Diversity, relative abundance, and habitat association of avian species in Tara Gedam Monastery forest and adjacent habitats, Northwestern Ethiopia

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ABSTRACT

Birds are important bio-indicators and provide various ecosystem services including pollination, dispersal, and pest control. However, they are threatened by habitat loss, fragmentation, and degradation. Study on species diversity, relative abundance, and habitat associations of avifauna were conducted in Tara Gedam Monastery forest patch and associated habitats from July 2016 to April 2017. Stratified random sampling approach was used to classify habitats and select sampling plots based on vegetation type. Consequently, forest, bushland, farmland, and plantation habitats were used for data collection. Point count and line transect methods were used to collect data, and Shannon-Weiner and Simpson's diversity indices were used to estimate the avian species diversity. One-way ANOVA was conducted to compare avian relative abundance and richness among the different habitat types. A total of 98 species of birds belonging to 14 orders and 41 families were recorded in Tara Gedam Monastery forest and associated habitats. Eighty-seven resident bird species and eleven Palearctic migrants were identified of which seven species are endemic to Ethiopia and Eritrea. The highest avian diversity (H'=4.23) was recorded in the study area during the wet season.The highest species similarity index (SI=0.47) was recorded between forest and bushland habitats during the wet season, while the lowest similarity index (SI=0.07) was found between bush-land and farmland habitats during the dry season. Species richness and relative abundance of bird species varied between the wet and dry seasons. Besides birds, Tara Gedam Monastery forest supports a large number of other wild fauna species, which indicates the area's potential to support biodiversity. Therefore, there must be a collaborative work between the monastery and different governmental and non-governmental organizations to protect the entire ecosystem in order to conserve the whole biodiversity of the area in general and the avifauna in particular.

Keywords: Abundance, Avifauna, Forest, Species diversity, Species similarity.
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INTRODUCTION

Avian species diversity and distributions are not uniform along with the different landscapes (Bibby *et al*., 1992). The highest diversity of birds occurs in lowland tropical and sub-tropical forests near the Equator of the globe and it declines towards the poles (Newton, 2003; Birdlife International, 2014). Tropical forests are known for their greatest number of species (Corlett and Primack, 2011). Mountain ecosystems are also recognized as biological diversity hotspots harboring rich biota with a high number of endemic species (Joshi *et al*., 2012). Ethiopia is one of the top 25 biodiversity-rich countries in the world, which consists of two of the world's 34 biodiversity hotspots, the Eastern Afromontane and the Horn of Africa Hotspots (WCMC, 1994). Likewise, of the 32 centers of avian endemism sites in Africa, Central Ethiopian Highlands, South Ethiopian Highlands and Juba and Shebelle Valleys occur in Ethiopia (Birdlife International, 2008; EWNHS, 2009). Altitudinal variations in Ethiopia have led to the occurrence of diverse ecosystems ranging from moist rain forests to deserts and contribute to the diverse plants and animals (Woldemariam Tesfahunegn, 2016). In addition to variations in topography, climate and soil types in the country result in variable vegetation and fauna compositions (Woldesilassie Gebremarkose, 1998).

In Ethiopia, over 860 species of birds are recorded and among these 16 species are endemic to the country, 14 species are endemic to both Ethiopia and Eritrea, 35 species are globally threatened, and one is introduced species (Lepage, 2018). There are 214 Palearctic migrants in Ethiopia, and among these 45 species have been found to over-summer within the boundaries of the country and have a breeding population (Jeffery *et al.,* 2004; Pol, 2006). Avian species play a vital role to maintain the ecosystem, they are also important in seed dispersal and pollination as they feed on fruits, flowers, seeds, and anthers. They are also good biological control agents as many of them feed on insects. Birds are the best biological indicator of the environment because they are sensitive to climate change and pollutants (Nason, 1992; Dessalegn Ejigu *et al.,* 2014).

