



# Bujagali Project: Critical Habitat Assessment

April 2018

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**Recommended citation:** E. Tatum-Hume, A. Serckx, C. Fletcher, V. Katariya, M. Starkey, J. Pilgrim. (2018). *Bujagali Project: Critical Habitat Assessment*. Report prepared on behalf of BEL by The Biodiversity Consultancy Ltd, Cambridge, UK.

**Acknowledgements:** This document has been prepared by The Biodiversity Consultancy Ltd, with thanks to Vianny Natugonza and NaFIRRI (National Fisheries Resources Research Institute), in particular Dr Winnie Nkalubo, for their support and specialist knowledge.

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## Executive summary

### Overview

This report is the Critical Habitat Assessment (CHA) for the Bujagali Hydropower Project (the Project), a hydroelectric development on the Upper Victoria Nile in Uganda operational since 2012. Social and Environmental Assessment (SEA) of the Project was carried out in 2006 (Burnside International Ltd 2006), according to the 2006 version of the International Finance Corporation (IFC) Performance Standard 6 (PS6) on Biodiversity Conservation and Sustainable Management of Living Natural Resources. The SEA concluded that the Project was not operating in Critical Habitat (Burnside International Ltd 2006).

The Project is now undergoing re-financing that will not result in any new construction or change in operation. In support of this re-financing, the IFC completed an Environmental and Social Review Summary (ESRS), including an Environmental and Social Action Plan<sup>1</sup> (ESAP). The ESAP requires the Project to update key biodiversity documents to align with the current IFC PS6 (IFC 2012a and 2012b).

This report details the assessment of the presence of Critical Habitat-qualifying biodiversity, and addresses the PS6 requirement for analysis of Natural and Modified Habitats.

The 2012 version of PS6 (2012a) and the accompanying Guidance Note 6 (2012b), provide clarification on the approach that should be applied to identify Critical Habitat. The Guidance Note includes the provision of quantitative thresholds for three of the Critical Habitat criterion to support the identification of Critical Habitat qualifying species. Applying the 2012 version of PS6, this CHA concludes that the Project is operating in Critical Habitat for a number of fish species (see Table 1). Hence, the ESAP requires the Project to respond to its Critical Habitat status by preparing a Biodiversity Action Plan (BAP) that *contributes toward net gain...via reasonable actions* within Project control<sup>2</sup> and to develop mechanisms that demonstrate progress towards net gain.

Key considerations following the CHA are:

- Screen Critical Habitat-qualifying species for likelihood and consequence of Project impact risk to appropriately focus management actions and effort;
- Develop a BAP based on the results of the risk screening to contribute towards net gain of Critical Habitat qualifying features via reasonable actions within the Projects control;

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<sup>1</sup> [IFC Project Information Portal – Bujagali Refinancing](#)

<sup>2</sup> [IFC Bujagali Refinancing ESAP item 13](#)

- Revise the monitoring approach to demonstrate and adaptively manage progress towards net gain.

#### Outcome of CHA

**Aquatic species:** a total of forty species<sup>3</sup> qualify under Criteria 1-3 (see Table 1). Some species qualify under more than one criterion. These represent the Project's priority biodiversity. Full details are given in [Sections 3, 4 and 5](#);

**Terrestrial species:** No Critical Habitat-qualifying terrestrial features were identified

**Highly threatened/unique ecosystems:** Lake Victoria-Upper Victoria Nile ecosystem

**Key evolutionary processes:** No Critical Habitat qualifying areas were identified.

**Protected areas:** The Project overlaps with the Jinja Wildlife Sanctuary ([IUCN Management Category VI site](#))<sup>4</sup>.

*Table 1: Summary of Project Critical Habitat-qualifying species under Criteria 1-3.*

IUCN Red List status: NE – Not Evaluated; DD – Data Deficient; LC – Least Concern; VU – Vulnerable; EN – Endangered; CR – Critically Endangered

Taxonomic group	Species	IUCN Red List category
Criterion 1, Tier 2		
Haplochromine	8 species	CR
Fishes	1 species	CR
Gastropods	1 species	CR
Criterion 2, Tier 1		
Haplochromine	10 species	NE
Criterion 2, Tier 2		

<sup>3</sup> Of these species, 25 (twenty five) remain undescribed species. They are included in the assessment based on the opinion of the Haplochromine specialist, Vianny Natugonza, and should be viewed with this in consideration until further information is available, particularly confirmation of their status as full species

<sup>4</sup> Project impacts to the Sanctuary were addressed via in 2006 via actions in the Environmental Mitigation and Monitoring Plan (Reeman Consulting 2017)

Taxonomic group	Species	IUCN Red List category
Haplochromine	4 species	CR
	1 species	VU
	2 species	DD
	15 species	NE
Gastropods	1 species	CR
Bivalves	1 species	EN
Criterion 3, Tier 2		
Fishes	1 species	LC

