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## **A Survey of Avian Fauna in Kabale Municipality, South Western Uganda**

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### ***Authors' contributions***

*This work was carried out in collaboration between both authors. Author SN designed the study and both authors SN and FT collected data. Author SN performed the analysis and wrote the first draft of the manuscript. Author FT addressed the Reviewers comments. Both authors read and approved the final manuscript before submission.*

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### **ABSTRACT**

Collection of data on avifaunal diversity is a crucial component for monitoring the effects of habitat changes on biodiversity. A rapid cross sectional survey to document common bird species present in Kabale municipality was conducted over a period of 3 months. Birds were categorized into families and the Shannon–Weaver (H') diversity index and the abundance of all the species was calculated. A total of 1770 bird individuals consisting of 67 species, 34 families were recorded, with an overall species diversity of 3.41. The Grey Crowned Crane (*Balearica regulorum*) an endangered species and the Woolly-necked Stork (*Ciconia episcopus*) a vulnerable species were among the species recorded. The relatively high diversity is probably attributed to the presence of trees on farmland areas within the municipality. This combination seems to provide various food sources or nesting and perching grounds for the birds. Information generated by this study will serve as a benchmark for monitoring of changes in species diversity and composition over time. In addition, the list of birds will be useful to residents of the area and the many ecotourists who visit Kabale town.

**Keywords:** *Kabale municipality; shannon–weaver; endangered; vulnerable; ecotourists.*

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## 1. INTRODUCTION

Birds represent an important component of global biodiversity and fulfill many ecological functions, which include disease regulation, biomass recycling, seed dispersal of fleshy fruits, and pollination [1]. Land-use change resulting from urbanization is a key driver of current and future biodiversity change. These land use changes often results in homogenous and artificial environments which are dominated by many exotic communities of flora and fauna [2].

A study of avifaunal diversity is therefore essential considering that birds have been known to be indicators of good environmental conditions [3].

Kabale municipality has been gazetted as a city, and as a result, huge infrastructure developments within and around the town are anticipated. Given that there is a positive correlation between availability of vegetation cover and bird biodiversity [4], the habitat changes resulting from urbanization are predicted to impact on this biodiversity. Besides, urban development scenarios such as roads and highways have been found to cause significant impact on bird assemblages [5]. In some birds' surveys, studies have shown that abundance, occurrence, and species richness of breeding birds are heavily impacted near roads, with larger declines near high-traffic roads than near lower traffic roads [6]. The main goal of this survey was therefore to document bird diversity in Kabale municipality for future conservation planning and action. The information generated from this study will also be useful to residents of the area and the many ecotourists who visit Kabale town.

## 2. STUDY AREA

Kabale municipality is located in Kabale district of the Kigezi sub-region, approximately 420kms (260 miles), southwest of Kampala city. It lies at 1°14'S, 29°58'E; 2,000m (6,600 ft) asl. This sub-region is composed of three (3) administrative units/divisions: Northern, Southern and Central Divisions. Being part of Kabale district, the municipality experiences an average annual temperature of 17.2 °and a precipitation of about 1018 mm per year. The municipality is located about 42 km from the famous Bwindi Impenetrable Forest via Kabale- Kisoro road and 7km from Lake Bunyonyi, both of them, biodiversity hotspots.

Data was collected from 3 sites within the municipality namely: Kabale University main campus located at Kikungiri hill in central division; White horse Inn located at Makanga hill in central division; and Uganda Christian University, Bishop Burham campus located on Rugarama hill (Fig. 1). These were chosen mainly for their relatively high tree cover. Currently, all these places have mainly exotic vegetation dominated by silk oak (*Grevillea robusta*), Pine (*Pinus*) spp and (*eucalptyus*) spp. Land use around and within the municipality includes, small gardens mainly of mixed agriculture and the major cultivated crop species were banana/plantain (*Musa spp*), sorghum (*Sorghum bicolor. L*), peas (*Pisum sativum. L*), beans (*Phaseolus vulgaris*), potato (*Solanum tuberosum. L*) and sweet potatoes (*Ipomea batatas*). Minor crops grown include Yams (*Dioscorea spp*), cassava (*Manihot esculenta*), maize (*Zea mays L*), fruits and Vegetables.

## 3. METHODS

### 3.1 Bird Survey

I conducted a general avian survey in Kabale municipality between 20<sup>th</sup> November 2019 and 20<sup>th</sup> January 2020. A total of 30 point counts (10 at each study site) over a period of six days were made. I spent 15 minutes at each point and using binoculars [7] observed and recorded all birds seen including those flying over. Surveys were conducted in the mornings as this is the time birds are most active [7]. Abundance estimates of small secretive species and/or camouflaged ones may have been underestimated due to low detectability.