Despite the rich diversity of birds, habitat destruction, fragmentation and loss have been observed for decades and severely impacted the survival of avian species in the country (Nega Tassie and Afework Bekele, 2008; Shimelis Aynalem and Afework Bekele, 2009). Habitat loss and degradation as a result of anthropogenic activities have caused a significant decline in avian diversity around the world (Taylor and Pollard, 2008). Human activities including farming, settlement, charcoal production, and firewood collection have contributed to habitat degradation which has widely damaged the natural habitat of birds and disturbed their variety and variability (Storch *et al*., 2003). Global studies on the community

composition, structure, distribution, and diversity of forest birds and the importance of forested areas to birds are far- reaching (Burgess *et al.,* 2007; Sekercioglu, 2012). Because, the majority of birds are conspicuous and relatively easy to study, they are among the best studied animals in the forest ecosystems (Şekercioğlu, 2006). However, the Ornithology of Ethiopia is still in its infancy stage that overlooked bird diversity, distribution and their contribution to ecosystem services. As a result, birds' checklist of Ethiopia is still incomplete. In Tigray National Regional State, Ethiopia, the Ethiopian Orthodox Tewahido Church forests support several bird species and are favorable places for birds to inhabit and provide good source of food (Hailemariam Araya and Tsegazeabe Hadush, 2013). Therefore, the main objective of this study was to investigate the diversity, relative abundance and habitat association of avian species in different habitats of Tara Gedam Monastery forest, and associated habitats.

MATERIALS AND METHODS

Description of the study area

Tara Gedam Monastery forest is located in South Gondar Zone within the Amhara National, Regional State, close to Addis Zemen town. The study area lies between the coordinates of 37°44'0"-37°46'0" E longitude, and 12°8'0"-12°10'0"N latitude (Fig.1). The altitude of the area ranges from 2217 to 2457 m. a.s.l with the highest peak at Wombera Mountain. Tara Gedam Monastry is located at about 82 km North of Bahir Dar, and 93 km South of Gondar town on the Addis Ababa-Bahir Dar-Gondar main road. Tara Gedam Monastery forest is characterized by a moderate climate, locally known as 'Woina Dega' and the area have a uni-modal rainfall distribution. The rainy season ranges from June to August, while the dry season extends from December to April. The climatic data of Tara Gedam Monastery obtained from the National Meteorological Services Agency showed that the mean annual maximum and minimum temperature is 27.9 °C and 11.1 °C, respectively. The mean monthly annual rainfall ranges from 900 mm to 1200 mm. The vegetation of Tara Gedam Monastery consists of forest, bushland, farmland and plantation habitats. The area is covered by volcanic rocks mainly basaltic and the rocks are light, dark, grey, whitish, reddish or brown. The fertility of the soil in the area deteriorates as a result of erosion and continuous cultivation (Mohammed Gedefaw and Teshome Soromessa, 2014)

In spite of the destruction of the vegetation around Addis Zemen, the Tara Gedam Monastery forest is conserved for a long time owing to the presence of the Monastery, which was established during the reign of Atse Gelawdewos in the 1600s, and it was protected as State Forest during the Derge Regime since 1979

E.C. At present, the forest covers an area of about 875 hectares (Mohammed Gedefaw and Teshome Soromessa, 2014).

