



## Bird species diversity and distribution in case of protected area

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### ABSTRACT

Study on bird species diversity and distribution is important for conservation efforts in different protected area. However, bird diversity and distribution is little known in Ethiopia. The study area was stratified into five habitat types based on land cover features. Point transect count was employed gently up to 30 m radius with random sampling technique. The data were analyzed by one-way ANOVA. This study revealed that a total of 112 species were identified. Of which two endemic to Ethiopia, five near endemic, 69 common residences, 22 Palearctic and 12 Intra-Africa migratory bird species were recorded. The mean of bird species abundance was significantly different between dry and wet seasons ( $f= 4.8, p<0.05, df = 1$ ). The distribution of bird among habitat type was

significantly different ( $f = 2.99$ ,  $p < 0.05$ ,  $df = 4$ ). Riverine forest was inhabited the highest species diversity ( $H' = 4.12$ ) with the highest evenness ( $J = 0.91$ ) while farmland was recorded the lowest species diversity ( $H' = 2.9$ ) with the lowest evenness ( $J = 0.68$ ), it could have a relation to availability of water, cover and food items in the habitat.

**Key word:** Abundance, bird species, distribution, diversity, protected area.

## 1. BACKGROUND

Birds are the most successful groups of vertebrates. The power of flight is a means of quick direct access of almost any spot on earth. They can feed on variety of food items and nest on infinite variety of sites. Most birds are useful to humans by providing meat and egg as sources of food, facilitating pollination, dispersing seed and fruits as well as biological control of insect pest like grasshopper, mosquito and others (Clout and Hay, 1989). Birds are also indicators of biodiversity and monitors of environmental change such as level of contaminations and environmental impact (Sutherland, 2000).

Birds occur on land, sea and freshwater, and in virtually every habitat, from the lowest deserts to the highest mountains (Rahbek and Graves, 2001). The most basic study of avifauna of a site is the preparation of a list of species. A list indicates the diversity of the site, and shows the presence of rare species if any. The number of rare and endemic species and the diversity of the species present at the site can be used as indicator of the importance of different sites or habitats for bird conservation (ICBP, 1992; Bibby et al., 1998).

The world's biodiversity is increasingly under threat in many parts of the world. Currently, 24% of mammals, 27% of reptiles, 20% of amphibians and 30% of fishes are listed by IUCN as globally threatened with extinction. Concerning the bird species of the planet, about 12% of them (i.e. is one in 8) have a real risk of becoming extinct in the next 100 years. Out of the 926 bird species found in Ethiopia, of which 21 are endemic and 19 are globally threatened species (Avibase-Bird Checklists of the World, 2005). Nationally, 73 Important Bird Areas (IBAs) have been identified, 30 of these sites comprise wetlands, while the rest 43 are representatives of terrestrial habitats (Aynalem, and Bekele, 2008).

Birds play an important link of food chain in ecological unit of nature, so they are the good indicators of ecological status of any given ecosystem (Gill, 1994; Hossain and Baki, 2015). Various studies have attempted to model species habitat relationships, while other studies have documented patterns in diversity along elevation gradients and have attempted to describe the mechanisms underlying those patterns, the consensus on the generality of pattern and processes is still a topic of discussion (Rahbek, 2005), most studies focused on species richness and distribution variation. Because elevation affects the condition of the physical environment and the kinds and amounts of resources available for breeding and foraging activities, the composition and structure of bird communities may change along elevation gradient (Rahbek, 2005).

