TÍTULO

CONSERVATION AND MANAGEMENT OF THE NILE CROCODILE "CROCODYLUS NILOTICUS" IN UGANDA

A CASE STUDY OF LAKE VICTORIA AND VICTORIA NILE RIVER AT MURCHISON FALLS NATIONAL PARK

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CONSERVATION AND MANAGEMENT OF THE NILE CROCODILE *Crocodylus niloticus* IN UGANDA, A CASE STUDY OF LAKE VICTORIA AND VICTORIA NILE RIVER AT MURCHISON FALLS NATIONAL PARK

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Declaration

I hereby declare that the work presented in this thesis is original and has not been presented in any other I institution or publication

Amanya Samuel

Dedication

This Master's thesis is dedicated to my son Isaac Amanya who was born shortly after starting the study.

Amanya Samuel

Acknowledgment

All the lecturers, tutors and advisors of UNIA, Makerere University Kampala and IUCN are appreciated for their technical guidance. The respondents in this research and technical assistants are all appreciated.

Amanya Samuel

List of acronyms

CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CNCP	CITES Nile Crocodile Project
CoPs	Conference of the Parties
HCC	Human Crocodile Conflict
IUCN	International Union for the Conservation of Nature
MFCA	Murchison Falls Conservation Area
MFNP	Murchison Falls National Park
PAAP	Protected Areas Assessment Program
PAC	Problem Animal Control
PASP	Protected Area System Plan
QENP	Queen Elizabeth National Park
UCL	Uganda Crocs Limited
UNP	Uganda National Parks
UWA	Uganda Wildlife Authority

Table of Contents

List of Figures

List of Tables

Abstract

The study focused on the conservation and management of *C.nilotus* in Uganda, in one protected habitat Murchison Falls National, and non-protected Lake Victoria. The study aimed at determining the *C. niloticus* population status, nature and extent of human-crocodile conflict and challenges facing the ranching program regulated by CITES.

During the study, day and night spotlight counts were carried out in both habitats, as well as a survey of human-crocodile conflict targeting the victims and residents. Local communities were interviewed to obtain indigenous knowledge on *C. niloticus* conservation and management. Key informant interviews were conducted with authorities and the ranching company.

Spotlight survey revealed 1,102 crocodiles in Murchison Falls National Park in a ratio of 1.5:1:2.5 for juveniles, sub-adults and adults, respectively. Also, 210 *C.niloticus* from Lake Victoria were estimated from direct observations collaborated with community interviews. There were 310 human crocodile attacks recorded from around L. Victoria and 32 incidents from the MFNP. The significant factors that collaborated in this conflict were ethnicity, age, sex, marital status, education, and water-based livelihood activities such as fishing and fetching water for domestic use. Ranching is largely affected by limited eggs and technology to increase outputs.

The results of this study point to the need to increase capture and conversion of problem crocodiles to breeding stock for eggs to support ranching, as well as ensure continuous species monitoring. Uganda mahy with CITES provisions if there is continuous monitoring and reporting on all aspects of crocodile ranching as provided under resolution Conf. 11.16.

CHAPTER 1: INTRODUCTION

1.1 Background

Living crocodilians include the 24 species of alligators, caimans, *C. niloticus* and gharials and inhabit water ecosystems across the tropics and warm temperate regions of the world (Magee and Höhna 2021). Despite having a rich fossil record, current crocodilian diversity is low since most populations suffered from over-hunting and habitat loss during the twentieth century (Roberto, Bittencourt et al. 2020). To the present day, many crocodilians face varying degrees of threat despite having been listed in Appendix I or II of CITES (Hutchinson, Stephens-Griffin et al. 2022). The IUCN Crocodile Specialist Group acknowledges that threats to crocodilians are essentially specific to particular areas and thus calls upon individual countries to provide regular information on the population status as well as potential threats of crocodilians within their boundaries (Chakanyuka and Utete 2022). Following CITES and IUCN's interest, country-specific efforts have been conducted to ascertain the most recent population status and threats of crocodile species within their borders.

Even though many species in different geographical areas remain critically endangered or threatened, a few have demonstrated either stability or recovery (Webb, Manolis et al. 2021). For example, in Florida (USA), the *C. acutus* population that had suffered a crash in 1970s after intense commercial hunting was recently, in 2007, federally downlisted from endangered to threatened species after positive evidence of recovery (Rossi, Menchaca-Rodriguez et al. 2020). Recovery has also been noted for *C. porosus* populations in Queensland, northern and western territories of Australia (Corey, Webb et al. 2018, Than, Strine et al. 2020). Like in Florida (USA), *C. porosus* suffered prolonged intense commercial hunting before it was protected in 1971 in Australia (Fukuda, Manolis et al. 2015, Than, Strine et al. 2020). *C. porosus* populations elsewhere in places like Palau have also exhibited resilience and exhibited genetic integrity in their environments that were invaded by other crocodilians (Brackhane, Xavier et al. 2018). In Asia, an example of population recovery has been recorded for *C. palustris* at Haleji Lake wildlife sanctuary in Pakistan (Raza, Aslam et al. 2023). For Africa, examples of

recovery have been noted for *C. niloticus* populations in Zimbabwe particularly in the South eastern region and lower Zambezi River (Isberg, Combrink et al. 2019, Utete 2021).

Unfortunately, crocodilian populations with uncertain future are more numerous and widespread and continue to heighten concern most especially among the conservation authorities globally. Several of these populations have experienced neither stability nor recovery (Sai, Utete et al. 2016, Versfeld, Leslie et al. 2016, Coetzee, Ferreira et al. 2018) and, worse still, many continue to be threatened, with numerous declines already documented (Platt and Rainwater 2017, Coetzee, Ferreira et al. 2018, Platt, Elsey et al. 2020). For instance, failure of recovery has been documented for *C. intermedius* in Meta and Vichada rivers in Colombia (Casal, Fornelino et al. 2013) and *C. niloticus* in Southern Africa, specifically in the Loskop Dam in South Africa (Pooley, Botha et al. 2020) and panhandle region of Okavango Delta in Botswana (Van Asch, Versfeld et al. 2019). Population declines have also been recognized for *C. niloticus* in KwaZulu-Natal in South Africa (Champion and Downs 2015), Kruger National Park (Coetzee, Ferreira et al. 2018). Declines have similarly been noted in other areas like Turneffe Atoll in Belize for *C. acutus* (Platt and Rainwater 2017), Koshi River in eastern Nepal for *C. palustris* (Lamichhane, Bhattarai et al. 2022), and in China for *C. siamensis* (Lueangsakulthai, Phosri et al. 2018).

In addition to declining populations, many threatened populations of crocodilians are known (McCranie 2018). The threats facing the respective populations vary in origin from anthropogenic activities to independent natural phenomenon such as emergence and spread of invasive species (Lourenço-de-Moraes, Campos et al. 2023). For instance, the population of *C. johstoni* in Victoria river in Northern Australia has suffered massive mortality after poisoning due to consumption of Cane toads (*Bufo marinus*) (Fukuda, Tingley et al. 2016). In most cases, anthropogenic activities have been held responsible for disappearance of crocodilian populations from their natural ranges. Today, these activities are associated with the presence of less than 100 mature individuals of *C. mindorensis* in Philippine and efforts at a head-starting the population through a captive

breeding problem have been initiated (Manalo, Tabayag et al. 2018). Moreover, only four adults of *C. palustris* recorded at Shuklaphanta Wildlife Reserve in Nepal and 326 noted at Nara Desert Wildlife Sanctuary in Pakistan all due to non-favourable anthropogenic activities such as water pollution, sedimentation, habitat destruction (Arya 2020, Dave and Bhatt 2021). Still in Asia, particularly at Bhitarkanika sanctuary in India, *C. porosus* population size reached 1610 from 24 in a span of 36 years but this increment has been considered unsatisfactory (Nayak and Padhi 2011). Threatened populations of crocodilians have also been documented in a few African countries where surveys have been conducted. Specifically, threatened populations of *C. niloticus* have been identified in Chad, Egypt and Mauritania, Ghana, and Cote d'Ivoire (Brito, Martinez-Freiria et al. 2011, Somaweera, Nifong et al. 2020). Similarly, for the slender-snouted crocodile *(Mecistops cataphractus*) and African dwarf crocodile (*Osteolaemus tetraspis*), threatened populations have been detected in Ghana and Cote d'Ivoire (Aubert, Le Moguédec et al. 2021). It is believed that many more crocodilian populations are most probably under threat though confirmation awaits results from surveys yet to be conducted across several habitats.

Successful conservation of threatened populations of crocodilians requires a clear understanding of the nature and extent of threats affecting the respective populations (Kindong, Xia et al. 2021). Once such threats are clearly identified and quantified, the design of optimal mitigation strategies can follow and, thereafter, implementation of such strategies by appropriate agents. However, for most populations, information on nature and extent of threats is either very limited or absent and this constitutes one of the major constraints to successful conservation of vulnerable crocodilian populations worldwide (Chakanyuka and Utete 2022, Cox, Young et al. 2022, Eustace, Gunda et al. 2022). The presence of a negative attitude towards crocodilians in many places across the world should not be ignored since it influences actions of people interested in reducing conflict between crocodilians and humans (Henkanaththegedara, Sideleau et al. 2023). The negative attitude has been detected even in developed areas of the world such as the USA. In particular, in South Florida (USA) where *C. acutus* occur, an investigation revealed that most people have negative attitudes to *C. niloticus* since they consider them

to be of high risk to humans (Hayman, Harvey et al. 2014). Moreover, in South Florida, towards the fall of the millennial decade, roadside kills of *C. acutus* were noted to have risen significantly as a result of less regard from motorists to crocodile safety when driving (Brien, Cherkiss et al. 2008). In Australia, negative attitude against *C. porosus* exists though it is linked to crocodile attacks against humans in ecosystems like Katherine River (Brien, Gienger et al. 2017). In such circumstances, Brien, Gienger et al. (2017) report that regular removal of *C. porosus* has been undertaken throughout the year to reduce likelihood of crocodile attacks against humans. Attacks on humans have also been registered in other countries such as Sri Lanka by *C. palustris (Thilakarathna and Godage 2021)*, and India by *C. porosus* (Patro and Padhi 2019). Similarly, across Africa, attacks against humans from *C. niloticus* have been documented in multiple countries including Tanzania, South Sudan, Zimbabwe, Uganda and South Africa (Venter, Kelly et al. 2020, Benansio, Demaya et al. 2022, Chakanyuka and Utete 2022, Eustace, Gunda et al. 2022).

To ensure survival of crocodilian populations under threat while eliminating the danger to people, several strategies have been explored by conservation authorities. Most of the strategies have focused on integrating communities in water resources management and supporting establishment of crocodilian farms and ranches (Das and Jana 2018, Baynham-Herd 2020, Chakanyuka and Utete 2022, Eustace, Gunda et al. 2022, Henkanaththegedara, Sideleau et al. 2023). Aquatic ecosystems with crocodilians as keystone species are under intense pressure from anthropogenic activities most especially fishing and agriculture (Shaney, Hamidy et al. 2019). Though it is clear that fishing depletes the food resources of *C. niloticus* and many *C. niloticus* die after accidentally getting entangled in fish-nets, the effects of agriculture are rather indirect and depend on the extent to which the population surrounding these ecosystems use agrochemicals and pesticides (Nde and Mathuthu 2018, Ouedraogo, Oueda et al. 2022). Precautionary and remedial strategies to improve and sustain water quality of crocodile habitats widely documented have continued to emphasise inclusion of interests and active participation of communities adjacent to respective aquatic ecosystems (Das and Jana 2018, Ouedraogo, Oueda et al. 2022, Henkanaththegedara, Sideleau et al. 2023).

Besides participation in water resources management, conservation authorities have encouraged communities to explore all possible ways through which they could assist in the conservation of *C. niloticus* in adjacent aquatic ecosystems. It has been noticed that apart from using economic incentives, cultural and intrinsic values can be invoked to facilitate conservation of *C. niloticus*. The latter values, after a public awareness campaign, were successfully used by rural communities in the northern Sierra Madre on Luzon to promote conservation of the Philippine crocodile (van der Ploeg, Cauillan-Cureg et al. 2011, Somaweera, Nifong et al. 2020). Elsewhere, considerable benefits have been realised from supplying the international market with products derived from crocodile farms and ranches (CITES 2022). Returns from several farms and ranches have been assisted by advances in knowledge of the best conditions under which *C. niloticus* can be raised under captivity (Chattopadhyay, Garg et al. 2019). Currently, documentation exists on the appropriate conditions under captivity for raising *C. mindorensis* (Brown, Shirley et al. 2021), *C. intermedius* (Moreno-Arias and Ardila-Robayo 2020, Desai, Mukherjee et al. 2022), *C. porosus* (Brien, Gienger et al. 2017, Johnston, Lever et al. 2021, Webb, Manolis et al. 2021).

In Uganda, populations of Nile *Crocodiles* (*C. niloticus*) exist in several places in and outside protected areas. The Nile River section (Victoria Nile) of Murchison Falls National Park, Kazinga Channel of Queen Elizabeth National Park and Kidepo Valley National Park are key protected areas inhabited by *C. niloticus* (Plumptre, Ayebare et al. 2016, Behangana, Magala et al. 2020). Outside protected areas, Lakes Victoria and Kyoga and River Semliki are the major aquatic ecosystems with *C. niloticus* (Isberg, Combrink et al. 2019). *C. niloticus* is also found in a number of wetlands and fresh waters in Uganda (Isberg, Combrink et al. 2019). However, the current population status, nature and extent threats facing the crocodile populations as well as challenges to attempts to mitigate conflicts arising from *C. niloticus* against humans are all poorly known.

1.2 Statement of the problem

Historically, wild crocodilians suffered from commercial over exploitation (Parker 1970), and recently poor enforcement of wildlife laws and inadequate management strategies (Behangana, Magala et al. 2020). Since 1996, UWA focused on wildlife within Wildlife Protected Areas with limited attention wildlife outside(UWA 2020). One of the major efforts to assist population recovery populations of *C. niloticus* in MFNP was the establishment of a crocodile ranch in early 1990s called Uganda Crocs Ltd, now Equator Crocs. The company would collect eggs for raising to about 3 years ready to generate skins for export market on profit. At the same time, the company would make an annual return of 3-year-old health *C. niloticus* equivalent to 5% of the eggs earlier collected to the wild. On the other hand, *C. niloticus* on L. Victoria (not a Protectected area) did not only suffer from extermination campaign by the then Game and Fisheries Department waged from 1920s to 1950 to promote fisheries (Stoneman 1969), but the remnants to continue to be translocated as man-eaters and others are trapped in fish nets in the overexploited waters(UWA 2020). The effect of some of the interventions can best be known if there is effective monitoring and collection of ecological data to support adaptive management. *C. niloticus* in a few water bodies in Uganda have been surveyed (Isberg, Combrink et al. 2019). Until the present day study, there was no other *C. niloticus* surveys on L. Victoria except in 1996 when Uganda was preparing for submission of the ranching proposal to CITES (Uganda 1997).

Whereas Uganda introduced crocodile ranching, by end of 2020, release has been conducted twice in 1996 (407)) and 1998 (342). The egg collection has reduced from 4050 of 1991 to zero in some years, and at 885 as at 2022. The skins exports have reduced from 4019 in 1994 to 500 as at 2022. Meanwhile, Uganda has increased human crocodile conflict (HCC) challenge especially outside Protected Areas such as L. Victoria. One of the major efforts to address HCC is by rescue/capture and re-location to new habitats. Around 2016, a new company EL-Emarat was licenced by Uganda to use problem *C. niloticus* for on-farm egg production for skin production.

Uganda's crocodile ranching program has since been described as moribund, no longer contributing or reducing the wild crocodile population whose assessment was of urgent concern (Chairman, Chairman et al. 2004). There has been limited information on crocodile populations of L. Victoria where the extent of the reported HCC has also, not been assessed. As such, uncertainty remains on the survival of the remaining crocodile population on L. Victoria, or the viability of use of adult problem *C. niloticus* for ranching. HCC appear to originate from unprotected where considerable depletion of crocodile populations was documented prior to 1970 (Parker 1970), but also in MFNP, ostensibly protected from human-crocodile interaction and the reasons remained unclear.

It is difficult to attribute the increase in conflicts to a rise in the numbers of *C. niloticus* inhabiting the respective water bodies because there is lack of an up-to-date census information. Ever since the last census was conducted nearly two decades ago (1996) on a few water bodies (Isberg, Combrink et al. 2019), this study was the latest to document the extensive exploration the nature and extent of the HCC and systematic understanding their potential relationship with crocodile ranching in Uganda. This study will address critical knowledge gaps in population status, pattern and extent of threats to *C. niloticus* in key aquatic ecosystems of L.Victoria and Murchison Falls and how this can potentially support ranching. In turn, there will be the required data and information to support the conservation and management of crocodile populations within Uganda.

1.3 Aim of the study

The aim of the study is to determine the *C. niloticus* population status, nature and extent of human-crocodile conflict and challenges facing *C. niloticus* ranching in Uganda.

1.4. Specific objectives of the study

i. To establish the size and structure of crocodile populations in L. Victoria and Murchison Falls National Park.

ii. To determine the nature and extent of human-crocodile conflict on the shores of L. Victoria and Murchison Falls National Park.

iii. To identify the challenges facing *C. niloticus* ranching based in Uganda

1.5 Research questions

i. What is the size and structure of *C. niloticus* populations in L. Victoria and Murchison Falls National Park?

ii. What is the nature and extent of human-crocodile conflict on the shores of L. Victoria and Murchison Falls National Park?

iii. What are challenges facing crocodile ranching?

1.6 Justification of the study

The majority of crocodile populations are under threat and CITES has tasked each country to conduct regular surveys to ascertain the population status as well as profile the nature and extent of threats in order to improve conservation and management of extant crocodile populations (CITES 2022). In some countries where *C. niloticus* exists, the surveys have provided valuable clues on the usefulness of management strategies in place and prompted reviews of the status quo (Combrink, Warner et al. 2017, Pooley, Botha et al. 2020). For example, a survey of *C. niloticus* in the Okavango Delta in Botswana estimated a total annual population of 2570 +/- 151.06 individuals, with an adult population of 649.2 individuals, including 364 females (Bourquin and Leslie 2012). Survey results recommended a halt to the harvesting of breeding animals for commercial purposes until population recovery in this region was achieved. Unfortunately, close to a decade later no follow-up study has been conducted to ascertain whether this was implemented. Elsewhere, in the Loskop Dam at Olifants River in South Africa, eight surveys carried out between 2001 and 2010 revealed that the distribution pattern of *C. niloticus* did not vary between winter and summer and that *C. niloticus* occur most frequently in the eastern and western inlets and not in the main basin of the dam (Botha 2011). Further, the study revealed that re-introduction of *C. niloticus* into the Loskop Dam was not a viable management strategy since the thirteen *C. niloticus* re-introduced into the dam during March 2007 could not be sighted two years later in August 2009

(Botha 2011). In Uganda's case, the surveys have been selectively done in protected areas and on a rather irregular basis (Behangana, Magala et al. 2020). Therefore, the latest census data provided through this study's surveys will support the Ugandans conservation authorities in ensuring appropriate planning and policy formulation.

For the past two decades, collections of eggs, capture and killing of problem individuals were and are still the main management strategies in use within Uganda even though they are not necessarily backed by evidence from population or nest surveys. These management strategies should not be encouraged without supportive evidence from surveys since it has been established that removal of small individuals, early breeding individuals and their eggs is strongly linked to survival of crocodile populations than previously thought (Platt, Elsey et al. 2020, Wei, Li et al. 2022). Killing of *C. niloticus* has been reported near water bodies shared with communities like Lakes Kyoga and Victoria which communities argue is an act of retaliation to crocodile attacks (UWA 2021). In a few cases, the conservation authorities have been able to rescue *C. niloticus* linked to conflict and transferred them to the ranch managed by Uganda Crocs Ltd or taken to the Murchison Falls National Park. In most cases, the human population who tend to kill *C. niloticus* are those with a negative attitude towards them because they pose real danger to life and property as reported elsewhere from a number of countries across the globe (Tsuji 2021). If not well-managed, the human-crocodile conflict may drive crocodile populations to very low numbers unable to reverse the trend leading to extirpation from particular habitats as has happened for Lake Sibaya in KwaZulu Natal South Africa (Isberg, Combrink et al. 2019). At Lake Sibaya, a decline of 95-98% of the estimated 1970 adult population was acknowledged in 2009 and this was directly linked to the neighbouring community which perceives *C. niloticus* as a threat to their lives and livestock and it was thus predicted that increasing human pressures on *C. niloticus* in the area would probably ensure *C. niloticus*' extirpation from Lake Sibaya (Combrink, Korrûbel et al. 2011). The relevance, adequacy and long-term impacts of capture as management strategy on survival of crocodile populations in Uganda is clearly understood in this study to avoid local extirpation of the species in L. Victoria

To reduce hostility and promote conservation of *C. niloticus*, the conservation authorities in Uganda supported the establishment of a ranch owned by the company Uganda Crocs Ltd. This ranch has harvested eggs from Murchison Falls National Park since 1991. The incubation of eggs takes place at the ranch which is more than 400km from collection site. However, in other countries such as Venezuela and Colombia, the collection of eggs and artificial incubation of *C. intermedius* in locations near the main Cojedes River has been registered as a successful strategy that could be integrated into a conservation program for the species, in which different sectors of society (fishermen, workers, and farm owners) should be involved (Parra-Torres, Moreno-Arias et al. 2020). In Uganda, new private stakeholders expressed interest to open up other ranches but the conservation authorities need a comprehensive appraisal of the original ranch before the new requests can be submitted to CITES. The ranching models expressed by most new applicants focus on capture and use of adult *C. niloticus* as egg laying stock which is not outrightly allowed under CITES, but rather, after scrutiny steps weighed against beneficial impacts to the wild population. This study evaluates the challenges that have affected the ranch in existence ever since its establishment and considers the results a useful basis to guide formulation of new guidelines for decisions associated with ranching and farming of *C. niloticus* in Uganda.

1.7 Significance of the study

The information from this study is helpful in several ways. First, it enables Uganda to be considered among countries that respond to CITES recommendations of conducting surveys and examining potential threats in order to establish more effective conservation and management strategies for crocodile populations within their borders (CITES 2022). Specifically, the information from population status data highlights the influence of anthropogenic activities such as egg collection, capture and killing on the respective crocodile populations. Second, hotspots associated with most frequent human-crocodile conflicts have been identified just as the various reasons that determine the extent of the human-crocodile conflicts, as acknowledged by the communities, have been exposed.

This information is important and can be used to guide design and implement more cost-effective environmental communication and education efforts in other developing countries (Utete 2021, Hutchinson, Stephens-Griffin et al. 2022). Such efforts are particularly needed in Africa where the human-wildlife conflict involving *C. niloticus* is recognised as most serious and is expected to increase as people and wildlife compete for limited resources (Marowa, Matanzima et al. 2021, Benansio, Demaya et al. 2022, Eustace, Gunda et al. 2022).

This study provides valuable insights of what any prospective rancher or farmer in Uganda should consider as they set out to establish a crocodile-based enterprise. These insights are based on documented challenges that Uganda Crocs Ltd as a company has faced ever since its establishment in 1991. These challenges are mainly linked to incubation conditions, hatchability, diet selection, survivorship from hatchling to juvenile stage and health management. Collectively, the challenges offer a valuable guide for formulation of a new proposal to CITES requesting further permission for utilisation of adult *C. niloticus* to the benefit of not only entrepreneurs but also conservation through release back to the wild, and monitoring.

Chapter 2: Literature review

2.1 Legal and operational framework for crocodile ranching

Crocodile ranching is an essential practice in crocodile ecological zones around the world as an effective way of generating significant returns from *C. niloticus* while conserving them at the same time (Macdonald, Gallagher et al. 2017). Whereas the crocodile ranching practice is largely carried out by the private sector, it is governed by policy, legal and operational guidelines at international, regional and national level for crocodile management and conservation. This is majorly premised on the backdrop that the value of *C. niloticus* is receiving growing interest and has led to their scramble in the wild (van der Ploeg, Cauillan-Cureg et al. 2011).

At the helm of the promulgation of legal and operational guidelines for the management and conservation of *C. niloticus* is the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) as well as the International Union for the Conservation of Nature (IUCN) (IUCN-CSG 2004, CITES 2022). These international bodies prescribe crocodile ranching as a critical practice that should be embraced by their membership to rescue eggs and juvenile *C. niloticus* that would have otherwise had very limited chances of surviving to adulthood if they were to be left in the wild (Challender, Harrop et al. 2015). CITES is also responsible for guiding the suitability of populations of countries on being subjected to commercial trade. This suitability is categorized in the form of appendices where permission to trade in *C. niloticus* is granted to member countries with crocodile ranching centres (Wijnstekers 2003). Due to the lucrative trade in *C. niloticus* skins, countries race towards establishing the ranching programs to attain appendix II status which permits commercial trade. Crocodile ranching has thus become a prominent venture that is currently a common sight in countries like Australia, Zimbabwe, Botswana, Namibia, India, Zambia, Togo and Madagascar (Caldwell 2015).

In Uganda, the Objective XIII of Uganda's 1995 Constitution obliges the state to protect important natural resources, and also provides for creation and development of Parks, Reserves, and recreation areas (Uganda 2005). This policy directive is buttressed under article 237(2)(b) of the same Constitution where it is emphasized that the government

holds in trust all game reserves, national parks and any land to be reserved for ecological and touristic purposes for the common good of all citizens. The Wildlife Policy of 2014 establishes a system of Wildlife Conservation Area as any area gazetted as a National Park, Wildlife Reserve, Wildlife sanctuary, Community Wildlife Area, or any other area declared as such by law(Uganda 2014). The Uganda Wildlife Act Cap 200 adopted the establishment of UWA by the Uganda Wildlife Act Cap 200 as a body responsible for conservation and management of wildlife in Uganda (Uganda 1996, Uganda 2019). The mission of UWA is to conserve, economically develop and sustainably manage the wildlife and wildlife protected areas of Uganda in partnership with the neighboring communities and other stakeholders for the benefit of the people of Uganda and the global community (UWA 2020). The private individuals including companies wishing to ranch *C. niloticus* can apply and be licenced by UWA with a wildlife use right under the established guidelines (UWA 2018, Uganda 2019).

The mission of UWA is to "conserve, economically develop and sustainably manage the wildlife and Protected Areas of Uganda in partnership with neighboring communities and other stakeholders, for the benefit of Uganda and the global community'. UWA has a five year (2007 – 2012) Strategic Plan that specifically underscores effective management of wildlife outside Protected Areas as one of the four critical areas that will lead to the achievement of UWA's mission (UWA 2007). The strategic plan recognizes and emphasizes the importance of managing wildlife outside Protected Areas in partnership with local communities, local governments and the private sector. This helps to ensure understanding and appreciation of wildlife conservation in relation to other land use options and also as a source of alternative income to enhance local community livelihoods while contributing to the overall national economic development.

In the year 1999, a Protected Area System Plan (PASP) was developed after a long period of Protected Areas Assessment Program (PAAP). Uganda Wildlife Authority has successful implemented PASP, which has led to the integrity of most Protected Areas being defended. The PAA programme largely confined its activities to what were the existing wildlife systems of National Parks, Wildlife Reserves, Forest Reserves and Community Hunting Areas. However, there are some areas outside the existing and

proposed system that should have been considered for inclusion such as crocodile habitats.

Apart from declaring certain areas as 'no-fishing' areas, the Department of Fisheries does not establish any formal 'Protected Areas'. Wetlands which are technically protected by the National Environment Act, 1995, are still inadequately represented within the PASP and *C. niloticus* therein cannot be considered as adequately protected / conserved?.

2.2 World trade in crocodile products

Crocodile leather has been used in various parts of the world for generation and it was during the 1940's to the 60's that trade in crocodile skins reached its peak (CITES 2022). Over 3 million wild taken skins were marketed each year. Then, as today, this trade was divided into two broad categories: high value but low volume classic skins and low value but high volume caiman skins (Caldwell 2017).

Generally, classic skins are considered to be those which are not ossified. They are principally derived from the American alligator and most true *C. niloticus* (Nilsen, Parrott et al. 2016). The whole belly skin from all these animals can be used to produce high value leather goods but even within the group, there is a marked hierarchy of value. Traditionally, the trade favors *Crocodylus porosus*, which it knows as the "Singapore small scale" paying a 25% premium over *C. niloticus*commonly known as Croco Afrique, which in turn is favoured by 10 – 20% of the "Alligator" *Alligator mississippiensis* (Caldwell 2012). In 1984, it was estimated that the total trade in classics was about 150,000 skins annually. This was less than half the estimated annual trade of 300,000 of the early 1970s and less than 1/3 of the peak trade of the 1950s and 60s which may have yielded 500,00 skins a year (Thorbjarnarson 1999).

The general decline in this trade resulted from a number of interrelated factors, principal amongst which were the over overexploitation of wild stocks (notably amongst classic species), habitat destruction, trade treaty restrictions (especially CITES) and consumer advocacy environmental awareness in western countries (CITES 2022). A most significant feature of this period which affects the current revival in production was the

marked reduction in specialist tanneries, particularly of classic skins which requires specialist treatment. This has resulted in a trade bottleneck and a virtual monopoly of the industry by a few competent tanners/traders.

By the late 1960's, large scale uncontrolled hunting had markedly declined in many countries, either because of legal protection (e.g. Zimbabwe) or because it was no longer economic to hunt (e.g. Batswana) (Le Roux 2020, Chakanyuka and Utete 2022). Not surprising therefore, the *C. niloticus* was listed at the Washington plenipotentiary conference in 1973 and already on Appendix I of the CITES when it came into force in 1975 held in Berne Switzerland (Kieirit 2013).

2.3 Adult *C. niloticus* as stock and source of eggs for ranching

Ranching under CITES is primarily expected to rely on crocodile eggs collected from the wild, but does not bar eggs produced on farm if the source is legal and not detrimental to the wild population (CITES 2010). It is a procedure in approval of such applications that proposals that include a component of a wild-adult harvest be examined much more stringently than those based purely on collection of eggs, neonates, larvae or other juvenile life stages. A consistent breeding population of 128 females and 16 males is considered an economically viable intensive crocodile production unit (Rooyen 2005).

Table 2. 1: A production system-based crocodile eggs produced on farm by adult females

	Years of Production				
Year	**1**	**2**	**3**	**4**	**5**
Clutch size per female	-	45	45	45	45
Eggs	-	5,760	5,760	5,760	5,760
Percentage hatching	-	75	75	75	75
Hatchlings	-	4,320	4,320	4,320	4,320
One year old	-	-	3,888	3,888	3,888
Two-year-old	-	-	-	3,694	3,694
Three-year-old	-	-	-	3,509	3,509
Total stock	144	4,464	8,352	15,555	15,555
Stick after harvesting	-	-	-	12,046	12,046
Skins Produced	-	-	-	3,509	3,509
Meat production (Kgs)				14,036	14,036

Source: (Rooyen 2005)

2.4 Crocodile surveys and population determination

The population and conservation status of *C. niloticus* throughout West and Central Africa is poorly known and the IUCN Crocodile Specialist Group's highest priority recommendations are country status surveys and examination of potential threats (Somaweera, Nifong et al. 2020). Until 2014, there were 23 species of crocodilians with no extensive survey on the implicit population of each of them (Utete 2021). In 2014, a 24th specie called the West African Crocodile *C. suchus* was added (Bogezi 2015). Notably, the *C. niloticus*is among the largest of all the crocodilians. They are widely distributed throughout sub-Saharan Africa, southern Israel and Algeria (Fergusson 2010). Surveys reveal that *C. niloticus* thrive in a wide variety of habitat types, including large lakes, rivers, and freshwater swamps (Kofron 1992). In some areas they extend into brackish water environments, an ecology noticeably suitable for the *C. niloticus* (Pooley 1982, Pauwels, Barr et al. 2007).

C. niloticus display an ontogenetic shift in diet, from insects and small aquatic invertebrates when young, to predominantly vertebrate prey among larger *C. niloticus* (B. Cott 1961, Wallace and Leslie 2008). Much as the *C. niloticus* are not known to be territorial animals, a survey done by Kofron (1992) on three crocodile species in Liberia revealed that only *C. niloticus* inhabit the Monrovia mangrove swamps and brackish-water mouths of rivers; and that there are no slender snouted or dwarf *C. niloticus* in these habitats. He highlighted that the slender snouted and dwarf *C. niloticus* thrived in fresh water lakes and are most common in small streams that meander rain forests and also a common sight in burrows of stream banks.

A survey by Dendi and Luiselli (2017) established a number of intrinsic crocodile characteristics. Findings therein established that crocodile sightings peaked between the months of June and August, with the highest mean number of sightings encountered on any single day being 67 (in July 2013). Assertions by Dendi and Co. clearly show that the distribution of the sub-population sampled followed a climatic regime. Furthermore, *C. niloticus* are most frequently observed to be in water (37%), Grassy banks, islands, river

mouths and sandy banks constituted about 47% of the habitats utilised by the crocodile population (Dendi and Luiselli 2017). While their main habitat is the water, *C. niloticus* nest by the shores of the lake. Nesting is very visible during the last quarter of the year and the first quarter of the new year. Studies reveal that factors important in site selection for nesting are shade, suitable soil, proximity to water and the degree of slope of the shore (Combrink, Warner et al. 2017).

The females dig the nests with their forelimbs, using them in turn. The hind limbs and the belly are used to push away the soil collecting at the mouth of the burrow. The female guards the nest constantly throughout the incubation period of three months against monitor lizards (Manolis and Webb 2016). Crocodile behavioural studies reveal that when the young are about to hatch, the mother releases them by digging up the nest (Rosenblatt 2003, Murphy, Evans et al. 2016, Murray, Crother et al. 2020). These studies reveal that the young (*C. niloticus*) when they hatch, are about 31.0 cm long and weigh about 76.8 g. They are guarded by the mother for at least six weeks.

With the widely documented aggressiveness of *C. niloticus* in protecting their nestings, it is apparent that egg collection for controlled hatching and crocodile captivity would be a rather complex and dangerous affair fettered with poor management outcomes (Edwards, Bidwell et al. 2019). Egg collection is a common and useful activity implemented for the management of different crocodilian species for commercial and conservation purposes. Studies indicate that the practice of egg collection shields the hatching of *C. niloticus* from natural factors such as predation of eggs and hatchlings, and loss of eggs due to unexpected flooding events (Espinosa-Blanco, Seijas et al. 2013). With the urge by economies to be allocated export quotas for *C. niloticus* skin, there is even greater need for the practice of egg collection as it is a major step towards establishment of ranching program needed as a pre-condition for export quota authorization (Janssen and Shepherd 2018). Egg collection is a vast exercise that starts with mapping locations of nests within the crocodile habitat. Researchers have noted that the process of locating nests can be a costly one for some habitats and may require more improvised collection means than just

hand picking the eggs (Evans, Jones et al. 2016). Yet, the timing of the egg collection exercise is a vital aspect. In a study they conducted on time of egg collection, Van Schalkwyk, Brand et al. (1999) found that eggs collected soon after they have been laid had a 16.6% chance of embryonic mortality while those left overnight in nests and collected the following morning had a higher chance of 22.9%. It therefore implies that the collection of eggs ought to be done as soon as possible to ensure greater multiplication of the hatchlings. When the eggs are collected and hatched on time, it sets the stage for a healthy breed of hatchlings.

