IMPACT OF SEASONAL CHANGES ON AVIFAUNA DIVERSITY IN NGURU WETLAND, YOBE STATE, NIGERIA

ABSTRACT

The research on impact of seasonal changes on avifauna diversity in Nguru Lake of Hadejia-Nguru Wetland was carried out in two different seasons for the period of six 6 months, from April to June (dry season) and July to September (wet season). The aim was to evaluate the impact of seasonal changes on avifauna diversity and the species richness in the study area. A reconnaissance survey was carried out to select study sites and sampling points. Five (5) different points were selected which comprises of Madauka, Kayayyashi, Farin Ruwa, Badum respectively and Point count census techniques were adopted. In each counting station, bird observation was carried out twice daily; morning between 6:00am and 10:00am and evening between 4:00pm and 6:00pm. Data compilation was done using Microsoft Excel and were analysed using statistical software Past 326b. Bird diversity was calculated using Shanon-Weiner diversity index. The findings of this research showed that the majority of birds identified were Resident species (12,225 individual birds), Migratory species (8,186 individual birds) and Palearctic Migrants (10,876 individual) species in the study area. Dominant bird species in Nguru lake were Philomachus pugnax, Actophilornis africanus and Phalacrocorax africanus. A total of 5,538 individual birds' was identified (Dry Season) in Nguru lake '' belonging to 21 families in which Ardeidae family had the highest (7) species of bird. Shannon Diversity Index' has 2.55 in dry season, while in Wet Season' has 3.40. This indicated that there was relatively equal and high diversity of bird species in Wet Season in the study area and has the total species richness of 6,711. Overgrazing and other anthropogenic activities which affect the population diversity of avifauna species serve as major threats to the continued existence of Wetlands. Typha grass also remained pressing problem which create microhabitats reducing critical habitat for feeding, nesting and roosting habitat for birds, as well as hampers the smooth flow of water used by many water bird species. In view of the findings of this study, effective monitoring and strategies for conservation to restore the population of bird species, provide public enlightenment of the people around the wetland and management of Hadejia-Nguru Wetland promptly advice the significant importance of the wetland in serving as home for resident and migratory bird

species.

Key Words: Impact, Seasonal, Changes, Avifauna, Diversity, Reconnaissance, Survey, Sampling.

INTRODUCTION

Avifauna is a general name for bird species. Birds are feathered, winged, egg–laying vertebrates. They belong to the Kingdom "Animalia," Phylum "Chordata" and Class "Aves". They have a worldwide distribution, living in and around oceans, rivers, forests and mountains. They are the most noticeable group in the animal kingdom. Their bright colours, distinct songs and calls, and showy displays add fun to human life. Many people derive great pleasure from watching birds and listening to their beautiful songs. Birds are social animals that communicate with visual signs, calls and songs. They display social behaviours such as cooperative breeding and hunting, flocking and mobbing of predators. Birds live and breed in most terrestrial habitats and on all the seven Continents. Nigeria is blessed with many species of birds scattered throughout the different ecological regions. As with any natural habitat, wetlands are important in supporting bird species diversity. Wetlands provide food for birds in the form of plants, vertebrates, and invertebrates. Some birds forage for food in the wetland soils, while some find food in the water column and others feed on the vertebrates and invertebrates that live on submerged and emergent plants. (Labe etal., 2018).

Studies on bird diversity by Burgess et al. (2002), Doggart et al. (2005), Frontier-Tanzania (2005), and Yanda and Munishi (2007) in the Uluguru area were confined to the forest emphasis in the general negative effects of forest conversion to human dominated habitats. Nevertheless, human dominated and agricultural habitats vary a lot and therefore the effect on birds can be very different (Tworek, 2002). Responses of birds to habitat changes differ depending on their strategies, some lifestyles benefit from habitat change, while for others it is a principal threat (Tworek, 2002). Birds are

very visible and integral part of the ecosystem that occupy many trophic levels in a food chain ranging from consumers to predators. Their occurrences have been helpful as environmental health indicator, plant pollinators and seed dispersal as well as pest controller (Hadley et al., 2012; Ramchandra, 2013). This research work identified avifauna species and determine its diversity in the study area.

