Global Advanced Research Journal of Agricultural Science (ISSN: 2315-5094) Vol. 5(11) pp. 405-412, November, 2016 Issue.
Available online http://garj.org/garjas/home

Full Length Research Paper

Checklist of Bird Species at the Hadejia-Nguru Wetlands, Nigeria

Sabo, B. B.

Jigawa Research Institute, PMB 5015, Kazaure, Jigawa State,
Email: bashirsabo@yahoo.com; Tel: +234 8034323687

Accepted 07 November, 2016

A study to generate a checklist of bird species at the Hadejia-Nguru wetlands, Nigeria, was conducted between October – December 2015. Eight point counts stations measuring 400 m were each placed on the different habitat types and each surveyed three times within the study period. One Hundred and Sixty four bird species from 50 families were recorded during the survey. Four of the 164 bird species recorded were endemic to Africa, which were the Senegal Parrot *Poicephalus senegalus*, Bearded Barbet *Lybiusdubius*, Vieillot's Barbet *Lybiusvieilloti*, and Ospray. The results of this study showed that the bird species found at the Hadejia-Nguru wetlands are either Residents like the African grey hornbill, Cattle Egret, Black-headed Heron, Vinaceous Dove, Grey-headed Kingfisher; Intra- African migrants like the Abdim Stork; Vagrants like the Squacco Heron, Black-crowned Night Heron and Palearctic Migrants like the White Stork. Majority of the bird species identified were of Least Concern 3.1 IUCN status, some are vulnerable like grey falcon, where as Pallid Harrier, Red-neck Falcon and Red-footed falcon are Near threatened and some bird species where not evaluated like intermediate egret and purple swamphen 3.1 IUCN status. The checklist produced will provide information for further research.

Keywords: Checklist, Bird species, Hadejia-Nguru Wetlands,

INTRODUCTION

A Wetland is an area of land where the soil is saturated with moisture either permanently or seasonally such areas may also be covered partially or completely by shallow pools of water. Wetlands are also defined as transitional land between terrestrial and aquatic system that are characterized by certain water regimes, plant species and soil characteristics. Convention on wetlands of international importance (RAMSAR) defined wetland as areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary with water that is static or flowing, fresh, brackish or salty including areas of marine water the depth of which at low tide does not exceeds six meters (Ramsar, 1994).

Wetlands are favored habitats for diverse, abundant and large invertebrates, seeds, tubers, and vertebrates which are important foods of birds (David *et al,* 2009; Muhammad et al, 2012), supporting valuable bird species such as songbirds and shorebirds besides a wide habitat range (LeGrange, 1997; Anderson, 2003). Wetlands are ideal habitats for birds serving as roosting and for thermoregulation (Shiemelis and Afework, 2008), also represent an important refuge for bird communities (Anderson, 2003). Globally, threatened avian species depends on wetlands (Paracuellos, 2006) and a servicing point for diverse bird species especially migratory birds to rest and refuel (Ramsar, 2000; Singh, and Laura, 2012).

thus, a hotspot for the conservation of important bird species (Lameed, 2011). Birds also use wetlands as a source of drinking water, shelter, and social interaction (Judy *et al.,* 1996) which provides an excellent nesting and feeding sites protected from predators (Donald, 1989; Crafter and Njaguna, 1992).

Avian adaptations to utilize wetlands are diverse and include anatomical, morphological, and behavioral changes. Anatomically, they include designs for diving and swimming, such as body compression to increase specific gravity (loons and grebes), compressed body structure to allow them to pass between dense vegetation (rails and bitterns), or adaptations for plunge- diving from great heights (Niemi, 1985; Milton, 1999, Lameed, 2011). Morphologically include bills that strain, peck, spear, walking, grabbing, and holding fish (Niemi, 1985). Not only do body parts differ in general form, but also size of bills, legs, and flight patterns differ across a gradient of wetland edges (Ezealor, 2001). Wetlands are known for their abundance of birds. The use of wetlands and their resources is widespread among many diverse bird taxa of the world. Avian adaptation to utilize wetlands and other aquatic systems are diverse and include anatomical, morphological, behavioral changes. Anatomically, they include designs for diving and swimming, such as body compression to increase gravity, or adaptation for plunge diving from great heights (Niemi, 1985). Respiratory physiology differs dramatically in those bird species that engage in long term and deep diving (Ezealor, 2002). Morphological adaptations include bills that strain, peck, spear, store and grab, and feet that allow swimming, diving, walking on mudflat, wadding or grabbing and holding fish. Not only do body parts differ in general form, but also size of bills, legs, and flight patterns differ across a gradient of wetland edges (Ezealor, 2001). As a result of these adaptations, birds are better equipped as a group to exploit wetland resources and are often used as indicators of conditions within a wetland ecosystem (Niemi, 1985).

