

Diversity of Bird Species and Conservation of two Lacustrine Wetlands of the Upper Benue Basin, Adamawa-Nigeria.

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Abstract: Between January 2004 to December 2005, studies were carried out on the bird species diversity and relative abundance of two lakes, Kiri and Gyawana near Numan using the "Timed Species Count (TSC)" method. 163 species in 53 bird families and 160 species in 55 bird families were recorded at Kiri and Gyawana lakes respectively. There was no significant difference in species diversity within bird families between the two lakes ($p > 0.05$). Whereas in Gyawana Lake, one of the sites qualifies for Ramsar site, none strongly qualifies as an Important Bird Area (IBA). The significance of these findings are discussed.

Key words: conservation, diversity, lacustrine, upper Benue, waterbirds, wetlands.

I. Introduction

Prior to the Ramsar Convention on Wetlands of International Importance, wetlands were generally regarded as wastelands, probably because of some problems (e.g. disease vectors) associated with them [1, 2]. However in 1972 at Ramsar [3] Iran, wetlands were the main issue at an international environmental convention, organized specifically to deliberate on conservation of the world's wetlands.

At that Convention, the criteria based on waterbirds were adopted for identifying wetlands that are of international importance:

1. Criteria for representative or unique wetlands

A wetland should be considered internationally important if any of the following apply:

- a. It is a particular good representative example of a natural or near-natural wetlands, characteristics of the appropriate biogeographical region;
- b. It plays a substantial hydrological, biological or ecological role in the natural functioning of a major river basin or coastal system, especially where it is located in a transborder position; or
- c. It is an example of a specific type of wetland, rare or unusual in the appropriate biogeographical region.

2. Criteria based on plants or animals

A wetland should be considered internationally important if any of the following apply:

- a. It supports an appreciable assemblage of rare, vulnerable or endangered species or subspecies of plant or animals, or an appreciable number of individuals of any one or more of these species;
- b. It is of special value for maintaining the genetic and ecological diversity of a region because of the quality and peculiarities of its flora and fauna;
- c. It is of special value as the habitat of plants or animals at a critical stage of their biological cycle;
- d. It is of special value for one or more endemic plant or animal species or communities.

3. Criteria based on waterfowl

A wetland should be considered internationally important if any of the following apply:

- a. It regularly supports 20,000 waterfowl;
- b. It regularly supports substantial numbers of individuals from particular groups of waterfowl;
- c. Where data on populations are available, it regularly supports 1% of the individuals in a population of one species or subspecies of waterfowl.

As in third set of Ramsar criteria, another environmental initiative the Important Bird Areas (IBA) programme uses birds as an index for assessing the quality of sites to be managed as conservation areas. The focus on birds as a fauna is partly because the ICBP [4] postulated that birds are good indicators of the health of the environment. Birds can also be used to predict the distribution and conservation status of other types of animals and plants.

The IBA criteria used in assessing the sites are grouped in four categories as follows:

Category A1 – Globally – threatened species: A site that qualifies under this category must “regularly hold significant numbers of a globally threatened species, or other species of global conservation concern.” For example, a site will qualify under this category if it holds the Ibadan Malimbe *Malimbus ibadanensis*, which is critically endangered, as well as being a Nigerian endemic.

Category A2 – Restricted range species: Sites that qualify under this category must be “known or thought to hold a significant component of a group of species whose breeding distributions define an Endemic Bird Area (EBA) or a Secondary Area”. For example a site, may qualify under this category if it holds a species such as the Red-headed Rock fowl *Picathartes oreas*, whose world range covers less than 50,000 km².

Category A3 – Biome restricted assemblages: A site qualifies in this category if it is “known or thought to hold a significant component of a group of species whose distributions are largely or wholly confined to one biome.” In Nigeria, this category is further subdivided into four biome assemblages, viz:

- * Sahel Savanna (A03)
- * Sudan-Guinea Savanna (A04)
- * Guinea-Congo Forests (A05)
- * Afrotropical Highlands (A07)

Category A4 – Globally important congregations: To qualify in this category a site must meet at least one of the four criteria below:

- i. The site is known or thought to hold, on a regular basis, 1% or more of a biogeography population of a congregatory waterbird species.
- ii. The site is known or thought to hold, on a regular basis, 1% or more of a global population of a congregatory seabird or terrestrial species.
- iii. The site is known or thought to hold, on a regular basis, at least 20,000 water-birds, or at least 10,000 pairs of seabird, of one or more species.
- iv. The site is known or through to be a ‘bottleneck site’ where at least 20,000 pelicans (Pelecanidae) and/or stocks (Ciconiidae) and/or raptors (Accipitriformes and Falconiformes) and/or cranes (Gruidae) pass regularly during spring and/or autumn migration.

