parrot	*Loriculus vernalis*	M	LC
	Apodidae			
26.	Indian Edible Nest Swiftlet	*Collocalia unicolor*	R	LC
27.	Asian Palm -Swift	*Cypsiurus balasiensis*	R	LC
28.	House Swift	*Apus affinis*	R	LC
	Hemiprocnidae			
29.	Crested Tree- Swift	*Hemiprocne coronate*	R	LC
	Strigidae			
30.	Spotted Owlet	*Athene brama*	R	LC
	Caprimulgidae			LC
31.	Common Indian Nightjar	*Caprimulgus macrurus*	R	LC
32.	Indian Jungle Nightjar	*Caprimulgus indicus*	R	LC
	Columbidae			
33.	Pompadour Green- Pigeon	*Treron pompadora*	M	LC
34.	Blue Rock Pigeon	*Coloba livia*	R	LC
35.	Eurasian Coloured- Dove	*Streptopelia decaocto*	R	LC
36.	Spotted Dove	*Streptopelia chinensis*	R	LC
37.	Red Collared Dove	*Streptopelia tranquebarica*	R	LC
38.	Little Brown Dove	*Streptopelia senegalensis*	R	LC
	Charadriidae			
39.	Red-Wattled Lapwing	*Vanellus indicus*	R	LC
	Accipitridae			
40.	Oriental Honey-Buzzard	*Pernis ptilorhyncus*	R	LC
41.	Black Kite	*Mivus migrans*	R	LC

S.no	Common name	Scientific name	Habitat	IUCN status
42.	Brahminy Kite	*Haliastar indus*	R	LC
43.	Shikra	*Accipeter badius*	R	LC
44.	Changeable Hawk-Eagle	*Spizaetus cirrhatus*	R	LC
	Ardeidae			
45.	Indian Pond- Heron	*Ardeola grayii*	R	LC
46.	Cattle Egret	*Babulcus ibis*	R	LC
	Irenidae			
47.	Gold-Fronted Chloropsis	*Chloropsis aurifrons*	R	LC
	Lanidae			
48.	Bay-Backed Shrike	*Lanius vittatus*	R	LC
49.	Rufous-Backed Shrike	*Lanius schach*	R	LC
	Corvidae			
50.	Indian Treepie	*Dendrocitta vagabunda*	R	LC
51.	House Crow	*Corvus splendens*	R	LC
52.	Jungle Crow	*Corvus macrorhynchos*	R	LC
53.	Small Minivet	*Pericrocotus erythropygius*	R	LC
54.	Common Wood Shrike	*Tephrodornis pondicerianus*	R	LC
55.	Black Drongo	*Dicrurus macrocerces*	R	LC
56.	White- Bellied Drongo	*Dicrurus caerulescens*	R	LC
57.	Black-Headed Oriole	*Oriolus xanthornus*	R	LC
58.	Asian paradise- Flycatcher	*Terpsiphone paradise*	R	LC
59.	Common Iora	*Aegithina tiphia*	R	LC
60.	Black-Headed Cuckoo-shrike	*Coracina melanoptera*	R	LC
	Muscicapidae			
61.	Asian Brown Flycatcher	*Muscicapa dauurica*	R	LC
62.	Oriental Magpie-robin	*Copsychus saularis*	R	LC
63.	Pied Bushchat	*Saxicola caprata*	R	LC
64.	Indian Robin	*Saxicoloides fulicata*	R	LC
	Sturnidae			
65.	Brahminy Starling	*Sternus pagodarum*	M	LC
66.	Common Myna	*Acridotherus tristis*	R	LC
	Hirundinidae			
67.	Common Swallow	*Hirundo rustica*	R	LC
68.	House Swallow	*Hirundo tahitica*	R	LC
69.	Streak -Throated Swallow	*Hirundo flavicola*	R	LC
	Pycnonotidae			
70.	Red-Vented Bulbul	*Pycnonotus cafer*	R	LC
71.	Yellow-Throated Bulbul	*Pycnonotus xantholaemus*	R	VU
	Cisticolidae			
72.	Jungle Prinia	*Prinia sylvatica*	R	LC
73.	Common Tailor Bird	*Orthotomus sutorius*	R	LC
74.	Paddyfield Warbler	*Acrocephalus Agricola*	R	LC
	Silvidae			
75.	Common Babbler	*Turdoides caudatus*	R	LC
76.	Jungle Babbler	*Turdoides striatus*	R	LC
	Alaudidae			
77.	Singing Bush-Lark	*Mirafra cantillans*	R	LC
	Nectarinidae			
78.	Tickell's Flowerpecker	*Dicaeum erythrorhynchos*	R	LC
79.	Purple -Rumped Sunbird	*Nectarinia zeylonica*	R	LC
80.	Small Sunbird	*Nectarinia minima*	R	LC
81.	Purple Sunbird	*Nectarinia asiatica*	R	LC
	Passeridae			
82.	House Sparrow	*Passer domesticus*	R	LC
83.	Paddy field Pipit	*Anthus rufulus*	R	LC
84.	Brown Rock Pipit	*Anthus similis*	R	LC
85.	Forest Wagtail	*Dendronanthus indicus*	R	LC
86.	Spotted Munia	*Lonchura punctulata*	R	LC
87.	Black-Headed Munia	*Lonchura Malacca*	R	LC

