

STATUS OF TWO THREATENED SPECIES IN TWO IBAS IN RWANDA

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Preliminary Project Report



the bp conservation programme



¹ Front Cover: Nsengiyunva and Kayijamahe holding trapped Grauer's Rush Warblers. Inset: the Papyrus Yellow Warbler. Background: Central region of Rugezi marsh and surrounding.

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Project Summary

The study assessed the status of Grauer's Rush Warbler (*Bradypterus graueri*) and Papyrus Yellow Warbler (*Chloropeta gracilirostris*) in Rugezi swamp and Volcanoes National Park in Rwanda. The study revealed that though habitat degradation is advanced in Rugezi the site still harbors a viable population of over 1,000 individuals of the endangered Grauer's Rush Warbler with a large concentration in the central sector of the marsh. Papyrus dwellers including the Vulnerable Papyrus Yellow Warbler (*Chloropeta gracilirostris*) are the most affected by drainage.

Though human activity is negligible in the protected Volcanoes National Park, population of Grauer's Rush Warbler therein remains low. Furthermore the Rugezi population of Grauer's Rush Warbler (*Bradypterus graueri*) is genetically distinctive from others. These facts coupled with habitat fragmentation advocate for immediate and effective conservation action outside protected areas specifically in Rugezi marsh.

List of Acronyms

| | |
|---------|---|
| ACNR | Association Rwandaise pour la Conservation de la Nature |
| AR | Albertine Rift |
| BP | British Petroleum |
| CBD | Convention on Biological Diversity |
| CITES | Convention on International Trade of Endangered Species |
| DRC | Democratic Republic of Congo |
| GRW | Grauer's Rush Warbler |
| IBA | Important Bird Area |
| IUCN | The World Conservation Union |
| MINAGRI | Ministère de l'Agriculture, Rwanda |
| MtDNA | Mitochondrial DNA |
| NP | National Park |
| ORTPN | Office Rwandais du Tourisme et des Parcs Nationaux |
| PAs | Protected Areas |
| PCFN | Project de Conservation pour la Forêt de Nyungwe |
| PNV | Volcanoes National Park |
| PYW | Papyrus Yellow Warbler |
| RGS | Royal Geographic Society, London |
| WCS | Wildlife Conservation Society |

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I. GENERAL INTRODUCTION

Despite its small size (26, 338 km²), Rwanda is endowed with unique biodiversity including ecosystems and species of great importance for conservation. The country devotes 8.4% of lands to protected ecosystems (MINAGRI, 2003). Protected areas play a key role in conservation and render invaluable services to the national economy and local communities. In Rwanda, protected areas have many management objectives beyond biodiversity conservation, including outdoor recreation, tourism, watershed protection, sustainable forestry, hunting or fishing, scientific research, and environmental education. Rwanda has ratified many regional and international measures relevant for the conservation of sites and species including the Convention on Biological Diversity.

The three major Protected Areas are the Volcanoes National Park herein referred to as PNV (12, 760 ha), the Akagera National Park (90,000 ha), and Nyungwe National Park (101,956 ha). The Volcanoes NP is globally known for its charismatic mountain gorilla, the most endangered primate whereas Nyungwe NP is the one of the most important montane rainforest in central Africa (Plumptre *et al.*, 2002) serving as watershed providing water to about 75% of the country. Akagera is home to most of wildlife that is associated with the great African game parks including lion, leopard, buffalo, hippopotamus, rhinoceros, elephant, topi, zebra and Impala. It once had a remarkable selection of birdlife in the swamps and wetlands, the most extensive in Africa together with the Okavango delta in Botswana. The park is strategically located at the junction of several biogeographical zones on the great Nile migration route from Europe and Asia.

Outside Protected Areas wildlife resources are receiving little attention thus impairing biodiversity conservation and depriving the country and local communities of sustainable development and welfare opportunities. This situation is even delicate in rural areas especially in mountain ecosystems with an adverse impact on the environment and natural resources.

Rugezi swamp constitutes the largest single block remaining in the country but without any protection status. The swamp was classified by BirdLife international as one of the seven Important Bird Areas. Important Bird Areas in general are areas important for conservation of birds and other wildlife (Fishpool and Evans, 2001). Despite initiatives for biodiversity conservation in the Albertine Rift region little is known about the status of endemic and endangered wildlife especially birds even within protected areas. Currently conservation efforts are being focused on the endangered primates and large mammals such as mountain gorilla, chimpanzees and elephants. All information on distribution and abundance of threatened species in the Albertine Rift come from primate studies (Plumptre *et al.*, 2003a & b).

Generally birds constitute the best-known group of vertebrates and useful indicators for monitoring environmental change and assessing biodiversity importance (Furness *et al.*, 1993; Stattersfield *et al.*, 1998). Rwanda plays a key role in bird conservation harboring about 666 bird species including 23 species of global conservation concern, many endemic and restricted-range species (Figure 1 and Table 1).

BirdLife Africa Partnership developed an International Species Action Plan for *Bradypterus graueri* and a national action plan for Rwanda; both of them emphasized the need for general surveys especially in Rugezi swamp (BirdLife International, 2003). BirdLife affiliate in Rwanda (ACNR: Action pour la Conservation de la Nature au Rwanda) was involved in the process and played a key role in strategy development for sustainable management of Rugezi.

Rugezi has been identified as having “critical” threat levels as a significant portion of its habitat was under immediate threat of modification due to human activity. Major threats include hydropower project by Electrogaz, agricultural expansion and unsustainable resource exploitation. Efforts are now being made to better understand the impact of human activity on the swamp and ways to restore this ecosystem. Interestingly all initiatives are being backed by local government which is struggling to mainstream biodiversity and development.

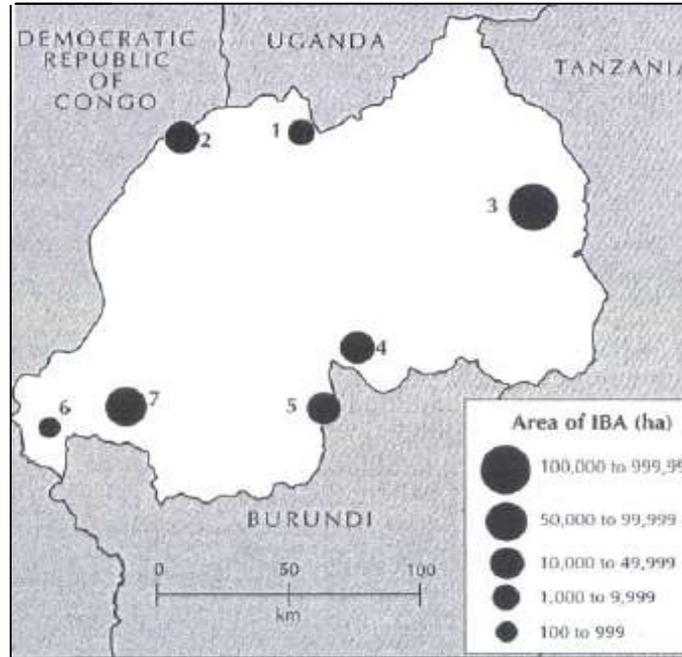


Fig.1. Important Bird Areas in Rwanda (Fishpool and Evans, 2001)
 1: Rugezi Marsh; 2: Volcans NP; 3: Akagera NP; 4: Nyabarongo Wetlands; 5: Akanyaru Wetlands; 6: Cyamudongo Forest; 7: Nyungwe NP

