



The Journal of Zoology Studies
JOZS
We Don't Love Animals,
We Live For Them

The Journal of Zoology Studies

We Don't Love Animals, We Live For Them

www.journalofzoology.com



The Journal of Zoology Studies
JOZS
We Don't Love Animals,
We Live For Them

ISSN 2348-5914
JOZS 2014; 1(5): 01-08
JOZS © 2014
Received: 06-09-2014
Accepted: 14-10-2014

Diversity and Abundance of Birds in Dbla Church Forest, Eastern Tigray, North Ethiopia

Authors: Kalayu Mesfin, Gebremedhin Teklu

Abstract

The present study was carried out in Dbla St.merry church entitled with Diversity and Abundance of Birds species from July 2013 to June 2014. The abundant supply of food, the availability of resting and perching structures has made Dbla St.merry church a favorable area for different species of birds. Point count method was employed to record the relative abundance of individual bird species. During this study a total of 21bird species, including the endemic species such Wattled Ibis (*Bostrychia carunculaa*), White-collared Pigeon (*Columba albitorques*) and Thick-billed Raven (*Corvus crassirostris*) were identified. The species composition decreases during wet season due to the departure of migratory birds. The Vultures were usually observed flying over the study area, roosting on the roof of the church house, and also on the ground either being around of feeding. Feeding activity was from 06: 00 – 18:00 hr. Most of the vultures were observed coming from southwest direction of the study area.

Keywords: Abundance, Bird, church forest, Diversity

1. Introduction

Mankind has been fascinated by birds, observed, used, painted, wrote and sung, kept in captivity, protected and gave them great respect, since the earliest times (Acha A *et al.* ^[1]). Birds have been particularly important to the cultural, religious and aesthetic sides of human life from time immemorial. Birds as a source of human food have played a part in human history. Domestic fowls, at present the most abundant bird in the world, were in use in India before 2000 B.C. and have since spread to all parts of the world (Bahat O *et al.* ^[2]).

People in the modern industrialized societies value birds very highly, for a variety of reasons. They serve as indicators of environmental conditions. The presence of diverse bird populations capable of sustained reproduction is one of the best indications of a healthy environment (Bibby CJ *et al.* ^[3]). Birds are often used as a biological model because they are good ecological indicators and they are easily observable (Clark and Clark ^[4]).

Kalayu Mesfin

Biology Department, Aksum
University, P.O. Box: 1010,
Aksum, Ethiopia

Gebremedhin Teklu

Biology Department, Aksum
University, P.O. Box: 1010,
Aksum, Ethiopia
E-mail: geb1225@gmail.com

Correspondence Author:

Kalayu Mesfin

Biology Department, Aksum
University, P.O. Box: 1010,
Aksum, Ethiopia.
Fax: +251-347-75-19-31
E-mail: kalkx.123@gmail.com

Birds can also be used as indicators of sites of high biodiversity (Clergeau P *et al.* ^[5]) examined the available data for other groups of organisms to compare with bird, and showed that endemism, at least among large vertebrates, is often related to that of birds.

The presence of rare or endangered species, concentration of species, affiliations of certain species with important ecosystems at a site, and other bird complement have shown parallel significance for other biodiversity (Marzluff JM *et al.* ^[6]). In Ethiopia particularly in Tigray region bird diversity and abundance is not well studied. So the main aim of this research was to fill full the gap by study the diversity and abundance of birds in Dbla St.merry Church Forest, Eastern Tigray, North Ethiopia.

2. Methods

2.1 Description of the study area

The study was conducted in Dbla church forest Eastern Tigray, North Ethiopia, which is about 921 km far from Addis Ababa and about 120 km from Mekelle town, the capital city of Tigray regional state. It is located at altitudinal ranges from 2000-3000 m.a.s.l and geographically located 14°16'34' N latitude and 39°27 '52' E longitudes. It has a unimodal rain fall distribution with the highest rain falling from June to early September. Annual average rain fall of the study area ranges from 450 mm to 600 mm and the minimum and maximum temperature is 6 °C and 21 °C respectively.