Hadejia-Nguru Wetland (HNW) supports a total of 378 wetland bird species and the highest total numbers of water birds recorded during surveys were 259,769 in 1995; 201,133 in 1996 and 324,510 in 1997 (Birdlife International, 2006). The ornithological importance of the Hadejia-Nguru wetlands was further confirmed by subsequent ornithological surveys and analyses reported by Garba-Boyi *et al***,** (1993). According to the report, the Hadejia-Nguru wetlands support more than 1% of the West African populations of at least nine waterfowl species. The species composition, especially those of *Anatidae,* is remarkably stable. Numbers do fluctuate but seem to be increasing in recent years. Recent surveys have also revealed an increasing importance of the wetland for other waterbirds, especially waders. For example, 70 845 Ruff *Philomachus pugnax* were in the Hadejia- Nguru wetlands in January 1995, about 30% of those recorded in West Africa at that time (Dodman and Taylor, 2001).

Birds are good environmental indicators, revealing the state of the ecosystems such as wetland, fadama and forest edges. It also serves as dispersal agents in transferring nutrients and spores from one place to another during their migration and local movements (Niemi, 1985). The aim of the study was thus, to provide information on the avifauna of the Hadejia-Nguru wetlands, by providing a checklist of bird species in the area.

MATERIALS AND METHODS

Study area

The study was conducted in Hadejia River located in northeast, Nigeria 12o 10' N and 13o 0' N, 10o15' E and 11o 30' E, (Figure 1). Hadejia-Nguru Wetlands (HNWs) comprise of permanent lakes and seasonally flooded pools connected by a network of channels. The wetlands complex is formed by the Hadejia-Jama'are Rivers which drained into Lake Chad and covered an area of about 3, 500 $km^{2.}$ It is a Ramsar site and an Important Bird Area (IBA) being recognized nationally and internationally as an ecological area for resident, inter-African and Palearctic migrant bird species in sub-Sahara region, Nigeria. The area experience two distinct seasons: wet season from May to September, and dry season from October to April. Total annual rainfall received in the area ranges between 500- 600 mm (Ogunkoya and Dami, 2007). The HNWs is bordered by three states of Bauchi, Jigawa and Yobe with human population of about 1.5 million (Blench, 2013).

METHOD

Bird Survey (Point Count)

Determination of bird species richness and generation of checklist

This survey was carried out from October – December, 2015. Point counts were used to record birds within study sites (Bibby *et al.,* 2000; Gregory *et al.,* 1998 and Wasilco *et al.,* 1995). This involved recording birds at predefined wetlands within the Hadejia- Nguru wetlands complex. Point counts were used because it allows the observer travel within the area and stop at predefined spots, allow the bird's time to settle, and then record all the birds seen or heard for a predetermined time, ranging, at the extremes, from 2 to 20 min. Bird count was from 06:30h to 10:00h in the morning and 16:00h to 18:00h in the evening. Upon arrival at a site, care was taken not to flush or disturb the birds. Global Positioning System (GPS) was used to mark location of each point. A total of 70 point counts were carried out across the wetlands. Sites were visited in the morning and repeated in the evening. These sites were

