RWANDA WATERBIRD COUNTS

An institutionalized long-term citizen science programme

REPORT OF ACTIVITIES 2021



Period of activity: 18-26 June 2021

Prepared by: Center of Excellence in Biodiversity and Natural Resource Management, University of Rwanda and

Birding Educational Tours Rwanda (BET)



Contents

Acknowledgements	
Executive Summary	5
Introduction	7
Objectives	7
Methods	
Results	10
Lake Ruhondo	10
Lake Burera	
Rugezi	13
Lake Mugesera	14
Lake Ihema	16
Umusambi Village	
Nyandungu wetland	19
Gikondo wetland	
Conclusions	
References	
Appendix 1. Waterbird species recorded at eight surveyed sites	
Appendix 2: Other bird species detected	

List of Figures

Figure 1. Location of surveyed sites for the 2021 Rwanda Waterbird Counts	9
Figure 2. Examples of activities observed in Lake Ruhondo, Rwanda in June 2021: cattle	e grazing in
buffer zone (left) and fishing (right)	11
Figure 3. Surveyed areas and threats distribution at Lake Ruhondo, Rwanda	11
Figure 4. Gray crowned crane (Balearica regulorum) at Lake Burera, Rwanda	
Figure 5. Surveyed areas and threats distribution at Lake Burera, Rwanda	13
Figure 6. Surveyed sites and threats recorded in the Rugezi wetland, Rwanda	
Figure 7. Surveyed sites and threats recorded at Lake Mugesera, Rwanda	15
Figure 8. Grass and Papyrus cutting at Lake Mugesera, Rwanda. (Photo by Thacien Hag	enimana)
Figure 9. Surveyed sites and threats record at Lake Ihema, Rwanda	
Figure 10. Surveyed sites at Umusambi Village, Rwanda	
Figure 11. Black-headed Heron (Ardea melanocephala) in Nyandungu urban eco-tourism	n park,
Rwanda (Photo by Claude Dusabimana)	
Figure 12. Surveyed sites and threats recorded in Nyandungu wetland, Rwanda	
Figure 13. Plastic waste dumped at Gikondo wetland, Rwanda. (Photo by Laurent Twize	yimana)
Figure 14. Surveyed sites and threats recorded in Gikondo wetland, Rwanda	

Acknowledgements

We thank the African Bird Club (ABC) for the financial support to conduct the 2021 summer waterbird census in Rwanda. We also thank Rwanda Environmental Management Authority for the administration support and recommendation to run the counts at all selected sites. Our gratitude goes to the Akagera Management Company for support of the activity in various ways among others the entrance to the park, guidance, and the boat to cover Lake Ihema. We thank local authorities of the Districts of Bugesera, Ngoma, Burera, Gicumbi, Musanze and Kigali City who allowed the access to the counting sites and guidance while counting birds.

We address our thanks to the institutions and their representatives: Gilbert Micomyiza from the Albertine Rift Conservation Society (ARCOS), Jean Claude Dusabimana from Nature Rwanda; Bernard Ndayisaba, Jean Paul Munezero, Felix Nsabumuremyi, and Laurence Uwera from the Rwanda Wildlife Conservation Association (RWCA); Diane Umutoni, Isaac Mbarushimana, and Daniel Nishimwe from the Akagera Management Company (AMC); Laurent Twizeyimana, Aliane Musabyuwera and Sylvere Kuradusenge from Birding and Educational Tours Rwanda (BET); Daniel Igirimbabazi, Aloysie Mukasangwa and Thacien Hagenimana from the Center of Excellence in Biodiversity and Natural Resource Management (CoEB) at University of Rwanda.

We thank the technical guidance of Prof. Beth Kaplin from the Center of Excellence in Biodiversity and Natural Resource Management at University of Rwanda and Maaike Manten from Birdlife International. Thanks to Dr Gatali Callixte (Lecturer and research associate with URCoEB) and Mr Claudien Nsabagasani of Birding Educational Tours, Rwanda who trained counters on waterbird counting techniques and recording of environmental threats. Our special thanks are addressed to Mrs Deborah Cyuzuzo and Mr Elie Sinayitutse who coordinated the logistics and external communications to make this activity possible.