### Conclusions and next steps

The Project is operating in an area of Modified and Natural Habitat, both areas of Natural and Modified Habitat contain Critical Habitat qualifying species. Some riverine areas have been modified due to the Project (e.g. the reservoir section of the river). The Modified Habitat is estimated to be up to 8 km of river (the approximate extent of the reservoir from the Bujagali dam to the tailrace areas of the Nalubaale and Kiira hydropower facilities). The riverine habitat downstream of the dam (as far as Isimba), has largely retained its pre-Project characteristics and is therefore considered to be Natural Habitat<sup>5</sup>. Whilst no net loss of Natural Habitat is a PS6 requirement, there are no new environmental impacts since the original Project SEA (Burnside International Ltd 2006), and the operational risks of the Project are lower than the construction phase risks. Therefore, one of the key Project focus area should be on maintaining riverine Natural Habitat and minimising indirect impacts to Modified Habitat via reasonable actions within Project control, including ensuring the continued avoidance/minimisation of any on-going risks to aquatic ecology.

To demonstrate alignment with PS6 (paragraph 17/18) and the IFC ESAP<sup>6</sup>, a BAP is required, via which the Project should develop actions that contribute toward net gain of these species.

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<sup>5</sup> The characteristics of this habitat, up to the Kalagala falls at least, will likely change once the Isimba Project is operational. The area of Natural Habitat between Bujagali and Kalagala falls is estimated to be 15 km. A further ~20 km of Natural Habitat lies between Kalagala falls and the Isimba Project.

<sup>6</sup> IFC Bujagali re-financing ESAP, item 14

Not all Critical Habitat-qualifying species are of equal priority for Project management action due to differences in conservation status, ecology, Project and non-Project influences and cumulative impacts. Thus, it is important to prioritize these features for further management actions and monitoring effort, to ensure that resources are effectively applied and sound conclusions are reached. This will be a key initial task to support BAP development.

CHA is an iterative process. As the information base is developed, knowledge of the distribution, population/extent and threat status of individual species (in particular DD/NE and otherwise) may change. Thus, the Critical Habitat-qualifying status of a given species may change in the future. Such changes can be monitored and their implications for the Project evaluated via implementation of the BAP. However, it should be noted that whilst further research may affect individual species currently identified as Critical Habitat-qualifying, the overall assessment of Critical Habitat status will not change. This is because Critical Habitat is identified on a weakest link approach, whereby qualifying biodiversity under any criterion confirms the Project as Critical Habitat.

## 1 Introduction

### 1.1 Background

This report is the Critical Habitat Assessment (CHA) for the operational Bujagali Hydropower Project (HPP) (the Project), on the Upper Victoria Nile in Uganda, approximately 8 km North West of Jinja (Figure 1). The 250 MW run-of-river Project has been operational since 2012. The dam is 28 m high, with a 388 ha reservoir extending back (upstream) to the tailrace areas of the Nalubaale (previously known as Owen Falls) and Kiira (previously Owen Falls Extension) hydropower facilities.

Social and Environmental Assessment (SEA) of the Project was carried out in 2006 (Burnside International Ltd 2006) according to IFC PS6 (2006). At that time, and based on prevailing policy and practice at the time, the Project was not considered to be in Critical Habitat. Recently, as part of an Environmental and Social Due Diligence review (ESDD) (Reeman Consulting 2017) undertaken to support Project refinancing, the Project was screened against IFC PS6 (2012) (IFC 2012a), which contains an updated approach to assessing Critical Habitat (CH).

The CH screening specifically considered changes in the conservation status of fish species since the first assessment (in 2006), and the aquatic ecological monitoring for the Project that has been carried out by the National Fisheries Resources Research Institute (NaFIRRI) since 2006<sup>7</sup>. The screening indicated that several haplochromine and non-haplochromine fish species could potentially qualify under the Critical Habitat criteria outlined in IFC Guidance Note 6 (IFC 2012b). Hence, one action arising from ESDD was that full CHA be carried out according to PS6 (2012) (Reeman Consulting 2017). This document details the approach to, and outcome of, the full CHA.

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<sup>7</sup> Annual monitoring was undertaken in 2006, 2007 and 2008 and bi-annual monitoring from 2009 to 2017





Figure 1: The Bujagali Project location

## 1.2 Purpose of this report

The aim of CHA is to:

- (1) **Identify** Critical Habitat-qualifying biodiversity associated with the Project;
- (2) **Outline the implications** of the outcome of CHA for the Project; and
- (3) **Identify the recommended next steps** for the Project.

## 2 The approach to CHA

CHA is carried out as follows (see IFC 2012b):

1. Identification of an appropriate **Discrete Management Unit(s)** (see [Section 2.1](#)):
  - These units are used to identify the presence of biodiversity features, and to undertake the analysis against IFC PS6's thresholds for Critical Habitat;
2. Collection and verification of available information on biodiversity (see [Section 2.2](#)):
  - From the SEA, baseline surveys, literature review, specialist consultation and analysis; and
3. Assessment against IFC criteria for species and habitats (see [Section 2.3](#)):
  - To identify which biodiversity features qualify the area as Critical Habitat.