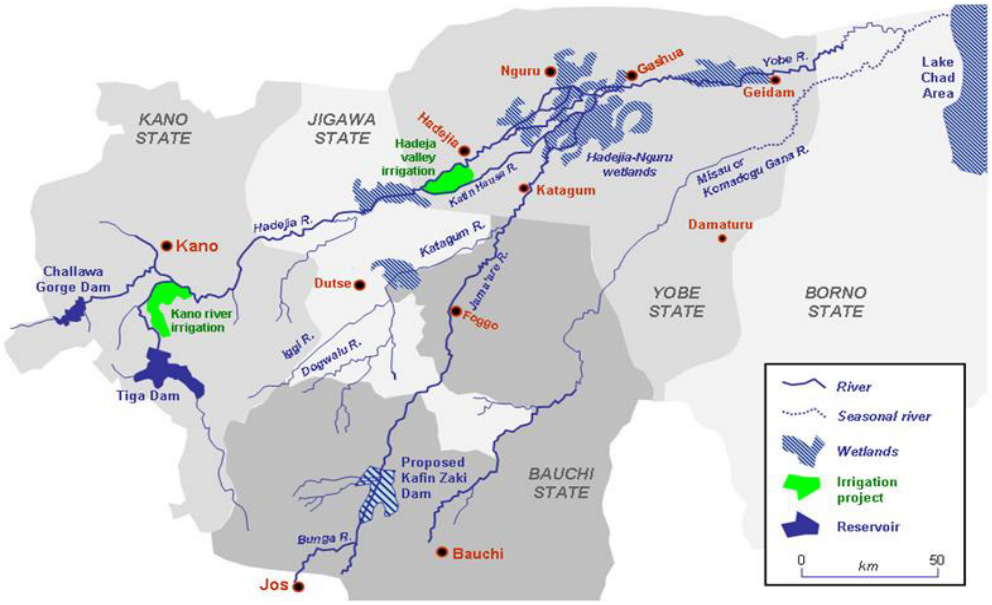

Figure 1: Map of Hadejia-Nguru Wetlands (Sulaiman et al., 2014)

Table 1: Bird Species and Population per Sampling Location

Location	Number of Bird Species	Total Count
Baturiya Kandamau	79	19736
Baturiya Kwasabat	68	14544
Hadejia Barrage	72	2938
Margadu	56	4144
Marma Channel	60	7126
Maikintari	64	5644
Muzza	85	2698
Nguru Barrack	60	4039
Nguru Lake	51	3021
Zemu	80	24215
TOTAL		88,105

Source: Field Survey, 2015

revisited three times, once every month. Number of points within each surveyed wetland depends on wetlands size (minimum of 6 and maximum of 8 points). Each point was surveyed for a period of 10 minutes with 2 minutes wait period and 400m interval between points and a radius of 150m. Bird identification was aided by the use of a pair of Binoculars (8 × 40) and a field guide to West African Birds by Borrow and Demey, (2014). Ten (10) wetland areas were selected based on accessibility to the areas. Count point stations were surveyed three times to maximize accuracy and to reduce errors.

Data Analyses

Data was analyzed using Paleontological statistics (PAST version 2.17) software package (Hermer *et al*, 2001). Shannon-Weiner diversity index at 5% level of significance was used to measure species diversity.

RESULTS

Bird species richness and checklist

The results presented in table 1 below showed the outcome of point count of bird species diversity in Hadejia-Nguru wetlands from October to December, 2015. Point count method detected a total of 88,105 individual birds that belong to 165 species of 50 families in Hadejia-Nguru wetlands as shown in table 2 below.

