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Full Length Research Article

BIRDS OF PREY OF DAGONA WATERFOWL SANCTUARY, NORTHEASTERN NIGERIA

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ABSTRACT

The dramatic increase in human pressure, deforestation and general decrease in tree cover, overgrazing and erosion, pesticide use, over-hunting and fishing, and sometimes direct persecution of predators, all impact negatively on birds of prey population. The aim of this research was to examine species of birds of prey in Dagona Waterfowl Sanctuary in Northeastern Nigeria. Transect line method was used for the bird survey. The survey was carried out for a period of six (6) months using transect line method and each site was surveyed twice every month during the study period. Bird observation was carried out twice daily; morning between 6:00 to 10:00 a.m. and evening between 4:00 to 6:30p.m by walking slowly along the transect line. Birds were counted as birds seen and birds inflight were also counted. Transect line survey method detected a total of 550 individual birds of prey that belong to twenty (20) species of 2 families. Accipitridae with 17 species is the richest family in species number and Falconidae with 3 species. Out of the 20 species recorded 13 are resident, 4 Palearctic migrant and 3 intra-African migrant. Four species of global conservation concern were also recorded; the Vulnerable Tawny eagle (*Aquila rapax)* ,the Near threatened Red-necked falcon (*Falco chicquera*) and Pallid harrier (*Circus macrourus*) and the Endangered Martial eagle (*Polemaetus bellicosus*). This survey shows that, the Dagona Waterfowl sanctuary still retained a considerable number of birds of prey species that normally occur in West Africa. The management needs to increase conservation measures that will ensure the protection of the wetlands.

Keywords: *Species, birds, survey, transect line*

INTRODUCTION

Birds of prey, or raptors, include species of bird that primarily hunt and feed on vertebrates that are large relative to the hunter. Additionally, they have keen eyesight for detecting food at a distance or during flight, strong feet equipped with talons for grasping or killing prey, and powerful, curved beaks for tearing flesh. The term *raptor* is derived from the Latin word *rapio*, meaning to seize or take by force. In addition to hunting live prey, most also eat carrion, at least occasionally, and vultures and condors eat carrion as their main food source.

Most species of raptor are conspicuous and they feed on a broad array of invertebrates and vertebrates across all natural and artificial habitats (Thiollay 2006). Today, the dramatic increase in human pressure, deforestation and general decrease in tree cover, overgrazing and erosion, pesticide use, over-hunting and fishing, and sometimes direct persecution of predators, all impact negatively on raptor population (Thiollay 2006). For example in West Africa an estimate of the mean abundance index of raptors between protected and unprotected areas has shown a 30 % decline of raptors in protected areas compared with a 67 % decline in unprotected areas (Thiollay 2006, 2007b).

As organisms at the end of terrestrial food chains and aquatic food webs, these birds are both biologically important (i.e., important ecological role in controlling populations of rodents and other small mammals) and environmentally sensitive, which serves as a barometer of wild ecological health (i.e., indicators of worldwide pollution by pesticide (Virani, Watson, 1998; Bildstein, 2006). They can also be used as "umbrella species" because their large home ranges and low nesting densities necessitate that any protected areas encompassing viable populations or complete communities protect sufficient habitat and populations of most, if not all, other species in the food web below them (Virani, Watson, 1998). Finally, an abundance and diversity of raptors invariably signals a largely undisturbed ecosystem (measure of our impact on landscapes, even in remote area), supporting an abundance of other wildlife (Bildstein, 2006).