### 2.1 Discrete Management Units

CHA is carried out at the landscape scale, using ecologically and/or administratively coherent Discrete Management Units (DMUs)<sup>8</sup>. DMUs are a means of identifying the presence of Critical Habitat-qualifying features that meet the quantitative Criteria 1-3 of PS6 (see [Section 2.3](#)). They are identified at a landscape scale considering large-scale ecological processes where appropriate. A DMU should be informed by the biodiversity features of concern and their ecological requirements, and may therefore be much larger than the project concession or lease area itself. This is the key departure from PS6 policy and practice at the time of original pre-project assessment. This precautionary approach ensures all potential Project risks are taken into consideration, accounts for natural biodiversity extent that is not usually defined by arbitrary project boundaries, and demonstrates transparency to relevant stakeholders. There may be separate DMUs for individual species/subspecies, or (more commonly) for a suite of species with broadly shared requirements, but DMUs are not range maps for Critical Habitat-qualifying species. In practice, as few DMUs as possible should be used to simplify the analysis.

#### 2.1.1 Project components included in CHA

The CHA considers the Project's operational area of influence, as follows:

Inside the permanent fence line (see Figure 1.2 of SEA (Burnside International Ltd 2006)):

- Dam, dam embankment and spillways;
- Power house;
- Workshop and stores;

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<sup>8</sup> Defined by the IFC as 'areas with a definable boundary within which the character of biological communities and/or management issues have more in common with each other than they do with those in adjacent areas' (Footnote GN22 in GN6).

- Substation;
- Site roads.

Outside the permanent fence line:

- Reservoir (impoundment/inundated area) (see Figure 1.2 and Figure 5.1 of SEA (Burnside International Ltd 2006));
- The length of river downstream from the Project dam to the Isimba dam, over which the Project has an influence on water levels and water flow velocity.

The CHA does not include the transmission line (the Interconnection Project, IP), because it is no longer considered 'associated infrastructure' (as it was in the 2006 SEA). The IP was constructed, and is owned and operated by, Uganda Electricity Transmission Company Ltd (UETCL). It was originally installed to connect the Project to the national grid but, since 2012 when the Project became operational, some national grid upgrades have taken place and consequently power from the Project can be evacuated via several different routes.

### 2.1.2 Terrestrial Area of Analysis

Based on the outcome of ESDD (Reeman Consulting 2017) and the findings of the 2006 SEA (Burnside International Ltd 2006) it was considered unlikely that area of operational Project influence contains any Critical Habitat-qualifying terrestrial species. Further, given the time elapsed since operations began, the Project has now reached a stage where peak interaction with terrestrial areas (e.g. the construction phase) has passed, affected areas have been restored and current use of terrestrial areas is minimal.

To verify this, an area of analysis based on the area directly managed by the Project was reviewed against PS6 Criteria 1 to 3 (Figure 2). No Critical Habitat-qualifying features were identified and thus no DMUs were identified for further assessment. The rest of this CHA is focused on the aquatic DMU.