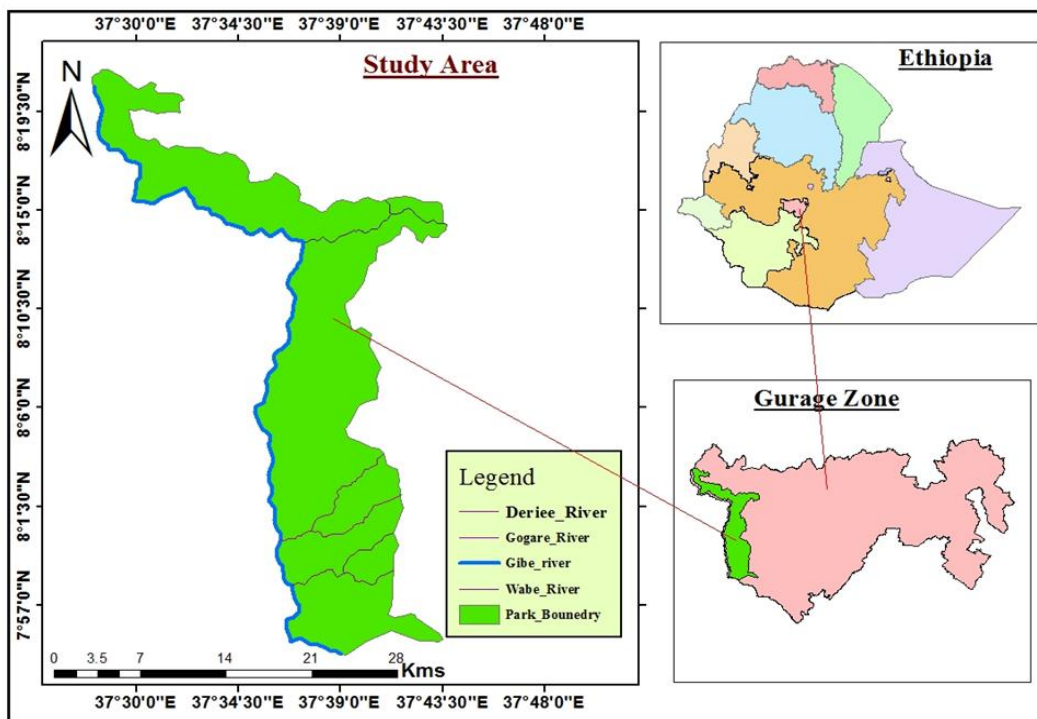
Bird diversity and distribution is probably the most important feature of Gibe Sheleko National Park. Despite various bird species are inhabited in the study area, no scientific study has been conducted regarding diversity and abundance of birds. Moreover, study species diversity and abundance are common tools that used by ecologists and biologist in order to understand community structure and critically important for conservation efforts. Given these in consideration, a survey of these bird species was a clear priority for this study. The study was aimed to assess the diversity and distribution of bird species in the study area.

The result of this finding is valuable for protected area managers, area specific management planers, conservationists, ecologists and provides baseline information for different scientific communities.

## 2. MATERIALS AND METHODS

### 2.1. Study Area Description

Gibe Sheleko National Park newly emerged national park of Ethiopia and managed by Southern Nation Nationalities Regional State. The study site is located in Gurage Zone, 178 and 18km far from Addis Ababa and Wolkite, respectively. It is geographically located between  $7^{\circ}54' 00''$  N to  $8^{\circ}21' 30''$  N and  $37^{\circ} 27' 00''$  E to  $37^{\circ} 45' 00''$  E (Fig.1). It covers an area of 360 square km, which characterized by heterogeneous landscape, flora, fauna and habitat type. It is situated within three districts: Cheha, Abeshigie and Enemurena-Ener (Tilahun et al., 2017). Average rainfall ranges from 960-1400 millimeter and altitudinal ranges 1050 to 1835 m above sea level. The study site temperature ranges 10 to 28 °C. The study site is classified within the climate zone of upper kola and dissected by deep gorges of the Gibe and Wabe rivers.



**Figure 1** Map of the study area

## 2.2. Methodology

Before the actual study, a pilot survey was conducted to gather general information about the vegetation cover, accessibility and birds roosting and nesting site in the study area through direct observation and interview. Data collection was carried out from December 2015 to October 2016 including wet and dry seasons of data. According to the rainfall distribution of the area from December to April were considered as dry season, while May to September were considered as wet season.

### 2.2.1. Study design and data collection method

For this study, the area was stratified into five habitat types based on land cover feature. Those habitat types were dense forest, wooded grassland, grassland, riverine forest and farmland. A random sampling design across the five stratified habitat types was used land to assess diversity and abundance of bird species.

Bird identifications and counting of individuals were conducted by direct observations with the aided of binoculars (8×32) and bird guide books. Observations were made by standing in the middle of the point transect and observing gently up to a distance of 30 m radius. Observation at each point transects lasted for 15 min (Girma et al., 2017). The English or local and scientific names of the birds have been taken during field observation. The following three characteristics were applied to identify the bird species. 1) External morphology (Color, shape, size, beak, leg and tail), 2) song and calls and 3) Habitat type (Hossain and Baki, 2015).

Point survey of birds' species was carried out in the morning time from 6:00 to 10:00 a.m. and 5:00-7:30p.m. in the early evening (Brower et al., 1990; Pomeroy, 1992).

