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Research Article

Effects of anthropogenic activities on Bird diversity and abundance at the Hadejia – Nguru Wetlands, Nigeria

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Abstract

Human pressures continue to change and affect natural wetland habitats. Bird diversity and abundance in relation to anthropogenic activities at the Hadejia – Nguru Wetlands, Nigeria was studied within an eleven-week period in 2011 to determine the effects of anthropogenic activities such as farming and hunting pressures. Thirty two wetlands within the Hadejia – Nguru Wetlands complex were surveyed. Point counts were used to survey birds. Bird diversity and abundance determined by counting birds was related to anthropogenic activities. A total of 110,162 of 119 bird species were recorded. Farms around the wetlands increased bird abundance and bird diversity increased in wetlands without hunting. Although the wetlands face pressures from anthropogenic activities, their effect on bird diversity and abundance is apparently of small biological effect. Continued research is needed to confirm this surprising result to allow the successful conservation and management of both the wetlands and its birds.

Keywords: Hunting, Farming, Wetlands, Bird Diversity and abundance

INTRODUCTION

Worldwide, wetland ecosystems are being altered and reduced at an increasing rate by human activities (Wilen, 1989). Growing recognition of wetlands as important environments for birds due to their habitat diversity and high productivity, have led to increasing concern about the impact of their loss (Dugan, 1990). Unfortunately, despite the value of wetland biodiversity and the influence of some wetland attributes on species diversity, in Chile, wetlands are still declining locally and regionally as a result of human pressure (Parra *et al.,* 1989).

One important anthropogenic effect is the spread of more invasive and non-native species into wetlands that profoundly further alters the abiotic and biotic conditions of the wetlands (Ramsar, 2000).Anthropogenic activities have great influence on the characteristics and so the bird abundance in wetlands. For example wetland size, depth and distribution in India and elsewhere in the world are greatly affected by human activity (Prasad, *et al*., 2002), and this has a great effect on the structure of bird community (Kler, 2002; Verma, *et al*., 2004; Reginald *et al.,* 2007). This study aimed at determining the effect of anthropogenic activities at the Hadejia Nguru Wetlands.

MATERIAL AND METHODS

Study Area

This research was carried out at the Hadejia-Nguru wetlands (HNW) which lies on the southern edge of the Sahel savanna in north-eastern Nigeria. The area is a flood-plain complex, comprised of a mixture of seasonally flooded lands

and dry uplands. Prior to the droughts of the 1970s, the wetlands covered an area of about 4,125 km², but are now reduced to 3,500 km². The wetland is supplied by the Hadejia and Jama' are rivers. The Jama'are rises in the Jos Plateau, the Hadejia in the hills around Kano; they join within the HNW to form the Yobe river, which discharges into Lake Chad. River flow is highly seasonal and varies considerably depending upon rainfall and run-off. Peak flow occurs in August and September when banks overflow and the area is inundated. Three broad vegetation-types are identifiable. One of these is scrub savanna, which includes the upland farmland areas and *Acacia* woodlands. The second grows on the 'tudu' lands, sandy ridges, which with the exception of scattered, ephemeral ponds, are never inundated. The third main vegetation-type includes the seasonally flooded marshes and 'fadama', in which the tree *Acacia nilotica* is common while Dum palms *Hyphaene thebaica* grow on small raised islands. Annual rainfall ranges between 200-600 mm, confined to the period late May-September.The wetlands support over 60 water bird species from 15 families (Hollis *et al*., 1993) and are considered to be of international importance as habitats for waterfowl populations (Ramsar, 2000).