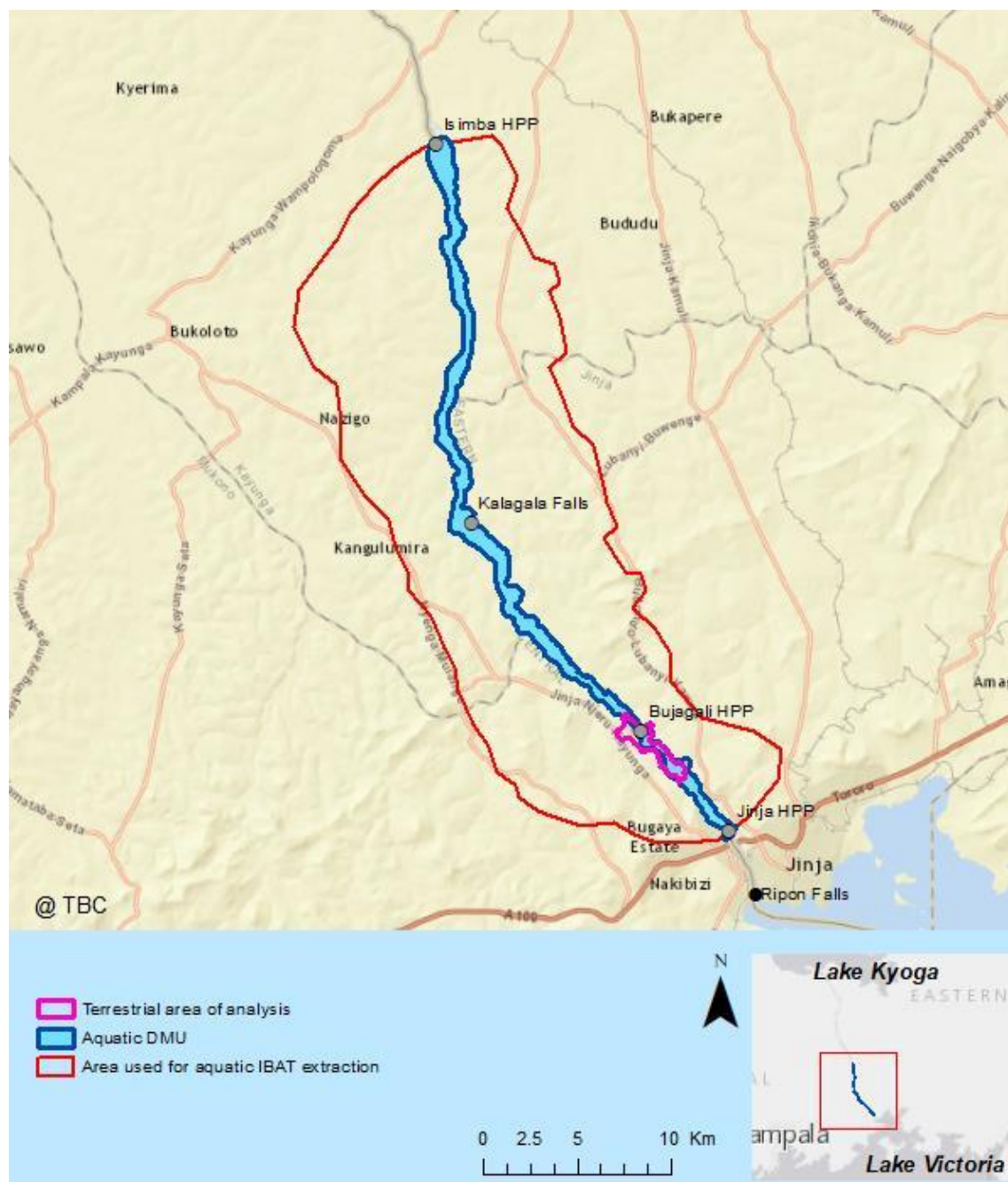


Figure 2: Aquatic DMU and terrestrial area of analysis

### 2.1.3 Aquatic DMU

Aquatic species are the focus of this assessment. For CHA of aquatic species, it is important to consider an appropriate ecologically contiguous area of freshwater habitat, taking into account the connectivity of freshwater systems – most importantly the Victoria Nile system. The Victoria Nile flows for approximately 480 km through Uganda from Lake Victoria, via Lake Kyoga to Lake Albert. The Project is located on the Upper Victoria Nile north (downstream) of Lake Victoria and south (upstream) of Lake Kyoga.



The Upper Victoria Nile contains both natural and man-made barriers that influence the freshwater system and its associated biodiversity. Approximately 8 km upstream of the Project, the Nalubaale dam (built in 1954) and Kiira dam (built in 2000) near Jinja form the first artificial barriers to aquatic species. Around 15 km downstream of the Project, the Kalagala Falls (a section of river containing natural rapids and falls) form a partial natural barrier, and a further ~20 km downstream the Isimba dam forms a permanent artificial barrier to aquatic species and will become operational in 2018.

The Nalubaale and Kiira dams (upstream) and Isimba dam (downstream) therefore bound the Project operational area of influence, and hence also mark the upstream and downstream limits of the aquatic DMU (Figure 2). This is the area over which the Project currently influences hydrological conditions: upstream, as noted in Section 1.1, the Project reservoir extends back to the tailrace areas of Nalubaale/Kiira; and downstream to Isimba, beyond Isimba, the Isimba Project becomes the primary anthropogenic influence on river conditions (not Bujagali)<sup>9</sup>. The total area of the aquatic DMU is 32 km<sup>2</sup>.

## 2.2 Available information

### 2.2.1 Literature review

The CHA is based on existing documentation and interpretation of global and regional datasets, including:

- The findings of the Critical Habitat screening carried out as part of ESDD for refinancing (Reeman Consulting 2017);
- NaFIRRI aquatic ecology monitoring data for Bujagali HPP (2001-2017);
- The IUCN Red List of Threatened Species;
- The FishBase Global Information System on Fishes (Froese & Pauly 2017);
- The Bujagali HPP SEA (Burnside International Ltd 2006);
- The Bujagali HPP haplochromine habitat study (WS Atkins 2001);
- The Isimba SEA Addendum (ERMC 2017);
- The 'Characterization of Habitats and Haplochromine Diversity to Guide Conservation of Biodiversity amidst Hydropower Developments along the Upper Victoria Nile' study (NaFIRRI 2017); and
- General literature review.

Monitoring has identified some species potentially new to science, and has increased the known distribution of other species. Spatial analysis of these data, global databases ([IUCN Red List](#)

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<sup>9</sup> Once Isimba is fully operational the Isimba project will become the primary anthropogenic influence over water flow and quality upstream of the Isimba dam to Kalagala falls.

spatial data layers<sup>10</sup> and [GBIF](#)<sup>11</sup>) was carried out to produce a candidate list of potential Critical Habitat-qualifying features known to occur within the aquatic DMU and terrestrial area of analysis, or whose distribution intersects with the DMU (see [Appendix 2](#)). Only species from the candidate list that have been recorded in the DMU through years of Project monitoring and other surveys were assessed for Critical Habitat.