The awareness generated by these two conservation initiatives, particularly the Ramsar Convention, led to the research works of Fiselier [5] and Barbier *et al.* [6] in which wetlands began to be recognized as very important and valuable ecosystems. Wangari [7] is of the view that scientific literature on tropical wetlands is poor, and that gaps stills exist in our knowledge of these important ecosystems. The percentage of Nigerian land under environmental reservation has declined from the near 11% of the 1980s as result of habitat degradation and loss, brought about by environmentally unfriendly anthropogenic activities. This has prompted the need for identification and placing of more land areas under some form of environmental protection especially for birds. It is with a view to contributing to the identification of such sites of conservation significance that this study was conceived and carried out.

II. Materials And Methods

The study was carried out in Upper Benue River Basin complex of Adamawa State (Fig. 1a) between January 2004 to December 2005 on two lakes — Kiri lake (09° 40'N 12°00'E; Fig. 1b) and Gyawana lake (09° 33'N 11°49'E; Fig. 1c), which are situated in the Guinea Savanna ecological zone.

The “Timed Species Count (TSC)” method developed by Pomeroy and Tengecho [8] was used for assessing the bird species diversity and relative abundance. Each TSC episode began between 07:00 – 07:30am or 16:30 – 17:00pm. Observations of birds were as outlined by Robertson and Liley and Robertson [9]. Distant birds were viewed for identification purposes with the aid of a pair of a 10 x 40 binoculars and a telescope. Identification and nomenclature of birds followed Borrow and Demey and Borrow [10].

Additionally, the number of times a species was encountered during the TSC, or incidentally after the TSC, was recorded on a separate datasheet. This enabled the estimation of total count for each species, so as to determine whether any of the sites qualifies for designation as a Ramsar site on the basis of the Ramsar Criterion 3 or as an IBA on the basis of category A4.

Following the statistical procedures described by Fowler and Cohen [11] and Sokal and Rohlf [12], Mann Whitney U – Tests were used to compare possible differences in birds’ diversity between the two lakes.

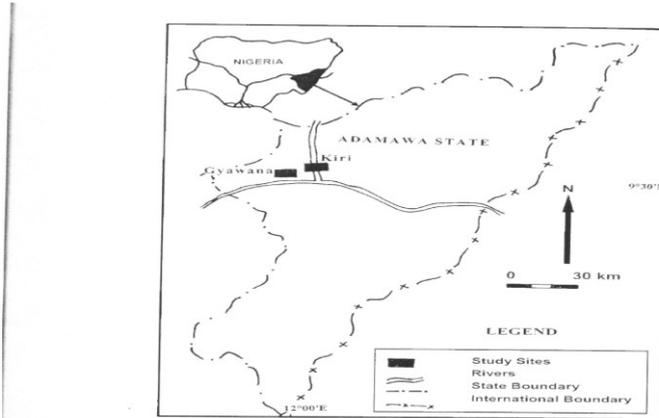


Figure 1a. Map of Adamawa State Showing the Study Sites

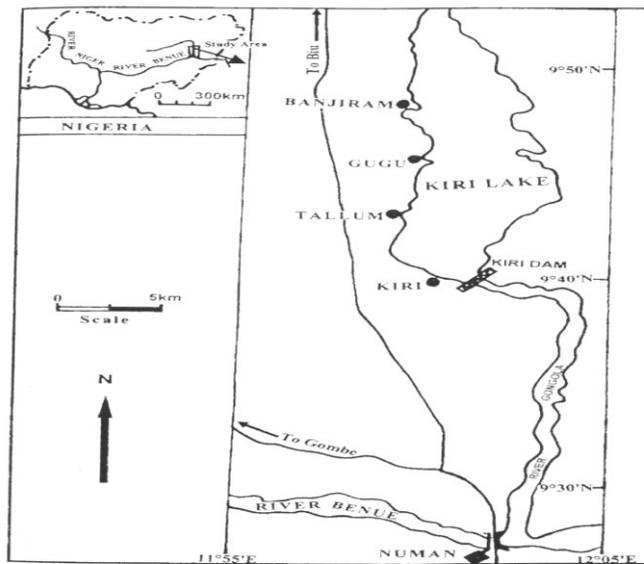


Figure 1b. The Location of Kiri Study Site

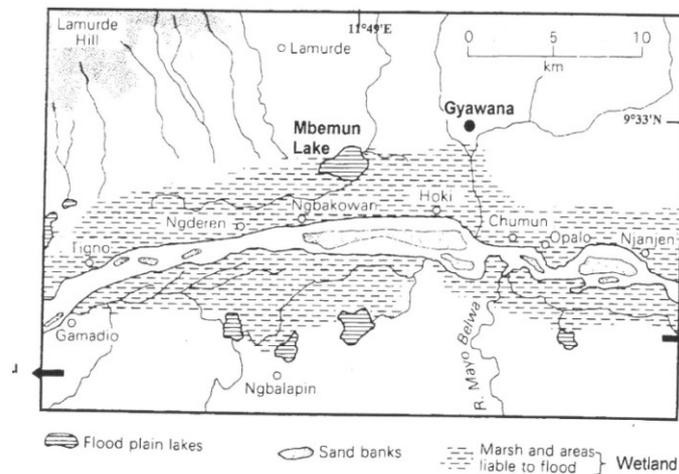


Figure 1c. The Location of Gyawana Study Site.
Source: Buckle (1976).