Table 1: Rwanda Red List (IUCN, 2004) and Albertine Rift Endemic Birds (Plumtre *et al.*, 2003b). **EN** Endangered; **VU** Vulnerable, **NT** Near Threatened; **AR** Albertine Rift Endemic; **DD** Data Deficient

| <i>Species</i> | <i>Common Name</i> | <i>Category</i> |
|--------------------------------------|-------------------------------|-----------------|
| <i>Fringilla nankaiensis</i> | Handsome Francolin | AR |
| <i>Glaucidium albertinum</i> | Albertine Owlet | VU, AR |
| <i>Phodilus prigoginei</i> | Congo Bay-Owl | EN, AR |
| <i>Rhynchops flavirostris</i> | African Skimmer | NT |
| <i>Phoenicopus minor</i> | Lesser Flamingo | NT |
| <i>Neotis denhami</i> | Stanley's Bustard | NT |
| <i>Torgos tracheliotus</i> | Lappet-faced Vulture | VU |
| <i>Lybius rubrifacies</i> | Red-faced Barbet | NT |
| <i>Laniarius mufumbiri</i> | Papyrus Gonolek | NT |
| <i>Glareola nordmani</i> | Black-winged Pratincole | DD |
| <i>Gallinago media</i> | Great Snipe | NT |
| <i>Falco naumanni</i> | Lesser Kestrel | VU |
| <i>Crex crex</i> | Corn Crake | NT |
| <i>Circus macrourus</i> | Pale Harrier | NT |
| <i>Chloropeta gracilirostris</i> | Papyrus Yellow Warbler | VU |
| <i>Balaeniceps rex</i> | Shoebill | VU |
| <i>Ardeola idae</i> | Madagascar Pond-Heron | EN |
| <i>Indicator pumilio</i> | Dwarf Honeyguide | NT |
| <i>Apalis personata</i> | Montane-masked Apalis | AR |
| <i>Apalis ruwenzorii</i> | Collared Apalis | AR |
| <i>Cossypha archeri</i> | Archer's Robin Chat | AR |
| <i>Alethe poliophrys</i> | Red-chested Alethe | AR |
| <i>Caprimulgus ruwenzorii</i> | Rwenzori Nightjar | AR |
| <i>Musophaga johnstoni</i> | Rwenzori Turaco | AR |
| <i>Graueria vittata</i> | Grauer's warbler | AR |
| <i>Hemitesia neumanni</i> | Short-tailed warbler | AR |
| <i>Phylloscopus laetus</i> | Red-faced Woodland warbler | AR |
| <i>Melaenornis ardesiacus</i> | Yellow-eyed Black Flycatcher | AR |
| <i>Zoothera tanganyicae</i> | Kivu Ground-Thrush | NT |
| <i>Batis diops</i> | Rwenzori Batis | AR |
| <i>Bradypterus graueri</i> | Grauer's Rush Warbler | EN, AR |
| <i>Parus fasciiventer</i> | Stripe-breasted Tit | AR |
| <i>Nectarinia alinae</i> | Blue-headed Sunbird | AR |
| <i>Apalis argentea</i> | Buff-throated Apalis | EN, AR |
| <i>Muscicapa lendu itombwensis</i> | Chapin's Flycatcher | VU |
| <i>Nectarinia regia</i> | Regal Sunbird | AR |
| <i>Kupeornis rufocinctus</i> | Red-collared Mountain Babbler | NT,AR |
| <i>Nectarinia purpureiventris</i> | Purple-breasted Sunbird | AR |
| <i>Cinnyris rockefelleri</i> | Rockefeller's Sunbird | VU, AR |
| <i>Malaconotus lagdeni centralis</i> | Lagden's Bush-Shrike | NT |
| <i>Cryptospiza jacksoni</i> | Dusky Crimson-wing | AR |
| <i>Ploceus alienus</i> | Strange Weaver | AR |
| <i>Cryptospiza shelleyi</i> | Shelley's Crimson-wing | VU, AR |

An unprecedented project for Rugezi was undertaken in 2004 by Helpage Rwanda, with support from the Netherlands Government. This project assessed the status of the swamp especially water level and documented ongoing activities in and around. A socio-economic survey was carried out around the site while recommendations were suggested for the protection and sustainable management of the Rugezi swamp.

However one of the major limitations of this project is the biological aspect that was superficially tackled. Though it is important to undertake development projects in biodiversity rich areas, baseline information about status of biological diversity remains a crucial component to consider in order to cater for full functionality of any particular site during planning processes. Integrated research is needed to meet global challenges of poverty and environment sustainability.

The aim of this study was to assess the status of two endangered warblers at two Rwandan IBAs and lobby for appropriate conservation action for Rugezi marsh. Mountain ecosystems in general are facing many environmental challenges. Hence, sustainable management of mountain resources and socio-economic development of the people deserves immediate action. To achieve this there is urgent need to generate and strengthen knowledge about the ecology and sustainable development of mountain ecosystems, promoting public awareness, integrated development and alternative livelihood opportunities.

II. STUDY AREAS AND METHODS

2.1. *The Parc National des Volcans (PNV)*

The Parc National des Volcans is located in the northwest Rwanda, on the joint border with Uganda and DR Congo, where it is contiguous with Mgahinga Gorilla National Park in Uganda and Virunga National Park in the Democratic Republic of Congo. The park contains eight Pleistocene volcanic peaks, which form part of the watershed between the Nile and Congo River systems, and includes Karisimbi (4,507 m). The terrain is often difficult and broken, with steep slopes. The vegetation varies considerably with altitude; at lower elevations (2,400–2,500 m) there is montane forest with *Neoboutonia*, above which there is a zone of bamboo *Arundinaria alpina* between 2,500 and 3,200 m, replaced on more humid slopes in the west and south by *Hagenia–Hypericum* forest. Montane bogs occupy some open areas. Subalpine vegetation with lobelias, evergreen bushland and thicket occurs between 3,500–4,000 m, while above 4,000 m there is an Afro-alpine vegetation of heath and thicket grassland. Average annual rainfall at Karisoke (3,100 m) is c.2, 000–2,400 mm (Kanyamibwa, 2001).

The park was created in 1929, although legislation for its current protection derives from a 1974 Decree, when it was reduced by about half to its current size. The park was designated as a Biosphere Reserve in 1983. Although human pressure around the park is very high, it is the best-protected park in Rwanda. Threats include demand for agricultural land, gorilla poaching for trading, encroachment, illegal wood, bamboo cutting and feral dogs.

Karisoke Research Centre, created by Diane Fossey, is among the oldest primate field research stations in Africa. Efforts have been made to extend research and tourism activities to other elements of the park. Public-awareness campaigns have been conducted around the periphery of the park, aimed at promoting understanding of the park and stimulating support within the local population. The protected Volcanoes National Park acted as control area in assessing the impact of habitat alteration on the species.

2.2. Rugezi Swamp

Rugezi marsh is located in an inundated valley in the north of Rwanda, to the east of Lake Burera on Uganda border. The vegetation of the marsh is dominated by *Miscanthidium violaceum* with stands of *Cyperus latifolius* around the fringes and an area of papyrus (*Cyperus papyrus*) near the point of outflow. Average annual rainfall is estimated at 1,200 mm.

Rugezi is an important site for bird conservation. Over 40 species have been recorded from the marsh and its immediate vicinity, including five of the Afrotropical Highlands biome, one Albertine Rift endemic and six Lake Victoria biome (Kanyamibwa, 2001). This site is important for *Bradypterus graueri*, Albertine Rift endemic and endangered species. The marsh has no legal protection and is under pressure for agriculture. The vegetation of the marsh is cut and burned during the dry season, resulting in progressive habitat degradation. A management programme involving local communities is required. For the purpose of this work we adapted MINALOC and HELPAGE, 2005 and subdivided the marsh into three major sectors as follows:

- The northern sector: includes Kamiranzovu and the area from the outlet extending far south of Butaro district for about 5 km. This region is the mostly degraded by human activity. This zone mostly covered by papyrus in the past has totally changed in the last ten years. Today vestige papyrus can be observed on a trampled soil with low capacity of retaining much water.