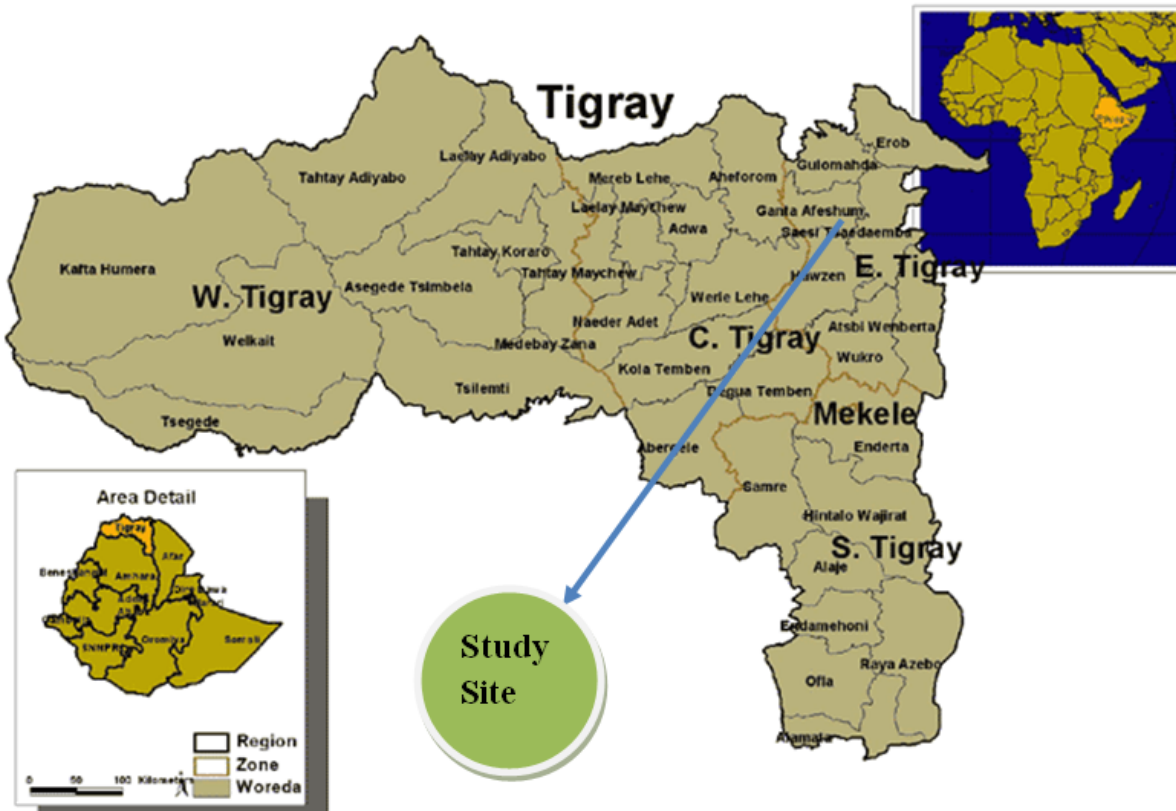


Fig 1: Study area

2.1. Methodology

Observations were made on the species using a binocular by walking along all parts of the study area, where birds were located. Birds flying over the area were also observed to identify the species. The whole area was surveyed thoroughly. The abundance of birds in and around the study area was studied using a modified point count method following (Coltherd ^[7]) and (Coltherd ^[8]).

Census data was collected twice a day, morning (10:30-11:30 hr) and late afternoon (15:30-16:30 hr). These are the periods where most of the avian species were active in the site.

The species diversity was calculated using the formula provided by Shannon and Weaver (Shannon and Weaver ^[9]), which is as follows:

$$H' = -\sum_{i=1}^s P_i \ln P_i$$

Where

H' = is the species diversity index.

S = is the number of species.

P_i = is the proportion of individuals of each species.

Descriptive statistics were used to compute the diversity, average abundance and relationship of the major bird species.

3. Result

3.1 Species Composition and Abundance

A total of 21 species of birds belonging to four Orders and 10 Families were recorded during the study period (Table 1). Among them, three species, Wattled Ibis (*Bostrychia carunculata*), White-collared Pigeon (*Columba albitorques*) and Thick-billed Raven (*Corvus crassirostris*) are endemic to Ethiopia. Yellow billed Kite, Tawny Eagle and Red-rumped Swallow are migratory Palearctic species with resident subspecies in Ethiopia. All the identified birds visit and stay at the study area for the purpose of feeding. Out of the total bird species of the study area, 23.8% belongs to the Family Accipitridae.