Globally, human-caused environmental impacts, such as habitat loss, have seriously impacted raptor species. Human activities are responsible for the catastrophic decline and extinction of thousands of animal and plant species throughout the world, and this loss is occurring at unprecedented rates (Ceballos *et al*., (2002); Ripple *et al*., (2014); Dirzo *et al*., (2014); Ceballos *et al*., (2020); Pimm *et al*., 2014). Raptors are some of the most threatened vertebrate taxa, and in the last three decades many species have experienced severe population declines or faced extinction (McClure *et al.,* 2018; Buechley *et al.,* 2019). This threat is primarily the result of habitat loss and fragmentation, pollution, human–wildlife conflicts, and global climate alterations (Donázar *et al*., 2016)

Their declining numbers and economic relationships warrant additional interest, and studies of total raptor populations are needed as a means by which we may elucidate their responses to changing pressures and environmental conditions (Zilo *et al.,* 2013). Raptors are among the most vulnerable taxa to environmental disturbance, and their presence often used as a proxy for high biodiversity values (Sergio *et al*., 2006, 2008). Strong raptor population declines have been reported throughout Africa (Thiollay, 2007a, b; Ogada & Keesing 2010; Virani *et al.*, 2011), notably in sub-Saharan West Africa, where the pressure on wildlife and their supporting habitats is high due to some of the highest human densities and growth rates on the continent (United Nations 2011). Although West Africa's protected area network has a crucial role in maintaining raptor assemblages in the face of growing human pressure (Thiollay, 2007b), it is highly fragmented and

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covers a small area compared to East and southern Africa (Chape *et al*., 2005), potentially constraining its effectiveness for wildlife conservation (Wilkie *et al*., 1998; Brashares *et al*., 2001).

Outside of protected areas, raptors have dramatically declined over vast areas of their former distribution range, some being on the brink of regional extinction (Thiollay, 2006c). This is alarming given the region's importance to raptor conservation, with 69 regularly occurring species (excluding vagrants; Borrow and Demey 2001) representing 22 % of the world's raptor species, the majority (c. 91 %) of which seasonally dependent on West African savannas. An understanding of biogeographical patterns of species distribution is a prerequisite for identifying priority areas and efficient protected area systems for conservation (Turpie, 1995). Because rainfall is a major driver of vegetation cover and prey availability for raptors in savannas (Thiollay & Clobert 1990), raptor richness and diversity in West African savannas is centred on the Sudan savanna zone. Diversity decreases in the Sahel zone to the north because of low dry-season food supply, and in the more productive Guinea savannas to the south because dense grass cover constrains prey accessibility during the wet season (Thiollay 1977, 1978a). Within the Sudan and Sahel zones, Inundation zones offer seasonally abundant prey for Palearctic and Afrotropical raptors (Zwarts *et al*., 2009), but floods and high grass cover limit prey accessibility during part of the year, reducing their suitability to most sedentary Afro-tropical raptors. Currently, few long-term inventories covering wet and dry seasons have been performed to allow an assessment of the relative importance of these biogeographical zones to raptors, and how large-scale human exploitation may influence such patterns. Assessing species richness distribution is critical to design reserves for biodiversity conservation, decision making and natural resource management (Bini, *et al.,* 2006; Benito *et al*., 2013). Factors determining species richness patterns on Earth have been explained with more than a hundred hypotheses (Palmer, 1994). Climate, productivity and landscape configuration have been identified as important factors in determining species richness (Field, *et al*., 2008; Zhao & Fang 2006), nonetheless these factors are scale dependent (Field, *et al*. 2008; Gaston & Blackburn 2000; Rahbek 2005). Although knowledge of geographic distribution and species richness patterns are important to evaluate vulnerability of birds of prey, no systematic studies have been conducted in Dagona waterfowl sanctuary to allow accurate assessment of the conservation status, or facilitate the design and implementation of effective conservation strategies.