MATERIALS AND METHOD

Study Area

This research was carried out at Hadejia-Nguru Wetlands (HNWs) located in the Sahelian Zone of Nigeria at a point where River Hadejia and flow through a fossil dune field before converging and draining into Lake Chad. It lies between latitude $12^0$13'N to
$12^0$55'N and longitude $10^0$15'E to $11^0$30'E (Ayeni et al., 2019), covering three Nigerian states namely; Bauchi, Jigawa and Yobe (Figure 1). The Hadejia-Nguru Wetlands named after two major towns (Hadejia and Nguru) are extensive floodplain wetlands in the dry lands of northern Nigeria which are surrounded by many villages. It supports a wide range of biodiversity and livelihood activities. (Ayeni et al., 2019).

The wetlands extend for approximately 120 km from west to east within Jigawa State and for a further 60-70km down-stream in adjacent Yobe State (Caro et al., 2011). In width, the wetlands range from 10km to more than 50 km from north to south, with approximately 8000km^2 of floodplain. The extent of the floodplain varies considerably from year to year depending on rainfall and complex interactions of river flow, dam releases, flood regimes and topography (Bourn, 2003).

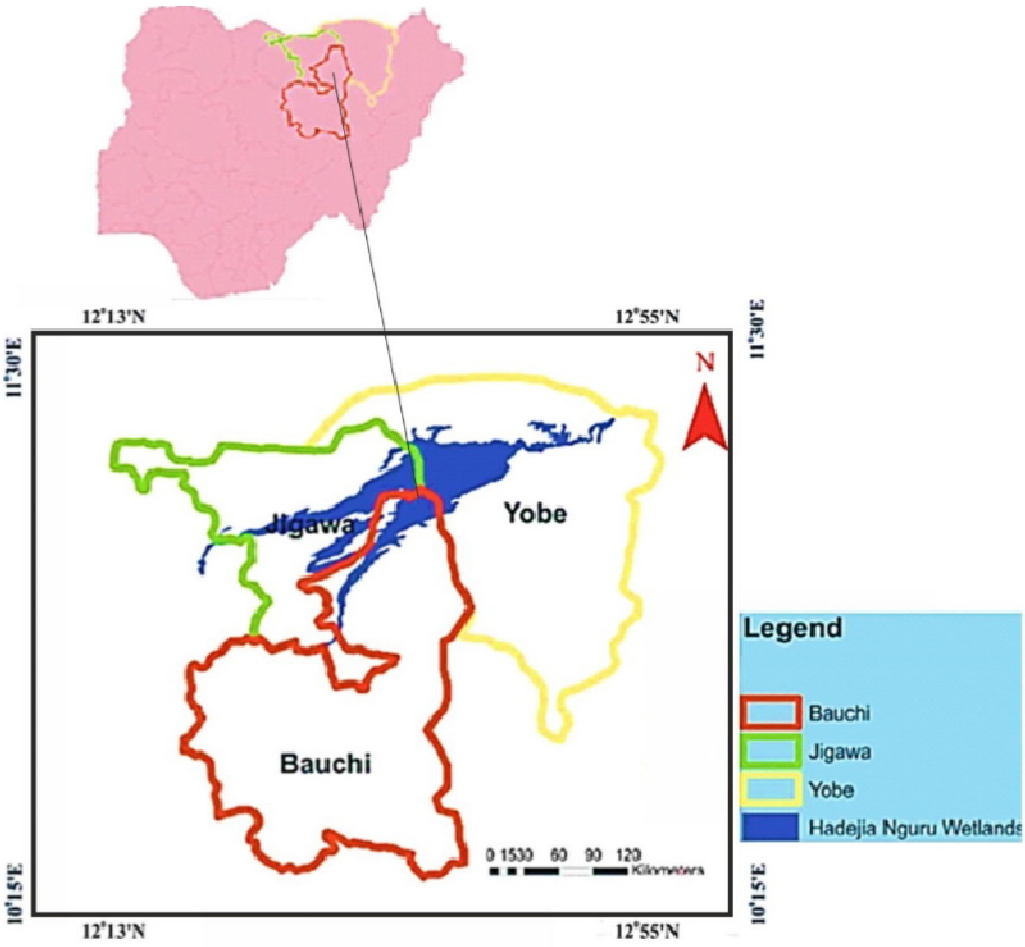

Figure 1: Map of Nigeria Showing the Study Area.
Source: (Ayeni et al., 2019)