### 2.2.2 Expert consultation

IFC PS6 strongly recommends that experts are consulted to support the identification of risks and impacts. This is particularly important for the context of this CHA where there is limited recent published information available on freshwater species diversity – specifically the haplochromines (see [Section 2.3.1](#)).

The Project engaged NaFIRRI (National Fisheries Resources Research Institute) and a national haplochromine specialist Vianny Natugonza to provide input into the assessment and review of the outcomes. Mr Natugonza has published haplochromine species descriptions and multiple scientific papers and reports on Lake Victoria fisheries. He holds an M.Sc. from Makerere University, Kampala, Uganda, a postgraduate certificate in FishBase and Fish Taxonomy and is currently undertaking a PhD in Ecological Modelling at the University of Iceland.

### 2.2.3 Haplochromine species and the Upper Victoria Nile

Haplochromine cichlids are one of the most abundant and diverse genera of freshwater fish in the world. The majority of haplochromine cichlids are found in the East African Great Lakes, which have a total of ca. 2000 species; most of them are endemic to specific water bodies (Danley *et al.* 2012). Among the most species-rich lakes, Lake Tanganyika has ca. 250 endemic haplochromine species (Coulter 1991), Lake Victoria ca. 500 species (Witte *et al.* 2007), and Lake Malawi >800 endemic haplochromines (Fryer & Iles 1972). The diversity and endemism of haplochromines is due to availability of various unique habitats, such as rocky areas, marginal wetlands, sandy and muddy bottoms, to which individual species adapted spatially, morphologically, nutritionally and behaviourally to evolve into numerous species endemic to these lakes.

An estimated 200 species of haplochromines (40% of haplochromine diversity) has been lost from Lake Victoria (Witte *et al.* 2007) due to environmental degradation, the introduction of the Nile perch and climatic variation. The Upper Victoria Nile flows over diverse habitats including

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<sup>10</sup> IUCN (2016). It should be noted that IUCN range maps are not available for all species, subspecies and populations on the Red List, and that the IUCN Red List is not an exhaustive list; many species, subspecies and populations have not yet been assessed under IUCN Red List criteria and therefore do not have threat status assigned to them. For example, there are very few global distribution maps available for plants which are assessed on the Red List.

<sup>11</sup> [Global Biodiversity Information Facility](#)

rocky areas, falls and rapids from an altitude of 1,134 metres above sea level (m.a.s.l.) on Lake Victoria to 615 m.a.s.l. on Lake Albert, providing suitable habitats for evolution of unique haplochromine taxa as well as refugia for species that might be under threat in Lake Victoria.

## 2.3 Criteria for identifying Critical Habitat

The DMU is screened for all biodiversity present in, or with range overlapping, the DMU (see Section 2 for information sources). This produces the list of candidate species (see [Appendix 2](#)) that are then reviewed against the criteria and thresholds defined in PS6, using the available data.

PS6 has three quantitative criteria, each of which has two Tiers (see Sections [3.1](#) - [4.1](#) - [5.1](#) and [Appendix 1](#)):

- Criterion 1: Critically Endangered and Endangered species;
- Criterion 2: Endemic/ Restricted Range Species; and
- Criterion 3: Migratory/Congregatory Species.

The Tiers are defined by quantitative thresholds expressed as percentages of global and national population sizes, or of proportions of known species ranges or distributions. Tier 1 Critical Habitat contains a greater proportion of a qualifying species' population or range than Tier 2 Critical Habitat, and so is consequently more important for that species.

Although identification of Critical Habitat is largely based on global conservation priorities, Criterion 1 also considers the presence of nationally important populations of nationally/regionally Critically Endangered and Endangered species in the DMU (Criterion 1e, see [Section 3.1](#) and [Appendix 1](#)). Currently, there is no Uganda national/regional Red List of threatened fish species, and therefore consultation with specialists is essential.

There are also two qualitative criteria (these criteria have one level only – they are not tiered):

- Criterion 4: Highly Threatened and/or Unique Ecosystems; and
- Criterion 5: Key Evolutionary Processes.

Thresholds and definitions for Critical Habitat criteria are given in the relevant report section, below, and summarised in [Appendix 1](#). PS6 also makes provision for Legally Protected and Internationally Recognised Areas<sup>12</sup> as Critical Habitat. Other areas of high biodiversity value (such as areas of primary/old growth forest, or areas required for the reintroduction of threatened species) may also qualify on a case-by-case basis.

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<sup>12</sup> Including UNESCO Natural World Heritage Sites, UNESCO Man and the Biosphere Reserves, Key Biodiversity Areas, Important Bird Areas and wetlands designated under the Convention on Wetlands of International Importance ('the Ramsar Convention').