III. Results

For each of the study sites, species checklists including the estimated abundance of each species were compiled. TABLE 1 compares the total count of bird species encountered at the two sites.

Table1. Comparative Total Count of Bird Species Encountered at Kiri and Gyawana lakes during 2004-2005

FAMILY Species	2004		2005	
	NUMBER COUNTED			
	KIRI	GYAWANA	KIRI	GYAWANA
PHALACROCORACIDAE-Cormorants				
Long-tailed Cormorant <i>Phalacrocorax africanus</i>	112	706	216	872
ARDEIDAE-Herons, Egrets and Bitterns				
Little Bittern <i>Ixobrychus minutes</i>	6	4	12	3
Black-crowned Night Heron <i>Nycticorax nycticorax</i>	14	16	-	117
Squacco Heron <i>Ardeola ralloides</i>	494	608	2214	4080
Cattle Egret <i>Bubulcus ibis</i>	3364	13632	8796	25718
Green-backed Heron <i>Butorides striatus</i>	26	28	74	250
Black Heron <i>Egretta ardesiaca</i>	126	2088	22	3852
Little Egret <i>Egretta garzetta</i>	476	1184	4512	7182
Intermediate Egret <i>E (Mesophoyx) intermedia</i>	98	514	526	1512
Purple Heron <i>Ardea purpurea</i>	22	28	30	82
Grey Heron <i>Ardea cinerea</i>	56	94	54	100
Black-headed Heron <i>Ardea melanocephala</i>	104	194	186	382
SCOPIDAE-Hammerkop				
Hammerkop <i>Scopus umbretta</i>	41	12	37	22
CICONIIDAE-Storks				
African Open-bill Stork <i>Anastomus lamelligerus</i>	62	284	60	818
Abdim's Stork <i>Ciconia abdimii</i>	60	42	196	176
THRESKIORNITHIDAE-Ibises and Spoonbills				
Glossy Ibis <i>Plegadis falcinellus</i>	-	64	-	190
Sacred Ibis <i>Threskiornis aethiopica</i>	-	20	-	104
African Spoonbill <i>Platalea alba</i>	-	10	-	-
ANATIDAE-Ducks and Geese				
White-faced Whistling Duck <i>Dendrocygna bicolor</i>	112	3318	1998	5211
Fulvous Whistling Duck <i>Dendrocygna viduata</i>	-	-	22	572
ACCIPITRIDAE-Cuckoo Falcon, Honey Buzzards, Kites, Fish Eagles, Vultures, Snake Eagles, Harriers, Hawks, Buzzards and Eagles.				
Eurasian Marsh Harrier <i>Circus aeruginosus</i>	4	16	10	44
African Harrier Hawk <i>Polyboroides typus</i>	-	-	4	-
African Kite <i>Milvus migrans</i>	38	56	74	96
Black shouldered Kite <i>Elanus caeruleus</i>	42	56	106	154
Gabar Goshawk <i>Micronisus gabar</i>	14	4	40	4
Lizzard Buzzard <i>Kaupifalco monogrammicus</i>	2	2	4	-
Skikra <i>Accipiter badius</i>	14	2	30	8
Grasshopper Buzzard <i>Butastur rufipennis</i>	4	4	18	16
Montagu's Harrier <i>Circus pygargus</i>	12	-	4	4
Dark Chanting Goshawk <i>Melierax metabates</i>	2	-	-	-
FALCONIDAE- Falcons				
Common Kestrel <i>Falco tinnunculus</i>	12	2	34	10
Red-necked Falcon <i>Falco chicquera</i>	4	2	22	10
Grey Kestrel <i>Falco ardosiaceus</i>	8	-	10	4
NUMIDIDAE-Guineafowls				
Helmeted Guineafowl <i>Numida meleargris</i>	-	24	-	-
PHASIANIDAE-Quails, Partridge and Francolins				
Double-spurred Francolin <i>Francolinus bicalcaratus</i>	24	26	-	14
Stone Partridge <i>Ptilopachus petrosus</i>	352	-	992	-
RALLIDAE-Rails, Flufftails, Crakes, Gallinules, Moorhens, Coots				
Black Crake <i>Amaurornis flavirostris</i>	168	1892	338	1398