Research Design

A reconnaissance survey was carried out with the aid of topographic map and

personnel assistant to select study sites and sampling points in the field after obtaining permission from the authorities of Nguru Wetland. The survey was carried out at study area and five (5) points were been selected namely; Madauka, Kayayyashi, Farin Ruwa, Badum and Guzan lakes respectively. The survey was carried out for the period of six (6) months (three months for dry season and three months for wet season. Birds' observation was carried out once in a month. Birds were counted as birds seen and heard around the area and birds in flight were also be counted within 100 meters radius to aid data collection. A pair of binoculars with magnification 988,000m Model 750 was used for birds viewing alongside with field guide book "Birds of Western Africa" by Borrow and Demey (2014) for identification of birds (Ramsar Convention Bureau, 2000). A Komery Digital Camera 24MP was also used for taking photographs of birds.

Method of Data Collection

Point count census techniques as outlined by Bibby et al. (1992) and Ralph et al. (1993) were adapted to count the birds for the study. Five (5) different points was selected randomly from each study sites, namely; Madauka, Kayayyashi, Farin Ruwa, Badum and Guzan.

In each counting station, bird observation was carried out twice daily; morning between 6:00am and 10:00am and evening between 4:00pm and 6:00pm. On arrival at each counting station, the observers stayed for five (5) minutes before beginning to count. This was to enable the birds to settle down following disturbance by the arrival of the observers. The observers at each counting point recorded the entire birds encountered for a period of ten (10) minutes with the aid of binoculars alongside with field guide book "Birds of Western Africa" by Borrow and Demey (2014). Data forms were structured for ease of recording all the information.

Data Analysis

Compilation and analysis of data was done using Microsoft Excel (2013 version). Data were analysed using statistical software Past 326b.

i. Table was used to present the types of avifauna species identified in the study area

for rainy season and dry season according to Lammeed (2011).

ii. Avifauna species diversity was calculated using Shannon-Weiner diversity index, H:

$$H = - \sum_{i=1}^{S} Pi \, 1n \, Pi$$

Where:

H = Shannon-Weiner Diversity Index

S = Total number of species of the community (number seen and heard).

Pi = Proportion of each or individual (1^{th}) species in the Sample.

1nPi = Natural Logarithm of the species proportion. (Lammeed, 2011).

RESULTS

Avifauna Species Identified in Nguru Wetland (NGW) in Dry Season

The result of the avifauna species identified in 'NGW' for the 1^{st}, 2^{nd} and 3^{rd} visits are presented in Table 1. The table showed that 2,148 bird species were identified in the first visit, 1,658 bird species were identified in the second visit and 1,732 species were identified in the third visit (Total = 5,538) belonging to 21 different families in dry season in the study area. The families of Bucerotidae, Coraciidae, Cuculidae, Motacillidae, Phalacrocoracidae, Ploceidae, Psittacidae, Pyconotidae, Recurvirostridae, Scolopacidae, Sternidae, Sturnidae and Viduidae contained 1 species each, families of Accipitridae, Alcedinidae, Charadriidae and Jacanidae contained 2 species each, family of Anatidae contained 3 species, while families of Columbidae and Rallidae contained 4 species and Ardeidae contained the highest number of 7 species in the study area.

Avifauna Species Identified in Nguru Wetland (NGW) in Wet Season

The result of the avifauna species identified in the study area for the 1^{st}, 2^{nd} and 3^{rd} visits are presented in Table 2. The table shows that 690, 281 and 202 bird species (Total = 1,173) were identified in the first, second and third visits respectively during rainy season, different families in the study area. The families of Bucerotidae,

Coraciidae, Cucilidae, Motacillidae, Phalacrocoracidae, Ploceidae, Psittacidae, Pyconotidae, Recurvirostridae, Scolopacidae, Sternidae, Sturnidae and Viduidae contained a single bird species each, meanwhile the families of Accipitridae, Alcedinidae, Charadriidae and Jacanidae contained 4 bird species each where only Anatidae family contained 3 species of birds, the families of Columbidae and Rallidae contained 4 bird species while Ardeidae contained 7 different bird species in the study area during wet season.

