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Species Richness and Abundance of Birds in and Around Nimule National Park, South Sudan

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Abstract
Nimule National Park is one of the important bird areas situated in Eastern Equatoria State, South Sudan. In this study, the current bird species checklist of the area was documented and bird species richness and abundance in the different sites of the park was compared. The point counts, mist-netting and direct opportunistic observation methods were used to collect the data. A total of 4946 birds, consisting of 211 species belong to 64 families were recorded in this study. The statistical analysis showed that the species diversity index differed significantly between the six selected study sites, namely Apalla, Paanzala, Commando, Onyama, Ray and Isumo, which provided good baseline information for future conservation and research on birds at the Nimule National Park.
Keywords: Abundance, bird diversity, Nimule National Park, species richness.

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Introduction

The study of avifaunal diversity is an essential ecological tool which acts as an important indicator to evaluate different habitats both qualitatively and quantitatively. It also fulfills many ecological functions which include disease regulation, biomass recycling, seed dispersal of fleshy fruits, and pollination [1-3]. Unfortunately, the global diversity of birds is decreasing incessantly primarily due to anthropogenic disturbances and climate change, habitat alteration and human disturbance [4, 5]. The Nimule National Park is an important bird area (IBA) contiguous with two designated IBAs in Uganda; Mount Kei Forest Reserve and Mount Otzi Forest Reserve. The park is rich in birdlife and is a relatively narrow and long small Park under great encroachment pressure from humans settled around it, particularly on the Nimule town side. The presence of the internally displaced persons, fishermen and livestock keepers who interact with the park and its buffer zone imposed several threats to avifaunal habitat. Due to inadequate or lack of food security base in the largely Nimule National Park area, 38,000 human population estimated in Nimule area have to fragment the vital avifaunal habitat in order to raise money to buy necessities [6]. The goals of this work were to explore the diversity and abundance of Avifaunal communities in Nimule National Park and compare the bird diversity of the different sites in and around the park that are subjected to various degrees of pressures from human disturbances.

Materials and methods

Study site

The study was conducted at the Nimule National Park, South Sudan. The Park is located between 3º 35' and 3º 49' 2" N and 31º 48' 3" and 32º 2' 2" E at the extreme south of Sudan-Uganda border. The northern border runs along river Kayu and the Nile, the eastern border along the river Nile, the southern border is along the Uganda borders from the river Nile while the western border runs along the Illungwa Mountain range to river Kayu [7-9]. We selected six study sites in villages around the park and inside the park having different level of human disturbances, sites (Onyama and Ray) were located in the villages adjacent to the Park and Apalla, Commando, Paanzala and Isumo were located inside the Park.

Data collection

This project was conducted during dry and wet field seasons from September 2014 to January 2015. All bird species in this survey were identified according to Sinclair and Peter [10]. In order to generate bird's species richness and abundance, the mist-netting was conducted for first ten days and then 252 random avian sample points were marked and investigated. Six study sites with different type of anthropogenic disturbance namely, Apalla,

Commando, Ray, Onyama, Paanzala and Isumo were chosen. On each study site, 42 avian census points were surveyed. Birds community composition was sampled using point counts method which is the most common and efficient method for estimating avian community composition and abundance with the help of the global positioning system (GPS) [11, 12]. The parallel transects of 500 meters were randomly established and marked at each habitat type. Each transect comprised of five marked avian census points fell along transect spaced at 100 meters intervals and fixed radius of 50 meter [13, 14]. All avian census points were visited two times. The survey were mostly conducted during morning (06:00 to 11:00) and evening (16:00 to 18:30) on non-rainy days for a period of five to ten minutes to improve the quality of the raw data in term of detectability. At each point, the species and number of all birds seen or heard within 50 meters radius were recorded following the previous methods [15-17]. Opportunistically, any bird's species seen or heard during the entire period of field work were identified and recorded using a pair of binocular and field guide to birds of Africa book.

Statistical analysis

One-way analysis of variance was used to test the variations among the six study sites after the data was normally distributed using the statistical package for social sciences (SPSS) version 16.0 statistical software (Chicago, USA).

Results and Discussion

A total of 4946 of bird individuals consisting of 211 species, 64 families and 20 orders were recorded during this study (Table S1). Out of these 211 species, 179 species were recorded using the point count method and 32 species were recorded using the mistnetting and the opportunistic observation (Table 1). A total of 95 species were recorded at Apalla site while Isumo, Paanzala, Commando, Ray and Onyama sites had 77, 69, 67, 60 and 47 bird species, respectively (Fig. 1). These species were recorded in the different habitats (wooded grassland, bushed grassland, riverine woodland and riverine papyrus). There was a significant difference in the species diversity of birds at the six study sites ($F= 2.60$, $P>0.022$) and birds abundance was also highly significantly different among the six study sites ($F= 3.785$, $P> 0.002$).