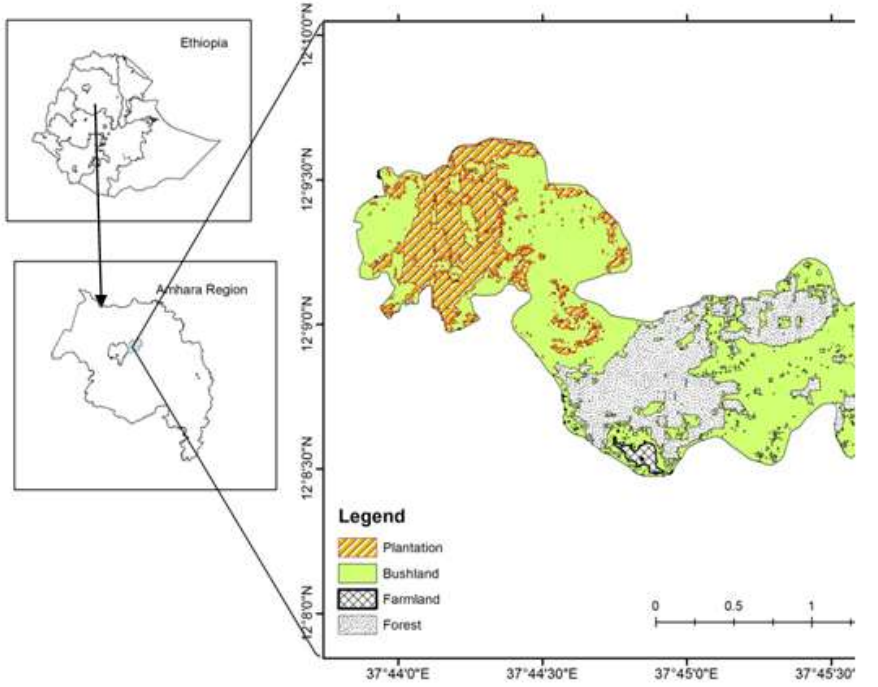

Figure1. Location map of the study area

Data collection

A reconnaissance survey was carried out from 15-30 July 2016 to be acquainted with the different habitat types of the area. During this survey, knowledge of the local people was used to locate surveying sites and identify potential transect trails and point location sites within each habitat type. In addition, all the available literatures about the study area and the ecology of forest birds were intensively reviewed. Following the information gathered during the reconnaissance survey, wet season data were collected from August 2016 to October 2016, and data for the dry season were collected from February 2017 to April 2017. Binoculars and video camera were used during data collection period in the field. Vegetation type was used to classify the study area into four habitat types as forest, bushland, farmland, and plantation. Sampling plots were randomly selected for each habitat type. The numbers of sampling plots were determined based on the size and the

nature of vegetation cover within the study area (Sutherland, 1996; Bibby *et al*., 1998).

The densely vegetated forest area was surveyed using a point count method, while the lines transect method was used in bushland, farmland, and plantation habitats (Buckland *et al*., 2001). Nine sampling plots were established, of these three sampling plots were in the forest, three in the bushland, one in the farmland, and two in the plantation habitats. Three line transects were laid in the bushland measuring a length of 450 m each. Two transects measuring 550 m each were used in the farmland, four transects with a length of 400 m each were used in the plantation area, and in the forest habitat, 42 point stations were laid with a width of 200 m along the length of the transects that measure 500 m.

Reverse counting was carried out to allow observers to detect birds that could have been missed at the beginning and/or the ending of counting routes. Survey routes were reasonably spaced out by 200 m to minimize repeated counting of birds (Shimelis Aynalem and Afework Bekele, 2008). All birds seen were recorded during a 15-minute count (Weber *et al*., 2008). During the first three minutes of the recording period, the observer stands still at the center of the point station, while in the latter part of the period the observer slowly rotates 360° to collect the actual bird data within the point station (Sutherland, 2000; Laiolo *et al*., 2004). The number of individuals of each species was recorded within the 30 m fixed radius point and the unlimited radius points at first detection (Bibby *et al*., 1998). The unlimited radius counts could give a better picture of species richness in the study area. Flying over bird species were recorded and considered in species richness calculation. To minimize the effect of time and weather conditions on bird detectability, point counts were undertaken only between 06:00 a.m. and 09:00 a.m. in the morning, and late in the afternoon between 3:00 pm and 6:00 pm, when most of the avian species are active under calm weather conditions (Jones, 1998; Canterbury *et al*., 2000).

