Global Journal of Science Frontier Research: H
Environment & Earth Science
Volume 19 Issue 3 Version 1.0 Year 2019
Type : Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 2249-4626 & Print ISSN: 0975-5896

Evaluation of Birds Species Abundance and Diversity in Borgu Sector of Kainji Lake National Park, Nigeria

By Kwaga, B.T., Suleiman, J.M., Ringin, M.I.G. & Khobe, D
Adamawa State College of Agriculture

Abstract- The study focused on bird's species abundance and diversity in Borgu sector of Kainji Lake National park Nigeria. Line transects were established in the collection of data on bird's species. Data collected were subjected to descriptive statistics (frequencies tables and percentages) as well as Simpson diversity index. The result on the checklist of birds obtained showed that there were 166 species belonging to 28 families. Results of the relative abundance of bird's species showed that *Bubulcus ibis* (77.88) and *Ictinaetusmalayensis* (0.29) had the highest and lowest relative abundance respectively. The result of the Simpson diversity index (0.939) of bird species by families showed that Ardeidae (593) and family Sturnidae (392) had the highest and lowest number of bird's species respectively. Environmental education (conservation, production and enrichment) campaign should be carried out on the status of birds and other components of the ecosystem to boost the tourism potentials of the park.

Keywords: *birds' species, list, abundance, diversity.*

GJSFR-H Classification: *FOR Code: 050211, 820199*

Strictly as per the compliance and regulations of:

Evaluation of Birds Species Abundance and Diversity in Borgu Sector of Kainji Lake National Park, Nigeria

Kwaga, B.T. [α], Suleiman, J.M. [σ], Ringin, M.I.G. [ρ] & Khobe, D [ω]

Abstract- The study focused on bird's species abundance and diversity in Borgu sector of Kainji Lake National park Nigeria. Line transects were established in the collection of data on bird's species. Data collected were subjected to descriptive statistics (frequencies tables and percentages) as well as Simpson diversity index. The result on the checklist of birds obtained showed that there were 166 species belonging to 28 families. Results of the relative abundance of bird's species showed that *Bubulcus ibis* (77.88) and *Ictinaetusmalayensis* (0.29) had the highest and lowest relative abundance respectively. The result of the Simpson diversity index (0.939) of bird species by families showed that Ardeidae (593) and family Sturnidae (392) had the highest and lowest number of bird's species respectively. Environmental education (conservation, production and enrichment) campaign should be carried out on the status of birds and other components of the ecosystem to boost the tourism potentials of the park.

Keywords: birds' species, list, abundance, diversity.

I. Introduction

Quantifying the species abundance of birds communities has gained increasing importance in environmental impact assessment especially in conservation planning and ecological research (Bibby *et al.,*(2000).Species inventories not only help in understanding species losses but also help determine the characteristics of species that are vulnerable to habitat perturbations (Koh *et al,.* 2004).The species richness is simply the total number of species within a habitat or community. Species richness is the most commonly used measure of diversity because it is a straightforward measure and it is intuitive. The main problem with using species richness is that it does not provide any information on how well each of the species is represented in the sampled area. Species diversity is a measure of both the number of species (species richness) and the relative contribution of each of these species to the total number of individuals in a community (evenness) (Stiling, 2002). Birds are warm blooded; they have been able to adapt themselves to living in climates varying from the ice snow of the Antarctic to the fringes of the hottest deserts.

Author α σ ρ: Department of Forestry and Wildlife Management, MAUTECH, Yola.
Author ω: Department of Animal Production, Adamawa State University, Mubi. e-mails: divinetizhe@yahoo.com, zifadi007@gmail.com

Diversity has been referred to as the quantitative measure that reflects how many different species are in existence in a data set. A variety of objective measures have been created in order to measure of diversity. The basic idea is to obtain a quantitative estimate of biological variability that can be used to compare biological entities, composed of direct components, in space or time (Albert, 2012; Magurran, 2004).

Monitoring of species is therefore important in determining conservation actions if set plans to be effective in achieving population objectives that for increasing populations to reach target levels. Assessment of birds' species richness and abundance of an area makes it possible for any organization to plan for future conservation and sustainable utilization of avifauna resources (Bird Life International BLI-2008). Hence, the need for this study which is aimed at evaluation of birds species richness and diversity in Borgu Sector of Kainji Lake National Park, Nigeria.

