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ECOLOGY, ANTHROPOGENIC THREATS, PEOPLE'S PERCEPTION AND CONSERVATION STATUS OF GREY CROWNED CRANE (BALEARICA REGULORUM) IN LUTEMBE BAY WETLAND, WAKISO DISTRICT UGANDA

ABSTRACT

The Grey Crowned Crane (Balearica regulorum), Uganda's national bird, is globally endangered due to habitat destruction, human-wildlife conflict, and illegal trade. This study assesses the and ecology, threats, community perceptions regarding the species within Lutembe Bay Wetland, a Ramsar-listed site in Wakiso District, Uganda. Field surveys, direct observations, and community interviews were conducted across three trails (Bulonde, Lutembe, and Nganjo) to determine population distribution, habitat and prevailing conservation use, challenges. Results indicate that Bulonde Trail supports the highest crane population, suggesting it offers optimal breeding and foraging conditions. Major habitat threats include loss from agricultural expansion, infrastructure development, and wetland encroachment. Although local perceptions toward crane conservation are generally positive, awareness gaps persist, necessitating targeted community engagement initiatives. Conservation efforts, including habitat restoration and education programs, require strengthening to mitigate threats and ensure the species' long-term survival. This study provides baseline data to inform conservation strategies for the Grey Crowned Crane in Uganda.

Byron Ssemambo, April 2025



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1.0 CHAPTER 1: OVERVIEW

1.1 Background

Undertaking this work stemmed from recognizing the urgent need to fill critical gaps in understanding the Grey Crowned Crane's status and habitat threats within Lutembe Bay Wetland. The construction of a flower factory and housing estates, coupled with the escalating demands for papyrus and developmental activities, pose imminent risks to the species and its habitat. Moreover, the wetland's significance as a Ramsar site and home to migratory birds underscore the necessity of documenting the Grey Crowned Crane's presence and implementing conservation strategies promptly. Published studies about biodiversity of Lutembe are few (Byaruhanga and Nalwanga 2007 and NatureUganda, 2019) however, studies documenting grey crowned cranes is none-existent. Previous survey was conducted in the afternoon (NatureUganda, 2019) when cranes are inactive.

While no direct identical studies were found, several projects focused on avian conservation and wetland management have been conducted in similar contexts. Initiatives involving endangered species preservation, wetland conservation, and community engagement shared thematic parallels. For instance, research on the impact of human activities on wetlands and endangered bird species conservation were conducted in various African countries. However, the uniqueness of our study lies in the comprehensive investigation focusing specifically on the Grey Crowned Crane's distribution, ecology, threats, and community perceptions in this particular wetland, emphasizing the urgency and relevance of conservation interventions.

The decision to embark on this study was prompted by the pressing need to generate scientific data crucial for developing effective conservation strategies, mitigating anthropogenic threats, and securing the survival of the Grey Crowned Crane in Uganda. Collaborating with local communities and leveraging their knowledge and participation in data collection aligns with the project's community-based conservation approach, aiming for sustainable biodiversity preservation and fostering positive behavioral changes towards wetland conservation.

This work is aligned with the IFC Performance Standard 6 (IFC, 2019) which prioritizes the protection and conservation of biodiversity. The standard requires that 'the risks and impacts identification process consider relevant threats to biodiversity and ecosystem services especially



focusing on habitat loss, degradation and fragmentation, invasive alien species, overexploitation, hydrological changes, nutrient loading, and pollution'. To achieve this, the standard outlines ideal strategies for management of impacts on biodiversity for both modified and natural habitats including critical habitats. Critical habitats represent areas with the high biodiversity value including habitat of significant importance to Critically Endangered and/or Endangered species (Stefan *et al.*, 2013). A critical species has an extremely high risk of extinction in the near future (IUCN, 2016).

1.2 The Grey Crowned Crane

The Grey Crowned Crane *Balearica regulorum* is globally listed as 'Endangered G_EN' (IUCN, 2019; Birdlife international, 2020). The species is also classified as Regionally Near Threated R_NT and Nationally Endangered U_EN in Uganda (NatureUganda, 2019 and WCS, 2016) to ensure that local threats are taken into account. The grey crowned crane is typically a Grassland species and Water bird specialists (normally restricted to wetlands or open waters). Although considered an icon of Africa's wetlands and savannahs, this species has been a victim of illegal hunting for captive trade market (Morrison, 2015), resulting in declining population. The species is known to have had a long-term population decline consequently being up listed from 'least concerned' to 'vulnerable' in 2009 and from 'vulnerable' to 'endangered' in 2012 on the IUCN red list of threatened species, suggesting an enduring long-term population decline and an increase of its threats (Morrison, 2015). The decline is attributed to the loss of wetland habitats which they depend on for food and reproduction (Olupot, 2014; Morrison, 2015; Olupot, 2016).

The species was once thought to be the most common crane in Africa however, the Grey Crowned Crane has experienced a shocking decline over the past ten decades with the global population declining by up to 80% (Beilfuss *et al.*, 2007). The global population is estimated to be between 26,500 and 33,500 (Morrison, 2015). According to birdlife International (2020), Uganda's crane population is thought to be between 500-8000 individuals making Ugandan resident to be 24% of the global crane population.

This decline has triggered international agreements for example during the Conservation of Afro-Eurasian Migratory Water birds (AEWA) workshop, the resolution was to develop an International Single Species Action Plan for the Conservation of the Grey Crowned Crane (Morrison, 2015).