Table 1: Avifauna Species Identified in the Study Area (Nguru Wetland) for Dry Season

S/N	Family	Scientific Name	Common Name	Frequency			Total
				1st Visit	2nd Visit	3rd Visit	
1.	Accipitridae	Circus ranivorus	African Marsh Harrier	3	2	1	6
	" "	Milvus aegyptius	Yellow billed Kite	4	2	10	16
2.	Alcedinidae	Halcyon leucocephala	Grey-headed Kingfisher	3	-	2	5
	" "	Ceryle rudis	Pied Kingfisher	1	6	19	26
3.	Anatidae	Nettapus auritus	African Pygmy Geese	-	-	84	84
	" "	Dendrocygna bicolor	Fulvous Whistling Duck	9	7	8	24
	" "	Dendrocygna viduata	White Face Whistling Duck	558	26	117	701
4.	Ardeidae	Egretta ardesiaca	Black Heron	3	28	23	54
	" "	Bubulcus ibis	Cattle Egret	24	22	12	58
	" "	Ardea cinerea	Grey Heron	14	19	12	45
	" "	Egretta intermedia	Intermediate Egret	1	-	-	1
	" "	Egretta garzetta	Little Egret	10	17	33	60
	" "	Ardea purpurea	Purple Heron	8	19	17	44
	" "	Ardeola ralloides	Squacco Heron	128	88	65	281
5.	Bucerotidae	Tockus erythrorhynchus	Red-billed Hornbill	-	2	-	2
6.	Charadriidae	Vanellus tectus	Black-headed Lapwing	9	11	-	20
	" "	Vanellus spinosus	Spur-winged Lapwing	-	15	69	84
7.	Columbidae	Streptopelia decipiens	African Mourning Dove	18	24	25	67
	" "	Streptopelia senegalensis	Laughing Dove	15	14	7	36
	" "	Columba guinea	Speckled Pigeon	34	18	27	79

	" "	Streptopelia vinacea	Vinaceous Dove	22	34	32	88
8.	Coraciidae	Coracias abyssinica	Abyssinian Roller	3	-	2	5
9.	Cuculidae	Centropus senegalensis	Senegal Coucal	2	5	4	11
10.	Jacanidae	Actophilornis africanus	African Jacana	245	184	475	904
	" "	Microparra capensis	Lesser Jacana	14	22	114	150
11.	Motacillidae	Motacilla flava	Yellow Wagtail	141	94	10	245
12.	Phalacrocoracidae	Phalacrocorax africanus	Longtail/Reed Cormorant	227	109	383	719
13.	Ploceidae	Ploceus cucullatus	Village Weaver	10	-	40	60
14.	Psittacidae	Psittacula krameri	Rose-ringed Parakeet	-	7	-	7
15.	Pyconotidae	Pycnonotus barbatus	Common Bulbul	4	-	8	12
16.	Rallidae	Amaurornis flavirostris	Black Crake	9	4	16	29
	" "	Gallinula chloropus	Common Moorhen	32	45	78	155
	" "	Gallinula angulata	Lesser Moorhen	-	-	10	10
	" "	Porphyrio madagascariensis	Purple Swamphen	6	4	19	29
17.	Recurvirostridae	Himantopus himantopus	Black-winged Stilt	-	8	-	8
18.	Scolopacidae	Philomachus pugnax	Ruff	550	770	10	1330
19.	Sternidae	Sterna nilotica	Gull-billed Tern	36	50	-	86
20.	Sturnidae	Lamprotornis caudatus	Longtail Glossy Starling	-	2	-	2
21.	Viduidae	Vidua chalybeata	Village Indigo	5	-	-	5
Total Number of Species Per Location				2,148	1,658	1,732	5,538

Source: Field Survey, 2024

Table 2: Avifauna Species Identified in the Study Area (Nguru Wetland) for Wet Season