Data analysis

A one-way ANOVA was conducted to understand whether avian relative abundance and richness differed among the three habitat types. The mean richness and relative abundance values were made by pooling the records based on the separate observations on each habitat type. Shannon-Weiner Index and Simpson Index were used to evaluate the diversity of bird species in different habitats within the study area. The Shannon-Weiner Index (H') provides an account for both abundance and evenness (Magurran, 1988). It does not disproportionately favor some species over the others as it considers all species according to their frequencies (Lou, 2006).

$H' = - (\sum P_i \ln P_i)$ (1)

Where, *Pi* is the proportion of the species relative to the total number of species (multiplied by the natural logarithm of this proportion, $ln(P_i)$, and the final product multiplied by -1.

Simpson Diversity Index (1-D) is a measure of diversity that takes into account both richness and evenness. It measures the probability that two individuals randomly selected from a sample will belong to the same species. The index gives the probability of any two individuals drawn from noticeably large community belonging to different species. It has been measured by:

$$D = \frac{\sum n(n-1)}{N(N-1)} \quad (2)$$

Where n=the total number of birds of a particular species, N= the total number of birds of all species in the given habitat. Species richness (S) is defined by:

$$S = \sum n \quad (3)$$

Where, n is the number of species in a community

Species evenness (E) was used to evaluate by Shannon's equitability index (E) which was calculated by:

$E = H'/ H_{max}$ (4)

Where, H_{max} is defined as ln(S), H' is the Shannon-Wiener diversity index, E values range between 0 and 1, 1 indicates `complete evenness.

Simpson's similarity index (SI) was used to evaluate the similarity of species between two different habitats in both seasons by using the formula:

$SI = 2C/A+B$ (5)

Where, SI=Simpson's similarity index; A=Number of species that occur in habitat A; B=Number of species that occur in habitat B; C = Number of common species that occur in both habitat A and B.

The relative abundance of avian species was determined using an encounter rate formula that give crude ordinal scales of abundance (Bibby *et al.,* 1998). Percent

encounter rate for each species was calculated by dividing the number of birds recorded by 100 field hours

$$\text{Encounter rate} = \frac{\textit{Totalnumberofindividualbirdsrecorded}}{\textit{Periodofobservationper100fieldhour}} \times 100 \qquad (6)$$

Following Bibby *et al.* (1992) encounter rate values were used to categorize each species under five abundance categories as: < 0.1 for rare, 0.1-2.0 uncommon, 2.1-10.0 frequent, 10.1-40.0 common, and > 40 abundant. SPSS version 20, and past software version 08 were used to analyze the association of birds to different habitats within the study area.

RESULTS

Species composition and relative abundance

A total of 9401 individuals of birds from 14 orders, 41 families, and 98 species were recorded. Among 98 avian species recorded, 71 and 76 species were recorded during the wet and dry seasons, respectively (Appendix). Of the recorded species, seven species such as Abyssinian slaty flycatcher (*Melaenornis chocolatinus*), banded barbet *(Lybius undatus*), black-winged lovebird (*Agapornis taranta*), Rüppell's black chat (*Myrmecocichla melaena*), white-billed starling (*Onychognathus albirostris*), white-winged cliff chat (*Myrmecocichla semirufa*) and Abyssinian oriole (*Oriolus monacha*) are endemics to both Ethiopia and Eritrea. The majority of the species 64(65.3%) recorded were grouped under the family Passeriformes. The forest habitat had the highest number of species richness and individuals per plot during both the wet and dry seasons, while plantation and farmland habitats had the least average species richness and individuals per plot during the wet and dry seasons, respectively (Table 1).