Replicated point counts and a presence-absence approach was used for bird censuses. All observed bird species was recorded with a prepared datasheet. Also the identified birds were grouped under migrant, rare, uncommon, fairly common, common and abundant in ascending order (Ian and Peter, 2003; Mengesha and Bekele, 2008). While surveying birds, double-counting the same species or individual birds at a point was avoided by using simultaneous counting, careful observation in roosting and nesting site of birds. Well experienced scouts and bird expertise were involved to collect accurate data. All observers received initial training how to employing the methodologies and usage of field materials and tools before conducted bird identification (Khanum et al., 1980; Grimmett et al., 1988).

### 2.2.2. Calculation of species diversity

The following formula was used to calculate Shannon diversity index as followed by Magurran, (1988), and Jarvis and Robertso (1999).

$$H' = -\sum p_i * \ln(p_i) \dots \dots \dots (1)$$

Where  $H'$  is Shannon-winner index,  $p_i$  is estimated as  $n_i/N$ , where  $n_i$  is the proportion of the total population of the  $i^{th}$  species and  $N = \sum n_i$ . This use proportions rather than absolute abundance values to reduce the effects of order of magnitude deference in bird numbers between species. This index provides a measure of 'evenness' in the proportion of each species occurring within squares.

$$J' = \frac{H'}{\ln(S)} \dots \dots \dots (2)$$

Where  $J'$  is Evenness index,  $H'$  is Shannon winner index and used the formula one and  $S$  is species richness.

Relative abundance (RA) (%) =  $n/N \times 100$ , where  $n$  is the number of individuals of particular species recorded and  $N$  is the total number of individuals of the species.

Encounter rate was calculated for each species by dividing the number of birds recorded by the number of hours spent searching (Bibby et al., 1992).

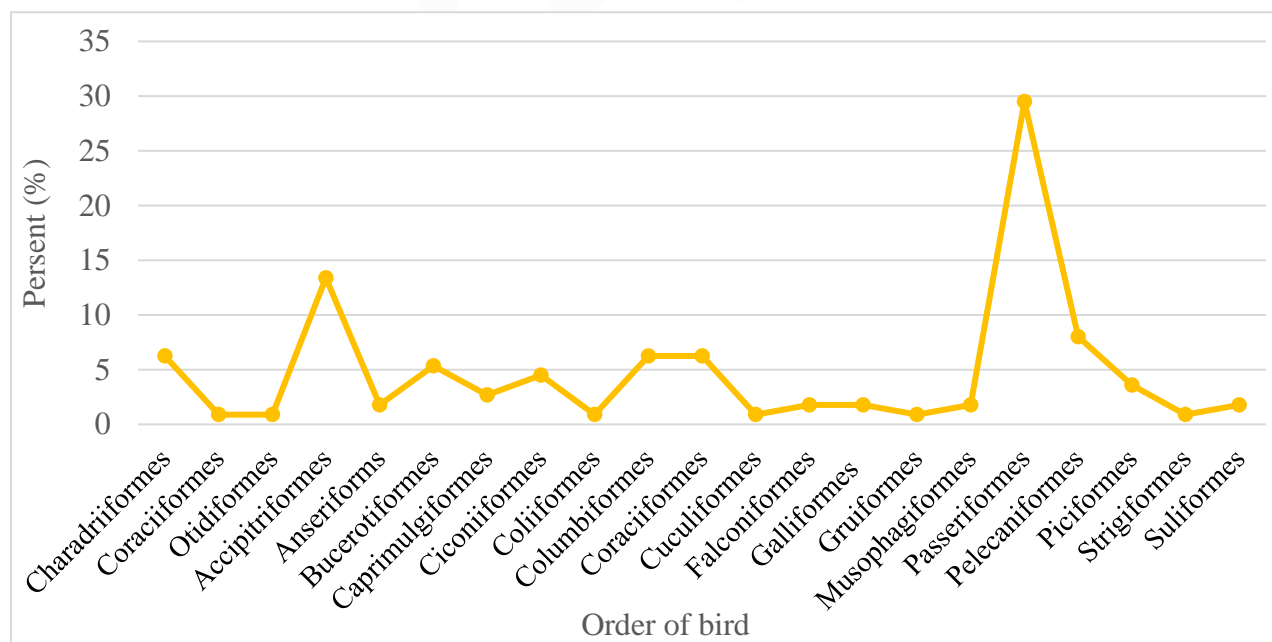
### 2.3. Data Analysis

All data were summarized per season per habitat types during study period in table. The distribution and abundance of species between wet and dry season and among habitat type was analyzed by descriptive statistics and One-way ANOVA. The relative abundance and species diversity index were calculated with Excel version 2016 based on formatted formulas.