Executive Summary

Waterbirds serve as important indicators of wetlands health and integrity. Many wetlands of Rwanda are considered Important Bird Areas (IBAs), significant for the conservation of waterbirds, including endangered and species endemic to the Albertine Rift. Although wetlands in Rwanda are experiencing significant threats from agriculture, pollution and industrial development, the status of and trends in waterbird populations in Rwanda is largely unknown as there has not been any consistent monitoring to date. This project developed a waterbird monitoring plan for Rwanda that includes the main wetlands in Eastern Province (Lake Ihema and Lake Mugesera) and Northern Province (Rugezi Marsh and the twin lakes of Ruhondo and Burera). These sites were selected based on their importance for hosting biodiversity and for provisioning important ecosystem services for the country. Several sites had waterfowl count data available from previous count activities. Waterbird counts were also conducted at the newly restored urban wetlands in Kigali to provide baseline information for monitoring and management.

The project also established a foundation for long-term waterbird sampling to ensure data will be collected and used for conservation, planning and management. Key to the success of this project was taking a participatory approach, working with governmental and private sector organizations and citizens to ensure sustainability of the counts into the future. The citizen science-based information provided by the waterbird counts is meant to guide decisions on the sustainable use of lakes and wetlands in Rwanda. Starting with this first round of counts, our aim is to promote biannual, volunteer-based waterbird counting activities that will provide data on presence and distribution of waterbirds and early detection of environmental change in these wetland ecosystems.

The counts were planned for January 2021, but due to COVID-19 restrictions, it was postponed to June 2021. The waterbird counts involved various categories of individuals including young conservation biologists, postgraduate students, researchers, and representatives of different governmental and non-governmental conservation organizations in Rwanda. Counts were carried out in eight selected sites: Lakes Mugesera and Ihema in Akagera Nationa Park (Eastern Rwanda), the twin Lakes Ruhondo and Burera, and Rugezi (a Ramsar site) in northern Rwanda, and

Umusambi Village, Nyandungu and Gikondo wetlands in Kigali City. Using direct observations, 49 waterbird species were recorded, of which 14 species are migrant including 3 Palearctic and 11 intra-African migrant species. According to the IUCN Red List (2021), 47 of the waterbird species observed are Least concern, one is a Near threatened species (Papyrus Gonolek, *Laniarius mufumbiri*) and one is an Endangered species (Gray-crowned crane, *Balearica regulorum*). The African Darter *Anhinga rufa* and the Great Cormorant *Phalacrocorax carbo* were the most common species recorded at Lake Ihema with 345 and 271 individuals, respectively. Lake Ihema included more than half of the species recorded in all sites.

Human activities including habitat degradation (e.g., agriculture activities, grass cutting, infrastructures), noise pollution, and overexploitation of resources were recorded as threats in the surveyed areas. The regular collection of waterbird observation data will provide important information on population trends and threats status to guide decision-making and sustainable solutions for conservation of waterbirds and wetland ecosystems. The inclusion of multiple stakeholders helps to ensure sustainability of regular waterbirds counts. The data have been entered into the Rwanda Biodiversity Information System (https://rbis.ur.ac.rw/) developed by the Center of Excellence in Biodiversity and Natural Resource Management in partnership with Rwanda Environment Management Authority and the Ministry of Environment and will enable access to the data.

Introduction

Waterbirds are globally known as good indicators of the health of wetland ecosystems. However, they are facing different threats that are leading to the decline of populations and local extinctions (BirdLife International, 2014, 2018). To date, waterfowl and wetlands that are habitats and food resources for several species are being threatened by human activities including unsustainable agriculture, overexploitation of aquatic resources and pollution, exacerbated by the impacts of climate change (BirdLife International, 2004, 2018; Peng et al., 2015). This waterbird counting survey aimed at assessing the waterbird populations in selected wetlands in Rwanda. A previous count was held in 2016, and because land use and environmental changes are continuously occurring there is a need for information about trends in the waterbird population in different wetland ecosystems in Rwanda.

The waterbird count in Rwanda followed the IWC protocol and started with training of all counters on the use of the protocol during the counting process, threat recording and classification, and waterbird data collection. The activity was carried out in eight selected sites: Lake Mugesera and Ihema in Eastern Rwanda, Lake Ruhondo and Burera, and Rugezi (a Ramsar site) in Northern Rwanda and Umusambi Village, Nyandungu and Gikondo wetlands in Kigali City. The waterbird count 2021 was co-led by the Center of Excellence in Biodiversity and Natural Resource Management (CoEB) at University of Rwanda (UR) and Birding and Educational Tours Rwanda (BET), and involved different institutions including Albertine Rift Conservation Society (ARCOS), Nature Rwanda, Rwanda Wildlife Conservation Association (RWCA), Akagera Management Company (AMC), Rwanda Environmental Management Authority (REMA), Kigali City, the staff of BirdLife International, and Master students in the Biodiversity Conservation and Natural Resources Management program at University of Rwanda. This report provides updates on the status of waterbird populations at the eight sites, the threats detected, and recommendations for the long-term conservation of freshwater ecosystems and the wildlife they host.