Species diversity and evenness indices

There were variations in species diversity among the habitat types during the wet and dry seasons. The forest habitat supported relatively higher diversity of birds (H′=4.23) during the wet season, while the bushland habitat supported the higher diversity (H′= 3.66) during the dry season. The least diversity of birds (H′=2.31) was recorded in plantation habitats during the wet season. The highest evenness (E=0.54) was recorded in the forest during the wet season, and in the bushland (E=0.54) during the dry season. Avian species richness was the highest in the forest habitat compared to other habitat types during the wet and dry seasons. The number of avian species decreased in the farmland habitat during the dry season.

The highest evenness index was recorded in both forests (E =0.54) and bushland (E=0.54) habitat types during the wet and dry seasons, respectively.

Table 1. Avian species diversity during the wet and dry seasons.

Habitat	Season	Number of species	Abundance	D	H′	E
Bushland	Wet	37	869	0.92	2.47	0.37
	Dry	42	882	0.95	3.66	0.54
	Both	48	1013	0.91	3.45	0.51
Farmland	Wet	30	1216	0.88	2.76	0.49
	Dry	25	658	0.84	2.42	0.37
	Both	36	1180	0.91	2.78	0.39
Forest	Wet	46	2539	0.83	4.23	0.54
	Dry	49	2638	0.89	2.89	0.37
	Both	58	2904	0.94	3.61	0.52
Plantation	Wet	28	651	0.95	2.31	0.35
	Dry	33	706	0.94	2.61	0.41
	Both	42	849	0.93	2.51	0.37

H′= Shannon-Wiener Index; D = Simpson Diversity Index; E = Evenness

In terms of relative abundances, Abyssinian oriole and greater blue eared starling had the highest score of relative abundance in the forest and farmland habitats during the wet season, while black-winged lovebird, white-billed starling, Rueppell's robin chat, the African paradise fly catcher had the highest relative abundance score in the forest, farmland and forest habitats during the dry season. During the wet season; 21, 11, 22 and 9 species were frequent in bushland, farmland, forest and plantation habitats, respectively, while during the dry season 13, 8, 18 and 13 species were frequent in bushland, farmland, forest and plantation habitats, respectively (Table 2). The abundance of bird species in the three habitats showed statistically significant difference among group means of the three habitats both in the wet ($p < 0.05$) and dry ($p < 0.05$) seasons. However, species richness showed no significant difference, wet ($p = 0.075$) and dry ($p = 0.063$) seasons.

Table 2. Relative abundance of bird species during the wet and dry seasons.

Habitat type	Season	Uncommon	Frequent	Common	Abundant
Bushland	Wet	-	21	16	-
	Dry	4	13	25	-
Farmland	Wet	-	11	17	2
	Dry	3	8	11	3
Forest	Wet	4	22	19	1
	Dry	-	18	26	5
Plantation	Wet	3	9	16	-
	Dry	5	13	15	-

Species similarity in different habitats

The highest similarity of avian communities (SI=0.47) was recorded between the bushland and forest habitats during the wet season, while the least species similarity was recorded between bushland and plantation (SI=0.28) habitats (Table 3).

Table 3. Similarity index of bird species during the wet and dry seasons.

	Farmland		Forest		Plantation	
	Wet	**Dry**	**Wet**	**Dry**	**Wet**	**Dry**
Bushland	0.14	0.07	0.47	0.23	0.28	0.17
Farmland	-	-	0.14	0.16	0.24	0.13
Forest	-	-	-	-	0.22	0.27

DISCUSSION

A total of 98 avian species belonging to 41 families identified in the Tara Gedam Monastry forest and adjacent habitats. The majority of the avian species are from the order Passeriformes, which is in line with the study of Agarnesh Desalegn and Subramanian (2015). The highest avian diversity (H′=4.23) was recorded in the forest during the wet season. The highest species similarity index (SI=0.47) was recorded between forest and bushland habitats during the wet season, while the lowest similarity index (SI = 0.07) was between bushland and farmland habitats during the dry season.