2.3 Conventional crocodile surveys

The methods commonly employed in surveys on crocodile monitoring and conservation are; visual encounter surveys, transect counts and opportunistic methods, by using boats and helicopters (Bayliss 1987). The choice of these methods is influenced by the constraints of cost, time, technical capabilities as well as survey objectives and interests (Fukuda, Saalfeld et al. 2013). Timings of the surveys are a critical component of monitoring *C. niloticus* as they have a binding on the cost and crocodile sightings. Crocodile scholars argue that nighttime surveys are a suitable and common method for monitoring crocodile populations (Eversole, Henke et al. 2015). With grounded experience, these scholars argue that nighttime crocodile monitoring surveys have an established protocol, they are cost effective, capture accurate information about the abundance, distribution, size and composition of the *C. niloticus* due to the provision that all *C. niloticus* are assembled in water at night time.

In company of the nighttime surveys, it is common practice that the communities along the shores of the crocodile infested water bodies are involved in interactive interviews that in most scenarios taken the form of focus group discussions and key informant interviews (Oliveros, Telan et al. 2006). The other prominent survey technique in crocodile monitoring is the mark-recapture photography methodology based on photograph identification of the unique scute markings of crocodile tails as a non-invasive means of monitoring their populations (Coetzee, Ferreira et al. 2018). Recent

technological advancements in wildlife conservation and management have led to the introduction of unmanned aerial vehicles (UAVs). These have been credited to be effective in surveillance, mapping, and monitoring and, combined with conventional remote-sensing techniques, offer enhanced scope and overcome several technological and operational challenges in wildlife research and management (Sawan, Mondal et al. 2023). They have helped to address the challenge of complex terrains having been highly effective in areas with low workforce for routine patrolling and long stretches of habitats. Drone surveys provide advantages over traditional methods, including precise size estimation, less disturbance, and the ability to cover greater and more remote areas. Drone survey photos also allow for repeatable and quantifiable habitat assessments, detection of encroachment and other illegal activities, and leave a permanent record (Aubert, Le Moguédec et al. 2021). This technique is extensively used in most crocodile monitoring surveys across Europe and a few African countries (Ezat, Fritsch et al. 2018, Aubert, Le Moguédec et al. 2021, Sawan, Mondal et al. 2023).

Challenges cited in crocodile monitoring surveys allude to difficulty in monitoring movements of *C. niloticus* because it can be cryptic, requires expertise to handle, and caudal tail tags and transmitters are often lost (Goit and Basnet 2011). The shoreline boat surveys also bear the shortcoming of observer bias and inexperience by most researchers yet this is the most prominent survey technique employed in most African countries (Aubert, Le Moguédec et al. 2021). The shortcomings of boat surveys notwithstanding, drone surveys have limited processing and power resources, trembling camera effects in the video feed, disturbance in transmission signals and a lack the researcher's attentiveness (Dilshad, Hwang et al. 2020). Since the drone survey takes away the opportunity of the researcher to interface with the locals, it would not offer conclusive solutions to efforts for resolving the human crocodile conflicts. Moreover, setting up a crocodile ranching program in an area would necessitate a face to face assessment of the human-crocodile relationship.

In order to circumvent the inadequacies in conducting the direct survey methods, wildlife authorities also adopt the use of indirect survey methodologies to monitor and manage crocodile populations. These methods do not require a face to face encounter with the *C. niloticus* to ascertain their population, abundancy and distribution. Among these is the technique of interviewing members of communities in the crocodile infested areas seeking their views on sightings and behaviors of the *C. niloticus* in their area (Zhang, Kuchinke et al. 2017). In order to derive optimal value from the interview technique, it is recommended that the target population is accurately defined, any hypothesis to be tested and procedures for the selection of participants documented, the questionnaire piloted, rationale for choice of method stated and the interviews made as simple as possible (White, Jennings et al. 2005).

Interviewing is an essential method of collecting vital information from the locals about *C. niloticus* in their area. It furnishes researchers with information that would complement the direct methods as well as picking the human's side of the story that would be key in the human crocodile conflict. For instance, a survey by Brackhane, Webb et al. (2019) on the human crocodile relations in East Timor-Leste used semi-structured interviews with Timorese stakeholders (25 local authorities, 10 national experts, 15 citizens) to understand the cultural beliefs and traditional ecological knowledge underlying human-crocodile interactions, and conflict (HCC) in Timor-Leste. Interviewees knew that *C. niloticus* were a risk (respect, fear) and its population was expanding, and had culturally determined beliefs (ceremonies, rituals) that included differentiating between local "ancestor". This was far critical in complementing findings gathered elsewhere towards crocodile management in the area.

Additionally, data obtained from the interviewing technique is even more enriching when integrated with data from the Geographical Information System (GIS). ArcGIS is highlighted as critical towards establishing the spartial distribution patterns of *C. niloticus* (Balaguera-Reina, Venegas-Anaya et al. 2018). Information on the distribution of *C. niloticus* is key in assessing differences between them, it also compliments views shared

by the locals in the face to face interviews. However, indirect methods of surveying *C. niloticus* have been noted to have shortfalls in accuracy. Guschanski, Vigilant et al. (2009) found that results generated using the indirect methods overestimated the those generated by the direct survey methods by 5%. They concluded that direct survey methods were more dependable as they derived more accurate and reliable estimates for characteristics of a wide variety of species.

2.5 Human crocodile relationship

Establishment of a crocodile ranching program in a locality necessitates that the communities therein have a harmonious co-existence with the *C. niloticus* (Balaguera-Reina and Farfàn-Ardila 2018). Whereas it is anticipated that communities that are also hosts to wildlife have a shared appreciation of the need to conserve, protect and preserve the wildlife within their vicinity, wildlife curiosity studies present varied experiences of the human-wildlife interactions (Soulsbury and White 2015, Bhatia, Redpath et al. 2020). In these studies, there are varied views on the human-wildlife interactions, and most particularly the human-crocodile relationships. Pooley (2016) argues that the human crocodile relationships are mostly dominated by conflict rather than the harmonious co-existence. This is not to however suggest that the large predators are detested by all their neighbors. In the subsequent sections, we share a varied outlay of the human-crocodile relations providing avenues of conflict but also those of positive relations with citations of community conservation, innovative relations management as well as anthropogenic activities that communities instigate for the deliberate conservation of *C. niloticus* within their landscape.

2.6 Community conservation

The sustainable conservation of animal wildlife inevitably warrants the involvement of the community hosting it (Bhatia, Redpath et al. 2020). For threatened species such as the *C. niloticus*, there is even greater need for the community to jealously guard against any threats to their existence as their extinction is always in sight (Gore, Mwinyihali et al. 2021, Marowa, Matanzima et al. 2021, Griffith, Lang et al. 2023). Community

conservation is also emphasized as an incredulous mechanism for the resolution of the human wildlife conflict (Pooley, Siroski et al. 2021). It is documented to yield greatly with acknowledgements of advantages of being sustainable, cost-effective, manageable and people-centred (Somaweera, Nifong et al. 2020, Parker, Jacobsen et al. 2022, White, Petrovan et al. 2022). It is opined that community conservation projects can be successful in highly populated areas. In almost all conservation studies, conservation practitioners are urged to involve local actors when planning and implementing initiatives citing it as an alternative to the more exclusionary protectionist policies of the past, which often alienated rural people from conservation efforts (Sam and Shanee 2015, Armitage, Mbatha et al. 2020, Somaweera, Nifong et al. 2020).

In specificity to *C. niloticus*, avenues for community conservation comprise of the participation of members of the community in egg collection, setting up ranches as well as taking up employment opportunities to manage ranches and wildlife sanctuaries for *C. niloticus* (Roe and Booker 2019, Marowa, Matanzima et al. 2021, Hermesch and Isberg 2022). The community is also extensively involved in gathering information about the conservation of *C. niloticus*, volunteering land space for the establishment of crocodile ranching and recreational facilities (Cavalier, Pratt et al. 2022, Chakanyuka and Utete 2022, Nyaupane, Poudel et al. 2022). Pertaining to egg collection, this has been implemented as one of the effective ways of ensuring the conservation and distribution of crocodile species where crocodile eggs are collected from the nests and incubated under controlled conditions (Corey, Webb et al. 2018, Hermesch and Isberg 2022, Larreal, Quintero-Torres et al. 2022).

Conservatively, when about 50 nests are collected, this guarantees production of at least 1200 hatchlings (Williamson, Evans et al. 2017). Research shows that the collection of eggs and artificial incubation in locations near the main river is a successful strategy and could be implemented as part of a conservation program for the species, in which different sectors of society (fishermen, workers, and farm owners) should be involved (Escobedo-Galvan, Elsey et al. 2019). An expertly managed egg collection process augments captive breeding programs that are vital for conservation translocations,

mitigates low productivity during incubation in wild populations, and further research on reproductive and environmental biology (Edwards, Bidwell et al. 2019).

When the community engages in egg collection, it is quintessential and sustaining as it moots ownership and strengthens the human-crocodile relationship (Bhatia, Redpath et al. 2020, Buijs and Jacobs 2021). In Zimbabwe, egg collection by authorized members of the community along the shores of lake Kariba has not only increased the country's population of *C. niloticus*, it has also ensured strengthened human-crocodile relations in fishing communities for years (Chakanyuka and Utete 2022). The locals have endeavored to acquire training in egg collection and hatching and have since got employed in the various incubation and ranching stations that have since been set up (Utete 2021). Community conservation can thus be an effective tool for strengthening human-crocodile relations albeit investment in the ranching programs that are superintended by a favorable regulatory framework.

2.7 Anthropogenic activities

As a result of the spate of industrialization sweeping world economies, activity along water bodies is uncontrollably causing deteriorating quality and cover of water quality (Keiser and Shapiro 2019, Bruce and Limin 2021, Ouda, Kadadou et al. 2021). For instance, Dar, Rashid et al. (2021) largely attribute this to residual effects of water pollution, swamp reclamation, land degradation and water silting. These vagaries are documented to be borne from such anthropogenic activities as farming, fishing, washing, cooking, and bathing, littering into the water body, and discharging waste water from households/industries into the water body (Sidabutar, Namara et al. 2017, Akhtar, Syakir Ishak et al. 2021). Yet, the sustenance of *C. niloticus* is more plausible in more open waters with sand banks and other suitable basking and nesting places (Cartagena-Otálvaro, Páez et al. 2020, Ezat, Naguib et al. 2020). This thus implies that the effect of the anthropogenic activities on crocodile infested water bodies has potential to antagonize the endurance of particular crocodile species and the persistence of such practices may as well result in their extinction (Somaweera, Brien et al. 2019). This is even most likely for

C. niloticus in the wild (Lourenço-de-Moraes, Campos et al. 2023, Nakiyende, Basooma et al. 2023).

It is worth noting that whereas there are crocodile conservation laws put in place to protect wildlife, wild *C. niloticus* face a higher risk of residual effects of anthropogenic activities as they may not be monitored as closely as those in captivity (Humphries, Myburgh et al. 2022). For instance, in India, locals insensitively use crocodile habitats for water extraction for drinking, irrigation including riverside agriculture as well as pollution from pharmaceutical industries (Bean, Chadwick et al. 2022). These activities have a ripple effect on the sustenance of *C. niloticus* as some are poisoned by Lead that spills from the sand mining activities, the nests are also vandalized by the falling logs from tree cutting practices, the deforestation activities also result into alterations in temperatures which impact the adaptation behavior of *C. niloticus* and have the potential to cause death (Price, Ezat et al. 2022).

Relatedly, the sprouting industrial activity in South Africa yields into incessant pollution that has been sighted in defects of crocodile eggs. Crocodile behavioral studies by du Preez, Govender et al. (2018) conducted in Kruger national park revealed that mortalities of *C. niloticus* noticed within the park were a result of pollution. They also discovered that eggs and egg shells they analysed from the park had very high concentrations of iron that made the egg shell too thick to allow for hatching. An earlier study done by Skaare, Ingebrigtsen et al. (1991) in Kenya also found that the use of organochlorine chemicals in industries and agriculture were inhaled by *C. niloticus* and manifested through the eggs they laid. As is the case in many other crocodile ecologies, it is noted that pollutants of water bodies in the cases of South Africa and Kenya are brazenly fueled by waste from industries, mining, farming and bush fires further exposing the vagaries of anthropogenic activities to the survival and conservation of *C. niloticus*.

2.7 Negative relationships

Negative relations between humans and *C. niloticus* are characteristically known as the human-crocodile conflicts (Balaguera-Reina and Farfàn-Ardila 2018, Marowa,

Matanzima et al. 2021). In regard to the establishment of crocodile ranching, scholars opine the need to understand critical parameters such as the causes, distribution, the nature and extent of the human-crocodile conflict (Macdonald, Gallagher et al. 2017, Balaguera-Reina and Farfàn-Ardila 2018, Marowa, Matanzima et al. 2021). These parameters, they argue, present resolute justifications for the creation of a safe haven for *C. niloticus*. Utete (2021) postulates that crocodile ranching has a contributory effect to crocodile populations citing the case of increased crocodile populations in Zimbabwe as an attribution of the crocodile ranching practice. That notwithstanding, Utete also elucidates that increasing human activities of encroachment and wetland degradation have made it a lot more imperative to keep *C. niloticus* in captivity as this has protected the alligators from negative encounters with the community. In their study on the human-crocodile conflict in India, Khan, Hore et al. (2020) highlight even more threats to the co-existence of humans and *C. niloticus*. They establish that the fatal and non-fatal attacks by *C. niloticus* on people and livestock in neighborhoods of the Bhitarkanika Wildlife Sanctuary escalated intolerance of communities towards *C. niloticus* and meant that a crocodile on sight by the locals ought to be exterminated rather being conserved.

Commonalities in most studies that enumerate causes of the human-crocodile conflict are the socio-demographic characteristics of communities that share the landscape with what, to them, are the nuisance alligators (Khan, Hore et al. 2020, Marowa, Matanzima et al. 2021, Benansio, Demaya et al. 2022, Chakanyuka and Utete 2022). The most notable socio-demographic characteristics are reliance on water as the main source of livelihood where the locals have to time and again use the lake to access drinking water, water for home consumption, production, livestock, fishing activities and recreation. Given that these communities share the same lake with the *C. niloticus*, negative encounters are always likely at an eventual interface (Cavalier, Pratt et al. 2022). Escalated by a lack of knowledge on the behavioral patterns of *C. niloticus*, the human-crocodile encounters result in fatalities that often times culminate into injury, loss of human life, livestock depredation and killing of *C. niloticus* (Whitaker and Srinivasan 2020, Cavalier, Pratt et al. 2022).

Additionally, scholars opine that the human-crocodile conflicts are particularly existential among the male persons between the ages of 19-40 years. In an Assessment of human–crocodile conflict in Mexico, García-Grajales and Buenrostro-Silva (2019) establish that males within age group 19-40 are bread winners of their households whose major occupation is fishing. They thus have higher chances of exposure to crocodile encounters that have been documented as hostile and life threatening. Community surveys conducted in Namibia also revealed grave fatalities of the human crocodile conflicts often times leading to crop losses, livestock killing and severe human injuries (Boulton 2023).

For Uganda's fishing communities, causes of the human crocodile conflicts are explained by a multiplicity of factors with some being cultural while others socio-economic (Pooley, Bhatia et al. 2021, Thilakarathna and Godage 2021). Pooley, Bhatia et al. (2021) allude that *C. niloticus* are known by Uganda's fishing communities as problem animals although fishermen also argue that when armed with techniques of interacting with them, it is possible to co-exist with the *C. niloticus* on the lake. In the report however, Pooley and colleagues also caution that the handful of fishermen with an aura of communicating with the *C. niloticus* should not be used to summarily define the human crocodile relationship in the country.

Moreover, justification of their assertion is validated by a number of other scholars that have severally documented a continued prevalence of injurious human crocodile relationships with ensuing dents of bitterness and misery (Benansio, Demaya et al. 2022, Henkanaththegedara, Sideleau et al. 2023). The negative human-crocodile encounters are exacerbated by the inevitable dependence of both humans and *C. niloticus* on aquatic resources whence either of the two could view the other a threat to their survival (Marowa, Matanzima et al. 2021).

2.8 Management of the human crocodile relations

With the fragile nature of the human-crocodile relationship, it is critical that the human-crocodile interactions are hierarchically managed (Cavalier, Pratt et al. 2022). Indeed,

wildlife authorities across the globe have institutional frameworks aimed at coordinating, managing and enabling the human-crocodile interactions (Princee 2016, McLoughlin, Riddell et al. 2021). In the context of human-crocodile relations management, there are international and national instruments through which the human-crocodile interactions are coordinated, regulated, managed as well as supported (Pooley, Barua et al. 2017, Swan, Redpath et al. 2017, Brackhane, Webb et al. 2019). With the Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES), International Union for the Conservation of Nature (IUCN) and the Crocodile Specialist Group, leading the way, there are guidelines that help to streamline the management of human-crocodile relations to ensure harmony of the human crocodile relations (IUCN-CSG 2016, Decker, Organ et al. 2017, CITES 2022). Guidelines towards the management of the human-crocodile relations include restricted trade, crocodile care and management, egg collection and hatching, crocodile capture and translocation (Manolis and Webb 2016). In the event of a human-crocodile conflict, these guidelines are followed by the national wildlife authorities in capturing and translocating the endangered crocodile or rather sensitizing the communities on modalities for a more harmonious co-existence (Akankwasa 2020).

In seeking to ensure that there is guided harmony in the human crocodile relations, scholars postulate that the management of human-crocodile relations should comprehensively incorporate both human (e.g., public education and safety awareness) and crocodile (e.g., population monitoring, removal of problem *C. niloticus*) components in the event of a conflict (Fukuda, Manolis et al. 2014, García Grajales and Buenrostro Silva 2018). The removal of problem *C. niloticus* from conflict zones to protected areas and ranching farms has been fondly regarded in crocodile management as an avenue for economic, social and political benefits to local communities and national economies, it is thus a critical tool for fostering harmonious human-crocodile relations (Gelabert, Rositano et al. 2017, Corey, Webb et al. 2018). For example, in Australia, Botswana and Zimbabwe, initial management programs for *C. niloticus* in the human crocodile communities included harvest of eggs, hatchlings, juveniles and adults from the wild to rear in captivity for production. In Australia, the 1998 management program also allowed

non-hatchlings to enter trade directly after harvesting, without the need to spend time in a farm (Saalfeld, Fukuda et al. 2016). These strides in countries such as Australia have since translated into significant revenue generation for local communities and a harmonized management of the human crocodile relations. The local communities now appreciate that *C. niloticus* can be used contribute to people's welfare rather than being threats to their lives and livelihood (Chakanyuka and Utete 2022). In East Africa, due to the lucrative business that crocodile products had as far back as 1939 they were generating over £4000, it was opined by wildlife authorities of Tanzania and Uganda that the classification of *C. niloticus* as vermin and killing them without license be halted (Pooley 2016). Like Australia, this meant that Tanzania and Uganda communities within the human crocodile localities had an appreciation of their co-existence with the *C. niloticus* albeit the management regulations by their respective governments (Anagnostou, Mwedde et al. 2020, Weldemichel 2020).

In furtherance to the establishment of breeding grounds, translocation of problem *C. niloticus* to protected areas and ranching farms, authorities have embarked on measures such as the establishment of a piped water system to keep the community that would otherwise have sought to fetch water away from the water body (Matanzima, Marowa et al.). Moreover, it is extensively reported that most human-crocodile fatalities occur when members of the community move to collect water from the crocodile harboring water bodies (Brackhane, Webb et al. 2018, Das and Jana 2018, Khan, Hore et al. 2020). Establishment of a piped water system is highly touted as a co-existence and adaptive co-management concept in human–crocodile conflict resolution. In Tanzania, Botswana and Zimbabwe, the wildlife management authority dug water wells and conjoined it with community sensitizations to educate the locals on ways they can avoid coming in contact with *C. niloticus* (Le Roux 2020, Chakanyuka and Utete 2022, Eustace, Gunda et al. 2022). Human crocodile relations were consequently reported to greatly improve with the locals becoming more compliant to calls of authorities to co-exist with the alligators.

2.6 Modern challenges of crocodile ranching in Africa

The main product accruing from crocodile ranching is the skin (CITES 2022). The most valuable part is the bottom or belly skins that end up in the exotic leather industry whose demand is becoming astoundingly high on the international market (Caldwell 2017). It is widely acknowledged that Leathers made from crocodile skins have very good market value because of their beauty, durability, texture and extraordinary properties (Chala, Aychiluhim et al. 2020). Although the crocodile skins industry was stagnated by the economic recession in mid 90's and covid-19 in the later 2000's, the demand has once again peaked with extensive innovations in the crocodile skin product range (Hughes 2021). Because of the blossoming demand, the industry has unfortunately been hit by the emergence of fraudulent skin tanners that threaten to bring the authenticity of leather products into question (Gao, Lin et al. 2021).

That notwithstanding, the actual value of the crocodile skin depends on factors like belly size, cuts on the skin, microbial deterioration during preservation and absence of scars or lesions. Hutton and Web (1990) noted that downgrading to a second quality implies a 25% loss in value, and the most serious damage leads to the third grade with a further 25% loss in value. Between the period 1996 to 2018, considering annual number of skins legally traded through CITES, the reptile leather for fashion trade rose by six fold from $140 million in 1996 to $600 million in 2018 with a record of over 1.3 million transactions being registered (Hughes 2021).

2.7 Wildlife management planning in Uganda

In Uganda, wildlife is managed by a statutory body called the Uganda Wildlife Authority (UWA) working in the ambits of the Ministry of Tourism, Wildlife and Antiquities (MTWA). The Ministry provides overall supervision of the wildlife sector (Wildlife and Antiquities 2014). UWA is a State authority agency with the responsibility to coordinate, monitor, regulate and supervise the wildlife in Uganda (Bamwine 2019). UWA is in charge of developing wildlife policies, rules, regulations, standards and recommendations as well as advising the Ugandan government on wildlife management.

The mission of UWA is to “conserve, economically develop and sustainably manage the wildlife and Protected Areas of Uganda in partnership with neighboring communities and other stakeholders, for the benefit of Uganda and the global community’ (Omoding, Walters et al. 2020). UWA has a five year (2020/21 – 2024/25) Strategic Plan that specifically underscores effective management of wildlife outside Protected Areas as one of the four critical areas that will lead to the achievement of UWA’s mission (UWA 2020). The strategic plan recognizes and emphasizes the importance of managing wildlife outside Protected Areas in partnership with local communities, local governments and the private sector. This helps to ensure understanding and appreciation of wildlife conservation in relation to other land use options and also as a source of alternative income to enhance local community livelihoods while contributing to the overall national economic development.

In the year 1999, a Protected Area System Plan (PASP) was developed after a long period of Protected Areas Assessment Program (PAAP). Uganda Wildlife Authority has successfully implemented PASP, which has led to the integrity of most Protected Areas being defended (Omoding, Walters et al. 2020). The PAA program largely confined its activities to what were the existing wildlife systems of National Parks, Wildlife Reserves, Forest Reserves and Community Hunting Areas. However, there are some areas outside the existing and proposed system that should have been considered for inclusion such as crocodile habitats.

Apart from declaring certain areas as 'no-fishing' areas, the Department of Fisheries does not establish any formal 'Protected Areas'. Wetlands which are technically protected by the National Environment Act, 1995, are still inadequately represented within the PASP and *C. niloticus* therein cannot be considered as adequately protected / conserved (Isabirye 2020).

2.8 Distribution and population status of *C. niloticus* in Uganda

C. niloticus dwell in more open waters with sand banks and other suitable basking and nesting places (Murray, Crother et al. 2020). Swamps especially those which are dominated by papyrus are not prime habitat for the *C. niloticus*. Strong anecdotal evidence suggests that at the turn of the century, *C. niloticus* were widespread and abundant virtually in all suitable habitats in Uganda with the exception of Lakes George and Edward, where they, until recently, had not existed (Behangana, Magala et al. 2020). However, crocodile numbers and the animal's range were much reduced during the 1950's and 1960's as a result of hunting and when exploitation pressures ceased, strong population recovery was prevented by human pressures (Pooley 2020).

Foremost, during an official eradication campaign by the fisheries department between 1928 and about 1948, over 1700 adult *C. niloticus* and 11700 eggs were destroyed on the shores of L. Victoria within 80 km of Entebbe (Pooley 2016). Although this led to a decline, it is the introduction of commercial exploitation for skins which had the most dramatic effect on crocodile populations (Webb, Manolis et al. 2021). The first commercial cropping for crocodile skins is believed to have started on L. Kyoga and in 1945 several thousand skins were exported, almost entirely from L. Kyoga and Kwania (Nsubuga, Botai et al. 2017). By 1948, in just 4 years, the Kyoga population had been reduced to such an extent that finding *C. niloticus* was difficult and the hunter's attention switched to Semliki River and elsewhere (Ali and Abd Ellah 2023). Again in just four years, the *C. niloticus* of Semliki had been reduced to such low numbers that hunting was no longer economical, but by this time, crocodile hunting was countrywide and largely uncontrolled.

Between 1953 and 1955, over 30,000 skins were exported and by 1958 it was reported that illegal crocodile hunting was common even within the Murchison Falls National Park (Cott and Pooley 1971). The population in MFNP was always noted for its density (Parker 1970, Cott and Pooley 1971). Parker (1970) considers that about 54, 000 crocodile skins came out of Uganda between 1960 and 1965 and by 1969, no *C. niloticus*

were seen during a survey of L. Kyoga, there was little or no breeding stock on L. Victoria and few *C. niloticus* left in the Semliki River and L. Albert. It is suspected that now there are few remaining individuals. Today, *C. niloticus* are not as ubiquitous in the majority of Uganda as they used to be in the 1940's when the population of Uganda was just 4 million people. At present, the population is over 40 million people and the fishing industry has also grown, for which gill-netting that heavily exerts pressure on crocodile populations is the main technique being used (Nakiyende, Basooma et al. 2023). No particular interest was paid at that time since this observation was largely considered as a mistaken identity for a giant monitor Lizard. Since that period, reports on Crocodile sightings have come regularly.

C. niloticus have also been sighted in several other parts of Uganda among them including Lake Mburo, Narus River in Kidepo Valley National Park, the river Nile outside Murchison Falls National Park, Semliki River, lakes Kyoga, Kawi, Opeta, Bisina, Victoria and Albert (Isberg, Combrink et al. 2019). *C. niloticus* have also been recorded in Wansolo, Nambieso, Namwendwa and Majanji (Berkeley Bay) Wetlands (Dendi and Luiselli 2017). It is however worth noting that up to the present time, apart from occasional observations, there has been no systematic research carried out on the *C. niloticus*. As such there is not enough information about them that can assist in making management decisions. At present, Murchison Falls National Park remains the only important area for crocodile conservation (Dendi and Luiselli 2017).

The crocodile population of the Victoria Nile between Murchison Falls and L. Albert is almost entirely within the protected area of MFNP and has always been exempt from legal control and cropping (UWA 2020). There is no good data on the total number of *C. niloticus* in the Murchison Falls area prior to the 1969 survey (Parker 1970), but there seems little doubt that by the survey, the population was already much depleted. Whereas it is anticipated that the population of *C. niloticus* could have considerably increased, there is a lack of a deliberate crocodile census and distribution in the country to ascertain it. The largest wild *C. niloticus* on record in Africa to date was collected in Semuliki

River in Uganda in 1953 with length of 5.94m and weighed an estimated 600Kgs (Parker 1970).

2.9 Reproductive ecology of *C. niloticus*

C. niloticus lay their eggs at selected nesting grounds suitably in sandy or sandy soils mixed with some pebbles (Nothling, Nothling et al. 2019). Vashistha, Lang et al. (2021) report that *C. niloticus* have some communal nesting sites but observed these sites being abandoned for new nesting sites most probably due to the ranchers excessively collecting eggs from the same nests each year.

Since *C. niloticus* have to guard their nest throughout the day against predators like baboons and monitor lizards, they prefer to have nests near shade where they resort when it becomes hot while still monitoring the nest (Evans, Jones et al. 2016). However, if the shade is absent the eggs are laid near water in the brooding females will frequent to cool itself when it is hot and when alarmed (Baker, Franklin et al. 2019). The *C. niloticus* put the nests a distance of 1.2 m to 7.6 m from the shoreline to avoid seasonal flooding that may destroy the nests (López-Luna, González-Soberano et al. 2020). In MFNP, the average clutch size is noted to be 55 eggs (33 – 78 eggs). Hatching starts at the beginning of March, peaks at around mid-March and continues through to early April (Dendi and Luiselli 2017). López-Luna, González-Soberano et al. (2020) observed that excessive jolting, bumping and noise to cause premature hatching while in transit could lead to abnormalities in juveniles and such *C. niloticus* also have a poor survival rate.

The optimum incubation temperature ranges from 24^0C to 34^0C but if kept longer than this may result in longer incubation period by as much as 14 days that the expected (Pooley 2016). After incubating, the mother digs out the hatchlings after which it starts making some croaking and yelping sounds (Geller, Casper et al. 2020). The monitor lizard *Varanus niloticus* and baboons *Papio anubis* are the most notorious predators of crocodile eggs (Samia, Angeloni et al. 2017). They dig out the eggs in the absence of the mother. Once a nest has been opened by a predator, they are more likely to be completely destroyed by predators. Other predators of eggs and hatchlings include herons,

mongoose, hyeana, sacred ibis. Hatchlings are often eaten by Goliath heron (*Ardea goliath*), African Fish Eagle (*Haliacetus vocifer*), Great white egret, (*Egretta alba*), Grey Heron, (*Ardea cinerea*) and the Yellow billed stork (*Ibis Ibis*) (Isberg, Combrink et al. 2019). A whole batch can easily be wiped out since the hatchling *C. niloticus* tend to congregate together. Some of the hatchlings are entangled in fishing nets.

Hatchlings spend most of the time in shallow waters near the nesting grounds resting under thick vegetation perhaps from possible predators (Behangana, Magala et al. 2020). They are protected by the adult *C. niloticus*. However, the hatchlings are continuously drifted by water currents to other areas if it is a river downstream from the nesting grounds (Frossard, Coppo et al. 2021).

During the breeding season, from around November to mid-March, adult *C. niloticus* concentrate in nesting sites which in MFNP are prominent in such areas like Falls Channel, Cotts camp, Nyamusika and Buligi unlike in the non-breeding seasons when the adult *C. niloticus* are distributed evenly along the entire river stretch (Dendi and Luiselli 2017).

2.10 Common diseases and parasites of *C. niloticus*

The *C. niloticus* is known to suffer from various diseases including Chlamydiosis, Salmonellosis, Coccidiossis and Adenovirus and poxyvirus (Conley and Shilton 2018, Marschang, Bogan et al. 2021). For instance, Hutton and Woolhouse (1989) observed *C. niloticus* juveniles (1.2 m in length) to have suffered high mortality of up to 80% over a period of 3 years as a result of the adenovirus. Fergusson (1992) further revealed that out of 20 juveniles (1.3 m TL) attached with radio telemetry equipment and released in the wild, only 8 animals were found alive after 6 months (four having been predated upon by larger *C. niloticus*). Cannibalism was also witnessed by McGrath, Peeters et al. (2007) but not in MFNP.

2.11 Status of the human-crocodile conflict in Uganda

Management of wildlife outside Protected Areas has been and is still a challenge to UWA (UWA 2020). Whereas a number of problem animal interventions, such as digging trenches, live thorny fences and stone walls among others, have been put in place in and around most Protected Areas, it has not been possible outside the Protected Areas other than responding to a few emergency calls from communities (Rossi 2018). For many years, communities around L. Victoria region including Rakai, Masaka, Mpigi, Wakiso, Mukono, Jinja, Mayuge, Iganga, Mukono, Kalangala, Bugiri and Busia districts, as well as other communities surrounding other crocodile habitats, have suffered damages and death due to attacks by *C. niloticus* (UWA 2021). Such losses increase resentment of local communities towards wildlife conservation efforts resulting into illegal killing of the species in question (Perfetto 2021, Thilakarathna and Godage 2021, Utete 2021).

The other challenge is that there has not been adequate monitoring of trends in attacks to establish problem occurrences, movement patterns, reasons and warning signals for crocodile attacks, predators, and critically affected areas among others (Venter, Kelly et al. 2020). UWA requires empirical data in order to find solutions and appropriate strategies to avoid further decline of crocodile population due to conflicts and need to reduce human losses (UWA 2020). For any approach that may be thought to manage *C. niloticus*, information on conservation status is necessary to design appropriate strategies.

2.12 Rationale for establishment of ranching in Uganda

Subsequent to the drastic decline in the number and range of *C. niloticus* as a result of heavy hunting, all of forms of utilization of the *C. niloticus* were prohibited under statutory instrument No. 075 of 1974 (CITES 2022). Though it is reported that the population seemed to recover but the numbers remained low, MFNP in particular, subsequent censuses indicated that the population was declining reaching the lowest in 1991 (Dendi and Luiselli 2017).

Consequently in 1991, the Uganda National Parks (UNP) licensed in a 10 year contract a commercial crocodile rancher (Uganda Crocs Ltd) and a Crocodile Management Plan for MFNP was constituted that UCL to annually collect 4,000 *C. niloticus* eggs from MFNP, artificially hatch the eggs and then return an equivalent of 5% of the total eggs collected as juveniles back to the park (Rossi 2018). The 5% return rate was assumed to be much higher than the natural 1% recruitment rate (mortality rate as high as 99% in the wild, Hutton and Woolhouse (1989) of *C. niloticus* in the population in the park would be considerably boosted. In a bid to promote population recovery, a programme of crocodile ranching was initiated in 1991, by the then Uganda National Parks.

The purpose was to "headstart" the crocodile population of the MFNP through the release of captive raised animals at a size beyond that susceptible to general predation (Rossi 2018). In addition, it was also thought that introducing sustainable use of wildlife would give wild *C. niloticus* an economic value for conservation especially outside protected areas (CITES 2022). This involved the subsequent proposal by Uganda to CITES to transfer Uganda's crocodile population from Appendix I to Appendix II to allow products to be exported which was granted in 1992 because the crocodile ranching program appeared very promising.