MATERIALS AND METHODS

The Study Area

Dagona Waterfowl sanctuary is part of the Bade-Nguru wetlands sector in Yobe state of Nigeria. The sector is found between latitudes 12°13'- 13°00'N and longitude 10°00'-11°00'E. It covers an area of 9385 Km^2. The Dagona Waterfowl Sanctuary being the focal point of the sector made Dagona village the most important of all the villages in the Bade Local Government Area. The Dagona Waterfowl Sanctuary is one of the three major ecological entities designated as fully protected areas under the control of Chad Basin National Park (Stopfords, 1999). It functions as a habitat for waterfowl. The area is a Fadama which is flooded in the wet season; it is endowed with diverse physical and biotic composition (Ipinjolu, 1999). The area is situated in a semi-arid environment. The climate therefore is hot and dry for most part of the year. Temperature rises up to 43°C in the hottest months of May to June, the dry season lasts from November to June, the rainy season starts in early July and ends in October. Rainfall is generally erratic in its distribution and amount; it roughly lasts for 120 days. Rainfall values ranging from 23 mm to 335 mm, while the mean annual rainfall is about 180 mm. (Auwalu, 2004). The vegetation is entirely Sahel savannah type which consist of mainly drought resistant tree species (xerophytes) such as Doum palm (*Hypenia thebaica*), African Mahogany (*Khaya Senegalis*), Acacia species such as Gum Arabic (*Acacia nilotica*) Senegal gum (*Acacia senegal*) Neem (*Azadiricta indica*) among others. Fishing, farming and hunting are the major economic activities in the area.

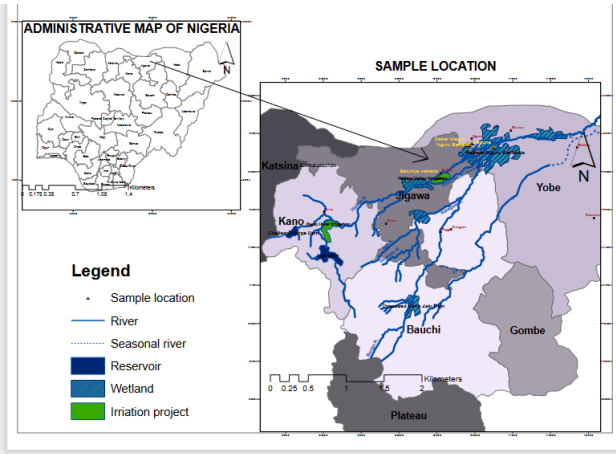

Figure 1: Map of Dagona Waterfowl Sanctuary (Source: Hadejia-Nguru Wetlands Project, 2015).

Dagona Waterfowl Sanctuary is significant by the internationally assisted conservation effort to protect the palaearctic migrant birds. It is open Sudan/scrub Sahelian vegetation, though a small part of the wetland is covered with water all year round yielding support for water birds and other wildlife found in that area. The sanctuary is bordered by some villages and the main occupation of the villagers is pastoral farming. So, there is very high incidence of grazing by the Fulani community in the area. The waterfowl sanctuary is among the Hadeija-Nguru wetlands and the management of the sanctuary is under the jurisdiction of the Chad basin national park. The sanctuary is under a multiple use management, and there is no free access to its wild resources (Wild animals, fish, birds). However, grazing and collection of wild resource are practiced by the local population illegally, and there is therefore a need for more strict enforcement of laws (Borrow and Demey, 2000).

BIRDS SURVEY

Line Transect method was used for the bird survey. This method proved most efficient in terms of data collection per unit effort(Yallop *et al*., 2003).The ability to detect birds ahead before they were flushed whilst walking lines led to the decision to choose line transects This census involves an observer moving slowly along the routes and recording all birds detected on either side of the route. The survey was carried out for a period of six (6) months using transect line method and each site was surveyed twice every month during the study period. Bird observation was carried out twice daily; morning between 6:00 to 10:00 a.m. and evening between 4:00 to 6:30p.mwhen the temperature was relatively cool and bird's activities are high (Bibby *et al.,* 2000) by walking slowly along the transect line. The census to count raptors was conducted

by observations along 5km transect line in each wetland using binoculars, telescopes and field guide to West African Birds by Borrow and Demey, (2014). The observations were conducted by long watches along the transect line. The number of the raptors seen flying around and perching was recorded. The coordinates of each observation point was recorded. Garmin 760CSx Global Positioning System (GPS) was used to collect coordinates of the sampling locations.