Table 2: Check List of Birds found in Hadejia-Nguru Wetlands during the Survey

Common Name	Scientific Name	Family	IUCN Red List Status
Abdim Stork	*Ciconia abdimii*	Ciconiidae	Least Concern
Abyssinian Roller	*Coracias abyssinica*	Coraciidae	Least Concern
African Grey Hornbill	*Tockus nasutus*	Bucerotidae	Least Concern
African Jacana	*Actophilornis africanus*	Jacanidae	Least Concern
African Marsh Harrier	*Circus ranivorus*	Accipitridae	Least Concern
African Mourning Dove	*Streptopelia decipiens*	Columbidae	Least Concern
African Openbill	*Anastomus lamelligerus*	Ciconiidae	Least Concern
African Palm Swift	*Cypsiurus parvus*	Apodidae	Least Concern
African Paradise Flycatcher	*Terpsiphone viridis*	Monarchidae	Least Concern
African Pygmy Geese	*Nettapus auritus*	Anatidae	Least Concern
African Pygmy Kingfisher	*Ispidina picta*	Alcedinidae	Least Concern
African Reed Wabler	*Acrocephalus baeticatus*	Acrocephalidae	Least Concern
African Silverbill	*Euodice cantans*	Estrildidae	Least Concern
African Swallow-tailed Kite	*Chelictinia riocourii*	Accipitridae	Least Concern
Allen's Gallinule	*Porphyrio alleni*	Rallidae	Least Concern
Bearded Barbet	*Lybius dubius*	Capitonidae	Least Concern
Beautiful Sunbird	*Cinnyris pulchellus*	Nectariniidae	Least Concern
Black Crake	*Amaurornis flavirostris*	Rallidae	Least Concern
Black headed Heron	*Ardea melanocephala*	Ardeidae	Least Concern
Black Heron	*Egretta ardesiaca*	Ardeidae	Least Concern
Black Kite	*Milvus migrans*	Accipitridae	Least Concern
Black Scrub Robin	*Cercotrichas podobe*	Muscicapidae	Least Concern
Black wood Hoopoe	Phoeniculus somaliensis	Phoeniculidae	Least Concern
Black-crowned Tchagra	*Tchagra senegala*	Malaconotida	Least Concern
Black-headed Lapwing	*Vanellus tectus*	Charadriidae	Least Concern
Black-headed Weaver	*Ploceus melanocephalus*	Ploceidae	Least Concern
Black-shouldered Kite	*Elanus caeruleus*	Accipitridae	Least Concern
Black-winged Stilt	*Himantopus himantopus*	Recurvirostridae	Least Concern
Blue spotted Wood Dove	*Turtur afer*	Columbidae	Least Concern
Blue-headed Dove	*Turtur brehmeri*	Columbidae	Least Concern
Blue-naped Mousebird	*Urocolius macrourus*	Coliidae	Least Concern
Brown-backed Honeybird	*Prodotiscus regulus*	Indicatoridae	Least Concern
Buffalo Weaver	*Bubalornis albirostris*	Ploceidae	Least Concern
Cattle Egret	*Bubulcus ibis*	Ardeidae	Least Concern
Chestnut Bellied Starling	*Lamprotornis pulcher*	Sturnidae	Least Concern
Common Bulbul	*Pycnonotus barbatus*	Pyconotidae	Least Concern
Common greenshank	*Tringa nebularia*	Scolopacidae	Least Concern
Common Kestrel	*Falco naumanni*	Falconidae	Least Concern
Common Moorhen	*Gallinula chloropus*	Rallidae	Least Concern
Common Sand martin	*Riparia riparia*	Hirundinidae	Least Concern
Common Sandpiper	*Actitis hypoleucos*	Scolopacidae	Least Concern
Common Snipe	*Gallinago gallinago*	Scolopacidae	Least Concern
Common Swift	*Apus apus*	Apodidae	Least Concern
Common Tern	*Sterna hirundo*	Sternidae	Least Concern
Crested Lark	*Galerida cristata*	Alaudidae	Least Concern
Cut-throat Finch	*Amadina fasciata*	Estrildidae	Least Concern

