

Bird Ecology in the Ruzizi Delta, Northern End of Lake Tanganyika in Burundi and in the Democratic Republic of Congo

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ABSTRACT

Bird ecology in the Ruzizi Delta was investigated during the months of April, July and October 2019-2021. Three species of water birds were the most prominent, the Cattle Egret (Ardeidae), *Bubulcus ibis* (Linnaeus, 1758) «Héron garde boeufs», the Black Crake (Rallidae) *Amaurornis flavirostris* (Swainson, 1837) «Râle à bec jaune» and the African Jacana (Jacanidae) *Actophilornis africanus* (Gmelin, 1789) «Jacana à poitrine dorée». The objective pursued by the research is the sustainable conservation of birds by protecting their habitats, the wetlands of the Ruzizi Delta, particularly the unprotected Ruzizi Congolese Delta. The research documents 490 bird species including 99 (20%) in the unprotected Ruzizi Congolese Delta, 191 (39%) in the protected Rusizi Burundian Delta, and 200 species (41%) in both the Ruzizi Congolese Delta and Rusizi Burundian Delta. The research presents 60 newly reported species in the Ruzizi delta of which four are reported only in the unprotected Ruzizi Congolese Delta, 37 in the protected Rusizi Burundian Delta and 19 newly reported species both in the Ruzizi Congolese Delta and Rusizi Burundian Delta. The list of bird species now known from the Ruzizi Congolese Delta is extended by 21 species and goes from 252 to 273, while that of the Rusizi Burundian Delta is extended by 56 bird species and goes from 410 to 466. The 490 bird species are distributed into 18 orders and 84 families. 238 species meet six Ramsar criteria of seven for bird protection, of which only 29 are recorded in the unprotected Ruzizi Congolese Delta, 107 in the Rusizi protected Burundian Delta and 102 species are reported in both the Ruzizi Congolese Delta and Rusizi Burundian Delta. The thesis provides the needed information for the creation of a protected area in the Ruzizi Congolese Delta for sustainable conservation of birds and biodiversity in the Ruzizi delta both in Burundi, the DRC and the Northern End of Lake Tanganyika, already subscribed on the UNESCO World Heritage List.

Key words: Bird ecology; water bird; Protection of wetlands; Density of bird species; Distribution of bird species.

INTRODUCTION

Bird ecology of birds tells us how Birds fit into the environment in which they live, and how they coexist with other organisms. There are two main aspects of bird ecology: feeding ecology and breeding ecology. We investigated some parameters of bird ecology focussing on three wetland bird species: Cattle Egret (Ardeidae), *Bubulcus ibis* (Linnaeus, 1758), «Héron garde boeufs»; Black Crake (Rallidae), *Amaurornis flavirostris* (Swainson, 1837), «Râle à bec jaune»; and African Jacana (Jacanidae) *Actophilornis africanus* (Gmelin, 1789), «Jacana à poitrine

dorée» in the low land of the Ruzizi Plain, main known as the Ruzizi Delta both in the Democratic Republic of Congo (DRC) and in the Republic of Burundi.

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Sampling fieldwork were conducted two times per week, once in DRC and once in Burundi for eleven months from April 2019 to March 2020, except December 2019 as we were to Workshop in Benin and in Bukavu.

The main research question was how these three wetland bird species fit into their environment, the Ruzizi Congolese Delta (RCD) and the Rusizi Burundian Delta (RBD) for their lasting conservation and management planning. We investigated the bird communities they live with, their feeding and breeding areas, stakeholder's opinions to protect their habitats along rivers, the Lake Tanganyika shore areas, in ponds and marshes surrounding ponds and rivers, as well as in steppe and shrub areas of the protected and unprotected areas in DRC and Burundi. The doctoral thesis on «Bird Ecology, Conservation and Management in the Ruzizi Delta of DRC and Burundi» is going along way to provide information needed for wetland habitats protection in DRC and enforcement bird conservation management both in DRC and in Burundi (Butchart, Stattersfield, & Collar, 2006).