Among the four studied habitats, the most diversified avian species was recorded in the forest habitat. The more heterogeneous vegetation community and vegetation strata in the forest habitat could have provided several niches for birds, allowing the forest habitat to support more avian species. Moreover, the highest diversity and relative abundance of birds in the forest habitat might be associated with the presence of a sufficient amount of food and availability of nesting materials. This is similar to the study conducted by Wilcoxen *et al.* (2015) in which an abundance of different foods, nesting sites, and vegetation structure in the forest habitat are the primary factors that attract more birds. In addition, in line with Gil-Tena *et al.* (2007) the difference in species diversity, a number of species and number of individuals of species among the different habitat types in the present study could be associated with differences in habitat characteristics and feeding habits of birds. Likewise, Deppe and Rotenberry (2008) described that vegetation structure can be an important factor in shaping the associations of birds with their environment.

The diversity of birds in the bushland habitat was the highest during the dry season. This might be due to the presence of large parts of the bushland habitats close to the cliff of the Quala Mountain with large patches of grasslands that provide food for birds. According to Nancy (1995), larger patched habitats support more species of birds and individuals than smaller ones as they possess diversified microhabitats. The results of the present study, in agreement with the findings of Girma Mengesha and Afework Bekele (20008); Yenew Genet and Dessalegn Ejigu (2017), showed that grassland interspersed patchy habitats have contributed to an increase in diversity, richness, and evenness of birds. The lowest number of species diversity was observed in plantation habitat during the wet season. The current result corroborates previous reports such as Kalkidan Esayas and Afework Bekele (2011) who reported the allelopathic effect of the eucalyptus plantations on the understory vegetation, which could otherwise serve as food for avian species, in the Entoto Natural Park and escarpment. Thus, habitat deterioration leads to a decline in the abundance and diversity of avian species.

The abundance of avian species was the highest during the dry season in all habitats except in farmland habitat. This might be because Tara Gedam Monastery forest is surrounded by many villages and farmlands, and food availability becomes scarce in the villages and nearby farmlands after the harvesting period during the dry season, so birds use the forest as their alternative habitat. Avian species seasonally shift their diet to feed on a different set of resources (Borghesio and Laiolo, 2004). Moreover, this might be due to an increased frequency of fruiting and flowering trees such as *Syzygium guineese*, *Ficus capensis,* and *Ficus ituriensis*in the forest habitat during the dry season. Similarly, Yenew Genet and Dessalegn Ejigu (2017) reported that increased frequency of fruiting and flowering trees in the forest habitat contributed to the presence of more avian species. Fruit and flower production is well synchronized with the seasons and fruiting is the highest towards the end of the dry season (Fleming, 1992). Thus, birds occupy in areas where food is periodically available.

Avian diversity and relative abundance were the lowest in the farmland habitat during the dry season. This might be because the farmlands are covered by major crops such as wheat (*Triticum asestivum*) and maize (*Zea mays*), and thus food availability gets depleted after the harvesting period during the dry season. Rana (2005) also reported that intensive farming in natural habitats affects the diversity of species. When resources are scarce, bird species locally migrate to areas where food resources and breeding habitats are abundant (Tsegaye Megersa *et al*., 2016). Furthermore, land conversion for agricultural expansion might force birds to migrate to nearby natural habitats.

Anthropogenic threats, including cutting trees and clearing vegetation for construction, charcoal and fire- wood production, are common in the present study area. Such kind of anthropogenic disturbance and degradation of the habitat would reduce the avian population in various ways. According to Lee and Rotenberry (2005) as the vegetation changes along complex geographical and environmental gradients, the number of a particular bird species increases or decreases and disappears as the habitat changes. Bird habitat destruction directly affects bird survival and reproductive success (Green and Hirons, 1991).