LC – Least Concern; VU – Vulnerable; R – Resident; M - Migrant

Table 2 : Bird population in different months

S.no	Common name	December 2012	January 2013	February 2013	March 2013	April 2013
1.	Common Quail	11	12	8	9	6
2.	Jungle Bush-Quail	16	16	16	16	16
3.	Grey Francolin	16	16	12	12	12
4.	Grey Jungle Fowl	6	6	5	5	4
5.	Indian Peafowl	8	10	10	8	8
6.	Lesser golden -Backed Woodpecker	2	2	0	1	1
7.	Blue -Throated Barbet	3	2	2	1	1
8.	Crimson-Throated Barbet	3	2	2	1	1
9.	Indian Grey Hornbill	4	4	4	0	4
10.	Common Hoopoe	5	4	4	4	3
11.	Indian Roller	4	4	4	4	4
12.	White-Breasted Kingfisher	4	4	4	4	2
13.	Chestnut -Headed Bee-Eater	19	20	20	21	20
14.	Small bee-eater	22	22	18	18	18
15.	Blue-Bearded Bee -Eater	4	4	4	2	2
16.	Common Cuckoo	3	5	3	3	3
17.	Indian Cuckoo	3	3	3	0	2
18.	Pied Crested Cuckoo	0	1	1	1	1
19.	Asian Koel	5	5	5	5	5
20.	Small Green- Billed Malkoha	6	4	6	6	6
21.	Lesser Coucal	5	5	4	4	4
22.	Rose -Ringed Parakeet	9	8	9	9	9
23.	Blue- Winged Parakeet	10	4	10	10	0
24.	Plum-headed Parakeet	12	12	12	12	0
25.	Indian Hanging -Parrot	0	10	7	0	0
26.	Indian Edible Nest Swiftlet	20	26	17	17	17
27.	Asian Palm -Swift	16	20	16	16	12
28.	House Swift	20	25	18	12	12
29.	Crested Tree- Swift	10	12	9	7	8
30.	Spotted Owlet	4	4	4	4	4
31.	Common Indian Nightjar	6	6	2	0	2
32.	Indian Jungle Nightjar	4	4	4	4	1
33.	Pompadour Green- Pigeon	20	30	20	20	20
34.	Blue Rock Pigeon	19	25	12	8	5
35.	Eurasian Coloured- Dove	6	6	6	6	6
36.	Spotted Dove	10	10	10	10	10
37.	Red Collared Dove	6	6	6	6	6
38.	Little Brown Dove	5	5	5	5	5
39.	Red-Wattled Lapwing	4	3	4	4	4
40.	Oriental Honey-Buzzard	2	2	0	1	0
41.	Black Kite	2	4	1	3	0
42.	Brahminy Kite	4	4	4	4	2
43.	Shikra	5	4	4	4	4
44.	Changeable Hawk-Eagle	4	4	4	4	4
45.	Indian Pond- Heron	10	10	8	8	8
46.	Cattle Egret	8	8	6	4	4
47.	Gold-Fronted Chloropsis	4	2	4	4	4
48.	Bay-Backed Shrike	6	6	6	4	4
49.	Rufous-Backed Shrike	0	2	2	2	2
50.	Indian Treepie	8	8	6	6	6
51.	House Crow	22	28	22	22	22
52.	Jungle Crow	22	36	22	22	18
53.	Small Minivet	3	2	2	2	0
54.	Common Wood Shrike	4	4	2	2	2
55.	Black Drongo	5	5	3	3	2
56.	White- Bellied Drongo	5	5	5	5	3
57.	Black-Headed Oriole	2	1	2	2	2
58.	Asian paradise- Flycatcher	2	2	0	2	2