Formerly stronghold for the papyrus endemic birds the sector has become poor in terms of biological diversity with very low water table level.

- The central sector: covering about 5 km south up to Murambo (Ruhunde). Though heavily degraded as well natural vegetation typical of highland marshes is observed from place to place. Water level seems moderate and a number of wetland species of birds were frequently recorded.

- The southern sector: water level is high with living and typical vegetation. Human activity is also high and varies with season. Agriculture and grass cutting in dry seasons, fishing in wet season.
A great number of large water birds thrive in this sector indicating that the area is more suitable for them than other sectors primarily due to high fish productivity.

2.3. Methods

Estimating population size and density is of paramount importance for conservation and management of endangered species. To achieve this appropriate data were collected by Distance sampling using Point Transects. DISTANCE 4.1 (Thomas *et al.*, 2004) is the version used for data analysis. This is Windows based computer software available freely to download via the webpage <http://www.ruwpa.st-and.ac.uk/distance/>. One of the biggest advantages of this method is the facility to import data from external sources. Furthermore detailed results output is split into pages and includes a high-resolution plot of the detection function (Bibby *et al.*, 2000).

In Point Transect method the observer stands still in one particular location (a census station) along a transect recording all the birds seen and heard during a fixed count period.

This method has been successfully used for measuring relative or absolute abundance (Reynolds *et al.*, 1980). Point transects were preferred to line transects in this study since we dealt with less mobile bird species and the habitat was not fine-grained. Response rate to playback technique was very low suggesting that this is not probably the best way of surveying Grauer's Rush Warbler.

Survey method used was point transects (variable circular plots); this method is suitable for designing and analyzing data surveys where the aim is to estimate density and abundance of a biological population. The distance between stations

was 100 m since the study focused upon a small, secretive and inconspicuous warbler. Birds flying away from the immediate area were recorded and a distance estimate made to their point of departure.

Guided data entry allows entering key information about the type of survey, measuring units and distance measurements, survey area, survey effort and individual observations. Densities were estimated in the three major sectors.

The GRW responded but not efficiently to playback surveys, which have been used elsewhere to study threatened birds (Njoroge & Bennun, 2000)

Data were analyzed using the DISTANCE 4.1 computer software (Thomas *et al.*, 2004). Analysis is done in Distance using *analyses engines*, of which there are currently two: the conventional distance sampling (CDS) engine and the multiple covariate distance-sampling engine.

Rugezi swamp (8,500 ha) is believed to hold the highest population of the endangered Grauer's Rush Warbler (vande Weghe, 1981 & 1983) and a number of other species of concern for conservation.

The swamp was subdivided into three major sectors: The northern, the central and the southern sector. This allowed visiting as many habitats as possible with maximum coverage occurring early in the morning and in the evening.

During fieldwork, data was collected on population densities for the two targeted species, in the two sites, habitat types, disturbance level, geo-references and socio-economics. Appropriate forms were designed for recording data in the field. Each site was divided into blocks, and then plots were chosen randomly inside those blocks. The observer made observations from points arranged at intervals along a transect and records all birds seen or heard calling.

On a few occasions mist netting was used for training in bird identification, marking birds and collecting material for genetic analysis. Mist nets were placed at the same location for point counts and operated early in the morning and late in the afternoon. Marking is important for census, studies of local ranging, habitat use and dispersal and life histories of individuals.

Vegetation structure

On each transect vegetation was qualitatively described showing dominant species.

Phylogenetics

DNA was extracted from blood samples from three individuals and sequences compared with others from a larger dataset (Kahindo, 2005). Others samples in the dataset were previously collected in southwest Uganda (Volcanoes, Bwindi), eastern DRC (Kahuzi-Biega), and southwest Rwanda (Nyungwe). A phylogenetic tree was generated following standard guidelines (Hall, 2004).

2.4. Taxa

Grauer's Rush Warbler *Bradypterus graueri* (Neumann, 1908) was listed as an endangered species following a severe decline in population densities and suitable habitat due to human activity. The population size is not well known but experts estimated it to be less than 10,000 based on reports from recent monitoring efforts and occasional field observations across its range (Birdlife, 2003). This species is one of the 41 Albertine Rift endemics (Plumptre *et al.*, 2003b) restricted to highland swamps in the mountains around Lakes Kivu and Edward, in eastern Democratic Republic of Congo (DRC), southwestern Uganda, northern and south-western Rwanda and northern Burundi. Little is known about its specific habitat requirements, ethology, feeding behaviour, breeding behaviour, nest and eggs. Threats to GRW habitat are primarily anthropogenic. Highland swamps are being reclaimed for subsistence agriculture and cash crop planting in all range countries.

Papyrus Yellow Warbler (*Chloropeta gracilirostris*) is a papyrus endemic and the most threatened of the birds endemic to papyrus swamps in Africa (IUCN, 2004). *Chloropeta gracilirostris* has a severely fragmented range in the Great Lakes region of Africa in DRC, Rwanda, Burundi, Uganda, Kenya, Tanzania and Zambia. Little is known about the ecology, distribution and taxonomic status of

the species. Draining and exploitation of papyrus swamps are the major threats to the species.

In Rugezi the Grauer's Rush and Papyrus Yellow Warblers were recorded occurring in sympatry with other key wildlife species (Fishpool and Evans, 2001).

2.5. Checklist

All birds species recorded (heard or seen) during fieldwork were compiled to update the checklist for Rugezi. Birds were identified in the field using Stevenson and Fanshawe (2000). Order followed Britton (1980).

Species were assigned ecological types to assess the importance of the ecosystem to a particular group with known habitat requirements. This can help establish link between bird communities and the ecosystem health. Swamps support characteristic communities of plants, birds and invertebrates that are likely to be affected by any modification to the habitat.

III.RESULTS

A total of 228 kilometers were walked along various transects in the three key sectors of the Rugezi swamp during our survey. Average density was calculated by estimating the density of birds for each sector.

In the Volcanoes National Park the distance covered was 8 km of which 6km in a marsh -between Mgahinga and Sabyinyo- and 2 km in small isolated swamps.

The following results were obtained:

Grauer's Rush Warbler (*Bradypterus graueri*)

This species was recorded all over the swamp (Table 1) though densities varied from place to place.

Table 2: Estimated densities of Grauer's Rush Warblers in Rugezi marsh and PNV

| Site | Density (birds per ha) | Lower CL | Upper CL |
|----------------|------------------------|----------|----------|
| Rugezi North | 1.9 | 0.6 | 5.5 |
| Rugezi Central | 19.4 | 16.0 | 23.5 |
| Rugezi South | 7.8 | 4.35 | 13.9 |
| PNV | 9.1 | 5.3 | 15.6 |

The density of GRW in the central sector of Rugezi was higher than in any other sector. Density in the central part was higher than the average for PNV. The lowest density was observed in the northern sector totally modified by water drainage and human activity.

Detection curves were computed from our data by plotting radial distances (in meters) against probability densities (Figure 2). These curves show that most records were made at higher distances generally beyond 10 m.