S/N	Family	Scientific Name	Common Name	Frequency			Total
				1st Visit	2nd Visit	3rd Visit	
1.	Accipitridae	Circus ranivorus	African Marsh Harrier	1	1	-	2
	" "	Milvusaegyptius	Yellow billed Kite	8	6	2	16
2.	Alcedinidae	Halcyonleucocephala	Grey-headed Kingfisher	7	1	-	8
	" "	Cerylerudis	Pied Kingfisher	24	11	7	42
3.	Anatidae	Nettapusauritus	African Pygmy Geese	3	-	-	3
	" "	Dendrocygnabicolor	Fulvous Whistling Duck	10	-	-	10
	" "	Dendrocygnaviduata	White Face Whistling Duck	23	-	-	23
4.	Ardeidae	Egrettaardesiaca	Black Heron	34	17	10	61
	" "	Bubulcusibis	Cattle Egret	36	9	6	51
	" "	Ardeacinerea	Grey Heron	34	12	9	55
	" "	Egrettaintermedia	Intermediate Egret	3	-	-	3
	" "	Egrettagarzetta	Little Egret	24	-	-	24
	" "	Ardeapurpurea	Purple Heron	13	8	7	28
	" "	Ardeolaralloides	Squacco Heron	32	12	7	51
5.	Bucerotidae	Tockuserythrorhynchus	Red-billed Hornbill	9	5	5	19
6.	Charadriidae	Vanellustectus	Black-headed Lapwing	25	14	10	49
	" "	Vanellusspinosus	Spur-winged Lapwing	14	7	4	25
7.	Columbidae	Streptopeliadecipiens	African Mourning Dove	16	12	9	37
	" "	Streptopeliasenegalensis	Laughing Dove	20	11	11	42
	" "	Columbaguinea	Speckled Pigeon	41	20	11	72
	" "	Streptopeliavinacea	Vinaceous Dove	28	15	10	53

8.	Coraciidae	Coraciasabyssinica	Abyssinian Roller	15	4	2	21
9.	Cuculidae	Centropussenegalensis	Senegal Coucal	8	7	7	22
10.	Jacanidae	Actophilornisafricanus	African Jacana	67	24	12	103
	" "	Microparracapensis	Lesser Jacana	32	20	11	63
11.	Motacillidae	Motacillaflava	Yellow Wagtail	9	-	-	9
12.	Phalacrocoracidae	Phalacrocoraxafricanus	Longtail/Reed Cormorant	28	12	11	51
13.	Ploceidae	Ploceuscucullatus	Village Weaver	13	4	4	21
14.	Psittacidae	Psittaculakrameri	Rose-ringed Parakeet	7	4	3	14
15.	Pyconotidae	Pycnonotusbarbatus	Common Bulbul	21	12	12	45
16.	Rallidae	Amaurornisflavirostris	Black Crake	13	8	8	29
	" "	Gallinulachloropus	Common Moorhen	5	4	8	17
	" "	Gallinulaangulata	Lesser Moorhen	11	5	4	20
	" "	Porphyriomadagascariensis	Purple Swamphen	4	2	2	8
17.	Recurvirostridae	Himantopushimantopus	Black-winged Stilt	4	-	-	4
18.	Scolopacidae	Philomachuspugnax	Ruff	18	-	-	18
19.	Sternidae	Sternanilotica	Gull-billed Tern	9	6	4	19
20.	Sturnidae	Lamprotorniscaudatus	Longtail Glossy Starling	16	3	1	20
21.	Viduidae	Viduachalybeata	Village Indigo	5	5	5	15
Total Number of Species Per Location				690	281	202	1,173

Source: Field Survey, 2024

Avifauna Species Diversity in the Research Area

The result of avifauna species diversity of Nguru Wetland during dry season is shown in Table 3. The result indicated that the Shannon Diversity Index was 2.548 for total individual species in the study area with Philomacus pugnax (0.34258) having the highest diversity and Egrettaintermedia (0.00156) being the lowest diversity.

The result of avifauna species diversity of Nguru Wetland, Wet Season is shown in Table 4. The result indicated that Shannon Diversity Index was 3.40307 for total individual species in the study area with Actophilonis africanus (0.2136) having the highest diversity while Circus ranivorus (0.01087), Egretta intermedia and Nettapus auritus (0.01527) respectively having the lowest diversity.

Table 3: Avifauna Species Diversity in the Study Area (Nguru Wetland) for Dry Season