## 3. RESULTS

### 3.1. Species Richness and Abundance of Birds

During study period a total of 112 bird species which belongs to 21 orders were identified in GSNP (Table 1). From identified species, order of Passeriformes was recorded the highest species 33(29.5%). While order of Strigiformes, Gruiformes, Cuculiformes, Coliiformes, Otidiformes and Coraciiformes were reordered the lowest (0.89%), (only one species) in the study area (Fig. 2).

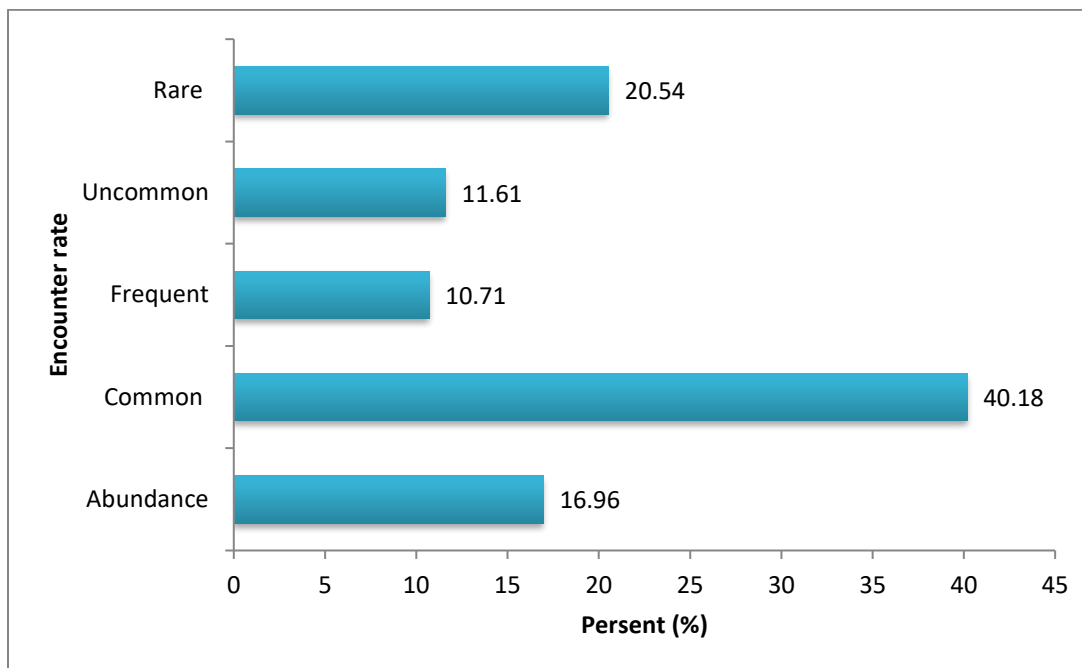


**Figure 2** Proportion of different orders of birds

This study recorded that; Abyssinian long claw (*Macronyx falvicolis*) and Ethiopian pytilia (*Pytilia lineata*) were endemic to Ethiopia. While, Wattled ibis (*Bostrychia carunculata*), White collard pigeon (*Columba albitorques*), White cheeked turaco (*Turaco*

*leucotis*) and Erlanger lark (*Calandrella erlangeri*) were endemic bird species to Ethiopia and Eritrea. Whereas, Abyssinian waxbill (*Estrilda ochrogaster*) was shared endemicty by Sudan and Ethiopia.

According to the rate of occurrence during the study period, 40.18% (45 species) species were commonly observed, 20.54% (23 species) rarely observed, 11.61% (13 species) locally uncommon bird species, 10.71% (12 species) frequent and 16.96% (19 species) were abundance bird species in the study area (Fig. 3).



