West African Ornithological Society
Société d'Ornithologie de l'Ouest Africain

Join the WAOS and support the future availability of free pdfs on this website.

http://malimbus.free.fr/member.htm

If this link does not work, please copy it to your browser and try again.

If you want to print this pdf, we suggest you begin on the next page (2) to conserve paper.

Devenez membre de la SOOA et soutenez la disponibilité future des pdfs gratuits sur ce site.

http://malimbus.free.fr/adhesion.htm

Si ce lien ne fonctionne pas, veuillez le copier pour votre navigateur et réessayer.

Si vous souhaitez imprimer ce pdf, nous vous suggérons de commencer par la page suivante (2) pour économiser du papier.

February / février 2010

Seasonal waterbird and raptor fluctuations on the Niger and Mékrou Rivers in Niger

by Julia Ambagis[1], Joost Brouwer[2] & Chris Jameson[3]

[1]US Peace Corps—Niger. Present address: 32 May Street, 1R, Worcester, MA 01610, U.S.A. <jambagis@yahoo.com>
[2]Brouwer Envir. & Agric. Consultancy, Wildekamp 32, 6721 JD Bennekom, The Netherlands. <brouwbar@bos.nl>
[3] US Peace Corps—Niger. Present address: 1610 C Beekman Place, NW, Washington, DC 20009, U.S.A. <jamesoncm@yahoo.com>

Received 13 February 2002; revised 10 February 2003.

Summary

Waterbirds and raptors were surveyed on the Niger and Mékrou Rivers in W National Park, SW Niger, most months between 1995 and 1999. During the study, 101 species of raptor and waterbird were identified, of which 73 were observed more than twice. Bird numbers and species composition fluctuated with the seasons, for all species, even those considered sedentary or resident. Species composition also differed between the two rivers, some species being found only or mostly on one river and not or rarely on the other. The two rivers support more individuals and species of Afrotropical waterbirds and raptors during the hot season (Mar–May), and more Palaearctic waterbirds in the cold season (Dec–Feb).

Résumé

Variations saisonnières des oiseaux d'eau et des rapaces sur les fleuves Niger et Mékrou au Niger. Les oiseaux d'eau et les rapaces furent suivis sur le Niger et le Mékrou dans le Parc National du W, sud-ouest du Niger, la plupart des mois entre 1995 et 1999. Durant cette étude, 101 espèces de rapaces et d'oiseaux d'eau furent identifiés, dont 73 observés plus de deux fois. La composition en nombre et en espèces variait avec les saisons, pour toutes les espèces, même celles considérées comme sédentaires ou résidentes. L'agencement en espèces différait aussi entre les deux rivières, et certaines espèces ne se trouvaient rares ou communes que sur une rivière et jamais ou rarement sur l'autre. Les deux rivières hébergeaient le plus grand nombre d'individus et d'espèces de sauvagine et de rapaces afrotropicaux pendant la saison chaude (mars-mai), et plus d'oiseaux d'eau en saison froide (déc-fév).

Introduction

Rivers and their floodplains form an important but scarce resource in Niger, both for people and for birds (Brouwer *et al.* 2001). By far the most important river in Niger is the Niger River, which flows for 550 km through the southwestern part of the country. Since 1992, waterbirds have been counted each year during January and February along various stretches of the Niger River, as well as at a number of isolated wetlands elsewhere in the country (Brouwer & Mullié 2001). The present study reports on the results of monthly waterbird and raptor surveys by US Peace Corps Volunteers from 1995 to 1999 along the Niger River and its tributary the Mékrou, in W National Park in Niger. W National Park was designated a Ramsar Site in 1987 in part because of its importance to waterbirds. CJ initiated the surveys in 1995, in part to determine what birds were using the protected habitat areas of the park. The results are also of interest for potential expansion of ecotourism on the Niger River. We focus on seasonal differences in presence for the various species encountered, and on differences between the two rivers.

Study areas and methods

The stretch of the Niger River where waterbirds and raptors were counted is approximately 75 km long, from Koro Gungu to Boumba (see Crisler *et al*. 2003 for a map of the area). This area lies within the northern Sudanian zone (Brouwer *et al.* 2001) and usually receives 500–800 mm of rain annually (May–October, with a marked peak in August). Minimum and maximum annual rainfall recorded are 221 and 1178 mm respectively. Maximum flow along this section of the Niger River occurs around February, when the peak of the floods originating in Guinea and Mali arrives. Maximum flow can be up to 1800 m^3s^{-1}, with the river up to 1 km wide. At flood stage, several large areas of floodplains and marshes are inundated. Minimum flow occurs around July, when it can be only tens of m^3s^{-1}. On rare occasions, surface flow even ceases altogether, although large pools of standing water always remain. During the period of minimum flow, extensive areas of rocks and sandbars are exposed and shallow backwaters are formed. The dominant vegetation along the river includes stands of palms *Borassus aethiopum*, and various kinds of marsh and aquatic plants. Where higher ground adjoins the river one can find baobab *Adansonia digitata*, kapok trees *Bombax costata, Prosopis africanus*, and various Combretaceae (Brouwer *et al.* 2001).