Table 1: List of birds recorded from Dbla church forest

No	Common name	Scientific name	Family	Order
1	Hamerkop	<i>Scopus umbretta</i>	Scopidae	Pelecaniformes
2	Woolly-necked Stork	<i>Ciconia episcopus</i>	Ciconiidae	Ciconiiformes
3	Marabou Stork	<i>Leptoptilos crumeniferus</i>	Ciconiidae	Ciconiiformes
4	Sacred Ibis	<i>Threskiornis aethiopicus</i>	Threskiornithidae	Pelecaniformes
5	Wattled Ibis	<i>Bostrychia carunculata</i>	Threskiornithidae	Pelecaniformes
6	Yellow billed Kite	<i>Milvus migrans</i>	Accipitridae	Falconiformes
7	Hooded Vulture	<i>Necrosyrtes monachus</i>	Accipitridae	Accipitriformes
8	African White-backed Vulture	<i>Gyps africanus</i>	Accipitridae	Accipitriformes
9	Rueppell's Griffon	<i>Gyps rueppellii</i>	Accipitridae	Falconiformes
10	Tawny eagle	<i>Aquila rapax</i>	Accipitridae	Accipitriformes
11	Speckled Pigeon	<i>Columba guinea</i>	Columbidae	Columbiformes
12	White-collared Pigeon	<i>Columba albitorques</i>	Columbidae	Columbiformes
13	African Mourning Dove	<i>Streptopelia decipiens</i>	Columbidae	Columbiformes
14	Red-rumped Swallow	<i>Cecropis daurica</i>	Hirundinidae	Passeriformes
15	Yellow Wagtail	<i>Motacilla flava</i>	Motacillidae	Passeriformes
16	Mountain Wagtail	<i>Motacilla clara</i>	Motacillidae	Passeriformes
17	Cape Crow	<i>Corvus capensis</i>	Corvidae	Passeriformes
18	Pied Crow	<i>Corvus albus</i>	Corvidae	Passeriformes
19	Thick-billed Raven	<i>Corvus crassirostris</i>	Corvidae	Passeriformes
20	Greater Blue-eared Glossy-Starling	<i>Lamprotornis chalybaeus</i>	Sturnidae	Passeriformes
21	Red-billed Fire finch	<i>Lagonosticta senegala</i>	Estrildidae	Passeriformes

3.1 Activity patterns

Activities recorded throughout the study period were soaring, feeding, threat and appeasement displays, watching, alert postures, flying, roosting, body care, basking and sleeping. But the distinction between these activities was not always clear-cut as they were engaged in two or more activities, simultaneously.

The most significant and attentively observable activity of birds was their feeding habit.

Birds start feeding on the dumping site early in the morning from 06:00 hr onwards. The first to arrive at the site was hooded and the last was Griffon. Most of

the birds after reaching the area rather than involving in feeding were perching on the nearby structures for a while. During this time, they stay by preening their feathers and sun-bathing.

During feeding, mainly four activities, viz., feeding, threat and appeasement displays, watching and alert postures were observed. Those feeding around the effluent, after feeding raise their feathers, shake their bodies and stretch their wings before settling the feather back into place. Then they may return to their feeding site or bask on the roosting place. Conflict at the feeding site was frequent among Vultures in areas

where fresh scraps were disposed. Griffon and African White-backed Vultures display threat and appeasement but Hooded Vultures try to kick with legs like a cock fight. Ibis feeds in groups probing ground regularly. Wagtails rarely fly to the feeding site in group, but after feeding, they usually return to their perching trees in groups. Kites spend long periods in low searching flight, seeking offal. Hamerkops standing in shallow waters at the bank of the river feed on aquatic animals, watching around carefully.

During the mid-day, most birds start to leave the feeding site for resting. They roost on the roofs, branches of trees and nearby structures. During the resting time, the Marabou spends many hours standing almost still, never observed sitting on the perch. The time spent for the different diurnal activity patterns and resting were variable.

3.2 Flight direction and Roosting sites

Most of the vultures were observed coming from the southwest direction, where enough roosting trees were located. Trees found inside and surrounding the study area. However, large number of Sacred Ibis came from the southeast direction.