**Figure 3** Encounter rate

**Table 1** The species richness, status and abundance of bird species

SN	Common name	Scientific name	Order	RA(%)
1	Wattled ibis <sup>NE</sup>	<i>Bostrychia carunculata</i>	Pelecaniformes	0.518
2	Hadedda ibis	<i>Bostrychia hagedash</i>	Pelecaniformes	0.923
3	White collard pigeon <sup>NE</sup>	<i>Columba albitorques</i>	Columbiformes	1.471
4	Speckled pigeon	<i>Columba guinea</i>	Columbiformes	3.128
5	Crowned lapwing (plover)	<i>Vanellus coronatus</i>	Charadriiformes	2.229
6	Black winged lapwing (plover)	<i>Vanellus melanopterus</i>	Charadriiformes	3.163
7	African wattled plover	<i>Vanellus senegallus</i>	Charadriiformes	1.373
8	Caspian plover*	<i>Charadrius asiaticus</i>	Charadriiformes	0.433
9	Common ringed plover*	<i>Charadrius hiaticula</i>	Charadriiformes	1.842
10	Cape eagle owl	<i>Bubo capensis</i>	Strigiformes	0.053
11	White breasted cormorant	<i>Phalacrocorax lucidus</i>	Suliformes	0.507
12	African darter	<i>Anhinga rufa</i>	Suliformes	0.390
13	White wagtail*	<i>Motacilla alba</i>	Passeriformes	0.266
14	Tawny pipit*	<i>Anthus campestris</i>	Passeriformes	1.001
15	Lineated (red billed) pytilia <sup>E</sup>	<i>Pytilia lineata</i>	Passeriformes	0.033

16	Wire tailed swallow+	<i>Hirundo smithii</i>	Passeriformes	0.819
17	Ethiopian swallow+	<i>Hirundo aethiopica</i>	Passeriformes	1.198
18	Pied king fisher	<i>Ceryle rudis</i>	Coraciiformes	2.059
19	Giant king fisher	<i>Megaceryle maxima</i>	Coraciiformes	1.341
20	Abyssinian roller+	<i>Coracias abyssinicus</i>	Coraciiformes	0.515
21	Black-headed heron	<i>Ardea melanocephala</i>	Pelecaniformes	0.443
22	Grey heron	<i>Ardea Cinerea</i>	Pelecaniformes	0.516
23	Purple heron	<i>Ardea purpurea</i>	Pelecaniformes	0.463
24	Helmeted guinea fowl	<i>Numida meleagris</i>	Galliformes	2.089
25	Little egret	<i>Egretta garzetta</i>	Pelecaniformes	1.355
26	Great white egret	<i>Egretta alba</i>	Pelecaniformes	0.673
27	Cattle egret	<i>Bubulcus ibis</i>	Pelecaniformes	1.591
28	Egyptian goose	<i>Alopochen aegyptiaca</i>	Anseriforms	0.721
29	Crested francolin	<i>Dendroperdix sephaena</i>	Galliformes	0.749
30	African black duck	<i>Anas sparsa</i>	Anseriforms	0.389
31	Yellow billed kite+	<i>Milvus aegyptius</i>	Accipitriformes	0.861
32	Black kite*	<i>Milvus migrans</i>	Accipitriformes	1.248
33	Scissor tailed kite+	<i>Chelictinia riocourii</i>	Accipitriformes	0.047
34	Hooded vulture	<i>Necrosyrtes monachus</i>	Accipitriformes	1.833
35	Egyptian vulture*	<i>Neophron percnopterus</i>	Accipitriformes	0.907
36	Lappet-faced vulture*	<i>Torgos tracheliotus</i>	Accipitriformes	0.194
37	White backed vulture	<i>Trigonoceps occipitalis</i>	Accipitriformes	0.768
38	Pallid harrier*	<i>Circus macrourus</i>	Accipitriformes	0.342
39	Lesser spotted eagle*	<i>Aquila pomarina</i>	Accipitriformes	0.094
40	Long crested eagle	<i>Lophaetus occipitalis</i>	Accipitriformes	0.184
41	African fish eagle	<i>Haliaeetus vocifer</i>	Accipitriformes	0.214
42	Black crowned crane	<i>Balearica pavonina</i>	Gruiformes	0.161
43	Kori bustard	<i>Ardeotis kori</i>	Otidiformes	0.255
44	Common sandpiper*	<i>Actitis hypoleucos</i>	Charadriiformes	0.556
45	Green sandpiper*	<i>Tringa ochropus</i>	Charadriiformes	0.422
46	Red eyed dove	<i>Streptopelia semitorquata</i>	Columbiformes	1.058
47	Namaqua dove	<i>Oena capensis</i>	Columbiformes	0.172
48	Blue spotted wood dove	<i>Turtur after</i>	Columbiformes	0.333
49	African mourning dove	<i>Streptopelia decipiens</i>	Columbiformes	2.059
50	Cape turtle dove	<i>Streptopelia capicola</i>	Columbiformes	0.954
51	White cheeked turaco <sup>NE</sup>	<i>Turaco leucotis</i>	Musophagiformes	0.094
52	Black-winged lovebird	<i>Agapornis taranta</i>	Psittaciformes	0.047
53	Standard winged night jar+	<i>Macrodipteryx longipennis</i>	Caprimulgiformes	0.030
54	Little swift	<i>Apus affinis</i>	Apodiformes	1.203