Grey Crowned Cranes are threatened by human factors often driven by lack of conservation awareness. It faces increasing threats due to habitat reduction and illegal trade (Morrison, 2015) despite symbolizing peace in Uganda.

1.3 Distribution of Grey Crowned Cranes in Uganda

Cranes are widely distributed in Uganda occupying various habitats. They are mostly encountered in wetlands, open saturated grasslands, and gardens (Olupot *et al.*, 2009). Most records were made in the southwestern and western part of the country, huge flocks were also recorded around lake Kyoga wetlands in Apac and Lira (Olupot *et al.*, 2009). It should be noted that most of the Cranes recorded are outside protected areas which puts them in direct competition for space with human activities such as grazing and farming (Olupot *et al.*, 2009). Their distribution and abundance are influenced by abundance and distribution of food and nest sites which also follow local rainfall regimes (Olupot *et al.*, 2009).

1.4 Contribution of this work

The primary objective is to comprehensively study the Grey Crowned Crane (*Balearica regulorum*) within Uganda's Lutembe Bay Wetland. The study aims to uncover crucial information regarding the species' distribution, ecology, breeding season, habitat use, threats, and local perceptions towards its conservation. This investigation is pivotal in addressing the lack of scientific understanding about this endangered bird and its habitat within the specified area.

By gathering comprehensive data on the Grey Crowned Crane's status and the anthropogenic pressures it faces, the project intends to facilitate the development of effective conservation policies and guidelines. The findings will aid in crafting targeted strategies to mitigate threats, particularly those posed by impending developmental activities such as the construction of a flower factory and housing estates, and the exploitation of wetland resources by local communities.

Moreover, the project aims to raise awareness among local communities about the importance of conserving wildlife habitats and the repercussions associated with habitat destruction. By engaging community-based field assistants, enhancing their monitoring skills, and involving them in data collection, the project aspires to foster a sense of ownership and responsibility among locals in protecting the Grey Crowned Crane and its habitat.



The tangible outcomes anticipated include increased integrity of wetland habitats, a potential reversal in the decline of the Grey Crowned Crane population, enhanced awareness among local communities about wildlife conservation, behavioral changes towards wetland protection, and the planting of indigenous trees to restore and conserve the wetland boundaries. Ultimately, the project endeavors to secure the survival of the Grey Crowned Crane while fostering community involvement and promoting biodiversity conservation in the region.

2.0 CHAPTER 2: MATERIALS AND METHOD

2.1 Study Area

The study was conducted in Lutembe bay wetland system (Figure 1, 2). The Lutembe Bay Wetland System (00°10'N 32°34'E) lies in the central part of Uganda (Figure 1), approximately 25 kilometers south of Kampala, strategically positioned between Kampala and Entebbe. Situated on the northern shores of the lake at the mouth of Murchison Bay with a large horticultural farm, the bay covers an area of about 500 ha (NatureUganda, 2019). It is a shallow, papyrus-fringed lagoon which has almost been cut off from the main lake by encroaching papyrus swamp on both sides with a narrow mouth allowing water to flow in and out of the main lake. The dominant vegetation is Papyrus, interspersed with patches of reed and tall grass. There are several muddy islands which are used as roost sites for terns, gulls and wading birds. Therefore, this wetland plays a critical ecological and socio-economic role in the region, with its climate categorized as tropical, characteristic of the Lake Victoria Climatic Zone. The area experiences two distinct seasons (rainy and dry) receiving annual rainfall between 2000 mm and 2500 mm, with temperatures fluctuating from 17.46°C to 26.7°C. Evapotranspiration rates are relatively high, ranging from 1450 mm to 1600 mm annually.





Figure 1: Shows a map of Lutembe Bay Wetland System in Uganda, Bing based map

Geologically, the wetland is underlain by Pre-Cambrian rocks, specifically Cenozoic–Pleistocene granitized formations. This composition supports alluvial lacustrine deposits, which contribute to the development of diverse wetlands and floodplains. The water entering Lutembe Wetland, largely influenced by the backwaters of Murchison Bay, has an average pH of 6.92, fostering a balanced aquatic environment. However, there remains a significant knowledge gap regarding parameters such as soil pH, water quality, sediment characteristics, water depth fluctuations, and soil chemistry.

The vegetation in the intact portions of Lutembe Bay Wetland consists predominantly of papyrus, phragmites, typha, and sedges, creating habitats that support roosting water birds, especially during the arrival of Palearctic migrants in October and February. Therefore, the bay serves as a critical habitat for several migratory bird species, including Grey-headed gulls, Gull-billed terns, and Black-headed gulls, originating from regions such as northern Europe, Scandinavia, and Russia. These birds spend their non-breeding periods in the area before returning to Europe for breeding. Designated as one of Uganda's 33 Important Bird Areas (IBA) and recognized as a Ramsar site since 2006, Lutembe Bay Wetland holds immense conservation significance due to its role in supporting diverse birdlife, particularly migratory species, and preserving crucial wetland ecosystems.



2.1.1 Study sites

2.1.1.1 The Bulonde Trail: A Sanctuary for Birds

The Bulonde Trail is characterized by its rich natural vegetation, dominated by papyrus sedges (*Cyperus papyrus*) and *Miscanthidium violaceum*, which supports small lagoons and tributaries. This trail is separated from open water by swampy divides and host a wide array of bird species. The dense macrophyte growth, while potentially limiting hunting efficiency for some bird species, creates a habitat rich in food resources. The extremely low levels of dissolved oxygen within the papyrus and Miscanthidium swamps provide unique microhabitats that sustain aquatic organisms, which in turn serve as food for many bird species.