### 3.2 Waterbird Composition and Species Diversity

Waterbirds were classified into families with reference to [8] and threat categories based on the IUCN REDLIST [9]. The Shannon–Weaver (H') diversity index [10] and the abundance of all the species was also calculated. This index is based on the relative composition of species in an area and how equally the individuals are distributed among the species groups or taxa. The more equal the distribution, the greater the overall diversity [10].

The Shannon-weaver diversity index, H' was calculated for each count as:

$$H' = \frac{-\sum(\text{Total of bird species}/(\text{Total birds}) \times \ln(\text{Total of bird species}/(\text{Total birds}))}{\ln(\text{Total of bird species}/(\text{Total birds}))}$$

#### 4. RESULTS

A total of 1770 bird individuals consisting of 67 species, 34 families were recorded during this study (Table 1). The species included among others the Grey Crowned Crane (*Balearica regulorum*) an endangered species and the Woolly-necked Stork *Ciconia episcopus* a vulnerable species (Table 1). Most bird species (98%) recorded are of Least Concern (Table 1). Non passerines as the Bronze Mannikin (*Spermestes cucullata*) and the African Firefinch (*Lagonosticta rubricate*) comprised of slightly more than a quarter of the overall abundance. There was evidence of the Black-headed Heron breeding within the centre of Kabale municipality (Plates 1 and 2). Overall species diversity was 3.41.

#### 5. DISCUSSION

An overall species diversity of 3.41 was recorded for Kabale Municipality. This is regarded as high given that typical values are generally between

1.5 and 3.5 in most ecological studies [10]. The abundance of many bird species are determined by the composition and characteristics of the vegetation that forms a major element of their habitats [3]. The high species diversity recorded in Kabale municipality is probably as a result of the presence of a relatively high number of trees and farmlands. Generally, wooded plant cover and farmlands offer many niches that are exploited by a variety of birds [11]. Trees provides various food sources or nesting or perching grounds for the survival of birds [11,12].

Birds such as African Paradise flycatcher (*Terpsiphone viridis*), African Dusky Flycatcher (*Muscicapa adusta*), and Yellow-fronted Canary (*Crithagra mozambica*) that have been recorded in Bwindi forest were also recorded within the municipality. This is probably because they are forest edge species, well adapted to riverine and open forests, woodlands or savannah habitats, and are regularly found in cultivated gardens in highly populated areas. Although the Black-headed Heron (*Ardea melanocephala*) was recorded breeding in town, it appears to be foraging in habitats outside of the municipality based on the low abundance recorded.

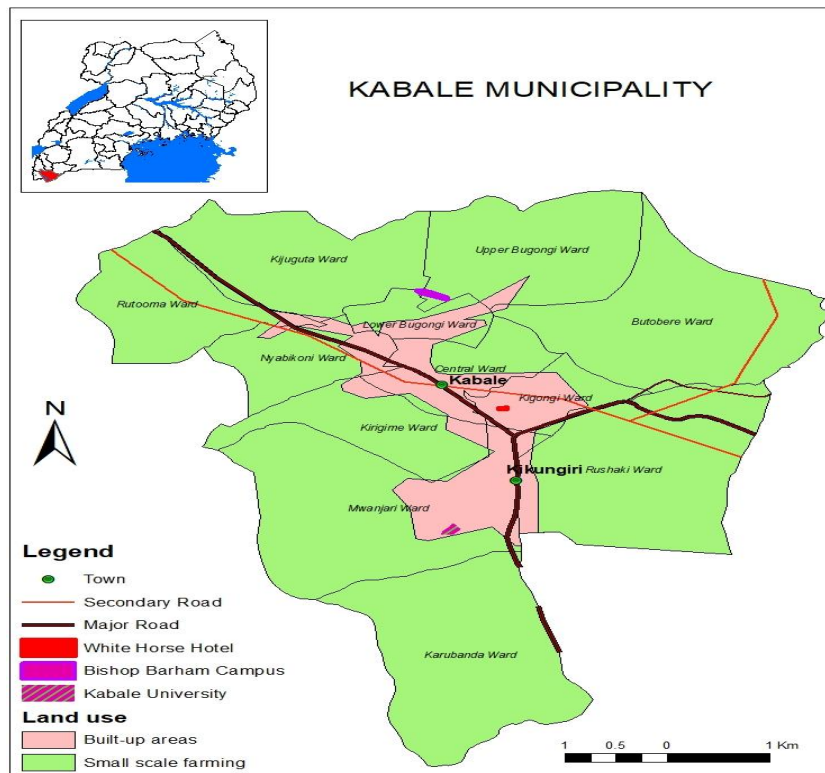


Fig. 1. Location of study sites within Kabale municipality

**Table 1. Bird species recorded within Kabale Municipality, South western Uganda. Families, common names, and scientific names follow [8]. Status follows IUCN REDLIST category [6]: EN = Endangered, VU = Vulnerable, Least Concern = LC. B = signs of breeding recorded in this survey**