S/N	Species	Frequency	Pi	lnPi	PilnPi
1.	Actophilornisafricanus	904	0.163236	1.81256	0.29587
2.	Amaurornisflavirostris	29	0.005237	5.25209	0.0275
3.	Ardeacinerea	45	0.008126	4.81273	0.03911
4.	Ardeapurpurea	44	0.007945	4.8352	0.03842
5.	Ardeolaralloides	281	0.05074	2.98103	0.15126
6.	Bubulcusibis	58	0.010473	4.55895	0.04775
7.	Centropussenegalensis	11	0.001986	6.22149	0.01236
8.	Cerylerudis	26	0.004695	5.36129	0.02517
9.	Circusranivorus	6	0.001083	6.82763	0.0074
10.	Columbaguinea	79	0.014265	4.24994	0.06063
11.	Coraciasabyssinica	5	0.000903	7.00995	0.00633
12.	Dendrocygnabicolor	24	0.004334	5.44133	0.02358
13.	Dendrocygnaviduata	701	0.12658	2.06688	0.26163
14.	Egrettaardesiaca	54	0.009751	4.6304	0.04515
15.	Egrettagarzetta	60	0.010834	4.52504	0.04903
16.	Egrettaintermedia	1	0.000181	8.61939	0.00156
17.	Gallinulaangulata	10	0.001806	6.3168	0.01141
18.	Gallinulachloropus	155	0.027988	3.57596	0.10009
19.	Halcyonleucocephala	5	0.000903	7.00995	0.00633
20.	Himantopushimantopus	8	0.001445	6.53995	0.00945
21.	Lamprotorniscaudatus	2	0.000361	7.92624	0.00286
22.	Microparracapensis	150	0.027086	3.60875	0.09775
23.	Milvusaegyptius	16	0.002889	5.8468	0.01689
24.	Motacillaflava	245	0.04424	3.11813	0.13795
25.	Nettapusauritus	84	0.015168	4.18857	0.06353
26.	Phalacrocoraxafricanus	719	0.12983	2.04153	0.26505
27.	Philomachuspugnax	1330	0.240159	1.42645	0.34258
28.	Ploceuscucullatus	50	0.009029	4.70737	0.0425
29.	Porphyriomadagascariensis	29	0.005237	5.25209	0.0275
30.	Psittaculakrameri	7	0.001264	6.67348	0.00844
31.	Pycnonotusbarbatus	12	0.002167	6.13448	0.01329
32.	Sternanilotica	86	0.015529	4.16504	0.06468

33.	Streptopeliadecipiens	67	0.012098	4.4147	0.05341
34.	Streptopeliasenegalensis	36	0.006501	5.03587	0.03274
35.	Streptopeliavinacea	88	0.01589	4.14205	0.06582
36.	Tockuserythrorhynchus	2	0.000361	7.92624	0.00286
37.	Vanellusspinosus	84	0.015168	4.18857	0.06353
38.	Vanellustectus	20	0.003611	5.62366	0.02031
39.	Viduachalybeata	5	0.000903	7.00995	0.00633
Total		5,538	1		2.548

Source: Field Survey, 2024

Table 4: Avifauna Species Diversity in the Study Area (Nguru Wetland) for Wet Season

S/N	Species	Frequency	Pi	lnPi	PilnPi
1.	Actophilornisafricanus	103	0.087809	2.43259	0.2136
2.	Amaurornisflavirostris	29	0.024723	3.70002	0.09148
3.	Ardeacinerea	55	0.046888	3.05999	0.14348
4.	Ardeapurpurea	28	0.02387	3.73512	0.08916
5.	Ardeolaralloides	51	0.043478	3.13549	0.13633
6.	Bubulcusibis	51	0.043478	3.13549	0.13633
7.	Centropussenegalensis	22	0.018755	3.97628	0.07458
8.	Cerylerudis	42	0.035806	3.32965	0.11922
9.	Circusranivorus	2	0.001705	6.37417	0.01087
10.	Columbaguinea	72	0.061381	2.79065	0.17129
11.	Coraciasabyssinica	21	0.017903	4.0228	0.07202
12.	Dendrocygnabicolor	10	0.008525	4.76473	0.04062
13.	Dendrocygnaviduata	23	0.019608	3.93183	0.07709
14.	Egrettaardesiaca	61	0.052003	2.95645	0.15375
15.	Egrettagarzetta	24	0.02046	3.88927	0.07958
16.	Egrettaintermedia	3	0.002558	5.96871	0.01527
17.	Gallinulaangulata	20	0.01705	4.07159	0.06942
18.	Gallinulachloropus	17	0.014493	4.23411	0.06136
19.	Halcyonleucocephala	8	0.00682	4.98788	0.03402
20.	Himantopushimantopus	4	0.00341	5.68103	0.01937
21.	Lamprotorniscaudatus	20	0.01705	4.07159	0.06942
22.	Microparracapensis	63	0.053708	2.92419	0.15705
23.	Milvusaegyptius	16	0.01364	4.29473	0.05858
24.	Motacillaflava	9	0.007673	4.8701	0.03737
25.	Nettapusauritus	3	0.002558	5.96871	0.01527
26.	Phalacrocoraxafricanus	51	0.043478	3.13549	0.13633
27.	Philomachuspugnax	18	0.015345	4.17695	0.0641
28.	Ploceuscucullatus	21	0.017903	4.0228	0.07202
29.	Porphyriomadagascariensis	8	0.00682	4.98788	0.03402