Objectives

The objectives of waterbird count were as follows:

• To update information on status of waterbird in Rwanda basing on the selected sites.

- To document the challenges in the conservation of waterbirds and their habitats.
- To raise awareness on conservation of waterbird and sustainable use of wetlands.
- To build the capacity among young conservation biologists who are interested in bird study and research to count waterbird and application of the IWC protocol.
- To provide essential information to assist in the protection of waterbirds and their habitats at national and international levels.
- To establish a framework for the long-term monitoring of waterbirds and their wetland habitats using a citizen science approach involving multiple stakeholders.

Methods

We counted waterbirds in eight selected sites namely Lake Mugesera and Lake Ihema in Eastern Rwanda, Lake Ruhondo and Lake Burera, and Rugezi, a Ramsar wetland in Northern Rwanda, and Umusambi Village, Nyandungu and Gikondo wetlands in Kigali City from 18 to 26 June 2021 (Figure 1). The census started with one day of training on the application of the waterbird counting protocol on 18 June 2021, and then the counting occurred from 19 to 26 June 2021. We used the direct counting method (Wetlands International, 2010), and every species observed or heard was recorded. We included birds that were detected flying over the site regardless of its destination (falling into the site or not). On a few occasions, a large population was encountered and the number was estimated. The counting period was from 07:30-12:00 on sampling days. Threats detected, GPS, and other bird-related information (breeding, migratory, age sex class, etc.) were also recorded. Finally, we made a checklist of all birds recorded (waterbirds and land birds) at each

During the waterbird counting, each participant had *a pair of binoculars* to scan birds from a distance as well as to facilitate the birds counting. The group had *Field Guide of Birds of East Africa*, both hard copies and digital versions, by Fanshawe and Stevenson (2001) to facilitate identification of birds especially for the new and young counters. site with the aid of eBird app.



Figure 1. Location of surveyed sites for the 2021 Rwanda Waterbird Counts

We used a data collection form that included a list of waterbird species known to be present arranged alphabetically to facilitate quick recording during the field observations. Every team of counters had a GPS unit for recording waypoints during the counts. The GPS coordinates were recorded for production of maps of the visited areas.

We counted birds on foot while walking along paths located along wetland boundaries by scanning for birds with naked eye or binoculars. Floating vegetation and open water constituted a site where various waterbirds are found when resting, foraging and/or socializing. To access such zones, we used boats and local canoes. All birds visible in the open water and in the riverine vegetation were recorded.

Results

In total, we recorded 49 waterbird species in 2335 observations of which three are Palearctic migrants and 11 are intra-African migrant species, and the remainder are resident (Table 1, Appendix 1). The African Darter *Anhinga rufa* and the Great Cormorant *Phalacrocorax carbo* were the most common species recorded at Lake Ihema with 345 and 271 individuals estimated, respectively.

Lake Ihema captured more than half of all species recorded (32 species: 65.3%) in all sites, and the only site where the Papyrus Gonolek *Laniarius mufumbiri* was recorded during the counting. According to the IUCN Red List (BirdLife International, 2021), amongst 49 recorded waterbird species, 47 are Least concern, one species is Near Threatened (Papyrus Gonolek) and one is Endangered (Gray-crowned crane). Below we present the results from each of the eight sites sampled.

Lake Ruhondo

Lake Ruhondo is located at 1° 29' 13.2" S latitude and 29° 44' 52.8"E longitude in the Northern Province (Figure 3). This Lake is of volcanic origin and is located in a highly populated region with steep slopes, and it is a source of electricity provided by the hydro-power plants of Mukungwa and Ntaruka that in combination with Burera provide 90% of the electricity for Rwanda. Due to high human population density around the lake, it is threatened by agriculture, overfishing and pollution/run off. Moreover, it has been highlighted that waste disposal from farming and agriculture may lead to the eutrophication of this lake (Habimana & Nsabimana, 2020). On 19 June 2021, we counted 25 bird species at this lake, with the Long-tailed Cormorant *Microcarbo africanus* having the highest population estimate of 65, followed by Yellow-billed Duck *Anas undulata* with 64 individuals.

During the counts at Lake Ruhondo we observed that it is threatened by agriculture expansion, cattle grazing, residential and commercial development, especially tourism and recreation areas, and exploitation of aquatic resources (Figure 2). The buffer zone distance should be monitored and managed to ensure the wildlife that depend on the lake shores buffer zone areas are protected.