Chapter 3: Materials and Methods

3.1 Study area

The study was carried out in selected areas of Murchison Falls National Park and along the northern shore of L. Victoria (Figure 1).

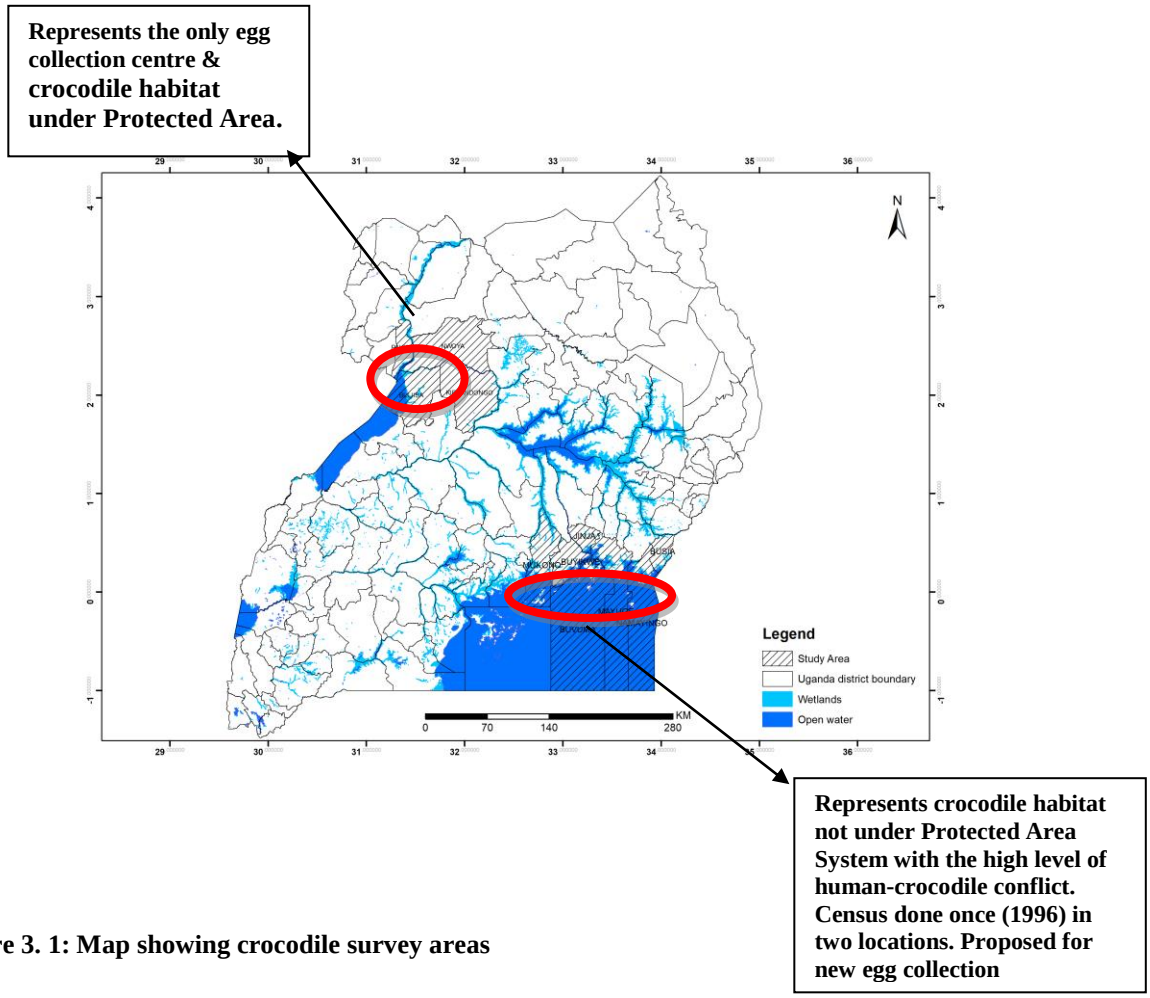

Figure 3. 1: Map showing crocodile survey areas

Murchison Falls National Park (MFNP)

At Murchison Falls National Park, the specific area of study was the Victoria Nile which is a section of River Nile found within a protected area. It is at Victoria Nile that collection of eggs has taken place since 1992.

Communities adjacent to Victoria Nile in the District of Bulisa participated in the focus group discussions aimed at profiling the human-crocodile conflict around Murchison Falls National Park.

L. Victoria Shoreline in Uganda

At L. Victoria, the study concentrated in the waters within the district boundaries of Mukono, Buikwe, Jinja, Mayuga, Buvuma, Namayingo, Bugiri and Busia. L. Victoria represents increased cases of human-crocodile conflict that has never been documented, and an area proposed for new eggs collections. A crocodile census for Victoria Nile was carried out in 1969, 1991 and 1996. L. Victoria had the first ever census in 1996 and only for two locations that represent approximately less than 5% of the entire lake waters with in Uganda territory. The 1996 survey strongly recommended that areas surveyed on L. Victoria should be increased which would constitute a baseline for the lake and thereafter a 2-3 year interval survey to monitor the situation. There was however no mention of human-crocodile conflict around L. Victoria in the report, which is now a national concern. The report also recommends regular monitoring of *C. niloticus* population of Victoria Nile, which appear that up-to-date, no much better has been done (Republic of Uganda, 1997).

Communities neighboring the northern shore of L. Victoria were among the participants in the focus group discussions aimed at ascertaining the nature and pattern of the human-crocodile conflict. It is around L. Victoria Basin region where most complaints associated with *C. niloticus* to conservation authorities originate. From records and discussion with proprietors of Uganda Crocs Ltd, data on the challenges encountered by the ranch during its existence was also obtained. Uganda Crocs Ltd is located at Katebo in Masaka District on the shores of L. Victoria, about 440 km from MFNP. It covers an area of 20 acres. The land was rented from Uganda Railways Corporation (URC) for 10 years (1991 to 2001) after which URC had plans to develop the area into a harbor.

3.2 Day and night crocodile surveys

Daylight counts were done on a motorboat with high-resolution binoculars to locate *C. niloticus*. The areas inspected during the day included those considered by the local communities and fishermen as primary habitats for *C. niloticus*. Night counts were done along transects followed previously during daytime. During night surveys, 12 voltage

high candlepower Q-beam spotlights were used. Observations of crocodile eye reflections were recorded and were categorized as hatchlings, juveniles, sub-adults, or adults based on visual estimates of total body length (TL) as judged by an observer from the snout length (eye-nostril distance). *C. niloticus* that submerged before TL could be determined were classified as 'eyeshine only' (EO)

The beginning and endpoints of each survey route, the distance traversed and the crocodile sightings, were determined (ANNEX A, ANNEX B). Encounter rates were calculated as the number of *C. niloticus* observed per kilometer of survey route. The team was careful to minimize visibility bias from *C. niloticus* submerged or in vegetation as emphasized by (Than, Strine et al. 2020)

The census crew covered 1,138km of distance during both night and daytime surveys. The distance covered represented 54.2% of the entire shoreline distance (2,097 Km) of the northern shoreline of L. Victoria. The night surveys covered 411km and the rest was covered during daytime.

3.3 Indirect estimations of *C. niloticus*

Estimates of crocodile numbers as perceived by fishermen and local communities were also undertaken as an indirect method. Indirect methods employed for this study were structured interviews and document reviews. The interview was conducted in 266 landing sites out of 285 that were surveyed. These interviews culminated into focus group discussions (Annex E, Annex F) that were further used to establish the state of the human crocodile conflict in the community.

Parameters whose data were recorded during the crocodile count estimate interviews with the locals were: administrative units, nature of the crocodile habitat and vegetation, GPS coordinates, fishing methods and gear used, nearby vegetation and water navigation challenges, historical presence of *C. niloticus*, recent sightings of adult and young *C. niloticus* as well as those captured in fishing nets.

3.4 Nest counts

In addition to the crocodile census exercise, a direct nest count survey was conducted in the study areas. However, due to field limitations, no nets were sighted along the shores of L. Victoria. Therefore, the nest survey methodology (ANNEX C) described in this thesis yielded results in Murchison Falls National Park (MFNP).

The nest count done at MFNP coincided with the early hatching season, which is usually within 80 days of nesting. Nesting in MFNP has been recorded to begin late December and end in early January. This period was considered ideal because all hatched nests would still appear fresh with disturbed soils and visible egg shells.

Nest sites were searched by one survey team from a motorboat driven at 5-25km/h, 2 100m from the shore. Three observers in a boat scanned the bank using binoculars looking for one or more of five signs of nesting activity. These signs were:

i. the presence ashore of a crocodile of nesting female size;
ii. patches of bare ground with tracks and usually, but not always, one or more regularly used “lays”;
iii. disturbed ground and uprooted grass that signified digging by *C. niloticus*;
iv. disturbed ground and/or eggshells resulting from the excavation of nests by predators;
v. and routes up the riverbank (or seasonal watercourse deltas) marked by crocodile belly tracks or footprints

Unlike L. Victoria, the nests at MFNP were traced with guidance from information of prior survey (Crocodile survey of 2009) which showed areas known to predominantly have significant numbers of hatchlings.

Some nests and nesting sites, however, were either not regularly, or not closely attended and were found only by systematic probing and digging (ANNEX D). At such/all potential sites, nests were located by probing with a sharp rod of 6.5mm diameter steel as practiced during egg collection. All suspected nests were confirmed by excavation or

presence of fresh egg shells. Because more than one nest was made at any given location, which itself was reused in successive seasons by varying numbers of *C. niloticus*, an attempt was made to differentiate between nest sites and nests. Sites were numbered serially.

3.5 Survey of human crocodile conflict

In order to ascertain the state of the human-crocodile conflict, the study sought to gain an understanding of attitudes and perceptions of the members of communities within the study areas of MFNP and L. Victoria. This was done in the form of focus group discussions (ANNEX G) held with a selection of community members. As such, emphasis was placed on seeking the views of locals in conflict sites. Specifically, a conflict site was a fish landing site in a parish[1] neighboring crocodile habitats in which at least a crocodile attack had occurred in the last 12 years[2]. These conflict sites (landing sites) are the lowest administrative units called cells in a parish. Each landing site on the planned crocodile census path was visited. Discussions and interviews were conducted with residents from 266 out of 367 landing sites along the L. Victoria northern shoreline and selected areas around MFNP.

Identification of FGD site and participants

Important features that guided the eligibility of an FGD site and participants included sites of crocodile sightings, sites of crocodile capture (for translocation), socio-economic information of victims, circumstances of attack, time of attack and awareness on crocodile behavior. Tape recorders in some cases were used to take victims' testimonies. The conflict sites were further mapped using GIS technology. Groups selected for the discussions comprised of at least 8 participants with shared experience of crocodile encounters. As such, FGDs included adult females and males that performed various socio-economic activities in and/or along the river and fish landing sites.

[1] A parish is combination of more than one cell. A cell is the smallest Local Government unit according to the decentralization system in Uganda. The size of a cell usually depends on the number of households often less than 200.

[2] The last 12 years corresponds with the last aerial survey time (1996) while preparing for CoP10, and coincides with the first democratic elections under the current government that is well remembered by most local communities.

Development of focus group discussion (FGD) guides

FGD guides were designed to capture the profile of victim and his/her household such as the name, village of residence, age, usual activities, marital status, education level, source of and average income, housing type and nature of dependence on water. The human-crocodile conflict parameters that informed the FGD guide were levels of conflict reporting, the actual events surrounding the crocodile attack site such as time, presence of witnesses, survivability, and the victim's activity before attack. Actions on the offending *C. niloticus* were also recorded for example whether it was captured, translocated or killed out of retaliation. Information on awareness of crocodile's conservation and uses were also recorded.

3.6 Interviews on challenges of crocodile ranching in Uganda

Review of reports held at UWA and the ranching company was done. These reports contained information on egg nests opened, number of eggs collected, GPS locations of nest sites, number of eggs hatched and survived to maturity, total skin exports and types of health conditions suffered by *C. niloticus* on the ranch. Further, in-depth interviews were held with UWA Headquarter Staff, Field Staff and those other staff that have previously monitored the ranching program. The ranch was visited and discussions with ranch staff on general operations and challenges were shared.

3.7 Secondary data collection

Data and reports from similar surveys at national and global level were interrogated to validate, compare and assess the trends in crocodile populations, nesting, egg collection, exports, human-crocodile conflict, capture and rescue of problem *C. niloticus*, and best crocodile ranching practices. This type of data was accessed through use of key informant guide (ANNEX K)

3.8 Analysis of *C. niloticus* census data

Sightings and observations of *C. niloticus* and nests were plotted on survey maps, frequency tables and graphs generated. The maps reflected the distribution of the *C.*

niloticus and nests along the shores of respective water bodies. The maps and tables reflected the relative abundance of *C. niloticus* and nests.

3.9 Analysis of human-crocodile conflict data

Descriptive statistics were used to identify areas where the conflict is more pronounced, the socio-demographic variables of the victims, and types of behavior that influence vulnerability of humans to crocodile attacks, the preventive and control measures the public undertook to minimize the conflict.

In order to predict the occurrence of the human crocodile conflict, a regression of the demographic characteristics of members of landing sites was undertaken using the STATA software. Variables that fitted in the model were the age, sex, marital status, education level, ethnicity and the relationship of respondents to victims of crocodile attacks at 95% confidence interval and p-value of 0.05. Data was analysed for the period 1996 to 2008 as collected from the shores of L.Victoria and Murchison Falls National Park.

3.10 Analysis of data on challenges of crocodile ranching

Descriptive statistics were used to determine the frequencies of crocodile ranching challenges.

3.11 Acquisition of crocodile survey skills

In the course of this study, the researcher acquired numerous skills in areas of crocodile management, conservation and crocodile scholarship. These skills were essential in the planning this study, data collection and preparation of this thesis.

As such, a training in crocodile survey/research techniques was organized and facilitated by Wildlife Conservation Society (WCS) in collaboration with UWA. Facilitators were renowned crocodile scholars namely, Dr. John Thorbjarnarson (late) and Dr. Shirley Matthew. This field-based training took place between 6th and 29th January 2010 in a number crocodile habitats including Lake Mburo in Lake Mburo National Park, Lake

George, Kazinga channel and Lake Edward in Queen Elizabeth National Park, and River Semliki in Semuliki National Park. The main objective of this training was to impart skills and knowledge to UWA staff on various techniques necessary to do quality research and monitoring activities on Uganda's *C. niloticus* (ANNEX M). Consequently, the researcher contributed to some scholarly reports (ANNEX Y) together with Dr. John Thorbjarnarson (late) and Dr. Shirley Matthew.

The researcher conducted a study tour to Santa-Fe province in Argentina to learn how to manage the crocodile release program, to Bankok Thailand and to Western Cape South Africa and Nairobi Kenya to learn how crocodiles are used in education and entertainment (ANNEX L).

3.12 Membership to IUCN-SSC-Crocodile Specialist Group

As a result of technical involvement in numerous *C. niloticus* surveys in Uganda, the researcher was recognized with Uganda's first membership to IUCN-SSC-Crocodile Specialist Group (ANNEX N). This membership enabled access to various scholarly resources and mentorship that informed the conceptualization and appreciation of the need to conserve *C. niloticus* in Uganda.

3.13 Field logistics and administration

Logistics to facilitate the management and coordination of field and off field study activities comprised of human and financial resources, as well as specialized equipment and tools (ANNEX B). These comprised of the following: 4-meter motorized boat for water-based activities in L. Victoria and Murchison Falls National Park; 4-wheel drive field vehicle for land based movements; life jackets, camera, binoculars, rain gear, GPS device, bags, charging batteries, high performance spotlights, diesel and petrol fuels, stationary and security provision. For each field day, there were field support team of atleast 4 members including the driver or/and coxswain, two observers and a local guide who also performed the role of translation whenever required. This team was facilitated with subsistence allowance and communication.

3.14 Ethical considerations

A clearance letter to conduct this study was obtained from the University of Andalucia. In order to conduct research on wildlife in Uganda, it is mandatory that an authorization letter is sought from the Uganda Wildlife Authority. This, as well as an introductory letter, were consequently obtained to ensure safe passage and community acceptance (ANNEX O, ANNEX P).

Relatedly, there was adherence to field ethical procedures to ensure a harmonious field exercise. These included; paying a courtesy call to local area authorities, seeking the consent of all respondents, assurances of confidentiality to all respondents and ensuring safety of the team/respondents from harm.

CHAPTER 4: RESULTS

4.1 Population status of *C. niloticus* in MFNP

In MFNP, 1,102 *C. niloticus* were counted on a survey distance of 130 kilometres. This corresponds to an encounter rate of 8.5 *C. niloticus* per km (Table 4.1 and Figure 4.1). The structure of this population was 2.5:1:1.5 for adults, sub adults, and juveniles respectively (ANNEX R). It is evident that the distribution of *C. niloticus* is not uniform with most *C. niloticus* confined to the Falls-Paraa crossing at densities ranging from 11.7 to 30.7 individuals per km. The Delta region has the least number of *C. niloticus* noted at a density of 3 individuals per km. In terms of age categories, the Falls-Paraa crossing (Zone A in Figure 4.1) had the highest number of adults at 358 individuals representing two thirds (66%) of all adults encountered along the survey area. Similarly, the Falls-Paraa crossing had more than three quarters (84%) of all juveniles encountered along the Victoria Nile. Furthermore, the same crossing contained more than half (54%) of all sub adults encountered. These observations highlight the importance of the Falls-Paraa crossing as a prime habitat for *C. niloticus* in Murchison Falls National Park.

Table 4. 1: Number of crocodiles along sections of MFNP

Survey Zone	Bank	A	SA	J	Eyes Only	Total	Km	Density
Falls- Para Crossing	North	249	71	169	1	490	15.9	30.7
	South	89	44	63	1	197	16.8	11.7
Para Crossing-Buligi	North	50	29	17	13	109	14.5	7.5
	South	67	14	15	2	98	14.7	6.7
Delta		88	55	60	5	208	68.2	3.0
Total		**543**	**213**	**324**	**22**	**1,102**	**130.1**	**8.5**

***A=adults (≥2.5m), SA= sub adults (1.5-2.5m), J= juvenile (<1.5m)**

Source: Researcher

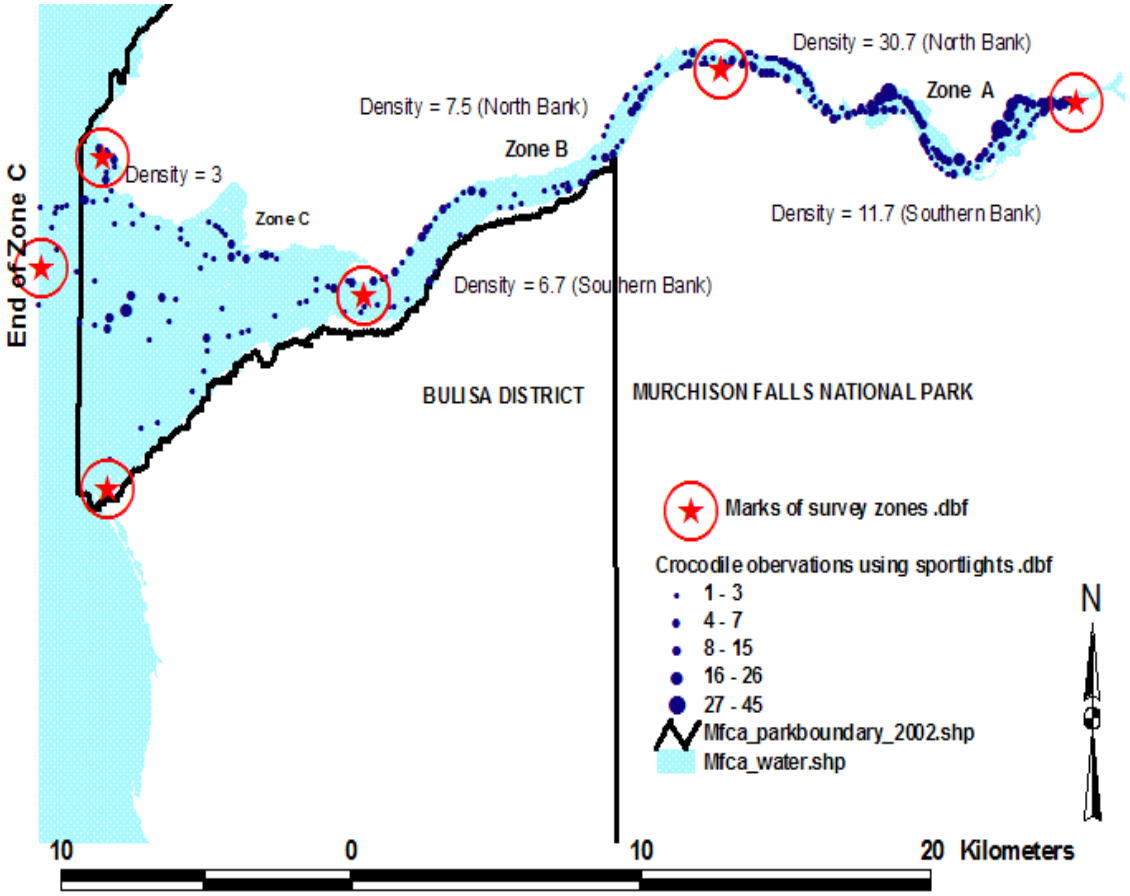

Figure 4. 1: Crocodile population distribution in MFNP and population density
Source: Researcher

4.2 Population status of *C. niloticus* on L. Victoria

Population status based on direct survey

Whereas 1982Km were moved on water during the study (ANNEX S), only 8 adult *C. niloticus* were sighted by the census crew (Table 4.2). Of the eight, one was observed during the day at 1753hrs on the shoreline bordering Bugiri District (Table 4.2). These results confirm the presence of *C. niloticus* along the shoreline of L. Victoria and that it is more likely to encounter *C. niloticus* during the night than the day. In terms of area of most likely encounter of *C. niloticus*, the results of the census crew suggest offshore waters bordering Buvuma district (Table 4.2 and Figure 4.2).

Table 4. 2: Crocodile sightings along the northern shores of L.Victoria

No	*District*	*GPS coordinates*		*Adults*	*Eyes*	*TOTAL*
		Northing	**Easting**	*(≥2.5m)*	*Only*	
1	Bugiri	593763	11323	1		1
2	Mayuge	562898	21175	1		1
3	Mayuge	566718	35373	1		1
4	Mayuge	558436	22682		1	1
5	Buvuma	511392	12436		2	2
6	Buvum	516656	13222		2	2
TOTAL				**3**	**5**	**8**

Source: Researcher

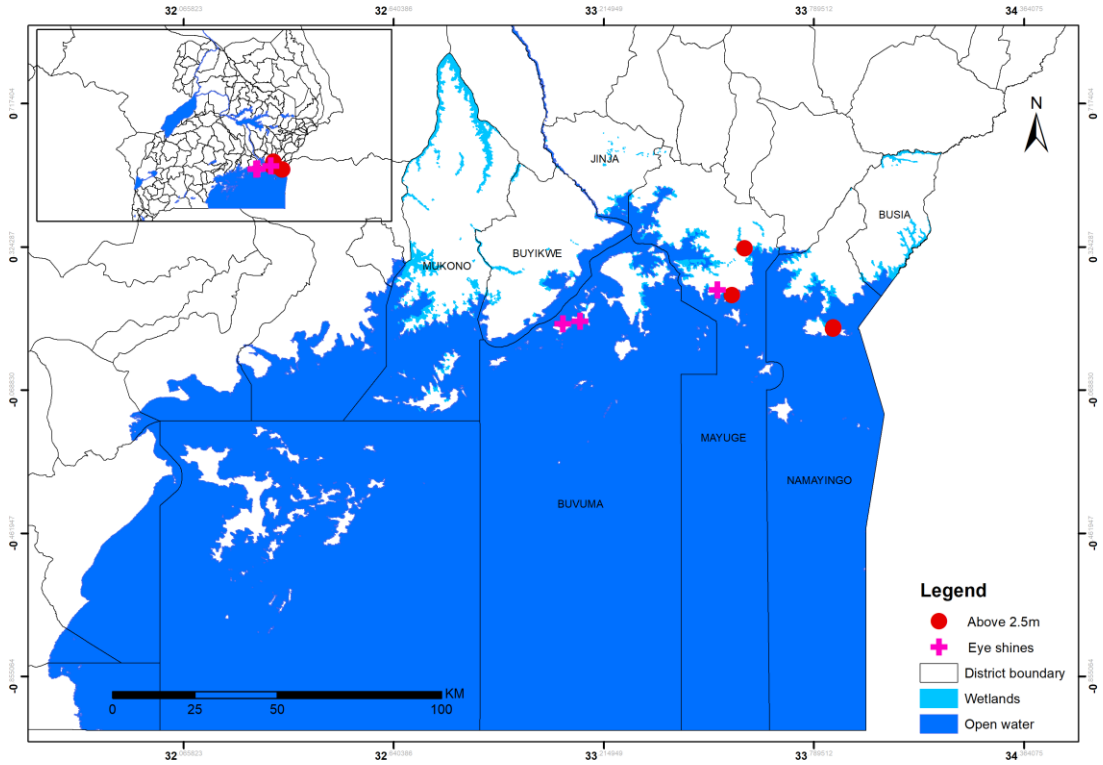

Figure 4. 2: Crocodile population distribution in L. Victoria as seen by census crew
Source: Researcher

Population status based on indirect survey

Through the indirect survey methods (FGDs), 213 adult *C. niloticus* were reported in 152 sites (Table 4.3, Figure 4.3, ANNEX T). Out of a total of the 285 sites visited therefore, there was no mention of a crocodile sighted by residents in 132 landing sites. Similarly, 18 hatchlings were reportedly seen by local communities from 14 landing sites.

Table 4. 3: Crocodile observations on L.Victoria

No	*Observations*	*Observation sites*	*Number of observations*
1	Adult *C. niloticus*	152	213
2	*C. niloticus* nests	22	38
3	Young *C. niloticus* (yearlings)	14	18

Source: Researcher

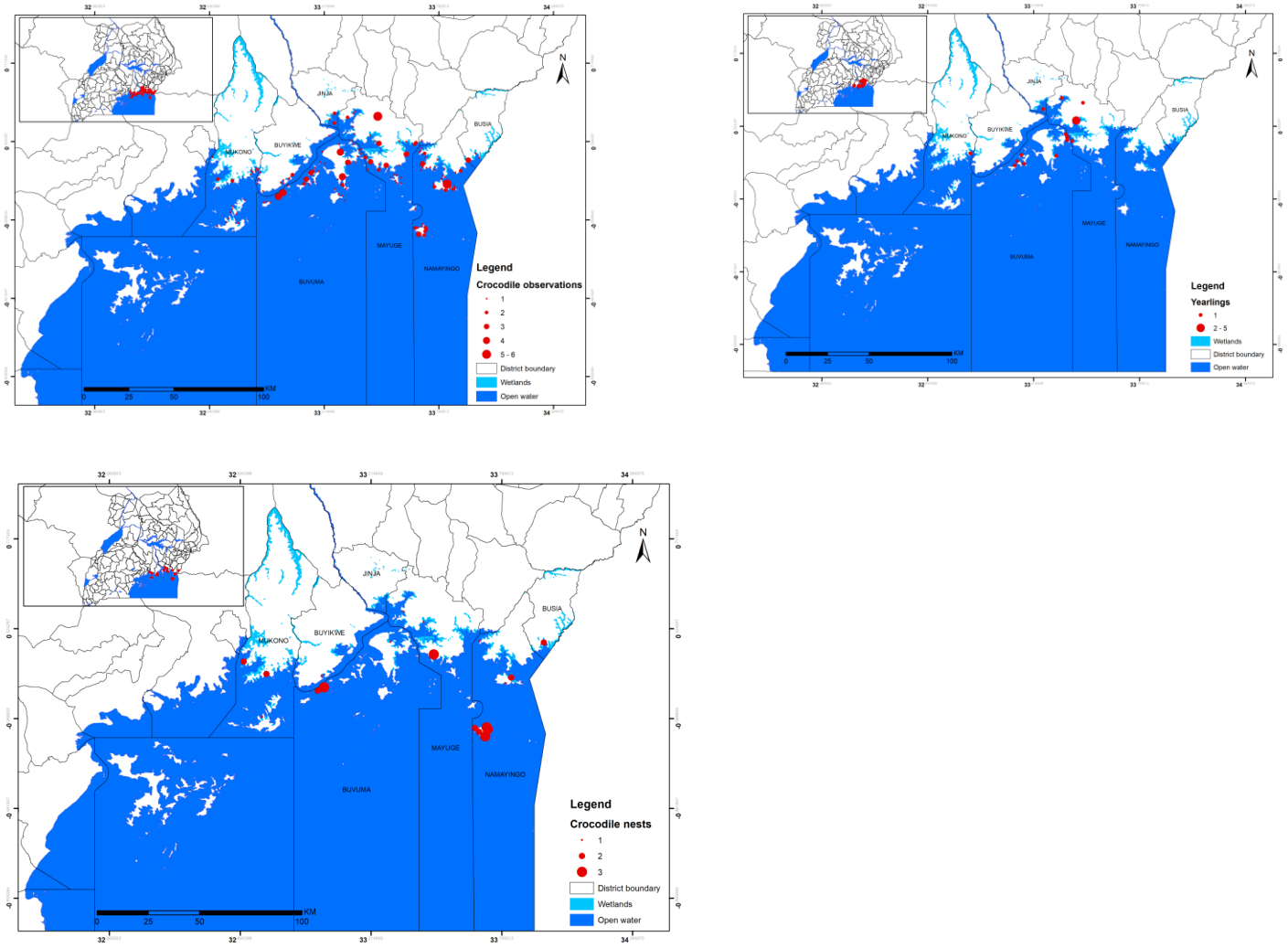

Figure 4. 3: Sightings of adult, young and nests of *C.niloticus* as reportedly seen by local fishermen in L.Victoria during daytime. Source: Researcher

4.3 Nest count survey in MFNP

A total of 17 crocodile nesting sites were seen in 2009 when the researcher conducted the survey (ANNEX U). Five (5) of these were historical nesting sites (four on the northern Bank and 1 on the southern bank). The count of crocodile nesting sites showed that the number of nesting sites in MFNP has not changed considerably since 1968, but instead, the number of nests had reduced (Figure 4.4).

From the survey where the 17 sights were confirmed, there were 49 nests with 1501eggs hence an average of 31 eggs per nest. 70 nests were counted. However, in the same year, only 33 had been accessed by Uganda Crocs limited for ranching purposes. Details of nests counted from each section of the park are shown (ANNEX U, ANNEX V).

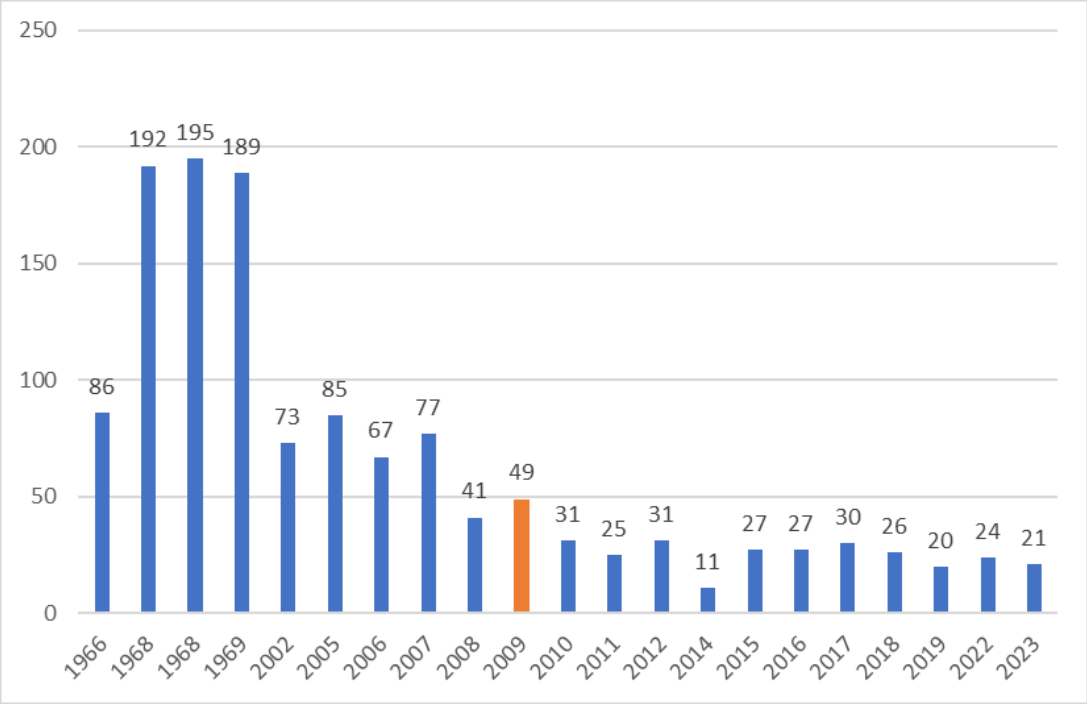

Figure 4. 4: Number of crocodile nests sighted from 1969-2023, survey year 2009 inclusive.
Source: Researcher, and Uganda Wildlife Authority

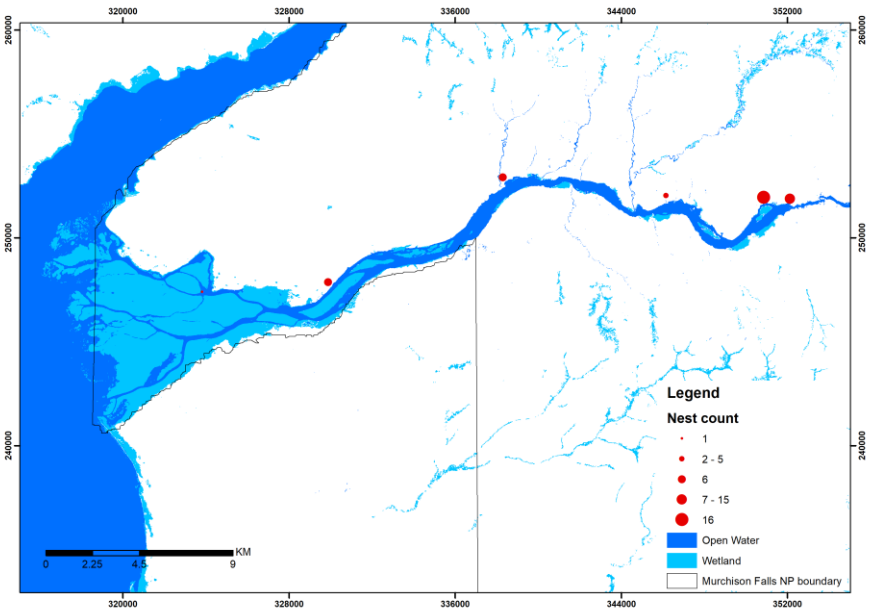

Figure 4. 5: Map showing nesting sites identified

Source: Researcher

4.4 Nest count survey on L. Victoria

At L. Victoria, 38 *C. niloticus* nests were reportedly seen in 22 landing sites comprising 7.7% of the total sites visited (Table 4.2 and Figure 4.6).