When birds return to their roosting sites, the first to leave the study area was Griffon vulture, at about 16:30 hr then the African White-backed vulture and Marabou disappear from the area. Following them most of the Hooded leave the site. The Sacred Ibis first left the feeding site and perch on the roof. Then starting from 17:20 h they were observed to fly to their roosting site. There was no consistency in the returning time of Pied Crow and Raven. Wattled Ibis and Kites were the last to depart from the church site.

Few Wattled Ibis and Marabou roost on trees inside the study area. They have alternative roosting sites. The Olive tree near the dumping site was used by Wattled Ibis unless Marabou roosts on it. Three to five Pied Crows roost on the roofs of the slaughter house. Few Hooded vulture and Ibis were observed roosting on trees in less than 2km radius from the study area. Vultures roost in groups ranging from 80 to 150.

4. Discussion

The present study area is used by different groups of birds, including wetland birds and Passeriformes. A noticeable characteristic of the bird census in the area was the presence of species that utilized the habitat only as a food source. The availability of food was responsible for the high population of birds in this area. From the total bird species of Addis Ababa as listed by (Diamond ^[10]), this small habitat comprises about 8%. These birds do not nest in the area.

The feeding site is not a protected area from other animals including humans. The human beneficiaries from the scrap are the major source of disturbance for the normal activities of birds in this area. This phenomenon has greatly affected the species composition and abundance. Disturbance and other extra factors influence urban bird populations and communities (Erz ^[11]). Even though human disturbance is high, birds keep on using the area. Among the recorded birds, the least in per cent are resident while the majorities are regular.

Wetland birds of the Order Ciconiforms, which comprised 25% of the bird species in the area, are migratory. Migration greatly alters the bird population by changing both its numbers and composition. Bird species diversity was highest during the dry season.

However, seasonal variation in the number of bird species is not related to the availability of food. Birds are able to find suitable food sources in this habitat and consequently one can find great number of bird species in the area during the wet season. The requirements for bird-life in urban habitats vary from species to species, but most species are limited by availability of food as described by (Houston ^[12] and Hounsome ^[13]). Seasonal fluctuations in the abundance of individual species were more extreme. For example, the number of Wattled Ibis was decreased dramatically even though they were seen scattered throughout the wet season. During the wet season, some species totally left the area, decreasing both in number of species and individuals. This is related to the findings of (John Wiley *et al.* ^[14]), different habitat features affected the habitat selection of wintering birds. Some birds, however, are not affected where there is a change in weather on the condition that food is available.

Although the abundance of the population changed from season to season, Vultures remained numerically the dominant birds of the study area. The three species, namely Hooded vulture, African White-backed vulture and Rueppell's Griffon were well represented in the area throughout the study period. The most numerous species are the "Hooded" and "White-backed" vulture, though it was surprising to find numerous Sacred Ibis and Wattled Ibis, because Ibis are not strictly meat eating species. The Sacred Ibis were seen in big numbers on the occasions when they are encountered. Although the case for the low number of Griffon is not clear, in most cases, food selection and the possibility of human activities might have been the main factors. Bone fragments, disarticulated by hyenas and other bone-crushing carnivores are an important part of Griffon vulture diet (Jokimaki *J et al.* ^[15]).

The fluctuation in the numbers of adult and immature Hooded and African White-backed vultures was indicative to show that some of the birds were either new visitor or may use other feeding sites. Hooded and African White-backed vulture number did not decline significantly in the area until the first week of November. The decline in the number from November onwards was also confirmed in their roosting sites. The increase in the percentage of immature vulture in the study area during the dry season after November might be related to the breeding season of the adults.

Sometimes, the Hooded vultures tend to be far more numerous than all other species. But during holidays, the number relatively decreases from the usual time. The main reason was people have traditional culture to slaughter animals by forming groups in their surroundings, institutions and enterprises. Due to this, waste and leftovers are disposed in various parts of the city such as sewage channels, on the streets and garbage dumps. The Hooded vultures, therefore, need not visit the study area to locate offal and scraps. Rather, they were observed to remain around the disposals in the city, with relatively fewer Hooded's frequenting the study area. However, information from interview strongly suggests that over the past years, vultures and other species have suffered massive declines in number. This goes in line with (Kahl ^[16]), at least several African raptors have declined, but a number of vultures and eagles fail to exist compared to other African raptors.