RESULTS AND DISCUSSIONS

Population Distribution of Birds of Prey in Dagona Waterfowl Sanctuary

In Dagona Waterfowl Sanctuary which is a protected area, 550 individuals' birds of prey of 20 different species were recorded (Table 1) during wet and dry season. In the dry season, 103 birds of prey belonging to 14 species were observed, while in the wet season 447 birds of prey of 12 species were recorded.

Table 1: Birds of prey Species in Dagona Waterfowl

S/NO.	Common Name	Scientific Name	No. of Individuals
1.	Pallid Harrier	*Circus macrourus*	7
2.	Gabar Goshawk	*Micronisus gabar*	53
3.	Black Shouldered Kite	*Elanus caeruleus*	64
4.	Black Kite	*Milvus migrans*	3
5.	Lizard Buzzard	*Kaupifalco monogrammicus*	9
6.	African Marsh Harrier	*Circus ranivorus*	23
7.	Dark Chanting Goshawk	*Melierax metabates*	18
8.	Yellow Billed Kite	*Milvus aegyptius*	299
9.	African Swallow Tailed Kite	*Chelictinia riocourii*	6
10.	Tawny Eagle	*Aquila rapax*	2
11.	Ovambo Sparrow Hawk	*Accipiter ovampensis*	2
12.	Red-necked Falcon	*Falco chicquera*	6
13.	Martial Eagle	*Polemaetus bellicosus*	8
14.	Montagus Harrier	*Circus pygargus*	5
15.	Fox Kestrel	*Falco alopex*	14
16.	African Fish Eagle	*Haliaeetus vocifer*	8
17.	African Goshawk	*Accipiter tachiro*	5
18.	Grey Kestrel	*Falco ardosiaceus*	2
19.	Grasshopper Buzzard	*Butastur rufipennis*	10
20.	Western Marsh Harrier	*Circus aeruginosus*	6
	TOTAL		550

Source: Field Survey, 2021

This research recorded higher number of birds of prey than Lameed (2011) and Ringim *et al*., (2017). Lameed (2011) recorded (9) birds of prey species in his research on Species diversity and abundance of wild birds in Dagona-Waterfowl Sanctuary. Although his studies was not on birds of prey species but on general birds species diversity. Ringim *et al*., (2017) also recorded 8 birds of prey species in his studies on species diversity of migrant birds between protected and unprotected areas of the Hadejia-Nguru wetlands, his research is also on the general bird's species diversity not birds of prey.

Out of the 20 birds of prey species recorded in this area, 13 are resident, 4 Palearctic visitors and 3 intra-African migrant (Borrow & Demey, 2014). Also, 2 species are Near threatened (Pallid Harrier and Red-necked Falcon), 1 Vulnerable (Tawny Eagle), 1 Endangered (Martial Eagle) and 13 Least concern (Table 2).

Table 2: Migratory and Conservation Status of Birds of Prey in Dagona Waterfowl Sanctuary

S/NO.	**Common Name**	**Conservation Status**	**Migratory Status**
1.	Pallid Harrier	NT	Palearctic visitor
2.	Gabar Goshawk	LC	Resident
3.	Black Shouldered Kite	LC	Resident
4.	Black Kite	LC	Palearctic visitor
5.	Lizard Buzzard	LC	Resident
6.	African Marsh Harrier	LC	Resident
7.	Dark Chanting Goshawk	LC	Resident
8.	Yellow billed Kite	LC	Intra-African migrant
9.	African Swallow Tailed Kite	LC	Intra-African migrant
10.	Tawny Eagle	VU	Resident
11.	Ovambo Sparrow Hawk	LC	Resident
12.	Red-necked Falcon	NT	Resident
13.	Martial Eagle	EN	Resident
14.	Montagus Harrier	LC	Palearctic visitor