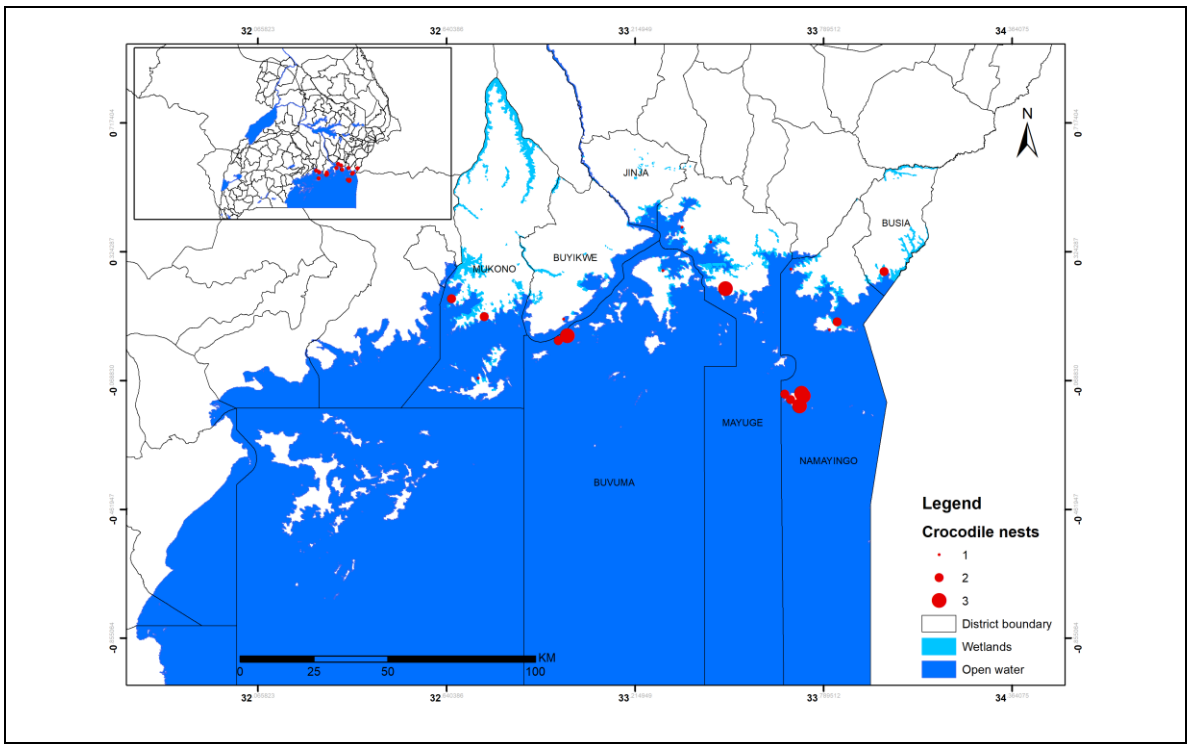

Figure 4. 6: Crocodile nests seen in 22 landing sites along L.Victoria (nest count survey)
Source: Researcher

4.5 Occurrence of conflict

C. niloticus have been involved in conflicts with people who utilize resources from aquatic ecosystems where they exist. In a number of cases, *C. niloticus* have attacked and even destroyed human property as well as life. This study examined the nature and pattern of the human crocodile conflict in the study areas of Murchison Falls Conservation Area (MFNP) as well as the northern shoreline of L. Victoria. Discussions and interviews were conducted from 266 out of 367 landing sites along the L. Victoria northern shoreline and selected areas around MFNP. Results revealed that, between 1996 and 2009, there were 310 incidents of human crocodile attacks recorded from around the L. Victoria study area and 32 incidents from the MFNP stretch. Of all these attacks, it was reported that 230 (74.2%) around L. Victoria were witnessed by someone while a witness was there for 23 (71.9%) of the incidents in MFNP.

4.6 Trends of occurrence of conflict

Generally, a significant increase between 1996 and 2009 in human crocodile attacks was noticed around L. Victoria ($r = 0.717$, $P = 0.004$). However in MFNP, there was no significant change ($r = -0.029$, $P = 0.921$) in the number of crocodile attacks over the years (Figure 4.7). All sites visited along the L. Victoria shoreline registered an increase in human-crocodile attacks since 1996 (Table 4.4). Namayingo and Mayuge have witnessed the highest number of human-crocodile attacks since 1996 and both account for more than three quarters (77%) of all (270) human- crocodile conflicts recorded along the shoreline from 1996 to 2009 (Table 4.4). Buvuma, Buikwe, Mukono, Jinja and Busia districts follow in that order in terms of decreasing magnitude of conflict.

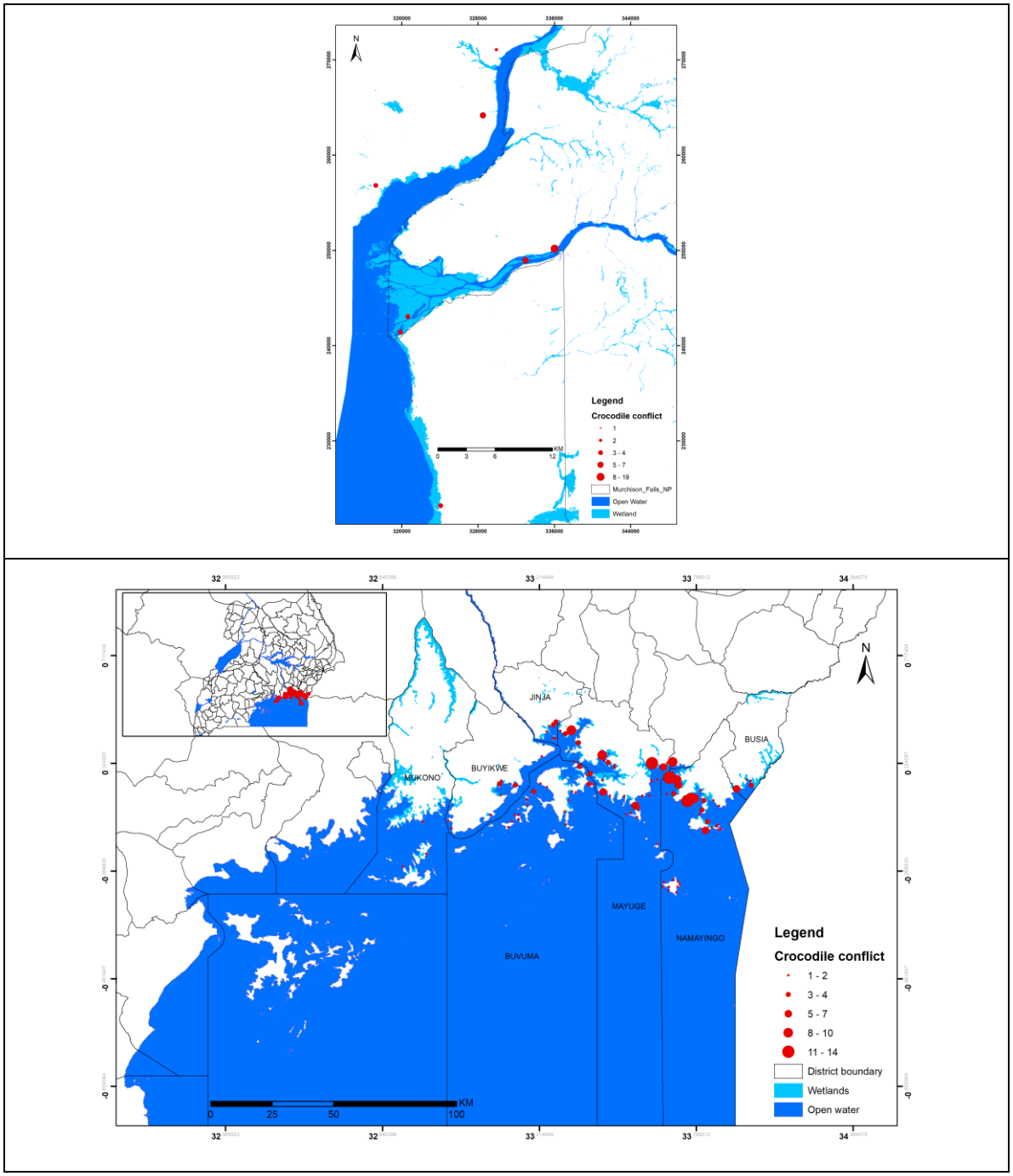

Figure 4. 7: Crocodile attacks around L.Victoria and Murchison Falls between 1996 and March 2009
Source: Researcher

Table 4. 4: Number of human crocodile attacks along L.Victoria since 1996

District	1996-2000	2001-2005	2006-2009	Total
Bugiri & Namayingo	30	34	45	109
Mayuge	23	20	56	99
Busia	1	3	6	10
Jinja	2	3	7	12
Mukono, Buvuma and Buikwe	6	12	22	40
Total	62	72	136	270

Source: Researcher

The people in the study areas attribute the rise in level of attacks to increasing numbers of *C. niloticus*. Along L. Victoria shoreline, 288 (92.9%) of the respondents noted that the population of *C. niloticus* was on the increase. This perception in the L. Victoria area is corroborated with a statistically significant positive correlation between the number of *C. niloticus* attacks and population size of *C. niloticus* reported per site *(r = 0.318, P = 0.04, N = 82*, Fig 4.8*)*. Still, along the L. Victoria shoreline, a majority 234 (84.5%) attributed the population increment to absence of hunting.

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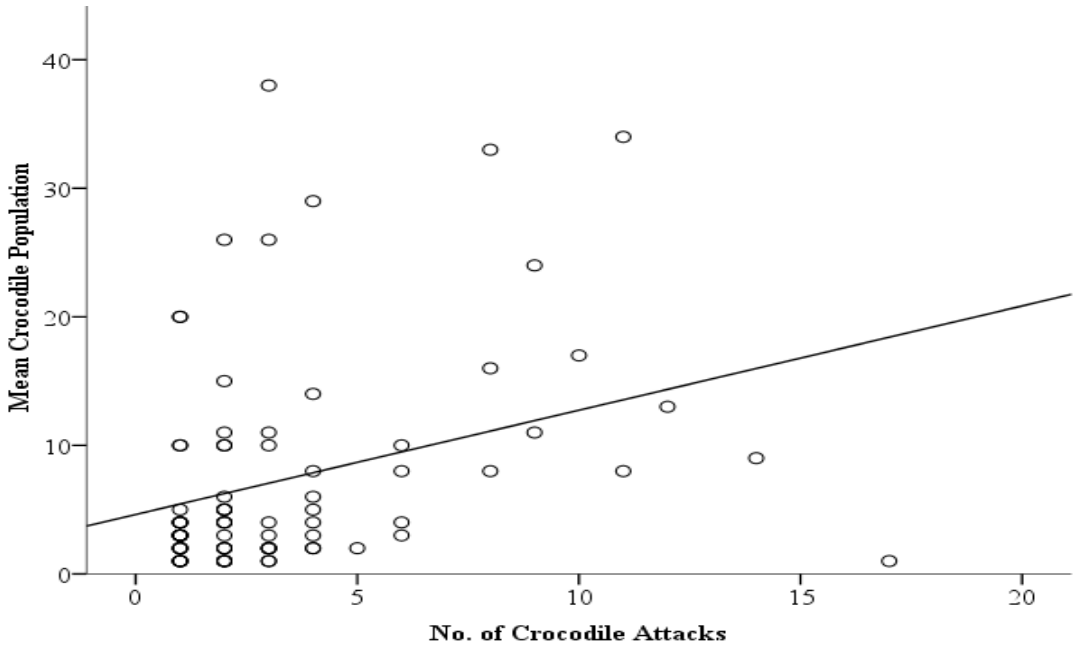

Figure 4. 8: Comparison between number of crocodile attacks and number of *C.niloticus* reported in a village along L.Victoria shoreline
Source: Researcher

4.7 Socioeconomic variables and time of attack of victims

Around L. Victoria, most victims were males 291 (94.2%) aged between 5 and 68 years (average 29 years). In MFNP, 22 (68.8%) of the victims were males of average age 37 years and a range of 16-62 years. Female victims were 18 in total and represented 5.8% of all crocodile victims in the L. Victoria region. The age of female victims ranged from 5 to 56 years with 21 years as the average in the L. Victoria region. Female victims in MFNP were 10 in number corresponding to 31.3% of all crocodile victims. The average age of the female victims in MFNP was 37 years while the range was 12 to 99 years.

For most of the victims in the L. Victoria area, 252 (84.3%) lived at the shores of the lake. In MFNP, all the 32 (100%) of the crocodile victims lived at the shores of the river. In the L. Victoria region, among the male victims, there were 194 (65.5%) fish mongers, 35 (11.8%) students, 27 (9.1%) farmers and 19 (6.5%) local leaders (Table 4.5).

The majority of male 15 (62.5%) and female 8 (80.0%) victims from MFNP were farmers (Table 4.5).

Accordingly, the main source of income for respondents was fishing 245 (79.8%), sale of livestock 83 (27.0%), trade 63 (20.5%) and 27 (8.9%) from other sources. The respondent directly depended on the water for fishing 218 (70.8%), domestic use 233 (75.6%), irrigation 18 (5.8%) and livestock 59 (19.2%).

During attacks around L. Victoria, 59 (19.2%) of the victims were alone while 118 (38.3%) were two people and 131 (42.5%) had more than one person in their company. Within MFNP, the victim was alone in 8 (25.0%) of the attacks, with another person in 11 (13.1%) of attacks and in company of at least two other more people in 13 (40.6%) of the attacks.

Around L. Victoria, almost all attacks 301(97.1%) occurred in the lake waters; 1 (0.3%) occurred in a swamp and 8 (2.6%) reportedly occurred on land (Table 4.6). Most people attacked by *C. niloticus* around L Victoria were either fishing without a boat (43%) or using a non-motorized boat (27%, Table 4.6). In contrast, the majority of people attacked by *C. niloticus* in MFNP were either bathing (50%) or fetching water (41%, Table 4.6).

Most attacks around L. Victoria reportedly occurred in the evening between 17:00hrs and 22:00hrs (Figure 4.9). However, around MFNP crocodile attacks mostly occurred in the afternoon hours (Figure 4.10).

Table 4. 5: Occupation of crocodile victims

Occupation	**L. Victoria (%)**		MFNP **(%)**	
	Males	*Females*	*Males*	*Females*
Fish monger	201 (72.8)	4 (23.5)	5 (20.8)	0 (0.0)
Farmer	22 (8.0)	5 (29.4)	15 (62.5)	8 (80.0)
Retail Business	6 (2.2)	0 (0.0)	2 (8.3)	1 (10.0)
LC leader	4 (1.4)	0 (0.0)	0.0	0 (0.0)
Students	43 (15.6)	8 (47.1)	2 (8.3)	1 (10.0)

Source: Researcher

Time of Occurrence of Human Crocodile Attacks

a) L. Victoria

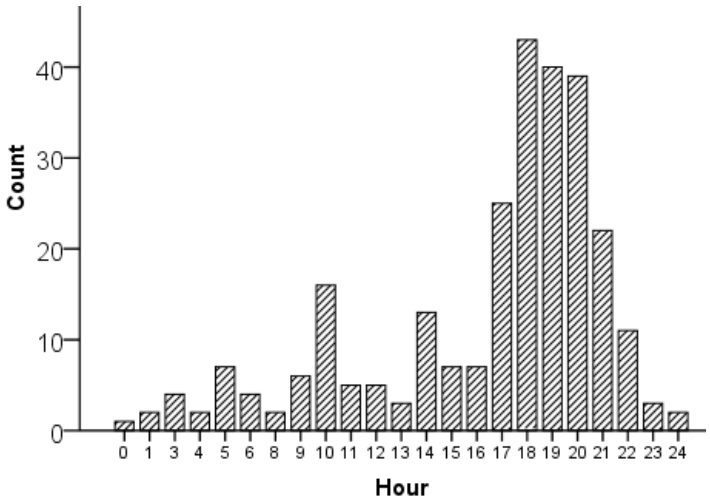

Figure 4. 9: Time of occurrence of human crocodile attacks on L.Victoria
Source: Researcher

b) MFNP

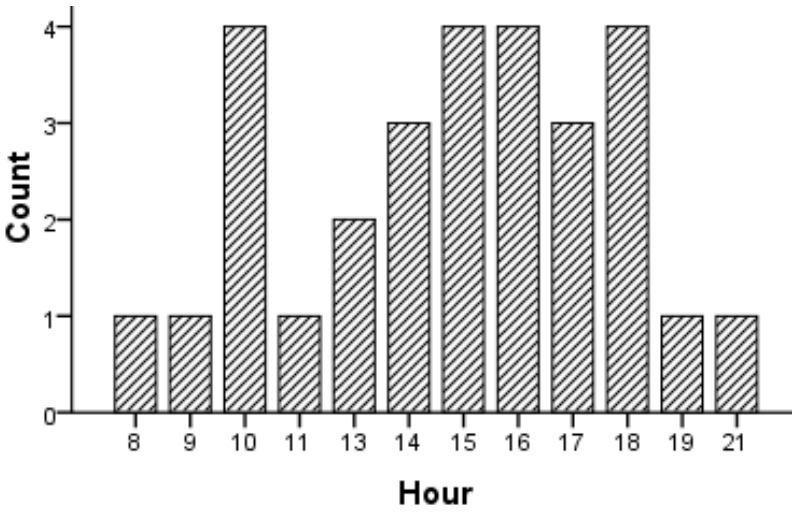

Figure 4. 10: Time of occurrence of human crocodile attacks on MFNP
Source: Researcher

Table 4. 6: Activities of victims during the crocodile attack

Activity During the Attack	*Number (%)*	
	L. Victoria	**MFNP**
Fishing in a boat without engine	82 (26.5)	1 (3.1)
Fishing in boat with engine	4 (1.3)	1 (3.1)
Fishing not in boat	133 (43.0)	-
Fishing from land	16 (5.2)	-
Bathing	36 (11.7)	16 (50.0)
Fetching water	22 (7.1)	13 (40.6)
Grazing	7 (2.3)	-
Other Activities	9 (2.9)	1 (3.1)

Source: Researcher

4.8 Crocodile attacks against livestock

C. niloticus have not only been a threat to human life but also a danger to domestic animals. Of the people interviewed, 105 (36.2%) respondents around L. Victoria and 17 (53.1%) from MFNP reported to have ever experienced a crocodile attack on their domestic animals and the respective total number of livestock killed by *C. niloticus* is presented in Table 4.7. From the Table, it is evident that more types of domestic animals have been lost in the L. Victoria area than the MFNP. In the later, sheep, goats and cattle have been attacked by *C. niloticus* whereas in in the L. Victoria area, in addition to the three, three other types of species have been lost to *C. niloticus*. In the L. Victoria region, most people lost ducks, dogs, cattle and sheep whereas the majority in MFNP lost goats.

Table 4. 7: Domestic animals killed by *C. niloticus*

Type of Livestock	MFNP		L. Victoria	
	Respondents	Animals	Respondents	Animals
Sheep	2	21	4	6
Goat	12	113	19	127
Cattle	10	43	43	149
Pigs	-	-	37	66
Dogs	-	-	38	178
Ducks	-	-	18	373

4.9 Consequences of human-crocodile attacks

In over three quarters of cases of crocodile attacks, victims either lost life or parts of their bodies to the *C. niloticus* (Table 4.8). In particular, 261 (84.2%) of the incidents around L. Victoria were fatal. Most people around L. Victoria, 237 (96.0%) were killed during attack and in 201 (84.8%), incidents the bodies were recovered. Of the 14 attacks in which the persons survived but died later, 11 sought hospitalization whereas 39 (80.0%) of the 49 victims that escaped death were hospitalized. In MFNP, 29 (90.6%) of the human crocodile attacks resulted in death. Similarly, most victims 21 (72.4%) were killed by the attacking *C. niloticus*. The other 8 deaths occurred after the victims were hospitalized following attacks. Still in MFNP, two of three survivors were hospitalized.

Table 4. 8: Crocodile attack on different parts of the body

Body Part Eaten	**L. Victoria**		MFNP	
	No.	**(%)**	**No.**	**(%)**
Whole body	45	15.6	17	58.6
Three quarters	38	13.2	-	-
Half body	38	13.2	-	-
Quarter	61	21.2	10	34.5
Internal organs only	15	5.2	-	-
Whole body recovered	14	4.9	-	-
Minor injury	69	24.0	2	6.9
only genitals	8	2.8	-	-

Source: Researcher

4.10 Community knowledge and use of *C. niloticus*

260 individuals corresponding to 83% of the sample population claimed to have seen *C. niloticus* in the wild. Further, 295 people representing 95% of sample population from L. Victoria region claimed to have good awareness of crocodile behavior. Most respondents

(90.7% from MFNP and 83.9% from L. Victoria region) admitted that they were aware that *C. niloticus* were protected species. More people around L. Victoria (176, 58.7%) were aware of the presence of crocodile ranching in Uganda than was the case in MFNP where only 7 individuals representing 22% of people were documented.

Use of crocodile parts was noted in MFNP and in L. Victoria region among people that were knowledgeable or ignorant of the practice of crocodile ranching in Uganda. Of those not aware of the crocodile ranching, 11 (44.0%) had use for genitals (6), meat (5), skin (2) and eggs (1) from *C. niloticus*. Notably, genitals were reported to be useful by 64 (37.9%) respondents who were aware of the practice of crocodile ranching and 81 (65.9%) of those not aware of the ranching practice.

4.11 Local strategies to mitigate human-crocodile conflict

The respondents in the study reported three major strategies that they consider appropriate to mitigate the human-crocodile conflict. The first strategy was migration from water sites where *C. niloticus* are regularly sighted. Of the three hundred ten respondents, 260 (84%) reported that they had used the migration strategy to avoid further attacks from *C. niloticus*. The second strategy utilized to mitigate crocodile conflict was killing (ANNEX H). Killing follows reports of problem *C. niloticus* by communities to local leadership as well as police force. It was observed in this study that most people (295, 94.9%) reported the cases for assistance. One hundred thirty eight (47.1%) reported to the Local Council, 80 (27.3%) to the police and 51 (17.4%) preferred reporting to the sub county chief.

Successful killing was witnessed by only 14 (4.5%) of respondents though failed attempts were witnessed by 111 (36.8%) respondents. Of the 14 witnesses to *C. niloticus* killed, only five agreed that the crocodile killed was the same as that which had attacked but the nine were not certain whether the same crocodile was the one killed. Further, of the fourteen successful cases, it was reported that 6 (42.9%) were killed by the Vermin Officer, 5 (35.7%) by the police, 2 (14.3%) by the community and 1 (7.1%) by others. The third strategy people consider could assist in the mitigation of the conflict is the

supply of piped water. This strategy was preferred by 174 (57.2%) of the respondents even though its effectiveness was still doubted by a rather substantial portion (42.8%, 130) of respondents.

4.12 Model on the occurrence of the human-crocodile conflict

Modelled results on the occurrence of the human crocodile conflict were significant for the demographic characteristics of ethnicity, age, sex, marital status and education. Results show that the more educated a member of the landing site is, the more they are likely to get into conflict with the crocodiles. Similarly, members belonging to the native ethnicity of the landing site are more likely to get into conflict with the crocodiles as is the older population of the landing site. Males are also more likely to come in conflict with the crocodiles as well as relatives to victims of the human crocodile conflict. On the contrary, persons of the landing site who are in marital unions are less likely to come into conflict with the crocodiles.

```
Finite mixture model                              Number of obs     =        211
Log likelihood =  5212.7357
------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
-------------+----------------------------------------------------------------|
       _cons |  -1.063376   .4092663    -2.60   0.009    -1.865523   -.2612288
------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
HCC          |
    q16ethni |   1.01e-16   6.07e-17     1.67   0.095    -1.77e-17    2.20e-16
      q18age |   3.30e-16   3.23e-17    10.22   0.000     2.67e-16    3.93e-16
      q19sex |    .4133379   .0352986    11.71   0.000     .3441539     .482522
    q110mari |  -6.81e-16   1.72e-16    -3.95   0.000    -1.02e-15   -3.44e-16
    q111educ |   2.58e-15   4.92e-16     5.25   0.000     1.62e-15    3.55e-15
    q116rela |   1.83e-15   1.76e-16    10.42   0.000     1.49e-15    2.18e-15
       _cons |          1
ln(q15barea) |          1  (exposure)
-------------+----------------------------------------------------------------
   var(e.HCC)|   1.60e-29   1.99e-30                      1.25e-29    2.04e-29
```

4.7 General challenges affecting performance of crocodile the ranch

The ranch has suffered several challenges since its inception in 1991. The main challenges have ben related to egg collection, hatchability, survival of hatchlings and other age categories, diet, housing, health and sales of crocodile products. Issues

associated with these challenges were responsible for the suspension the ranch's operations between 1996 and 1999, and non-collection of eggs for some years. Specifically, the suspension by conservation authorities was based on observations of inadequate maintenance of facilities, recurrent diseases, lack of trained staff, insufficient documentation and overall poor management of the ranch. The emergence and persistence of the above challenges is presented below.

4.8 Egg collection, hatchability and mortality

The site for egg collection for the ranch is along the banks of the Victoria Nile between Murchison falls and L. Albert in MFNP. The collection is normally in the month of February before the eggs were about to hatch. However, the siting of nests and transportation of collected follows an approach that can best be described as rudimentary. This approach has not changed since the ranch's inception. The ranch personnel move to presumed nest sites using cues such as presence of females who usually guard their nests. The exact position of the eggs is determined if need be by plunging a sharp spike of about 1.0 m into a suspected nest. Confirmation of presence of a nest is through observation of fluids at the tip of the spike.

Thereafter, the ranch personnel excavate the nest and remove eggs, place them in plastic cans containing sand recovered from the same nest. The use of the same source of sand is done to ensure maintenance of the natural environment that is vital for the incubation process at the ranch. The top of the cans is open while the sides are drilled with holes to permit sufficient ventilation. In packing the eggs within the sand in the cans, caution is taken to ensure that each egg maintains its original position as it were in the nest. Each clutch of eggs is put in its own can and therefore eggs from separate nests are not mixed. Details of eggs per nest, number of rejects and locality are recorded.

According to records of egg collection (ANNEX X), the quotas issued to the ranch have greatly reduced in the recent years when compared to those issued in the first years of operation. In particular, from 1991 to 1995, the firm was issued an annual quota to the tune of 4000 eggs but in the period after 1999 to date the firm has received lower annual

quotas with the lowest registered at 500eggs in 2014 and 1000 eggs in 2022. Of the expected 132,000 eggs expected to have been collected in the last 33 years, only 70,900(53.70%) were permitted. But still, of the 70,900 eggs were permitted for MFNP between 1991 and 2023 42,321 (60%) were collected. According to UWA, reduction of quotas reflects loss of confidence in the ranch's capacity to handle higher quotas as earlier considered at the inception of the ranch, but also the suspicion that there were fewer nests seen overtime.

The incubation technology at the ranch has also not changed since the start of the ranch in 1991. At the ranch, the eggs in their cans are incubated in more or less artificial conditions. The cans with eggs are placed on shelves in a hatchery equipped with electric heaters and fans to control incubation temperature. Normally, the hatchery is constantly visited at least twice a day for any croaking or yelping when the hatchlings are ready to be dug out. After the eggs hatch, the sand is gently removed and hatchlings moved to a clean container in separate rooms from the hatcheries. The removal of hatchlings is a precautionary measure against premature hatching because, if the young are left in the hatchery, they may induce premature hatching of other clutches due to their cloaking sound. Not always do eggs from the same clutch hatch at once. Usually, the yet-to-hatch eggs are covered again with sand and such eggs tend to hatch a few days afterwards.

The results of hatchability ever since the ranch was established reflect two clearly marked phases, one of good performance and the other of poor performance. The good performance phase runs from 1991 to 1995 where hatchability ranged from 72 to 88% (Table 4.9). It is worth noting that this level of performance was witnessed when the ranch also had highest quotas for egg collection. Though not all hatching data was availed, the phase for poor performance starts in the year 1999 to date. During this phase, the ranch has not kept records for hatchability for a long period stretching. This makes the proper assessment of the ranch's performance on hatchability rather difficult but, nevertheless, it is worth recognizing that the ranch does not follow regulations as expected from conservation authorities. In the few years after 1999 when the ranch has kept records on hatchability, results have ranged from as low as 63 to 87% (Table 4.9).

Mortality at the ranch was monitored and records kept from 1991 to 1995 (Table 4.9). These records highlight that mortality was initially low at 8% in 1991 but rose to 52% but the ranch was able to lower it to 38% by 1995. Prior to 1999, the ranch was also charged with responsibility of ensuring successful re-introduction of juvenile *C. niloticus* from sites where it had collected eggs. This responsibility was reflected in the Crocodile Management Plan.

Specifically, in the plan, it was stipulated that the ranch was expected to return to MFNP juveniles *C. niloticus* with a size of 1.2 – 1.5 m long at the age of 2 -3 years at a female to male ratio of 4:1. To the contrary, when the ranch provided its first cohort of *C. niloticus* for reintroduction in MFNP in 1994, the female to male ratio was 2.7:1. In further contrast, the ranch delivered 86% undersize juveniles that were below 1.3m recommended in the Crocodile Management Plan. Further still, the ranch provided poor transport conditions that led to stress and, ultimately, death of many *C. niloticus*. Indeed, in the first cohort of translocation 4.2% of juveniles died during transportation and 20.2% before release. In total, 182 tagged juvenile *C. niloticus* were released in 5 different locations that had been previously surveyed and recommended as suitable for young *C. niloticus*. These locations were shallow back-waters that were not frequented by *C. niloticus*. The water in these locations was more or less still.

Preliminary studies were undertaken by then Uganda Institute of Ecology (UIE) until 1996 to establish the survival rate of released *C. niloticus* in MFNP. Unfortunately, it was observed that the survival rate of released juvenile *C. niloticus* declined considerably with time to as low as 5.5% of the released *C. niloticus* after 2 years. The main reason for the low survival rate was attributed to stress during translocation of the *C. niloticus* over long distances (440 km) from UCL to MFNP but also in overcrowded containers. Another factor suggested to explain the poor survival were poor adaption to habitat especially running water of River Nile before release which could drift the juvenile *C. niloticus* towards L. Albert, making them highly vulnerable to predation.

In 1996, crocodile egg collection from Murchison Falls National Park was suspended on grounds that the population of *C. niloticus* was bound to continue declining because of

on-going removal of eggs without satisfactory survival of re-introduced juveniles that were evidently unable to cope with the natural conditions of River Nile.

Despite the suspension, the ranch together with Makerere University and the Uganda Institute of Ecology, the research arm of Uganda National Parks, continued to conduct research on the general ecology of the *C. niloticus* in particular nesting ecology, the dispersal and survival patterns of juvenile *C. niloticus* released in MFNP. To date, this baseline data is still used as guide to support management and conservation of *C. niloticus* in MFNP. The same information triggered the resumption of ranch operations in 1999. Unfortunately, a spillover of poor management is detectable in the operations of the ranch even after resumption of operations. For instance, records for annual mortality are missing and the only option left is to compare egg collection records with those of exported skins in order to approximate the magnitude of mortality at the ranch. Export Figures suggest that much higher mortality than pre-1999 period, most probably between 41.6% (Table 4.9), was experienced at the ranch.

Table 4. 9: Egg collections, hatchability and mortality between 1991 and 1995

Year	Quota permitted	Eggs collected	No. of Nests	Rejected Eggs	Hatchability (No, %)	Mortality (No., %)
1991	4000	4050	76	400	3483, (86%)	288, (8%)
1992	4000	4025	*	644	3381, (84%)	560, (17%)
1993	4000	3244	*	908	2336, (72%)	1232, (52%)
1994	4000	3914	76	191	3405, (87%)	630, (28%)
1995	4000	3887	78	126	3536, (88%)	135, (38%)
Total	20000	19120		2269	16141, (82%)	2845, (28%)

Source: Researcher

4.7 Production of eggs from rescued problem *C. niloticus*

For the period 2004 to 2022, UWA has rescued 305 adult *C. niloticus* from 26 (17.8%) Districts representing 17.8%. However, 4 died before destination to the new habitat. Most rescues were from Apac (42) followed by Nakasongola (32) all found around Lake Kyoga that provided 20% following L. Victoria with 26% of all the rescues. A total of 126(42%) were females *C. niloticus* while 136(45%) were confirmed females. For a

wildlife ranch to be successful, it requires 126 adult females and 16males (Rooyen 2005). A total of 61 adult *C. niloticus* including 31 females, 23 males and 9 whose sex was not determined have been released to the two companies ranching *C. niloticus* in Uganda (Table 4.10, ANNEX W).

Table 4. 10: Destination sites and habitats of C. niloticus rescued as problem animals

Destination after Rescue	Female	Male	Unknown Sex	Total	%ge
Zoo Facility	8	7	3	18	6
Protected Area	87	106	27	220	73
Ranching Licensee	31	23	9	63	21
Total	126	136	39	301	
%ge	42	45	13		

Source: Researcher

CHAPTER 5: DISCUSSION

5.1 Population status

This study explored the population status in two prime habitats of *C. niloticus* in Uganda. These prime habitats were the northern shoreline of L. Victoria and the Victoria which a section of the River Nile that runs from Murchison Falls to Lake Albert. This section of the River Nile is located within the larger protected area known as Murchison Falls Conservation Area. Previous data on the population size for *C. niloticus* in Victoria Nile reflected a decline from 14.69 to 6.15 individuals per km in 1969 and 1991, respectively. However, results from this study suggest that the population of *C. niloticus* is on the rise again and today the encounter rate is estimated at 8.5 individuals per km.

As previously observed in 1969 and 1991, this study recorded the most number of *C. niloticus* along the stretch from the Falls to the Paraa crossing while the least number of *C. niloticus* at a density of 3 individuals per km was noted at the Delta region. In 1969, 84% of *C. niloticus* observations were registered along the Falls-Paraa crossing stretch but a lower percentage of 77% was reported for 1991. Moreover, the encounter rate of *C. niloticus* along this stretch had fallen from 25.79 to 9.85 individuals per km in the years 1969 and 1991, respectively. Fortunately, this study reveals that the crocodile population along the stretch is on an upward trend since encounter rates range from as low as 11.7 to as high as 30.7 individuals per km. The significance of the Falls-Paraa crossing is further emphasized by the proportion of *C. niloticus* currently present with respect to age categories. The Falls-Paraa crossing has the highest number of adults at 358 individuals representing two thirds (66%) of all adults encountered along the Victoria Nile during the study. More, the Falls-Paraa crossing harbors more than three quarters (84%) of all juveniles encountered along the Victoria Nile. More still, the same crossing contains more than half (54%) of all sub adults encountered along the Victoria Nile during this study. Overall, these observations highlight the importance of the Falls-Paraa crossing as a prime habitat for *C. niloticus* along the Victoria Nile.