This study is unique for Bird Ecology, Conservation and Management both in the Ruzizi Congolese Delta (RCD) in DRC and in the Rusizi Burundian Delta (RBD) in Burundi. It will update the list of birds both in the RCD and in the RBD. It will contribute to the expansion of protected areas in the DRC and to strengthening the management of protected areas in Burundi with a view to combating climate change, epidemics and disasters and preventing the extinction of certain species of birds

RESULTS & DISCUSSION

Bird species communities include orders, families, resident, migrant bird species, species that fulfil the Ramsar criteria, and bird species with IUCN status. All of them are important bird species for conservation in the Ruzizi Congolese Delta (RCD) and the Rusizi Burundian Delta (RBD)

Bird communities

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Bird species number per Family and per order from the Ruzizi Delta

Table 1 presents the number of species (sp) and the number of families per order represented in the Ruzizi Delta. Orders represented are: **Podicipediformes**, one family Podicipedidae (3 sp); **Pelecaniformes**, three families: Pelecanidae (2 sp), Phalacrocoracidae (2 sp),

Anhingidae (2 sp); **Ciconiiformes**, four families: Ardeidae (16 sp), Scopidae (1 sp), Ciconidae (7 sp), and Threskiornithidae (4 sp); **Phoenicopteriformes**, one family Phoenicopteridae (5 species); **Anseriformes**, one family Anatidae (17 sp); **Falconiformes**, two families: Accipitridae (26 sp) and Falconidae (11 sp); **Galliformes**, two families: Numididae (1 sp) and Phasianidae (8 sp); **Gruiformes**, four families: Sarothruridae (3 sp), Rallidae (11 sp), Gruidae (3 sp) and Otididae (1 sp);

Table 1 Bird species numbers and family numbers per order from the Ruzizi Delta

Nb	Orders	FNb	SNb
1	Podicipediformes	1	3
2	Pelecaniformes	3	6
3	Ciconiiformes	4	28
4	Phoenicopteriformes	1	5
5	Anseriformes	1	17
6	Falconiformes	2	37
7	Galliformes	2	9
8	Gruiformes	4	18
9	Charadriiformes	12	67
10	Columbiformes	1	12
11	Psittaciformes	1	1
12	Cuculiformes	2	15
13	Strigiformes	1	6
14	Caprimulgiformes	1	4
15	Apodiformes	3	11
16	Coraciiformes	6	27
17	Paciformes	4	9
18	Passeriformes	35	215
	Total	84	490

Legend: Nb, Ordinal number; FNb, Family Number; SNb, Species Number

Charadriiformes, 12 families: Jacanidae (2 sp), Recurvirostridae (2 sp), Dromatidae (1 sp), Rostratulidae (1 sp), Burhinidae (2 sp), Glareolidae (5 sp), Charadriidae (19 sp), Scolopacidae (21 sp), Stercorariidae (2 sp), Laridae (4 sp), Sternidae (7 sp), and Rynchopidae (1 sp); **Columbiformes**, one family Columbidae (12 sp); **Psittaciformes**, one family Psittacidae (1 sp); **Cuculiformes**, two families: Musophagidae (2 sp), and Cuculidae (13 sp); **Strigiformes**, one family Strigidae (6 sp); **Caprimulgiformes**, one family (4 sp); **Apodiformes**, three families: Apodidae (7 sp), Coliidae (3 sp) and Trogonidae (1 sp); **Coraciiformes**, 6 families: Alcedinidae (9 sp), Meropidae (9 species), Coraciidae (3 sp), Phoeniculidae (2 sp), Upupidae (2 sp), and Lybiidae (2 sp); **Paciformes**, four families: Indicatoridae (4 sp), Picidae (2 sp); Eurylaimidae (1 sp), and Pittidae (1 species); and finally **Passeriformes**, 35 families: Alaudidae (4 sp), Hirundinidae (11 sp), Motacillidae (8 sp), Campephagidae (2 sp), Pycnonotidae (6 sp), Turdidae (12 sp), Acrocephalidae (8 sp), Locustellidae (2 sp), Sylviidae (3 sp), Scotocercidae (1 sp), Phylloscopidae (3 sp), Macrosphenidae (1 sp), Hyliotidae (1 sp), Cisticolidae (23 sp), Muscapidae (13 sp), Platysteiridae (1 sp), Monarchidae (3 sp), Pellorneidae (2 sp), Leiothrichidae (4

sp), Paridae (1 sp), Timaliidae (2 sp), Zosteropidae (1 sp), Nectarinidae (14 sp), Oriolidae (3 sp), Laniidae (7 sp), Malaconotidae (7 sp), Vangidae (1 sp), Dicruridae (1 sp), Corvidae (2 species), Sturnidae (9 species), Passeridae (2 sp), Ploceidae (28 sp), Estrildidae (19 sp), Viduidae (2 sp), and finally the Family of Fringilidae (8 sp). The 18 orders, 84 families and the number of 490 bird species from the Ruzizi Delta are presented by Table 1 The difference between the bird species numbers and the numbers of families per orders is significant (T^1 cal= 5,891; DF= 34; $p < 0.001$).