II. Methodology

a) Location of the Study Area

Kainji Lake National Park is situated in Niger State located between latitudes 8°00'N and 11°00'N, and longitudes 4°00'E and 11°30'E. The study area Borgu sector is located between latitudes 7°00'N and 9°45'N, and longitude 4°30'E and 8°30'N (Ayeni *et al.,* 2007).The park lies only 560km North of Lagos and 385km to the northwest of the Abuja, the Federal Capital of Nigeria. The park covers a total land area of 5340.82km^2. It is made up of two non-contiguous sectors (Borgu and Zugurma). The Borgu sector lies astride the Borgu and Baruten local government areas of Niger and Kwara states, with an area of 3,970.02km^2. Zugurrna sector on the other hand, occupies a relatively smaller area of 1,370.80km^2 situated in the Mariga local government area of Niger State (Ezealor, 2002).

The wet seasons extends from May to October while the dry season extend from November to April. The mean annual rainfall of the Borgu sector varies from 1,100mm in the eastern part to 1,150mm in the Western part. The rainfall data for Zugurma sector shows that the sector receives a mean annual rainfall of about 1,167mm.Rain generally lasts for 8 to 9 months of the

year. It starts in March and ending in October or November (Ezealor, 2002).

Temperature is highest in the dry season and lowest during the wet season. Temperatures pick up again towards the end of the wet season and later drop to the lowest value in December and January during the harmattan. Temperature at 9hour and 12 hours are higher than at 15 hour and 18 hours. Mean daily maxima are greatest during February and march with values of about 37°C while the lowest values of about 30°C occur during the height of the harmattan that is December and February (Ezealor, 2002).

The relative humidity appears to increase gradually from low values (less than 20%) at the beginning of thedry season to a peak during the wet season (96%). A transitional period ofvariable conditions occurs at the end of both the dry and the wetseason; it is characterized by strong easterly winds, which are associated with line squalls. The highest' wind speed usually occurs in April with values of 6.21 - 6.39 km/hr while the lowest speed of 2.23-2.28 km/hr occurs in October (Ezealor, 2002).

The major vegetation type of the Kainji lake National park is typically Northern Guinea Savanna Ecotype. Ayodele, (1988) also identified over seven vegetation sub-types for the park. These are; *Burkia Africana / Detariu,* wood land, *Afzelia africana* wood land, *Isoberlinia tomentosa* wood land, *Terminalia macroptera* wood land, *Diospyros mespiliformis woodland,* Acacia complex, Oli complex and Riparian forest among others.

Some of the fauna species found in the park includes; Roan antelope, *Hippotamus hippopotamus amphibius,Hippotragus equines, Kob Kobus kob,* Serval *cat Felis serval,* Ratel, Honey badger *Mellivoracapensis, Hare Lepus capensis,* Green *Monkey Cercopithecus aethiops.* African *Mrulatee Trichechus senegalensis,* Lizard buzzard *Kaupifalco monogrammnieus. Avifauna* species;cattle egret *Bululcus ibis,* Grey heron *Ardea cinerea,*Little egret *Egreta gazetta,* African grey hornbill *Tockus nasutus,* Little paradise kinfisher *Tanysuptera hydrocharis,* Helmete guineafowl *Numida meleagris,* stone patridge *Ptilopachus petrosus,* White throated bee eater *Merups allibicolis,* Abysinian roller *Corasins absinnicus,* Mourning dove *Zenaida macroula,* Laughing dove *Stigmatopelia Senegalensis,* Black froncolin *Francolinus francolinus,* Red eyed dove *Streptopelia semiquata,* Black billed wearer *Ploceus melanogoaster,* Hadada Ibis *Bostrychia hagedash.* Reptilian species crocodile *Crocodilus niloticus,* aligator, monitor lizard etc. (Ayodele, 1988).