15.	Fox Kestrel	LC	Resident
16.	African Fish Eagle	LC	Resident
17.	African Goshawk	LC	Resident
18.	Grey Kestrel	LC	Resident
19.	Grasshopper Buzzard	LC	Intra-African Migrant
20.	Western Marsh Harrier	LC	Palearctic visitor

Source: Field Survey, 2021
Key: LC – Least Concern, VU – Vulnerable, EN – Endangered, NT – Near Threatened

Birds of Prey Species Richness in Dagona Waterfowl Sanctuary

Highest richness index was registered in this area (3.011). The highest species richness index in the study area was due to dense vegetation cover of the area which provides favorite breeding sites, availability of food in microhabitats which favored certain varieties of bird species, cover from predators, and less disturbance compared to other areas. This corroborate with the findings of Sethy *et al*., (2015) and Takele and Afework (2018) who conducted research in North Orissa University and Choke Mountains, East Gojjam, Ethiopia respectively. Both identified favorite breeding site and availability of food as the main factors influencing birds' higher species diversity index.

The present study shows that Dagona Waterfowl Sanctuary habitats have dense vegetation cover to serve as a foraging site for a substantial number of bird species. The large size of the area, as compared to the other sites, might contribute to the highest richness and abundance of bird species. As reported by Nabaneeta and Gupta (2010), bird species richness and abundance are influenced by the size of habitat patches, local resource availability and vegetation composition. This is because of the availability of multiple, and varied, alternative feed sources for the birds; moreover, a large area is inaccessible for people contributing to a favorable condition for breeding, feeding and nesting sites (Aynalem and Bekele, 2008). It was also pointed out by Prakash and Manasvini (2013) that a higher abundance of birds in a habitat might be brought by the vegetation composition that forms the main element of their habitat, or it may be influenced by landscape, floral diversity, anthropogenic activities, as well as predation. Various workers have reported significant changes in species richness of avian communities along gradient of vegetation (Krebs, 2000) and the effect on raptors is indirect by limiting the availability of their herbivorous prey.

Relative Abundance of Birds of Prey in Dagona Waterfowl Sanctuary

Dagona Waterfowl Sanctuary holds a total of 550 individual birds of prey (35.2% of all detections) during the study period. They belong to 20 species of two families. The results indicated that, yellow billed kite (*Milvus aegyptius)* (54.4%), black shouldered kite (*Elanus caeruleus*) (11.6%) and gabar goshawk (*Micronisus gabar*) (9.6%) were the dominant birds of prey in the wetlands. In contrast, western marsh harrier (*Circus aeruginosus*) (1%), African goshawk (*Accipiter tachiro)* (0.9%), Montagus harrier (*Circus pygargus*)(0.9%), Ovambo Sparrow hawk (*Accipiter ovampensis*) (0.4%), Tawny eagle (*Aquila rapax*) (0.4%) and Grey kestrel (*Falco ardosiaceus*)(0.4%) were the rarest raptor species recorded in the area (Table 3).The higher relative abundance of yellow billed kite in the study area is connected to its migration pattern. It leaves southern hemisphere around March – April to northern hemisphere at the beginning of rainy season.

The large size of the Waterfowl Sanctuary, might contribute to the highest richness and abundance of bird species. As reported by Nabaneeta and Gupta (2010) in their study on avian community analysis in fragmented landscapes of Cachar District, Assam that, bird species richness and abundance are influenced by the size of habitat patches, local resource availability and vegetation composition. This is because of the availability of multiple, and varied, alternative feed sources for the birds; moreover, a large area is inaccessible for people contributing to a favorable condition for breeding, feeding and nesting sites (Aynalem & Bekele, 2008). It was also pointed out by Prakash and Manasvini (2013) in their research on urban avifaunal diversity in southern Ridge of Delhi, that a higher abundance of birds in a habitat might be brought by the vegetation composition that forms the main element of their habitat, or it may be influenced by landscape, floral diversity, anthropogenic activities, as well as predation.