The cryptic perching behavior of Pied Crow made it difficult to count except the call. Similarly, it arise problem in the feeding site while it is flying here and there. The population of Marabou increased greatly in July and August showing an inverse relationship with that of migratory birds. Marabou disappeared from the area by the mid-September. The disappearance persisted for only four weeks. The Raven population in September was substantially higher than other months. The reason for the increase in number during this month is not found in literatures. But the dispersion of Hooded Vultures in the city might enforce them to feed from the abattoirs. The acrobatic and tireless flight behavior of the Yellow Wagtail makes them difficult to count. However, they were counted when feeding on insects and worms on the ground.

The study area was free of migrant birds during July and August as they migrate to other places where the climate is more favorable. Among the migrants, the Yellow billed Kites were the first to arrive in the study area, during the second half of September. Sacred Ibi;s and Yellow Wagtails appeared on the last week of

September. This being the period with rainfall decreasing and the insect population was increasing.

Different species of birds were usually seen throughout the day around the study area. There was a strong interaction between the dumping site characteristics, the presence of abundance or competitive species and the composition of bird assemblages. Most species were active at certain times of the day. Their activity and the time spent for different activities varied with the type of weather, length of the day and availability of fresh food. Birds do not wander indiscriminately, but confine their activities within local, measurable areas mainly where fresh scraps were dumped.

Comparatively, the availability of food and the interference of human have more dominance than weather in affecting the activity of birds in the area. However, they prefer sunny and warm days than dull and cold weather. During the dry season, some birds were actively involved in feeding at 06:00 hr. commonly; five to ten Hooded vultures were seen either on the roof or on the dumping area. The other species arrive at late and the last to visit the area is Griffon, after 10:30 hr. (Kress ^[17]) found that Griffon vultures were able to show a clear dependence of body temperature on ambient temperature.

Most of the species feed in flocks in the study area. Vultures were social in their feeding habits as described by (Kruuk H *et al.* ^[18]). During feeding, individuals in a flock look in all directions. When they spot a person or any other intruder, they watch suspiciously. In the meantime, if any one of them flew, others follow and the remaining ones will be in alert. Usually, the first to give signal and fly were Wattled Ibis. When flock is flushed, all arise and call, continuing to do so as they fly away (Pain H *et al.* ^[19]). If the intruder does not approach, they continue their usual activities. Otherwise, they abandon the site (Pennycuik ^[20]). In general, any sign of life or movement will drive them away from their feeding and perching sites.

Although the enterprise authority took some measures to prevent the presence of men (beneficiaries) in the dumping site, they are still observed taking meat from the scraps starting from 09:00 hr. Until the beneficiaries leave the area, numerous short flights are made by birds between the dumping and roosting sites. During this period, few Vultures frequently exchange perches. There were innumerable variations in the skill of individual vultures and in the reactions of their intruders. For example, Griffon and African White backed vultures when disturbed may desert their feeding sites and fly far away from the study area. But,

Hooded vultures perch on the roofs, or stay on the ground near the beneficiaries. If there is human activity around the dumping site, the Sacred Ibis remain in their roost. When the beneficiaries leave the area, in half an hour time, most of the birds aggregate on the feeding site. Due to human interference, birds were sometimes forced to change their normal feeding time. Occasionally, they were observed when feeding actively during the mid-day, especially in relatively undisturbed areas. (Rebele ^[21]) Stated earlier, Pied Crow was not involved in feeding between 12:30 – 15:30 hr.

The time spent for resting increases from mid-day to early afternoon. Much of a resting time is devoted to caring for their feather, which must be carefully preened to stay in good condition. This is a common trend to birds, as (Richardson PR *et al.* ^[22]) stated preening besides smoothening and rejoining the separated barbs also helps to reduce the number of parasites in their feather. During the active feeding time (in the morning), the shortest and longest time spent at any perch were dependent on the type of food and the specific feeding site of the birds. Since the Yellow Wagtail feeds on flying insect their perching time was less than one minute. On the other hand, the feeding site of Sacred Ibis was the road where the human beneficiaries use. So, their perching time was more than two hours. Except Hooded Vultures, all Griffon and most African White-backed Vultures leave the area during the resting time.