Table 2: Continue

Dark Chanting Goshawk	*Melierax metabates*	Accipitridae	Least Concern
Dwarf Bittern	*Botaurus stellaris*	Ardeidae	Least Concern
Ethiopian Swallow	Hirundo aethiopica	Hirundinidae	Least Concern
Eurasian Reed Wabler	*Acrocephalus scirpaceus*	Acrocephalidae	Least Concern
Fulvous Whistling Duck	*Dendrocygna bicolor*	Anatidae	Least Concern
Gabar Goshawk	*Micronisus gabar*	Accipitridae	Least Concern
Garganey	*Anas querquedula*	Anatidae	Least Concern
Glossy Ibis	*Plegadis falcinellus*	Threskiornithidae	Least Concern
Grasshopper Buzard	*Butastur rufipennis*	Accipitridae	Least Concern
Great Egret	*Ardea alba*	Ardeidae	Least Concern
Great spotted Cuckoo	*Clamator glandarius*	Cuculidae	Least Concern
Greater honeyguide	*Indicator indicator*	Indicatoridae	Least Concern
Greater Reed Wabler	*Acrocephalus arundinaceus*	Acrocephalidae	Least Concern
Greater Swamp Wabler	*Acrocephalus rufescens*	Acrocephalidae	Least Concern
Greater-blue eared Starling	*Lamprotornis chalybaeus*	Sturnidae	Least Concern
Green Sandpiper	*Tringa ochropus*	Scolopacidae	Least Concern
Green Wood-hoopoe	*Phoeniculus purpureus*	Phoeniculidae	Least Concern
Green-wood Hoopoe	*Phoeniculus purpureus*	Phoeniculidae	
Grey Falcon	Falco hypoleucos	Falconidae	Vulnerable
Grey Heron	*Ardea cinerea*	Ardeidae	Least Concern
Grey Kestrel	*Falco ardosiaceus*	Falconidae	Least Concern
Grey-backed Camaroptera	*Camaroptera brevicaudata*	Sylviidae	Least Concern
Grey-backed Heron	*Ardea cinerea*	Ardeidae	Least Concern
Grey-headed Kingfisher	*Halcyon leucocephala*	Alcedinidae	Least Concern
Gull-billed Tern	*Sterna nilotica*	Sternidae	Least Concern
Hoopoe	*Upupa epops*	Upupidae	Least Concern
Intermediate Egret	*Egretta intermedia*	Ardeidae	Not Evaluated
Knob billed duck	Sarkidiornis melanotos	Anatidae	Least Concern
Lanner Falcon	*Falco biarmicus*	Falconidae	Least Concern
Laughing Dove	*Streptopelia senegalensis*	Columbidae	Least Concern
Lesser Jacana	*Microparra capensis*	Jacanidae	Least Concern
Lesser Moorhen	*Gallinula angulata*	Rallidae	Least Concern
Lesser Reed Wabler	Acrocephalus gracilirostris	Acrocephalidae	Least Concern
Lesser Swamp Wabler	*Acrocephalus gracilirostris*	Acrocephalidae	Least Concern
Little Bee-eater	*Merops pusillus*	Meropidae	Least Concern
Little Bittern	*Ixobrychus minutus*	Ardeidae	Least Concern
Little Egret	*Egretta garzetta*	Ardeidae	Least Concern
Little Stint	*Calidris minuta*	Scolopacidae	Least Concern
Little Swift	*Apus affinis*	Apodidae	Least Concern
Little Tern	*Sterna albifrons*	Sternidae	Least Concern
Little Weaver	*Ploceus luteolus*	Ploceidae	Least Concern
Lizard Buzzard	*Kaupifalco monogrammicus*	Accipitridae	Least Concern
Longtail Cormorant	*Phalacrocorax africanus*	Phalacrocoracidae	Least Concern
Longtail Glossy Starling	*Lamprotornis caudatus*	Sturnidae	Least Concern
Malachite Kingfisher	*Corythornis cristatus*	Alcedinidae	Least Concern
Marsh Sandpiper	*Tringa stagnatilis*	Scolopacidae	Least Concern
Namaqua Dove	*Oena capensis*	Columbidae	Least Concern
Night Heron	*Gorsachius leuconotus*	Ardeidae	Least Concern
Northern Grey Headed Sparrow	*Passer griseus*	Passeridae	Least Concern