The vegetation along this trail remains largely intact, providing essential breeding grounds and food security for avian populations. Despite minimal human disturbance, the ecological balance along the Bulonde Trail continues to favor bird conservation and biodiversity.

2.1.1.2 The Lutembe Trail: A Hub for Fishing and Resource Utilization

The Lutembe Trail is distinguished by its flat, indented, and forested shoreline, which offers shallow waters (less than 30 meters deep) ideal for fishing activities. This trail features sandy beaches and clay-rich habitats that support fish species such as lungfish and tilapia. However, the ecosystem faces challenges from the proliferation of the water hyacinth (*Eichhornia crassipes*), an invasive species that has significantly altered the water's ecology.

In addition to its ecological significance, the Lutembe Trail serves as a vital resource for the local communities. It provides raw materials for crafts, building, and domestic use, as well as water for livestock. The trail's landing sites facilitate fishing operations that supply fish to Kampala and nearby fish processing plants, underpinning livelihoods and the local economy. Prominent landing sites include Lutembe, which remains a focal point for fish trade in the region.

2.1.1.3 The Nganjo Trail: A Mosaic of Ecosystems and Agricultural Activities

The Nganjo Trail presents a diverse ecological landscape, with papyrus dominating the open water areas and species such as Miscanthus and Vossia thriving toward the dryland. The shallow bay merges seamlessly with medium-altitude moist semi-deciduous forest remnants to the north, while horticultural farms occupy the northwest. The trail's adjacent areas feature dry Combretum



savannahs and Combretum-Hyparrhenia woodlands, alongside patches of Elephant grass and forest remnants.

This trail is heavily influenced by human activity, particularly commercial horticulture for export and small-scale subsistence farming. Common crops include bananas, sweet potatoes, yams, cassava, sugarcane, vegetables, and beans, while agroforestry initiatives contribute to environmental sustainability. Additionally, livestock farming complements agricultural practices in the catchment areas, reflecting a multifaceted land-use system.



Figure 2. Map showing location of Grey Crowned Cranes along the trails in Lutembe bay Wetland

2.2 Method

The surveys followed recommendations by IFC performance standards for assessing critical species (IFC, 2019) with multiple assessments including monitoring programme in both wet and



dry seasons. The sites visited were selected from prior observations and knowledge of Grey Crowned Cranes in the area. Community informants were used to provide knowledge on recent sightings. Questionnaires were used to explicitly capture the necessary information from the community.

Observations were made from 05:55hr to 18:05hr when birds are active and this is in line with Bibby *et al.* (1998, 2000). Direct counts along each trail included crane visual detection, census counts and geo-referencing using hand held GPS. Whenever Grey Crowned Cranes were sighted, activity and behavioural patterns were documented and pictures taken. The number of cranes, age class (chicks/juvenile or adult) and immediate activities (foraging, flying, roosting) were recorded.

2.3 Habitat Characterization

Habitat assessment was conducted along each trail to profile natural and anthropogenic habitat features and any land use related threats to Grey crowned crane conservation.

2.4 Data analysis

Both monitoring and questionnaire data were summarized. Frequency distribution was computed. One way Analysis of variance (ANOVA) was performed on a pooled sample of grey crowned cranes distribution from three villages in Lutembe Bay Wetland System. To test for heteroscedasticity, Fligner–Killeen test of homogeneity of variances was used. Box-and-whisker plot was used to inspect the data. Linear model was used to test for effect size. To understand the perception of the community in and around Lutembe bay wetland, was summarised and frequency distribution tabulated.

3.0 CHAPTER 3: RESULTS AND DISCUSSION

3.1 Grey Crowned Cranes Population

A total of 212 Grey Crowned Cranes were recorded in Lutembe bay wetland system, of which 123 individuals (50.9%) were along Bulonde trail, 27 along Lutembe trail and 62 along Nganjo trail (Table 1). The Grey crowned cranes were recorded when heard calling, seen roosting, flying or foraging along the trails. Of the total number of grey crowned cranes recorded, eight were chicks observed along Bulonde trail. Majority of the cranes were recorded along Bulonde trail and the



least along Lutembe trail. The aforementioned observation suggests that Bulonde village presents minimal disturbance, a quality habitat for foraging, breeding, cover and roosting.

Previous study in Lutembe bay (*NatureUganda*, 2019) did not document cranes hence there is no reference to assess whether the population is increasing or decreasing. However, results from monitoring data show that grey crowned crane population is stable to a large extent (65.14%) (appendix I (h)) whereas from questionnaire data, a majority 41.66% of respondents answered that the population of Grey crowned cranes has decreased in the past five years (appendix I (j)). On the other hand, 36.66% of respondents were not sure about grey crowned cranes population trend and 6.6% did not realize any change. Therefore, this survey serves as a baseline for monitoring the population of grey crowned cranes in Lutembe bay wetland system and the immediate environment. The Grey Crowned Crane is Globally Endangered (IUCN, 2019, Birdlife international, 2020), Regionally Near Threatened and Nationally Endangered (*NatureUganda*, 2019 and WCS, 2016) with decreasing population. The classification is intended to ensure that threats are combated to a large extent.