III. Study Design and Data Collection Techniques

The entire study area was classified into five (5) woodland associations (site 1 *Burkia/Detarium macrocarpum* woodlands, site 2 *Afzelia Africana* woodlands, site 3 *Acacia* complex, site 4 *Isoberlinia tomentosa* woodlands and site 5 *Riparian* forest) based on the existing species. A 4km length of transects were established in each association. In each of the five sections and along each transects, observations (on calls, feathers, sounds) were carried out between the hours of 6.00am to 10.00 am (morning section) and 4.00 pm to 6.00 pm (evening section) following Akosim *et al.,* (2007), Nik and Ron (2008) and Kwaga *et al*, (2017) guides. The materials used include: Bird field guide books (Bibby *et al.,* 2000; Khobe and Kwaga, 2017) and a pair of binocular, recording sheet and a pen.

Direct (sighting by use of binocular) and indirect (indicators eg. Feathers, calls, sounds) methods as well as group/composition and number of birds identified were recorded. Methods of bird census were employed in the identification of bird species in the area. Interaction was also entertained for more identification of the species. 5 transects of 4km in length were established using a stratified random sampling procedure (Plumptre &Reynolds, 1994). Line transects were chosen as sampling units due to the open nature of much of the area following Bibby *et al., (*2000) and Khobe and Kwaga (2017) guides.

The observer walking along transects and, on sighting bird's species waits for a few minutes to allow the disturbed birds to settle. Counting was carried out for ten (10) minutes individual bird was counted once and all birds Seen or heard out-side the band but was identified was recorded, Birds, Indices, Feathers, calls were also recorded. Species composition of birds observed was recorded along the 4km transect in each of the five sections following Eshiamwata (2007), Nik and Ron (2008) and Kwaga*et al.,* (2017) guides.

IV. Statistical Analysis of Data

a) Birds Species List and Abundance

Data collected on species list and abundance were analyzed using descriptive statistics(frequencies table, percentages).

b) Diversity of bird species

Data on bird's species diversity was analyzed using Simpson's diversity index as adopted by Akosim *et al.*, (2007) and Khobe and Kwaga (2017).The index is mathematically stated thus;

$$D = 1 - \left(\frac{\sum n(n-1)}{N(N-1)}\right)$$

D, = Simpson's diversity index, n, = Total number of organisms of each individual species
N = Total number of organisms of all species, s = Number of species present
$\sum$ =Summation sign.

V. Results

The result of checklist of birds species in the study area is presented in Table 1. The result showed that*Tanysiptera hydrocharis*, *Ceyx pictus Egretta garzetta, Bubulcus ibis, Coracias abyssinicus, Centropus senegalensis, Merops albicollis, Numida meleagris, Ptilopachus petrosus, Francolinus francolinus, Batis mixta, Ploceus melanogaster, Pulsatrix koeniswaldiana, Lamptrotormis purpureus, Lamptrotormis chalybaeus, Lamptrotormis chloropterus, Lamptrotormis splendidus, Bostrychia hagedash, Anthracothorax veraguensis, Sayormis nigricans* and *Mitrephanes phaeocerus* were available in the study area.

a) Species Relative Abundance

The result of bird species relative abundance in the study area is shown in Table 2. The result showed that the highest relative abundance is in Site 2 (101.51%) followed by site 3 (100.01%) and site 1 being the lowest (99.95%) respectively.

The result also showed that *Bibulcus ibis* is the highest (77.88%) followed by *Numida meleagris* (51.87%), *Sayornis nigricans*(26.41%), *Batis mixta*, *Ploceus melonagaster* and *Lamprotornis purpureus* species had thesame relative abundances in across the sites with 22.56%, 22.56% and 22.56%. *Apus apus* had the lowest(22.52%), while the least is *Ictinaceous malayensis* (0.29%) in the study area.

b) Birds Diversity

Result of bird species diversity in the study area is presented in Table 3. The result showed the species diversity of D=0.939, respectively.

VI. Discussions

a) Checklist of Birds Species in the Study Area

The findings of this study suggested few species list of birds. This is not in agreement with the reports of Sodhi *et al.,*(2005) who identified 61 species in similar studies and BLI (2008) who recorded over 180 species. However, this isin conformity with Nason (1992) who reported that throughout the world, there are over 9000 species of birds of which Nigeria has approximately 840 species.

b) Birds Species Relative Abundance in the Study Area.