55	White rumped swift+	<i>Apus caffer</i>	Apodiformes	1.324
56	Speckled mouse bird	<i>Colius striatus</i>	Coliiformes	0.498
57	Eurasian hoopoe*	<i>Upupa epops</i>	Bucerotiformes	0.231
58	Half collared king fisher	<i>Alcedo semitorquata</i>	Coraciiformes	1.737
59	Woodland kingfisher+	<i>Halcyon senegalensis</i>	Coraciiformes	1.493
60	Malachite kingfisher	<i>Alcedo cristata</i>	Coraciiformes	1.889
61	Grey-headed kingfisher+	<i>Halcyon malimbica</i>	Coraciiformes	2.162
62	Abyssinian ground hornbill	<i>Bucorvus abyssinicus</i>	Bucerotiformes	1.567
63	Yellow billed hornbill	<i>Tockus flavirostris</i>	Bucerotiformes	0.909
64	Hemprich's hornbill	<i>Tockus hemprichii</i>	Bucerotiformes	0.717
65	African grey hornbill	<i>Tockus nasutus</i>	Bucerotiformes	1.327
66	Cardinal wood-pecker	<i>Dendropicos fuscescens</i>	Piciformes	1.831
67	Bearded wood pecker	<i>Dendropicos namaquus</i>	Piciformes	1.593
68	Thekla lark	<i>Galerida theklae</i>	Passeriformes	0.219
69	Erlanger lark <sup>NE</sup>	<i>Calandrella erlangeri</i>	Passeriformes	0.405
70	Abyssinian long claw <sup>E</sup>	<i>Macronyx falvicollis</i>	Passeriformes	0.981
71	African pipit	<i>Anthus cinnamomeus</i>	Passeriformes	0.606
72	Cape/black/crow	<i>Corvus capensis</i>	Passeriformes	0.601
73	Long billed pipit	<i>Anthus similis</i>	Passeriformes	0.509
74	Tree pipit*	<i>Anthus rufulus</i>	Passeriformes	1.025
75	Eurasian golden oriole*	<i>Oriolus oriolus</i>	Passeriformes	1.373
76	White-winged black-tit	<i>Parus leucomelas</i>	Passeriformes	1.254
77	African fire-finch	<i>Lagonostica rubricata</i>	Passeriformes	1.781
78	Lanner falcon	<i>Falco biarmicus</i>	Falconiformes	0.462
79	Abyssinian waxbill <sup>NE</sup>	<i>Estrilda ochrogaster</i>	Passeriformes	0.409
80	Lesser masked weaver	<i>Ploceus intermedius</i>	Passeriformes	3.709
81	Village weaver	<i>Ploceus cucullatus</i>	Passeriformes	4.627
82	Black Bishop	<i>Euplectes gierowii</i>	Passeriformes	0.163
83	Levaillant's cuckoo+	<i>Clamator levaillantii</i>	Cuculiformes	0.219
84	Grey wagtail*	<i>Mutacilla cinerea</i>	Passeriformes	0.159
85	Common kestrel*	<i>Falco tinnunculus</i>	Falconiformes	0.179
86	Booted eagle*	<i>Aquila pennatus</i>	Accipitriformes	0.238
87	Crowned hawk eagle	<i>Stephanoaetus coronatus</i>	Accipitriformes	0.284
88	African sacred ibis	<i>Threskiornis aethiopicus</i>	Pelecaniformes	1.306
89	Yellow billed stork+	<i>Mycteria ibis</i>	Ciconiiformes	1.408
90	White stork*	<i>Ciconia ciconia</i>	Ciconiiformes	0.309
91	Black stork*	<i>Ciconia nigra</i>	Ciconiiformes	0.12
92	Marabou stork	<i>Leptoptilos crumeniferus</i>	Ciconiiformes	0.213
93	Saddle billed stork	<i>Ephippiorhynchus senegalensis</i>	Ciconiiformes	0.231