African Crake <i>Crex egregia</i>	32	38	-	44
Lesser Moorhen <i>Gallinula angulata</i>	-	6	-	-
OTITIDAE-Bustards				
Black-bellied Bustard <i>Eupoditis melanogaster</i>	4	-	14	-
JACANIDAE-Jacanas				
Lily Trotter <i>Actophilornis africana</i>	88	1528	152	1530
Lesser Lily Trotter <i>Microparra capensis</i>	-	9	-	-
ROSTRAULIDAE-Painted-Snipe				
Greater Painted-Snipe <i>Rostratula benghalensis</i>	-	128	4	84
RECURVIROSTRIDAE -Stilts and Avocets				
Black-Winged Stilt <i>Himantopus himantopus</i>	56	162	74	246
GLAREOLIDAE-Egyptian Plover, Coursers and Pratincoles				
Egyptian Plover <i>Pluvianus aegyptius</i>	54	-	26	-
Collared Pratincole <i>Glareola pratincola</i>	-	5186	-	2658
CHARADRIDAE-Plovers and Lapwings				
African Wattled Lapwing <i>Vanellus senegalus</i>	84	214	246	296
Black-headed Lapwing <i>Vanellus tectus</i>	60	100	60	36
Spur-winged Lapwing <i>Vanellus spinosus</i>	226	676	530	1628
Little Ringed Plover <i>Charadrius dubius</i>	-	184	6	270
Little Ringed Plover <i>Charadrius pecuarius</i>	-	264	12	296
White headed Lapwing <i>Vanellus albiceps</i>	-	8	30	34
Long-toed Lapwing <i>Vanellus crassirostris</i>	-	450	-	1989
Common Ringed Plover <i>Charadrius hiaticula</i>	-	296	-	-
SCOLOPACIDAE-Sandpipers, Snipe and Phalaropes				
Common Greenshank <i>Tringa nebularia</i>	26	144	80	290
Common Sandpiper <i>Actitis hypoleucos</i>	68	256	148	237
Green Sandpiper <i>Tringa ochropus</i>	-	118	98	228
Wood Sandpiper <i>Tringa glareola</i>	-	98	44	331
Marsh Sandpiper <i>Tringa stagnatilis</i>	-	104	-	-
Common Redshank <i>Tringa tetanus</i>	-	30	-	-
Common Snipe <i>Gallinago gallinago</i>	-	6	-	7
STERNIDAE-Terns				
Little Tern <i>Sterna albifrons</i>	-	202	-	204
Whiskered Tern <i>Chlidonias hybridus</i>	-	108	-	127
White-winged Black Tern <i>Chlidonias leucopterus</i>	-	56	-	84
PTEROCLIDAE-Sandgrouses				
Four-banded Sandgrouse <i>Pterocles quadricinctus</i>	36	22	144	28
COLUMBIDAE-Pigeons and Doves				
Bruce's Green Pigeon <i>Treron waalia</i>	30	30	112	276
Blue spotted Wood Dove <i>Turtur afer</i>	464	225	1123	342
Red-eyed Dove <i>Streptopelia semitorquata</i>	422	366	1538	880
African Mourning Dove <i>Streptopelia decipiens</i>	312	232	1178	686
Vinaceous Dove <i>Streptopelia vinacea</i>	2546	1464	2682	2502
Laughing Dove <i>Streptopelia senegalensis</i>	654	362	1878	1866
Black-billed Wood Dove <i>Turtur abyssinicus</i>	460	220	1866	296
Speckled Pigeon <i>Columba guinea</i>	4825	246	6199	395
Namaqua Dove <i>Oena capensis</i>	206	6	293	34
MUSOPHAGIDAE-Turacos and Plantain –eaters				
Western Grey Plantain Eater <i>Crinifer piscator</i>	36	61	190	132
CUCULIDAE-Cuckoos and Coucals				
Senegal Coucal <i>Centropus senegalensis</i>	186	270	452	490
Black Coucal <i>Centropus grillii</i>	-	-	-	17
Klaa's Cuckoo <i>Chrysococcyx cupreus</i>	20	-	28	6
Didric Cuckoo <i>Chrysococcyx caprius</i>	10	-	-	3
Levaillant's Cuckoo <i>Oxylophus levaillantii</i>	4	-	4	4
Jacobin Cuckoo <i>Oxylophus jacobinus</i>	-	2	-	-
Black-Cuckoo <i>Cuculus clamosus</i>	-	2	-	-