S.no	Common name	December 2012	January 2013	February 2013	March 2013	April 2013
59.	Common Iora	4	3	4	4	4
60.	Black-Headed Cuckoo-shrike	6	7	4	3	5
61.	Asian Brown Flycatcher	0	2	2	2	2
62.	Oriental Magpie-robin	6	5	6	5	5
63.	Pied Bushchat	6	6	4	4	2
64.	Indian Robin	4	4	4	4	2
65.	Brahminy Starling	16	7	16	16	16
66.	Common Myna	21	31	10	10	12
67.	Common Swallow	25	25	12	12	12
68.	House Swallow	24	24	24	12	12
69.	Streak -Throated Swallow	26	30	26	26	26
70.	Red-Vented Bulbul	22	20	22	22	22
71.	Yellow-Throated Bulbul	7	8	16	7	7
72.	Jungle Prinia	0	2	1	1	0
73.	Common Tailor Bird	4	4	4	3	3
74.	Paddyfield Warbler	9	9	9	8	6
75.	Common Babbler	22	22	19	19	19
76.	Jungle Babbler	21	40	21	21	21
77.	Singing Bush-Lark	2	2	2	2	2
78.	Tickell's Flowerpecker	12	18	15	10	8
79.	Purple -Rumped Sunbird	9	9	7	7	4
80.	Small Sunbird	7	7	3	4	3
81.	Purple Sunbird	8	5	8	8	8
82.	House Sparrow	17	36	16	10	14
83.	Paddy field Pipit	8	10	4	0	2
84.	Brown Rock Pipit	0	2	2	2	0
85.	Forest Wagtail	3	5	4	4	4
86.	Spotted Munia	15	19	15	13	10
87.	Black-Headed Munia	15	23	15	12	11

Table 3 : Per cent occurrence of bird family

S.no	Family	Percent occurrence
1.	Phasianidae	5.54 %
2.	Picidae	1.12 %
3.	Megalaimidae	2.19 %
4.	Bucerotidae	1.12 %
5.	Upupidae	1.12 %
6.	Coraciidae	1.12 %
7.	Dacelonidae	1.12 %
8.	Meropidae	3.44 %
9.	Cuculidae	5.54 %
10.	Centropodidae	1.12 %
11.	Psittacidae	4.60 %
12.	Apodidae	3.44 %
13.	Hemiprocnidae	1.12 %
14.	Strigidae	1.14 %
15.	Caprimulgidae	2.19 %
16.	Columbidae	6.89 %
17.	Charadriidae	1.12 %
18.	Accipitridae	5.54 %
19.	Ardeidae	2.19 %
20.	Irenidae	1.12 %
21.	Lanidae	2.19 %
22.	Corvidae	12.60 %
23.	Muscicapidae	5.54 %
24.	Sturnidae	2.19 %
25.	Hirundinidae	3.44 %
26.	Pycnonotidae	2.19 %
27.	Cisticolidae	3.44 %
28.	Silvidae	2.19 %
29.	Alaudidae	1.12 %
30.	Nectarinidae	5.54 %
31.	Passeridae	6.80 %