Table 2: Continue

Northern Pintail	*Anas acuta*	Anatidae	Least Concern
Northern Red Bishop	*Euplectes franciscanus*	Ploceidae	Least Concern
Ospray	*Pandion haliaetus*	Pandionidae	Least Concern
Painted Snipe	*Rostratula benghalensis*	Rostratulidae	Least Concern
Pallid Harrier	*Circus macrourus*	Accipitridae	Near threatened
Piapiac	*Ptilostomus afer*	Corvidae	Least Concern
Pied Crow	*Corvus albus*	Corvidae	Least Concern
Pied Kingfisher	*Ceryle rudis*	Alcedinidae	Least Concern
Pin-tailed Whydah	*Vidua macroura*	Viduidae	Least Concern
Pin-tailed Whydah	*Vidua macroura*	Viduidae	
Plain Martin	*Riparia paludicola*	Hirundinidae	Least Concern
Purple Glossy Starling	*Lamprotornis purpureus*	Sturnidae	Least Concern
Purple Heron	*Ardea purpurea*	Ardeidae	Least Concern
Purple Swamphen	*Porphyrio madagascariensis*	Rallidae	Not Recognized
Red Cheeked Cordon-blue	*Uraeginthus bengalus*	Estrilididae	Least Concern
Red-billed Firefinch	*Lagonosticta senegala*	Estrildidae	Least Concern
Red-billed Hornbill	*Tockus erythrorhynchus*	Bucerotidae	Least Concern
Red-billed Quelea	*Quelea quelea*	Ploceidae	Least Concern
Red-eyed Dove	*Streptopelia semitorquata*	Columbidae	Least Concern
Red-footed Falcon	*Falco vespertinus*	Falconidae	Near Threatened
Red-headed Love bird	*Agapornis pullarius*	Psittaculidae	Least Concern
Red-neck Falcon	*Falco chicquera*	Falconidae	Near Threatened
Rose-ringed Parakeet	*Psittacula krameri*	Psittacidae	Least Concern
Ruff	*Philomachus pugnax*	Scolopacidae	Least Concern
Sandgrouse	*Pterocles exustus*	Pteroclidae	Least Concern
Scaly Francolin	*Francolinus squamatus*	Phasianidae	Least Concern
Sedge wabler	*Acrocephalus schoenobaenus*	Acrocephalidae	Least Concern
Senegal Coucal	*Centropus senegalensis*	Cuculidae	Least Concern
Senegal Kingfisher	Halcyon senegaloides	Alcedinidae	Least Concern
Senegal Parrot	*Poicephalus senegalus*	Psittacidae	Least Concern
Shikra	*Accipiter badius*	Accipitridae	Least Concern
Southern Grey Shrike	*Lanius meridionalis*	Laniidae	Least Concern
Speckle Fronted Weaver	*Sporopipes frontalis*	Ploceidae	Least Concern
Speckled Pigeon	*Columba guinea*	Columbidae	Least Concern
Spotted Red Shank	*Tringa erythropus*	Scolopacidae	Least Concern
Spur-winged Geese	*Plectropterus gambensis*	Anatidae	Least Concern
Spur-winged Lapwing	*Vanellus spinosus*	Charadriidae	Least Concern
Squacco Heron	*Ardeola ralloides*	Ardeidae	Least Concern
Standard-winged Nightjar	*Macrodipteryx longipennis*	Caprimulgidae	Least Concern
Stone Patridge	*Ptilopachus petrosus*	Phasianidae	Least Concern
Sudan Golden Sparrow	*Passer luteus*	Passeridae	Least Concern
Tambourine Dove	*Turtur tympanistria*	Columbidae	Least Concern
Tawny Flank Prinia	*Prinia subflava*	**Sylviidae**	Least Concern
Thick-billed Cuckoo	*Pachycoccyx audeberti*	Cuculidae	Least Concern
Velliot's Barbet	*Lybius vieilloti*	Capitonidae	Least Concern
Village Indigo	*Vidua chalybeata*	Viduidae	Least Concern
Village Weaver	*Ploceus cucullatus*	Ploceidae	Least Concern
Vinaceous Dove	*Streptopelia vinacea*	Columbidae	Least Concern
Vitelline Masked Weaver	*Ploceus vitellinus*	Ploceidae	Least Concern
West African Swallow	*Hirundo domicella*	Hirundinidae	Least Concern

Table 2: Continue

Western Grey Plantain eater	*Crinifer piscator*	Musophagidae	Least Concern
Western Marsh Harrier	*Circus aeruginosus*	Accipitridae	Least Concern
Western Olivaceous Wabler	*Iduna opaca*	Acrocephalidae	Least Concern
Western Reed Wabler	*Acrocephalus stentorius*	Acrocephalidae	Least Concern
Whiskered Tern	*Chlidonias hybridus*	Sternidae	Least Concern
White breasted Kingfisher	Halcyon smyrnensis	Alcedinidae	Least Concern
White Face Whistling Duck	*Dendrocygna viduata*	Anatidae	Least Concern
White Stork	*Ciconia ciconia*	Ciconiidae	Least Concern
Winding Cisticola	*Cisticola galactotes*	Sylviidae	Least Concern
Wood Sandpiper	*Tringa glareola*	Scolopacidae	Least Concern
Wood-chat Shrike	*Lanius senator*	Laniidae	Least Concern
Yellow billed Kite	*Milvus aegyptius*	Accipitridae	Least Concern
Yellow Bishop	*Euplectes capensis*	Ploceidae	Least Concern
Yellow Crown Gonolek	*Laniarius barbarous*	Malaconotida	Least Concern
Yellow Fronted Canary	*Serinus mozambicus*	Fringillidae	Least Concern
Yellow Wagtail	*Motacilla flava*	Motacillidae	Least Concern
Yellow-bill Oxpecker	*Buphagus africanus*	Sturnidae	Least Concern
Zitting Cisticola	*Cisticola juncidis*	Sylviidae	Least Concern