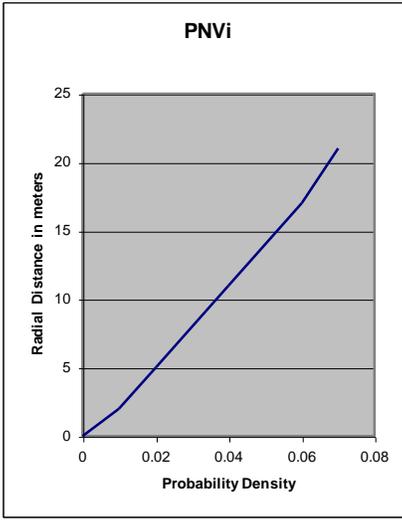
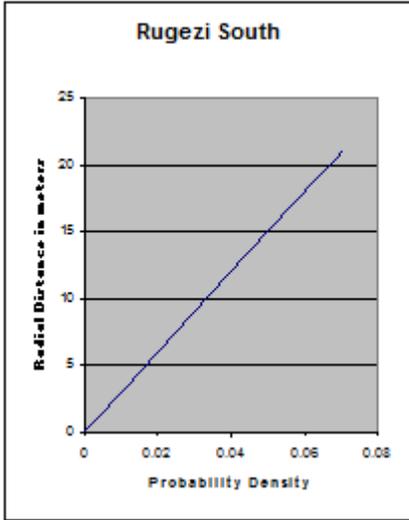
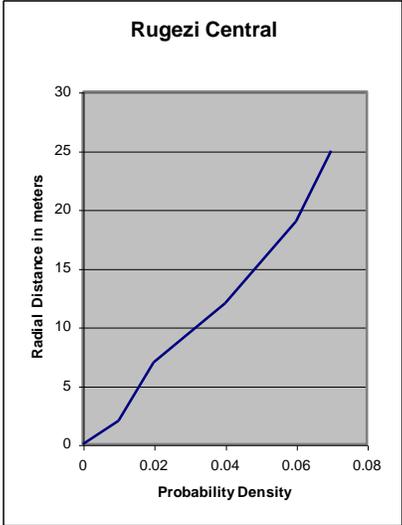
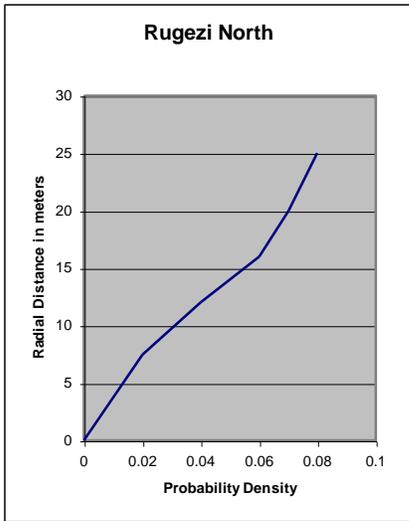


Figure 2: Detection curves for GRW in three sectors of Rugezi Marsh and PNVi

The Papyrus Yellow Warbler (*Chloropeta gracilirostris*)

A small population of less than 100 individuals of this species was observed in the central part in remnant papyrus patches apparently planted on purpose by local people at the edge of the swamp.

Nest record for the GRW (*Bradypterus graueri*)

An active cup-shaped nest with two eggs was discovered in March 2005 in the central part of the Rugezi marsh near Twa village settlement. Two young boys from the community led us to the site after persuading them. This nest has never been described before (Urban *et al.*, 1997). It was placed at 30 cm high above ground in the center of *Miscanthus* grass just near a path commonly used by people. The nest was made of *Cyperus* leaves and lined with fine grass at less than 20 m from the edge. GRW was observed seated on the white eggs marked with brown spots (Figure 3).

Checklist for Rugezi Marsh

A total of 38 bird species were recorded in Rugezi marsh. Species found outside the swamp are not included. A checklist of species known from Rugezi swamp is presented in Appendix I. This checklist also presents old records by vande Weghe (1981, 1983).

Phylogenetics

A preliminary analysis shows that Rugezi population is distinctive from others. The tree generated shows a clear differentiation, all the three individuals from Rugezi forming a separate group located at the bottom of the tree (Figure 4).

Threats

-Drainage

Electrogaz, a parastatal company generating power, carried out the last drainage of Rugezi marsh in 2000 and this has led to a serious drop of water level in the northern and central part with subsequent modification of the structure of the

marsh. During our study we found that water level was very high in the southern sector, moderate in the central part and very low in the northern sector (Figure 5).

-Human activities

In each sector there was evidence of agriculture, grazing, bee keeping, hunting and grass cutting all over Rugezi marsh as depicted on these pictures (Figure 6).



Fig. 2. Nesting site and active nest of the GRW (*Bradypterus graueri*)

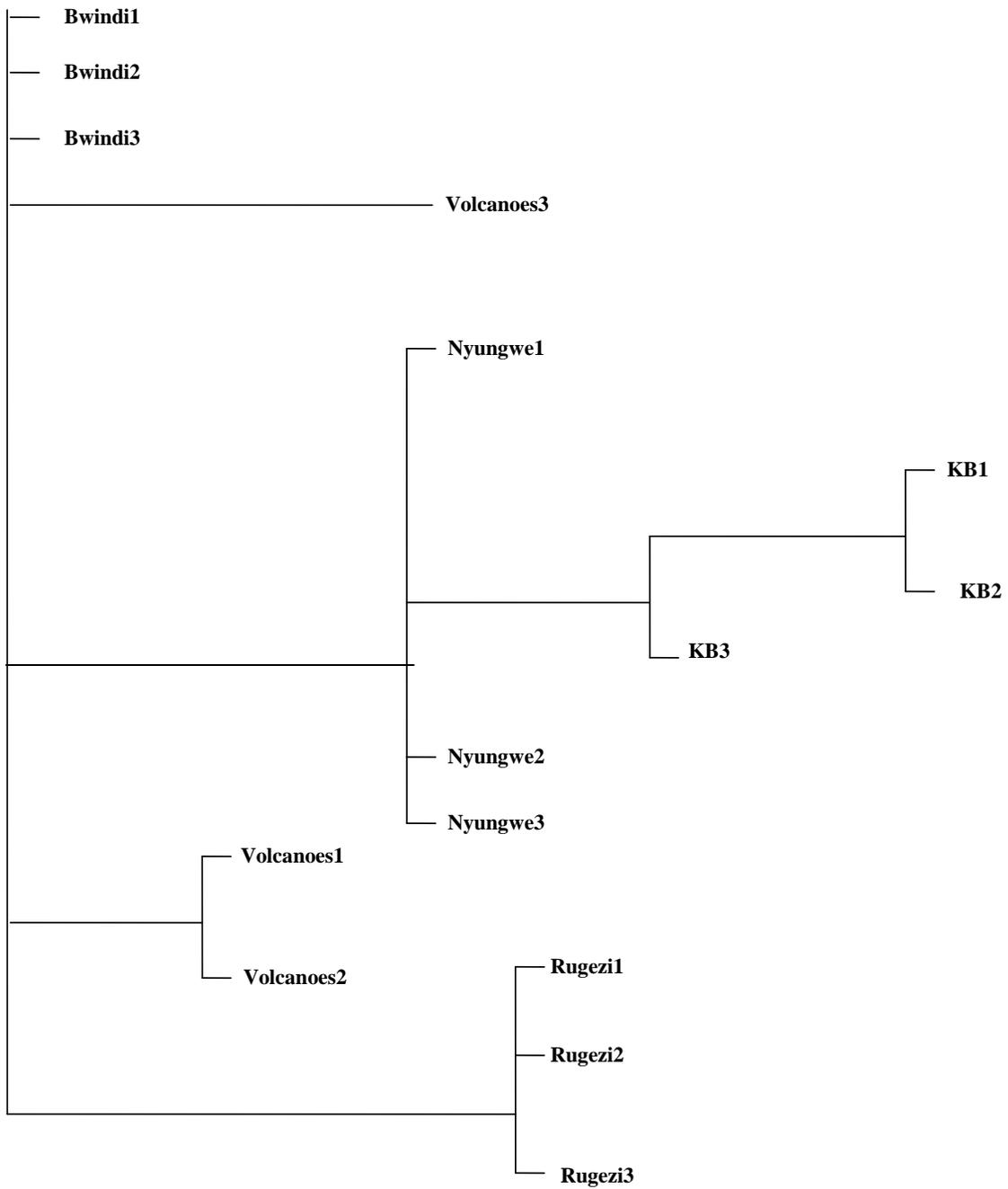


Figure 4: Neighbor-joining tree constructed with PAUP*. The dataset included 15 individuals from 5 localities (KB=Kahuzi-Biega)