## 2.4 Implications of Critical Habitat for the Project

Being within Critical Habitat means that the Project needs to be aware of the management of biodiversity impacts, and highlights the priority biodiversity features and processes that the Project needs to consider that are within its reasonable control (Reeman Consulting 2017). Table 2 shows the requirements of PS6 paragraph 17 and 18, with respect to Critical Habitat.

*Table 2: IFC PS6 paragraph 17 and 18 on Critical Habitat*

PS6 reference	PS6 text
PS6 paragraph 17	<p>'In areas of critical habitat, the client will not implement any project activities unless all of the following are demonstrated:</p> <ul style="list-style-type: none"> <li>• <b>No other viable alternatives</b> in the region exist for development of the project on Modified or Natural Habitats that are not Critical;</li> <li>• The project <b>does not lead to measurable adverse impacts</b> on those biodiversity values for which the Critical Habitat was designated, and on the ecological processes supporting those biodiversity values;</li> <li>• The project <b>does not lead to a net reduction</b> in the global and/or national/regional population of any Critically Endangered or Endangered species over a reasonable period of time;</li> <li>• A robust, appropriately designed, and <b>long-term biodiversity monitoring and evaluation program</b> is integrated into the client's management program'.</li> </ul>
PS6 paragraph 18	<p>'In such cases where a client is able to meet the requirements defined in paragraph 17, the project's mitigation strategy will be described in a <b>Biodiversity Action Plan (BAP)</b> and will be designed to achieve <b>net gains</b> of those biodiversity values for which the critical habitat was designated'.</p>

### 2.4.1 Issues arising when undertaking CHA of freshwater species

The IFC PS6 Critical Habitat criteria are difficult to interpret for freshwater species, especially those that are restricted range, such as the haplochromine cichlids of the Upper Victoria Nile, Uganda (see [Section 2.4.2](#)). This is because:

- **For Criterion 1 (CR/EN species):** The species data held by the IUCN Red List does not usually contain any population data or information on the detailed distribution or number of known locations of freshwater fish species (unlike for many terrestrial species). This makes it difficult to distinguish between Tier 1 and Tier 2 of Criterion 1. CHA for the Project could assume the precautionary position that all CR and EN species are Tier 1, but this would not provide sufficient granularity for the analysis. Given that tiering is used to inform the likelihood of project compliance, and that this project is post-construction with no additional impacts expected, lack of data to inform tiering is



not considered relevant in this case. Further, many haplochromine species are classed as Data Deficient or have not yet been evaluated on the IUCN Red List, which means their conservation status is unclear and there is a risk of them being missed from CHA.

- **For Criterion 2 (restricted-range species):** The IFC guidance threshold for a freshwater species to qualify as restricted-range is 20,000 km<sup>2</sup>. Many haplochromine species that are evaluated on the IUCN Red List and registered in Lake Victoria would not qualify as restricted-range species as the Red List uses Lake Victoria (68,000 km<sup>2</sup>) as a proxy for their Extent of Occurrence (EOO). However, many haplochromine species are not present throughout the lake but are restricted to shallower areas or other habitat niches. Using the lake area as a proxy for the extent of occurrence (EOO) for haplochromines would thus result in many species that are considered as restricted-range (based on expert opinion) being missed from the Critical Habitat analysis.
- **For Criterion 3 (migratory and congregatory species):** There is little published information on whether haplochromine fish species migrate or congregate, such as for spawning (most appear not to), but the increasing presence of dams in the region renders it especially important to properly assess this criterion, since migration routes may be lost.

#### 2.4.2 Addressing these issues in Project CHA

To support the quantitative assessment of Critical Habitat Criteria 1-3, we divided the Upper Victoria Nile system into several 'locations'. Locations are defined as areas of the Upper Victoria Nile divided from other locations by a semi-permeable barrier (i.e. natural falls or rapids that may allow some movement e.g. downstream) or an impermeable barrier (i.e. a manmade dam that prevents all upstream movement and significantly reduces downstream movement). These locations are (Figure 3):

- **Location 1:** Mouth of Upper Victoria Nile at Lake Victoria to the Nalubaale and Kiira (Jinja HPPs);
- **Location 2:** Nalubaale and Kiira (Jinja HPPs) to Bujagali HPP (the Project);
- **Location 3:** Bujagali HPP (the Project) to Kalagala Falls;
- **Location 4:** Kalagala Falls to Isimba HPP;
- **Location 5:** Isimba HPP to the mouth of Lake Kyoga.

Locations 2-4 are within the aquatic DMU. Locations 1 and 5 are outside the DMU, and are included in order to provide a basis for assessing the riverine species registered in the DMU within the wider context of the Upper Victoria Nile.

To allow assessment against PS6 Criteria 1-3, the thresholds/definitions for each of these have been re-defined and expressed according to the Locations from which a species is known. All species/species records were reviewed, irrespective of the species IUCN Red List status (or lack thereof), to ensure that all species of potential conservation concern were considered. More detail on the use of the Locations for each PS6 criterion is given in Sections [3](#), [4](#) and [5](#).