Bird taxonomic divisions from the Ruzizi Delta

Figure 1 presents taxonomic divisions of the bird species recorded in the Ruzizi Delta 2019-2020 including: 18 orders, 84 families and 490 species. There is a highly significant difference between the bird taxonomic divisions in the Ruzizi Delta, ($\chi^2 = 488,926$; DF=2; $p < 0.001$).

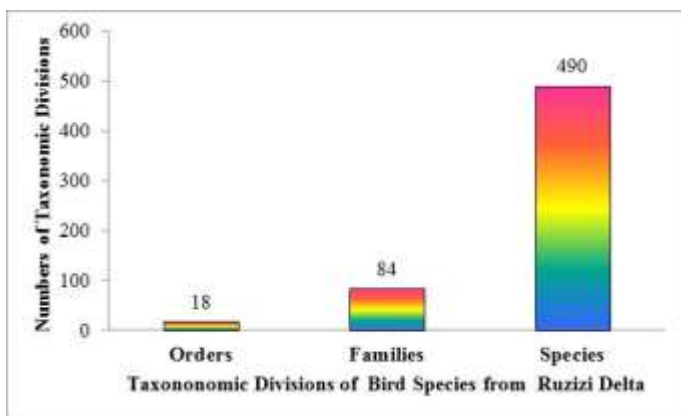


Figure-1. Taxonomic Divisions of Bird Species from Ruzizi Delta

We assume that the minimum respect of Congolese regulations for environment and biodiversity conservation (Chiambeng, Aziza, Mafuta, & Kasongo, La répression des crimes fauniques en RDC: comment améliorer les poursuites judiciaires? Rapport decembre 2018, 2018); (RDC, 2016) and (RDC C. P., 2003) may lead to the full protection of the banks of the rivers, natural ponds and the Lake Tanganyika shore areas at Uvira. Following are bird species fluctuation and bird densities per sampling area and per sampled sites in the Ruzizi Delta both in the DRC and the Republic of Burundi.

Bird Species occurrence in the Ruzizi Delta

We recorded 490 bird species of which 99 (20%) in the unprotected Ruzizi Congolese Delta (RCD), 191 (39%) in the protected and Ramsar site of Rusizi Burundian Delta (RBD), and 200 (41%) species both in the RCD and in the

RBD (Figure 2). There is a significant difference of bird occurrence between the unprotected RCD and the protected RBD ($\chi^2 = 38.257$; DF= 2; $p < 0.001$).

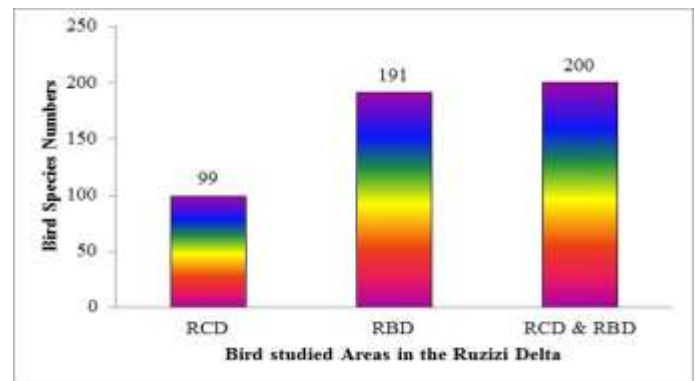


Figure 2 Bird Species Occurrence in the Ruzizi Delta 2019-2021

Resident bird species occurrence in the Ruzizi Delta

Figure 3 presents occurrence of resident bird species in the studied areas of the Ruzizi Delta. Of 490 species, 359 (73%) are resident bird species. Of 359 bird species, 74 (21%) were recorded in the Ruzizi Congolese Delta (RCD), 148 (41%) were recorded in the Rusizi Burundian Delta (RBD) and 137 (38%) were both recorded in the RCD and the RBD. The difference between resident bird species occurrence among sampled habitat areas of Ruzizi Delta is significant ($\chi^2 = 48, 31$; DF=2; $p < 0.001$).