Village	Number Seen	Number roosting	Number flying	Number calling
Bulonde Village	59	11	31	22
Lutembe Village	13	2	7	5
Nganjo Village	36	2	19	5

Table 1. Number of Grey Crowned Cranes recorded

3.2 Other notable bird species

The location of Lutembe bay wetland system along Lake Victoria makes it an ideal location for various bird species some of which are migrants. The site has been monitored since the 1990s and previous records show that Lutembe bay is a major Palearctic migration stopover site (*NatureUganda*, 2019; Plate). The bay regularly holds up to 50,000 birds and counts of over 2,000,000 white winged Black terns have been recorded between 1999 to 2003 (Byaruhanga and Nalwanga, 2007). A total of 1,276 individuals from 28 species were recorded, including 12 species



of conservation concern (*NatureUganda*, 2019). Among these were 10 Palearctic Migrants and two regionally near-threatened species; the African Marsh Harrier and Green-backed Heron. The most abundant species was the Grey-headed Gull which were recorded on muddy islets used as roost and feeding sites. Surprisingly, waterfowl counts and bird population monitoring between July and August 2019 by *NatureUganda* did not document any individuals of Grey Crowned Cranes in Lutembe bay wetland system.



Plate 1: A congregation of White-winged Black Terns gracing the waters of Lutembe Bay Wetland.

3.3 Habitat association/use

Grey crowned cranes are typically a Grassland dwellers and Water bird specialists normally restricted to wetlands or open waters. They use wetland habitats for foraging, roosting, calling and flying. However, results from our study case (monitoring) shows that wetland is mostly used for



foraging (43.12%) and roosting (25.69%) (appendix I (a)). However, majority (88.07%) of respondents answered that Grey crowned cranes rarely use wetland habitats (appendix 1 (b)).

Grey Crowned Cranes occurrence in any particular area is driven by abundance of food and vegetation for cover during breeding. In Lutembe bay, grey crowned cranes were encountered in different habitats. Meine and Archibald (1996) reported that ideal crane breeding habitat is a swamp with tall grass and scattered trees although Olupot (2009) indicated that Grey crowned cranes inhabit a variety of vegetation types from primarily short grass swamp through mixed tall grass / papyrus / shrub / tree habitat to pure papyrus swamp. In our study case, more individuals were recorded along Bulonde trail including chicks. This trail presents a mosaic of unique habitats, described as a sanctuary for birds (*Section 2.1.1.1*).

3.4 Grey Crowned Crane activity patterns

3.4.1 Foraging

Foraging had two peak hours where heavy concentrated feeding took place in the morning starting from 6:45hrs to 8:38hrs followed by light sporadic feeding and from 17:02hrs to 17:43hrs. This finding is consistent with results from a study by Muheebwa-muhoozi (2001). Some cranes were foraging as singles (*Plate 2*), in pairs and quadruplets. The majority of cranes (73.39%) were encountered foraging on the ground (appendix I (d)). A study by Nagwere (2011) found that Grey crowned cranes forage on tender grass tips, assortments of seeds and various invertebrates. This justifies the need for habitat conservation to ensure its suitability for species' use.





Plate 2: Grey Crowned crane foraging in partially burnt saturated grassland

3.4.2 Flying

Flying was usually performed when the Grey Crowned Cranes were moving from one location to another. In most cases, they concentrated on feeding in one area and only flew away when disturbed (*Plate 3*). They also flew when looking for food and moving to roosting sites.





Plate 3: A Grey Crowned Crane takes to the sky as people approach, showcasing its elegance and agility

3.4.3 Roosting

Roosting involved perching on roosting sites usaully late in the evening however, some cranes were encountered perching in the course of the day especially to get vantage points. Cranes usually



require big trees for roosting as reported by Olupot (2016) and Nagwere (2014). However, cutting down roosting trees (table 4) was used as local solution to get rid of grey crowned cranes in Lutembe bay although survey results show that most grey crowned cranes (63.3%) roost on trees and a few (12.84%) on the ground (appendix I (g)). Thus, there is need for integrated approach to protect the roosting sites. On the other hand, grey crowned cranes were observed preening especially during perching and this was sporadic throughout the day.

3.4.4 Breeding

Chicks were encountered along Bulonde trail, suggesting that. The general description of Bulonde trail portrays presence of quality habitat for breeding activities. Tall grass is known to provide good cover for individuals (Birdlife international, 2020). Other than the eight chicks, no pair was observed displaying breeding behaviour i.e. courtship display performance or making low booming calls. The majority of respondents (88.99%) did not know the breeding habitats for grey crowned cranes (appendix I (e)). However, 5.5% answered that the species breed on the ground while 4.59% answered that they breed on trees. This result indicates that there is a knowledge gap regarding preferred breeding sites/habitats by grey crowned cranes. Chicks were encountered in early October. This suggests that grey crowned crane breeding season in the area is between September and October.

3.4.5 Calling and Preening

Calling was mostly documented early in the morning and evening in few cases. Individuals/pairs were recorded calling on trees (56.88%) and a few on the ground cover (appendix I (f)). Calling is a communication tool used to connect with other individuals in case they are separated.

3.5 Grey Crowned Crane distribution in Lutembe bay wetland system

The mean abundance was highest in Bulonde and lowest in Lutembe while the variances differed greatly, hence the need to test for heteroscedasticity. The result from Fligner-Killeen test showed no evidence of any significant difference in variance across the three trails; $X^2 (2) = 6.081$, p = 0.048, therefore, we performed one-way ANOVA. However, we first used box-and-whisker plot to inspect the data (Figure 3).