Besides data on population size, support for recovery of crocodile population in Victoria Nile exists also from data on current population structure.

From the census of 1991, using Figures of spotlight surveys, the calculated population structure was 0.87:1.06:1 for juveniles, sub adults and adults respectively. This population structure reflected less recruitment as deduced from the observation that the juveniles were the lowest in number. In contrast, this study estimated a population structure of 1.5:1:2.5 for juveniles, sub adults and adults, respectively. The current structure demonstrates that more juveniles are born by an even higher number of adults than was the case previously. Surprisingly, the apparent recovery of the population in the Victoria Nile has taken place amidst annual harvesting of crocodile eggs by a single ranch that commenced its operations in 1991. This fact suggests that the current practice of harvesting eggs on quota basis is not detrimental to the crocodile population in this particular habitat and should continue to be recognized among the strategies for sustainable management of Uganda's crocodile population.

There are few reports documenting recovery of *C. niloticus* populations in areas where active egg collection is done. A recent study in the lower Zambezi reported a recovery of the *C. niloticus* population after encountering a density ranging from 1.4 to 3.1 individuals per km (Isberg, Combrink et al. 2019). The *C. niloticus* population in Victoria Nile habitat, at a density of 8.5 per km, is considerably at higher level than that observed by Isberg, Combrink et al. (2019). These two areas appear exceptional since most reports on *C. niloticus* across Africa demonstrate failure of recovery or further decline in populations. Failure of recovery has been documented in the panhandle region of the Okavango Delta in Botswana (Isberg, Combrink et al. 2019) and Loskop Dam at Olifants River in South Africa (Pooley, Botha et al. 2020). Still in South Africa, decline in populations has been recognized, particularly, in the Kruger National Park (McLoughlin, Riddell et al. 2021) and at Lake Sibaya (Pooley 2020). Further declines are expected for several populations under severe threat in countries like Mauritania (Naia and Brito 2021), Ghana and Cote-d'Ivoire (Aubert, Le Moguédec et al. 2021).

Despite covering a distance of 1,138km that was close to nine fold that of the Victoria Nile, this study sighted only nine *C. niloticus* along the northern shoreline of L. Victoria. This observation translates into an encounter rate of 0.0079 individuals per km. Though apparently low, this encounter rate should not be disregarded because the northern shoreline of L. Victoria is not a protected area and registers the highest incidence of human-crocodile conflicts in Uganda. The magnitude of the crocodile conflict is well understood by the local people whose estimate of crocodile population stands at 220. This estimate was derived from interactions with local people from 266 of the 310 villages that stretch across the 2,097 km- long northern shoreline of L. Victoria. Further, the local people reported that they had sighted crocodile nests on islands within the boundaries of Mayuge and Namayingo districts (Figure 4.9). However, arriving at a fairly accurate estimate is made difficult by lack of data on dispersal or movement range of either female or male *C. niloticus* in such a large water body as L. Victoria. Even then, after putting into consideration the average distance a crocodile could curve out as its core territory, a figure of 220 seems to be rather on the higher side.

A conservative territorial size would be at most 10km long and this would suggest presence of at least 210 *C. niloticus* across the 2,097km-long northern shoreline of L. Victoria. The territorial size estimate of 10km is based on several studies of the other crocodilians especially *C. porosus. C. porosus* , is an extensively studied species in South East Asia and Australia, and studies suggest that males, more than females, are able to travel distances of less than a kilometer to as much as fifty four kilometers daily depending on whether it is breeding or nesting season (Shaney, Hamidy et al. 2019, Rose, Fukuda et al. 2020). Moreover, this same species has been found to display variable site fidelity and high potential of homecoming even after translocation much farther away from their native habitats (Brackhane, Xavier et al. 2018, Than, Zaw et al. 2021). It has been observed that *C. niloticus* are able to travel long distances not only through active swimming but also through use of water currents (Rose, Fukuda et al. 2020).

5.2 Nature and pattern of human-crocodile conflict

The study found that the human-crocodile conflict was pronounced and on the increase in the two areas investigated. The conflict affected both life and property of the people with different socio-economic backgrounds. Moreover, the conflict affected the people in the two areas at different times within the day. Even though the people in the two areas were informed of the special conservation status of the *C. niloticus*, some of the countermeasures they used to mitigate the conflict were contrary to those proposed for a species of conservation concern. Similarities as well as variations in the nature and pattern of the conflict across the two areas are discussed in detail below. Most communities in affected areas still interact with waters infested with man eater *C.niloticus* using very rudimentary tools and systems making them more vulnerable (ANNEX I, ANNEX J).

The *C. niloticus* is recognized among the top dangerous predators responsible for continued increase of the human-wildlife conflicts especially across Africa (Isberg, Combrink et al. 2019, Rose, Fukuda et al. 2020). This observation is supported by results of this study specifically from the L. Victoria region. In particular, this study revealed that, between 1996 and 2009, there were 310 incidents of human- crocodile attacks recorded from around the L. Victoria study area and 32 incidents from the MFNP stretch. During this period, the human-crocodile attacks around L. Victoria registered a significant increase ($r = 0.717$, $P = 0.004$,) unlike those in MFNP ($r = -0.029$, $P = 0.921$, Fig. 9). Surprisingly, this increment has taken place despite the fact that most people (295, 95%) claim to have good awareness of crocodile behavior. Within the L. Victoria region, Namayingo and Mayuge have witnessed the highest number of human-crocodile attacks and both account for more than three quarters (77%) of all (270) human-crocodile conflicts recorded along the shoreline from 1996 to 2009 (Table 5). Mukono, Jinja and Busia districts follow in that order in terms of decreasing magnitude of conflict. The apparent increase of human-crocodile conflicts requires deeper scrutiny to ascertain the key drivers whose solutions should form the foundation of the species conservation and management plan in Uganda.

To the local community, the presumed rise in human-crocodile conflicts is linked to the perception that the *C. niloticus* population is on an upward trend. This perception is held by most people (92.9%) along L. Victoria shoreline and is corroborated with a statistically significant positive correlation between the number of *C. niloticus* attacks and estimated population size of *C. niloticus* per site (*r = 0.318, P = 0.04, N = 82*, Fig 9). However, owing to lack of sufficient systematic surveys on crocodile populations, it is quite to consider population increment as the major driver for rise in conflicts. Alternative explanations can be obtained from the socio-demographic profiles and behavioral practices of the victims.

This study observed that the victims of the attacks mostly lived close to the water shores. In the case of L. Victoria area, 84.3% (252) of the victims lived at the shores whereas in MFNP, all the 32 (100%) of the crocodile victims lived at the shores of the river. In terms of gender, most of the victims were male (94.2% (291) around L. Victoria; 68.8% (22) in MFNP). For employment, most of the male victims were fishmongers 65.5% (194) in the L. Victoria region and farmers 62.5% (15) in MFNP (Table 6). The location of attacks was in water in 97.1% (301) cases in L. Victoria region and involved people who were either fishing without boats (43%) or using a non-motorized boat (27%, Table 7) especially between 17:00hrs and 22:00hrs (Fig. 13).In contrast, the majority of people attacked by *C. niloticus* in MFNP were either bathing (50%) or fetching water (41%, Table 7) especially in the afternoon hours (Fig. 13). This study demonstrates that a remarkable conflict between *C. niloticus* and artisanal fishermen exists in the L. Victoria region as has been detected elsewhere in northeastern Namibia (Inman, Hobbs et al. 2020) and lower Zambezi (Nyirenda 2015). Similar to the lower Zambezi, the local people near MFNP utilize water for domestic activities and agriculture and this exposes them to danger from *C. niloticus* (Nyirenda 2015).

The main consequences of the crocodile attacks have been loss of human life and domestic animals. Specifically, around L. Victoria, 261 (84.2%) of the incidents were

fatal whereas in MFNP, 29 (90.6%) of the human-crocodile attacks resulted in death (Table 9). These fatality proportions are much higher than reported elsewhere. For example, in the Chiawa Game Management area in the lower Zambezi, fatality proportion stands at 62.2% (Isberg, Combrink et al. 2019). Attacks on domestic animals were reported by 105 (36.2%) of the respondents around L. Victoria and 17 (53.1%) from MFNP (Table 8). From the Table, it is evident that more types of domestic animals have been lost in the L. Victoria area than the MFNP. In the later, sheep, goats and cattle have been attacked by *C. niloticus* whereas in in the L. Victoria area, in addition to the three, ducks and dogs have been lost to *C. niloticus*. In the L. Victoria region, most people lost ducks, dogs, cattle and sheep whereas the majority in MFNP lost goats. These results underscore the seriousness of the human-crocodile conflict in L. Victoria region and MFNP. Extensive loss of domestic animals to *C. niloticus* has also been documented elsewhere in north eastern Namibia where it is estimated that 255 cattle are lost annually (Inman, Hobbs et al. 2020).

Substantial levels of loss of human life and property as a result of attacks tend to generate fear and hostility against *C. niloticus*. This fear largely explains the strategies people tend to adopt to deal with the menace from *C. niloticus*. The respondents in the study reported three major strategies that they consider appropriate to mitigate the human-crocodile conflict. The first strategy was migration from water sites where *C. niloticus* are regularly sighted. Of the three hundred ten respondents, 260 (84%) reported that they had used the migration strategy to avoid further attacks from *C. niloticus*. The second strategy utilized to mitigate crocodile conflict was killing. Surprisingly, this strategy is supported even though most respondents (90.7% from MFNP and 83.9% from L. Victoria region) admitted that they were aware that *C. niloticus* were protected species. Killing follows reports of problem *C. niloticus* by communities to local leadership as well as police force.

It was observed in this study that most people (295, 94.9%) reported the cases of problem *C. niloticus* mostly to the local authorities or police. However, successful killing was limited, witnessed by only 14 (4.5%) of respondents whereas unsuccessful attempts were

witnessed by 111 (36.8%) respondents. Unfortunately, the local people have very limited use for products from killed *C. niloticus*, the most prized being genitals, which are among the ingredients for traditional rituals. The third strategy people consider could assist in the mitigation of the conflict is the supply of piped water or construction of boreholes. This strategy was preferred by 174 (57.2%) of the respondents. Such a strategy has also been demanded by local communities in northeastern Namibia (Inman, Hobbs et al. 2020).

Despite the existence of a crocodile ranch in Uganda since 1991, it was surprising to note that translocation of problem *C. niloticus* to the ranch was not mentioned among the strategies for mitigating conflict. This reflected lack of awareness among local communities on alternative strategies to mitigate crocodile conflict. Indeed, this lack of awareness was supported by the observation that only 22% of respondents from MFNP and 58.7% from L. Victoria region were aware of the presence of crocodile ranching in Uganda.

5.3 Challenges affecting performance of ranch

Crocodile farming and ranching are central in promoting conservation as well as supplying the valuable products demanded by the international markets(CITES 2010). Farming and ranching were adopted after realizing that wild stocks of *C. niloticus* were on the brink of depletion at the hands of hunters interested in feeding the lucrative international market of crocodile-derived products. Efforts have been made to study and get to know the best conditions under which *C. niloticus* can be managed under captivity (Boucek, Heithaus et al. 2017). These conditions highlight minimum requirements for the keeping of *C. niloticus* in private and public institutions, important aspects such as the design of enclosures, secure handling and keeping, thermoregulation, protection of animals, feeding, behavioral enrichment and diseases and their prophylaxis (Boucek, Heithaus et al. 2017). In addition to the general, species-specific conditions have been identified for *C. mindorensis* (Brown, Shirley et al. 2021), *C. intermedius* (Moreno-Arias and Ardila-Robayo 2020, Larreal, Quintero-Torres et al. 2022), *C. porosus* (Brackhane, Xavier et al. 2018, Ghosh, Platt II et al. 2020, Webb, Manolis et al. 2021).

The management of *C. niloticus* under captivity has been going in Uganda since 1991. However, the ranch under UCL has experienced several challenges. This study observed that the ranch has faced challenges of reducing egg quotas, poor incubation technology, insufficient rearing facilities, inadequate food for *C. niloticus*, diseases, poor record keeping, fluctuating market demand and prices for skins and other products from *C. niloticus*, and insufficient technical capacity to effectively and efficiently manage the ranch. Some of the disease challenges especially in relation to Salmonella were also been detected on farms in Botswana (Le Roux 2020). Overall, the performance of the ranch has been unsatisfactory but since the market for skins exists, the ranch should be encouraged to continue its operations though under stricter monitoring to ensure adherence to better benchmarks.

5.4 Limitations of this study

The study was unable to cover other essential *C. niloticus*' habitants within the study areas. The survey on L. Victoria could have covered the districts of Kalaanga District, Mpigi Masaka and Kyotera. Also, the part of the lake in Kenya and Tanzania need to be explored for presence and absence. Including such areas can support the L. Victoria management initiatives under the East African Community. At Murchison Falls Conservation Area, the part of Victoria Nile between the falls and Karuma bridge could have been part of the study to give a full crocodile situation of the protected zone. The area not covered includes the part where 201 (65%) of the problem *C. niloticus* have been translocated.

The crocodile survey was done 13 years since the last study that was done, and was generally rapid in preparation of ranching proposal to CITES. There were very few IN-country experts with local knowledge on the crocodile conservation or literature to refer too. It was also very difficult to get information from the ranchers, the companies licensed to carry out ranching in Uganda. As such, data on mortality was grossly missing. This could have given us a bigger impression of the ranching challenges in Uganda.

Lastly, the study could have covered more years of conflict survey but there was limited resources, hence the 1996 to 2009 data was used.

5.5 Recommendations

1. Censuses should be conducted for other aquatic ecosystems where *C. niloticus* are known to occur
2. Studies on ranging patterns of *C. niloticus* in L. Victoria should be undertaken to enable calculation of better estimates of population size and structure of the *C. niloticus* within this ecosystem
3. Investigations aimed at locating nest sites of *C. niloticus* should be planned and executed in order to identify potential sources for eggs for ranchers as well as manage population growth of *C. niloticus* in this ecosystem
4. Boreholes should be constructed for communities along water courses where *C. niloticus* exist
5. Campaigns to raise awareness on the predisposing factors to crocodile attacks should be conducted by responsible authorities to eliminate risks from crocodile attacks.
6. Efforts to trap and translocate problem *C. niloticus* should be intensified.
7. Initiatives integrating local communities into alternative uses of *C. niloticus* such as development of tourism should be supported by responsible authorities.
8. A crocodile farm based on utilization of adult captured problem *C. niloticus* for provision of eggs for ranching should be established, preferably along L. Victoria and Lake Kyoga where the numbers will evidently support the initiative.
9. In line with the above, capture and auction of problem *C. niloticus* to prospective ranchers should be given attention by the government.
10. A crocodile incubation facility should be set up in the vicinity of the Victoria Nile to enhance hatchability and survival of hatchlings that should be marketed to prospective crocodile farmers. This approach is more profitable than allowing a single rancher whose incubation technology and hatchling management skills have not shown satisfactory improvement in a very long time.

11. Current rancher and prospective farmers should be regular monitored to ensure their compliance to prescribed management and technical skills benchmarks. Noncompliance should be made unattractive through suspension or withdrawal of operational licenses.
12. Conservation authorities should engage in regular ecological monitoring of crocodile habitats in order to gather information necessary for enhancing conservation and management of *C. niloticus* in Uganda.
13. Conservation authorities should also support research in feeding and disease management of *C. niloticus* especially under captivity.
14. Uganda should consider submission of amended ranching proposal to CITES Secretariat in line with Res.Cof 11.16 that requires any changes in the original proposal on ranging to be shared and approved.
15. The is a need for a studay to reevaluate the performance of *C. niloticus* captured and relocated as problem animals. Since a number are taken to protected areas 65%, there is need to investigate the extent this approach is helping conservation of *C. niloticus* in Uganda.

5.6 Conclusions

This study estimated the population size of *C. niloticus* as 1,102 for Victoria Nile and 210 along the northern shoreline of L. Victoria. The population structure of *C. niloticus* was estimated for only the Victoria Nile and this was 1.5:1:2.5 for juveniles, sub-adults and, adults respectively. The distribution of the *C. niloticus* was not uniform with most crocodiles of all three age categories observed along the Murchison Falls-Paraa crossing at densities ranging from 11.7 to 30.7 individuals per km. The Delta region of the Victoria Nile registered the least number of crocodiles at a density of 3 individuals per km. With respect to age, the Falls-Paraa crossing still has the highest number of adults at 358 individuals representing two thirds (66%) of all adults encountered along the Victoria Nile during the survey. Similarly, the Falls-Paraa crossing harbors more than three quarters (84%) of all juveniles encountered along the Victoria Nile. Furthermore, the same crossing contains more than half (54%) of all sub adults encountered along the

Victoria Nile during the survey. In general, the above underscores the significance of the Falls-Paraa crossing as a prime habitat that should be kept intact to promote conservation of *C. niloticus* in Uganda.

The human-crocodile conflict is present and intense on the shores of L. Victoria and River Nile with reports revealing that, between 1996 and 2009, there were 310 incidents of human crocodile attacks recorded from around the L. Victoria study area and 32 incidents from the MFNP stretch. This conflict mainly affects men who go fishing during the night without using motorized boats in the waters of L. Victoria. Along the River Nile, men are also most affected though such men are mainly farmers who prefer to wash their bodies in the water and also collect water for domestic use. Most encounters have been fatal for both people and livestock. Even though killing has been practiced as response to problem *C. niloticus*, few *C. niloticus* have been successfully killed and the conflict has intensified over the years along the L. Victoria shores. Alternatives to killing have been suggested and these are construction of boreholes and provision of piped water in addition to evacuation of the affected of the affected personnel.

This study identified the challenges that affect performance of the crocodile ranch as reducing egg quotas, poor incubation technology, insufficient rearing facilities, inadequate food for *C. niloticus*, diseases, poor record keeping, fluctuating market demand and prices for skins and other products from *C. niloticus* and, insufficient technical capacity to effectively and efficiently manage the ranch.

Uganda's rescue and relocation of problem *C. niloticus* has led to survival of 220 *C. niloticus* in the last 20 years which is a recognizable management approach. As human population continue to increase and interaction with crocodile habitats, this approach, once sustained may be a good conservation case to follow and study its effects.

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ANNEX 1

DATA SHEETS FOR CROCODILE SURVEYS

Date: **Start Time:** **Air Temp:**

Zone Name: **Start.36N:** **HO_2 Temp:**

Start Name: **Start.UTM:** **Water level:**

End Name: **End.36N:** **Cloud:**

Dist (km): **End.UTM:** **Moon:**

Av. Speed: **End Time:**

Time	Grid E	Grid N	Adults	Sub-Adults	Juveniles	Yearlings	EO	Total	Dist (m) to animal	Behaviour (active/ inactive)	HO_2 condition (rain, wind/ waves)	Habitat (Dense/Open)
	36N	UTM										
	36N	UTM										
	36N	UTM										
	36N	UTM										
	36N	UTM										
	36N	UTM										
	36N	UTM										
	36N	UTM										
	36N	UTM										
	36N	UTM										
	36N	UTM										
	36N	UTM										
	36N	UTM										
	36N	UTM										
	36N	UTM										
	36N	UTM										
	36N	UTM										
	36N	UTM										

ANNEX B

CROCODILE CENSUS PHOTOGRAPHS

Fig. A.1. Spotlight equipments for census on L. Victoria and MFNP

Fig. A.2. Chargers for spotlights equipment

Fig. A.3. Daytime scanning of shoreline, Lake Victoria

Fig. A.4. Daytime scanning of shorelines, L Victoria

Fig. A.5. Daytime *C.nilotics* sightings at Delta zone, MFNP

Fig. A.6. Daytime *C.niloticus* sightings at Delt, MFNP

Fig. A.7. Adult *C.niloticus* night sighting using spotlight, MFNP

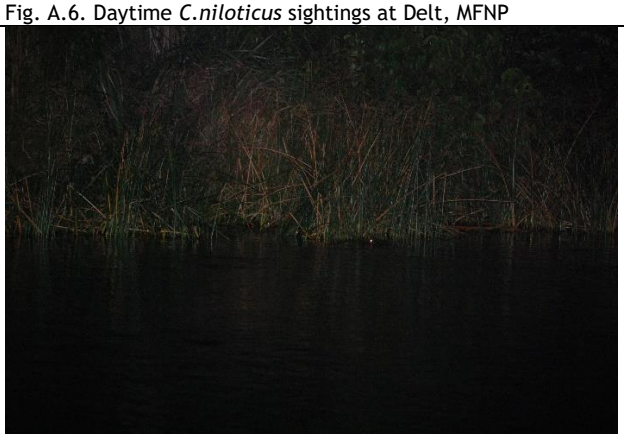


Fig. A.8. Hatchlings *C.niloticus* night sighting using spotlight, MFNP

ANNEX C

NEST COUNT DATASHEET

Category	Sub-category	Response				Remark
		Nest Site 1	Nest Site 2	Nest Site 3	Nest Site 4	
Location & Environment	Run No.					
	Way Point					
	Date					
	Time					
	Name of place					
	36N					
	UTM					
	Shading (Full shade, Partial shade, Full sun)					
	Distance searched to Left (m)					
	Distance searched to Right (m)					
Nests Condition	No. of nests seen					
	No. destroyed/damaged					
	Extent of damage (all, half,)					
	Likely cause of damage floods, predators					
	Av. dist. from water to first nest (m)					
	Av. dist. from water to last nest (m)					
	Av. height above water (m)					
	Nearest dist from each other (m)					
	Longest dist from each other (m)					
Habitat	Sandy					
	Short grass					
	Swampy					
	Cliffs					
	Open cover					
	Dense cover					
	Others (specify)					
Utilization	No. of nests opened					
	Nos. of eggs taken					

Filled by……Date completed……Tel……Sign……..

Data Sheet No…….

ANNEX D

CROCODILE NEST SURVEYS AND EGG COLLECTION

Fig. A.9. Survey crew approaching a nesting area as an adult female *C.niloticus* runs to water MFNP

Fig. A.10. Signs *C.niloticus* nesting point, belly 'stamp' MFNP

Fig. A.11. Open patches showing *C.niloticus* nests at, MFNP

Fig. A.12. Signs *C.niloticus* nesting point, belly 'stamp', MFNP

Fig. A.13. Removing *C.niloticus* eggs from nest, MFNP

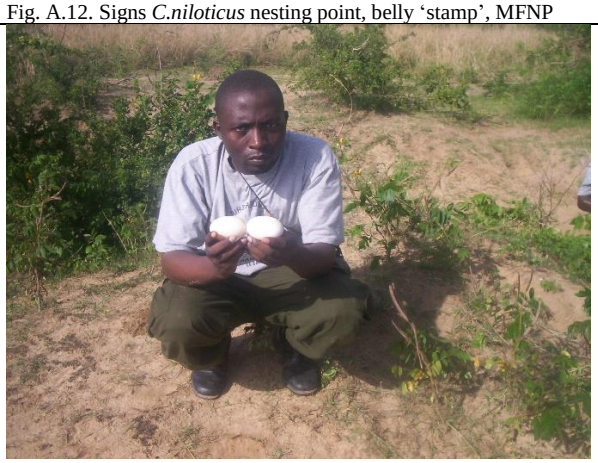


Fig. A.14. Examining the fertility of eggs of *C.niloticus*, MFNP

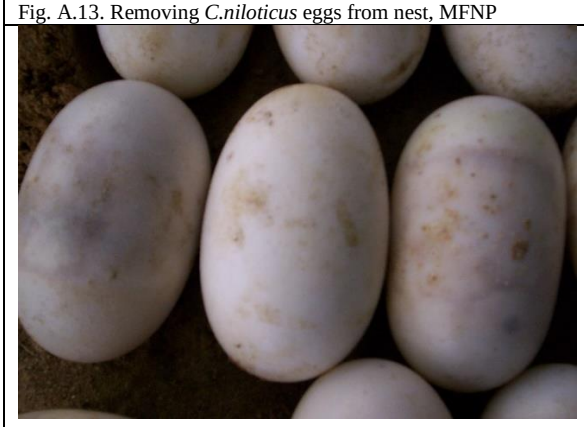


Fig. A.15. Fertilised egg (in between) of *C.niloticus* compared with rotten eggs on sides, MFNP

Fig. A.16. Infertile (left) and fertile(right) eggs of *C.niloticus* using natural light view technology, MFNP

ANNEX E

GUIDING QUESTIONS ON INDIGENOUS KNOWLEDGE OF CROCODILES

SECTION A: LANDING SITE PROFILE

Qn1.1: Village /Landing Site Name: ……..	**Qn1. 2:** Parish ……	**Qn.1.3:** Sub county …… …	**Qn 1.4 :** County …… ….	**Qn 1. 5:** District ……
Qn1. 6: GPS Coordinates 36N……	**Qn1. 7:** GPS Coordinates UTM……	**Qn.1.8:** Date of Visit ……	**Qn.1.9:** Time of Visit …….	
Qn.1.10: Estimated Male Respondents ……..	**Qn.1.16:** Estimated Female Respondents ……..	**Qn.1.17:** Estimated Child Respondents ……..	**Qn.1.18:** Estimated Total Number of Respondents **……**	

Qn 1.19: Physical location of landing site 1. Bay (Kyondo) 2. Open Beach 3. Note sure 4. Others (specify)	**Qn. 1.20: Fishing Method (multiple)** 1. Gill netting (boda) 2. Light fishing (omukene) 3. Hook fishing (okuloba) 4. Long lining (malobo)	**Qn.1.21: Other Fishing Methods (multiple)** 1. Cast netting (tupa-tupa) 2. Boat seining (bungulubu) 3. Beach seining (kokota/ligogo) 4. Fish poisoning (guma ofwe) 5. Trap and basket (omukono)	**Qn: 1.22: Navigation Challenges (multiple).** **1.**Many under-water rocks. 2. Under water rocks 3. Very Strong Waves. 4. Strong waves 5. Vey shallow water. 6. Shallow water 7. Others (specify)….
Qn.1.23: Nets met before landing site 1. Yes **2.** No	**Qn.1.24: Nets cut before landing site (in whole number)** …….	**Qn.1.25: Nearby Vegetation type:** 1. Hard and flat; 2. Bare rocks; 3. Open sandy; 4. Open grass; 5. Scattered trees; 6. Closed swamps; 7. Open swamps; 8. Shrubby; 9. Forested; 10. Others (specify)……	

SECTION B: HUMAN-CROCODILE CONFLICT

Qn2.1.: Estimated number of people attacked at/ near landing site (3km radius) since 1996	**Qn.2.2: When last person was attacked** Month……Year……	**Qn.2.3:** Estimated number of mature crocodiles killed/captured at or near site (3km radius) since 1996 ……	**Qn.2.4: When last crocodile was killed** Month……Year……
Qn.2.5: Presence of crocodiles damaging nests 1. Yes 2. No	**Qn.2.6: Size of crocodiles last captured in nests** 1. None ever 2. Young crocodiles 3. Mature crocodiles	**Qn.2.7: When was/were the last crocodile(s) captured in fish net?** Month……Year……	**Qn.2.8: How often are crocodile capture in nest** 1. Daily 2. Weekly 3. Monthly 4. Yearly 5. Irregular

SECTION C: LANDING SITE/VILLAGE CONTACTS

Qn3.1: Contact Name……. Tel……..	**Qn3.2: BMU Chairperson** Name……. Tel……..	**Qn3.3: LC1 Chairperson** Name……. Tel……..	**Qn3.4: Complied by:** Name……. Tel……..

SECTION D: CROCODILE POPULATION STRUCTURE, ABANDANCE AND DISTRIBUTION

Qn	question	answer and options		code	skips & remarks
4.0 Historical Presence AND Abundance of Crocodiles					
4.1	Have you ever seen crocodiles (within 3km radius) since the establishment of this landing site/village?	YES	1		If 2, end interview
		No	2		
4.2	When was/were crocodile(s) first seen?	Time immemorial	1		
		Others (Month……Year……)	2		
4.3	Have you ever seen more than one mature crocodile at the same time (together) at/near (within 3km radius) this landing site?	Yes	1		If 2, skip to 5.1
		No	2		
		Not sure	3		
4.4	If you have seen more than one, how many did you see last?		.....		
4.5	If you have seen more than one, when did you last see them?	Month…… Year……			
5.0 Recent Sightings: Mature Crocodiles					
5.1	How many mature crocodiles were last seen? *(in whole numbers)*				If '0' seen, skip to 6.1
5.2	When did you see mature crocodiles?	Month…… Year……			
5.3	Where did you see mature crocodiles?	Name……..……			
		Distance (km)……			
		Direction……			
5.4	How often do you see mature crocodiles?	Daily	1		
		Weekly	2		
		Monthly	3		
		Once in a year	4		
		Very irregular	5		
		Not sure	6		
6.0 Recent Sightings: Young Crocodiles					
6.1	How many young crocodiles were seen last? *(in whole numbers)*				If '0' seen, skip to 7.1
6.2	When did you see young crocodiles?	Month…… Year……			
6.3	Where did you see young crocodiles?	Name……			
		Distance (km)……			
		Direction……			
6.4	How often do you see young crocodiles ones? *(see Qn 5.4 above)*	1,2,3,4,5, or 6	…….		
7.0 Recent Sightings: Crocodile nests					
7.1	How many crocodile nests were seen last *(in whole numbers)*				If '0' seen, end here!
7.2	When did you see the last crocodile nests?	Month…… Year……			
7.3	Where did you see the last crocodile nests?	Name……..……			
		Distance (km)……			
		Direction……			
7.4	How often do you see crocodile nests ones? *(see Qn 5.4 above)*	1,2,3,4,5, or 6	…….		

Do you have any related questions that you want to ask or any other information that can be shared on crocodiles? Thanks

ANNEX F

FIELD DATA COLLECTION EXPERIENCES AND CHALLENGES

Fig. A.17. Conducting FGD under shade, L.Victoria

Fig. A.18. Conducting FGD in a survey boat, L. Victoria

Fig. A.19. Strong waves that sometimes-stopped surveys, L. Victoria

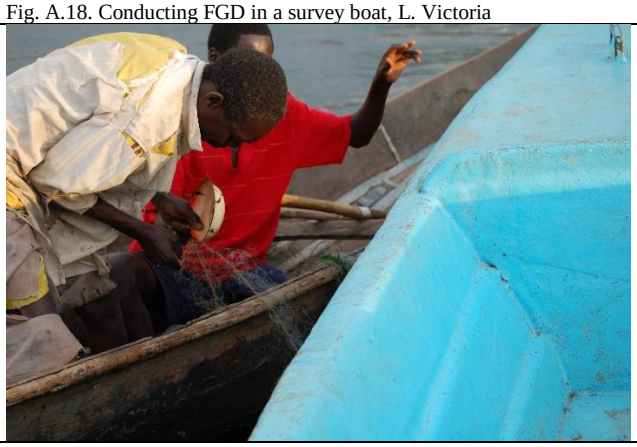


Fig. A.20. Several fish gill nets holding survey engine propellers, Victoria

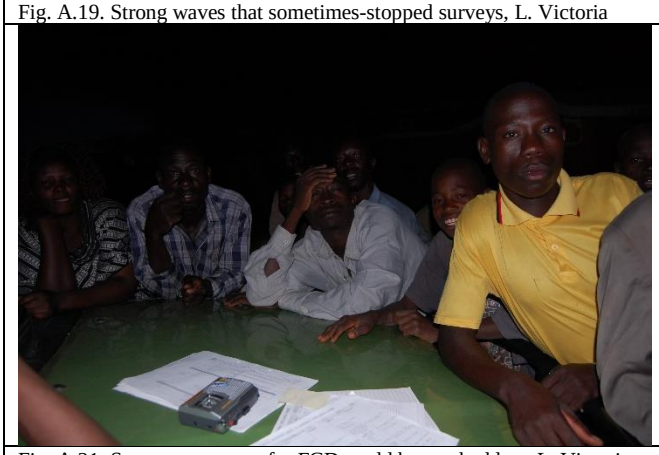


Fig. A.21. Some target areas for FGD could be reached late, L. Victoria

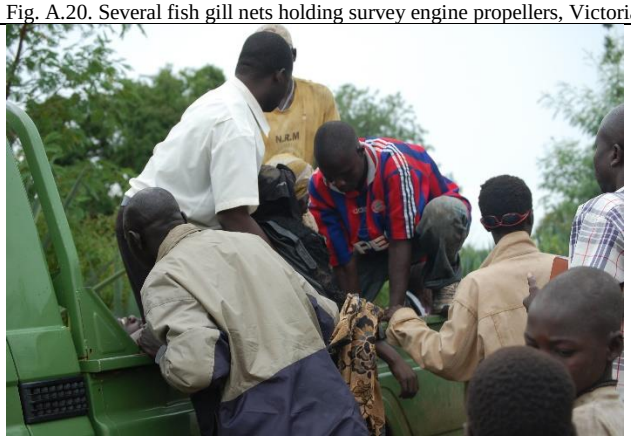


Fig. A.22. Survey team sometimes involves to HCC rescues, MFNP

Fig. A.23. Several protruding and underwater rocks damaged the survey boat engine boat, L. Victoria

Fig. A.24. Community HCC structures blocked some survey routes, Busia L. Victoria

ANNEX G

HUMAN-CROCODILE CONFLICT QUESTIONNAIRE

(to fill one form for each report of attack that caused injury or death to humans or livestock. Note any remarks in side margins)

Introduction

My name is ……. and we are conducting a survey on human crocodile conflict around Lake Victoria. The information collected may help to start programs that will lead to reducing crocodile death and damages. Your village/your household has been selected to represent the wider community to provide the information related to crocodiles. Kindly, give us your honest responses to our questions so that we can be able to plan and improve the safety of the people in this village.