Figure 5: Drainage for hydropower, a valuable project which adversely impacted on biodiversity in Rugezi Marsh

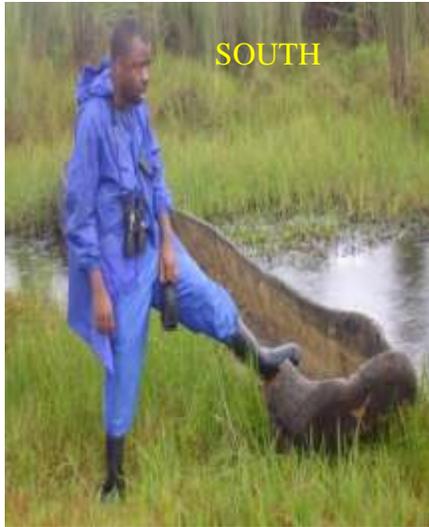


Figure 6. Illegal activities in the three sectors of Rugezi Marsh



Figure 7: Papyrus products from Rugezi marsh on the market

IV. DISCUSSION

Despite high levels of disturbance GRW is still present in Rugezi swamp in viable numbers especially in the central sector. The Helpage report (MINALOC, 2005) could not confirm the presence of the bird in the area probably due to lack of expertise. Bird identification by song requires some prior knowledge or experience. This seems very critical in tropical areas generally with high diversity of birds in a same habitat. The song of the GRW can easily be confused with that of many other warblers occurring in similar or adjacent habitats. In Rugezi the sympatric *Cisticola carruthersi* has a closer call but an experienced birder can tell them apart.

During field surveys birds were seen and heard all over with a highest density in the central part (Table 1). A total of 546 and 54 individuals were respectively recorded for the whole Rugezi marsh and PNV. These include mostly singing males (92.1 %) and only a few seen moving. This gives us a total estimate of 1006 individuals for and 108 individuals respectively for Rugezi Marsh and PNV. However from our data it was difficult to accurately estimate the population densities for the whole swamp due to the following factors:

- Habitat quality largely varies from place to place within the swamp making extrapolation difficult and unrealistic. Considering the swamp size of 8500 ha, extrapolated population estimates would exceed the total estimates for all sites across the species range (BirdLife, 2003).

- Stations were not placed randomly due to technical and field constraints. Rugezi is a remote and large site, which would require significant resources for a thorough survey. However selected sites were adequately sampled in the northern, central and southern sectors.

The difference was highly significant between sites (chi square =16.7, $p < 0.01$). The uneven distribution was apparently related to water levels in the soil. This could be a major factor determining food availability as the GRW mainly feeds on the ground (Urban *et al.*, 1997). The northern sector with little water in

the soil has the lowest density (1.9 birds per ha) whereas the central part with moderate water levels has the highest densities (19.4 birds per ha). However in the southern sector largely flooded with vegetation covered in many places we found a density of 7.8 birds per ha. This suggests that though GRW uses this zone too much water may limit feeding and nesting options.

The GRW was recorded in various types of habitat as reported in previous studies (vande Weghe, 1983). It was more common in *Cyperus* but also present in areas with *Miscanthidium*, *Typha*, *Sphagnum*, *Lobelia*, *Juncus* and *Papyrus*. The bird was occasionally seen using tall vegetation in the swamp to perch, display or when singing.

Probability densities exponentially increased with distance and were not normally distributed as shown on detection curves. Fewer birds were recorded at shorter distances despite the fact that necessary precaution was taken during the survey. This bias was probably due to the habitat itself or the bird's behaviour. In an open area the birds easily see the observer and this can affect their activities. Birds were generally found in areas heavily degraded by human activities including agriculture, beekeeping, grass cutting. Communities living close to the swamp are quite conversant with the bird, its call and behavior that inspired its local name. All this shows that human settlement itself may not be a threat to this bird but rather to the habitat. Furthermore the bird apparently has no commercial or cultural value (Kahindo, pers.com.). Conservation of this species should target the community using the habitat for law enforcement about resource use and awareness campaigns.

The nest was described for the first time. However there are previous breeding indications in Eastern DRC at almost the same period of the year (Urban *et al.*, 1997). Given that the bird nests near the ground any human activity within the swamp disrupts breeding sites and jeopardizes the reproduction success of the bird. In Rugezi swamp, there are many trails across and within the swamp with people and cattle freely crossing in all directions. Though movements of people and cattle were observed throughout the year these were limited in the southern sector during rainy season as the area is over flooded

making it hard to cross unless using boats. Fishing activity takes place during this period. The active nest found was located in an area heavily degraded and constantly used by local communities. Grass cutting is common and this adversely alters breeding sites. Grass is overexploited mostly for hutching, making fire and mulching. Swamp degradation is exacerbated due to increased demand for products from poor people living around worsened by lack of legal status of the swamp. Economic limitations increase dependency on natural resources in the Albertine Rift region. This was highlighted in a study around protected areas (Plumptre *et al.*, 2004). For many people around Rugezi, wildlife was an essential source of animal protein (fish, bushmeat) but now they are experiencing a shortage (Kahindo, pers. com.). This indicates their willingness to actively participate in any initiative aiming at restoring the quality of the ecosystem. However this needs to be documented further for proper valuation by involving all key stakeholders and interest groups.

Natural habitat for the Papyrus Yellow Warbler in the northern sector is gone. The northern part of the Rugezi marsh, formerly colonized by papyrus has been turned into agricultural land for growing crops and cattle grazing. Reduction of water level due to drainage was detrimental to the papyrus that degenerated with time though it did not totally disappear. Live remains of papyrus vegetation in form of weedy-looking plants are easily seen across the swamp.

Far south in the central and southern sectors, with high levels of water table, some people have purposely planted papyrus along the edge and it is in these patchy belts that we discovered the remnant individuals of the papyrus yellow warbler *Chloropeta gracilirostris*. These birds apparently moved south when the northern part was drained as papyrus progressively shrunk off.

Local people replanted papyrus on their own for domestic consumption. Papyrus is waived into mats, baskets, fishing traps, used as fuel, in fencing or making ropes and is a source of income for poor communities around the swamp (Figure 7). The plant also may have some medicinal value (Kahindo, pers.com.). All this implies that if there is opportunity for restoring the swamp, papyrus planting should be promoted as it serves both as habitat for the bird and as source of

income for local communities coupled with the fact that it people' willingness to plant it. In places like India land use and traditional practices play a key role in maintaining bird diversity on farmlands (Ramakrishnan, 1992). The only true papyrus endemic (vande Weghe, 1981) found in Rugezi marsh is the papyrus Canary *Serinus koliensis*, which also has a very-restricted range. The other two namely white winged Warbler (*Bradypterus carpalis*) and Papyrus Gonolek (*Laniarius mufumbiri*) were not recorded during this trip. They are either wiped out from the marsh or now confined to a few sites within papyrus patches. This can only be ascertained by general surveys across the marsh. Rugezi was the only site where GRW and the white winged Warbler (*Bradypterus carpalis*) occurred in sympatry (vande Weghe, 1983) but this seems no longer to be the case.