are battling with conservation challenges under the ever accelerating threats of anthropogenic disturbances to biodiversity. Birds occupy almost all habitat types and diversity of birds often serves as a good indication of overall diversity of a given area (Furness and Greenwood, 1993). Birds are also known to be responsive to any kind of changes to their ambient conditions hence can be used as bioindicator (Padoa *et al.*, 2006). Since holistic inventory of diversity needs impossible levels of time and effort (Lawton *et al.*, 1998) scientists around the globe most recently have emphasized on performing rapid inventories and biodiversity estimation becoming ever popular and in this regard preparation of checklists of birds on a wider scale has been given much importance (Roy *et al.*, 2011).

From the study it was observed that the migration of birds starts from November and it continuous up to April. These migratory bird species moved from higher altitude to the study area during the months of December, January, February, March, April. The occurrence of these birds was consistently seen in the period of study. This occurrence may be due to change in the climate and also availability of its feed viz. Especially fruit bearing trees shrubs and herbs in the above months and the other 81 species are residential birds. Naaz *et al.* (2005) had reported only 39 bird species from Buxa Tiger

Table 4 : Species diversity – and species richness Shannon-wiener Index

Month	Species diversity	Species richness
December 2012	4.154	81
January 2013	4.1875	87
February 2013	4.1705	84
March 2013	4.1575	82
April 2013	4.148	79

Reserve conducted during the month of February.

Species richness generally decreases with increasing elevation (Begon *et al.*, 1996). Bird distribution and abundance varies with habitat (Ramesh *et al.*, 2011), climatic condition, food resource and evolutionary history of the area (Jayson, 1994). The species richness recorded was high in the study area. This was probably the study area has more deciduous and scrub jungle which may support high food availability. Thus, in this heterogeneous matrix of habitat it is essential to maintain and conserve intact forests.

In Kalakad-Mundanthurai Tiger Reserve, Raman *et al.* (2005) revealed that bird community composition significantly correlated with elevation and tree species composition of sites, indicating the influence of deterministic factors on bird community structure. Resource abundance and availability are described as the most important factor in determining the community structure (Recher & Davis, 2002). The present study which recorded 87 bird species reflects a moderately healthy overall biodiversity of the present study location

Conclusion

To conclude it may be noted that only a few selected patches of forests were studied for shorter time spans, a more intensive study would surely result in identifying many more avifaunal species. The impact of anthropogenic pressure in alteration of the habitats in and around the present study area is the need of the hour.

निलगिरी, तमिलनाडु, भारत के पहाड़ों की तराई में पक्षी प्राणिजातीय विविधता तथा प्रजाति समृद्धता पर अध्ययन

एस.जॉन पीटर, आर. रीवाथी, आई. जयशंकर एवं पी. दुरई रासू

सारांश

अध्ययनक ेद ौरानस थलीयए वंअ ध्र-जलीयप क्षियोंक े1 3ग णोंए वं3 1कु लोंस ्स बंधितक ुल8 7प क्षीप,जातियोंक ीप हचानक रके अभिलिखित किया। जनवरी माह इसके बाद दिसम्बर में पक्षी प्रजातियों की उच्चतम आबादी अभिलिखित की गई। पक्षियों की अधिकतम संख्या कॉर्विडा कुल (11 प्रजातियां) में प्रेक्षित की गई, इसके बाद कॉलूम्बिडा (6 प्रजाति) तथा पासिरिडा (6 प्रजाति) थी। 4.19 की अधिकतम विविधता जनवरी माह में प्रेक्षित की गई, इसके बाद फरवरी की रही और अप्रैल में न्यूनतम थी। इस अध्ययन ने अध्ययन क्षेत्र में पक्षी विविधता पर उपयोगी सूचना को दर्शाया, जो भावी अनुवीक्षण कार्यक्रमों के लिए एक आधार रेखा के रूप में कार्य करेगी।

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