CONCLUSION

The distribution of birds in different habitats is based on the availability of food, and vegetation cover. Accordingly, the forest habitat had the highest avian species diversity and richness during the wet season, while the bushland habitat comprised the highest diversity during the dry season. The highest seasonal similarity of bird species is observed between the forest and bushland habitats during the wet season. This might be due to the availability of similar resources in both habitats than the other habitat types. Moreover, the similarity of vegetation structure between the forest and bushland habitats could be inhabited by similar avian species or often interchanging species between the habitat types. The relatively low seasonal similarity of bird species observed between bushland and farmland habitats might be due to local migration of birds to the forest, plantation and other nearby habitats when resources are scarce in the farmland. Many bird species migrate between different habitats, thereby optimizing the availability of food sources and breeding habitats. Birds often prefer to utilize multiple habitats and depend on the quality and productivity of the habitats in terms of food accessibility, shelter and breeding sites to maintain viable populations. In this connection, Tara Gedam Monastery forest and associated habitats support a large number of avian species and confirms the area's potential for bird watching tourism that can integrate economic gain with biodiversity conservation. Therefore, there must be a need for protecting the forest ecosystem to conserve the biodiversity of the area in general and the avifauna in particular.

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APPENDIX

Appendix. Bird species recorded during the wet and dry seasons in the study area.

Common Name (Scientific Name)	Season		
	Wet	Dry	Both
Rüppell's Robin chat (*Cossypha semirufa)*			✓
Abyssinian oriole (*Oriolus larvatus)*			✓
Common bulbul (*Pycnonotus barbatus)*			✓
White-cheeked turaco (*Tauraco leucotis)*			✓
Red-eyed dove (*Streptopelia semitorquata)*			✓
Blue-spotted wood dove (*Turtur afer)*			✓
African mourning dove (*Streptopelia decipies)*			✓
Laughing dove (*Streptopelia senegalenesis)*			✓
Dusky turtle dove (*Streptopelia lugens)*			✓
Speckled pigeon (*Columba guinea)*			✓
African paradise fly catcher (*Terpsiphone viridis)*			✓
Common fiscal (*Lanius collaris)*			✓
Black cap (*Sylvia atricapilla)*			✓
Northern puff back (*Dryoscopus gambensis)*			✓
Tropical boubou (*Laniarius aethopicus)*			✓
African gray hornbill (*Tockus nasutus)*			✓
Cardinal wood pecker *(Dendropicos fuscescens)*			✓
Helmeted guineafowl (*Numida meleagris*)			✓
Harlequin quail (*Coturinx delegorguei)*	✓		
Olive thrush (*Turdus olivaceus)*			✓
African ground thrush (*Turdus pelios)*			✓
Black -headed batis (*Batis minor)*			✓
Brown- throated wattle eye (*Platysteira cyanea)*			✓
White-backed Vulture (*Gyps africanus*)	✓		
Augur Buzzard (*Buteo augur)*			✓
Speckled Mouse bird (*Colius striatus)*			✓
Narnia Trogon (*Apaloderma narina)*			✓
Green Wood hoopoe (*Phoeniculus purpureus)*			✓
Little Bee-eater (*Merops pusillus)*			✓
Little sparrow hawk (*Accipiter minullus)*	✓		
Black-winged Love bird (*Agapornis taranta)*			✓
Lesser Gray Shrike (*Lanius minor*)		✓	
Pied Crow *(Corvus albus)*			✓
Mouse colored Penduline Tit (*Anthoscopus musculus)*	✓		
Willow Warbler (*Phylloscopus trochilus*)	✓		
Puff-bellied Warbler (*Phyllolais pulchella)*	✓		
Tawny-flanked Prinia (*Prinia subflava)*			✓
African Yellow White-eye (*Zosterops senegalensis*)			✓
Silver bird (*Empidornis semipartitus)*	✓		
Abyssinian Slaty-Flycatcher (*Melaenornis chocolatinus)*			✓
White-browed Robin-Chat (*Cossypha heuglini)*	✓		
Olivaceous warbler (*Hippolais pallid)*			✓
Greater Blue-eared Starling (*Lamprotornis chalybaeus)*			✓
Scarlet-chested Sunbird (*Chalcomitra senegalensis)*			✓
Variable Sunbird (*Cinnyris venustus)*			✓
Bush Petronia (*Petronia dentate*)			✓
Swanson's Sparrow (*Passer swainsonii*)			✓