It appears from this work that the future of the two globally threatened species in Rugezi marsh remains uncertain. For GRW human activities are likely to affect the breeding success as nesting sites are continuously disturbed and overexploited. PYW remain in low densities in disconnected patches. Because of its special habitat requirement it faces more threats than the GRW.

Though it is difficult to estimate the minimum viable population (MVP) for a species, for the PYW the number of individuals seems closer to the to the threshold of 50 proposed by Franklin (1980) reported in Shaffer (1990) in order to ensure short-term fitness. Inbreeding may occur and with its subsequent impact on the future of the species. Small isolated populations may lose genetic variability as they pass through 'bottlenecks', then they may lack the fitness or genetic flexibility to cope with the normal fluctuations of the environment.

The good thing is that the habitat is not totally fragmented, especially in the central part relatively less disturbed. The Rugezi marsh remains as one single block that can easily be progressively rehabilitated with minimal resources. This would require combined effort from government and non-government institutions. On the other hand conservation bodies should take advantage of indigenous knowledge to promote the rehabilitation of the site on a large scale.

The Neighbor-Joining tree depicts a differentiation of the Rugezi population from other major populations in Bwindi, Volcanoes, Kahuzi and Nyungwe. Like the other populations in recent study (Kahindo, 2005), the Rugezi group also may constitute a distinct evolutionary significant unit (Moritz, 1994) suggesting that management should ensure that habitat quality is effectively monitored and maintained. Thus biodiversity loss in Rugezi is detrimental to the local and global community as it affects unique and restricted-range genetic resources. Similar information could not be generated for the PYW due to lack of resources. More samples and further analysis would elucidate this further and tell more about health, status and natural history of the Rugezi populations.

vande Weghe (1981, 1983) recorded 44 species in Rugezi marsh of which 35% were not associated with water. Our data didn't record all these species, as this was not our goal. However we added a number of species (13) to previous checklists (Appendix 1). This brings to sixty the number of species known from Rugezi. The new species list is a mixture of aquatic and widespread species, which are not new to the national checklist. Rugezi still harbours a number of species important for conservation and qualifies as important bird area. The fact that wandering species not frequent in swamps were commonly found in Rugezi marsh suggests that the habitat has been degraded by human activities. Given the heterogeneity of the marsh bird communities varied from site to site with many piscivorous species in the southern sector. General surveys are needed to assess which species have gone extinct from the site and what are the new colonizers thus updating the checklist.

V. CONCLUSION AND RECOMMENDATIONS

- Our work has ascertained the presence of the Grauer's Rush Warbler (*Bradypterus graueri*) and Papyrus Yellow Warbler (*Chloropeta gracilirostris*) in Rugezi swamp despite high levels of disturbance by human activities. Due to change in levels of water table and habitat structure the densities are now unevenly distributed.
 - Habitat destruction and fragmentation have caused population decline of the species.
 - Our findings have been partly used by the government, which proposed Rugezi marsh for a designation as Ramsar Site in a move to ensure sustainable development while conserving biodiversity.
 - Capacity-building was achieved by the project with six students trained in field techniques, data collection and analysis (Appendix 4). This is an asset for Rwanda as a country and the Albertine Rift as a region for biodiversity management.
 - We recommend that effective action should be taken to enforce law and reduce human activities in the Rugezi marsh and appropriately plan for the sustainable management of the swamp.
 - We acknowledge the effort by Electrogaz to stop draining the swamp and other partners interested in promoting the protection of this critical site. However there is a lot remaining to be done such as general surveys, zoning by incorporating the biodiversity element and socio-economic factors of people around the swamp.
- Rwanda, signatory to many conventions including the Convention on Biological Diversity, is actually committed to integrate conservation and sustainable use of biological diversity and natural resources into relevant sector plans, programs and policies. This initiative deserves regional and international support from conservation bodies.

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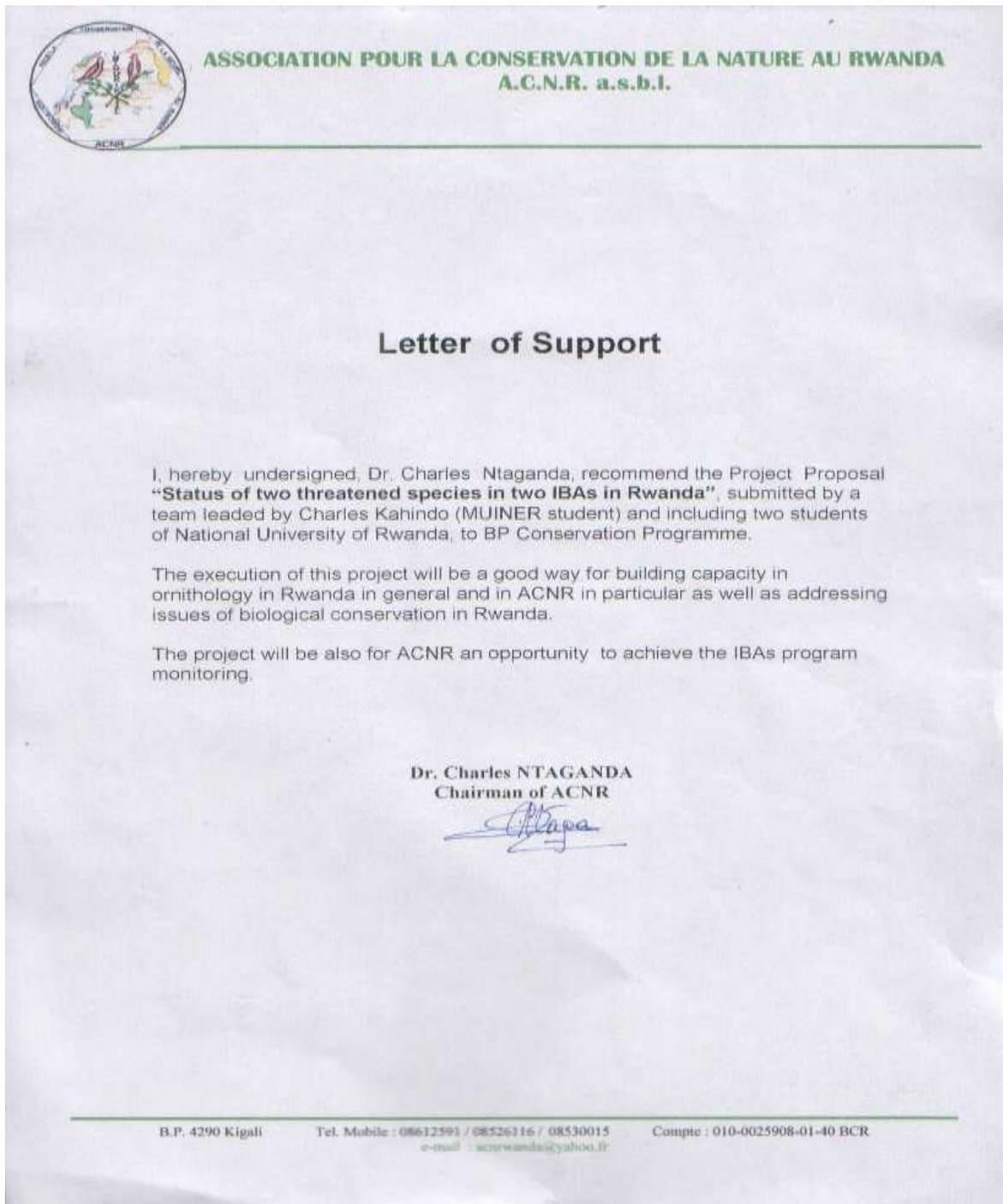
APPENDIX 1: Species Checklist for Rugezi Marsh