30.	Psittaculakrameri	14	0.011935	4.42826	0.05285
31.	Pycnonotusbarbatus	45	0.038363	3.26066	0.12509
32.	Sternanilotica	19	0.016198	4.12288	0.06678
33.	Streptopeliadecipiens	37	0.031543	3.4564	0.10903
34.	Streptopeliasenegalensis	42	0.035806	3.32965	0.11922
35.	Streptopeliavinacea	53	0.045183	3.09703	0.13993
36.	Tockuserythrorhynchus	19	0.016198	4.12288	0.06678
37.	Vanellusspinosus	25	0.021313	3.84844	0.08202
38.	Vanellustectus	49	0.041773	3.1755	0.13265
39.	Viduachalybeata	15	0.012788	4.35927	0.05575
	Total	3.40307	1,173	1	

Source: Field Survey, 2024

Table 5: Shannon-Weiner Indices for Avifauna Species Diversity in the Study Area (Nguru Wetland).

Indices	Dry Season	Wet Season
	LAD	LAW
Taxa_S	39	39
Individuals	5538	1173
Dominance_DM	0.1253	0.03948
Simpson	0.8747	0.9605
Shannon_H	2.548	3.403
Evenness_e^H/S	0.3277	0.7707
Equitability_J	0.6955	0.9289

Source: Field Survey, 2024

Key: LAD – Location 'A' Dry and LAW – Location 'A' Wet Season

DISCUSSION

The finding of this study shows that the majority of bird species identified during the research were Resident (12,225), Migratory (8,186) and Palearctic Migrant (10,876) species in the study area. Some of the resident species recorded include, African Jacana, Longtail/Reed Cormorant, African Mourning Dove, Vinaceous Dove, Pied Kingfisher, Common Moorhen; Migratory birds include, Yellow Wagtail, African Marsh Harrier, Intermediate Egret, Red-billed Hornbill, Garganey; and the Palearctic migrant bird species were White-faced Whistling Duck, Squacco Heron, Fulvous Whistling Duck, Yellow Billed Kite and Green Sandpiper. According to Osunsina et al. (2018) the majority of birds observed during the study were resident species, migratory and Palearctic migrant species. Similar observation was made by Sabo, (2016). This shows that bird species found are either residents, intra-migrants, Vagrant and Palearctic Migrant. Also Lameed, (2011) in his study, showed that the majority of wetland birds observed were Resident, Migratory and Palearctic species. The finding of this study could be established that the most dominant bird species in Nguru Lake were Philomachus pugnax (1,330), Actophilornis africanus (904), Phalacrocorax africanus (719), Columba guinea(79).

The findings of the study on diversity of avifauna species in Nguru Wetland

shows that the Shannon Diversity Index for the area was 2.55 in Dry Season, while that of Wet Season the area has 3.40. The results are indicative of relative high diversity of bird species in the Wet Season. This finding strongly agrees with the statement of Bibi and Ali (2013) who clearly stated that the values of Shannon-Weiner Diversity Index usually falls between 1.5 and 3.5, only rarely it surpasses 4.5. This relative equal and high diversity of bird species at Nguru Lake is an indication of quantitative measure that reflects how many different species are in existence in the sites. This result supports Mengesha and Bekele (2008) who reported that the avian diversity is an indication of habitat heterogeneity and the number of species and individuals in an area implies the importance of the area. Each habitat has a specific set of microenvironment that is suitable for the species.

CONCLUSION

This study was conducted to investigate the status and diversity of Avifauna species in the study area, the information on the occurrence of birds every month obtained was used for seasonality analysis. However, species identified in dry season was higher compared to the wet season, due to the presence of migrants and Palearctic migrant avifauna species in the study area (dry season) in which this study coincided with the period of their migration in the area. Species diversity attained concentrated in the area, it could be due to the availability, abundance of food in the area.

RECOMMENDATIONS

In view of the findings of this study, the following recommendations are made:

i. Effective monitoring and strategies for conservation to restore the declining population of bird species.

ii. Provide public enlightenment of the people around the wetland on values of

Nguru Wetlands.

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