The findings on birds species relative abundance in all the sites sampled is very low. However, the findings also shows the relative abundance of birds species utilizing the study area, it shows that total relative abundance of *Bubulcus ibis* is higher followed by *Numida meleagris, Sayornis nigricans*, *Apus apus*, *Bats mixta*, *Ploceus melanogaster* and *Lamprotornis purpureus*. The high relative abundance may not be unconnected with availability of food, water, breeding sites which are supported by various authors. Khobe and Kwaga (2017) reported that the level of distribution of bird species in a habitat is normally as a result of an occurrence of plant species that support their population and to variation in species specification requirements in the choice of habitat. This finding is also in agreement with Kwaga *et al.*, (2017) that the distribution of birds' species is largely dependent on the availability of food, water and cover.

Stiling (2002) asserted that monitoring of birds species is therefore important in determining if conservation actions resulting from set plans are effective in achieving populations objectives. Heagy and McCracken (2004) observed that through continuous monitoring, the Ontario Eastern Bluebirds in North America formally considered threatened in the area but as a result of net box programs and other conservation actions, the bluebird's population has made a dramatic comeback and it is no longer considered to be at risk.

c) Birds Species Diversity in the Study Area

The diversity of bird species in the study area shows D=0.939. This indicate that there is high bird's species diversity in the area, the findings signifies that there is no significant difference (P>0.05) between the ranges in bird species composition in the study area.

The high bird species diversity in the Kainji Lake National Park (KLNP) in relation to habitat characteristics is very encouraging, meaning that they do breed well in the area most especially the *Bubulcus ibis* and *Numida meleagris* whose population is on a high side. The causes of this high diversity of birds could be as a result of available ecological requirements in the study area. This is in contrast with Eshiamwata (2007) who asserted that the causes of bird populations declined includes natural system modification, biological resource use, climate change and severe weather. BLI, (2008) also confirmed that many birds species are sensitive to toxic chemicals, and therefore are bio-sentinels. The birds' species are highly mobile, and will either desert habitats that no longer meet their environmental needs or colonize habitats that have been altered and now satisfy their needs. The high diversity indicates that most of the birds are indigenous species; they have been able to adapt themselves to living in the area. This is in agreement with Stiling (2002) who asserted that birds are warm blooded, they have being able to adapt themselves to living in climates varying from the ice snow of the Antartic to the fringes of the hottest deserts.

VII. Conclusion

From the findings of the study, it suggests that the bird species list and abundance (total number) in Borgu Sector of Kainji Lake National Park (KLNP) habitat is low. This shows that relatively few successful species such as the family Ardeidae, followed by Numidae still exist in KLNP habitat in low number. It also indicates that the KLNP environment is quite stressful with relatively few ecological niches, where only a few birds' species

are really adapted to that environment. Also the low population number could be as a result of toxic chemicals birds used during farming activities by the communities around the park. It is therefore imperative to ensure that proper conservation and management of species habitat is enhanced for bird species sustainability in Kainji Lake National Park.