TYTONIDAE-Barn Owl				
Barn Owl <i>Tyto alba</i>	-	24	-	-
STRIGIDAE				
Marsh Owl <i>Asio capensis</i>	-	-	-	4
Pearl-spotted Owlet <i>Glaucidium perlatum</i>	-	-	-	4
APODIDAE-Spinetails and Swifts				
African Palm Swift <i>Cypsiurus parvus</i>	228	1802	3298	2966
Little Swift <i>Apus affinis</i>	20258	1289	18504	4523
ALCEDINIDAE-Kingfishers				
Woodland Kingfisher <i>Halcyon senegalensis</i>	58	19	40	22
Malachite-Kingfisher <i>Corythornis cristata</i>	18	15	36	20
Pied Kingfisher <i>Ceryle rudis</i>	30	49	72	50
Grey-headed kingfisher <i>Halcyon leucocephala</i>	10	-	38	6
MEROPIDAE-Bee-eaters				
Little Bee-eater <i>Merops pusillus</i>	250	358	398	-
White-throated Bee-eater- <i>Merops albicollis</i>	30	382	26	899
Carmine Bee-eater <i>Merops nubicus</i>	20	740	56	782
Red-throated Bee-eater <i>Merops bulocki</i>	04	-	692	-
CORACIIDAE-Rollers				
Abyssinia Roller <i>Coracias, abyssinica</i>	16	40	115	63
Broad-Billed Roller <i>Eurystomus glaucurus</i>	-	11	-	8
PHOENICULIDAE-Wood-Hoopoes				
Green Wood-Hoopoe <i>Phoeniculus purpureus</i>	100	-	70	24
BUCEROTIDAE-Hornbills				
Red-billed Hornbill <i>Tockus erythrorhynchus</i>	148	68	512	220
African Grey Hornbill <i>Tockus nasutus</i>	6182	230	852	403
CAPITONIDAE-Barbets and Tinkerbirds				
Yellow-fronted Tinkerbird <i>Pogoniulus chrysocomus</i>	48	6	112	-
Bearded Barbet <i>Lybius dubius</i>	68	4	60	20
Vieillot's Barbet <i>Lybius vieilloti</i>	24	-	58	-
White-headed Barbet <i>Lybius leucocephelus</i>	2	-	-	-
INDICATORIDAE-Honeyguides				
Lesser Honeyguides <i>Indicator minor</i>	10	4	8	8
Greater Honeyguide <i>Indicator indicator</i>	-	-	2	-
PICIDAE-Wrynecks and Woodpeckers				
Grey Woodpecker <i>Dendropicos geortae</i>	26	14	26	6
ALAUDIDAE-Larks				
Crested Lark <i>Galerida cristata</i>	18	10	166	30
Chestnut-backed Sparrow-Lark <i>Eremopterix leucotis</i>	20	16	716	-
Sunlark <i>Galerida modesta</i>	-	8	-	-
HIRUNDINIDAE-Swallow and Martins				
Common Sand Martin <i>Riparia riparia</i>	106	1320	1380	2258
Wire-tailed Swallow <i>Hirundo smithii</i>	7982	6284	9680	9876
Ethiopian Swallow <i>Hirundo aethiopica</i>	3060	4150	6285	7168
Plain Martin <i>Riparia paludicola</i>	158	208	-	172
Mosque Swallow <i>Hirundo senegalensis</i>	748	-	12096	-
Red-rumped Swallow <i>Hirundo daurica</i>	-	-	844	-
MOTACILLIDAE-Wagtails, Pipits and Longclaws				
Yellow Wagtail <i>Motacilla flava</i>	2246	4454	2060	7928
Plain-backed Pipit <i>Anthus leucophrus</i>	-	74	-	37
Red-throated Pipit <i>Anthus cervinus</i>	-	20	-	-
PCYNONOTIDAE-Bulbuls				
Common Garden Bulbul <i>Pycnonotus barbatus</i>	512	230	1002	760