Date: _____ Respondent ID Number: _____ Respondent Victim: _YES_____No_____(if no, do not fill question 1.13-1.18)

SECTION A: PROFILE OF VICTIM AND HOUSEHOLD (in this section, circle the right answer)

Village name of victim' s usual residence :	**Qn1.1.** Is the victim's village at the shoreline? 1. Yes --- 2. No	***Qn1. 2*** *If not at shoreline*: What is the Distance? 1. Less than-1Km 2. 1Km-3km 3. 3km-5km 4. Above 5km		**Qn.1.3**. **Parish**	**Qn 1.4** Sub-county	**Qn 1. 5.** District / **Qn 1.6.** Ethnicity/Tribe of Household
Qn **1.7.** **Name of victim**	**Qn1.8.** **Age of victim** ____.years	**Qn1. 9.** **Sex of victim** 1. Male 2. Female	**Qn1. 10.** **Marital status of victim** 1. Single 2. Married 3. Separated/Divorced 4. Widow(er) 5. Single with children 6. Married with children 7. Separated with children 8. Widow(er) with children	**Qn1. 11.** **Education level of victim** 0. None 1. Primary 2. Lower Sec. (S1-2) 3. Upper Sec. (S3-6, TTCs) 4. Above Sec. (Specify – 5. Other	**Qn 1.12 Usual activities of victim (multiple)** 1. Fish monger 2. Boat owner 3. Fish processing 4. Farmer 5. Hotel/Restaurant operator 6. LC leader 7. LG leader (LC3 or 5) 8. Others (specify)	
(If respondent is not a victim) Qn **1.13** **Name of Respondent:**	**Qn. 1.14** **Age of respondent** ____years	**Qn.1.15** **Sex of Respondent**: 1. Male 2. Female	**Qn.1.16** **Relationship to the victim** 1. Wife 2. Husband 3. Friend 4. Child *(only if >18 yrs)* 5. Other (specify ---	**Qn. 1.17** **Educ. level of respondent** 1. None 2. Primary 3. Lower Sec. (S1-2) 4. Upper Sec. (S3-6, TTCs) 5. Above Sec. (Specify – 6. Other	**Qn 1.18** **Usual activities of respondent (multiple)** 9. Fish monger 10. Boat owner 11. Fish processing 12. Farmer 13. Hotel/Restaurant operator 14. LC leader 15. LG leader (LC3 or 5)	
Qn. 1.19 **Average annual household income** 1. < 100,000 Shs 2. 100,000 - 500,000 Sh 3. 500,001 - 1,000,000 4. > 1,000,000 Shs	**Qn.1.20** **Roof type** 1. Iron sheets 2. Reeds 3. Others ----------	**Qn.1.21** **Wall type** 1. Bricks 2. mud and wattle 3. grass 4. Others ----------	**Qn.1.22** **Main source of Income** 5. Sale of livestock products 6. Fishing 7. Transfer earnings 8. Trade 9. Other(s) specify……	**Qn.1.23** **Direct Dependence on crocodile habitats water** 1. Drinking 2. Fishing 3. Irrigation 4. Washing 5. Cleaning utensils 6. For Livestock	**Qn.1.24** **Time of Use of Water from Lake /River** ***Activity Time*** 1. Drinking---------- 2. Fishing---------- 3. Irrigation---------- 4. Washing---------- 5. Cleaning utensils---------- 6. For Livestock----------	

SECTION B: Human – Crocodile Conflict

Qn. No.	Question	Answer and options		Code	Skip
2.0 Reporting					
2.1	Was the crocodile attack reported?	YES	1		If 2, skip 2.5
		No	2		
2.2	Who reported the crocodile attack?	Victim	1		
		Other (specify	2		
2.3	To whom was the report made?	LCI	1		
		Police	2		
		Health	3		
		UWA	4		
		Others (specift)…	5		
2.4	Date reported (dd/mm/yr)	……..			
2.5	Date attacked (dd/mm/yr)	……..			
3.0 Attack site/scene					
3.1	Actual location of attack (village or nearest known village)	……..			
3.2	GPS Coordinates at interview area	WP…… 36N…… UTM……			
3.3	Estimated Distance (Km) from interview area to area of attack				
3.4	Time of attack (in am/pm)	……..			
3.5	Type of water during attack	Lake	1		
		River	2		
		Swamp	3		
		Others (specify)…….	4		
3.6	Witness before attack	YES	1		
		No	2		
3.7	How many people around at time of attack	Alone	1		
		Two	2		
		More than 2	3		
3.8	Activity before attack	Fishing in a boat (without engine)	1		
		Fishing in boat (with engine)	2		
		Fishing not in boat	3		
		Fishing from land	4		
		Bathing/swiming	5		
		Collecting water	6		
		At water edge	7		
		Leaning out of boat into water	8		
		Getting into boat	9		
		Asleep on beach/near water	10		
		Near crocodile nest	11		
		Others (specify) ……..	12		
3.9	Person killed during attack	YES	1		If 2, skip to 3.11
		No	2		
3.10	Body recovered	YES	1		
		No	2		
3.11	Survived but died later	YES	1		If 2, skip to 3.13
		No	2		
	Survived with injury	YES	1		

3.12		No	2		
3.13	Went to hospital	YES	1		
		No	2		
3.14	Part of the body affected eg leg, arm, stomach etc)	Describe damage here!			
4.0 Action to the attacker crocodile					
4.1	Crocodile killed later	YES	1		If 2, skip to 4.4
		No	2		
4.2	Killed by whom?	Vermin Officer	1		
		Police	2		
		LDU	3		
		Community	4		
		Others (specify)	5		
4.3	Crocodile attached the same killed	YES	1		
		No	2		
		Not sure	3		
4.4	Attempted to hunt for it but failed to kill any	YES	1		
		No	2		
4.5	Size of crocodile attacked	Large	1		
		Medium	2		
		Small	3		
4.6	What are you doing or what have you done to avoid future attacks	No going to water	1		
		Migrated	2		
		Non	3		
		Other	4		
5.0 Awareness of crocodile conservation					
5.1	Do you know that crocodiles are protected species	YES	1		
		No	2		
5.2	Do you think crocodile population is increasing or decreasing here	YES	1		
		No	2		
		Reason……...	3		
5.3	Have you seen crocodile in the wild	YES	1		
		No	2		
		No	2		
5.4	Awareness on crocodile behavior (why, when, where, and what it attacks. to be assessed by interviewer)	Very good	1		
		Good	2		
		Poor	3		
5.5	How many crocodiles do you think are available in your area of operation (fishing village and elsewhere you fish)	……			
6.0 Dependency on water					
6.1	Do you go fishing	YES	1		If 2, skip to 6.4
		No	2		
6.2	Mode of fishing	Gill net	1		
		Hooks	2		
		Other(specify)	3		
6.3	How long have you been fishing (in years)	……..			

6.4	Is the lake the only source of water for drinking	YES	1		
		No	2		
6.5	Would supply of piped water or rain water harvesting stop your interaction with crocodile waters	YES	1		
		No	2		
6.6	Have crocodile ever attacked your livestock?	YES	1		If 2, skip to 7.1
		No	2		
		NA	3		
6.7	If 1 in above, how many have been killed so far were killed	Sheep	1		
		Goat	2		
		Cattle	3		
		Other (specify)	4		
		Ducks	5		
		Dogs			
7.0 Crocodile uses					
7.1	Do you have any positive use from crocodiles	YES	1		If 2, skip to 7.3
		No	2		
7.2	If yes, what part of the crocodile do you use	Collect eggs	1		
		Skin	2		
		Meat	3		
		Other(specify)	4		
7.3	Are you aware that there crocodile farming in Uganda	YES	1		
		No	2		
		Not sure	2		
7.4	Are you aware of crocodile damaging fishnets in this area?	YES	1		
		No	2		

Do you have any questions that you want to ask about the interview or any other information that can be shared on crocodiles? Thanks

Filled by……Date completed……Tel……Sign……..

ANNEX H

HUMAN NEGATIVE IMPACTS ON CROCODILE

Fig. A.25. Poachers or retaliatory. Using poached rotting hippo skin to trap *C.niloticus* in Bulisa District, MFNP

Fig. A.26. Survey crew removing a laid crocodile wire snare associated with bait for *C.niloticus* under Fig.A25. Bulisa District, MFNP

Fig. A.27.Plunging of a sharp spike in suspected nest areas to harvest *C.niloticus* eggs by Uganda Crocs Ltd staff, MFNP

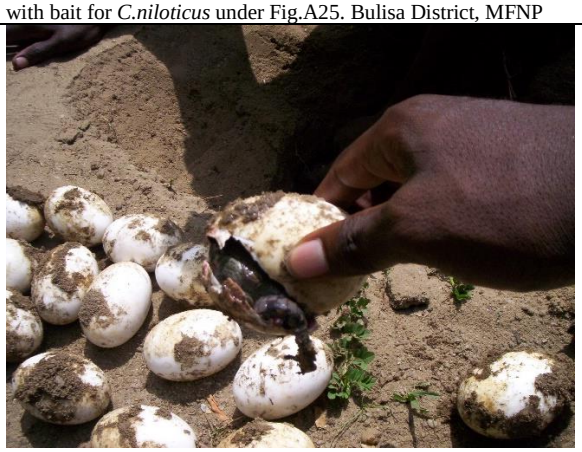


Fig. A.28. Damaged *C.niloticus* about to hatch egg due to the plunging of a sharp spike in suspected nest areas staff, MFNP

Fig. A.29.Tourist boats whose presence scares off mother *C.niloticus* from their nests, exposing them to predators, MFNP

Fig. A.30. Blocked water water-ways preventing adult crocodiles and survey crew from reaching a lagoon at Busia, L. Victoria

ANNEX I

HUMAN HABITS THAT INCREASE VULNERABILITY TO HCC

Fig. A.31. Open watering of livestock in *C.niloticus* habitat, L.Victoria

Fig. A.32. Washing clothes by women in *C.niloticus* habitats, L.Victoria

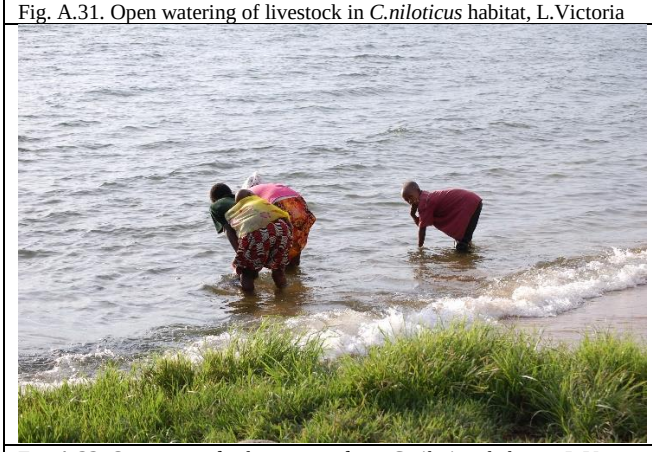


Fig. A.33. Open water fetching water from *C.niloticus* habitats, L.Victoria

Fig. A.34. Open hook fishing in *C.niloticus* habitats, L.Victoria

Fig. A.35. Using small fishing boats in C.niloticus habitats, L.Victoria

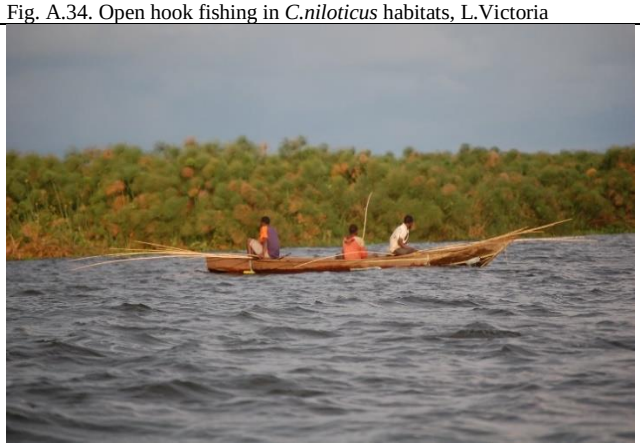


Fig. A.37. Stationary boat/hook fishing in *C.niloticus* habitats, L.Victoria

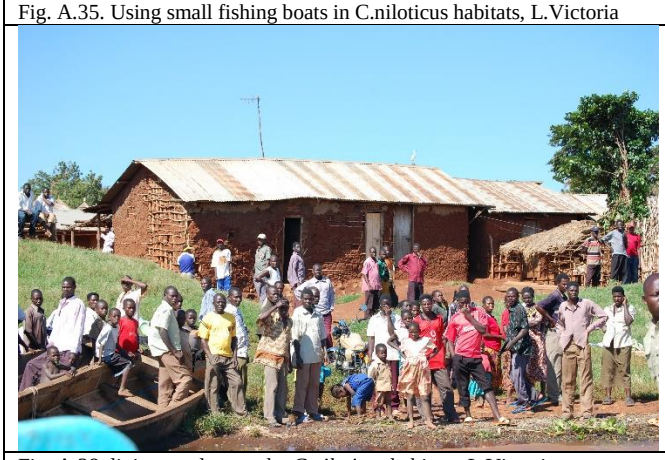


Fig. A.38. living so close to the *C.niloticus* habitats, L.Victoria

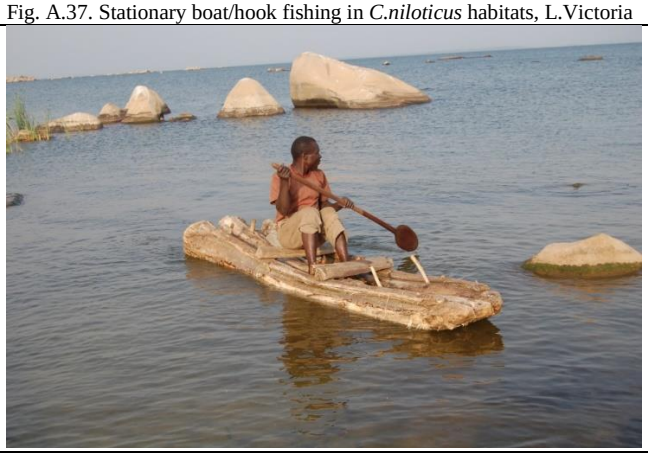


Fig. A.39. Using local boats for transport in *C.niloticus* habitats, L.Victoria

ANNEX J

NEGATIVE IMPACTS OF C.niloticus ON HUMANS AND MEASURES TO REDUCE RISKS

Fig. A.40. Living with trauma and scare after *C.niloticus* attack, two surviving victims showing injuries to survey crew at Packwach MFNP

Fig. A.41. Disabled victim after encounter with on *C.niloticus* habitats, L.Victoria

Fig. A.42. Using big boat engines to scare problem *C.nilotics*, Victoria

Fig. A.43. Construction of water fetching enclosure to avoid problem *C.niloticus* habitats, MFNP

ANNEX K

KEY INFORMANT INTERVIEW GUIDE

Introduction

I am ……. conducting an academic study on the crocodile census, surveying human-crocodile conflict, and identifying challenges related to crocodile ranching in Uganda. The study areas include Lake Victoria and Murchison Falls, crocodile ranching sites/farms, and relevant government offices. You have been identified as a critical informant in this study. The information collected may help to start programs that will reduce crocodile-related damages and ranching such that their management and conservation is enhanced. Kindly, give share your honest responses to the following questions

Date: _____ Respondent ID Number: _____

RESPONDENTS FROM GOVERNMENT AUTHORITIES

Name of Institution: _____Location_____

1. What are your particulars (names, official titles, and what you generally)?
2. How is the human-crocodile conflict manifesting, and what are you doing to address the challenges?
3. What are the challenges facing crocodile ranching in Uganda, and what are you doing to address them?
4. If you have some data/information related to the above, share it with me on my email ssamanya@gmail.com

RESPONDENTS FROM CROCODILE RANCHING COMPANY

Name of COMPANY: _____Location_____

1. What are your particulars (names, official titles, and what you generally)?
2. How is the human-crocodile conflict, and what are you doing to participate in addressing challenges?
3. What are the challenges facing crocodile ranching at your company what are you doing to address them?
4. If you have some data/information related to the above, share it with me on my email ssamanya@gmail.com

Do you have any questions that you want to ask about the interview or any other information that can be shared on crocodiles? Thanks

Interview conducted by ……Date and time of interview…….

Tel……..……Sign……

ANNEX L

CAPACITY BUILDING ON CROCODILE STUDIES

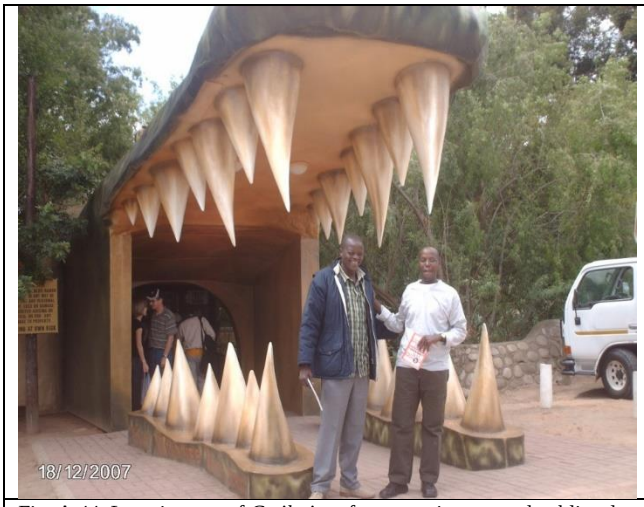


Fig. A.44. Learning use of *C.niloticus* for entertainment and public education as well as species promotion/popularization. Site visit at Cango Wildlife Ranch with Supervisor in Western Cape, South Africa, 2007

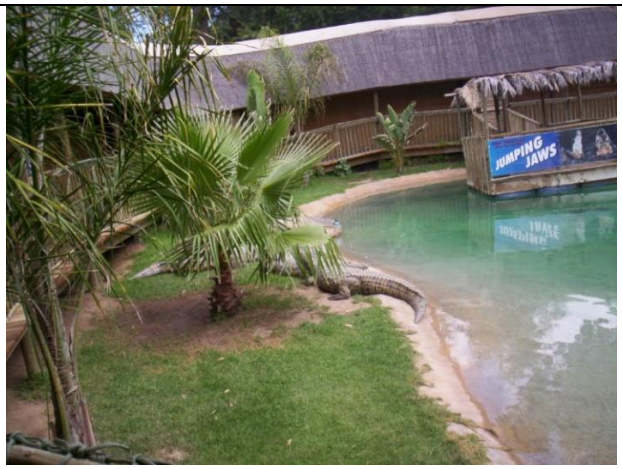


Fig. A.45. Learning safety construction designs for *C.niloticus* for public viewing for education. Site visit at Cango Wildlife Ranch in Western Cape, South Africa, 2007

Fig. A.46. Learning mixed use of *C.niloticus* for public viewing for education and adult stock for eggs production for ranching program. Site visit at Nairobi Park, Kenya,2014

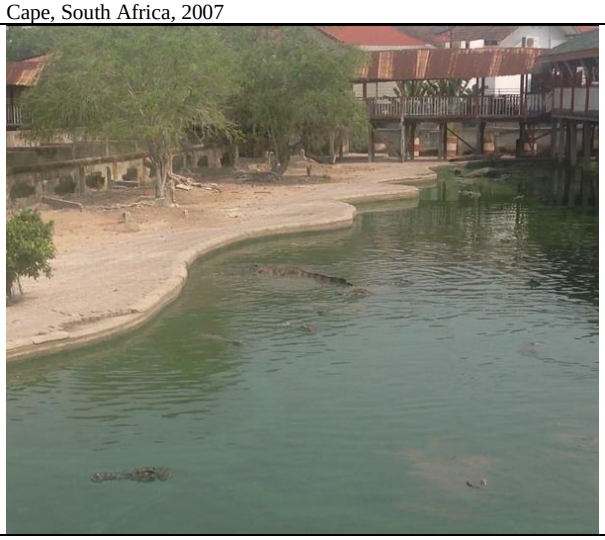


Fig. A.47. Learning safety construction designs for public viewing for education and adult stock for eggs production for ranching program. Site visit at Bankok Thailand 2013

Fig. A.48. Learning preparation and release of on-farm grown juvenile *Caiman yacare* to the wilderness. Site visit at Santa Fe, Argentina 20214

Fig. A.49. Learning and participation of actual release of on-farm grown juvenile *Caiman yacare* to the wilderness. Site visit at Santa Fe, Argentina 20214

ANNEX M

CAPACITY BUILDING ON CROCODILE STUDIES

Fig. A.50. Learning capture and release of *C.niloticus*. Field practicals at Lake Edward Queen Elizabeth National Park, Uganda, 2010

Fig. A.51. Learning the measuring of parameters of eggs of *C.niloticus*. Lake Edward Queen Elizabeth National Park, Uganda, 2010

Fig. A.52. Understanding of nest conditions for *C.niloticus.* Field practicals at Lake Edward Queen Elizabeth National Park, Uganda, 2010

Fig. A.53. Learning the scute marking system and procedure of *C.niloticus* for release at Queen Elizabeth National Park, Uganda, 2010

Fig. A.54. Learning the *C.niloticus* morphology for release at Queen Elizabeth National Park, Uganda, 2010

Fig. A.55. Learning the use of specialized torches/light for *C.niloticus* egg fertility determination at Queen Elizabeth National Park, Uganda, 2010

Fig. A.56. Learning how to search and capture *Osteolaemus tetraspis* at Semliki National Park, Uganda, 2010

Fig. A.57. Learning how to capture and examine *C.niloticus* at Lake Mburo National Park, Uganda, 2010

ANNEX N
APPOINTMENT AS A CROCODILE SPECIALIST

IUCN - World Conservation Union • Species Survival Commission

Chairman: Dr Grahame Webb; Vice-Chairmen: Dr. Dietrich Jelden, Mr. Alejandro Larriera, Ms Christine Lippai, Dr James Perran Ross, Mr Charlie manolis.
Executive Officer: Mr. Tom Dacey, PO Box 530 Sanderson, NT 0813, Australia. E-mail: gwebb@wmi.com.au

Mr Samuel Amanya
Uganda Wildlife Department
Uganda

Email: samuel.amanya@ugandawildlife.org

Dear Samuel

Letter of Appointment: IUCN-SSC-Crocodile Specialist Group

I am writing on behalf of the Chair of the IUCN Species Survival Commission (SSC), Dr. Simon N. Stuart, to invite you to serve as a member of the IUCN SSC Crocodile Specialist Group.

As a member of the Crocodile Specialist Group, you will become a member of the SSC, the largest of the six volunteer commissions of IUCN -The World Conservation Union. The SSC is a global network of scientists, field biologists and other professionals committed to the conservation of biodiversity. By combining the skills and insights represented by its broad membership, SSC is uniquely positioned to identify and promote actions necessary to stem the loss of the world's biological diversity through the restoration of threatened species to healthy population levels. The types of expertise required to accomplish the ambitious work of the SSC are wide-ranging. Yours would be particularly valuable to the work of the Crocodile Specialist Group.

I would be grateful if you would reply to this invitation and, if accepting, provide our Executive Officer, Tom Dacey, at csg@wmi.com.au with your full contact details to register you as a member of the SSC and so that we can communicate effectively. Please bear in mind that, for you to be registered as a member of the IUCN SSC Crocodile Specialist Group, it is essential that we receive confirmation of your acceptance.

IUCN is in the process of developing an online registration system for Commission Members and, once this is up and running, you will be asked to directly input further

information on yourself into the database, such as your areas of taxonomic, thematic and geographic expertise. I have been asked to clarify to you that, in accepting your appointment as an SSC Member, you agree that the information provided by you (with exception of private telephone and fax numbers) may be made publicly available through the SSC Membership Directory or database in print or electronic format. The private telephone and fax numbers will be kept only for use by Specialist Group Chairs and SSC/Species Programme staff on occasions where communication with a member is urgent.

Finally, you will find enclosed a document entitled "Welcome to the IUCN Species Survival Commission". Please read this as it provides important information about the work of the SSC, its structure, vision, goal and objectives. As Chair of the Crocodile Specialist Group, I am required in my Terms-of-Reference to report the Group's progress against the SSC's objectives. An important task will therefore be to establish goals, objectives and measurable targets for the Crocodile Specialist Group and formulate an operational plan to achieve these. Should you accept your appointment, I look forward to your inputs in formulating these important guidelines for the future work of the Group.

If you would like more information about the Crocodile Specialist Group, please don't hesitate to ask our Executive Officer, Tom Dacey, or visit our website at www.iucnCSG.org . If you wish to know more about SSC, a comprehensive set of documents is available at : http://www.iucn.org/about/work/programmes/species/about_ssc/ .

I hope that you will accept this invitation and I look forward to working with you as a member of the Crocodile Specialist Group.

Yours sincerely,

Dr. Grahame Webb
Chair, IUCN SSC Crocodile Specialist Group
6 June 2016

cc Dr Simon N. Stuart
Chair, IUCN Species Survival Commission

ANNEX O
APPROVAL BY UNIA TO CONDUCT RESEARCH PROJECT

UNIVERSIDAD INTERNACIONAL DE ANDALUCÍA
Sede Antonio Machado

Mr. Amanya Samuel,
Uganda Wildlife Authority
P. O. Box 3530 Kampala, Uganda

11, April, 2007

Dear Samuel,

RE: REQUIREMENTS FOR, MASTERS, DIPLOMA OF ADVANCED STUDIES AND PhD AT INTERNATIONAL UNIVERSITY OF ANDALUSIA

Following the completion of tutorial classes and submission of of your research project proposal for the fulfillment of the requirements for THE 6th MASTER'S DEGREE IN MANAGEMENT, ACCESS AND CONSERVATION OF SPECIES IN TRADE: THE INTERNATIONAL FRAMEWORK (2006-2008), AND DIPLOMA OF ADVANCED STUDIES, the University Management is informing you that you have been accepted to continue your research process that will make it possible for you to continue with Doctorate Research .

Please note ;

SUBMISSION OF MASTERS THESIS

1. This must be at an average of 100 to 200 pages submitted between 23/12/2007 and 23/03/2009 and will comprise 12 credits.
2. The Thesis must be submitted in 2 copies and 1 CD to UNIA

PRESENTATION OF INTERMIDIATE RESEACH

The procedures for presenting this paper in order to obtain the Diploma of Advanced Studies, as established in Art. 6 of Royal Decree 778/1998 of April 30 are outlined below.

1. The research paper must be submitted to UNIA Sede Antonio Machado by 30/09/2008 and must contain the contents of the knowledge and skills obatined from the first four sections of the Masters tutorial work and masters research project completed.
2. You will be required to submit under your supervisor's authorisation, four copies of their research project and another copy in digital format. Three of these copies will be for the members of the commission. The fourth and digtal copies are to remain with the University.
3. At the proposal of the programme coordinators, the International University of Andalucia will designate a committee to judge the research work. Three PhD members will make up this committee.
4. The Doctoral commission has provided for the possibility of granting an extension period for presentation of research paper upon request by candidates who allege justified reasons. A candidates must apply for any such extension

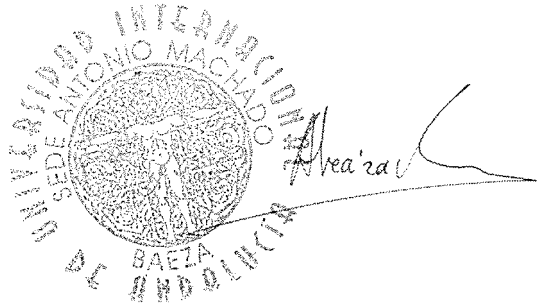
Palacio de Jabalquinto. Plaza de Santa Cruz, s/n. 23440 Baeza (Jaén,España) • Tf.: 34 953742775 • Fax.: 34 953742975 • e-mail: machado@unia.es • http://www.unia.es

UNIVERSIDAD INTERNACIONAL DE ANDALUCÍA
Sede Antonio Machado

HOW TO OBTAIN THE DIPLOMA OF ADVANCED STUDIES (D.E.A)

1. When students have successfuly passed the residence requirements and the research project, the UNIA will evaluate their achievement in both phases. This evaluation will assess the skills the students have gained from the various courses,seminars, and supervised research periods they have completed in public defence before the specific jury in charge of each programme. This jury, appointed by the International University of Andalusia Doctoral Commission, will be made up of three PhD members. Atleast one member will be a full university professor, one will not belong to the programme or the department offering it, and two must have participated in the programme.
2. Atleast 5 days before the date schedule for the presentation, students must submit a report to the jury, comprising their post graduate CV and the work performed during the class period and the tutored research period. In this report, students may also include their PhD dissertation proposal and indicate the field of study they prefer.
3. Under the aforementioned Royal Decree, the candidate is obliged to be present at this defence, which will therefore be held at UNIA site where the candidate completed studies. Understanding that for foreign students, a considerable distance may be involved, the Doctoral Commission will accept student's virtual presence, through a vedeo conferance, as long as a series of requisites are met. These requisites are explained to each student who chooses this option. Students must notify the commission atleast three months prior to deadline if they wish to hold this evaluation by videoconference.
4. A successful outcome of this defence will determine candidates research aptitude, allowing them to obtain the Certificate of Advanced Studies for the courses they have taken. This certificate consititutes recogonition of the work carried out in a specific field of knowledge and accredition of students' reseach aptitude. A candidate to embark upon the doctoral dissertation process must first obtain this Certificate, as provided in Art.7 of Royal Decree 778/1998 of April 30, and Arts. 11 to 14 of RD 56/2005 OF March 21.

Best regards,



.....

Director of the International University of Andalusia

Palacio de Jabalquinto. Plaza de Santa Cruz, s/n. 23440 Baeza (Jaén,España) • Tf.: 34 953742775 • Fax.: 34 953742975 • e-mail: machado@unia.es • http://www.unia.es

ANNEX P

APPROVAL TO CONDUCT RESEARCH BY UWA

UGANDA WILDLIFE AUTHORITY

HEADQUARTERS, PLOT 3 KINTU ROAD NAKASERO

P O Box 3530, Kampala Uganda

Your Ref:

Our Ref: UWA/TDO/33/02 25th September 2008.

Amanya Samuel
P. O. Box 36646,
Kampala
Uganda.

RE: RESEARCH APPLICATION APPROVAL

I am in receipt of your application dated September 16, 2008 seeking to carry out research in Murchison Falls National Park and Lake Victoria addressing **"Conservation and management of the Nile crocodiles"** as part your Masters program.

I am glad to inform you that your research application has been approved for you to carry out research from October 1, 2008 to March 30, 2009. You will be expected to submit a final report of your findings by July 2009 to Uganda Wildlife Authority. Should you be unable to work within these dates, please notify me in writing.

Please report to the Conservation Area Manager and the Monitoring and Research Warden of MFCA, on arrival in the park for registration and guidance.