References Références Referencias

1. Akosim, C., Kwaga, B.T., Amadi D.C.A and Inah, E.I. (2007). Ecological potentials of Beekeeping in Adamawa State, Nigeria. *Journal of Agricultural Sciences, Environmental Technology (*ASSET) University of Agriculture, Abeokuta, Nigeria PP67-76.
2. Albert, O.H. (2012). Measurement of Species Diversity in Developing Nations. *Journal of Applied Ecology.* B lackwell Publishing. Oxford, U.K. Pp 22-29.
3. Ayeni, J.S:O. (2007). Participating management plan of KLNP, Environ- Consult: Lagos l5Opg.
4. Ayodele, T, A (1988). Ecological basis for the management of old. Oyo national park, Nigeria, Unpublished, PhD theses university of Ibadan l08pg,
5. B. T. Kwaga, D. Iliya, A. Ali and Khobe, D. (2017). Avifauna abundance and diversity in Jos Wildlife Park, Nigeria (2017). *International Journal of Agricultural science and Technology*. Faculty of Agriculture, Trakia University, Stara Zogara, Bulgaria. Volume 9, Number 3. Pp234-239. ISSN 1313-8820 (print), ISSN 1314-412X (online).
6. Bibby, C. J., Burgess, N., Mustoe, S.H. & Hill, D.A. (2000). *Bird Census Techniques*. London. Academic Press.
7. Birdlife International Council (2008). Bird Life's online World Bird Database: the site for bird conservation. Version 2.1 .Cambridge, UK: *Birdlife International*. Available: http://www.birdlife.org (accessed 16/8/2011).
8. Eshiamwata, G. (2007). Biodiversity conservation, livelihoods, wetland services and local communities. The Wadden Sea-Strengthening Management and Research along the African Eurasian Flyway Workshop, BPS. Nairobi, Kenya.
9. Ezealor, AU. (2002). Critical Sites for Biodiversity Conservation in Nigeria. Nigeria Conservations Foundation: Lagos, Nigeria. Pg.l2
10. Heagy, A, E and McCracken J. D. (2004). Monitoring the state of Ontarios migration land birds. Bird Studies Canada 2004
11. Khobe, D. and Kwaga, B. T. (2017).Check-list of Birds Species of Jos Wildlife Park, Nigeria. *International Journal of Agriculture , Environment and Bioresearch.* Vol. 2, issue 4. ISSN: 2456-8643. Pp 216-229.
12. Koh, L. P., Sodhi, N. S., and Brook, B. W, (2004). Prediction extinction proneness of tropical butterflies. *Conservation Biology, 18, 1571—1578.*
13. Nason, A. (1992). Discovering Bird Origins, An introduction to the birds of Nigeria. Information Press, Oxford, UK. Pp.4-100.
14. Nik, B. and Ron, D. (2008). *Helm Field Guide Birds of West Africa.* Black Publishers Ltd. 38 Soho Square, London. WID 3HB; Pp1-509.
15. Plumptre, A.J. & Reynolds, V. (1994). The impact of selective logging on the primate populations in the Budongo Forest Reserve, Uganda. *Journal of Applied Ecology, 31 631 641.*
16. Sodhi, N.S., Lee, T. M., Koh, L. P., and Dunn, R. R. (2005).A Century of Avifaunal Turnover in a small tropical rainforest fragment. Animal Conservation, 8,217—222.
17. Stiling, P. (2002*). Ecology Theories and. Applications 4th edition* Prentice Hall of India private Ltd New Delhit l000lpg 300.

Table 1: Checklist of Bird Species in the Study Area

S/N	Family name	Common name	Scientific name	Authority	Site 1	Site 2	Site 3	Site 4	Site 5
1	Accipitridae	African Harrier-hawk	*Polyboroides typus*	(Smith, 1829)	-	-	+	+	-
2	Accipitridae	Black Eagle	*Ictinaetus malayensis*	(Temminck, 1822)	-	-	+	-	-
3	Accipitridae	African Chanting Goshawk	*Melierax metabates*	(Temminck, 1823)	-	-	+	+	-
4	Alcedinidae	Little Paradise-Kingfisher	*Tanysiptera hydrocharis*	(Gray, 1858)	+	+	+	+	+
5	Alcedinidae	African Pygmy-Kingfisher	*Ceyx pictus*	(Boddaert, 1783)	+	+	+	+	+
6	Apodidae	Common Swift	*Apus apus*	(Linnaeus, 1758)	+	+	+	+	-
7	Apodidae	African Black Swift	*Apusbarbatus*	(Sclater, 1865)	-	+	+	+	-
8	Ardeidae	Little Egret	*Egretta garzetta*	(Linnaeus, 1766	+	+	+	+	+
9	Ardeidae	Cattle Egret	*Bubulcus ibis*	(Linnaeus, 1758)	+	+	+	+	+
10	Ardeidae	Rufous-bellied Heron	*Ardeola rufiventris*	(Sundevall, 1851)	+	+	-	-	-
11	Ardeidae	Grey Heron	*Ardea cinerea*	(Linnaeus 1758)	+	-	-	+	-
12	Bucorvidae	Abyssinian Ground-hornbill	*Bucorvus abyssinicus*	(Boddaert, 1783)	+	-	-	-	+
13	Bucorvidae	African Grey Hornbill	*Tockus nasutus*	(Linnaeus, 1766)	+	+	-	-	+
14	Charadrilldae	Hooded Plover	*Thinornis rubicollis*	(Gmelin, 1789)	-	-	+	+	+
15	Columbidae	Mourning Dove	*Zenaida macroura*	(Linnaeus, 1758)	+	+	+	-	+
16	Columbidae	Laughing Dove	*Stigmatopelia senegalensis*	(Linnaeus, 1766)	+	+	-	+	+
17	Columbidae	Red-eyed Dove	*Streptopelia semitorquata*	(Ruppell, 1837)	-	+	+	+	-
18	Columbidae	Vinaceous Dove	*Streptopelia vinacea*	(Gmelin, 1789)	+	+	+	+	-
19	Coraciidae	Abyssinian Roller	*Coracias abyssinicus*	(Linnaeus, 1766)	+	+	+	+	+
20	Cuculidae	Senegal Coucal	*Centropus senegalensis*	(Linnaeus, 1799)	+	+	+	+	+
21	Hirundinidae	Grey- rumped Swallow	*Pseudhirundo griseopyga*	(Sundevall, 1850)	-	+	-	+	+
22	Laridae	Lesser Crested Tern	*Sterna bengalensis*	(Lesson, 1831)	-	-	+	+	-
23	Malaconotidae	Sooty Boubou	*Laniarius leucorhynchus*	(Hartlaub, 1848)	-	+	+	+	-
24	Meropidae	White-throated Bee-eater	*Merops albicollis*	(Vieillot, 1817)	+	+	+	+	+
25	Musophagidae	Western Grey Plantain-eater	*Crinifer piscator*	(Carriker, 1933)	+	-	-	-	+
26	Nectariniidae	Scarlet-chested Sunbird	*Nectarinia senegalensis*	(Linnaeus, 1766)	-	+	-	+	-