Protecting this buffer zone will also reduce the risks from erosion and flooding. Education and raising awareness amongst local communities who depend on the Lake's resources, as well as enhanced law enforcement in these zones can help to regulate the resource use and to avoid soil conversion for the conservation of the lake in the long-term.



Figure 2. Examples of activities observed in Lake Ruhondo, Rwanda in June 2021: cattle grazing in buffer zone (left) and fishing (right).



Figure 3. Surveyed areas and threats distribution at Lake Ruhondo, Rwanda.

Lake Burera

Lake Burera is located in Northern Rwanda in Burera district at 1° 26' 56.4" of latitude and 29° 46' 12" of longitude (Figure 5), and it is 25 km from Musanze City in the west of the Lake. Lake Burera lies to the North East of Lake Ruhondo and borders Rwanda and Uganda on the slopes of the Muhabura. It is fed by Rugezi as the primary inflow and emptied by Ntaruka as the main outflow. The early study highlighted that Lake Burera and Ruhondo (above) are at the risk of eutrophication due to the accumulation minerals, specifically nitrogen and phosphorus in the water which may accelerate the growth of algae (Habimana & Nsabimana, 2020).

We counted at Lake Burera on 20 June 2021, and 16 waterbird species were recorded. The Yellow billed Duck was the prevalent species in the area with a high population of 49 individuals, and a low population was the Black-headed Heron *Ardea melanocephala* with 1 individual. The Gray crowned crane *Balearica regulorum* – an endangered species was also recorded at Lake Burera (Figure 4.). The Lake Burera is threatened by agriculture and intensive farming by small holders (Figure 5). However, the farming is operated on the limited space with slopes. This may lead to erosion and flooding due to continuous cattle trampling, and the increase in the concentration of nutrients from wastes of cattle which could facilitate the growth of algae and other unwanted vegetation. We recommend the increase of effort of conservation of coastal areas and the education of people to raise their awareness about conservation of biodiversity.



Figure 4. Gray crowned crane (Balearica regulorum) at Lake Burera, Rwanda.



Figure 5. Surveyed areas and threats distribution at Lake Burera, Rwanda.

Rugezi

The Rugezi marsh is an Important Bird Area, recognized by Bird Life International since 2001, and a Ramsar wetland since 2015 (Figure 6). This site is located in Northern Province at latitude: 01⁰29'00" and longitude: 29⁰51'00", and bounds between southern latitude 1⁰ 21'30" and 1⁰ 36'11" and eastern longitude 29⁰49'59" and 29⁰59'50". Rugezi hosts the Grauer's Swamp Warbler *Bradypterus graueri* which is endemic to the Albertine Rift, and the endangered Gray crowned crane *Balearica regulorum*. The Grauer's Swamp Warbler was not detected in the 2021 waterbird census.

Common plant species in the Rugezi marsh area include *Miscanthidium violaceum, Cyperus latifolius*, and *Papyrus C. pyuapyrus*. The counting was carried out on 23 June 2021, and 19 waterbird species were recorded with Hadada Ibis *Bostrychia hagedash* the most abundant species with 75 individuals counted, followed by Long-toed Lapwing *Vanellus crassirostris* with 39 individuals. Threats detected in this marsh include clay extraction for pottery and fodder collection (Figure 6). These activities need to be controlled as it disturbs the habitat that some species depend on for example, for their breeding. There is a need of law enforcement and prevention of human disturbances to limit the pressures of human activities in the marsh.



Figure 6. Surveyed sites and threats recorded in the Rugezi wetland, Rwanda.

Lake Mugesera

Lake Mugesera is located in Eastern Province at latitude 2°6'29" and longitude 30°18'54", and touches three districts: Rwamagana, Bugesera and Kayonza with an area of 4,000 hectares (Figure 7). The main inflow of the Lake Mugesera is the Nyabarongo River. Other rivers and streams originating on the ridges to the north, east and south constitute secondary inflows, mainly during the rainy seasons. Lake Mugesera is home to fish, many waterbird species, crocodiles, water turtles, snakes and otters. The counting at this lake was conducted on 19 June 2021 and 18 waterbird species were recorded. The Pied Kingfisher *Ceryle rudis* was the most common species with 47 individuals. This species has reduced to 10% of estimate recorded during the previous

census in 2016, which was 400 individuals. The Papyrus Gonolek *Laniarius mufumberi*, a near threatened species (NT) was recorded on this site. Other species were also reduced in number compared to the last census. Monitoring the industry-related activities is recommended to manage further consequences to the lake and its biodiversity.