Figure 3: The aquatic DMU and the locations used for assessment of PS6 criterion 1-3

### 3 Criterion 1: Critically Endangered and/or Endangered species

#### 3.1 PS6 criteria

Tier 1 Critical Habitat-qualifying species are the most sensitive biodiversity features in the Project landscape. Tier 1 Critical Habitat is of extreme global importance for the long-term

survival of these species. Species may qualify as **Criterion 1, Tier 1** because they are highly threatened (Criterion 1a or 1b). Species may qualify as **Criterion 1, Tier 2** because they are globally threatened and listed on the IUCN global Red List, or because they are nationally threatened and listed on the Uganda Red List. The thresholds for Criterion 1 and application in the context of the Bujagali CHA are found in Table 3.

Table 3: Application of Criterion 1 for the Bujagali CHA

Tier	PS6 Criterion		Threshold/definition (IFC 2012b)	Location-based threshold/definition (see Section 2.4.2)
Tier 1	Criterion 1: CR or EN species	1a	Habitat required to sustain ≥ 10% of the global population of a CR or EN species/subspecies where there are known, regular occurrences of the species and where that habitat could be considered a discrete management unit for that species	i. There is no available information on global population size for species in the candidate list; therefore this criterion has not been applied.
		1b	Habitat with known, regular occurrences of CR or EN species where that habitat is one of 10 or fewer discrete management units for that species	i. CR/EN species known <i>only</i> from the DMU (i.e. at least one of Locations 2, 3 and 4). Species also known from outside the DMU were shown during analysis to generally have the majority of their distribution (i.e., >10 comparable DMUs) outside of the DMU, either in the lakes or Upper Victoria Nile downstream.
1c		Habitat that supports the regular occurrence of a single individual of a CR species and/or habitat containing regionally-important concentrations of a Red-listed EN species where that habitat could be considered a discrete management unit for that species/ subspecies	i. CR species known from both within <i>and</i> outside the DMU (i.e. at least one of Locations 2, 3 or 4, <i>and</i> from Location 1 and/or Location 5) AND/OR ii. EN species recorded only in the DMU (i.e. at least one of Locations 2, 3 or 4) and in Location 5 qualify here. This is because if the species has <i>only</i> been recorded in the Upper Victoria Nile, the <i>Upper Victoria Nile</i> represents a regionally important population of the species (whereas if the EN species is also found in Lake Victoria and/or Lake Kyoga, then the <i>lakes</i> hold much more habitat for most haplochromines and are thus likely to represent the regionally important populations of the species, not the Upper Victoria Nile)	
1d		Habitat of significant importance to CR or EN species that are wide-ranging and/or whose population distribution is not well understood and where the loss of such a habitat could potentially	i. Any CR/EN species found in the DMU <i>and</i> in other rivers (i.e. wide-ranging species), for which there is evidence that the Upper Victoria Nile (Locations 2-5) is important for the long-term survival of the species AND/OR	

			impact the long-term survivability of the species.	ii. Any CR/EN species found in Locations 2 to 5 for which the IUCN Red List (or specialist knowledge) states that the distribution is not well understood qualify here, if the DMU represents a significant portion of the distribution range (approximately one third) and is thus important for the long-term survival of the species
		<b>1e</b>	As appropriate, habitat containing nationally/regionally important concentrations of an EN, CR or equivalent national/regional listing.	i. As per 1dii (above). Any CR/EN species found in Locations 2 to 5 will qualify here if the DMU represents an important portion of the distribution range (approximately one third) and therefore, in the absence of knowledge about spawning behavior, may hold an important concentration of the species.

## 3.2 Criterion 1 qualifying features

Criterion 1 Critical Habitat-qualifying features are shown in Table 4. There are:

- **No** Criterion 1, Tier 1 species; and
- **Ten** Criterion 1, Tier 2 species.

See [Appendix 4](#) for species accounts.

*Table 4: Criterion 1, Tier 2 Critical Habitat-qualifying features*

Taxa	Species	IUCN	Location-based sub-criterion
<b>TIER 2</b>			
Haplochromine	<i>Haplochromis aelocephalus</i>	CR	1c
Haplochromine	<i>Haplochromis brownae</i>	CR	1c
Haplochromine	<i>Haplochromis crassilabris</i>	CR	1c
Haplochromine	<i>Haplochromis guiarti</i>	CR	1c
Haplochromine	<i>Haplochromis microdon</i>	CR	1c
Haplochromine	<i>Haplochromis parvidens</i>	CR	1c
Other fishes	<i>Labeo victorianus</i>	CR	1d
Haplochromine	<i>Xystichromis</i> sp. nov. "Kyoga flameback"	CR	1c
Other fishes	<i>Oreochromis variabilis</i>	CR	1d
Gastropods	<i>Ceratophallus concavus</i>	CR	1c

IUCN Red List status: CR – Critically Endangered

## 3.3 Implications of Criterion 1 for the Project

Mitigation of potential impacts on highly threatened (Criterion 1, Tier 1) Critical Habitat features will be the highest concern of lenders and many stakeholders, in the national and international conservation community. Given the operational status of the Project, good stewardship of river habitat where the Project is operating and monitoring of CH species will promote the understanding of their presence and distribution.