94	Black billed barbet	<i>Lybius guifsobalito</i>	Piciformes	0.266
95	Bateleur	<i>Terathopius ecaudatus</i>	Falconiformes	0.209
96	Yellow wagtail*	<i>Motacilla flava</i>	Passeriformes	0.428
97	European bee-eater*	<i>Merops apiaster</i>	Coraciiformes	0.248
98	Northern red Bishop	<i>Euplectes franciscanus</i>	Passeriformes	0.053
99	Black winged bishop	<i>Euplectes hordeaceus</i>	Passeriformes	0.038
100	Fan-tailed raven	<i>Corvus rhipidurus</i>	Passeriformes	0.106
101	Greater blue-eared starling	<i>Lamprotornis chalybeus</i>	Passeriformes	1.396
102	Golden breasted starling	<i>Cosmopsarus regius</i>	Passeriformes	1.406
103	Ruppell's starling	<i>Lamprotornis purpuropterus</i>	Passeriformes	0.943
104	Pallid harrier*	<i>Sircus macrourus</i>	Accipitriformes	0.507
105	Red-cheeked cordonbleu	<i>Ureaginthus bengalus</i>	Passeriformes	1.915
106	Swainson's sparrow	<i>Passer swainsonii</i>	Passeriformes	2.41
107	Bush petronia sparrow	<i>Petronia dentate</i>	Passeriformes	1.854
108	African paradise flycatcher+	<i>Terpsiphone viridis</i>	Passeriformes	0.648
109	Common redstart	<i>Phoenicurus phoenicurus</i>	Passeriformes	0.281
110	Mosque swallow	<i>Cecropis senegalensis</i>	Passeriformes	0.320
111	Silver cheeked hornbill	<i>Bycanistes brevis</i>	Bucerotiformes	0.396
112	Lesser Honeyguide	<i>Indicator minor</i>	Piciformes	0.222

**NB:**\*=Palearctic migrant, +=Intra-African migrant, E=Endemic, NE=Near Endemic, RA: Relative abundance.

During the study period, Black winged lapwing/plover (*Vanellus melanopterus*) was recorded the highest relative abundance 3.16% (2083 individuals), whereas Standard winged night jar (*Macrodipteryx longipennis*) was showed the lowest relative abundance 0.03% (20 individuals) in the study area (Table 1).

Of the identified species of birds, 95 species and 86 species were reordered in wet and dry season. 69 bird species were common however, 16 and 25 species were recorded exclusively in wet and dry season respectively. Of which 22 species were Palearctic migrant and 12 were intra-African migrant.

The mean of bird species abundance between dry and wet seasons was significantly difference ( $f= 4.8$ ,  $P<0.05$ ,  $df = 1$ ). Wet season mean of bird abundance was higher than mean of abundance ( $305.2\pm 27.99$ ) dry season (Table 2).

**Table 2** Abundance of bird species in wet and dry season

Season	Mean	Std. Error Mean (SE)	F	df	P-Value
Wet season	305.2	27.99	4.8	1	0.029
Dry season	246.6	20.7			

### 3.2. Diversity and Distribution of Bird Species

The distribution of birds' species among habitat type was significantly different ( $f= 2.99$ ,  $p = 0.019$ ,  $df = 4$ ). Farmland habitat was recorded the highest distribution ( $122.51\pm 10.26$ ) while wooded grassland recorded the lowest distribution ( $77.24\pm 13.52$ ). Riverine forest was inhabited the highest species richness (91 species), grassland was harbored the lowest species richness (50 species) in the study area (Table 3).

**Table 3** Bird species distribution across habitat type

Habitat types	No of species	Mean	Standard deviation	Standard error(SE)	F	df	P-value
Dense forest	79	77.89	22.89	11.36			



Wooded grassland	74	77.24	13.52	10.19			
Grassland	50	79.68	9.46	10.2	2.99	4	0.019
Riverine forest	91	104.02	12.93	10.98			
Farmland	72	122.51	10.26	12.98			

Riverine forest recorded the highest species diversity of birds ( $H' = 4.12$ ) with the highest evenness ( $J = 0.91$ ) followed by wooded grassland habitat ( $H' = 3.72$ ). Farmland was recorded the lowest species diversity ( $H' = 2.9$ ) and had the lowest evenness index ( $J = 0.68$ ) in the study area (Table 4).

**Table 4** Bird species diversity index along habitat type

Habitat type	No. of species	Diversity( $H'$ )	Evenness ( $J$ )
Dense forest	79	3.23	0.74
Wooded grassland	74	3.72	0.86
Grassland	50	3.02	0.77
Riverine forest	91	4.12	0.91
Farmland	72	2.9	0.68

## 4. DISCUSSION

### Species Richness and Abundance of Birds

During study period a total of 112 species were identified in GSNP; it showed that the study area is home for various bird species, it could be due to altitudinal difference and presence of various habitat types (Hossain and Baki, 2015; Girma et al., 2017).