27	Numididae	Helmeted Guineafowl	*Numida meleagris*	(Linnaeus, 1766)	+	+	+	+	+
28	Passeridae	Rufous- tailed Weaver	*Histurgops ruficaudus*	(Reichenow, 1887)	-	+	+	-	+
29	Phasianidae	Stone Partridge	*Ptilopachus petrosus*	(Gmelin, 1789)	+	+	+	+	+
30	Phasianidae	Black Francolin	*Francolinus francolinus*	(Linnaeus, 1766)	+	+	+	+	+
31	Picidae	Crimson-crested Woodpecker	*Campephilus melanoleucos*	(Gmelin, 1788)	-	+	-	+	+
32	Platysteiridae	Short- tailed Batis	*Batis mixta*	(Shelley, 1889)	+	+	+	+	+
33	Ploceidae	Black- billed Weaver	*Ploceus melanogaster*	(Shelley, 1887)	+	+	+	+	+
34	Psittacidae	Dusky Parrot	*Pionus fuscus*	(Muller, 1776)	+	-	-	+	-
35	Scopidae	Hamerkop	*Scopus umbretta*	(Gmelin, 1789)	+	-	-	+	-
36	Strigidae	Tawny-browed Owl	*Pulsatrix koeniswaldiana*	(Bertoni & Bertoni, 1901)	+	+	+	+	+
37	Sturnidae	Purple Glossy-starling	*Lamprotornis purpureus*	(Muller, 1776)	+	+	+	+	+
38	Sturnidae	Greater Blue-eared Glossy-starling	*Lamprotornis chalybaeus*	(Ehrenberg, 1828)	+	+	+	+	+
39	Sturnidae	Lesser Blue-eared Glossy-starling	*Lamprotornis chloropterus*	(Swainson, 1838)	+	+	+	+	+
40	Sturnidae	Splendid Glossy-starling	*Lamprotornis splendidus*	(Vieillot, 1822)	+	+	+	+	+
41	Threskiornithidae	Hadada Ibis	*Bostrychia hagedash*	(Latham, 1790)	+	+	+	+	+
42	Trochilidae	Veraguan Mango	*Anthracothorax veraguensis*	(Reichenbach, 1855)	+	+	+	+	+
43	Tyrannidae	Black Phoebe	*Sayornis nigricans*	(Swainson, 1827)	+	+	+	+	+
44	Tyrannidae	Tufted Flycatcher	*Mitrephanes phaeocercus*	(Sclater, 1859)	+	+	+	+	+
					32	34	33	37	30
	Total								166

Source: Field Survey,(2018)