| Britton No. | Scientific Name | Common Name | Ecol. Type | Record | Reference |
|-------------|-----------------------------------|---------------------------|------------|--------|------------|
| 23 | <i>Ixobrychus minutus</i> | Little Bittern | W | O | VW1 |
| 25 | <i>Ardea cinerea</i> | Grey Heron | W | R | BP |
| 27 | <i>Ardea melanocephala</i> | Black-headed Heron | w | R | BP |
| 28 | <i>Ardea purpurea</i> | Purple Heron | W | O | VW1 |
| 30 | <i>Ardeola ralloides</i> | Common Squacco Heron | W | O | VW1 |
| 31 | <i>Ardeola rufiventris</i> | Rufous-bellied Heron | W | O | VW1 |
| 33 | <i>Butorides striatus</i> | Striated Heron | W | O | VW1 |
| 38 | <i>Mesophoyx intermedia</i> | Intermediate Egret | W | R | BP |
| 40 | <i>Nycticorax nycticorax</i> | Black-crowned Night-Heron | W | O | VW1 |
| 51 | <i>Bostrychia hagedash</i> | Hadada Ibis | w | R | BP |
| 54 | <i>Threskiornis aethiopicus</i> | Sacred Ibis | W | R | BP |
| 72 | <i>Anas undulata</i> | Yellow-billed Duck | W | R | BP |
| 92 | <i>Circus aeruginosus</i> | Eurasian Marsh-Harrier | w | O | VW1 |
| 95 | <i>C. ranivorus</i> | African Marsh-Harrier | W | O | VW1 |
| 194 | <i>Balearica regulorum</i> | Grey Crowned Crane | W | R | BP |
| 201 | <i>Limnocolax flavirostris</i> | Black Crake | W | RO | BP, VW1 |
| 225 | <i>Actophilornis africanus</i> | African Jacana | W | R | BP |
| 355 | <i>Turtur afer</i> | Blue-spotted Wood-Dove | w | RO | BP, VW1 |
| 372 | <i>Corythaeola cristata</i> | Great Blue Turaco | w | O | VW1 |
| 404 | <i>Centropus monachus</i> | Blue-headed Coucal | w | RO | BP, VW1 |
| 459 | <i>Colius striatus</i> | Speckled Mousebird | w | RO | BP, VW1 |
| 465 | <i>Ceryle rudis</i> | Pied Kingfisher | W | O | VW1 |
| 732 | <i>Pycnonotus barbatus</i> | Common Bulbul | w | RO | BP, VW1 |
| 784 | <i>Saxicola torquata</i> | Common Stonechat | w | R | BP |
| 810 | <i>Acrocephalus rufescens</i> | Greater Swamp Warbler | W | RO | BP, VW1 |
| 811 | <i>A. schoenobaenus</i> | Sedge Warbler | W | O | VW1 |
| 812 | <i>A. scirpaceus</i> | Eurasian Reed Warbler | W | O | VW1 |
| 834 | <i>Bradypterus carpalis</i> (E) | White-winged Warbler | W, LV | O | VW1 |
| 836 | <i>B. graueri</i> | Grauer's Rush Warbler | W, EN, AH | RO | VW2, BP, K |
| 842 | <i>Chloropeta gracilirostris</i> | Papyrus Yellow Warbler | W, VU, LV | RO | BP, VW1 |
| 853 | <i>Cisticola carruthersi</i> | Carruther's Cisticola | W, LV | RO | BP, VW1 |
| 855 | <i>C. chubbi</i> | Chubb's Cisticola | w | RO | BP, VW1 |
| 875 | <i>Eminia lepida</i> | Grey-capped Warbler | w | O | VW1 |
| 937 | <i>Muscicapa aquatica</i> | Swamp Flycatcher | W | RO | BP, VW1 |
| 993 | <i>Motacilla capensis</i> | Cape Wagtail | W | R | BP |
| 1009 | <i>Laniarius mufumbiri</i> (E) | Papyrus Gonolek | W, LV | O | VW1 |
| 1024 | <i>Tchagra minuta</i> | Marsh Tchagra | W | RO | BP, VW1 |
| 1035 | <i>Lanius mackinnoni</i> | Mackinnon's Fiscal | w | R | BP |
| 1066 | <i>Onychognathus tenuirostris</i> | Slender-billed chestnut- | W, AH | O | VW1, K |

| | | | | | |
|------|--------------------------------|--------------------------------|-------|----|---------|
| | | winged Starling | | | |
| 1098 | <i>Nectarinia erythrocerca</i> | Red-chested Sunbird | w | O | VW1 |
| 1103 | <i>Nectarinia kilimensis</i> | Bronze Sunbird | w | R | BP |
| 1140 | <i>Euplectes axillaris</i> | Fan-tailed Widowbird | w | RO | BP, VW1 |
| 1141 | <i>Euplectes capensis</i> | Yellow Bishop | w | R | BP |
| 1159 | <i>Ploceus baglafecht</i> | Baglafecht Weaver | W, AH | RO | BP, VW1 |
| 1164 | <i>P. castanops</i> | Northern Brown-throated Weaver | w | O | VW1 |
| 1165 | <i>P. cucullatus</i> | Black-headed Weaver | w | RO | BP, VW1 |
| 1177 | <i>P. ocularis</i> | Spectacled Weaver | w | RO | BP, VW1 |
| 1179 | <i>P. pelzeni</i> | Slender-billed Weaver | W | RO | BP, VW1 |
| 1189 | <i>P. xanthops</i> | Golden Weaver | w | RO | BP, VW1 |
| 1226 | <i>Estrilda astrild</i> | Common Waxbill | w | RO | BP, VW1 |
| 1230 | <i>E. nonulla</i> | Black-crowned Waxbill | w | RO | BP, VW1 |
| 1231 | <i>E. paludicola</i> | Fawn-breasted Waxbill | w | O | VW1 |
| 1243 | <i>Nesocharis ansorgei</i> | White-collared Oliveback | w, LV | O | VW1, K |
| 1265 | <i>L. bicolor</i> | Black-and-white Mannikin | w | RO | BP, VW1 |
| 1266 | <i>Lonchura cucullata</i> | Bronze Mannikin | w | RO | BP, VW1 |
| 1281 | <i>S. burtoni</i> | Thick-billed Seed-eater | W, AH | O | VW1, K |
| 1283 | <i>S. citrinelloides</i> | African Citril | w | RO | BP, VW1 |
| | <i>S. frontalis</i> | Western Citril | W, AH | O | VW1, K |
| 1287 | <i>Serinus koliensis</i> (E) | Papyrus Canary | W | RO | BP, VW1 |
| 1292 | <i>S. striolatus</i> | Streaky Seed-eater | w | RO | BP, VW1 |

Legend: **O** Old record (vande Weghe, 1981, 1983; Kanyamibwa, 2001), **R** Recent record by BP Team (heard or seen); **E** Papyrus Endemic; **W** Aquatic/Swamp species; **w** Widespread; **EN** endangered; **EN** Endangered; **VU** Vulnerable; **AH** Afrotropical Highland Biome; **LV** Lake Victoria Biome; **VW1** vandeWeghe 1981; **VW2** vandeWeghe 1983; **K** Kanyamibwa 2001; **BP** BP Team

APPENDIX 2: PERMITS AND RECOMMENDATIONS



APPENDIX 3: OUTPUTS FROM THE PROJECT BP103004

I. Conservation team study rare Rwandan warblers

Posted on www.birdlife.net

In Rwanda, a team of BP Conservation Award winners studying two globally threatened warbler species have been busy in the northwestern part of the country. After preliminary surveys in the Albertine Rift region, the team found that the Endangered Grauer's Scrub-warbler *Bradypterus graueri* has a viable population but is unevenly distributed in the Rugezi swamp, which has a high amount of human interference. Sound recordings gave a very preliminary suggestion that there were about 370 singing males in the population.