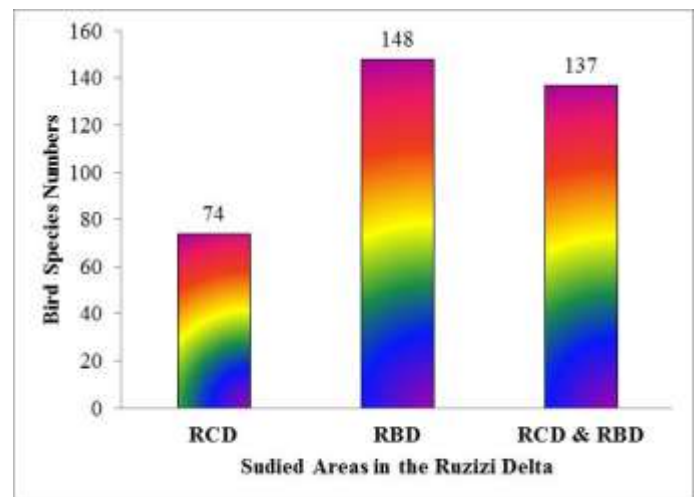


Figure 3 Resident bird species occurrence in the Ruzizi Delta

Migrant bird species occurrence in the Ruzizi Delta

Figure 4 presents occurrence of migrant bird species in the Ruzizi Delta. Of 490 bird species recorded, 131 are migrant bird species. Of migrant species, 24 (18%) were

¹ T, Student t-test

recorded in the Ruzizi Congolese Delta (RCD), 44 (34%) in the Rusizi Burundian Delta (RBD) and 63 (48%) migrant bird species were recorded both in the RCD and the RBD. The difference of occurrence of migrant bird species between sampling areas is significant ($\chi^2 = 17.42$; $DF=2$; $p < 0.001$).

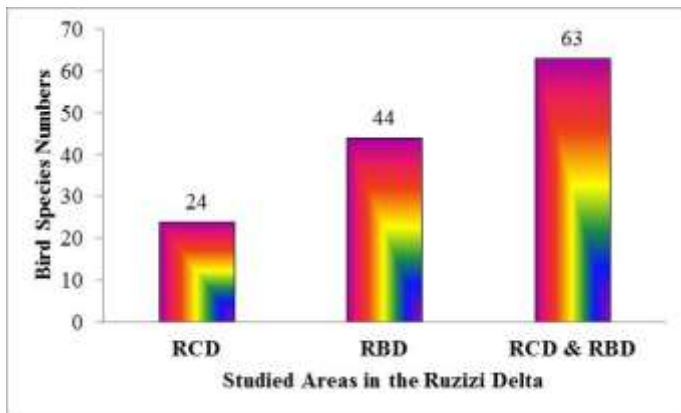


Figure 4 Migrant bird species fluctuation in the Ruzizi Delta 2019-2021

The Ramsar Criteria fulfilled by the Ruzizi Delta

Fluctuation of the bird species that fulfil the Ramsar Criteria per sampling areas

Of 490 bird species recorded from the Ruzizi Delta, 238 fulfil six of seven Ramsar Criteria of bird conservation. Of them, 29 (12%) were recorded in the Ruzizi Congolese Delta (RCD), 107 (45%) in the Rusizi Burundian Delta, and 102 (43%) bird species were recorded both in the RCD and the RBD (Figure 5 and Figure 6). The Ramsar bird species occurrence between the sampled areas is highly significant in the Ruzizi Delta ($\chi^2 = 48,059$; $DF=2$; $p < 0.001$).