The first part of the Niger River that we surveyed, from Koro Gungu to Boscia, runs between farmland on the left bank and the Réserve de Tamou and W National Park on the right bank. The Tamou reserve was set up to act as a buffer zone between the park and human cultivation and habitation (Dufresne *et al.*1982). The second section, from Boscia to Boumba, runs along the W Park on its right bank and

comprises well separated villages, fields and fallow areas on the left. Areas outside the park have much less natural savanna vegetation, and are under pressure from cultivation and grazing (IUCN 1993).

The stretch of the Mékrou River that we surveyed was approximately 15 km long, from Boumba on the Niger River to the Rapids of Barou. Some months, the Mékrou River section was shorter or impassable due to sandbars and rocks that became exposed as the water level dropped. Because the Mékrou has a more local origin, in northern Togo, it is usually at its highest around January, when it is up to 50 m wide. It often does not flow at the end of the dry season, from April or May to July. This section of the Mékrou River differs from the sections of the Niger in several ways. It is narrower, almost dry part of the year, supports much more gallery forest and has much less intensive land use along its banks.

In the variable environment of the Sahel, most waterbirds and raptors are likely to show some degree of mobility in response to environmental variability, be it seasonal or irregular. Thus the surveys were conducted once every month, when possible (see Table 1), although few were carried out after August 1997. The data used here are from February 1995 to April 1999. Immediately prior to the rainy season, surveys were often missed, especially on the Mékrou River, because of low water levels. A number of other months were missed due to boat failure and other technical difficulties. Months not surveyed were calculated as missing data, not zeros. The monthly surveys will in due course permit detection of long-term trends in bird numbers.

Table 1. Surveys from which results were used in this paper.

Year	River	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1995	Niger		1	1	1	1	1	1	1	1	1	1	1	11
	Mékrou			1	1				1	1	1	1	1	7
1996	Niger	1	1	1	1	1	1	1	1	1	1	1	1	12
	Mékrou	1	1	1	1				1	1	1	1	1	9
1997	Niger	1	1	1	1	1	1	1	1					8
	Mékrou	1	1	1										3
1998	Niger							1						1
	Mékrou							1				1		2
1999	Niger		1	1	1									3
	Mékrou		1											1
Total	Niger	2	4	4	4	3	3	4	3	2	2	2	2	35
Total	Mékrou	2	3	3	2			1	2	2	2	3	2	22

The survey crew consisted of a local boat driver and two or three biologists, who were not the same for all surveys. Participants included CJ (1995–7), Abdou Hamidou (1995–8), Denise Foy (1996–7), Katie Furbur (1996–7), Donata Roome (1997), JA (1997–8), Jessie Bulloch (1997–9), Kara Gregor (1998–9), Ousmane Halidou (1998–

9) and Adrian VerHagen (1999). We tried to minimize observer bias by overlapping old and new surveyors. We surveyed waterbirds and raptors because both groups are easily identifiable and good indicators of the status of the riparian environment. Surveys on the Niger River began at *c.* 7h30 on consecutive days (one day Boscia–Koro Gungu, the next day Boscia–Boumba), using a small motorboat at an average speed of about 15 km of river per hour. The Mékrou survey began after surveyors completed the Boscia-Boumba section, at *c.* 10h30. We counted birds in front of us on the river and on both banks, and as far out as we could positively identify them. The precise route along the river varied according to circumstances such as water level, location of sand banks and presence of hippopotamus *Hippopotamus amphibius*. We disembarked once per Niger River section, to survey specific marshy islands with high individual bird counts and species diversity.

The months were grouped into cold (Dec–Feb), hot (Mar–May), rainy (Jun–Aug) and mini-hot (Sep–Nov) seasons, to facilitate the identification of possible seasonal effects on bird numbers. Bird names and migratory status are taken from Brown *et al.* (1982), Urban *et al.* (1986), Fry *et al.* (1988) and Dowsett & Forbes-Watson (1993).