When the temperature is low, after mid-day, the resting period diminishes and almost all birds become engaged in feeding activities until dusk. Griffon vulture was absent from the area until 16:00 hr. Unlike most bird species, the upper critical ambient temperature for Griffon vultures is 25 °C similar to the Peruvian Penguin (Thiollay ^[23]).

They are used to feed for a short period of time after 16:00 h.

Occasionally, threat and appeasement displays occur between birds of the same and/or different species on feeding and roosting sites. In their threat display, Griffon and African White-backed Vultures extend their neck and curve like a bow, the closed bill usually pointed and wing extending as if to attack. Actual fights among birds were rare because of the appeasement posture, retreating from a threat and more often there was tolerance. This agrees with the statement of (Urban and Brown ^[24]), a bird in an appeasement posture frequently hunches its shoulders, lowers its beak, and turns away from the threaten bird. Yellow billed Kites are fearless birds during searching flight and as described by (Weathers ^[25]), often fly

swooping down to snatch meat from other birds. They even snatch from the human beneficiaries with agile twists and turns.

The activity patterns of dry and wet seasons show distinct variability. The wet season is the most critical time for many birds. They do not reach early in the morning in the dumping site and even after reaching there; stay perching for hours before getting involved in feeding. (Weidensaul ^[26]) have suggested that vultures were dependent on temperature-driven when the heat was high and were therefore less active during the early hours of the day. The reduced food requirements and the ease of satisfying them during the dry season permit the birds to spend longer hours perched quietly in cool area. This is related to the statement of (WCMC ^[27]), the physiological ability to increase body temperature as ambient temperature is raised is well known in birds and save energy expenditure by minimizing the difference between ambient and body temperature. Also ample supply of food (scraps), shortened the periods of feeding.

Birds were observed approaching the study area from different directions. Heavy woodcutting (firewood, charcoal, poles and timber) has turned large tracts of woodlands into shrub lands and buildings in the surroundings. However, trees are still available within the urban matrix, as remnants. These trees provide valuable roosting sites for birds. Some of them were coming from the northeastern direction and the surrounding roosting sites, while the majority was from the southwest direction. The roosting sites were localized on trees, which are far from human activities or secured place such as in institutions, churches, near to hill sides and rivers.

The distance of roosting sites from the study area was variable. Some are localized inside and around the study area. However, birds like Sacred Ibis flies up to 30 km away from the colonies to feed. Most of the Sacred Ibis roost around Lake Aba Samuel, southeast of the study area. This area might be chosen due to less human disturbance and availability of proper roosting site.

Different species of birds return to the roosting sites at different times. Griffon, Marabou and Sacred Ibis have a fixed time, while others continue feeding if there is no disturbance. Hamerkops sometimes continue their feeding around the river after 18:00 hr and return to roost almost at dark.

5. Conclusion

The Dbla St.merry church has favorable places for birds to be around and a good access to food and water resources. These factors attract large number of bird species. The present study shows that Dbla St.merry church supports 21 species of birds belonging to four Orders and ten Families. Of these, three species of birds are endemic to the country.

Among vultures, Hooded were numerically more successful than Griffon and African White-backed Vultures because they rely more constantly on adequate source of food, are less restrictive in their selection of feeding sites and do not escape from the intruders like the others. Activities recorded throughout the study period were soaring, feeding, threat and appeasement displays, watching, alert postures, flying, roosting, body care, basking and sleeping. Most of the vultures were observed coming from the southwest direction, where enough roosting trees were located.

During the study period, 11 dead and five injured birds were observed at different periods. These were: Hooded Vulture (seven), African White-backed Vulture (two), Marabou (one) and Sacred Ibis (one). Mutilations of toes were observed in the five individuals of Hooded Vulture. Nothing is known about the reason for these, but, high tension power line had much effect on many species. Two individuals of African White backed Vultures were observed tied on their leg (one with long electric wire and the other with rope).

6. Acknowledgments

The authors are thankful to the local community of the study area for their hospitality and kind response for sharing their accumulative indigenous knowledge to our inquire data. Next our truly grateful goes to Mr. Mebrahtu Hishe for his continuous support. Finally thank you Biology and Biotechnology department of Aksum University.