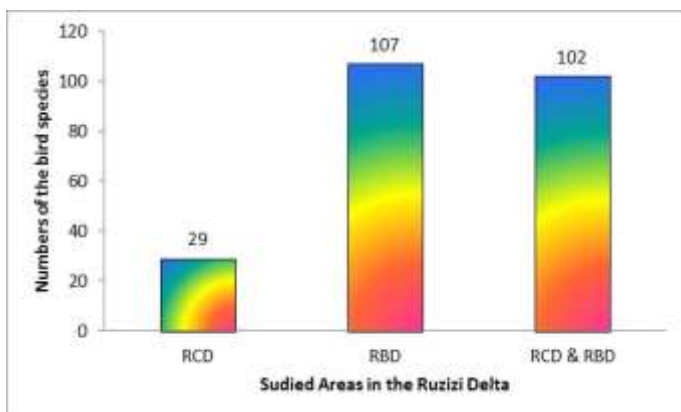


Figure 5 Bird species that fulfil the Ramsar Criteria fluctuation in the Ruzizi Delta

Legend: RCD, Ruzizi Congolese Delta; RBD, Rusizi Burundian Delta

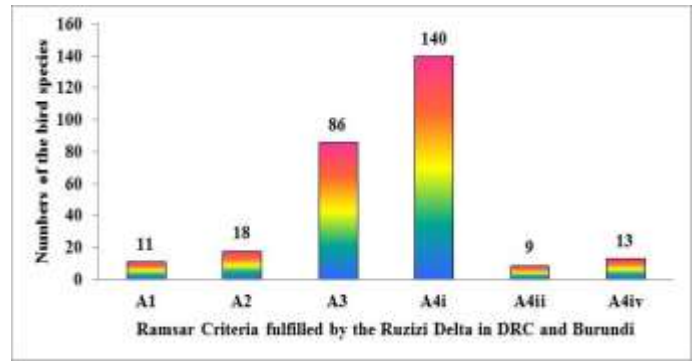


Figure 6 The Ramsar Criteria fulfilled by the Ruzizi Delta in DRC and Burundi

Figure 7 presents bird species density per sampling areas, RCD (Ruzizi Congolese Delta) area and RBD (Rusizi Burundian Delta) area and per sampling sites. In RCD area, the bird species densities were: 75 bird species/ km² in the site of Kyamvubu (Kya); 165 in the site of Kavimvira Border Ponds (KBOP); 91 species in the site of Kahorohoro Village (Kah); and 64 bird species /km² in the site of Vugizo. The bird species density of the whole sampling RCD area was 86 bird species/ km².

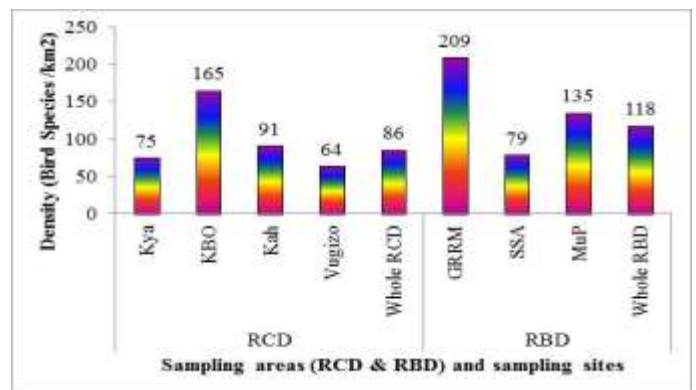


Figure 7 Bird Species Density per sampling area and sampling site

In the area of RBD (Rusizi Burundian) area, the bird species densities were: 209/ km² in the site of GRRM (Great Rusizi River Mouth); 79 in the site of SSA (Steppe and Shrub Areas); and 135 bird species in the site of MuP (Mukartutsi Ponds. The bird density of the whole sampling area of RBD was 118 bird species/ km². The bird species densities of the protected Rusizi Burundian Delta were not significantly higher compared to the bird densities of the unprotected Ruzizi Congolese Delta ($\chi^2 = 0.112$; $DF= 6$; $p > 0.001$).

New bird species records from the Ruzizi Delta

Figure 8 presents the new bird species numbers recorded from the Ruzizi Delta. These are 60 new bird species records of which four from the Ruzizi Congolese Delta

(RCD), 37 from the Rusizi Burundian Delta (RBD) and 19 new bird species records from both the RCD and the RBD. The difference of the distribution of the new bird species recorded between studied areas is highly significant ($\chi^2=27.3$; DF= 2; $p<0.001$).