Figure 3. Box and whisker plot for grey crowned cranes mean distribution in Lutembe bay

Median number of cranes was lowest along Lutembe and highest along Bulonde trail. On the other hand, there was considerable variation within each village with some outliers (*Figure 3*). It looks as if mean numbers in Bulonde will turn out to be significantly higher than in Lutembe since their boxes overlap slightly.

ANOVA result indicates that there is no significant difference in mean grey crowned crane distribution across the trails in Lutembe bay (F= $2.564_{(2, 108)}$, p=0.0817). However, when effect size was tested, the difference between Bulonde and Lutembe trails is significantly different while the difference between Bulonde and Nganjo is very minimal (*Table 2*). This suggests that the distribution vary across sites with Bulonde exhibiting a more even distribution along the trail compared to Nganjo with clustered distribution and Lutembe with a more random distribution (*Figure 2*).



Table 2. The Effect size

Coefficients:	Estimate	Std. Error	t value	Pr(> t)
Intercept	3.3243	0.6370	5.219	8.78e-07 ***
Lutembe	-1.8649	0.9008	-2.070	0.0408 *
Nganjo	-1.6486	0.9008	-1.830	0.0700.

3.5.1 Peoples' Perception on Grey Crowned Cranes in Lutembe Bay Wetland

Of all respondents, the overall majority 66.66% were males with Bulonde and Njanjo both having 70% males.



Figure 4: Proportion of respondents in Lutembe bay



3.5.2 Age group, Occupation and duration of stay in the area

Of the respondents, majority 41.66% were between the age of 31-45, followed by 18-30 (36.66%) and the least (5%) 61 and above (*Figure 5*). This suggests that the bigger percentage of the population interviewed in the area was of mid age are.



Figure 5: Age group of respondents in Lutembe bay

On the other hand, the majority 55% of respondents were less than ten years while 20% are ten to twenty years in the area. This suggests that there has been increased influx in the last ten years resulting into increased demand for land hence increased threat to wildlife especially grey crowned cranes.

3.5.3 Occupation

The majority 35% of respondents were farmers followed by 23.3% fishermen (appendix (i)). Fishing and farming occupy the would be foraging and breeding habitats, subsequently reducing the quality and extent. The above-mentioned result guides the decision regarding the target group for further engagements.



3.5.4 Education level

A majority of respondents (48.3%) attained primary education followed by 33.33% secondary education, with males dominating both levels (*Figure 6*). On the other hand, 13% of respondents did not receive any formal education while 3.33% attained tertiary education and only 1.66% reached University level. This result shows that most people in the area have limited formal education and such has a bearing on socio-economic activities and overall perception of grey crowned cranes.



Figure 6: Respondents' education levels in Lutembe bay

3.5.5 Knowledge and attitude towards Grey Crowned Crane

Regarding the knowledge of the grey crowned cranse, 78.33% of respondents were very familiar while 18.33% were somewhat familiar and only 3.33 were familiar. A mojority of 43.33% respondents see cranes weekly while 31.66% rarely see cranes and 18.33% see them monthly. On the other hand, 5% of respondents see cranes daily while one respondent had never seen the grey crowned cranes. Daily crane sightings were along Nganjo and Bulonde trails. This result indicates that the community in and around Lutembe bay regularly interact with cranes as they execute daily chores.



The majority 73.33% of respondents had a positive attitude towards the grey crowned cranes of which 8.33% were very positive. Another 18.33% were neutral while 6.66% had a negative attitude towards the cranes with 1.66% very negative (appendix (p)). The respondent with a very negative perception was a farmer along Bulonde trail with no formal education. This suggest that there is need for awareness sessions to ensure paradigm shift and coexist with Grey crowned Cranes.

Perception varied across villages. In Bulonde, majority were neutral whereas in Lutembe and Nganjo, majority was positive. On the other hand, young and mid age people had a positive attitude towards grey crowned cranes while those with university education were neutral and majority with primary/secondary education were positive. Generally, the majority of respondents were farmers and fishermen with (farmers 63.64% and fishermen 85.71%) had positive attitude towards grey crowned cranes.

3.5.6 Roles of Grey Crowned Cranes in the wetland ecosystem

A majority of 50% of the respondents answered that grey crowned cranes play an important role in wetland ecosystem. Another 46.67% were not sure about the role of grey crowned cranes in the wetland ecosystem and 1.67% answered that Grey crowned cranes are not important.

A majority of 52.1% respondents answered that cranes attract tourists while 26% answered that they control pests and 14.5% believe that they are indicators of wetland health (figure 7). A small percentage of respondents answered that grey crowned cranes are important for seed dispersal while others answered that it is a national bird. This suggests that the respondents actually acknowledge the importance of grey crowned cranes in the area.





Figure 7: Perceived roles of Grey Crowned Cranes in Lutembe bay

3.5.7 Existing Conservation efforts for Grey Crowned Cranes in the Lutembe Bay

A majority of 83% of respondents were generally aware of existing conservation efforts for Grey crowned cranes while 15% were not aware and 1.6% had no idea (appendix I (m)). Of the total, a vast majority of 47.62% respondents answered that community education programs are in place to create awareness (appendix I (n)). Another 22.62% answered that anti-poaching measures are in place while 17.86% answered that some areas are protected to regulate/prevent destruction of their habitats and illegal harvest of adults, chicks and eggs. On the other hand, a few of respondents answered that some areas are protected and 2.3% acknowledged the existence of restoration effort to reinstate destroyed habitats. On the other hand, 8% were not aware of any conservation effort. This suggest that conservation efforts are in place, however there is need to enhance their effectiveness and sustainability.