The decline in bird populations may be caused by the increase of pressures to the lake. Major threats recorded at Mugesera Lake include agricultural activities, grass and papyrus cutting in the buffer zone, fishing, the water treatment plant, and livestock grazing (Figures 7 & 8). The season and habitat structure may be other causes for lower counts. The previous waterbird count in 2016 was conducted in January, the period of migratory bird presence in Rwanda. There is a need of organizing regular annual counts to understand the trends in bird population and challenges in waterbird study in this lake as well as in various wetlands of Rwanda. Moreover, conservation efforts are needed to conserve this lake in the face of progressively increasing human activities around the area.



Figure 7. Surveyed sites and threats recorded at Lake Mugesera, Rwanda.



Figure 8. Grass and Papyrus cutting at Lake Mugesera, Rwanda. (Photo by Thacien Hagenimana)

Lake Ihema

Lake Ihema is located inside the boundaries of Akagera National Park (ANP), in eastern Rwanda. The lake is in Kayonza district at latitude of 1⁰51'48" and longitude of 30⁰48'40" with an estimated surface elevation of 1292 m. It is the largest lake in the ANP and the second largest in Rwanda (Figure 9). Lake Ihema is one of the complex system of lakes that host a large biodiversity including up to 600 bird species and mammals (REMA, n.d., 2015). ANP is also home to the endangered Shoebill, Papyrus Gonolek and large animals such as hippopotamuses, crocodiles, buffalo, and to fish (approximately 35 species), and other aquatic species (REMA, 2015). ANP is one of the richest parks in East Africa with regards to bird diversity. The lake is under the management of the Akagera Management Company. The water supply for this lake is from the Akagera River that also feeds a number of lakes in the park. The vegetation at Lake Ihema includes *Cyperus papyrus, Polygonum pulchtrum, Phragmites mauritianus, Echinochloa spp., Hydrocotyle ranunculoides* and *Dissotis incana*.

The counting was conducted on 20 June 2021, and 32 waterbird species were recorded. The African Darter *Anhinga rufa* and the Great Cormorant *Phalacrocorax carbo* were the most abundant species with 345 and 271 individuals respectively. The population of other species was also high

compared to the other sites with the same species. For example, the estimated population of the African Openbill *Anastomus lamelligerus* was 158, and the Black-crowned Night Heron *Nycticorax nycticorax* and the Spur-winged Goose *Plectropterus gambensis* were 126 and 114 respectively. The Papyrus Gonolek *Laniarius mufumberi* was also recorded at this site during the waterbird census. These high waterbird counts suggest that many species prefer the conserved areas over the more disturbed environments sampled. This highlights the importance of the conservation efforts that limit pressures on biodiversity and habitats. Such waterbird populations in Ihema were not recorded in any other sites sampled and may be due to increasing threats in the other sites. There are many lakes in Akagera National Park, and we only sampled Lake Ihema, so it is likely we would find other large populations of waterbirds on the other lakes. The main threat observed during the counts at Lake Ihema was the invasive water hyacinth, which tends to form dense mats if it is not controlled (Figure 9). Regular monitoring and removal of this species is recommended to protect the lake and its biodiversity.

During the training session prior to the start of the waterbird counts, participants discussed the Shoebill (*Balaeniceps rex*) which has been sighted in the past in very low numbers in the ANP, and which may prefer swampy habitats. It is very difficult to spot this bird unless with aerial methods. We urge a serious study and regular monitoring in wetland areas of the ANP to determine the abundance and distribution of the Shoebill in the park. This will also be an important step towards more scientific research and tourism oriented around this species.



Figure 9. Surveyed sites and threats record at Lake Ihema, Rwanda.

Umusambi Village

The Umusambi Village is a privately managed and protected urban wildlife sanctuary and nature center located just outside of Kigali City. The aim of the sanctuary is to conserve the wetland ecosystem that runs through the site and the species that live there, and to provide a sanctuary for the Gray-crowned cranes *Balearica regulorum* that have been rescued from captivity and released at the site (Figure 10). The Umusambi Village is a successfully restored wetland with approximately 21 hectares. More than 50 cranes have been released at Umusambi Village after being recovered from the human households where they had been kept in captivity. This reserve is home to not only cranes, but also to more than 100 bird species including the White-collared Oliveback *Nesocharis ansorgei*, Purple-crested Turaco *Tauraco porphyreolophus*, parrots, woodpeckers and others.