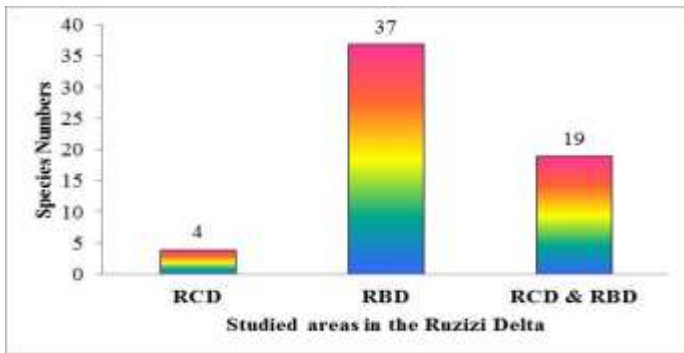


Figure 8 New bird species records from the Ruzizi Delta

Three Wetland Bird Species densities in the Ruzizi Delta

Three wetland bird species were more intensively investigated by their individual counting and some ecological elements recording. These are: **Cattle Egret** (Ardeidae), «Héron garde boeuf» *Bubulcus ibis* (Linnaeus, 1758); **Black Crake** (Rallidae), «Râle à bec jaune», *Amaurornis flavirostris* (Swainson, 1837); and **African Jacana** (Jacanidae), «Jacana à poitrine dorée», *Actophilornis africanus* (Gmelin, 1789).

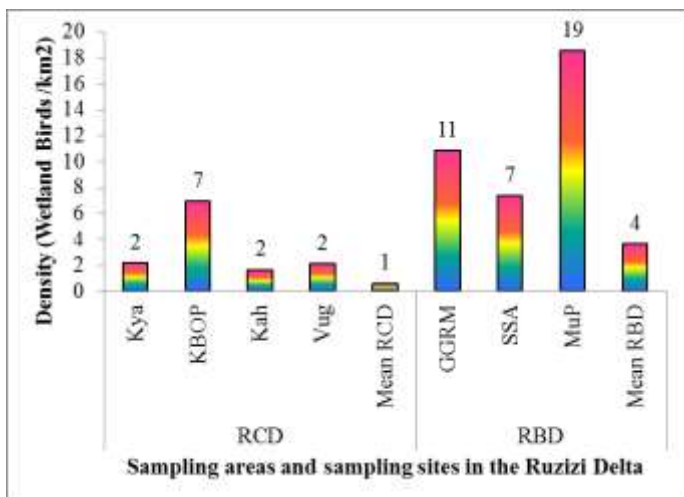


Figure 9 Wetland bird densities (Birds/ km²) in the Ruzizi Delta

Figure 9 presents the wetland bird densities per sampling areas (RCD and RBD) and per sampling sites for the above three species. The densities per sampling sites in RCD (Ruzizi Congolese Delta) area were: In DRC, 2 wetland birds /km² in the Kyamvubu site (Kya), in Kahorohoro Village site (Kah), and in the site of Vugizo (Vug); and

7 wetland birds/ km² in the site of Kavimvira Border Office Ponds (KBOP). In the whole area of Ruzizi Congolese Delta, the density was 1 wetland bird/ km². In Burundi, the densities were: 11 wetland birds/ km² in the site of Great Rusizi River Mouth (GRRM); 7 wetland birds/ km² in the site of Steppe and Shrub Areas (SSA); and finally 19 wetland birds/ km² in the site of Mukartutsi Ponds (MuP). The wetland bird species showed four records/ km² in the whole sampled area of Rusizi Burundian Delta (RBD). The wetland bird densities were significantly higher in the protected wetland areas of the Rusizi Burundian Delta compared to the unprotected wetland areas of the Ruzizi Congolese Delta ($\chi^2_6= 31.500$; DF=6; $p<0.001$).

Wetland birds fluctuations per sampling periods

Figure 10 presents fluctuations of wetland birds per sampling periods in the Ruzizi Delta in 2019-2020. In the RCD (Ruzizi Congolese Delta), wetland bird fluctuations peaked in May with an average of seven recorded individuals and the minimum occurred in July, the least rainy month of the year with an average of three birds. In the RBD (Rusizi Burundian Delta), wetland bird fluctuations peaked as well in May with an average of 24 birds and the minimum occurred in July with an average of eight wetland birds. Yet, there is no significant difference of wetland bird fluctuations between the Ruzizi Congolese Delta and the Rusizi Burundian Delta due to similar habitats loss ($T^7_{cal}= 1.983$; DF= 20; $p>0.001$).