Sincerely,

Anying Pamela
For: EXECUTIVE DIRECTOR

c.c: Conservation Area Manager, MFCA
c.c: Monitoring and Research Warden, MFCA

P.O. Box 3530 Kampala, Uganda Tel: +256-41-4355000 Telegrams: SIMBA E-Mail: uwa@uwa.or.ug

Website: www.uwa.or.ug

ANNEX Q

MAP OF UGANDA SHOWING DISTRICTS OF *C.Niloticus* RESCUE 2004-2022

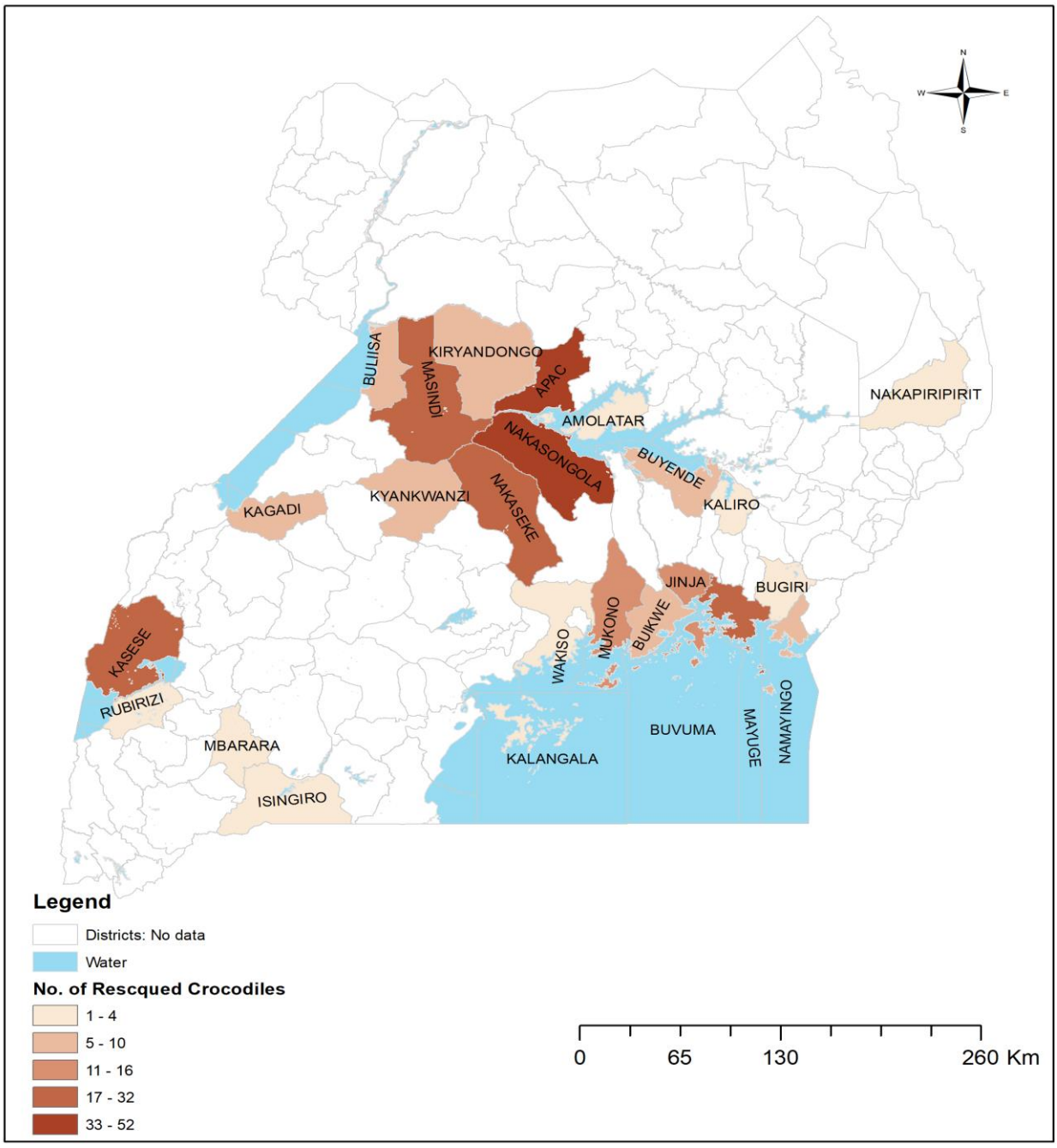


Fig. A.57. Map showing districts where *C. niloticus* have been rescued in Uganda

Source: Researcher

ANNEX R

SPOTLIGHT COUNT RESULTS FROM VICTORIA NILE MURCHION FALLS NATIONAL PARK

No	DATE__	TIME	EASTINGS	NORTHINGS	ADULTS	SUBADULTS	JUVINILES	EYE SHINE	TOTAL	METHOD	AREA	ZONE
3	03/05/2009	19:43	340353	253017		3			3	Spotlight	North Bank	B
4	03/05/2009	19:45	339992	253015				1	1	Spotlight	North Bank	B
5	03/05/2009	19:46	339651	253121	4	2			6	Spotlight	North Bank	B
6	03/05/2009	19:48	339347	253142	1				1	Spotlight	North Bank	B
7	03/05/2009	19:52	338395	252779		1			1	Spotlight	North Bank	B
8	03/05/2009	19:52	338417	252797	1				1	Spotlight	North Bank	B
9	03/05/2009	19:53	338178	252634			1		1	Spotlight	North Bank	B
10	03/05/2009	19:54	338029	252517			1		1	Spotlight	North Bank	B
11	03/05/2009	19:56	337610	252195		1	1		2	Spotlight	North Bank	B
12	03/05/2009	19:57	337398	251989		1	1		2	Spotlight	North Bank	B
13	03/05/2009	19:58	337281	251899			2	1	3	Spotlight	North Bank	B
14	03/05/2009	20:00	336860	251416				2	2	Spotlight	North Bank	B
15	03/05/2009	20:01	336690	251180				1	1	Spotlight	North Bank	B
1	03/05/2009	20:02	336524	250932			1		1	Spotlight	North Bank	B
16	03/05/2009	20:05	336224	250340	2				2	Spotlight	North Bank	B
17	03/05/2009	20:09	335726	249683	1	1			2	Spotlight	North Bank	B
18	03/05/2009	20:11	335300	249611			2		2	Spotlight	North Bank	B
19	03/05/2009	20:12	335144	249575			1		1	Spotlight	North Bank	B
20	03/05/2009	20:13	334855	249499	1	1	1		3	Spotlight	North Bank	B
21	03/05/2009	20:14	334512	249451		2			2	Spotlight	North Bank	B
22	03/05/2009	20:18	333474	249323		1			1	Spotlight	North Bank	B
2	03/05/2009	20:22	332436	249393	2	2		1	5	Spotlight	North Bank	B
23	03/05/2009	20:24	332006	249435	2	3		3	8	Spotlight	North Bank	B
24	03/05/2009	20:25	331739	249377	1			1	2	Spotlight	North Bank	B
25	03/05/2009	20:27	331470	249195			2		2	Spotlight	North Bank	B
26	03/05/2009	20:28	331262	249053	2				2	Spotlight	North Bank	B
27	03/05/2009	20:29	331034	248893	6				6	Spotlight	North Bank	B
28	03/05/2009	20:30	330767	248658	2			1	3	Spotlight	North Bank	B
29	03/05/2009	20:31	330481	248415	3	1	2		6	Spotlight	North Bank	B
30	03/05/2009	20:31	330576	248511		1			1	Spotlight	North Bank	B
31	03/05/2009	20:32	330290	248206	5	2		1	8	Spotlight	North Bank	B
32	03/05/2009	20:35	329918	247776	1	3	1		5	Spotlight	North Bank	B
33	03/05/2009	20:36	329631	247494	1				1	Spotlight	North Bank	B
34	03/05/2009	20:38	329372	247261	5	1	1		7	Spotlight	North Bank	B
35	03/05/2009	20:39	329098	247099		2			2	Spotlight	North Bank	B
36	03/05/2009	20:40	328950	247045	1				1	Spotlight	North Bank	B
37	03/05/2009	20:41	328662	246981	2	1		1	4	Spotlight	North Bank	B
38	03/05/2009	20:44	327915	246950	5				5	Spotlight	North Bank	B
39	03/05/2009	20:45	327709	247007	2				2	Spotlight	North Bank	B
40	03/05/2009	20:50	328413	246493	1				1	Spotlight	South Bank	B
41	03/05/2009	20:53	328822	246391	1				1	Spotlight	South Bank	B
42	03/05/2009	20:55	329189	246315	2				2	Spotlight	South Bank	B
43	03/05/2009	20:57	329357	246322	1				1	Spotlight	South Bank	B
44	03/05/2009	21:01	329801	246511	1				1	Spotlight	South Bank	B
45	03/05/2009	21:30	330538	246946	1				1	Spotlight	South Bank	B
46	03/05/2009	21:31	330568	246981	6	1			7	Spotlight	South Bank	B
47	03/05/2009	21:33	330752	247285	1				1	Spotlight	South Bank	B
48	03/05/2009	21:34	330843	247466	2				2	Spotlight	South Bank	B
49	03/05/2009	21:35	330885	247528	1				1	Spotlight	South Bank	B
50	03/05/2009	21:41	331615	248278	1				1	Spotlight	South Bank	B
51	03/05/2009	21:50	332982	248948		1			1	Spotlight	South Bank	B
52	03/05/2009	21:53	333408	249023	1				1	Spotlight	South Bank	B
53	03/05/2009	21:55	333734	249082	1				1	Spotlight	South Bank	B
54	03/05/2009	22:02	334977	249370	1				1	Spotlight	South Bank	B
55	03/05/2009	22:05	335383	249465		1	4		5	Spotlight	South Bank	B
56	03/05/2009	22:07	335747	249594		2			2	Spotlight	South Bank	B
57	03/05/2009	22:09	335912	249676	1		1		2	Spotlight	South Bank	B
58	03/05/2009	22:10	336090	249786			1		1	Spotlight	South Bank	B
59	03/05/2009	22:11	336182	249948	1				1	Spotlight	South Bank	B
60	03/05/2009	22:14	336653	250317	12	1			13	Spotlight	South Bank	B
61	03/05/2009	22:16	336872	250431	2			2	4	Spotlight	South Bank	B
62	03/05/2009	22:17	337018	250581	1	1			2	Spotlight	South Bank	B
63	03/05/2009	22:18	337185	250772	1				1	Spotlight	South Bank	B
64	03/05/2009	22:24	337542	251532	8				8	Spotlight	South Bank	B
65	03/05/2009	22:26	337691	251738	12	1			13	Spotlight	South Bank	B
66	03/05/2009	22:28	337845	251972	4				4	Spotlight	South Bank	B
67	03/05/2009	22:30	337992	252117	1	1			2	Spotlight	South Bank	B
68	03/05/2009	22:31	338165	252207	2	1			3	Spotlight	South Bank	B
69	03/05/2009	22:35	338678	252512			1		1	Spotlight	South Bank	B
70	03/05/2009	22:39	339210	252753		1			1	Spotlight	South Bank	B
71	03/05/2009	22:40	339374	252813			2		2	Spotlight	South Bank	B
72	03/05/2009	22:41	339517	252837	1		3		4	Spotlight	South Bank	B
73	03/05/2009	22:43	339925	252869			2		2	Spotlight	South Bank	B
74	03/05/2009	22:43	339954	252869		1			1	Spotlight	South Bank	B
75	03/05/2009	22:44	340092	252860		2	1		3	Spotlight	South Bank	B
81	04/05/2009	19:33	320686	248778			1		1	Spotlight	North Bank	C
82	04/05/2009	19:35	320298	249041			2		2	Spotlight	North Bank	C
83	04/05/2009	19:39	319445	249181			1		1	Spotlight	North Bank	C
84	04/05/2009	19:44	318993	249131	2				2	Spotlight	North Bank	C

No	DATE__	TIME	EASTINGS	NORTHINGS	ADULTS	SUBADULTS	JUVINILES	EYE SHINE	TOTAL	METHOD	AREA	ZONE
85	04/05/2009	19:46	318651	249212	8				8	Spotlight	North Bank	C
76	04/05/2009	19:49	318099	249050	1				1	Spotlight	North Bank	C
86	04/05/2009	19:50	317920	248989	1	1			2	Spotlight	North Bank	C
87	04/05/2009	19:51	317730	248949	1		1		2	Spotlight	North Bank	C
88	04/05/2009	19:54	317169	248965			1		1	Spotlight	North Bank	C
89	04/05/2009	20:42	321188	248466			1		1	Spotlight	North Bank	C
90	04/05/2009	20:48	322002	248389	2	1			3	Spotlight	North Bank	C
77	04/05/2009	20:54	323003	248566	1				1	Spotlight	North Bank	C
91	04/05/2009	20:55	323197	248501			1		1	Spotlight	North Bank	C
92	04/05/2009	20:56	323334	248433		2			2	Spotlight	North Bank	C
93	04/05/2009	20:57	323461	248332		1			1	Spotlight	North Bank	C
94	04/05/2009	20:58	323555	248234		1	1		2	Spotlight	North Bank	C
95	04/05/2009	21:00	323732	247954	4	2	1		7	Spotlight	North Bank	C
78	04/05/2009	21:02	323776	247632	6	1			7	Spotlight	North Bank	C
96	04/05/2009	21:06	323121	247600			1		1	Spotlight	North Bank	C
97	04/05/2009	21:07	322861	247672	1				1	Spotlight	North Bank	C
98	04/05/2009	21:09	322708	247347			1		1	Spotlight	North Bank	C
99	04/05/2009	21:10	322248	247954	1	1	1		3	Spotlight	North Bank	C
100	04/05/2009	21:11	321996	248168	1				1	Spotlight	North Bank	C
101	04/05/2009	21:26	323969	247722	1		2		3	Spotlight	North Bank	C
102	04/05/2009	21:28	324318	247603		5		2	7	Spotlight	North Bank	C
79	04/05/2009	21:30	324782	247672	1				1	Spotlight	North Bank	C
103	04/05/2009	21:31	324945	247684	4				4	Spotlight	North Bank	C
104	04/05/2009	21:32	325132	247672	2				2	Spotlight	North Bank	C
80	04/05/2009	21:33	325312	247607		3			3	Spotlight	North Bank	C
105	04/05/2009	21:41	326698	247019			2		2	Spotlight	North Bank	C
106	04/05/2009	21:43	327053	246857		1			1	Spotlight	North Bank	C
107	04/05/2009	21:45	327304	246785	4	1			5	Spotlight	North Bank	C
111	05/05/2009	19:34	326710	246732	1				1	Spotlight	Delta Area	C
112	05/05/2009	19:36	326145	246432		2			2	Spotlight	Delta Area	C
113	05/05/2009	19:36	326291	246491	1				1	Spotlight	Delta Area	C
108	05/05/2009	19:40	325248	246058			1		1	Spotlight	Delta Area	C
114	05/05/2009	19:43	324347	245684	1				1	Spotlight	Delta Area	C
115	05/05/2009	19:44	324116	245645	2				2	Spotlight	Delta Area	C
116	05/05/2009	19:46	323627	245530		1	1		2	Spotlight	Delta Area	C
117	05/05/2009	19:49	322875	245439	2	2			4	Spotlight	Delta Area	C
118	05/05/2009	19:54	321638	245918		2			2	Spotlight	Delta Area	C
119	05/05/2009	20:00	320256	246616			11		11	Spotlight	Delta Area	C
109	05/05/2009	20:05	319045	246997		2			2	Spotlight	Delta Area	C
120	05/05/2009	20:08	318421	247256			1		1	Spotlight	Delta Area	C
121	05/05/2009	20:31	320125	246202	17	1			18	Spotlight	Delta Area	C
110	05/05/2009	20:35	319557	246010	3	4	2		9	Spotlight	Delta Area	C
122	05/05/2009	20:51	321381	246587	2	2			4	Spotlight	Delta Area	C
123	05/05/2009	20:54	321858	246527			1		1	Spotlight	Delta Area	C
124	05/05/2009	21:03	323422	246250		2			2	Spotlight	Delta Area	C
125	06/05/2009	19:56	317575	248423	1		1		2	Spotlight	Delta-Panyamul-South End	C
126	06/05/2009	20:05	317692	248817	1				1	Spotlight	Delta-Panyamul-South End	C
127	06/05/2009	20:39	317706	247830			1		1	Spotlight	Delta-Panyamul-South End	C
128	06/05/2009	20:53	317100	247346	1				1	Spotlight	Delta-Panyamul-South End	C
129	06/05/2009	21:02	317132	246393		1			1	Spotlight	Delta-Panyamul-South End	C
130	06/05/2009	21:17	318539	245873		2			2	Spotlight	Delta-Panyamul-South End	C
131	06/05/2009	21:18	319028	245808		1	1		2	Spotlight	Delta-Panyamul-South End	C
132	06/05/2009	21:19	319440	245743		2	2		4	Spotlight	Delta-Panyamul-South End	C
133	06/05/2009	21:29	320897	245414			1		1	Spotlight	Delta-Panyamul-South End	C
134	06/05/2009	21:45	327644	246150			1		1	Spotlight	Delta-Panyamul-South End	C
135	06/05/2009	21:46	328198	246137		1			1	Spotlight	Delta-Panyamul-South End	C
136	06/05/2009	21:47	328354	246279			1		1	Spotlight	Delta-Panyamul-South End	C
137	07/05/2009	19:42	319390	241398			2		2	Spotlight	Wanseko-Panyamul Channel	C
138	07/05/2009	19:49	319543	242203			2		2	Spotlight	Wanseko-Panyamul Channel	C
139	07/05/2009	19:58	320646	243056				2	2	Spotlight	Wanseko-Panyamul Channel	C
140	07/05/2009	20:00	321196	243206	3				3	Spotlight	Wanseko-Panyamul Channel	C
141	07/05/2009	20:08	322407	244040			1		1	Spotlight	Wanseko-Panyamul Channel	C
142	07/05/2009	20:10	322793	244608		1	1		2	Spotlight	Wanseko-Panyamul Channel	C
143	07/05/2009	20:13	322908	245118			1		1	Spotlight	Wanseko-Panyamul Channel	C
144	07/05/2009	20:57	320345	248541	1		1		2	Spotlight	Pearson-Dead Channel 4	C
145	07/05/2009	21:01	319738	248549	2				2	Spotlight	Pearson-Dead Channel 5	C
146	07/05/2009	21:14	319627	249405	2				2	Spotlight	Pearson Far-North Channel	C
147	07/05/2009	21:16	319417	249700	1	2	3		6	Spotlight	Pearson Far-North Channel	C
148	07/05/2009	21:17	319420	249933			2		2	Spotlight	Pearson Far-North Channel	C
149	07/05/2009	21:18	319303	250266	2				2	Spotlight	Pearson Far-North Channel	C
150	07/05/2009	21:19	319213	250449		1			1	Spotlight	Pearson Far-North Channel	C
151	07/05/2009	21:20	319238	250559	1	3			4	Spotlight	Pearson Far-North Channel	C
152	07/05/2009	21:21	319411	250496				1	1	Spotlight	Pearson Far-North Channel	C
153	07/05/2009	21:22	319531	250420		2	2		4	Spotlight	Pearson Far-North Channel	C
154	07/05/2009	21:24	319690	250253	2	1	3		6	Spotlight	Pearson Far-North Channel	C
155	07/05/2009	21:25	319764	250093	1				1	Spotlight	Pearson Far-North Channel	C
156	08/05/2009	19:50	341503	253129			1		1	Spotlight	North Bank	A
157	08/05/2009	19:51	341619	253118		1	0		1	Spotlight	North Bank	A
158	08/05/2009	19:52	341810	253064			1		1	Spotlight	North Bank	A
159	08/05/2009	19:54	341955	530140		1	2		3	Spotlight	North Bank	A

No	DATE__	TIME	EASTINGS	NORTHINGS	ADULTS	SUBADULTS	JUVINILES	EYE SHINE	TOTAL	METHOD	AREA	ZONE
160	08/05/2009	19:56	342174	253010	1		1		2	Spotlight	North Bank	A
161	08/05/2009	19:57	342324	253002		1	0		1	Spotlight	North Bank	A
162	08/05/2009	19:58	342508	252982		1	2		3	Spotlight	North Bank	A
163	08/05/2009	19:58	342401	252996			2		2	Spotlight	North Bank	A
164	08/05/2009	19:59	342655	252941	1		1		2	Spotlight	North Bank	A
165	08/05/2009	20:01	342647	252904	1		0		1	Spotlight	North Bank	A
166	08/05/2009	20:04	342845	252896	3	4	0		7	Spotlight	North Bank	A
167	08/05/2009	20:05	342962	252829	3	1	0		4	Spotlight	North Bank	A
168	08/05/2009	20:06	343107	252799	1		1		2	Spotlight	North Bank	A
169	08/05/2009	20:07	343266	252729	4		1		5	Spotlight	North Bank	A
170	08/05/2009	20:09	343359	252653			2		2	Spotlight	North Bank	A
171	08/05/2009	20:09	343514	252356	2	2			4	Spotlight	North Bank	A
172	08/05/2009	20:12	343463	252527	2	1			3	Spotlight	North Bank	A
173	08/05/2009	20:13	343540	252405	3				3	Spotlight	North Bank	A
174	08/05/2009	20:14	343667	252268		1			1	Spotlight	North Bank	A
175	08/05/2009	20:15	343738	252167			3		3	Spotlight	North Bank	A
176	08/05/2009	20:16	343818	251972		1	2		3	Spotlight	North Bank	A
177	08/05/2009	20:18	343981	251831			1		1	Spotlight	North Bank	A
178	08/05/2009	20:20	344238	251640	3		1		4	Spotlight	North Bank	A
179	08/05/2009	20:21	344399	251528			1		1	Spotlight	North Bank	A
180	08/05/2009	20:23	344462	251354	2	13			15	Spotlight	North Bank	A
181	08/05/2009	20:24	344776	251633	2				2	Spotlight	North Bank	A
182	08/05/2009	20:26	345117	251551			1		1	Spotlight	North Bank	A
183	08/05/2009	20:27	345324	251541		1			1	Spotlight	North Bank	A
184	08/05/2009	20:28	345452	251612		1	3		4	Spotlight	North Bank	A
185	08/05/2009	20:30	345656	251711	1				1	Spotlight	North Bank	A
186	08/05/2009	20:31	345907	251838		1	1		2	Spotlight	North Bank	A
187	08/05/2009	20:31	345774	251786			5		5	Spotlight	North Bank	A
188	08/05/2009	20:32	346021	251902	1		25		26	Spotlight	North Bank	A
189	08/05/2009	20:39	346195	251956	1				1	Spotlight	North Bank	A
190	08/05/2009	20:41	346409	252037	3	5	37		45	Spotlight	North Bank	A
191	08/05/2009	20:44	346561	252021	4		1		5	Spotlight	North Bank	A
192	08/05/2009	20:46	346795	251963	3				3	Spotlight	North Bank	A
193	08/05/2009	20:47	346978	251891	5				5	Spotlight	North Bank	A
194	08/05/2009	20:49	347116	251773	11	2	1		14	Spotlight	North Bank	A
195	08/05/2009	20:50	347216	251604		3	1	1	5	Spotlight	North Bank	A
196	08/05/2009	20:52	347368	251456	4	1	2		7	Spotlight	North Bank	A
197	08/05/2009	20:54	347446	251347	4				4	Spotlight	North Bank	A
198	08/05/2009	20:55	347535	251202	8	2			10	Spotlight	North Bank	A
199	08/05/2009	20:58	347627	250876	4	1			5	Spotlight	North Bank	A
200	08/05/2009	20:59	347731	250742			1		1	Spotlight	North Bank	A
201	08/05/2009	21:01	347921	250537			2		2	Spotlight	North Bank	A
202	08/05/2009	21:01	348038	250470	2	2			4	Spotlight	North Bank	A
203	08/05/2009	21:02	348120	250376	3	3	2		8	Spotlight	North Bank	A
204	08/05/2009	21:03	348254	250296	6	2	1		9	Spotlight	North Bank	A
205	08/05/2009	21:06	348477	250210	3		1		4	Spotlight	North Bank	A
206	08/05/2009	21:09	348781	250271	17	2			19	Spotlight	North Bank	A
207	08/05/2009	21:15	349104	250160	1				1	Spotlight	North Bank	A
208	08/05/2009	21:17	349456	250254			1		1	Spotlight	North Bank	A
209	08/05/2009	21:18	349543	250311			4		4	Spotlight	North Bank	A
210	08/05/2009	21:19	349682	250447			5		5	Spotlight	North Bank	A
211	08/05/2009	21:20	349853	250662	1		1		2	Spotlight	North Bank	A
212	08/05/2009	21:22	350052	250905	2	1	2		5	Spotlight	North Bank	A
213	08/05/2009	21:23	350184	251082	31	5			36	Spotlight	North Bank	A
214	08/05/2009	21:27	350491	251444	15		4		19	Spotlight	North Bank	A
215	08/05/2009	21:30	350566	251671	8				8	Spotlight	North Bank	A
216	08/05/2009	21:31	350638	251789	7	2	13		22	Spotlight	North Bank	A
217	08/05/2009	21:33	350799	251905	5	1	1		7	Spotlight	North Bank	A
218	08/05/2009	21:34	350915	251932	5				5	Spotlight	North Bank	A
219	08/05/2009	21:35	351044	251894		2			2	Spotlight	North Bank	A
220	08/05/2009	21:36	351099	251867	10	2			12	Spotlight	North Bank	A
221	08/05/2009	21:37	351203	251812	5				5	Spotlight	North Bank	A
222	08/05/2009	21:39	351324	251793	3	4			7	Spotlight	North Bank	A
223	08/05/2009	21:40	351521	251773	3				3	Spotlight	North Bank	A
224	08/05/2009	21:42	351670	251821	7	1			8	Spotlight	North Bank	A
225	08/05/2009	21:43	351812	251843	12				12	Spotlight	North Bank	A
226	08/05/2009	21:44	351917	251843	19		5		24	Spotlight	North Bank	A
227	08/05/2009	21:46	352269	251799			1		1	Spotlight	North Bank	A
228	08/05/2009	21:46	352200	251772	1		8		9	Spotlight	North Bank	A
229	08/05/2009	21:47	352323	251837			6		6	Spotlight	North Bank	A
230	08/05/2009	21:48	352402	251875			6		6	Spotlight	North Bank	A
231	08/05/2009	21:49	352569	251847	5				5	Spotlight	North Bank	A
232	08/05/2009	21:52	352748	251818	4				4	Spotlight	South Bank	A
233	08/05/2009	21:54	352243	251727		1	6		7	Spotlight	South Bank	A
234	08/05/2009	21:54	352384	251790	4	1			5	Spotlight	South Bank	A
235	08/05/2009	21:56	351980	251648			2		2	Spotlight	South Bank	A
236	08/05/2009	21:57	351818	251581	1		1		2	Spotlight	South Bank	A
237	08/05/2009	21:57	351697	251538	7	2			9	Spotlight	South Bank	A
238	08/05/2009	21:58	351487	251437			1		1	Spotlight	South Bank	A
239	08/05/2009	21:59	351349	251337	1		1		2	Spotlight	South Bank	A

No	DATE__	TIME	EASTINGS	NORTHINGS	ADULTS	SUBADULTS	JUVINILES	EYE SHINE	TOTAL	METHOD	AREA	ZONE
240	08/05/2009	22:00	351215	251201		2	1		3	Spotlight	South Bank	A
241	08/05/2009	22:01	351000	250972	3	1			4	Spotlight	South Bank	A
242	08/05/2009	22:02	350840	250868			1		1	Spotlight	South Bank	A
243	08/05/2009	22:06	350480	251008	4				4	Spotlight	South Bank	A
244	08/05/2009	22:08	350706	251171	2				2	Spotlight	South Bank	A
245	08/05/2009	22:09	350806	251286	2				2	Spotlight	South Bank	A
246	08/05/2009	22:12	351115	251586	1				1	Spotlight	South Bank	A
247	08/05/2009	22:18	350263	250603		1	6		7	Spotlight	South Bank	A
248	08/05/2009	22:20	349928	250370		1	2		3	Spotlight	South Bank	A
249	08/05/2009	22:21	349813	250292		2			2	Spotlight	South Bank	A
250	08/05/2009	22:23	349430	250088	2				2	Spotlight	South Bank	A
251	08/05/2009	22:24	349067	249981	7				7	Spotlight	South Bank	A
252	08/05/2009	22:26	348600	249856	3	3	1		7	Spotlight	South Bank	A
253	08/05/2009	22:27	348427	249896		1	2		3	Spotlight	South Bank	A
254	08/05/2009	22:29	348183	250037		1	1		2	Spotlight	South Bank	A
255	08/05/2009	22:30	347991	250133			1		1	Spotlight	South Bank	A
256	08/05/2009	22:31	347808	250329		1	2		3	Spotlight	South Bank	A
257	08/05/2009	22:32	347715	250479		1	1		2	Spotlight	South Bank	A
258	08/05/2009	22:32	347681	250537			1		1	Spotlight	South Bank	A
259	08/05/2009	22:33	347561	250696	3	2			5	Spotlight	South Bank	A
260	08/05/2009	22:34	347460	250813		1	1		2	Spotlight	South Bank	A
261	08/05/2009	22:38	346846	251532	1		1		2	Spotlight	South Bank	A
262	08/05/2009	22:40	346593	251580	4	1			5	Spotlight	South Bank	A
263	08/05/2009	22:41	346406	251604		1			1	Spotlight	South Bank	A
264	08/05/2009	22:41	346257	251589	4	3			7	Spotlight	South Bank	A
265	08/05/2009	22:43	345924	251567	5	1			6	Spotlight	South Bank	A
266	08/05/2009	22:44	345770	251536	4	1	4		9	Spotlight	South Bank	A
267	08/05/2009	22:45	345569	251526		1			1	Spotlight	South Bank	A
268	08/05/2009	22:46	345398	251524	1				1	Spotlight	South Bank	A
269	08/05/2009	22:46	345224	251494	2				2	Spotlight	South Bank	A
270	08/05/2009	22:47	344967	251431	2	1	2		5	Spotlight	South Bank	A
271	08/05/2009	22:49	344667	251395			1	1	2	Spotlight	South Bank	A
272	08/05/2009	22:51	344182	251525			5		5	Spotlight	South Bank	A
273	08/05/2009	22:53	343885	251710	1	1			2	Spotlight	South Bank	A
274	08/05/2009	22:54	343660	251845	1		2		3	Spotlight	South Bank	A
275	08/05/2009	22:56	343292	252112	1				1	Spotlight	South Bank	A
276	08/05/2009	22:58	342856	252435	3	1	2		6	Spotlight	South Bank	A
277	08/05/2009	23:00	342550	252582		1	1		2	Spotlight	South Bank	A
278	08/05/2009	23:01	342375	252570	5	1			6	Spotlight	South Bank	A
279	08/05/2009	23:02	342184	252613	4	2	1		7	Spotlight	South Bank	A
280	08/05/2009	23:02	342056	252626	5		2		7	Spotlight	South Bank	A
281	08/05/2009	23:04	341744	252737	2	4			6	Spotlight	South Bank	A
282	08/05/2009	23:05	341629	252834			2		2	Spotlight	South Bank	A
283	08/05/2009	23:06	341436	253008		2			2	Spotlight	South Bank	A
284	08/05/2009	23:08	340978	252958		2	3		5	Spotlight	South Bank	A
285	08/05/2009	23:10	340733	252841			6		6	Spotlight	South Bank	A
286	08/05/2009		340955	252858			1		1	Spotlight	North Bank	A
287	08/05/2009		340730	252730			2		2	Spotlight	North Bank	A
288	08/05/2009		341341	252841	1		3		4	Spotlight	North Bank	A

Table. A 1. Night spotlight count results from MFNP. Source: Researcher

ANNEX S

LAKE VICTORIA WATER DAILY SURVEY RESULTS (EXCLUDES OFF-SHORE DRIVE FINDINGS/RESULTS)

Survey Serial	Crew	Date	District	Start time	End time	Hours	Min.	Total Dist covered	Speed	Fuel (lts)	Lubricant (lts)	Dist Day	Dist Night	Effective Survey Dist Day	Effective Survey Dist Night	Overlap Dist	Actual Survey Dist	Washout distance	No. Landing sites	No. of Lading Sites visited	Crocs Seen	Est. Attacks
1	S F P R	26th March 2009	Mukono	5:55pm	1:23am	7	27	69.2	9.89	80	4	21.1	47.3	15.6	48.1	21.1	42.6	26.6	12	3	0	0
2	S F P R	27th March 2009	Mukono	6:24pm	10:06pm	3	42	37.03	12.34	60	3	14.5	18	9.2	5.9	0	15.1	21.93	5	3	2	4
3	S F P R	28th March 2009	Jinja and Mukono	5:56pm	1:19am	6	23	51.02	8.50	60	3	12.77	32.16	8.26	25.8	14.5	19.56	31.46	15	11	0	13
4	S P	29th March 2009	Mayuge	6:09pm	1:00am	6	51	58.3	9.72	60	3	13.2	46.3	5	33.6	0	38.6	19.7	8	4	0	14
5	R, P	30th March 2009	Mukono,Buikwe, Buvuma	4:09pm	10:36pm	6	27	64.63	10.77	60	3	35.6	26.4	12.3	12.3	0	24.6	40.03	12	10	0	2
6	R, P	31st March 2009	Mukono,Buikwe, Buvuma	4:06pm	10:48pm	6	42	69.6	11.60	80	4	39	30	21.1	12	0	33.1	36.5	12	9	0	7
7	R, P	1st April 2009	Mukono,Buikwe, Buvuma	3:38pm	12:11am	7	33	61.19	8.74	80	4	20.4	41.05	20.13	16.05	0	36.18	25.01	12	5	2	4
8	S,P,R	2nd April 2009	Mukono,Buikwe, Buvuma	4:27pm	12:54am	8	27	76	9.50	80	4	36.4	40.3	25	23.6	0	48.6	27.4	15	13	0	9
9	S,P,R	3rd April 2009	Mukono,Buikwe, Buvuma	5:15pm	12:50am	7	35	73.23	10.46	80	4	25.2	48.3	7.98	18.93	0	26.91	46.32	10	10	0	14
10	S,P,R	4th April 2009	Mukono,Buikwe, Buvuma	12:17pm	8:23pm	8	6	82.96	10.37	100	5	82.96	4.6	19.3	4.6	0	23.9	59.06	13	12	0	5
11	S,P,R	5th April 2009	Mukono,Buikwe, Buvuma	8:26am	3:43pm	7	17	79.2	11.31	100	5	79.2	0	48.3	0	0	48.3	30.9	18	8	0	1
12	R, P	6th April 2009	Mayuge	1:14pm	11:30pm	10	16	119.55	11.96	100	5	63.35	56.2	49	28.9	24.4	53.5	66.05	9	4	0	5
13	S,J	7th April 2009	Bugiri, Namayumba	8:36pm	12.19am	3	47	32.8	10.93	100	5	0	32.8	0	32.8	11.1	21.7	11.1	5	5	0	2
14	R, P	7th April 2009	Mayuge	6:21pm	11:39pm	11	18	33.89	3.08	0		10.7	23.19	10.7	12.5	0	23.2	10.69	4	4	1	18
15	S, J	8th April 2009	Bugiri, Namayumba	9:50am	12:09am	14	19	93.17	6.66	80	4	37.2	55.97	24.5	43.47	24.2	43.77	49.4	7	7	0	34
16	R, P	8th April 2009	Mayuge	9:07am	10:58pm	13	51	77.3	5.95	60	3	34.6	42.7	25.5	33.8	29.3	30	47.3	10	6	2	10
17	S,J	9th April 2009	Bugiri, Namayumba	11:37am	7:00pm	7	23	52.2	7.46	60	3	52.3	0	30.2	0	0	30.2	22	6	6	0	47
18	R, P	19th April 2009	Mayuge	9:10am	10:15pm	13	5	76.09	5.85	60	3	44.15	32.4	44.15	32.4	32.4	44.15	31.94	2	2	0	8
19	S,P,J	14th April 2009	Mayuge	3:46pm	8:53pm	4	7	36.5	9.13	40	2	25	11.2	23.3	7.2	4.4	26.1	10.4	7	7	0	3
20	S,P,J	15th April 2009	Mayuge and Bugiri	12:28pm	09:32pm	9	4	47.17	5.24	80	4	31.66	15.5	31.66	4.6	0	36.26	10.91	8	8	0	29
21	S,P,J	16th April 2009	Bugiri, Namayumba	10:14am	10:11pm	11	57	96.11	8.74	80	4	66.7	29.1	52.06	12.7	12.9	51.86	44.25	16	16	0	23
22	S,P,J	17th April 2009	Busia	9:32am	3:39pm	6	7	33.99	5.67	120	6	33.99	0	32.29	0	1.7	30.59	3.4	4	4	0	10
23	S,P,J	18th April 2009	Bugiri, Namayumba	5:20am	8:33pm	15	13	81.18	5.41	0		81.18	0	46.78	0	13.7	33.08	48.1	12	12	0	16
24	S,P,J	19th April 2009	Mayuge	6:37am	10:45am	4	8	45.1	11.28	40	2	45.1	0	19	0	0	19	26.1	2	2	0	0
25	S,R,P	20th April 2009	Mukono,Buikwe, Buvuma	3:04pm	8:09pm	5	5	51.94	10.39	100	5	39.34	12.6	39.34	0	0	39.34	12.6	10	10	0	3
26	S,R,P	21st April 2009	Mukono,Buikwe, Buvuma	10:05am	6:34pm	8	29	71	8.88	60	3	71	0	60.5	0	0	60.5	10.5	17	17	0	3
27	R,P	22nd April 2009	Mukono,Buikwe, Buvuma	9:21am	7:29pm	10	8	86.37	8.64	80	4	86.37	0	77.37	0	0	77.37	9	17	17	0	0
28	S,R,P	23rd April 2009	Mukono,Buikwe, Buvuma	10:14am	7:42pm	9	28	102.23	11.36	140	7	102.23	0	75.23	0	0	75.23	27	16	16	0	4
29	S,R,P	24th April 2009	Mukono,Buikwe, Buvuma	7:48am	8:06pm	12	20	123.18	10.27	60	3	115.48	7.7	82.08	2.7	0	84.78	38.4	21	21	0	3
						235	**695**	**1982.13**		**2,100**	**105**	**1320.68**	**653.77**	**915.83**	**411.95**	**189.7**	**1138.08**	**720.45**	**305**	**252**	**7**	**291**
																		844.05				

Liters of gas per Km			1.06
Total time on water in hours	246.58333		
Average speed per day		8.038378	
Average time on water per day	9.4839744		
Distance per day		110.1183	
Average speed per day per Km	11.61099		

S-Sam
F-Fred
P-Peter
R-Richard
J-Julius

Table A2. Summary of Lake Victoria Survey methods and results
Source: Researcher

ANNEX T

LAKE VICTORIA FINDINGS OF NESTS, ADULT, AND YOUNG *C. niloticus* SIGHTINGS AS REPORTED BY LOCAL COMMUNITIES THROUGH FOCUS GROUP DISCUSSIONS