#	Common Name	Species Name	Family	Status	Abundance	% Abundance
1	Cattle Egret	<i>Bubulcus ibis</i>	Ardeidae	LC	30	1.69
2	Black-headed Heron	<i>Ardea melanocephala</i>	Ardeidae	LC (B)	20	1.13
3	Woolly-necked Stork	<i>Ciconia episcopus</i>	Ciconiidae	VU	6	0.34
4	African Open-billed Stork	<i>Anastomus lamelligerus</i>	Ciconiidae	LC	35	1.98
5	Marabou Stork	<i>Leptoptilos crumeniferus</i>	Ciconiidae	LC	32	1.81
6	Hammerkop	<i>Scopus umbretta</i>	Scopidae	LC	6	0.34
7	Hadada Ibis	<i>Bostrychia hagedash</i>	Threskiornithidae	LC	10	0.56
8	Sacred Ibis	<i>Threskiornis aethiopicus</i>	Threskiornithidae	LC	15	0.85
9	African Spoonbill	<i>Platalea alba</i>	Threskiornithidae	LC	6	0.34
10	Black-shouldered Kite	<i>Elanus axillaris</i>	Accipitridae	LC	5	0.28
11	African harrier Hawk	<i>Polyboroides typus</i>	Accipitridae	LC	2	0.11
12	Long crested Eagle	<i>Lophaetus occipitalis</i>	Accipitridae	LC	3	0.17
13	Grey-crowned Crane	<i>Balearica pavonina</i>	Gruidae	EN	60	3.39
14	African green Pigeon	<i>Treron calvus</i>	Columbidae	LC	25	1.41
15	Red-eyed Dove	<i>Streptopelia semitorquata</i>	Columbidae	LC	12	0.68
16	Ring-necked Dove	<i>Streptopelia capicola</i>	Columbidae	LC	3	0.17
17	Brown-headed Parrot	<i>Poicephalus cryptoxanthus</i>	Psittacidae	LC	18	1.02
18	Eastern Grey Plantain Eater	<i>Crinifer zonurus</i>	Musophagidae	LC	5	0.28
19	White-browed Coucal	<i>Centropus superciliosus</i>	Cuculidae	LC	4	0.23
20	Barn Owl	<i>Tyto alba</i>	Strigidae	LC	2	0.11
21	White-rumped Swift	<i>Aerodramus spodiopygius</i>	Apodidae	LC	50	2.82
22	Little swift	<i>Apus affinis</i>	Apodidae	LC	25	1.41
23	Speckled Mouse bird	<i>Colius striatus</i>	Coliidae	LC	39	2.2
24	Woodland King fisher	<i>Halcyon senegalensis</i>	Alcedinidae	LC	8	0.45
25	Little Bea eater	<i>Merops pusillus</i>	Meropidae	LC	6	0.34
26	Black and White Casqued Hornbill	<i>Bycanistes subcylindricus</i>	Bucerotidae	LC	8	0.45
27	Grey-headed wood pecker	<i>Picus canus</i>	Picidae	LC	2	0.11
28	Barn Swallow	<i>Hirundo rustica</i>	Hirundinidae	LC	13	0.73
29	Mosque Swallow	<i>Cecropis senegalensis</i>	Hirundinidae	LC	15	0.85
30	House martin	<i>Delichon urbicum</i>	Hirundinidae	LC	32	1.81
31	African Pied wagtail	<i>Motacilla aguimp</i>	Motacillidae.	LC	25	1.41
32	Common bulbul	<i>Pycnonotus barbatus tricolor</i>	Pycnonotidae	LC	44	2.49
33	Heuglins Robin Chat	<i>Cossypha heuglini</i>	Muscicapidae	LC	16	0.9