Results

Individual species

A total of 101 species of waterbird and raptor was seen during the surveys. Of these, the following 28 were seen only once or twice and are not included in the statistical calculations for individual species: Pink-backed Pelican *Pelecanus rufescens*, Dwarf Bittern *Ixobrychus sturmii*, Yellow-billed Stork *Mycteria ibis*, African Openbill Stork *Anastomus lamelligerus*, Woolly-necked Stork *Ciconia episcopus*, African Spoonbill *Platalea alba*, Fulvous Whistling Duck *Dendrocygna bicolor*, Egyptian Goose *Alopochen aegyptiacus*, African Pigmy Goose *Nettapus auritus*, Northern Pintail *Anas acuta*, Honey Buzzard *Pernis apivorus*, Lappet-faced Vulture *Torgos tracheliotus*, Montagu's Harrier *Circus pygargus*, Red-tailed Buzzard *Buteo auguralis*, Booted Eagle *Hieraaetus pennatus*, Martial Eagle *Polemaetus bellicosus*, Lesser Kestrel *Falco naumanni*, African Hobby *Falco cuvierii*, Black Crake *Amaurornis flavirostris*, Painted Snipe *Rostratula benghalensis*, Rock Praticole *Glareola nuchalis*, Black-tailed Godwit *Limosa limosa*, Common Redshank *Tringa totanus*, Little Stint *Calidris minuta*, Common Tern *Sterna hirundo*, African Skimmer *Rynchops flavirostris*, Pel's Fishing Owl *Scotopelia peli*, and Blue-breasted Kingfisher *Halcyon malimbica*. Except for the Honey Buzzard, Lappet-faced Vulture and Pel's Fishing Owl, these were all seen on the Niger River, with about nine of these species observed there each season except the mini-hot season (only three species).

For the remaining 73 species, Table 2 presents the average, minimum and maximum numbers of birds per species that were seen for each river and each season.

Table 2. Numbers of birds, quoted as mean (min.–max.), of each species observed per survey and per river during each season. Numbers for the Niger River are for 75 km; those for the Mékrou River are for a maximum of 15 km of river (depending on navigability). Status = migratory status in Niger according to Dowsett & Forbes-Watson (1993): I = intra-African migrant; P = Palaearctic migrant; R = resident.

	Status	Niger River				Mékrou River			
		cold Dec–Feb	hot Mar–May	rainy Jun–Aug	mini-hot Sep–Nov	cold Dec–Feb	hot Mar–May	rainy Jun–Aug	mini-hot Sep–Nov
Phalacrocoracidae									
Phalacrocorax carbo Great Cormorant	R	0	1.5(0–12)	0	0	0.9(0–6)	0	0	0
P. africanus Reed Cormorant	R	12.3(25–73)	13.6(1–34)	5.5(0–15)	0.2(0–1)	0.1(0–1)	9.0(5–14)	0.3(0–1)	0
Anhinga rufa African Darter	R	0	0.4(0–4)	0	0	0	0	0	0
Ardeidae									
Ixobrychus minutus Little Bittern	R,P	0	0.1(0–1)	0.1(0–1)	0	0	0	0.3(0–1)	0.9(0–6)
Nycticorax nycticorax Black-crowned Night Heron	P,R	14(0–50)	25(0–152)	0.2(0–2)	8.2(2–18)	0	22(0–88)	0	0.7(0–3)
Ardeola ralloides Squacco Heron	R,P	20(2–55)	4.2(0–23)	0.9(0–7)	1.2(0–7)	0.4(0–2)	6.6(0–21)	1.0(0–3)	0.1(0–1)
Bubulcus ibis Cattle Egret	R	159(0–319)	96(1–562)	73(0–445)	74(6–215)	0.9(0–4)	23(0–90)	0.7(0–2)	25(0–114)
Butorides striatus Green Heron	R	0	0.7(0–2)	2.0(0–7)	1.5(0–5)	1.3(0–3)	3.0(0–11)	0.3(0–1)	2.0(0–4)
Egretta garzetta Little Egret	R,P	18(3–51)	19(0–72)	1.5(0–6)	1.8(0–5)	0.3(0–1)	0	0	0.1(0–1)
E. intermedia Yellow-billed Egret	R	11(1–36)	17(0–54)	3.2(0–15)	0	0	1.0(0–4)	0	0
E. alba Great White Egret	P,R	8.8(0–26)	12(0–46)	1.5(0–15)	0.2(0–1)	0	0.4(0–2)	0	0
Ardea purpurea Purple Heron	P,R	26(2–70)	18(2–32)	6.7(1–14)	3.5(0–9)	3.6(0–7)	7.0(0–22)	0	0.6(0–3)
A. cinerea Grey Heron	R,P	53(35–72)	130(38–282)	77(6–331)	31(12–55)	1.3(0–3)	2.8(0–9)	0.3(0–1)	2.4(0–5)
A. melanocephala Black-headed Heron	R	8.6(0–20)	36(1–167)	19(3–45)	5.8(1–16)	0.6(0–3)	1.8(0–5)	1.0(0–3)	1.6(0–8)
Scopidae									
Scopus umbretta Hamerkop	R	2.4(0–6)	2.1(0–7)	1.1(0–3)	1.8(0–5)	0.9(0–3)	0.2(0–1)	1.0(0–3)	2.0(0–5)
Ciconiidae									
Ciconia abdimii Abdim's Stork	I	0	5.8(0–44)	13.4(0–26)	0	0	0	0	0.1(0–1)