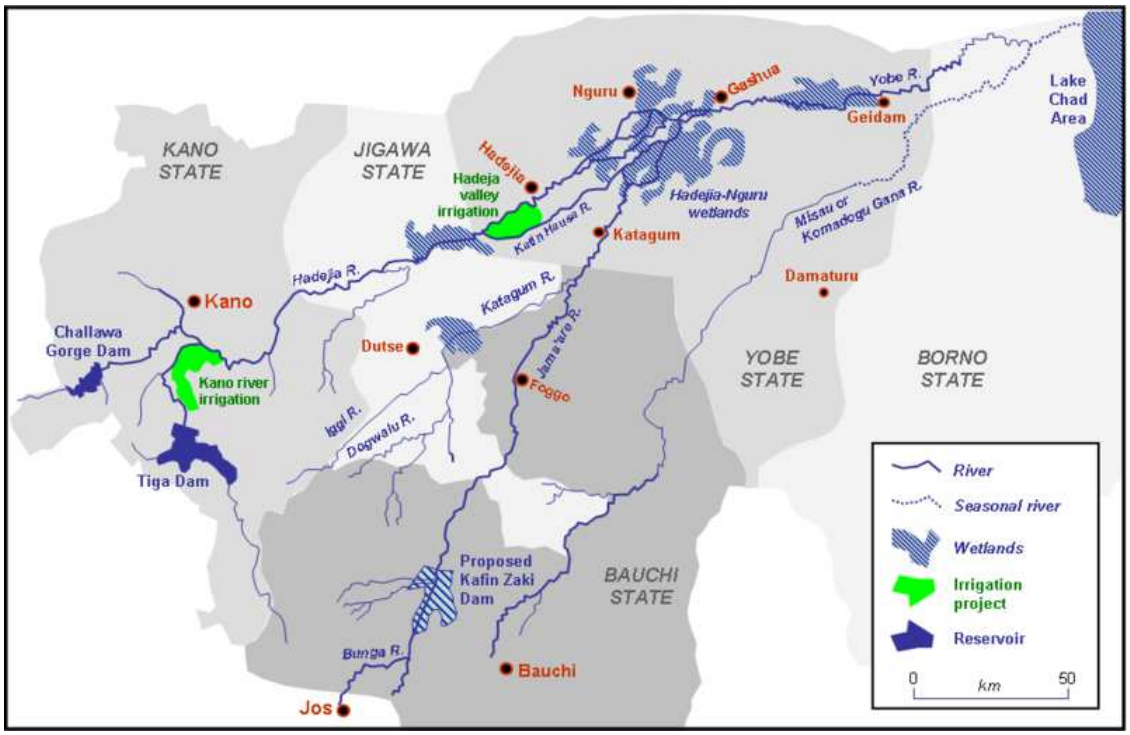

Figure 1. Map of Hadejia-Nguru Wetlands

METHODS

This survey was carried out from May 17th – August 2nd, 2009. Point counts were used to record birds within study sites (Bibbey *et al.,* 2000; Gregory and Jeffery, 1998; Wasilco and Soulliere, 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. Other advantages are: Point count suits populations at higher density and more species rich as well as suited to situations where access is restricted. Although time is lost moving between points, counts gives time to spot and identify shy and cryptic birds. (Gregory *et al.,* 2004)

Bird count was from 06:30h to 11:00h 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 revisited, in the first visit; number of points within each surveyed wetland depends on wetlands size (minimum of 1 and maximum of 11 points). Each point was surveyed for a period of 10 minutes with 2 minutes wait period and 150m interval between points. In the second visit, these points were reduced to two at most and surveyed for a period of 10 minutes in 6 repeats at each point. But for wetlands with more than four points (5 to 11), the number of points and methods remained the same as in the first visit.

Anthropogenic activities such as farmlands, fishing, grazing, aquatic vegetation, hunting of water bird and other domestic uses around the wetlands were recorded through visual observation. Data were analyzed using R-Statistical package (version 2.12.0).

DATA ANALYSES

The data was first explored for normality, Linear Mixed Effect models (LME) was used to test the effect of variables on bird species diversity and abundance. Two separate models were used to test the effect of anthropogenic activities on bird abundance and diversity. Mean number of birds seen and diversity index were dependent variables (in two separate models) while anthropogenic activities were the explanatory variables. Models of bird abundance and diversity were run with the aforementioned explanatory variables, non-significant variables were deleted one after the other following the AIC value until the smallest AIC was reached.

Raw data were used to illustrate results. Tukey multiple comparison tests were used to evaluate which factors were significantly different and all P values quoted are adjusted using the single-step Scheffe method. Box plots were plotted to show the relationship between species abundance and diversity with categorical variables such as Farming (Presence and absence), and Hunting (Presence and absence).