Of the identified species, the highest numbers of bird species (29.5%) were belonging to order of Passeriformes in the study area; it is similar with finding of Jeevan et al. (2013).

This study revealed that, two endemic species of Ethiopia and five near endemic species; including these IUCN threatened species were inhabited in the study area. Hence, the presence of endemic and near-endemic species and globally threatened species in the area indicate that the mosaic landscape at varying altitude that consists different habitat type, is important area of endemism and conservation priority area (Vivero, 2001; Ian and Peter, 2003; Mengesha and Bekele, 2008; Girma et al., 2017).

According to the rate of occurrence during the study period, the highest proportion bird species (40.18%) were locally common, followed by rarely observed species (20.54%) in the study area. According to Mengesha and Bekele (2008) report, most species (97 species) are locally rare in Alatish National Park. Species occurrences and bird community assemblages are primarily determined by suitability of habitat type and degree of disturbance in the area (Vallejo et al., 2009). During the study period, Black winged plover was recorded the highest relative abundance (3.16%) whereas Standard winged night jar was showed the lowest relative abundance (0.03%) in the study area. Violet wood hoopoe is sporadically occurring and show that the lowest numbers of individuals birds in the area (Jarvis and Robertso, 1999).

Of the identified species, 16 and 25 species were recorded exclusively in wet and dry season respectively while 69 bird species were common residence during the study period. However, 22 species were Palearctic migrant and 12 Intra-African migrant bird species whereas the remaining 9 species were locally migrant bird in the study area. According to Mengesha and Bekele (2008), 57 species of birds exclusively recorded during wet season and 21 during dry season in Alatish National Park. According to Aynalem and Bekele (2008) report, 21 Palearctic Migrants and one Intra-African Migrant species are occurred in southern tip of Lake Tana Ethiopia.

The mean of bird species abundance between dry and wet seasons was significantly different ( $P < 0.05$ ,  $df = 1$ ). The mean of bird species abundance in wet season ( $305.2 \pm 27.99SE$ ) was higher than dry season ( $246.6 \pm 20.7SE$ ). This variation could be due to seasonal movement patterns, local and regional habitat changes, large-scale population changes and climatic conditions (Gaston et al., 2000; Aynalem and Bekele, 2008). Hence, wet season created conducive environmental condition for bird species in terms of food, cover and other habitat requirements to had high distribution in the study area.

### Diversity and Distribution of Bird Species

The distribution of birds' species among habitat type was showed significantly different. Bird species recorded the highest distribution in Farmland habitat while in wooded grassland recorded the lowest. Riverine forest was recorded the highest species richness. It also supported the highest species diversity of birds with the highest evenness followed by wooded grassland habitat. Thus, riverine forest habitat was favorable habitat for many bird species both during dry and wet season in the study area. It could

be due to comparatively low habitat disturbance by human activities and availability of sufficient water, shelter and food in this habitat for many bird species (Mengesha and Bekele, 2008). The presence of variety of food items, water and cover throughout the study period contributed to the higher species diversity richness and evenness in this habitat (Girma et al., 2017). Hence the study indicated that, the site is the home for diversity of bird species and it is important conservation priority area.

## 5. CONCLUSION

The study revealed that GSNP was suitable area for various birds' species including many endemic, near endemic, globally threatened, rare and migratory species. Therefore, GSNP is important place and providing heterogeneous habitats for the bird's species conservation. Hence, the area possible to qualify the criteria of an important bird area of Ethiopia. Consequently, the area should be recognized as important bird area of Ethiopia and considered as local and national valuable site to attract tourists especially interested in bird watching. So that, the study area should be given to further conservation measure to keep existing bird species diversity. Moreover, since this study was the first investigation, there might be limited to discover cryptic and nocturnal bird species so further study shall be conducted to discover more bird species.

### DECLARATIONS

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#### **Consent for publication**

The Authors agreed to publish our manuscript on the journal of species.

#### **Availability of data and materials**

All raw data and/or analyzed data during the current study are available from the corresponding author on reasonable request.

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#### **Authors' contributions**

All authors contributed for this manuscript preparation. KA, BT & AF accompanied bird survey, analyzed and interpreted the data, and writes the report. TK and AA collected and coded the data.

#### **Ethics approval and consent to participate**

Not applicable.

#### **Competing interests**

The authors declared that there is no any conflict of interest.

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