Names are written following (Borrow and Demey, 2014).

DISCUSSIONS

Sulaiman et al, (2014a) and Garba et al, (2010) reported 110,162 and 101,450 birds count in the study area. Although we used the same methodology (point count) they covered 20 wetlands. Also, the time of the research differs. Sulaiman undertook the research from May to August, 2009, while Garba carried out the study in January 2010. Whereas this research was conducted in October, November and December, 2015 at the time when the Palearctic migrants have arrived and covered ten wetlands.

Lameed, (2011) recorded 135 bird species of 40 families in the area while recent work (Sulaiman *et al.,* 2014) recorded 119 bird species of 43 families in the study area. Both of them carried their research during rainy season when migratory birds have not arrived.

The low occurrence of birds like the Ospray, White Stock and Northern Carmine Bee-eater, occurring not more than twice during the study, could be as a result of their migratory status.

The results of this study show that the bird species found at the Hadejia-Nguru wetlands are either Residents like the African grey hornbill, Cattle Egret, Black-headed Heron, Vinaceous Dove, Grey-headed Kingfisher; Intra migrants like the abdim stork; Vagrant like the Squacco Heron, Black Night Heron and Palearctic Migrant like the White Stork.

CONCLUSION

The study concludes that the Hadejia-Nguru wetlands is an ecologically rich site, which provides a critical habitat to a wide variety of both aquatic and terrestrial bird species. The area also holds a high species of both Afro residents and palearctic migrants, thus, the protection and conservation of the area, will not only help preserve what is left of the avifauna, but will ensure the persistence of biodiversity and future boost tourism.

RECOMMENDATION

The study recommends that bird species and vegetation monitoring should be a continuous process, and a long term survey of at least ten years on biodiversity may be useful. International effort is also needed to conserve international important species in the red list like the pallid harrier (*Charadrius pallidus veustus)* and migratory species that were identified and others not identified by this study.

ACKNOWLEDGEMENTS

This work was funded by Centre for Dryland Agriculture, Bayero University, Kano, Nigeria (CDA). I thank the Nigeria Conservation Foundation (NCF) for providing me with office accommodation during data collection.

LITERATURE CITED

Anderson SH (2003). The bird community of Kaitoke wetland. Great Barriers' land, *Notornis* **50**: 201–209

Bibby C, Burgess N, Hill D, Mustoe S (2000). **Bird Census Techniques** (2nd Edition ed.). London, UK: Academic Press. 1–302.

Birdlife International (2010). In Nigeria, the Birdlife partner is assisting wetland restoration to safeguard ecosystem services. Cambridge, United Kingdom.

Borrow N, Demey R (2014). Field Guide to the Birds of Western Africa. Princeton University Press, United States.

Crafter SA, Njaguna SG (2003). Wetlands of Kenya. In: Abebe YD and Geheb K (Eds). The Proceedings of the third International wetlands Conference, Eastern Africa, 31st December 2006, International Union for the Conservation of Nature. Gland, Switzerland.

David MM, Cesar P, Francisco AC (2009). Avian communities' preferences in recently created agricultural wetlands in irrigated landscapes of semi-arid areas. *Biodiversity Conservation*, **18**: 811-928

Dodman T, Taylor Diagana C (2001). *African Waterbird Census 1999, 2000 and 2001*. Wetlands International Global Series no. 16. Wageningen: Wetlands International.