Table 2 continued

	Status	Niger River				Mékrou River			
		cold Dec–Feb	hot Mar–May	rainy Jun–Aug	mini-hot Sep–Nov	cold Dec–Feb	hot Mar–May	rainy Jun–Aug	mini-hot Sep–Nov
Leptoptilos crumeniferus Marabou Stork	R	0	8.9(0–58)	0.9(0–9)	0	0	0.2(0–1)	0	0
Threskiornithidae									
Threskiornis aethiopicus Sacred Ibis	R	4.4(1–10)	15(0–51)	0	0	0	0	0	0
Plegadis falcinellus Glossy Ibis	R,P	1.6(0–7)	10(0–31)	0.5(0–4)	2.5(0–14)	0	0.4(0–1)	0	0.6(0–4)
Bostrychia hagedash Hadada	R	7.8(0–16)	9.5(0–33)	1.0(0–10)	3.7(0–13)	0.3(0–2)	1.8(0–9)	0	0.9(0–4)
Anatidae									
Dendrocygna viduata White-faced Tree-Duck	R	1435(1–6338)	3290(47–6292)	361(1–2773)	50(2–130)	0	0	0.3(0–1)	0.3(0–1)
Plectropterus gambensis Spur-winged Goose	R	116(0–250)	222(0–638)	74(0–337)	11(0–20)	0	0.4(0–2)	2.7(0–8)	3.7(0–14)
Sarkidiornis melanotos Knob-billed Duck	I	204(8–404)	351(25–742)	39(5–145)	8.8(0–20)	16(0–70)	5.2(0–21)	1.7(0–3)	1.3(0–7)
Anas querquedula Garganey	P	20(0–132)	0	0	6.3(0–35)	0	0	0	0
Accipitridae									
Elanus caeruleus Black-shouldered Kite	R	0.3(0–1)	0	0	0	0.1(0–1)	0	0	0
Milvus migrans Black Kite	P	13(3–24)	17(3–40)	4.4(0–20)	5.7(0–12)	6.1(2–10)	4.4(2–7)	1.3(0–4)	3.4(0–10)
Haliaeetus vocifer River Eagle	R	6.0(2–14)	7.7(0–18)	5.0(2–8)	3.3(1–5)	0.3(0–1)	0.2(0–1)	0.7(0–2)	0.3(0–2)
Necrosyrtes monachus Hooded Vulture	R	2.0(0–5)	0.6(0–3)	2.6(0–24)	3.3(0–11)	1.3(0–3)	1.2(0–3)	1.0(0–3)	1.6(0–10)
Gyps africanus White-backed Vulture	R	13(0–70)	11(0–54)	5.0(0–28)	12(0–26)	15(0–28)	3.6(0–7)	1.7(0–5)	8.6(1–28)
G. rueppellii Rüppell's Griffon	R	0.4(0–3)	0	0	0	0.3(0–2)	1.0(0–5)	3.0(0–8)	0.3(0–2)
Trigonoceps occipitalis White-headed Vulture	R	0	0.1(0–1)	0	0	0	0.4(0–2)	0.7(0–2)	0
Circaetus gallicus Short-toed Eagle	P,I	0.5(0–2)	0.2(0–2)	0.1(0–1)	0.5(0–2)	0	0	0	0.3(0–1)
C. cinereus Brown Snake Eagle	R	0.1(0–1)	0.4(0–3)	0.6(0–3)	1.0(0–3)	0.6(0–2)	0.2(0–1)	0.3(0–1)	0.4(0–2)
Terathopius ecaudatus Bateleur	R	0	0.5(0–3)	0.8(0–4)	0.2(0–1)	0.3(0–1)	0.6(0–3)	0	0.4(0–2)
Polyboroides typus Harrier-Hawk	R	0.3(0–2)	1.0(0–3)	0.2(0–1)	0.3(0–2)	0.9(0–3)	0.8(0–2)	0.7(0–1)	0.4(0–1)
Circus aeruginosus Marsh Harrier	P	14(4–30)	6.2(0–18)	2.7(0–9)	6.5(0–16)	1.9(0–5)	1.4(0–5)	1.0(0–3)	0.6(0–2)