Key: + = Present, − = Absent

Table 2: Relative Abundance of Bird's Species Utilizing the Study Area

S/N	Scientific name	Site 1	Site 2	Site 3	Site 4	Site 5	Total
1	*Polyboroides typus*	0	0	0.88	0.38	0	1.26
2	*Ictinaetus malayensis*	0	0	0.29	0	0	0.29
3	*Melierax metabates*	0	0	6.64	1.77	0	8.41
4	*Tanysiptera hydrocharis*	0.71	6.4	0.74	0.76	1.01	9.62
5	*Ceyx pictus*	5.66	0.94	0.88	1.39	0.58	9.47
6	*Apus apus*	0.71	12.62	7.67	1.52	0	22.52
7	*Apus barbatus*	0	0.56	3.1	0.76	0	4.42
8	*Egretta garzetta*	0.88	0.94	1.18	0.38	0.43	3.81
9	*Bubulcus ibis*	2.12	6.4	3.1	32.45	33.81	77.88
10	*Ardeola rufiventris*	0.35	0.38	0	0	0	0.73
11	*Ardea cinerea*	1.06	0	0	0.25	0	1.31

12	*Bucorvus abyssinicus*	0.71	0	0	0	0.72	1.43
13	*Tockus nasutus*	2.65	2.26	0	0	1.73	6.64
14	*Thinornis rubicollis*	0	0	0.88	0.63	0.58	2.09
15	*Zenaida macroura*	0.71	0.38	0.44	0	0.29	1.82
16	*Stigmatopelia*	2.3	0.75	0	0.76	1.73	5.54
17	*Streptopelia semitorquata*	0	2.26	0.44	0.63	0	3.33
18	*Streptopelia vinacea*	7.79	4.33	2.1	0.51	0	14.73
19	*Coracias abyssinicus*	4.6	0.56	0.88	0.89	2.31	9.24
20	*Centropus senegalensis*	1.06	2.45	7.23	0.76	4.62	16.12
21	*Pseudhirundo griseopyga*	0	0.56	0	0.25	0.29	1.1
22	*Sterna bengalensis*	0	0	8.26	0.51	0	8.77
23	*Laniarius leucorhynchus*	0	2.45	1.77	0.38	0	4.6
24	*Merops albicollis*	4.78	0.94	0.88	3.17	0.87	10.64
25	*Crinifer piscator*	7.43	0	0	0	3.18	10.63
26	*Nectarinia senegalensis*	0	0.38	0	1.52	0	1.9
27	*Numida meleagris*	5.66	1.13	23.0	4.31	17.77	51.87
28	*Histurgops ruficaudus*	0	0.38	0.74	0	0.87	1.99
29	*Ptilopachus petrosus*	2.83	0.75	0.44	3.29	0.58	7.89
30	*Francolinus francolinus*	0.88	0.75	3.1	9.88	1.01	15.62
31	*Melanoleucos campehilus*	0	2.07	0	2.66	3.03	7.76
32	*Batis mixta*	7.61	2.26	4.72	2.91	5.06	22.56
33	*Ploceus melanogaster*	1.06	7.72	3.1	4.18	6.50	22.56
34	*Pionus fuscus*	0.71	0	0	0.38	0	1.09
35	*Scopus umbretta*	3.72	0	0	1.52	0	5.27
36	*Pulsatrix koeniswaldiana*	2.3	3.95	1.62	2.66	0.29	10.82
37	*Lamprotornis purpureus*	4.07	8.47	3.69	4.31	2.02	22.56
38	*Lamprotornis chalybaeus*	5.66	2.26	0.74	1.65	0.87	11.18
39	*Lamprotornis chloropterus*	3.19	4.56	3.54	0.76	1.01	13.06
40	*Lamprotornis splendidus*	1.06	4.89	0.74	5.45	4.62	16.76
41	*Bostrychia hagedash*	5.66	0.94	0.88	1.77	0.29	9.54
42	*Anthracothorax veraguensis*	0.35	0.75	0.44	0.13	0.43	2.11
43	*Sayornis nigricans*	7.78	10.55	3.69	2.66	1.73	26.41
44	*Mitrephanes phaeocercus*	3.89	4.52	2.21	1.77	1.73	14.12
	Total	99.95	101.51	100.01	99.96	99.96	

Source: Field Survey, (2018)