TURDIDAE-Thrushes and Chats				
West African Thrush <i>Turdus pelios</i>	216	208	236	227
Snowy-crowned Robin-Chat <i>Cossypha niveicapilla</i>	20	6	58	19
Northern Anteater Chat <i>Myrmecocichla aethiops</i>	34	-	28	-
Whinchat <i>Saxicola rubetra</i>	-	4	-	4
SYLVIIDAE- Warblers				
Singing Cisticola <i>Cisticola cantans</i>	14	12	-	-
Zitting Cisticola <i>Cisticola juncidis</i>	6	161	55	204
Winding Cisticola <i>Cisticola galactotes</i>	422	704	447	690
Tawny- Flanked Prinia <i>Prinia subflava</i>	194	166	219	92
Grey-Backed Camaroptera <i>Camaroptera brachyuran</i>	216	108	209	95
Great Reed Warbler <i>Acrocephalus arundinaceus</i>	10	10	-	-
European Reed Warbler <i>Acrocephalus scirpaceus</i>	-	6	12	-
Melodious Warber <i>Hippolais polyglotta</i>	6	12	-	10
Olivaceous Warbler <i>Hippolais pallida</i>	-	6	18	4
Northern Crombec <i>Sylvietta brachyura</i>	152	-	43	-
Sedge Warbler <i>Acrocephalus schoenobaenus</i>	10	-	9	-
Common Whitethroat <i>Sylvia communis</i>	4	-	19	-
Garden Warbler <i>Sylvia borin</i>	-	-	18	-
Red-winged Warbler <i>Heliolais erythroptera</i>	-	-	6	-
MUSCICAPIDAE- Flycatchers				
Pale Flycatcher <i>Melaenornis (Empidornis) pallidus</i>	2	14	10	12
Pied Flycatcher <i>Ficedula hypoleuca</i>	77	14	-	-
Northern Black Flycatcher <i>Melaenornis (E) edoloioides</i>	16	-	-	-
Spotted Flycatcher <i>Muscicapa striatus</i>	-	6	-	-
Swamp Flycatcher <i>Muscicapa aquatica</i>	-	-	7	-
PLATYSTEIRIDAE-Flycatchers, Batises and Wattle-eyes				
Senegal Batis <i>Batis senegalensis</i>	16	-	45	-
Common Wattle - eye <i>Platysteira cyanea</i>	-	-	7	-
MONARCHIDAE- Paradise (Monarch) flycatchers				
African Paradise Flycatcher <i>Terpsiphone viridis</i>	42	81	34	79
TIMALIIDAE-Babblers				
Brown Babbler <i>Turdoides plebejus</i>	36	134	60	146
ZOSTEROPIDAE- White-eyes				
Yellow White-eye <i>Zosterops senegalensis</i>	14	30	26	143
NECTARINIIDAE- Sunbirds				
Pigmy Long-tailed Sunbird <i>Hedydipna platurus</i>	50	22	52	12
Beautiful Sunbird <i>Cinnyris pulchella</i>	238	108	248	80
Scarlet-chested Sunbird <i>Chalcomitra senegalensis</i>	120	-	199	30
Olive-bellied Sunbird <i>Cinnyris chloropygia</i>	10	-	7	-
Variable Sunbird <i>Cinnyris venusta</i>	6	-	19	-
Copper Sunbird <i>Cinnyris cupreus</i>	-	-	15	7
LANIIDAE- True Shrikes				
Isabelline Shrike <i>Lanius isabellinus</i>	-	4	-	6
Woodchat Shrike <i>Lanius senator</i>	-	-	-	4
Yellow-billed Shrike <i>Corvinella corvina</i>	-	-	-	8
MALACONOTIDAE-Brubus, Boubous, Gonoleks, Puffback and Bush-shrikes				
Yellow-crowned Gonolek <i>Laniarius barbarus</i>	378	226	384	224
Sulphur-breasted Bush-Shrike <i>Telophorus sulfureopectus</i>	6	5	6	-
Black-crowned Tchagra <i>Tchagra senegala</i>	60	-	91	-
Grey-headed Bush-shrike <i>Malaconotus blanchoti</i>	4	-	5	-
DICRURIDAE-Drongo				
Fork-tailed Drongo <i>Dicrurus adsimilis</i>	4	-	-	-
CORVIDAE-Magpies, Crows and Ravens				
Pied crow <i>Corvus albus</i>	36	40	-	58