Birds showed highest species richness and abundance at Apalla site, of most were forest birds than any other study site because this site has less human disturbance and good quality of habitat. The lowest species richness and abundance was recorded at Paanzala, Onyama and Ray sites which are mostly dominated by common birds related to human activities. According to Balmford et al. [18], both common and rear bird's species respond differently to anthropogenic activities disturbance in their habitat.

There were four (Hooded vulture, Lappet- faced vulture, Southern ground hornbill and Black Crowned-Crane) globally threatened birds and three near threatened species recorded in this study. Three of the globally threatened bird species that were recorded in the study area, are native to South Sudan [19-22] except Southern Ground Hornbill, a native to Uganda, which is not ecologically different from the Nimule National Park [23].

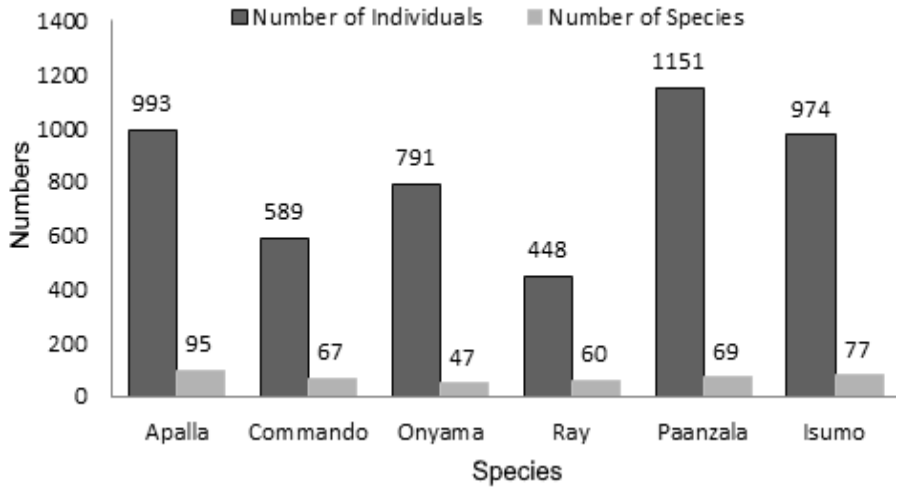

Fig. 1 The species richness and abundance of birds at the different sites of the Nimule National Park.

Table 1 Abundance of birds caught during mist-netting.

Common name	Scientific name	No.
Golden Backed Weaver	*Ploceus jacksoni*	33
Northern Masked Weaver	*Ploceus taeniopterus*	30
Village Weaver	*Ploceus cucullatus*	29
Southern Masked Weaver	*Ploceus velatus*	28
Northern Red Bishop	*Euplectes franciscanus*	11
Cinnamon Weaver	*Ploceus badius*	10
Lesser Masked weaver	*Ploceus intermedius*	5
Croaking Cisticola	*Cisticola natalensis*	5
Beautiful Sunbird	*Cinnyris pulchellus*	4
Red Headed Quelea	*Quelea erythrops*	3
Red-Cheeked Cordonbleu	*Uraeginthus bengalus*	3
Blue Spotted Wood Dove	*Turtur afer*	3
Rufous Chatterer	*Turdoides rubiginosa*	3
Great reed warbler	*Acrocephalus arundinaceus*	3
Little Weaver	*Ploceus luteolus*	2
Red winged Grey Warbler	*Drymocichla incana*	2
Silver Bird	*Empidornis semipartitus*	2
Red-Billed Firefinch	*Lagonosticta rufopicta*	2
Parrot Billed Sparrow	*Passer gongonensis*	2
D' Arnaud's Barbet	*Trachyphonus darnaudii*	2
Speckle Fronted Weaver	*Sporopipes frontalis*	1
Red Collared Widowbird	*Euplectes ardens*	1
African Pygmy Kingfisher	*Ceyx pictus*	1
Black Headed Gonolek	*Laniarius erythrogaster*	1
Singing Bush Lark	*Mirafra cantillans*	1
Eastern Olivaceous warbler	*Iduna pallida*	1
Grey Backed Camaroptera	*Camaroptera brevicaudata.*	1
Eurasian Hoopoe	*Upupa epops*	1

Conclusions

A total of 211 species of birds recorded during this study. The information provided by this study provides a very good baseline information for future conservation and research on birds at the Nimule National Park. The sites with less human disturbance were found to have high species richness and abundance and support many rare birds species.

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