3.5.8 Crop Damage by Grey Crowned Crane

Grey crowned cranes were reported to have damaged farmers' crops including potatoes, beans, maize and green vegetables. The damage was considered minimal by the majority (68.81%) of



respondents while a few (24.77%) respondents answered that the damage was considerable (appendix I (i)). This has a bearing on the general perception towards grey crowned cranes and community approach to prevent further crop damage.

3.5.9 Threats to Grey Crowned Cranes in Lutembe Bay Wetland

Several threats were documented ranging from anthropogenic activities, retaliation due to crop loss and natural events (table 3). The pooled results show that nest and egg destruction (12.5%) followed by stoning (9%), scaring away (8.7%), cutting down roosting trees (8.5) and bush/forest clearing (8.3%) were the major threats to Grey crowned cranes in Lutembe bay (table 3).

Table 3. Threats to Grey Crowned Crane in Lutembe bay

Threats	% Bulonde	% Lutembe	% Nganjo	% Pooled
Trapping	5.37	3.50	1.36	3.42
Killing and poaching for food	10.40	3.18	1.02	4.86
Bush/forest clearing	8.05	7.01	9.86	8.28
Bush/forest burning	7.38	5.41	8.16	6.95
Stoning	9.06	10.19	7.82	9.05
Nest exposure by cultivation	1.34	7.64	10.54	6.51
Scaring away	7.05	9.24	9.86	8.72
Cutting down roosting trees	6.71	9.24	9.52	8.50
Nest and egg destruction	11.07	12.74	13.61	12.47
Livestock trampling on nest	0.67	0.32	0.34	0.44
Killing by domestic animals	2.68	3.18	3.74	3.20
Poisoning	4.36	4.46	4.08	4.30
Papyrus cutting	3.02	0.96	2.38	2.10



Flower factory	2.35	6.05	5.10	4.53
Sand mining	0.00	0.64	1.69	0.77
Habitat destruction	5.03	3.82	2.72	3.86
Climate change	2.35	4.14	2.04	2.87
Infrastructure development	2.35	2.87	3.06	2.76
Pollution/waste disposal	1.01	0.32	0.00	0.44
IAS	0.00	0.32	0.00	0.11
Agriculture	5.70	4.78	3.06	4.53
Fishing	0	4.03	0.00	1.32

Some of the threats to Grey Crowned Cranes in Lutembe bay wetland were actually local solutions used to get rid of grey crowned cranes while others were human activities which affect grey crowned cranes' population. Anthropogenic activities destroy or fragment habitats, thus compromising its quality for foraging, breeding and roosting.

Agriculture and Flower factory (23.56%) were found to be the main human activities affecting grey crowned cranes in the area. These are followed by infrastructure development (14.36%), poaching (13.79%) and cutting of papyrus (10.9%) (appendix I (r)). The forementioned activities result into encroachment on wetlands hence reduction in quality of preferred breeding sites.

Majority of respondents (64.22%) answered that the severity of threats was high while another 26.61% answered that it was medium (appendix (c)). The response from monitoring data followed the same trend (appendix I (q)) although such responses are usually subjective and vary from person to person.

Generally, a majority of respondents answered that the threats have intensified in the last five years (appendix (k)). This suggest that there has been influx into pristine areas subsequently affecting habitat quality.



Several threats were documented ranging from anthropogenic activities, local solutions to get rid of grey crowned cranes to natural events (table 3). A Study by Fakarayi, *et al.*, (2016) showed that Grey Crowned Cranes are threatened by the loss and reduction in habitat quality of wetland breeding areas driven by changes in land-use. While Birdlife international (2020) found that wetland cultivation, persecution in agricultural fields, trade in live birds and their eggs, disruption of breeding by destruction of nests, and reduction in quality of preferred habitat through continued wetland encroachment.

Cattle grazing resulting in competition for foraging space and overgrazing reduces habitat quality. Cattle have been observed wading through wetlands and such disrupts breeding activity while risking trampling on eggs. Meine and Archibald, (1996) found that livestock grazing has the least impact compared to other threats and this is in agreement with our findings (table 3).

The rising water levels have submerged wetlands and marshes, which are vital habitats for Grey Crowned Cranes. This habitat loss has several negative consequences. Since these birds rely on shallow wetlands for nesting, the submersion of these areas makes it difficult for them to find suitable nesting sites, potentially reducing their reproductive success. Additionally, wetlands serve as key foraging grounds, providing insects, amphibians, and plant matter. Their loss could lead to increased competition for food and scarcity of resources. As a result, cranes may be forced to relocate to drier areas or human-dominated landscapes, heightening the risk of human-wildlife conflict, predation, and threats such as poaching. The disappearance of wetland habitats affects not only cranes but also other wildlife and plant species that depend on these ecosystems. This could have cascading effects on biodiversity.

Over the past decade, the area has experienced a growing population, which has intensified pressure on wetlands. Increased harvesting of wetland resources and the expansion of agricultural fields have led to habitat degradation, ultimately reducing the quality of breeding and foraging grounds for Grey Crowned Cranes.

The reported reduction in number of grey crowned cranes could be attributed to the declining habitat quality. The main cause of this could be loss of roosting sites and reduction in quality of breeding sites. Despite their being critical species, it is noteworthy that Birdlife international (2020) reported a continued reduction in Grey Crowned Crane population.