RESULTS

Total of 110162 of 119 bird species from 32 wetlands were recorded which is an indication that the area has a considerably high number and diversity of bird species.

All of the anthropogenic activities around the wetlands do not have a significant effect on bird abundance and diversity except for farming (Figure 2) and hunting (Figure 3) which had significant effect only on bird abundance and diversity respectively. Wetlands with farms (14.1 ± 2.2) around them had a higher number of bird species than Wetlands without farms (6.2 ± 4.5). Wetlands without hunting (0.1 ± 0.03) had a higher bird diversity index than with hunting (0.04 ± 0.03).

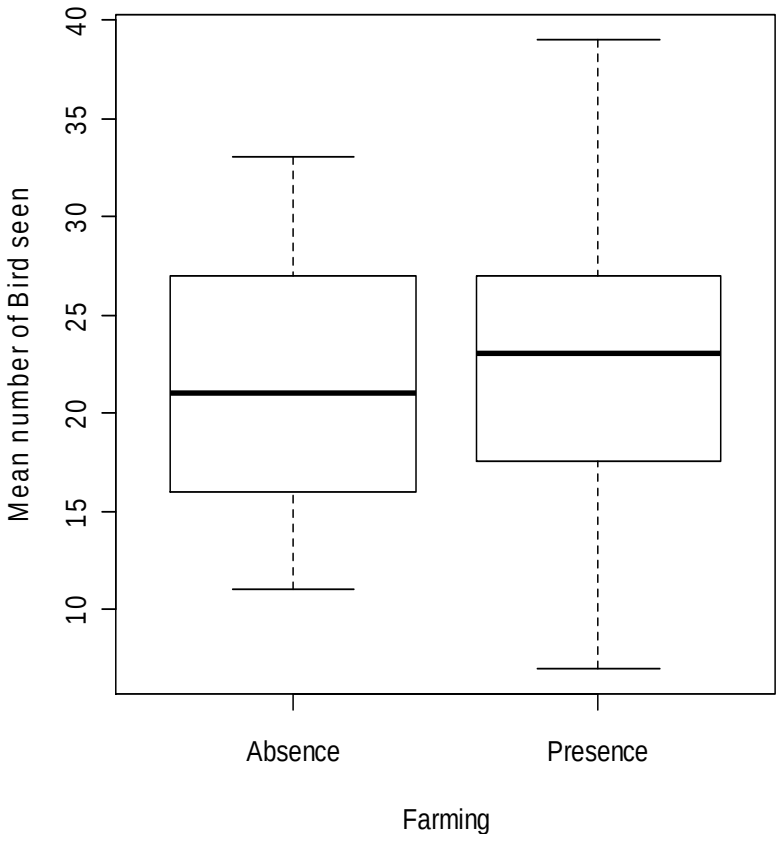

Figure 2. Relationship between number of birds seen and Farming

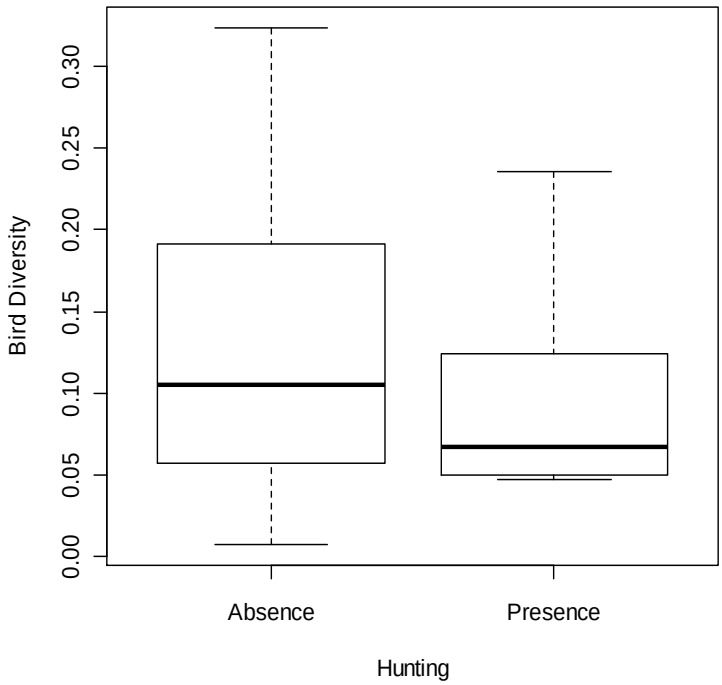

Figure 3. Relationship between bird diversity and hunting

DISCUSSION

Duncan *et al*., (1999) showed a negative effect of agriculture intensification on wintering ducks populations. Long, *et al*., (2007) concluded that an increase in the area of agricultural land could be associated with decreasing populations in Anseriformes. However, there are some studies reporting positive effects of agriculture on certain species of waterbirds (e.g., Gauthier *et al*., 2005; Fasola *et al*., 2010), which is in accordance with my findings. In this research, wetlands with farms had a higher number of bird species. 70% of the farms around the wetlands were rice farms, although beans, millet, cassava and sweet potatoes farming also take place. Previous work suggests that rice fields may be an important habitat for waterbirds throughout the world and in some areas may in fact be the primary foraging habitat available to them (Czech and Parsons, 2002). Several studies have shown the importance of rice fields as a wintering site for waterbirds in different locations around the world, such as California (Elphick and Oring, 1998 and 2003) or Cuba (Acosta *et al*., 1996) in North America; Portugal (Lourenc and Piersma, 2008) or Spain (Rendo *et al*., 2008) in Europe; or Japan (Maeda, 2005) in Asia. Furthermore, rice fields are used by a variety of waterbirds as breeding sites (Fasola and Ruiz, 1996), although to a lesser extent than as foraging sites (Czech and Parsons, 2002). Nevertheless, there are also agricultural benefits derived from having waterbirds in rice fields, since they improve straw decomposition (Bird *et al*., 2000) or weed control (Van Groenigen *et al*., 2003).