C. macrourus Pallid Harrier	P	0.4(0–1)	0.4(0–3)	0	0	0	0.2(0–1)	0	0
Melierax metabates Dark Chanting Goshawk	R	0.3(0–1)	0	0.2(0–2)	0.5(0–3)	0	0	0	0.4(0–2)
M. gabar Gabar Goshawk	R	0.5(0–1)	0.1(0–1)	0.2(0–2)	0.2(0–1)	0.3(0–2)	0	0	0
Accipiter badius Shikra	R	0.1(0–1)	0.1(0–1)	0.1(0–1)	0.3(0–2)	0.1(0–1)	0	0	0.3(0–1)
Aquila wahlbergi Wahlberg's Eagle	I	0.3(0–1)	0	0.3(0–1)	0.5(0–1)	0.3(0–2)	0	0	0.3(0–1)
A. rapax Tawny Eagle	R	0	0.5(0–2)	0.8(0–2)	1.0(0–3)	0.1(0–1)	0	0	0.4(0–1)
Lophaetus occipitalis Long-crested Eagle	R	0.5(0–3)	0.1(0–1)	0.4(0–1)	0	0.9(0–2)	0	0	0
Pandion haliaetus Osprey	P	0.1(0–1)	0	0	0.5(0–2)	0	0.6(0–2)	0	0.3(0–1)
Falconidae									
Falco tinnunculus Common Kestrel	R,P	0	0.4(0–3)	0.8(0–8)	0	0	0	0	0
F. ardosiaceus Grey Kestrel	R	0.3(0–2)	0.2(0–1)	0.2(0–1)	0.3(0–2)	0	0	0	0.1(0–1)
F. chicquera Red-necked Falcon	R	0.4(0–2)	0.2(0–2)	0.6(0–2)	0.5(0–1)	0.3(0–2)	0.2(0–1)	0	0.1(0–1)
Rallidae									
Gallinula angulata Lesser Moorhen	I	0	0.1(0–1)	0.4(0–2)	0	0	0	0	0
Gruidae									
Balearica pavonina Black Crowned Crane	R	0	0.9(0–3)	0.4(0–2)	0	0	0	0	0
Jacanidae									
Actophilornis africana African Jacana	R	5.9(0–16)	11(0–28)	7.0(0–35)	2.3(0–7)	0.3(0–1)	1.2(0–3)	0.3(0–1)	0
Recurvirostridae									
Himantopus himantopus Black-winged Stilt	P	15(0–65)	3.2(0–16)	0	1.0(0–6)	0	0	0	0.6(0–4)
Burhinidae									
Burhinus senegalensis Senegal Thick-knee	R	1.4(0–8)	7.5(0–41)	3.2(0–17)	2.2(0–8)	0	0	0	0
Glareolidae									
Pluvianus aegyptius Egyptian Plover	R	44(22–62)	84(23–204)	39(0–102)	15(2–53)	1.0(0–4)	1.4(0–4)	1.3(0–4)	2.7(0–12)
Glareola pratincola Common Pratincole	R,P	0	0.2(0–2)	4.3(0–41)	0	0	0	0	0
G. cinerea Grey Pratincole	I	0	0.3(0–3)	2.7(0–13)	0	0	0	0	0
Charadriidae									
Vanellus senegallus African Wattled Plover	R	1.9(0–4)	15(0–46)	3.8(0–17)	1.0(0–4)	0.4(0–2)	2.0(0–5)	0	2.3(0–16)