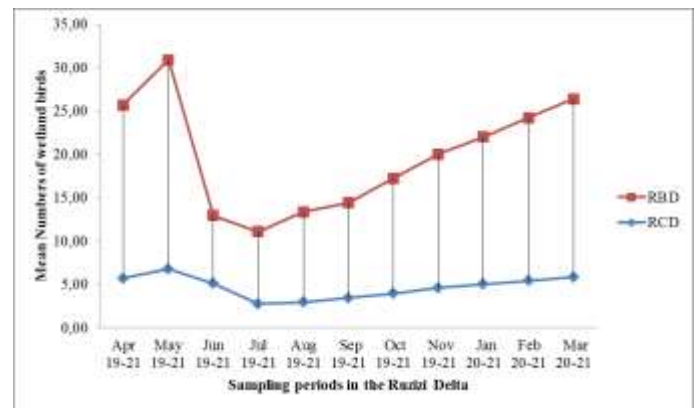


Figure 19. Wetland birds species fluctuations in the Ruzizi Delta

Constraints and limitations of the study

Constraints of the study

The constraints to bird ecology studies in the Ruzizi delta are linked to the difficulties of the Congolese and Burundian governments to finance fundamental research in order to bring out trends according to national research plans. National research plans sometimes do not exist or

⁶ χ^2 , Chi squared test

are dependent on electoral trends. A prime minister or a minister during an election period has a research plan drawn up in order to stay in power and sometimes he does not have the means to have it carried out. In the event of a change of government, previous plans are abandoned to develop so-called more innovative ones without budgetary or financial means to implement them.

This is why the few studies carried out are sometimes supported by external partners who at times impose their tendencies as a line of research to follow and after their funding, data collection stops. The Ruzizi Congolese Delta, for example, has not been the subject of any ornithological research supported by the DRC. The same is true for the entire Ruzizi Congolese Plain where only the Belgian Technical Cooperation had funded my research for my master's dissertation at Makerere University Kampala Uganda in 2010-2011.

The most apparent case is the Lake Tanganyika Congolese shoreline, about 677 km in length, where no recent ornithological study has been conducted. Species to be listed there for the first time and even new species are probably still ignored.

5.2 Limitations of the study

Limitations to bird ecology, conservation and management in the Ruzizi Congolese Delta are mainly due to the poor land distribution policy and non-compliance with laws on wetlands and biodiversity. These are given from the following extract of law no 011/2002 (Kabila, 2003).

CONCLUSION

In this chapter on bird ecology, we have reviewed the communities of birds that compete for natural resources, particularly plants as resting and breeding grounds in the Ruzizi Delta, namely 490 bird species divided into 84 families and in 18 orders. 56 new bird species records are made in the Rusizi Burundian Delta, shifting the bird species known there from 410 to 466. Similarly 23 new bird species records are made in the Ruzizi Congolese Delta, shifting the bird species now known there from 252 (Bashonga B. , 2013) to 275. Bird frequencies and densities are significantly higher in the protected areas of the Rusizi Burundian Delta compared with the unprotected areas of the Ruzizi Congolese Delta.

Birds in wetlands behave differently; The Cattle Egret adapts to anthropogenic variations in its environment, but the Black Crake cannot tolerate the destruction of marshes just as the African Jacana does not tolerate pond vegetation massive removal for fishing. Moreover, the African Jacana was not found in fast-moving water areas without vegetation.

RECOMMENDATIONS

In the DRC as in Burundi, we recommend compliance with regulatory texts on environmental protection with regard to the protection of wetlands, which are the bastions of biodiversity necessary for the well-being of current and future human communities; For the DRC, we recommend decision makers to create a protected area in the RCD wetlands which matches with the Ramsar Criteria for bird conservation and therefore a potential Ramsar site; For the Congolese Institute for Nature Conservation (ICCN), we recommend the submission of the RCD to the Ramsar Secretariat for designation as a Ramsar Site, as soon as it will be accepted as a protected area; For the provincial government of South Kivu, to take a decision agreement for a Community protected wetland of the RCD; For Mayor and territorial authorities, to sensitise people to wetlands protection referring to the Ramsar Convention ratified by the Congolese government and environmental regulations.

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Conflicts of Interest

Authors declare that there is no conflict of interests regarding the publication of this paper.

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