Spectacled Weaver (*Ploceu socularis*)	✓		
Northern Red Bishop (*Euplectes franciscanus*)	✓		
Black-winged red Bishop (*Euplectes hordeaceus*)	✓		
Red-billed Fire finch (*Lagonosticta senegala*)	✓		
African Fire finch (*Lagonosticta rubricate*)		✓	
Village Indigo bird (*Vidua chalybeate*)	✓		
Vinaceous Dove (*Streptopelia vinacea*)			✓
Common Chiffchaff (*Phylloscopus collybita*)			✓
Gray Wren-Warbler (*Calamonastes simplex*)	✓		
Common Stone chat (*Saxicola torquatus*)			✓
Spotted Flycatcher (*Muscicapa striata*)			✓
Grey-backed Camaroptera (*Camaroptera brevicaudata*)			✓
White-bellied Canary (*Serinus dorsostriatus*)	✓		
Montane white eye (*Zosteropes poliogastrus*)			✓
Yellow -billed kite (*Milvus egypticus*)			✓
Pale fly catcher (*Bardornis pallidus)*			✓
Rüppell's griffon vulture (*Gyps rueppelli*)		✓	
Lizard Buzzard (*Kaupifalco monogrammicus*)		✓	
Black Kite (*Milvus migrans*)	✓		
Tambourine Dove (*Turtur tympanistria*)		✓	
Abyssinian Long-eared Owl (*Asio abyssinicus*)		✓	
Banded Barbet (*Lybius undatus*)		✓	
Red-shouldered Cuckoo shrike (*Campephaga phoenicea*)		✓	
Gray-backed Fiscal (*Lanius excubitoroi*)	✓		
Cape Crow (*Corvus capensis*)		✓	
Green-backed Eremomela (*Eremomela canescens*)		✓	
Northern Black-Flycatcher (*Melaenornis edolioides*)		✓	
Northern Wheatear (*Oenanthe oenanthe*)	✓		
White-crowned Wheatear (*Oenanthe leucopy*)		✓	
White-winged Cliff-Chat (*Hamnolaea semirufa*)		✓	
Ground scraper thrush (*Psophocichla litsipsirupa*)		✓	
White-billed Starling (*Onychognathus albirostris*)		✓	
African Pipit (*Anthus cinnamomeus*)		✓	
Nyanza Swift (*Apus niansae*)		✓	
Yellow-fronted Tinker bird (*Pogoniulus chrysoconu*)	✓		
Rüppell's black Chat (*Myrmecocichla melaena*)		✓	
Little Rock-Thrush (*Monticola rufocinereus*)		✓	
Song Thrush (*Turdus philomelos*)			✓
Village weaver (*Ploceus cucullatus*)	✓		
Wahlberg's eagle (*Hieraaetus wahlbergi*)		✓	
Blue rock thrush (*Monticola solitaries*)		✓	
Blue- headed coucal (*Centropus monachus*)		✓	
Africa gray wood pecker (*Dendropicos goertae*)		✓	
Black cuckoo shrike (*Campephaga flava*)		✓	
Hemperchis horn bill (*Tockus hemprichii*)		✓	
Copper sunbird (*Cinnyris cupreus*)			✓
Abyssinian white eye *(Zosterops abissinicus*)			✓
Red-cheeked Cordon blue (*Uraeginthus bengalus*)			✓
White rumped babbler (*Turdiodes leucopygius*)			✓
Crested Francolin (*Francolus sephaena*)			✓
African Goshawk (*Accipiter tachiro*)	✓		