Donald AH (1989). "Constructed Wetlands for Wastewater Treatment: Municipal, Industrial and Agricultural, Lewis publishers", Florida, USA. pp 107-113

Ezealor AU (2001). Nigeria: Important Bird Areas in Africa and associated islands: priority sites for Conservation. BirdLife Conservation series No.11. pp 673- 682 in L.D.C and M.L. Evans, eds. Newbury, U.K.: Pisces publications.

Ezealor AU (2002). Hadejia-Nguru Wetlands. Critical Sites for Biodiversity Conservation in Nigeria, Nigerian Conservation Foundation, Lagos. pp 66-68.

Garba B, Polet M, Isalo G, Dutse S, Akinsola OA (1993). The survey of water fowls and water related Birds of the Hadejia-Nguru wetlands Nigeria. *Biodiversity of the Hadeija-Nguru Wetland: Report* of a Survey, D. U. U. Okali and H. H. Blidiya (eds.). IUCN/HNWCP.

Garba BM, Harry H, Sulaiman IM (2010). Report on the Survey of Waterfowl and Water Related Birds of the Hadejia-Nguru Wetlands, Nigeria. Submitted to the Nigerian Conservation Foundation, February 2010.

Gregory JS, Jeffery MZ (1998). Comparison of bird species richness and abundance and grassland and a grassland-wetland complex in Eastern Upper Michigan. Wildlife Division Report No 3277.

Hammer Ø, Harper DAT, Ryan PD (2001). PAST: Paleontological Statistics Software Package for Education and Data Analysis. Palaeontologia Electronica 4(1): 9pp.

International Union For The Conservation Of Nature (2015). The IUCN Red List of Threatened Species. Version 2015-4. Available at: www.International Union for the Conservation of Natureredlist.org. (Accessed: 19 November 2015).

Lameed F (2011). Species diversity and abundance of wild birds in Dagona-Waterfowl Sanctuary Borno State , Nigeria. *African Journal of Environmental Science and Technology,* 5: 855-866.

Le Grange T (1997). *Guide to Nebraska's wetlands and their conservation needs*. Lincoln, NE, USA: Nebraska Game and Parks Commission. Pp 1-34

Milton WW (1999). *Wetland birds*. Cambridge University press: United Kingdom. Pp 1-3

Muhammad GB, Harry H, Sulaiman IM (2012). The 2012 Survey of waterfowl and water Related birds of the Hadejia-Nguru Wetlands, Nigeria. A Report submitted to the Nigerian Conservation Foundation February 2012.

Niemi GJ (1985). Patterns of morphological evolution in bird genera of New World and Old World Peatlands. Ecology, 66: 1215-1228.

Paracuellos M (2006). Factors affecting the distribution of a waterbird community: the role of habitat configuration and bird abundance. Waterbirds 27: 446–453.

Ramsar Bureau (1994). The Ramsar Convention on Wetlands. Convention on Wetlands of International Importance especially as Waterfowl Habitat. Ramsar Convention Bureau, Gland, Switzerland.

Ramsar Covention Bureau (2000). Background papers on wetland values and function. Gland, Switzerland: Ramsar Convention Bureau.

Shimelis aynalem & afework bekele (2008). Species Composition, relative abundance and distribution of bird fauna of riverine and wetland habitats of Infranz and Yiganda at Southern tip of lake Tana, Ethiopia. Tropical Ecology 49(2): 199-209, 2008 ISSN 0564-3295 © International Society for Tropical Ecology www.tropecol.com

Singh A, Laura JS (2012). Avian and Plant Species Diversity and their Inter-relationship in Tilyar Lake , Rohtak (Haryana), *Bulletin of Environmental Pharmacology and Life Sciences,* **1**:9,65-68

Sulaiman IM, Apeverga PT, Ringim AS, Ibrahim KM (2014b). Effects of anthropogenic activities on bird diversity and abundance at the Hadejia–Nguru Wetlands, Nigeria. *Standard Scientific Research and Essays*, **2**:10, 546-551

Sulaiman IM, Cresswell W, Dami FD (2014a). Bird diversity and abundance in relation to *Typha* occurrence at the Hadejia- Nguru wetlands, Nigeria. *Biotropic Research International Journal*, **6**:1,1-5

Wasilco MR, Soulliere GJ (1995). Initial waterbird use of created wetlands in Eastern Upper Michigan. Mich. Dept. National Resource., Wildlife. Division. Lansing.