Documenting chicks along Bulonde trail highlights the importance of the Lutembe bay wetland as a breeding site for the Grey crowned cranes. The observed association of Grey crowned cranes with areas of tall grass for instance papyrus sedges suggests its importance for Grey crowned cranes. Grey crowned cranes have had to find alternative sources of food as their preferred habitat has continuously reduced. Nagwere (2014) recorded flocks of Grey crowned cranes in maize, millet and sorghum gardens however, study by Olupot (2009) found that cranes face direct threats in gardens as they conflict with farmers. As such, farmers resort to poisoning, stoning, destroying their nests, trapping them etc. This creates the need for protection of the preferred natural habitats which provide a variety of food options for the Cranes as reported by Birdlife international (2020).

3.5.10 Current state of habitat

The Lutembe bay wetland habitats are under threats due to anthropogenic activities and changing weather conditions. Wetland habitats have been affected mostly by developments which have severely degraded them than any other habitat in the world (MA, 2005). Potapov *et al.* (2022) reported a considerable expansion of agriculture worldwide during the 21st century, particularly in Africa.

Wetlands have traditionally been seen as vast land available for development. The allocation of wetlands for industrial development set the stage for wetlands encroachment. Industries put pressure on wetlands through heavy pollution loads and drainage for infrastructure development (UWA, 2016).

Reduction of Uganda's wetland cover is a general concern. Country wide wetland coverage dropped from 37,346.3 Sq. Km in 1994 (15.5%) to 21,526.3 Sq. Km (8.9%) of the total national surface area (MWE, 2020). The same author further asserted that if this trend is not reversed by a deliberate and dedicated restoration programs countrywide, we shall be left with only 1.6% by 2040.

Wetland encroachment could be attributed to ignorance about their intrinsic values and population pressure. The growing population is a major factor driving encroachment into wetlands for settlement, agriculture and for other resources. The extent of wetland encroachment is directly related to proximity to built-up areas and roads, population density, market accessibility and market influence. Roads close to swamps offer an easy means to transport wetland goods to



market. Erratic development plans also at times encourages wetlands degradation with investors and even government institutions being licensed to develop wetlands (UWA, 2016).

The most common economic activity was agriculture. Both commercial and subsistence agricultural practices are heavily dependent on the use of agro-chemicals ranging from herbicides, pesticides and fertilizers hence compromising water/habitat quality.

Harvesting of papyrus reeds destroy habitat areas and gives opportunity for burning and cultivation hence affecting the ecology of grey crowned cranes to a greater extent. Such disturbances open up areas for invasion by non-native species which replace native wetland flora.

It is evident that wetland habitats were directly impacted by human activities. Agricultural activities have impacted the wetlands to a larger extent followed by burning. Such activities destroy habitat elements that provide cover, foraging and breeding grounds for grey crowned cranes. Hence, there is need for integrated interventions to maintain the integrity of these wetlands.



Figure 8. Photographic representation of habitat features in Lutembe bay wetland system. (A) A pair of Grey Crowned Cranes foraging in a marsh (B) A flower farm in the wetland (C)
Permanent building in the wetland (D)Papyrus reeds with Eucalyptus plantation in the background (E) Sand mining, (F) A road between degraded area and a garden



4.0 CHAPTER 4: CONCLUSION AND RECOMMENDATIONS

The Lutembe Bay Wetland System with its distinct trails in the three villages (Bulonde, Lutembe, and Nganjo) represents a complex interplay of ecological richness and human activity. While these trails support biodiversity, they also underpin the livelihoods of local communities through fishing, farming, and resource extraction. The survey documented the population of Grey Crowned Cranes and the current state of habitat across three villages in Lutembe bay wetland. The result may not explicitly represent the current population of Grey Crowned cranes given the type of interaction between cranes and humans. Hence, there is need for monitoring program during both dry and wet seasons to ascertain spatial-temporal variation in their population. Additionally, there is need to determine water quality parameters as this has direct implication on habitat quality and consequently species occurrence. On the other hand, there is need to sensitize the masses about the intrinsic values of conserving cranes and their habitats. This should be championed by deliberate strategies to conserve existing wetlands and associated habitat including buffer zones. Protection of available roosts and planting of more trees will help create roosting spots for Grey crowned cranes and this can be achieved through sensitization campaigns, encouraging local people to preserve trees in their spaces. Furthermore, there is need for collaborative initiatives involving members of local communities, government agencies, academic institutions and conservation agencies/organizations to ensure sustainability.

5.0 CHAPTER 5: REFERENCES

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Appendix I. Data summary

(a) The use of wetland habitats by Grey crowned Cranes				
Activity	Frequency	Percentage		
Flying-over	14	12.84		
Foraging	47	43.12		
Roosting	28	25.69		
Calling	10	9.17		
No response	10	9.17		
(b) Frequency of wetland use by cranes for the above activity				
Wetland use by cranes	Frequency	Percentage		
Rare	96	88.07		
Never	2	1.83		
At least once in 2 years	2	1.83		