The result of the study revealed that hunting has no significant effect on bird abundance. Waterbird hunting is widespread and common throughout Europe, affecting waterbird populations directly through the kill (e.g. Anderson and Burnham, 1976; Nichols, 1991; Ebbinge, 1991; Fox and Madsen, 1997) and indirectly through disturbance. Most waterbirds are scared by gunshots within 80 m (Tempel, 1992; Fox and Madsen, 1997). It has been demonstrated that hunting causes local disturbance effects (reviewed by Meltofte, 1982; Bell and Owen, 1990; Madsen and Fox, 1995; Fox and Madsen, 1997), and constitutes a major source of disturbance to waterbirds in autumn and winter. There is no direct evidence; however, that hunting disturbance has an impact at the population level of any waterbird species (Madsen and Fox, 1997). Wetlands without hunting had a higher bird diversity index than wetlands with hunting. Ducks and Geese such as Fulvous Whistling-Duck (*Dendrocygna bicolour*), Spur-winged Goose (*Plectropterus gambensis*), White-faced whistling Duck (*Dendrocygna viduata*) and Knot-billed Duck (*Sarkidiornis melanotos*) are large and most hunted species within the wetlands. That is to say, wetlands with hunting are likely to have only waders which are usually smaller in size. This will off course reduce bird diversity in such wetland. Hunting is one of the human activities that affect wildlife most, and it has received increasing attention given its environmental, social and economic dimensions, particularly in Europe (Lucio and Purroy, 1992; Martı´nez and Villafuerte, 2002).

CONCLUSION

Although the wetlands face pressures from anthropogenic activities, their effect on bird diversity and abundance is apparently of small biological effect.

RECOMMENDATION

The results of this study have further relevance when considering conservation of the Hadejia - Nguru wetlands and its bird. Anthropogenic activities may seem to have a little effect now but may have a negative effect if this continues and more pressure is mounted. More so, the large number of people and cattle visiting the fringes of wetlands increases the risk of eggs and chicks being trampled. Wetlands need to be patrolled to minimize disturbance in the more sensitive areas, particularly during the breeding season. For sustainable upkeep of the water bodies it is important to involve local people and sensitize them about the role of these wetlands in the welfare of humans.

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