No of site	Coordinates - Eastings	Coordinates - Northings	Adult crocodiles	Crocodiles Nests	Young crocodiles (Yearlings)
1	497867	5844	6	2	
2	539794	44123	5	1	
3	498433	5304	4	1	
4	500977	7465	4	3	
5	534105	16336	4		
6	532911	30009	4		
7	592439	12229	3	1	
8	592439	12229	3	1	
9	576671	9984395	3		
10	537132	24451	3		
11	604256	25562	3		
12	553724	49739	3		
13	5544737	34880	3		
14	569672	28872	3		
15	549746	24679	3		
16	516643	18587	3		1
17	513911	14967	3		
18	558428	22649	3		
19	578723	23524	3		
20	580202	9985972	2	1	
21	472719	14012	2	2	
22	574637	9987818	2	2	
23	580944	9987178	2	3	
24	580357	9988004	2	3	
25	579686	9983766	2	3	
26	579913	29181	2		
27	575058	35183	2		
28	464718	14914	2		
29	506240	17433	2		
30	599973	19526	2		
31	591568	8834	2		
32	585343	10672	2		
33	517676	19212	2		
34	534053	11840	2		
35	574456	34325	2		
36	537003	49170	2		
37	529627	46037	2		1
38	512597	12320	2		1
39	547147	26880	2		1
40	529708	51472	2		
41	554333	20105	2		
42	553724	49739	2		

No of site	Coordinates - Eastings	Coordinates - Northings	Adult crocodiles	Crocodiles Nests	Young crocodiles (Yearlings)
43	499698	13083	1	1	
44	589772	9487	1	1	
45	470665	9993232	1	1	
46	576768	30014	1	1	
47	608362	29165	1	2	
48	554574	23347	1	3	
49	493915	1934	1		
50	504335	15631	1		
51	503954	14963	1		
52	578074	32095	1		
53	589273	15294	1		
54	596973	10250	1		
55	564314	13007	1		
56	488298	18723	1		
57	590140	16904	1		
58	472541	9999862	1		
59	491588	2336	1		
60	474935	9995646	1		
61	475762	9990758	1		
62	472611	9998356	1		
63	464323	9988936	1		
64	469372	9991156	1		
65	464783	99972	1		
66	471782	9996666	1		
67	461823	27266	1		
68	479471	3580	1		
69	490220	2063	1		
70	503574	11558	1		
71	526930	48254	1		
72	486661	12712	1		
73	487523	15313	1		
74	486668	14292	1		
75	487125	20265	1		
76	48574	21184	1		
77	483488	19882	1		
78	484032	18984	1		
79	485878	20390	1		
80	501070	12725	1		
81	501002	14494	1		
82	489776	8353	1		
83	505509	17016	1		
84	526579	39162	1		
85	515848	11975	1		
86	522886	30165	1		
87	577598	30719	1		
88	578851	9990164	1		
89	578387	9988814	1		
90	576411	9988344	1		
91	575540	9987832	1		
92	580606	27081	1		

No of site	Coordinates - Eastings	Coordinates - Northings	Adult crocodiles	Crocodiles Nests	Young crocodiles (Yearlings)
93	577814	20053	1		
94	578885	21547	1		
95	585570	21997	1		
96	591188	16078	1		
97	590959	20759	1		
98	590413	13479	1		
99	596513	11082	1		
100	594080	10044	1		
101	595935	9356	1		
102	584740	12113	1		
103	542462	27675	1		
104	541503	24528	1		
105	538598	36443	1		
106	540303	34474	1		
107	531450	14822	1		
108	536034	9597	1		
109	538751	24154	1		
110	529865	9502	1		
111	531881	6609	1		
112	533810	5850	1		
113	534720	11154	1		
114	610336	26982	1		
115	574462	9998044	1		
116	551960	36160	1		
117	565717	35902	1		
118	539794	44123	1		
119	540327	51363	1		
120	540777	40127	1		
121	578251	36429	1		
122	562922	17544	1		
123	561146	15924	1		
124	566927	12648	1		
125	566978	15863	1		
126	564501	17284	1		
127	563598	14170	1		
128	565849	22713	1		
129	54825	20278	1		
130	545917	27363	1		
131	595935	9356	1		
132	513929	14912	1		1
133	485625	19580	1		1
134	540857	52561	1		1
135	543333	30898	1		1
136	544009	29105	1		1
137	553724	49739	1		1
138	518071	13411	1		1
139	549568	39134	1		5
140	483016	17724	1		
141	520508	19318	1		
142	524294	23624	1		

No of site	Coordinates - Eastings	Coordinates - Northings	Adult crocodiles	Crocodiles Nests	Young crocodiles (Yearlings)
143	521519	24376	1		
144	586931	25864	1		
145	515280	18350	1		
146	535390	3089	1		
147	518945	21175	1		
148	569799	35801	1		
149	597097	18663	1		
150	544700	31768	1		
151	585317	20100	1		
152	532175	34445	1		
153	580861	21320	1		
154	582974	21618	1		
155	549568	39134		1	
156	533347	29512		1	
157	461720	19990		2	
158	576673	9986010		2	
159	537486	18061			1
160	544145	27426			1
TOTAL			**213**	**38**	**18**
No of Sites			**152**	**22**	**14**

Table A3. Findings from Lake Victoria Survey from focus group discussions

Source. Researcher

ANNEX U

RESULTYS OF THE NEST SURVEY AND EGG COLLECTION (FOR RANCHING) CONDUCTED JOINTLY WITH UGANDA CROCS LTD STAFF, AT MFNP

Run No.	Time	Date	Name of place	Eastings	Northings	No. of nests seen	Weather	Distance searched to Left (m)	Distance searched to Right (m)	Total Distance Searched	No. destroyed /damaged	Extent of damage (all, half,)	Likely cause of damage floods, predators)	Av. dist. from water to first nest (m)	Av. dist. from water to last nest (m)	Av. height above water (m)	Nearest dist from each other (m)	Longest dist from each other (m)	Vegetation (Sand, Hard flat, Short grass, Trees, Cliff)	No. of nests opened	Nos. of eggs taken
1	11:37	27/02/2009	Crocodile bar up	352445	251957	2	Sunny	20	30	50				100	110	2	5	10	s,t	2	30
2	12:23	27/02/2009	Crocodile bar	352126	251884	12	Sunny	500	20	520				20	25	1	2	15		12	350
3	14:08	27/02/2009	Crocodile bar	351834	251954	1	Sunny	10	500	510				20		1			sg	1	35
4	14:43	27/02/2009	Crocodile bar	350937	251975	3	Sunny	0	100	100				5	6	1	1	3	h,sg	3	115
5		27/02/2009	Lower Bar	350874	251959	1	Sunny	0	100	100				10	10	0.5			h,sg	1	40
6	14:55	27/02/2009	First hand from Falls	350855	251941	12	Sunny	80	50	130				2	8	2	2	10	h,sg	12	400
7	17:17	27/02/2009	Nyamusika	346155	252035	3	Sunny	100	300	400				20	5	2	3.5		open	3	85
8	18:05	27/02/2009	Nyamusika	345798	251854	1	Sunny	20	5	25				5		1			s,sg	1	30
9	18:28	27/02/2009	Nyamusika	345524	251657	1	Sunny														
10	08:59	28/02/2009	Songe River	338288	252913	6	Sunny	150	300	450	0	0		10	25	1	1	15	y sg	6	215
11	10:43	28/02/2009	Buligi	331236	249176	2	Sunny	50	100	150	0	0		5		1.5			t	1	20
12	11:22	28/02/2009	Buligi	329880	247873	1	Sunny	100	50	150				6		5			s, t	1	31
13	11:45	28/02/2009	Buligi	329713	247682	1	Sunny	30	50	80				4		6			s,t	1	40
14	12:18	28/02/2009	Buligi	329592	247589	1	Sunny	10	10	20	1	0.8	Nile Monitor	3					s,t	1	0
15	12:29	28/02/2009	Buligi	329477	247456	1	Sunny	20	30	50	2			2		4			s,t	1	30
16	13:01	28/02/2009	Kafunu	329450	247251	2	Sunny	10	20	30				4	8	4	1.5	8	sd, s, t	2	80
17	14:04	28/02/2009	Kafunu	323803	247406	1	Sunny	50	50	100				10					sd, sg	1	35
						49		1,100	1,665	2,765										48	1501

Table A4. Summary of *C. niloticus* nest survey results, Murchison Falls National Park
Source: Researcher

ANNEX V

HISTORICAL TO PRESENT DAY *C.niloticus* NEST SIGHTINGS AT MFNP (1966 TO 2023)

No	Year the Site was Recorded	Easting	Northing	Number of Nests
1	2023	352134	251877	1
2	2023	352117	251909	1
3	2023	352115	251900	1
4	2023	352108	251885	1
5	2023	352089	251906	1
6	2023	352074	251915	1
7	2023	351920	252003	1
8	2023	351882	251993	1
9	2023	350940	251988	1
10	2023	350885	251975	1
11	2023	350614	251887	1
12	2023	345999	251958	1
13	2023	345901	251958	1
14	2023	345901	251903	1
15	2023	345572	251750	1
16	2023	344190	251780	1
17	2023	344171	251780	1
18	2023	343957	251918	1
19	2023	338268	252909	1
20	2023	338257	252863	1
21	2023	338254	252871	1
22	2022	352450	251945	1
23	2022	352134	251877	1
24	2022	352134	251874	1
25	2022	352129	251876	1
26	2022	352128	251880	1
27	2022	352127	251883	1
28	2022	352127	251880	1
29	2022	352126	251884	1
30	2022	350940	251988	1
31	2022	350885	251975	1
32	2022	350872	251967	1
33	2022	350849	251947	1
34	2022	350815	251938	1
35	2022	350811	251941	1
36	2022	345999	251958	1
37	2022	345901	251903	1
38	2022	345572	251750	1
39	2022	344190	251780	1
40	2022	344171	251780	1
41	2022	343957	251918	1
42	2022	338268	252909	1
43	2022	338257	252863	1
44	2022	338256	252859	1
45	2022	338254	252871	1
46	2019	352033	251937	1
47	2019	351304	251849	1
48	2019	350600	251828	1
49	2019	350516	251480	1
50	2019	350489	251389	1
51	2019	350340	250591	1
52	2019	348730	249886	1
53	2019	348669	250211	1
54	2019	348094	250469	1
55	2019	347705	250536	1
56	2019	347611	250637	1
57	2019	347102	251368	1
58	2019	346633	251526	1
59	2019	344777	251431	1
60	2019	343860	251709	1
61	2019	342411	252601	1
62	2019	341929	252657	1
63	2019	341744	252643	1
64	2019	340927	252961	1
65	2019	340768	252889	1
66	2018	352033	251937	1
67	2018	351322	251334	1
68	2018	351136	251230	1
69	2018	350847	250865	1
70	2018	350822	251325	1
71	2018	350340	250591	1
72	2018	349636	250121	1
73	2018	348730	249886	1
74	2018	348669	250211	1
75	2018	348094	250469	1
76	2018	347936	250585	1
77	2018	347842	250382	1
78	2018	347705	250536	1
79	2018	347611	250637	1
80	2018	347102	251368	1
81	2018	346633	251526	1
82	2018	345505	251496	1
83	2018	344777	251431	1
84	2018	343860	251709	1
85	2018	342605	252561	1
86	2018	342411	252601	1
87	2018	341929	252657	1
88	2018	341744	252643	1
89	2018	340927	252961	1
90	2018	340768	252889	1
91	2018	340533	252833	1
92	2017	352157	251840	1
93	2017	352033	251937	1
94	2017	351724	251503	1
95	2017	351322	251334	1
96	2017	351304	251849	1
97	2017	351136	251230	1
98	2017	350847	250865	1
99	2017	350822	251325	1
100	2017	350600	251828	1
101	2017	350516	251480	1
102	2017	350340	250591	1
103	2017	349636	250121	1
104	2017	348730	249886	1
105	2017	348669	250211	1
106	2017	348094	250469	1
107	2017	347842	250382	1
108	2017	347705	250536	1
109	2017	347611	250637	1
110	2017	347102	251368	1

No	Year the Site was Recorded	Easting	Northing	Number of Nests
111	2017	346633	251526	1
112	2017	345505	251496	1
113	2017	344777	251431	1
114	2017	343860	251709	1
115	2017	342605	252561	1
116	2017	342411	252601	1
117	2017	341929	252657	1
118	2017	341744	252643	1
119	2017	340927	252961	1
120	2017	340768	252889	1
121	2017	340533	252833	1
122	2016	352157	251840	1
123	2016	352033	251937	1
124	2016	351724	251503	1
125	2016	351322	251334	1
126	2016	351304	251849	1
127	2016	350847	250865	1
128	2016	350822	251325	1
129	2016	350489	251389	1
130	2016	348803	250346	1
131	2016	348730	249886	1
132	2016	348669	250211	1
133	2016	348094	250469	1
134	2016	347936	250585	1
135	2016	347922	250919	1
136	2016	347842	250382	1
137	2016	347705	250536	1
138	2016	347611	250637	1
139	2016	347102	251368	1
140	2016	346633	251526	1
141	2016	345505	251496	1
142	2016	344777	251431	1
143	2016	343860	251709	1
144	2016	342605	252561	1
145	2016	342411	252601	1
146	2016	340927	252961	1
147	2016	340768	252889	1
148	2016	340533	252833	1
149	2015	351724	251503	1
150	2015	351322	251334	1

No	Year the Site was Recorded	Easting	Northing	Number of Nests
151	2015	350847	250865	1
152	2015	350822	251325	1
153	2015	348730	249886	1
154	2015	348730	249886	1
155	2015	348669	250211	1
156	2015	348669	250211	1
157	2015	348094	250469	1
158	2015	347936	250585	1
159	2015	347842	250382	1
160	2015	347705	250536	1
161	2015	347611	250637	1
162	2015	347102	251368	1
163	2015	346633	251526	1
164	2015	345804	251832	1
165	2015	345505	251496	1
166	2015	344900	251620	1
167	2015	344777	251431	1
168	2015	343877	251986	1
169	2015	343860	251709	1
170	2015	343772	252144	1
171	2015	343425	252589	1
172	2015	343235	252561	1
173	2015	342605	252561	1
174	2015	340927	252961	1
175	2015	340768	252889	1
176	2014	347611	250637	1
177	2014	347102	251368	1
178	2014	345505	251496	1
179	2014	344777	251431	1
180	2014	343860	251709	1
181	2014	342605	252561	1
182	2014	341929	252657	1
183	2014	341744	252643	1
184	2014	340927	252961	1
185	2014	340768	252889	1
186	2014	340533	252833	1
187	2012	352157	251840	1
188	2012	352033	251937	1
189	2012	351304	251849	1
190	2012	350600	251828	1

No	Year the Site was Recorded	Easting	Northing	Number of Nests
191	2012	350516	251480	1
192	2012	350489	251389	1
193	2012	348803	250346	1
194	2012	348366	250718	1
195	2012	347922	250919	1
196	2012	347571	251116	1
197	2012	347242	251659	1
198	2012	347099	251841	1
199	2012	346527	252003	1
200	2012	345804	251832	1
201	2012	344900	251620	1
202	2012	343877	251986	1
203	2012	343425	252589	1
204	2012	343235	252561	1
205	2012	342971	252875	1
206	2012	341867	253019	1
207	2012	340450	253096	1
208	2012	339876	253113	1
209	2012	339591	253226	1
210	2012	338865	253174	1
211	2012	338293	252700	1
212	2012	338205	252704	1
213	2012	338039	252600	1
214	2012	337535	252173	1
215	2012	337464	252086	1
216	2012	337154	251858	1
217	2012	337081	251788	1
218	2011	352157	251840	1
219	2011	351304	251849	1
220	2011	350600	251828	1
221	2011	350516	251480	1
222	2011	350489	251389	1
223	2011	348803	250346	1
224	2011	348366	250718	1
225	2011	347922	250919	1
226	2011	347571	251116	1
227	2011	347242	251659	1
228	2011	347099	251841	1
229	2011	345804	251832	1
230	2011	344900	251620	1

No	Year the Site was Recorded	Easting	Northing	Number of Nests
231	2011	343425	252589	1
232	2011	343235	252561	1
233	2011	342971	252875	1
234	2011	341867	253019	1
235	2011	339876	253113	1
236	2011	339591	253226	1
237	2011	338865	253174	1
238	2011	338293	252700	1
239	2011	338205	252704	1
240	2011	338039	252600	1
241	2011	337464	252086	1
242	2011	337154	251858	1
243	2010	352157	251840	1
244	2010	352033	251937	1
245	2010	351304	251849	1
246	2010	350600	251828	1
247	2010	350516	251480	1
248	2010	350489	251389	1
249	2010	348803	250346	1
250	2010	347922	250919	1
251	2010	347571	251116	1
252	2010	347242	251659	1
253	2010	347099	251841	1
254	2010	346527	252003	1
255	2010	345937	251910	1
256	2010	345804	251832	1
257	2010	344900	251620	1
258	2010	343877	251986	1
259	2010	343772	252144	1
260	2010	343425	252589	1
261	2010	343235	252561	1
262	2010	343056	252840	1
263	2010	342971	252875	1
264	2010	341867	253019	1
265	2010	340450	253096	1
266	2010	340162	253098	1
267	2010	339876	253113	1
268	2010	339591	253226	1
269	2010	338865	253174	1
270	2010	338293	252700	1

No	Year the Site was Recorded	Easting	Northing	Number of Nests
271	2010	338205	252704	1
272	2010	336687	251234	1
273	2010	336586	251096	1
274	2009	352126	251884	12
275	2009	350855	251941	12
276	2009	338282	252913	6
277	2009	350937	251975	3
278	2009	346155	252035	3
279	2009	352445	251957	2
280	2009	329249	247252	2
281	2009	352126	251884	1
282	2009	352126	251884	1
283	2009	352126	251884	1
284	2009	352126	251884	1
285	2009	352126	251884	1
286	2009	352126	251884	1
287	2009	352126	251884	1
288	2009	352126	251884	1
289	2009	352126	251884	1
290	2009	352126	251884	1
291	2009	352126	251884	1
292	2009	352126	251884	1
293	2009	351834	251954	1
294	2009	350937	251975	1
295	2009	350937	251975	1
296	2009	350937	251975	1
297	2009	350874	251959	1
298	2009	350855	251941	1
299	2009	350855	251941	1
300	2009	350855	251941	1
301	2009	350855	251941	1
302	2009	350855	251941	1
303	2009	350855	251941	1
304	2009	350855	251941	1
305	2009	350855	251941	1
306	2009	350855	251941	1
307	2009	350855	251941	1
308	2009	350855	251941	1
309	2009	350855	251941	1
310	2009	346155	252035	1

No	Year the Site was Recorded	Easting	Northing	Number of Nests
311	2009	346155	252035	1
312	2009	346155	252035	1
313	2009	345798	251854	1
314	2009	345798	251854	1
315	2009	340254	252820	1
316	2009	338282	252913	1
317	2009	338282	252913	1
318	2009	338282	252913	1
319	2009	338282	252913	1
320	2009	338282	252913	1
321	2009	338282	252913	1
322	2009	331236	249176	1
323	2009	329881	247870	1
324	2009	329712	247681	1
325	2009	329596	247590	1
326	2009	329477	247456	1
327	2009	329249	247252	1
328	2009	329249	247252	1
329	2009	329249	247252	1
330	2008	352141	251872	1
331	2008	352141	251872	1
332	2008	352141	251872	1
333	2008	352141	251872	1
334	2008	352141	251872	1
335	2008	352141	251872	1
336	2008	352141	251872	1
337	2008	352141	251872	1
338	2008	351839	251963	1
339	2008	351839	251963	1
340	2008	351839	251963	1
341	2008	350940	251987	1
342	2008	350940	251987	1
343	2008	350940	251987	1
344	2008	350940	251987	1
345	2008	350940	251987	1
346	2008	350940	251987	1
347	2008	350940	251987	1
348	2008	350842	251952	1
349	2008	350842	251952	1
350	2008	350842	251952	1

No	Year the Site was Recorded	Easting	Northing	Number of Nests
351	2008	350842	251952	1
352	2008	350842	251952	1
353	2008	350842	251952	1
354	2008	350803	251932	1
355	2008	350803	251932	1
356	2008	350803	251932	1
357	2008	350803	251932	1
358	2008	350803	251932	1
359	2008	350803	251932	1
360	2008	350803	251932	1
361	2008	350803	251932	1
362	2008	346431	252128	1
363	2008	346431	252128	1
364	2008	346431	252128	1
365	2008	346431	252128	1
366	2008	346431	252128	1
367	2008	346431	252128	1
368	2008	346160	252017	1
369	2008	346160	252017	1
370	2008	346160	252017	1
371	2007	346168	252036	15
372	2007	352095	2511897	13
373	2007	350840	251951	11
374	2007	338260	252906	10
375	2007	348283	249919	9
376	2007	350934	251991	7
377	2007	344201	251780	4
378	2007	345957	251947	2
379	2007	345814	251868	2
380	2007	352095	2511897	1
381	2007	352095	2511897	1
382	2007	352095	2511897	1
383	2007	352095	2511897	1
384	2007	352095	2511897	1
385	2007	350934	251991	1
386	2007	350934	251991	1
387	2007	350934	251991	1
388	2007	350840	251951	1
389	2007	350840	251951	1
390	2007	350840	251951	1
391	2007	350840	251951	1
392	2007	348283	249919	1
393	2007	348283	249919	1
394	2007	348283	249919	1
395	2007	346168	252036	1
396	2007	346168	252036	1
397	2007	346168	252036	1
398	2007	346168	252036	1
399	2007	346168	252036	1
400	2007	346168	252036	1
401	2007	344201	251780	1
402	2007	344055	251841	1
403	2007	338260	252906	1
404	2007	338260	252906	1
405	2007	338260	252906	1
406	2007	338260	252906	1
407	2007	338187	252756	1
408	2007	338105	252616	1
409	2007	338090	252794	1
410	2006	350731	251900	14
411	2006	338256	252908	11
412	2006	346430	252124	9
413	2006	346153	251938	9
414	2006	349750	250634	6
415	2006	346234	252053	6
416	2006	331229	249178	5
417	2006	329708	247685	4
418	2006	345952	251938	2
419	2006	350731	251900	1
420	2006	350731	251900	1
421	2006	350731	251900	1
422	2006	350731	251900	1
423	2006	350731	251900	1
424	2006	349750	250634	1
425	2006	349750	250634	1
426	2006	346430	252124	1
427	2006	346430	252124	1
428	2006	346430	252124	1
429	2006	346234	252053	1
430	2006	346153	251938	1
431	2006	346153	251938	1
432	2006	346153	251938	1
433	2006	346153	251938	1
434	2006	338256	252908	1
435	2006	338256	252908	1
436	2006	338256	252908	1
437	2006	338256	252908	1
438	2006	331229	249178	1
439	2006	331229	249178	1
440	2006	329708	247685	1
441	2006	329708	247685	1
442	2006	329370	247354	1
443	2005	352453	251961	1
444	2005	352445	252079	1
445	2005	352060	252096	1
446	2005	352047	252101	1
447	2005	351862	251978	1
448	2005	351484	251914	1
449	2005	351399	251949	1
450	2005	351393	251948	1
451	2005	350938	251990	1
452	2005	350937	251992	1
453	2005	350936	251993	1
454	2005	350872	251965	1
455	2005	350854	251940	1
456	2005	350848	251948	1
457	2005	350847	251950	1
458	2005	350846	251941	1
459	2005	350844	251958	1
460	2005	350842	251950	1
461	2005	350841	25950	1
462	2005	350838	251945	1
463	2005	350828	251941	1
464	2005	350826	251936	1
465	2005	350820	251938	1
466	2005	350819	251942	1
467	2005	350812	251933	1
468	2005	350809	251936	1
469	2005	350807	251936	1
470	2005	350795	251961	1

No	Year the Site was Recorded	Easting	Northing	Number of Nests
471	2005	350787	251960	1
472	2005	350787	251956	1
473	2005	349769	250638	1
474	2005	349767	250637	1
475	2005	349763	250637	1
476	2005	349762	250635	1
477	2005	349750	250645	1
478	2005	349750	250645	1
479	2005	349749	250638	1
480	2005	349748	250639	1
481	2005	349746	250643	1
482	2005	349742	250650	1
483	2005	349742	250646	1
484	2005	349741	250650	1
485	2005	349741	250649	1
486	2005	349741	250649	1
487	2005	349720	250672	1
488	2005	349714	250682	1
489	2005	349711	250676	1
490	2005	349707	250689	1
491	2005	346226	252072	1
492	2005	346172	252036	1
493	2005	346171	252037	1
494	2005	346170	252040	1
495	2005	346168	252040	1
496	2005	346167	252031	1
497	2005	346164	252028	1
498	2005	346161	252011	1
499	2005	346159	252029	1
500	2005	346153	252026	1
501	2005	346135	252018	1
502	2005	346029	251978	1
503	2005	346007	251960	1
504	2005	345998	251970	1
505	2005	345817	251859	1
506	2005	345806	251858	1
507	2005	345800	251851	1
508	2005	345582	251733	1
509	2005	345572	251727	1
510	2005	345420	251662	1

No	Year the Site was Recorded	Easting	Northing	Number of Nests
511	2005	345420	251662	1
512	2005	345418	51660	1
513	2005	345417	251661	1
514	2005	345417	251660	1
515	2005	345415	251660	1
516	2005	345320	251663	1
517	2005	344203	251778	1
518	2005	338281	252903	1
519	2005	338280	252929	1
520	2005	338277	252915	1
521	2005	338277	252900	1
522	2005	338277	252900	1
523	2005	338267	252913	1
524	2005	338264	252912	1
525	2005	338264	252908	1
526	2005	338259	251912	1
527	2005	338245	252874	1
528	2002	350809	251940	13
529	2002	352125	251871	10
530	2002	345796	251246	8
531	2002	345836	251868	7
532	2002	338143	252628	7
533	2002	350937	252986	6
534	2002	349745	250629	6
535	2002	346170	252031	6
536	2002	348268	249898	4
537	2002	344170	251777	3
538	2002	343981	251864	2
539	2002	353083	252059	1
540	1969	3530	2521	36
541	1969	3516	2519	29
542	1969	3382	2526	22
543	1969	3478	2504	13
544	1969	3464	2521	13
545	1969	3447	2519	10
546	1969	3318	2495	10
547	1969	3464	2514	7
548	1969	3410	2527	7
549	1969	3464	2521	5
550	1969	3459	2519	5

No	Year the Site was Recorded	Easting	Northing	Number of Nests
551	1969	3502	2502	2
552	1969	3532	2520	1
553	1969	3525	2520	1
554	1969	3524	2519	1
555	1969	3520	2519	1
556	1969	3496	2498	1
557	1969	3482	2499	1
558	1969	3473	2518	1
559	1969	3472	2521	1
560	1969	3470	2522	1
561	1969	3468	2522	1
562	1969	3468	2522	1
563	1969	3467	2521	1
564	1969	3466	2521	1
565	1969	3464	2521	1
566	1969	3463	2521	1
567	1969	3461	2520	1
568	1969	3461	2520	1
569	1969	3455	2514	1
570	1969	3442	2518	1
571	1969	3439	2519	1
572	1969	3438	2520	1
573	1969	3430	2522	1
574	1969	3378	2525	1
575	1969	3376	2524	1
576	1969	3370	2517	1
577	1969	3305	2487	1
578	1969	3299	2480	1
579	1969	3297	2477	1
580	1969	3294	2474	1
581	1969	3290	2472	1
582	1968C	3382	2526	18
583	1968C	3410	2527	17
584	1968C	3464	2514	16
585	1968C	3455	2514	15
586	1968C	3478	2504	14
587	1968C	3482	2499	13
588	1968C	3496	2498	12
589	1968C	3502	2502	11
590	1968C	3530	2521	10

No	Year the Site was Recorded	Easting	Northing	Number of Nests
591	1968C	3520	2519	9
592	1968C	3516	2519	8
593	1968C	3466	2521	7
594	1968C	3464	2521	6
595	1968C	3464	2521	5
596	1968C	3461	2520	4
597	1968C	3459	2519	3
598	1968C	3447	2519	2
599	1968C	3532	2520	1
600	1968C	3525	2520	1
601	1968C	3524	2519	1
602	1968C	3473	2518	1
603	1968C	3472	2521	1
604	1968C	3470	2522	1
605	1968C	3468	2522	1
606	1968C	3468	2522	1
607	1968C	3467	2521	1
608	1968C	3464	2521	1
609	1968C	3463	2521	1
610	1968C	3461	2520	1
611	1968C	3442	2518	1
612	1968C	3439	2519	1
613	1968C	3438	2520	1
614	1968C	3430	2522	1
615	1968C	3378	2525	1
616	1968C	3376	2524	1
617	1968C	3370	2517	1
618	1968C	3318	2495	1
619	1968C	3305	2487	1
620	1968C	3299	2480	1
621	1968C	3297	2477	1
622	1968C	3294	2474	1
623	1968C	3290	2472	1
624	1968	3530	2521	22
625	1968	3502	2502	21
626	1968	3455	2514	19
627	1968	3516	2519	16
628	1968	3520	2519	15
629	1968	3464	2521	14
630	1968	3461	2520	12
631	1968	3464	2521	10
632	1968	3459	2519	10
633	1968	3466	2521	9
634	1968	3478	2504	8
635	1968	3447	2519	6
636	1968	3532	2520	1
637	1968	3525	2520	1
638	1968	3524	2519	1
639	1968	3496	2498	1
640	1968	3482	2499	1
641	1968	3473	2518	1
642	1968	3472	2521	1
643	1968	3470	2522	1
644	1968	3468	2522	1
645	1968	3468	2522	1
646	1968	3467	2521	1
647	1968	3464	2521	1
648	1968	3464	2514	1
649	1968	3463	2521	1
650	1968	3461	2520	1
651	1968	3442	2518	1
652	1968	3439	2519	1
653	1968	3438	2520	1
654	1968	3430	2522	1
655	1968	3410	2527	1
656	1968	3382	2526	1
657	1968	3378	2525	1
658	1968	3376	2524	1
659	1968	3370	2517	1
660	1968	3318	2495	1
661	1968	3305	2487	1
662	1968	3299	2480	1
663	1968	3297	2477	1
664	1968	3294	2474	1
665	1968	3290	2472	1
666	1966	3442	2518	18
667	1966	3378	2525	7
668	1966	3525	2520	6
669	1966	3467	2521	5
670	1966	3524	2519	3
671	1966	3376	2524	3
672	1966	3530	2521	2
673	1966	3520	2519	2
674	1966	3473	2518	2
675	1966	3470	2522	2
676	1966	3461	2520	2
677	1966	3447	2519	2
678	1966	3305	2487	2
679	1966	3299	2480	2
680	1966	3532	2520	1
681	1966	3516	2519	1
682	1966	3502	2502	1
683	1966	3496	2498	1
684	1966	3482	2499	1
685	1966	3478	2504	1
686	1966	3472	2521	1
687	1966	3468	2522	1
688	1966	3468	2522	1
689	1966	3466	2521	1
690	1966	3464	2521	1
691	1966	3464	2521	1
692	1966	3464	2521	1
693	1966	3464	2514	1
694	1966	3463	2521	1
695	1966	3461	2520	1
696	1966	3459	2519	1
697	1966	3455	2514	1
698	1966	3439	2519	1
699	1966	3438	2520	1
700	1966	3430	2522	1
701	1966	3410	2527	1
702	1966	3382	2526	1
703	1966	3370	2517	1
704	1966	3318	2495	1
705	1966	3297	2477	1
706	1966	3294	2474	1
707	1966	3290	2472	1

Table A4. C.niloticus nets sigtings at MFNP 1966 -2003. Source: Uganda Wildlife Authority and Researcher (2009)

ANNEX W
PROBLEM *C.niloticus* RESCUED BY UWA BETWEEN 2004 AND 2022 AND DISTRICT OF ORIGIN

	DISTRICT	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
1	Amolota															1					1
2	Apac			1						2	16	10	6	7	8	2					52
3	Bugiri		1																		1
4	Buikwe											2						3	1		6
5	Buliisa					1	3				2		2								8
6	Buvuma													2		6	1	1	3	3	16
7	Buyende								2				1			1	2			1	7
8	Isingiro											2				1					3
9	Jinja							2	8		2	2	1					1			16
10	Kagadi																1				1
11	Kalangala													1		2			1		4
12	Kalilo															1			1		2
13	Kasese								8	18	3	3									32
14	Kiryandongo									2	2								1		5
15	Kyankwanzi																1	2	3	2	8
16	Masindi													12	8						20
17	Mayuge							10		2			2	2	2	1		1	2		22
18	Mbarara	1								2								1			4
19	Mukono							2			2	1		1	3	2		2	1		14
20	Nakansogola											2									2
21	Nakapiripirit								2												2
22	Nakaseke			1				2	4			6		1		3		2		3	22
23	Nakasongola				1	1	3	10		10		2	3	4	7	2		1		2	46
24	Namayingo									4						2				2	8
25	Rubirizi										1										1
26	Wakiso													1					1		2
	Total	1	1	2	1	2	6	26	24	40	28	30	15	31	28	24	5	14	14	13	305

Table A6. Problem crocodile rescued by UWA from Districts between 2004 and 2022.
Source: Uganda Wildlife Authority

ANNEX X

SUMMARY OF *C.niloticus* EGGS COLLECTED, HATCHED AND SKINS EXPORTED FROM UGANDA

Year	Eggs Permitted	Eggs Collected	Eggs hatched	UG Records Skins Exported	CITES Records of Skin Exports
1991	4,000	4,050	3,483		
1992	4,000	4,025	3,381		
1993	4,000	3,244	2,336		4,019
1994	4,000	3,914	3,405		9,086
1995	4,000	3,887	3,536		
1996	4,000	-			
1997	4,000	-			
1998	4,000	-			
1999	3,000	2,500			
2000	4,000	2,350			508
2001	3,000	750			900
2002	1,000	1,000			302
2003	1,000	-			600
2004	-	-			600
2005	2,000	2,000			901
2006	3,000	1,160	828		300
2007	1,600	1,090	822		
2008	1,200	1,000	752		290
2009	4,000	1,546	1,350	-	
2010	1,500	1,176	1,047	500	1,000
2011	1,300	1,061		-	
2012	1,300	1,011		400	405
2013	1,000	1,000		400	400
2014	500	500		600	515
2015	1,000	-		600	600
2016	1,000	-		-	550
2017	1,500	1,172		600	600
2018	1,000	1,200		550	550
2019	1,000	800		500	1,500
2020	1,000			-	
2021	1,000			-	
2022	1,000	885	780	500	500
2023	1,000	1,000			
Total as at 2023		42,321	21,720	4,650	24,126
Total as at 2019		40,436			23,626
					58.40%

Table A7. Eggs permitted, collected, hatched and skins exported from Uganda of *C.niloticus*

Source: Uganda Wildlife Authority

ANNEX Y

CAPACITY BULDING THROUGH CO-REPORTING ON *C. niloticus*

Evaluation of the Populations of Nile Crocodile (*Crocodylus niloticus*) and Congo Dwarf Crocodile (*Osteolaemus osborni*) in Queen Elizabeth and Lake Mburo National Parks, Uganda

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