Table 2 continued

	Status	Niger River				Mékrou River			
		cold	hot	rainy	mini-hot	cold	hot	rainy	mini-hot
		Dec–Feb	Mar–May	Jun–Aug	Sep–Nov	Dec–Feb	Mar–May	Jun–Aug	Sep–Nov
V. spinosus Spur-winged Plover	R	77(36–135)	88(29–231)	62(11–120)	28(7–66)	0.9(0–2)	1.6(0–3)	0	0.3(0–2)
Scolopacidae									
Gallinago gallinago Common Snipe	P	0.8(0–5)	0	0	2.3(0–14)	0	0	0	0
Tringa stagnatilis Marsh Sandpiper	P	0.4(0–2)	0.9(0–7)	0.1(0–1)	0	0	0.2(0–1)	0	0
T. nebularia Common Greenshank	P	1.0(0–6)	0.2(0–2)	0	0	0	0	0	0
T. ochropus Green Sandpiper	P	0.8(0–3)	0.5(0–5)	0	1.8(0–6)	0	0.2(0–1)	0	0
T. glareola Wood Sandpiper	P	0.8(0–4)	1.7(0–13)	0	0	0	0.2(0–1)	0	0
Actitis hypoleucos Common Sandpiper	P	5.1(1–11)	4.2(0–11)	0.9(0–3)	4.7(1–13)	1.6(0–4)	1.8(0–3)	1.0(0–2)	1.6(0–5)
Philomachus pugnax Ruff	P	317(0–927)	29(0–149)	0	0	2.9(0–20)	0	0	0
Sternidae									
Gelochelidon nilotica Gull-billed Tern	P	0.6(0–2)	0.8(0–3)	0.2(0–2)	0.3(0–1)	0	0	0	0
Sterna albifrons Little Tern	I	0	5.5(0–29)	11.5(0–38)	0	0	0	0	0
Chlidonias leucopterus White-winged Tern	P	0.3(0–2)	0.1(0–1)	0.3(0–3)	0	0	0	0	0
Alcedinidae									
Alcedo cristata Malachite Kingfisher	R	0	0	0	0.2(0–1)	0	0.6(0–2)	2.3(0–4)	0.1(0–1)
Ceyx pictus Pygmy Kingfisher	I	0	0	0.1(0–1)	0	0	0.2(0–1)	0.3(0–1)	0.1(0–1)
Halcyon leucocephala Grey-hooded Kingfisher	I	0	3.1(0–29)	5.3(0–19)	0.8(0–3)	0.1(0–1)	0	2.0(0–5)	2.0(0–4)
H. senegalensis Woodland Kingfisher	I	0	0	4.7(0–16)	5.0(0–11)	0	0	2.0(0–5)	2.3(0–6)
Megaceryle maxima Giant Kingfisher	R	0.3(0–1)	0.3(0–3)	0.5(0–2)	0.5(0–3)	0.7(0–2)	1.4(1–2)	1.0(0–3)	1.9(0–4)
Ceryle rudis Pied Kingfisher	R	38(14–56)	46(28–74)	30(11–46)	19(8–47)	16(3–28)	18(10–23)	11(5–17)	12(5–25)

The following species met the Ramsar Convention criterion of 1% of global population, according to the 1% figures in Rose & Scott (1997). *Dendrocygna viduata* (threshold 2500 individuals): average number during the hot season was 3290, and two counts exceeded 6000 (6338 in Feb 1997, 6292 in May 1995). *Plectropterus gambensis* (threshold 500): exceeded during the hot season in May 1995 (638), and April 1997 (543). *Sarkidornis melanotus* (threshold 500): exceeded during the hot season in May 1995 (742), Apr 1996 (660), May 1996 (630) and Apr 1997 (510). *Pluvianus aegyptius* (threshold 200): exceeded in May 1995 (204), with counts of 100 or more common.

Almost all species showed evidence of movement, including supposedly resident species (Dowsett & Forbes-Watson 1993) such as *Anhinga rufa*, *Phalacrocorax africanus*, and *Egretta intermedia.* At the same time, some individuals of many Palaearctic migrants remained during the boreal summer (wet season). These were probably of pre-breeding age.

The Niger and Mékrou rivers differed in species composition and abundance (Table 2). The much shorter section of the Mékrou River contained higher absolute numbers of the following species: *Ixobrychus minutus, Butorides striatus, Pandion haliaetus, Terathopius ecaudatus, Polyboroides typus, Alcedo cristata*, and *Megaceryle maxima*.

Species groups

Total number of waterbirds and raptors varied significantly across seasons (ANOVA $F_3 = 4.901$, $P = 0.002$). Total number of species on the rivers varied by season and varied differently on the two rivers (Table 3). For both calculations the species seen only once or twice were included, but their effect on total number of birds seen and on number of species seen per survey was always very small.

The highest numbers of species on the Niger River were sighted during the hot season (total 70), although the average number of species seen per survey was slightly higher during the cold season (34.1 vs. 31.9). The fewest species were seen in the mini-hot season (total 52, average 26.3). On the Mékrou River, the total number of species seen ranged from 45 in the mini-hot season to 30 in the rainy season. The number of species observed per survey on the Mékrou River did not differ significantly between the seasons, and was usually between 13 and 20.