The counting at this site happened on 26 June 2021, and 14 waterbird species were detected including the Gray-crowned cranes with 50 individuals. Pied kingfishers were observed with 30 individuals in total, while the remaining species were in small numbers. Other bird species were

detected including the Western Plantain Eater *Crinifer piscator*, the first record in the area. We recommend daily monitoring of this species to know its distribution and ecological behavior in the area.



Figure 10. Surveyed sites at Umusambi Village, Rwanda.

Nyandungu wetland

Nyandungu wetland ranges from Kicukiro to Gasabo district in Kigali City. This urban wetland is being restored and developed into an urban eco-tourism park for the public to conserve biodiversity, respond to the green economy and provide recreational services to the citizens of the Kigali City and countrywide.

During our counting on 26 June 2021, a total of 58 bird species were detected including 12 waterbird species of which the Hamerkop *Scopus umbretta* and Black Crake *Amaurornis flavirostra* were the most abundant with 5 and 4 individuals respectively, and the Black-headed Heron *Ardea melanocephala* (Figure 11). The surprising birds in the area were the Bare-faced Goaway Bird *Crinifer personatus* and the Black-headed Gonolek *Laniarius erythrogaster*, both recorded in the southern part of the wetland. The prevalent threats detected during the counting

include infrastructure (paved road and houses), water pollution arriving into the wetland from the surrounding industrial activities of Kigali City, noise pollution which will likely increase after the launch of the eco-park, and fodder collection which constitutes a high threat in the wetland. Many grass collectors are present during the daytime at the wetland.

We recommend a baseline ecological survey be conducted, and particular attention to plant species to be planted as part of a restoration program in the area; this is a paramount parameter for animal species including waterbird conservation in the long run, and priority may be given to plants that attract birds, insects, and that are good for their breeding. The grass cutting needs to be prohibited as this activity destroys breeding and spawning grounds and habitats of different species including birds and insects. Figure 12 shows the sampled sites and disturbances observed during the counts.



Figure 11. Black-headed Heron (Ardea melanocephala) in Nyandungu urban eco-tourism park, Rwanda. (Photo by Claude Dusabimana)



Figure 12. Surveyed sites and threats recorded in Nyandungu wetland, Rwanda.

Gikondo wetland

Gikondo wetland was formerly the location of industries involved in plastic material production (Figure 13) in Kigali City. In 2005 it was gazetted as a wetland by the Rwanda Environment Management Authority (REMA) after being identified as a polluted and degraded area and a source of pollution into Lake Victoria by the Lake Victoria Environment Management Project (LVEMP). The degradation and pollution of the Gikondo wetland does not only impact Lake Victoria, but also undoubtedly on the water supply systems in Kigali City.

The Government of Rwanda decided to restore Gikondo wetland and protect it for the environmental health of Kigali City. The restoration process started with the relocation of industries to the Kigali Special Economic Zone (KSEZ) outside the wetland, and establishment of laws that prohibit the construction of houses and other infrastructure in the wetland. The bird counting in Gikondo wetland was carried out on 26 June 2021, and 26 bird species were recorded including 9 waterbird species. Hadada Ibis were the most common waterbird species counted. This site is threatened by water pollution from waste disposal and human disturbances from exploitation

of industrial remains (metals), agriculture and grass cutting (Figure 13 & 14). We urge an ecological survey to identify priorities for the management and sustainable conservation of the area considering the main objectives of the ecosystem restoration.



Figure 13. Plastic waste dumped at Gikondo wetland, Rwanda. (Photo by Laurent Twizeyimana)



Figure 14. Surveyed sites and threats recorded in Gikondo wetland, Rwanda.

Conclusions

A total of 49 waterbird species were recorded, of which 14 species are migrant including 3 Palearctic and 11 intra-African migrants. According to IUCN Red List, one species, Gray-Crowned crane is endangered and another species, Papyrus Gonolek is near threatened. The prevalence of threats was detected in newly restored wetlands namely Nyandungu and Gikondo wetlands. These areas need specific ecological surveys to support monitoring and sustainable conservation of the wetlands and dependent biodiversity. Agriculture, aquatic resources harvesting and grass cutting were found to be common human activities in the sampled lakes. Buffer zones need to be restored and regularly monitored for the protection of species and lake conservation.

The collaboration and participation of several different state, private, and local stakeholders in this waterbird count project help to ensure sustainability of this activity on a regular basis into the future. These participating individuals have been trained in the protocol and understand the significance of regular waterbird counts. The 2021 waterbird counts have created a foundation for a participatory citizen science-based count programme where individuals need not have a high level of expertise in waterbirds but working together in teams with those who have expertise, valuable information can be collected to inform management and early detection of environmental change.