#	Common Name	Species Name	Family	Status	Abundance	% Abundance
34	White-browed Robin chat	<i>Cossypha heuglini</i>	Muscicapidae	LC	12	0.68
35	African Thrush	<i>Turdus pelios</i>	Turdidae	LC	24	1.36
36	Garden Warbler	<i>Sylvia borin</i>	Sylviidae	LC	7	0.4
37	Winding Cisticola	<i>Cisticola marginatus</i>	Cisticolidae	LC	12	0.68
38	Tawny-flanked Prinia	<i>Prinia subflava</i>	Cisticolidae	LC	14	0.79
39	Grey-backed Cameroptera	<i>Camaroptera brevicaudata</i>	Cisticolidae	LC	10	0.56
40	African Dusky Fly catcher	<i>Muscicapa adusta</i>	Muscicapidae	LC	14	0.79
41	African Paradise flycatcher	<i>Terpsiphone viridis</i>	Muscicapidae	LC	6	0.34
42	African Blue Flycatcher	<i>Elminia longicauda</i>	Muscicapidae	LC	4	0.23
43	Bronze Sunbird	<i>Nectarinia kilimensis</i>	Nectariniidae	LC	30	1.69
44	Red-chested Sunbird	<i>Cinnyris erythroceru</i>	Nectariniidae	LC	22	1.24
45	Collared Sunbird	<i>Hedydipna collaris</i>	Nectariniidae	LC	4	0.23
46	Black-headed Bushshrike	<i>Laniarius erythrogaster</i>	Malaconotidae	LC	12	0.68
47	Tropical Boubou	<i>Laniarius major</i>	Malaconotidae	LC	4	0.23
48	Common Fiscal	<i>Lanius collaris</i>	Laniidae	LC	10	0.56
49	Pied Crow	<i>Corvus albus</i>	Corvidae	LC	60	3.39
50	Black Kite	<i>Milvus migrans</i>	Accipitridae	LC	10	0.56
51	African Drongo	<i>Dicrurus adsimilis</i>	Dicruridae	LC	2	0.11
52	Long-tailed glossy Starling	<i>Lamprotornis caudatus</i>	Sturnidae	LC	23	1.3
53	Grey-headed Sparrow	<i>Passer griseus</i>	Passeridae	LC	32	1.81
54	Black-headed Weaver	<i>Ploceus melanocephalus</i>	Ploceidae	LC	22	1.24
55	Fan-tailed widowbird	<i>Euplectes axillaris</i>	Ploceidae	LC	6	0.34
56	Cardinal Quelea	<i>Quelea cardinalis</i>	Ploceidae	LC	3	0.17
57	Red-billed Quelea	<i>Quelea quelea</i>	Ploceidae	LC	100	5.65
58	Red-billed Firefinch	<i>Lagonosticta senegala</i>	Estrildidae	LC	2	0.11
59	African Firefinch	<i>Lagonosticta rubricata</i>	Estrildidae	LC	200	11.3
60	Red-cheeked Cordonbleu	<i>Uraeginthus bengalus</i>	Estrildidae	LC	60	3.39
61	Common Waxbill	<i>Estrilda astrild</i>	Estrildidae	LC	150	8.47
62	Pin-Tailed Whydah	<i>Vidua macroura</i>	Viduidae	LC	4	0.23
63	Bronze Mannikin	<i>Spermestes cucullata</i>	Estrildidae	LC	300	16.9
64	Yellow-fronted Canary	<i>Crithagra mozambica</i>	Fringillidae	LC	4	0.23
65	Grey-green Bush Shrike	<i>Chlorophoneus bocagei</i>	Malaconotidae	LC	8	0.45
66	Augur Buzzard	<i>Buteo augur</i>	Accipitridae	LC	2	0.11
67	Grey-backed Fiscal	<i>Lanius excubitoroides</i>	Laniidae	LC	15	0.85



**Plate 1. Closer view of the nesting tree *Cassia sp***



**Plate 2. Full view of the nesting tree *Cassia sp***

The Woolly-necked Stork is a widespread tropical species which breeds in Asia, India, Indonesia and throughout Africa [13]. It has been found to use agricultural fields as foraging grounds in addition to wetlands and grasslands, making it Vulnerable [14]. Fairly larger flocks of Woolly-necked Stork have been recorded in other parts of the world for example [15] in India, [16] in Nepal. However, very small flocks of 1-2 individuals were recorded during this study.

The Grey Crowned-cranes (*Balearica regulorum*), are found scattered across their range in Africa, which extends from South Africa in the south, to Uganda and Kenya in the north.

The Grey Crowned-crane is listed as Endangered in the 2012 IUCN Red Data List because threats such as habitat loss and the illegal removal of birds and eggs from the wild have resulted in the species decline [17]. Similar to the Woolly-necked Stork, the Grey Crowned-cranes has been found to use agricultural fields as foraging grounds [18]. This bird species has also adapted to changing environment [18], and it has been recorded foraging and roosting in urban areas [19]. Although widespread across south-western, southern and south-eastern parts of the country, they are concentrated in the Mbarara / Bushenyi, Masaka and Kabale Regions in the south-western parts of the country

[20]. The presence of Woolly-necked Stork and Grey Crowned-cranes within Kabale municipality is not surprising given that small scale farms are a widespread land use.

## 6. CONCLUSION

The study established that Kabale Municipality has a sizable number of bird species which is probably attributed to the presence of trees on farmland areas within the municipality. However, given the rapid urbanisation of many towns that have now been upgraded to city status Kabale inclusive, the presence of these birds is threatened. It is therefore imperative to conduct regular avifaunal surveys to guide conservation planning. Extending the survey to the bigger part of the municipality to include all habitat types is highly recommended.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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