No response	9	8.26		
(c) Severity of threat				
Severity	Frequency	Percentage		
High	70	64.22		
Medium	29	26.61		
Low	3	2.75		
No response	7	6.42		
(d) Grey Crown Crane Foraging A	Activity	•		
Foraging site	Frequency	Percentage		
Ground cover	80	73.39		
Trees	4	3.67		
Hydrology (water sources)	1	0.92		
No response	24	22.02		
(e) Grey Crown Crane breeding A	ctivity	·		
Breeding site	Frequency	Percentage		
Ground cover	6	5.5		
Hydrology	1	0.92		
Trees	5	4.59		
No response	97	88.99		
(f) Grey Crown Crane calling Act	ivity			
Calling site	Frequency	Percentage		
Ground cover	10	9.17		
Hydrology (Water sources)	13	11.93		
Trees	62	56.88		
No response	24	22.02		
(g) Grey Crown Crane roosting Activity				
Roosting site	Frequency	Percentage		
Trees	69	63.30		
Ground cover	14	12.84		
No response	26	23.85		
(h) Grey crowned crane Population Trend in Lutembe bay				



Population trend	Frequency	Percentage
Stable	71	65.14
Decreasing	28	25.69
Increasing	7	6.42
No response	3	2.75
(i) Severity of Damage		
Severity	Frequency	Percentage
Considerable (1-25% of crop loss)	27	24.77
Minimal (1% of crop lost)	75	68.81
No response	7	6.42
(j) Changes in the population of G	Grey Crowned Cran	es over the past 5 years
Perceived population trend	Frequency	Percentage
Increase	9	15
Not sure	22	36.67
Decrease	25	41.67
No change	4	6.67
(k) Period of threat		
Period of Threat	Frequency	Percentage
Period of Threat During this year	Frequency 12	Percentage 20
Period of Threat During this year Last 5 years	Frequency 12 24	Percentage 20 40
Period of Threat During this year Last 5 years 6-10 years ago,	Frequency 12 24 5	Percentage 20 40 8.33
Period of Threat During this year Last 5 years 6-10 years ago,	Frequency 12 24 5	Percentage 20 40 8.33
Period of ThreatDuring this yearLast 5 years6-10 years ago,Last year	Frequency 12 24 5 16	Percentage 20 40 8.33 26.67
Period of ThreatDuring this yearLast 5 years6-10 years ago,Last yearNo response	Frequency 12 24 5 16 1	Percentage 20 40 8.33 26.67 1.67
Period of ThreatDuring this yearLast 5 years6-10 years ago,Last yearNo response20+ years ago	Frequency 12 24 5 16 1 2	Percentage 20 40 8.33 26.67 1.67 3.33
Period of ThreatDuring this yearLast 5 years6-10 years ago,Last yearNo response20+ years ago(I) Occupation of respondents	Frequency 12 24 5 16 1 2	Percentage 20 40 8.33 26.67 1.67 3.33
Period of ThreatDuring this yearLast 5 years6-10 years ago,Last yearNo response20+ years ago(1) Occupation of respondentsOccupation	Frequency 12 24 5 16 1 2 Frequency	Percentage 20 40 8.33 26.67 1.67 3.33 Percentage
Period of ThreatDuring this yearLast 5 years6-10 years ago,Last yearNo response20+ years ago(1) Occupation of respondentsOccupationBusiness	Frequency 12 24 5 16 1 2 Frequency 7	Percentage 20 40 8.33 26.67 1.67 3.33 Percentage 11.67
Period of ThreatDuring this yearLast 5 years6-10 years ago,Last yearNo response20+ years ago(1) Occupation of respondentsOccupationBusinessFarmer	Frequency 12 24 5 16 1 2 Frequency 7 21	Percentage 20 40 8.33 26.67 1.67 3.33 Percentage 11.67 35
Period of ThreatDuring this yearLast 5 years6-10 years ago,Last yearNo response20+ years ago(1) Occupation of respondentsOccupationBusinessFarmerHouse wife	Frequency 12 24 5 16 1 2 Frequency 7 21 1	Percentage 20 40 8.33 26.67 1.67 3.33 Percentage 11.67 35 1.67



Livestock keeper	2	3.33		
Local employee	2	3.33		
None	4	6.67		
Sand mining	4	6.67		
Security guard	1	1.67		
Student	1	1.67		
Teacher	1	1.67		
Fishermen	14	23.33		
Boda-boda	1	1.67		
Farmer/fisher	1	1.67		
(m)Conservation effort awareness				
conservation effort awareness	Frequency	Percentage		
No	9	15		
Yes	50	83.33		
no idea	1	1.67		
(n) Existing Conservation efforts				
Existing conservation effort	Frequency	Percentage		
Community education programs,	40	47.62		
Anti-poaching measures	19	22.62		
Protected areas	15	17.86		
Habitat restoration	2	2.38		
Strict laws	1	1.19		
No response	7	8.33		
(o) Effectiveness of the current conservation efforts				
Effectiveness	Frequency	Percentage		
Neutral	22	36.67		
Very ineffective	1	1.67		
Effective	14	23.33		
Ineffective	7	11.67		
No response	6	10		
very effective	10	16.67		



(p) What is your perception of the Grey Crowned Crane?				
Perception	Frequency	%		
Neutral	11	18.33		
Positive	39	65		
Negative	3	5		
very positive	5	8.33		
very negative	1	1.67		
No response	1	1.67		
(q) Severity of Threat	•			
Severity of Threat	Frequency	%		
High	29	48.33		
medium	26	43.33		
Low	3	5		
No response	2	3.33		
(r) Human activities that affect grey	crowned cranes			
Activities	Frequency	Percentage		
Papyrus cutting	19	10.92		
Flower factory	41	23.56		
Sand mining	7	4.02		
Livestock trampling/grazing	1	0.57		
Poaching/hunting	24	13.79		
Infrastructure development	25	14.36		
Pollution/waste disposal	4	2.29		
Agriculture	41	23.56		
Fishing	12	6.89		