7. References

1. Acha A, Blanco G, Ruiz P, Martinez OF Doval G. A great banquet at a Spanish vulture restaurant. Does Europe end at the Pyrenees? *Vulture News*, 1998; 39: 34-39.
2. Bahat O, Choshniak I, Houston DC. Nocturnal variation in body temperature of Griffon Vultures. *Condor*, 1998; 100: 168-171.
3. Bibby CJ, Burgess ND, David H. *Bird Census Techniques*. Academic Press, London. 1992.
4. Clark RA Clark A. Daily and seasonal movements of the Sacred Ibis at Pretoria, Transvaal. *Ostrich*, 1979; 50: 94-103.
5. Clergeau P, Mennechez G, Sauvage A, Lemoine A. Human perception and appreciation of birds: A motivation for wildlife conservation in urban environments of France. **In:** *Avian Ecology in an Urbanizing World*, 2001; 69-88.
6. Marzluff JM, Brwman R, Donnelly R. Kuwer Academic Publishers, Norwell, MA. 1995.
7. Clifford B, Frith B, Beehler BM. *Birds of Paradise*. Oxford University Press, Oxford. 1998.
8. Coltherd JB. (The domestic fowl in ancient Egypt. *Ibis*, 1966; 108: 217-223.
9. Shannon CE, Weaver W. *The Mathematical Theory of Communication*, University of Illinois press, Urbana, Ill, USA, 1949.
10. Daimond AW. A global view of cultural and economic uses of birds. **In:** *The Value of Birds*, pp. 109-111,
11. Erz W. Ecological principles in the urbanization of birds. *Ostrich Supple*. 1966; 6: 357-363.
12. Houston DC. Ecological isolations of African scavenging birds. *Ardea*, 1975; 63:55-64.
13. Hounsoume M. Bird life in the city. **In:** *Nature in cities*, pp. 180-201, (Laurie, C., ed.), 1979.
14. John Wiley, Jokimaki J, Suhonen J, Inki K, Jokinen S. Biogeographical comparison of winter bird assemblages in urban environments in Finland. *J. Biogeogr*. 1996; 23: 379-386.
15. Jokimaki J, Clergeau P, Kaisanlahti JM. Winter bird communities in urban habitats: a comparative study between central and northern Europe. *J. Biogeogr*. 2002; 29: 69-79.
16. Kahl MP. Observations on the behavior of the Hamerkop *Scopus umbreta* in Uganda. *Ibis*, 1967; 109: 25-32.
17. Kress SW. *Birders's Handbook*. Dorling Kindersley Publishing, Inc., New York. 2000.
18. Kruuk H, Lancaster RK, Rees WE. Bird communities and the structure of urban habitats. *Canad. J. Zool*. 1967; 57: 2358-2368.
19. Pain H, Stephanie J, Alan V. *A Checklist of the Birds of Addis Ababa*. Ethiopian Wildlife and Natural History Society, Addis Ababa. 1975.
20. Pennycuick CJ. Soaring behavior and performance of some East African birds, observed from a motor-glider. *Ibis*, 1972; 114: 178-218.

21. Rebele F. Urban ecology and special features of urban ecosystems. *Glob. Ecol. Biogeogr.* 1994; 4: 173-187.
22. Richardson PR, Mundy PJ, Plug I. Bone crushing carnivores and their significance to osteodystrophy in Griffon vulture chicks. *J. Zool.* 1986; 210: 23-43.
23. Thiollay JM. The decline of raptors in West Africa: long-term assessment and the role of protected areas. *Ibis*, 2006; 148: 240-254.
24. Urban E, Brown L. A Checklist of Birds of Ethiopia. Haile Sellasie I University Press, Addis Ababa. 1980.
25. Weathers WW. Physiological thermoregulation in heat-stressed birds: Consequences of body size. *Physiol. Zool.* 1981; 54: 345-361.
26. Weidensaul S. *Raptors*. Swan Hill Press, England. 1996.
27. WCMC. Global Biodiversity: Status of the Earth's Living Resources. Chapman and Hall, London, 1991 and 1992.

Mesfin K, Teklu G. Diversity and Abundance of Birds in Dbla Church Forest, Eastern Tigray, North Ethiopia. *Journal of Zoology Studies*. 2014; 1(5):01-08.