References

- BirdLife International. (2004). *State of the world's birds2004: Indicators for our changing world*. BirdLife International.
- BirdLife International. (2014). Important Bird and Biodiversity Areas: A global network for conserving nature and benefiting people. Cambridge, UK. *BirdLife International*.
- BirdLife International. (2018). *State of the world's birds: taking the pulse of the planet*. BirdLife International.
- Habimana, V., & Nsabimana, A. (2020). Water Physico-Chemical Characteristics of the Lakes Burera and Ruhondo, Water Physico-Chemical Characteristics of the Lakes Burera and Ruhondo, Rwanda. *Rwanda Journal of Engineering Science Technology and Environment*, 3(2), 1–9. https://doi.org/10.4314/rjeste.v3i2.5
- Peng, S., Zhou, T., Wang, D., Gao, Y., & Zhong, Z. (2015). Chapter 10 Restoration of Degraded Ecosystem. *Contemporary Ecology Research in China*, 235–263. https://doi.org/10.1007/978-3-662-48376-3
- REMA. (n.d.). PART 2 : State of the environment chapiter 5: Biodiversity and Genetic. *Rwanda Environment Management Authority*, 1–14.
- REMA. (2015). State of Environment and Outlook Report 2015. Rwanda Environment Management Authority.
- Wetlands International. (2010). Guidance on waterbird monitoring methodology : Field Protocol for waterbird counting. *Wetlands International*, 1–15.

Appendix 1. Waterbird species recorded at eight surveyed sites

Common name	Scientific name	Lake Mugesera	Lake Ihema	Lake Burera	Lake Ruhondo	Rugezi Marsh	Umusambi Village	Gikondo I. area	Nyandungu wetland	IUCN red list status	Note
African Crake	Crex egregia	2								LC	IntraAfrican Migrant
African Darter	Anhinga rufa		345							LC	
African Fish-eagle	Haliaeetus vocifer		21		1					LC	
African Jacana	Actophilornis africanus	6	3	2	10	7				LC	
African Marsh-Harrier	Circus ranivorus	1				2		1		LC	
African Openbill	Anastomus lamelligerus		158							LC	IntraAfrican Migrant
African Pygmy- Kingfisher	Ispidina picta	1								LC	
African Sacred Ibis	Threskiornis aethiopicus		34	12	38	18	3		2	LC	
African Spoonbill	Platalea alba			2		1				LC	
African Wattled Lapwing	Vanellus senegallus		4		4				2	LC	
Black Crake	Amaurornis flavirostra	17	6		1				4	LC	

Black Heron	Egretta ardesiaca		1						LC	
Black Stork	Ciconia nigra	1							LC	Palearctic Migrant
Black-crowned Night Heron	Nycticorax nycticorax		126			5			LC	IntraAfrican Migrant
Black-headed Heron	Ardea melanocephala	1	1	1	1	12	2	1	LC	
Cattle Egret	Bulbulcus Ibis		11						LC	IntraAfrican Migrant
Egyptian Goose	Alopochen aegyptiaca		13						LC	
Eurasian Moorhen	Gallinula chloropus							1	LC	
Goliath Heron	Ardea goliath		6						LC	
Gray Heron	Ardea cinerea		5	3	5				LC	
Great Cormorant	Phalacrocorax carbo	7	271	4	8				LC	IntraAfrican Migrant

Great Egret	Ardea alba		6		11					LC	
Gray-crowned crane	Balearica regulorum				5	9	50			EN	
Hadada Ibis	Bostrychia hagedash	4	6	14	24	75	7	5	2	LC	
Hamerkop	Scopus umbretta		1	4	7	2	1		5	LC	
Hotentot Teal	Spatula hottentota					2				LC	

Intermediate Egret	Egretta intermedia	12	3		17	2	3		LC	IntraAfrican Migrant
Little Egret	Egretta garzetta		10		12				LC	IntraAfrican Migrant
Little Grebe	Tachybaptus ruficollis			15	32	5		3	LC	
Long-tailed Cormorant	Microcarbo africanus	9	24	6	65			2	LC	
Long-toed Lapwing	Vanellus crassirostris			2	2	39			LC	
Long-crested Eagle	Lophaetus occipitalis							1	LC	