The other species, the Vulnerable Papyrus Yellow Warbler *Chloropeta gracilirostris*, was represented by only a few individuals in an apparently rehabilitated papyrus patch, and habitat disturbance is viewed as the most likely culprit for their low numbers. Habitat preference for both birds is still not documented, since in some disturbed areas the birds are thriving and in others they are not. Factors such as the type and extent of the disturbance may be the cause of the variation, and the team is continuing to study these mysteries.

These two species of birds are extremely shy and elusive, and apparently even the most experienced researchers find them very difficult to study. However, after some short rains passed through the study area, the team noticed a measurable increase in the number of birds they were able to record, and they are excited to return to the field once the water table has increased.

One last positive observation was that in Volcano National Park, the Grauer's Scrub-warbler was greatly benefitting from the protection of other wildlife, such as the Mountain Gorilla, yet their habitat density was still much lower there than in Rugezi swamp. All of these phenomena will be analysed once the team has returned from the field after the rains.

II. Découvertes sur deux fauvettes menacées.

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Rwanda - Décembre 2004

Au Rwanda, une équipe d'ornithologues étudiant deux espèces globalement menacées de fauvettes ont fait de belles découvertes dans une région du Nord-ouest du pays. Après des études préliminaires dans la région de l'Albertine Rift, l'équipe a noté la présence d'une population viable de Bouscarles de Grauer (*Bradypterus graueri*) dans le marais de Rugezi, malgré une forte présence humaine. Les enregistrements sonores y ont permis d'estimer la présence d'environ 370 mâles chanteurs sur le site.

Par contre, le Chloropète aquatique (*Chloropeta gracilirostris*) n'était représenté que par quelques individus, dans un massif de payrus en régénération. La perturbation de l'habitat semble la cause de cette faible présence.

Les biologies de ces deux espèces ne sont pas bien connues. Il semblerait que la nature et l'ampleur des perturbations jouent un rôle dans la présence des oiseaux, et l'équipe continue ses études sur le sujet.

Ces deux espèces sont extrêmement discrètes, et même les chercheurs les plus expérimentés les trouvent très difficiles à étudier.

Une autre donnée intéressante a été obtenue dans le parc national des volcans, où l'on a constaté que la Bouscarle de Grauer bénéficiait de la protection accordée à d'autres espèces comme le Gorille des montagnes. Les travaux de l'équipe reprendront après la saison des pluies.

III. Community Participation: the key to saving the Endangered Grauer's Scrub-warbler

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The Grauer's Rush Warbler *Bradypterus graueri* is an endangered Albertine Rift Endemic species confined to a few highland swamps. It has a very small, severely fragmented range in Burundi, the Democratic Republic of Congo, Rwanda and Uganda. The Rugezi marsh in northern Rwanda constitutes the largest suitable habitat for the species, making it globally important for biodiversity conservation. It is also of ecological and socio-ecological value to the surrounding communities. However, the site has no formal protection, and is threatened in a region with one of the highest human population densities in Africa. The area has been affected through swamp drainage for hydropower, agriculture and resource over-exploitation.

A team of BP Conservation Programme award winners has been assessing the status of Grauer's Scrub-warbler at two sites, including Rugezi marsh, with some exciting preliminary results. During the rainy season, guided by two local boys, the team discovered an active nest with two eggs on 1 March 2005 in a heavily disturbed part of the swamp edge. The nest, a cup made of dried *Cyperus* leaves, was built in a *Miscantidium* shrub, 70 cm high above ground. Little is known about the ecology of Grauer's Scrub-warbler, but the species is well-known to local people who call it "Inchenchebereza", after its shy characteristics and (presumably) its voice.

Although local communities largely depend on natural resources from the swamps, their interaction with the endangered wildlife has never been documented. There is clearly much potential for public awareness campaigns action in the area.

La participation communautaire est la clé pour sauver la Bouscarle de Grauer menacée d'extinction

La Bouscarle de Grauer, *Bradypterus graueri*, est une espèce menacée endémique du fossé albertin, qui est limitée à quelques marécages montagneux. Son aire de répartition est de petite taille et elle est gravement fragmentée au Burundi, dans la République démocratique du Congo, au Rwanda et en Ouganda. Le marécage de Rugezi dans le nord du Rwanda est l'habitat approprié pour cette espèce le plus vaste dans le monde, ce qui le rend important mondialement pour la conservation de la diversité biologique. Il présente également une valeur écologique et socio-écologique pour les communautés des environs. Cependant, ce site n'est pas officiellement protégé

et il est menacé dans une région où la densité de population humaine est une des plus élevées d'Afrique. La zone a été affectée par le drainage des marécages pour l'énergie hydroélectrique, l'agriculture et par la surexploitation des ressources.

Une équipe des gagnants du prix du Programme de conservation de BP a évalué la situation de la Bouscarle de Grauer dans deux sites, y compris le marécage de Rugezi, et les résultats préliminaires sont excitants. Au cours de la saison des pluies, l'équipe guidée par deux garçons vivant localement a découvert un nid actif avec deux œufs le 1^{er} mars 2005 dans une partie très perturbée à la lisière du marécage. Le nid, une coupelle fabriquée avec des feuilles de *Cyperus* séchées, se trouvait dans un arbuste de *Miscantidium*, à 70 cm du sol. L'écologie de la Bouscarle de Grauer est peu connue mais la population locale connaît bien l'espèce qu'elle appelle "Inchenchereza" à cause de sa timidité et supposément de son chant.

Bien que les communautés locales dépendent en grande partie des ressources naturelles provenant des marécages, leur interaction avec la faune sauvage menacée n'a jamais été documentée. Il existe clairement un potentiel important pour des campagnes de sensibilisation du public et une action de conservation dans la zone.

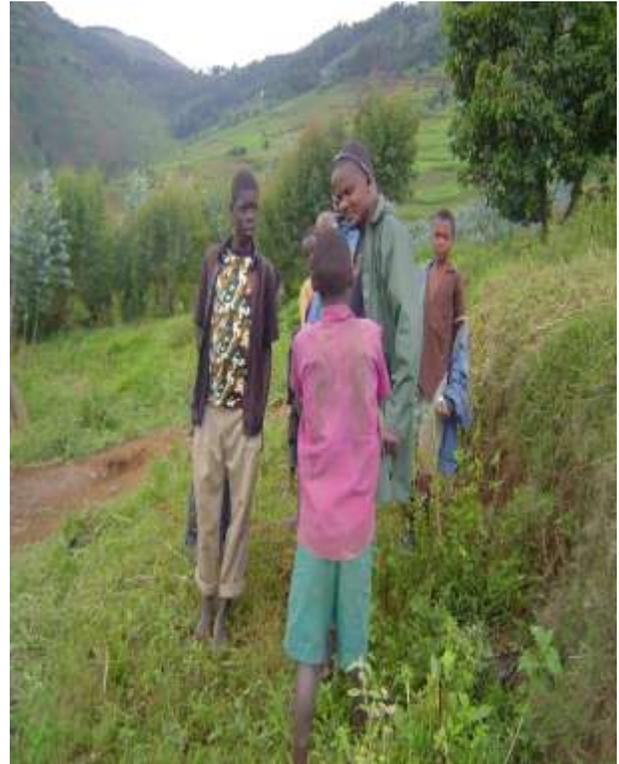
APPENDIX 4: OTHER PROJECT ACHIEVEMENTS ILLUSTRATED



Capacity-building for conservation and biological surveys



Team spirit at various stages: planning and information sharing



Digging out traditional knowledge was proven to be efficient in documenting the ecology of endangered wildlife such as the GRW (*Bradypterus graueri*)