ORNIOLIDAE- Orioles				
African Golden Oriole <i>Oriolus auratus</i>	6	4	-	-
STURNIDAE- Starlings				
Long-tailed Glossy Starling <i>Lamprotornis caudatus</i>	278	210	432	440
Purple Glossy Starling <i>Lamprotornis purpureus</i>	180	268	330	406
Chestnut-bellied Starling <i>Lamprotornis pulcher</i>	38	-	-	-
BUPHAGIDAE- Oxpeckers				
Yellow-billed Oxpecker <i>Buphagus africanus</i>	50	50	86	-
PASSERIDAE- Sparrows				
Northern Grey-headed Sparrow <i>Passer griseus</i>	298	76	348	110
Bush Petronia <i>Petronia dentata</i>	110	-	196	-
PLOCEIDAE-Typical Weavers				
Red-billed Quelea <i>Quelea quelea</i>	10,828	24,938	14,733	36,083
Northern Red Bishop <i>Euplectes (orix) franciscanus</i>	167	216	151	319
White-billed Buffalo Weaver <i>Bubulornis albirostris</i>	48	36	-	-
Village Weaver <i>Ploceus cucullatus</i>	2,510	13,90	3,050	2,512
Little Weaver <i>Ploceus luteolus</i>	1592	796	1906	1089
Yellow-crowned Bishop <i>Euplectes afer</i>	14	84	-	40
Chestnut-crowned Sparrow-weaver <i>Plocepasser superciliosus</i>	512	-	816	-
Black-headed Weaver <i>Ploceus melanocephalus</i>	189	394	287	580
Red-headed Quelea <i>Quelea erythrops</i>	-	-	4065	-
ESTRILDIDAE- Estrildid Finches				
Red-billed Firefinch <i>Lagonosticta senegala</i>	1628	806	2945	1123
Black-rumped Waxbill <i>Estrilda troglodytes</i>	769	522	1859	974
Bronze Mannkin <i>Lonchura cucullata</i>	420	458	526	1429
Zebra Waxbill <i>Amandava subflava</i>	96	96	-	631
Red-cheeked Cordon-bleu <i>Uraeginthus bengalus</i>	1338	464	2040	1816
Warbling Silverbill <i>Lonchura cantans</i>	280	1236	477	1537
Lavender Waxbill <i>Estrilda caerulescens</i>	122	-	96	-
Black-faced Firefinch <i>Lagonosticta larvata</i>	36	-	-	-
VIDUIDAE-Indigobirds and Whydah				
Village Indigobird <i>Vidua chalybeata</i>	139	160	133	138
Pin-tailed Whydah <i>Vidua macroura</i>	3096	8422	5888	921
FRINGILLIDAE-True finches				
Yellow-fronted Canary <i>Serinus mozambicus</i>	70	16	42	22
White-rumped Seed-eater <i>Serinus leucopygius</i>	410	-	835	64
Streaky-headed Seed-eater <i>Serinus gularis</i>	118	-	434	22
EMBERIZIDAE-Buntings				
Cinnamon-breasted Rock-bunting <i>Emberiza tahapis</i>	163	-	253	-

TABLE 2 compares the diversity of this vertebrate class of family, genus and species levels.

Table 2: A Comparison of the Bird Species of the Two Wetlands

Taxonomic class	Kiri lake			Gyawana lake		
	Family	Genus	Species	Family	Genus	Species
Aves	53	111	163	55	113	160

163 species in 53 bird family families were recorded at Kiri lake, while 160 species in 55 bird families were recorded at Gyawana lake. There was no significance difference in species diversity within bird families between the two lakes ($p \leq 0.05$; Mann – Whitney U –Test).

TABLES 3 and 4 compare the biotic characteristics of the two wetlands against the criteria used in assessing sites for designation as Ramsar or IBA sites.

Table3. Comparison of the Biotic Characteristics of the lakes against the Ramsar Criteria

Ramsar Criteria	Whether or not site qualifies under the criteria		
		Kiri lake	Gyawana lake
Criteria 1: Criteria for representative or unique wetlands	a.	No	Yes (Naturalness)
	b.	No	Yes (Sump for flood water)
	c.	No	No
Criteria 3: Criteria based on water fowl	a.	No	No
	b.	No	Yes (Long-toed Lapwing)
	c.	No	No

One of the sites (Gyawana lake) qualifies as Ramsar site under criteria 1 and 3.

Table 4: Weighing Of the Biotic Characteristics of the Lakes against the IBA Categories

IBA Categories	Whether or Not Site Qualifies Under the Category		
		Kiri lake	Gyawana lake
Category A1: Globally threatened species		No	No
Category A2: Restricted range species		No	No
Category A3: Biome restricted assemblages	A03: Sahel	Yes (1 of Nigeria's 10 Sahel biome restricted species)	No
	A04: Sudan Guinea	Yes (8 of Nigeria's 42	Yes (5 of Nigeria's 42 Sudan-
	A05: Guinea- Congo Forest	Sudan-Guinea biome restricted)	Guinea biome restricted species)
		No	No
Category A4: Globally important congregations	A07: Afrotropical Highlands	No	No
	i.)	No	No
	ii.)	No	No
"Bottleneck site"	iii.)	No	No
		No	No

Both sites are very weakly qualified as IBAs Category A3 (A04); i.e., assemblages of Sudan-Guinea Biome restricted species. Where as one of the sites (Gyawana lake) qualify for designation as Ramsar site under criteria 1 and 3, none strongly qualifies as an IBA.

IV. Discussion

Wetlands continue to attract diverse and large numbers of Palearctic migrants, Afrotropical water-birds and resident. Each of the two wetlands holds species that represent more than 10% of Nigeria's birdlife.

Ezealor [13] reported that Nigeria has about 910 species of birds in 90 families. Obot [14] recorded 120 bird species in 50 families in a survey of the Upper Banue basin (Wuro Bokki to Jen) out of which 14 species in 11 families was recorded at Kiri lake while no record has been documented for Gyawana lake. These diverse and large numbers of birds may be attributed to the flora and fauna these two wetlands support which are utilized as food, cover or shelter.