Table 3: Diversity of Bird Species in the Study Area

S/N	Family name	Common name	Scientific name	Number (n)	n(n-1)
1	Accipitridae	African Harrier-hawk	*Polyboroidestypus*	9	72
2	Accipitridae	Black kite	*Ictinaetusmalayensis*	2	2
3	Accipitridae	African Chanting Goshawk	*Melieraxmetabates*	59	3422
4	Alcedinidae	Little Paradise-Kingfisher	*Tanysipterahydrocharis*	56	3080
5	Alcedinidae	African Pygmy-Kingfisher	*Ceyxpictus*	58	3306
6	Apodidae	Common Swift	*Apus apus*	135	18090
7	Apodidae	African Black Swift	*Apus barbatus*	30	870
8	Ardeidae	Little Egret	*Egrettagarzetta*	24	552
9	Ardeidae	Cattle Egret	*Bubulcus ibis*	557	309692
10	Ardeidae	Rufous-bellied Heron	*Ardeolarufiventris*	4	12

11	Ardeidae	Grey Heron	*Ardeacinerea*	8	56
12	Bucorvidae	Abylssinian Ground-hornbill	*Bucorvusabyssinicus*	9	72
13	Bucorvidae	African Grey Hornbill	*Tockusnasutus*	39	1482
14	Charadrilldae	Hooded Plover	*Thinornisrubicollis*	15	210
15	Columbidae	Mourning Dove	*Zenaidamacroura*	11	110
16	Columbidae	Laughing Dove	*Stigmatopelia*	35	1190
17	Columbidae	Red-eyed Dove	*Streptopeliasemitorquata*	20	380
18	Columbidae	Vinaceous Dove	*Streptopeliavinacea*	85	7140
19	Coraciidae	Abyssinian Roller	*Coraciasabyssinicus*	58	3306
20	Cuculidae	Senegal Coucal	*Centropussenegalensis*	106	11130
21	Hirundinidae	Grey- rumped Swallow	*Pseudhirundogriseopyga*	7	42
22	Laridae	Lesser Crested Tern	*Sterna bengalensis*	60	3540
23	Malaconotidae	Sooty Boubou	*Laniariusleucorhynchus*	28	756
24	Meropidae	White-throated Bee-eater	*Meropsalbicollis*	69	4692
25	Musophagidae	Yellow browned toucanet	*Plantain turaco*	64	4032
26	Nectariniidae	Scarlet-chested Sunbird	*Nectariniasenegalensis*	14	182
27	Numididae	Helmeted Guineafowl	*Numidameleagris*	351	122850
28	Passeridae	Rufous- tailed Weaver	*Histurgopsruficaudus*	13	156
29	Phasianidae	Stone Partridge	*Ptilopachuspetrosus*	53	2756
30	Phasianidae	Black Francolin	*Francolinusfrancolinus*	115	13110
31	Picidae	Crimson-crested Woodpecker	*Melanoleucos campehilus*	53	2756
32	Platysteiridae	Short- tailed Batis	*Batismixta*	145	20880
33	Ploceidae	Black- billed Weaver	*Ploceus melanogaster*	146	21170
34	Psittacidae	Dusky Parrot	*Pionusfuscus*	7	42
35	Scopidae	Hamerkop	*Scopus umbretta*	33	1056
36	Strigidae	Tawny-browed Owl	*Pulsatrixkoeniswaldiana*	68	4556
37	Sturnidae	Purple Glossy-starling	*Lamprotornispurpureus*	141	19740
38	Sturnidae	Greater Blue-eared Glossy-starling	*Lamprotornischalybaeus*	68	4556

39	Sturnidae	Lesser Blue-eared Glossy-starling	*Lamprotornischloropterus*	71	4970
40	Sturnidae	Splendid Glossy-starling	*Lamprotornissplendidus*	112	12432
41	Threskiornithidae	Hadada Ibis	*Bostrychiahagedash*	59	3422
42	Trochilidae	Veraguan Mango	*Anthracothoraxveraguensis*	13	156
43	Tyrannidae	Black Phoebe	*Sayornisnigricans*	158	24806
44	Tyrannidae	Tufted Flycatcher	*Mitrephanesphaeocercus*	87	7482
	Total			3255	644314

Simpsons Diversity Index's =0.939

Source: Field Survey, (2018)

Global Journals Guidelines Handbook 2019

www.GlobalJournals.org