The findings of this study is in agreement with Rodrigues, *et al.*, (2020) who recorded 25 birds of prey species with grey kestrel and lanner falcon as rare species in eastern Guinea-Bissau.

Abundance of bird species is largely influenced by the distribution of some key environmental resources (McCain, 2009). As a result, various studies elsewhere in the world attempted to study factors that affect bird abundance and distribution at spatial and temporal scales (Peterson & Zimmerman, 1999). Seasonality plays a major role in determining the abundance and distribution of birds. Seasonality affects food and cover availability of bird population, which in turn affects breeding success and ultimately survival of the bird species (Fuller, 2010). The seasonal variation in the amount of rainfall, temperature and temporal microhabitat conditions are known to affect the availability of various food items for birds (Peterson & Zimmerman 1998). Based on species sensitivity to the type of habitat, these could alter the diversity, abundance, and distribution of birds in an area. Particularly, it has been revealed that processes acting in breeding and wintering grounds determine both the patterns of habitat occupancy and seasonal abundance in migratory bird species (Newman, 2000). Tropical and subtropical countries witness a certain type of seasonal migration of birds, which is not well known in the northern latitudes (Fuller, 2010).

Table 3: Birds of prey Species in Dagona Waterfowl Sanctuary

Common Name	No. of Individuals	Relative Abundance (%)
Pallid Harrier	7	1.273
Gabar Goshawk	53	9.636
Black Shouldered Kite	64	11.636
Black Kite	3	0.545
Lizard Buzzard	9	1.636
African Marsh Harrier	23	4.182
Dark Chanting Goshawk	18	3.273
Yellow Billed Kite	299	54.364
African Swallow Tailed Kite	6	1.091
Tawny Eagle	2	0.364
Ovambo Sparrow Hawk	2	0.364
Red-necked Falcon	6	1.091
Martial Eagle	8	1.455
Montagus Harrier	5	0.909
Fox Kestrel	14	2.545
African Fish Eagle	8	1.455
African Goshawk	5	0.909
Grey Kestrel	2	0.364
Grasshopper Buzzard	10	1.818
Western Marsh Harrier	6	1.091
TOTAL	550	

Source: Field Survey, 2021

A worrying sign is that only two eagle's species were observed in Dagona Waterfowl Sanctuary during the study. Eagles require much larger areas of pristine primary forest compared with most other species and there have been past concerns that many reserves and even national parks are simply too small to support and ensure the long-term survival of some eagle species. Dagona National Reserve is one of the largest protected areas in Northern Nigeria spanning over two thousand square kilometers, therefore is unlikely to be the case.

CONCLUSION

This survey shows that, the Dagona waterfowl sanctuary still retained a considerable number of birds of prey species that normally occur in West Africa.

The highest number of birds of prey species was recorded in dry season, showing seasonal variation in species richness. Factors such as food availability and foraging ground are responsible. Habitat destruction via logging of trees especially in the area was the major threat to birds community.

Relative abundance of birds in the study area showed that most of the species were abundant with yellow billed kite, black shouldered kite and gabar goshawk having the highest relative abundance in the study area and seasons. Whereas, on the contrary, birds of prey species like, martial eagle, black kite, red-necked falcon, montagus harrier, and western marsh harrier showed the least relative abundance in the wetlands.

RECOMMENDATIONS

The study area harbors many birds of prey species, including globally threatened species. However, in order to maintain the bird community and other biodiversity of the area, the management needs to increase conservation measures that will ensure the protection of the wetlands. This can be done through training and re-training of more forest guards to ensure protection of the wetlands. Public awareness should be raised to inform the local populace about the importance of these species to the environment vis-à-vis protecting the infrastructures used by the birds. More studies on birds of prey species diversity and abundance during migration period (winter season) are needed to provide a complete checklist on the wetlands birds of prey community including Palearctic, resident and the intra African migrant.

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