Large skeins of waterfowl which congregate at the lakes during the daytime often forage on the fruits and flowers of *Nymphaea lotus*. Other waterfowls and water – related birds species were observed foraging for invertebrates on decomposing floating mats of *Nymphaea lotus*. Ezealor [15] also observed that aquatic macrophytes (primary producers *Nymphaea lotus*) were used for food and cover and aquatic invertebrates, many insect species, e.g. *Dytiscus* beetles and their larvae were consumed.

Birds play an important role in cycling, importing and exporting of nutrients in the ecosystem due to their large number. The pellets and faecal droppings, which represent a significant nutrient input into the agro-ecosystem contains nitrogen that is readily available to plants and is usually deposited along with other essential nutrients such as phosphorus and potassium (NPK). In view of the scarcity and exorbitant price of artificial fertilizers in the study area, this can be substituted. Egested pellets of water-related birds may also be an important source of food for fishes especially around heronries where large amount of food are brought nestlings. This study contradicts the study of Obot [14] in which less number of birds were numerated at Kiri lake. This contradiction could be attributed to the time laps/frame, some environmental factors and the season the study was conducted.

V. Conclusion

In conclusion, none of the birds recorded in the area is of global conservation significance but the study brings into notice the need to conserve natural wetland ecosystems as even small sized natural wetlands compare favourably in renewable natural resources with larger human-made lakes in the same ecological area.

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References

- [1] W.E. Odum, C.C Welvor, and J.J. Smith III, The ecology of the mangroves of South Florida: a community profile. (U.S. Fish and Wildlife Service, Office of Biological Service, Washington, D.C. FWS/OBS-81/24. 1985) p.144.
- [2] P.R.O. Kio and B.A. Ola-Adams, Utilization and Development in T.V.I. Akpata and D.U.U. Okali (Ed.) Nigerian wetlands. Man and Biosphere State – of – Knowledge Workshop on Nigerian Wetlands. The Nigerian MAB Committee, UNESCO and the Nigerian Conservation Foundation. 14 (Yemi Press, Semonda, Ibadan ,1990) P 68.
- [3] Ramsar Convention Website (2003). www.ramsar.org.
- [4] ICBP putting diversity on a map: priority area for global conservation. Published by the International Council for Bird Preservation (ICBP, now Birdlife International). (sThe Burlington Press, Cambridge, U.K. 1992, 90p.
- [5] J.L. Fiselier, Living off the floods: strategies for the integration of conservation and sustainable resource utilization in floodplains. (Environmental Database on Wetland Interventions (EDWIN, The Netherlands. 1990) p.112.
- [6] E.B. Barbier, W.M. Adams, and K. Kimmage, Economic valuation of wetland benefits: the Hadejia – Jama’are floodplain, Nigeria. The London Environmental Economics Center, International Institute for Environment and Development (IIED, London, 1991) p.26.
- [7] E.O. Wagari, Message from UNESCO. in T.V. Akpata and D.U.U Okali (Ed.), Nigerian Wetlands: Man and Biosphere State – of – Knowledge Workshop on Nigerian Wetlands. The Nigerian MAB Committee, UNESCO and the Nigerian Conservation Foundation (Yemi Press, Semonda, Ibadan, 1990) 4-6.
- [8] D. Pomeroy and B.C. Tenengecho, Studies of birds in a semi-arid area of Kenya III- the use of ‘time species – counts’ for studying regional avifauna. Journal of Tropical Ecology 2, 1986, 231-237.
- [9] D. Liley and P.A. Robertson Assessment of sites: Measurement of species richness and diversity, in C. Bibby, M. Jones and S. Marsden(Ed.), Expedition Field Techniques: Birds Survey. (Published by the Expedition Advisory Center, Royal Geographical Society, London, 1998) 76-98.
- [11] R. Demey and N. Borrow, Birds of western Africa. (Published by Christopher Helm, London. 2001) p.832.
- [12] J. Fowler, and L. Cohen, Statistics for Ornithologists. Guide No. 22. British Trust for Ornithology. (Undated) p. 150.
- [13] R.R Sokal and F.J. Rohlf, Biometry: the Principles and Practice of Statistics in Biological Research. (W.H. Freeman and Company, New York, 2000) p 887.
- [14] A.U. Ezealor, Ecological profile of a Nigerian Sahelian Wetland: Toward Integrated Vertebrate Pest Damage Management. L. diss. Virginia Polytechnic Institute and State University, Blacksburg, Virginia, USA, 1995.
- [15] E.Obot, Wetlands of the Upper Benue Basin. A Biodiversity Survey of the Upper Benue River (Wuro Bokki to Jen). 2000. P.35.
- [16] A.U. Ezealor, Critical sites biodiversity conservation in Nigeria.(Nigerian Conservation Foundation: Lagos, Nigeria, 2002). p12.