Malachite Kingfisher	Corythornis cristatus	11		б	8	9	3	3	1	LC	
Palm-nut Vulture	Gypohierax angolensis	1	2				2	1		LC	
Papyrus Gonolek	Laniarius mufumberi	1	1							NT	
Pied Kingfisher	Ceryle rudis	47	30	4	25	1	30	3		LC	
Pink-backed Pelican	Pelecanus rufescens			3	1	5				LC	
Purple Heron	Ardea purpurea		10		1		10			LC	Palearctic Migrant
Rufous-bellied Heron	Ardeola rufiventris		3		1	3	3			LC	
Spur-winged Goose	Plectropterus gambensis		114				5			LC	IntraAfrican Migrant

Spur-winged	Vanellus spinosus	14		5		LC	IntraAfrican
Lapwing							Migrant

Squacco Heron	Ardeola ralloides		19							LC	Palearctic
											Migrant
Striated Heron	Butorides striata		10							LC	
Swamp Flycatcher	Muscicapa aquatic	29	4		2		1		2	LC	
Three-banded Plover	Charadrius tricollaris					1		1		LC	IntraAfrican
											Migrant
White-faced	Dendrocygna viduata		10							LC	
Whistling											
Duck											
Woodland	Halcyon senegalensis	1	3				2			LC	IntraAfrican
Kingfischer											Migrant
Yellow-billed Duck	Anas undulata	1		49	64	47		1		LC	
Yellow-billed Stork	Mycteria ibis			12	10		1			LC	
Total		152	1275	139	355	245	123	20	26	2335	

Common names	Scientific names
Red-eyed Dove	Streptopelia semitorquata
Northern Fiscal	Lanius humeralis
Chubb's Cisticola	Cisticola chubby
Winding Cisticola	Cisticola marginatus
Angola Swallow	Hirundo angolensis
Red-rumped Swallow	Cecropis daurica
Lesser Striped Swallow	Cecropis abyssinica
White-headed Sawwing	Psalidoprocne albiceps
Black Sawwing	Psalidoprocne pristoptera
Swamp Flycatcher	Muscicapa aquatic
Common Waxbill	Estrilda astrild
African Pied Wagtail	Motacilla aguimp
Pied Crow	Corvus albus
Bronze Sunbird	Chalcomitra kilimensis
Cape Wagtail	Motacilla capensis
Common Bulbul (Dark-capped)	Pycnonotus tricolor
Tropical Boubou	Laniarius willardi
Bronze Mannikin	Spermestes cucullata
Ring necked Dove	Streptopelia capicola
Speckled Mousebird	Colius striatus
Village Weaver	Textor cucullatus
African Thrush	Turdus pelios
African Citril	Crithagra frontalis
Yellow fronted Canary	Crithagra mozambica
Black-headed Weaver	Textor melanocephalus
Yellow- billed Kite	Milvus aegyptius
Variable Sunbird	Cinnyris venustus
White-browed Coucal	Centropus superciliosus
Bare-faced Go-away-bird	Corythaixoides personatus
White-rumped Swift	Apus caffer

Appendix 2: Other bird species detected

Common names	Scientific names
Eurasian Moorhen	Gallinula chloropus
African Harrier-Hawk	Polyboroides typus
Hooded Vulture	Necrosytes monachus
Long-crested Eagle	Lophaetus occipitalis
Little Bee-eater	Merops pusillus
Black Cuckooshrike (female)	Campephaga flava
Brown-throated Wattle-eye	Platysteira cyanea
Black-crowned Tchagra	Tchagra senegalus
Black-headed Gonolek	Laniarius erythrogaster
Gray-headed Bushshrike	Malaconotus blanchoti
Fork-tailed Drongo	Edolius adsimili
African Paradise-Flycatcher	Terpsiphone viridis
Gray-backed Fiscal	Lanius excubitoroides
Green-backed Camaroptera	Camaroptera chloronota
Tawny-flanked Prinia	Prinia subflava
Gray-capped Warbler	Eminia lepida
Little Rush Warbler	Bradypterus baboecala
African Yellow White-eye	Zosterops senegalensis
Arrow-marked Babbler	Turdoides jardinei
White-browed Robin-Chat	Cossypha heuglini
African Stonechat	Saxicola torquatus
Scarlet-chested Sunbird	Chalcomitra senegalensis
Marico Sunbird	Cinnyris mariquensis
Slender-billed Weaver	Textor pelzelni
Holub's Golden-Weaver	Textor xanthops
Fan-tailed Widowbird	Euplectes axillaris
Grosbeak Weaver	Amblyospiza albifrons
Red-cheeked Corbonblue	Uraeginthus bengalus
Green-winged Pytillia	Pytilia melba

Common names	Scientific names
Reb-billed Firefinch	Lagonosticta senegala
Pin-tailed Whydah	Vidua macroura