Total number of birds sighted also varied by season and river (Table 3). On both rivers, highest numbers were seen during the hot season, with the cold season coming second on the Niger River and the mini-hot season on the Mékrou River.

There were also differences in the densities of different bird groups between seasons, calculated by dividing the number of birds by the length of river surveyed. Density of Anseriformes (Anatidae, all species) fluctuated significantly with the seasons (ANOVA $F_3 = 4.231$, $P = 0.032$). Anseriformes, Charadriiformes (Recurvirostridae, Burhinidae, Glareolidae, Charadriidae, Scolopacidae, Sternidae), and Ciconiiformes (Ardeidae, Scopidae, Ciconiidae, Threskiornithidae) occurred at

higher densities on the Niger River than on the Mékrou River (all data combined, Wilcoxon sign test Z = -3.043, -3.314, -2.314 respectively, $P < 0.05$ in all cases). Coraciiformes (Alcedinidae) and Falconiformes (Accipitridae, Falconidae) occurred at higher densities on the Mékrou River (Z = 3.629, 2.786 respectively, $P < 0.05$). There was no significant difference between rivers for Pelecaniformes (Phalacrocoracidae) and Gruiformes (Rallidae, Gruidae, Jacanidae). More Anseriformes were seen in the hot season than any other season. Three of the most variable species were *Dendrocygna viduata, Plectropterus gambensis*, and *Sarkidornis melanotos* (Table 2). For these species the highest numbers occurred during the hot season and the lowest numbers were recorded in the mini-hot season. Of the African Charadriiformes, *Pluvianus aegyptius* was most commonly seen in the hot season (Table 2) but was visible throughout the year (observed during 34 out of the 35 surveys).

Table 3. Seasonal differences in the number of birds and species, quoted as mean (min.–max.), observed per river section.

Season:	Cold Dec–Feb	Hot Mar–May	Rainy Jun–Aug	Mini-hot Sep–Nov
Niger River (75 km)				
Number of surveys	8	11	10	6
Birds per survey	2714(671–8264)	4638(967–9645)	899(122–4696)	334(210–523)
Species per survey	34.1(20–40)	31.9(26–40)	27.0(20–41)	26.3(22–32)
Total species during study	61	70	65	52
Mékrou River (≤ 15 km)				
Number of surveys	7	5	3	7
Birds per survey	78(44–131)	128(42–288)	41(39–44)	87(46–139)
Species per survey	15.4(13–18)	19.8(12–26)	13.0(9–16)	16.4(13–24)
Total species during study	38	41	30	45

Discussion

The Niger and Mékrou Rivers differ in the numbers of bird species and individuals found on them. Moreover, the bird numbers change, sometimes dramatically, between the seasons.

Of course, not every bird on every survey could be counted and numbers counted are thus minima. Both banks were visible on all surveys, but as the river was wider in and after the rainy season (June–August) both shores could not be seen equally well the entire time. Also some birds are more cryptic and thus more easily missed. On the Niger River, vegetation cover is patchy, while on the Mékrou River, woody vegetation is thick all along its banks. In addition, the timing of the surveys may have

had some effect on the results. Surveys on the Niger River were conducted early in the morning while the Mékrou was surveyed mid-morning. This will have affected survey results in different but consistent ways: for some species a later survey hour generally means less activity, for others it means more activity.

More birds were seen in the hot season than in the rainy season. Waders were mostly of Palaearctic origin and were therefore most prevalent during the cold season (and on the Niger River). Anatidae were mostly of Afrotropical origin and most numerous during the hot season. Other local wildlife was also more prevalent on the riverbanks in the hot season. This is in part because smaller waterholes in other parts of the bush dry up during the hot season and the Niger River itself drops 3 m or more. Thus, birds and animals are drawn to the remaining water in the river.

On the Niger River, the second most important season after the hot season, for waterbirds and raptors in general, was the cold season, whereas for the Mékrou River it was the mini-hot season. This is probably due to differences in hydrological conditions between rivers. During the cold season the Niger River still has quite a bit of water, a scarce resource at that dry time of year. The Mékrou dries out more quickly, so that river is more important for waterbirds and raptors at the start of the dry season, i.e. during the mini-hot season.

Some species require specific habitats. The Niger River is a larger, faster flowing body of water with less vegetation on its banks than the Mékrou River. Thus, it is a better habitat for ducks and waders, some of which, such as *Dendrocygna viduata*, use the large Niger River as a flyway. These can also be seen during the dry season in huge rafts on the Niger River or on exposed islands in the middle of the river. Ciconiiformes utilize the sloping bare banks and scattered islands for foraging and nesting habitats.

The smaller Mékrou River with its densely vegetated banks and forest was better for species such as kingfishers that require riparian habitat for both nesting and foraging, often perching on branches next to or overhanging the river. Such branches are much less common on the Niger River. In addition the Mékrou River lacks islands and long sloping banks. All the same, some Ciconiiformes were seen regularly on the smaller Mékrou, but mostly the smaller species and less frequently than on the Niger. Falconiformes were observed frequently on both rivers. The riparian habitat, as well as farm and grazing land, contain abundant prey for them.

Conclusions

W National Park protects savanna habitat, which is becoming increasingly rare in West Africa. It also protects significant areas of wetland and its associated birds along the Niger and Mékrou Rivers. The diversity of habitat along these rivers is important to Palaearctic migrants as well as Afrotropical birds (see also IUCN 1986). Our data indicate that the park merits its status as a Wetland of International Importance under

the Ramsar Convention. These baseline data now permit assessment of long-term trends in waterbird and raptor numbers. Waterbirds and raptors can be important indicators of the environmental integrity of the park and rivers.

In this variable environment many taxa move regularly or irregularly. The rivers and isolated wetlands have in part complementary ecological functions, providing suitable feeding and resting habitat to the same species but at different times of the year. This complicates the assessment of the migratory status of a number of waterbird species. To determine if movements that we noted were seasonal migration or local movements, surveys would need to be conducted on the rivers and the isolated wetlands simultaneously during each season, and percentages of juveniles would need to be noted.

We show that, for Afrotropical waterbirds at least, the importance of certain wetlands is better demonstrated by counts during the hot season than by counts during the cold season, as is more commonly done, although for Palaearctic waterbirds obviously the best time is the cold season. For observing large numbers and many species of Afrotropical waterbirds and raptors along the two rivers, the hot (late dry) season is obviously best. Local people report that, on certain large isolated wetlands in S Niger, the largest concentrations of waterbirds are also found during the dry season.

Acknowledgments

This work was performed as part of a contract for the United States Peace Corps (USPC). JA and CJ gratefully acknowledge the USPC for their support of the project and volunteers working on the survey. Thanks go to the Nigérien boat drivers, Abdou Hamidou and Ousmane Halidou, without whom this work could not have happened, and to our fellow surveyors Denise Foy, Katie Furbur, Jessie Bulloch, Donata Roome, Kara Gregor and Adrian VerHagen. Many thanks to Tim Dodman, Lincoln Fishpool, Alan Tye and an anonymous referee, who offered valuable advice on drafts of this paper. JA would also like to thank Chris Petersen and Sean Todd for their guidance and statistical advice regarding this manuscript.

References

BROUWER, J. & MULLIÉ, W.C. (2001) A method for making whole country waterbird population estimates, applied to annual waterbird census data from Niger. *Ostrich* Suppl. 15: 73–82.

BROUWER, J., CODJO, S.F. & MULLIÉ, W.C. (2001) Niger. Pp. 661–672 *in* L.D.C. FISHPOOL and M.E. EVANS (eds), *Important Bird Areas of Africa and Associated Islands*. BirdLife International, Cambridge.

BROWN, L.H., URBAN, E.K. & NEWMAN, K. (1982) *The Birds of Africa*, vol. 1. Academic Press, London.

CRISLER, T., JAMESON, C. & BROUWER, J. (2003) An updated overview of the birds of Park W, southwest Niger. *Malimbus* 25: 4–30.

DOWSETT, R.J. & FORBES-WATSON, A.D. (1993) *Checklist of Birds of the Afrotropical and Malagasy Regions. Volume 1: Species limits and distribution*. Tauraco Press, Liége.

DUFRESNE, A., CLOUTIER, A. & THORSELL, J. (1982) 28ème Réunion de la Commission des Parcs Nationaux et des Aires Protégées. Parc National du "W", Niger, 18–22 mars 1982. Compte Rendu. IUCN, Niger.

FRY, C.H., KEITH, S. & URBAN, E.K. (1988) *The Birds of Africa*, vol 3. Academic Press, London.

IUCN (1993) *Environmental Synopsis, Niger*. IUCN, Gland.

IUCN (1986) *The IUCN Sahel Report. A long term strategy for environmental rehabilitation.* IUCN, Gland.

ROSE, P.M. & SCOTT, D. (1997) *Waterfowl Population Estimates*. 2nd ed. Wetlands International, Wageningen.

URBAN, E.K., FRY, C.H. & KEITH, S. (1986) *The Birds of Africa*, vol. 2. Academic Press, London.