Criterion 1, Tier 2 species for which Critical Habitat has been identified will also be of high concern to lenders and to national and international stakeholders. Because these species are at high global risk of extinction, the Project should undertake activities that do not contribute to a

further decline of their conservation status and demonstrate that activities do not lead to a net reduction in these species over a reasonable time.

It is understood that per the ESAP 14 that all actions taken by the Project for the protection of any species will be performed via reasonable actions within the Project's control ([ESAP](#)).

## 4 Criterion 2: Endemic and/or restricted-range species

As mentioned in [Section 2.3.1](#), the IFC guidance threshold for a species to qualify as restricted range is 20,000 km<sup>2</sup>, but the use of the area of Lake Victoria (68,000 km<sup>2</sup>) as a proxy for the extent of occurrence (EOO) of haplochromine species is not appropriate (primarily because much of this habitat is not suitable for haplochromines<sup>13</sup>, because few of them are pelagic or deep water species). Thus, the Project assessment of Criterion 2 is based on the following assumptions:

- The area of Lake Victoria is 68,000 km<sup>2</sup>
- The area containing potentially suitable habitat for haplochromines is estimated to be approximately one third of the area of the entire lake (i.e. around 23,000 km<sup>2</sup>, based on a preferred depth of between 0 and 27 m, see [Appendix 3](#). This area represents a refined proxy for the EOO for haplochromines)
- The area of the Upper Victoria Nile is approximately 102 km<sup>2</sup>
- The area of the freshwater DMU is approximately 32 km<sup>2</sup>
- The area of Lake Kyoga is approximately 1,720 km<sup>2</sup>

Using these assumptions:

- A species only known from the Upper Victoria Nile, or from both the Upper Victoria Nile AND Lake Kyoga has an EOO of less than 20,000 km<sup>2</sup> (about 1,822 km<sup>2</sup>) and should therefore be assessed under Criterion 2;
- A species currently only known from *one* area in Lake Victoria *and* from the Upper Victoria Nile is likely to have an EOO of less than 20,000 km<sup>2</sup> and should therefore be assessed under Criterion 2;
- A species known from *two* areas in Lake Victoria *and* from the Upper Victoria Nile would potentially have an EOO of less than 20,000 km<sup>2</sup> and should therefore be assessed under Criterion 2;
- A species known from *three* sites in Lake Victoria (or described as widely distributed in Lake Victoria in the species description of the IUCN Red List) *and* from the Upper

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<sup>13</sup> As per the footnote to paragraph GN77 of the PS6 Guidance Note

Victoria Nile would be *unlikely* to have an EOO of less than 20,000km<sup>2</sup> and assessment under Criterion 2 is not necessary.

## 4.1 PS6 criteria

The IFC PS6 thresholds and the location-based thresholds for Tier 1 and Tier 2 endemic/restricted-range species are as follows:

Tier	PS6 Criterion	Threshold/definition (IFC 2012b)	Location-based threshold/definition (see <a href="#">Section 2.3.2</a> )
Tier 1	<b>Criterion 2: Endemic/restricted-range species</b>	2a Habitat known to sustain ≥ 95% of the global population of an endemic or restricted range species where that habitat could be considered a discrete management unit for that species (e.g. a single-site endemic)	i. The species is only found in the DMU only (i.e. in at least one of Locations 2, 3 or 4)
Tier 2		2b Habitat known to sustain ≥ 1 percent but < 95 percent of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species, where data are available and/or based on expert judgment	<p>i. For species found in the DMU and in Lake Victoria (Location 1):</p> <ul style="list-style-type: none"> <li>Species known from only <i>one</i> site in Lake Victoria qualify;</li> <li>Species known from <i>two</i> sites in Lake Victoria potentially qualify;</li> <li>Species known from <i>three</i> or more sites in Lake Victoria are not likely to qualify;</li> <li>Species known from Lake Victoria, the DMU and Lake Kyoga would not qualify.</li> </ul> <p>ii. Species found in the DMU and Lake Kyoga and/or its satellite lakes (but <i>not</i> Lake Victoria) qualify.</p>



## 4.2 Criterion 2 qualifying features

Criterion 2 Critical Habitat-qualifying features are shown in Table 5. There are:

- **Ten** Criterion 2, Tier 1 species; and
- **Twenty-four** Criterion 2, Tier 2 species.

Of these species, 25 (twenty five) remain undescribed species. They are included in the assessment based on the opinion of the Haplochromine specialist, Vianny Natugonza, and should be viewed with this in consideration until further information is available, particularly confirmation of their status as full species. See [Appendix 4](#) for species accounts.

*Table 5: Tier 1 and Tier 2 Criterion 2 Critical Habitat-qualifying features*

Taxa	Species	IUCN	Location-based sub-criterion
<b>TIER 1</b>			
Haplochromine	<i>Astatotilapia</i> "red tail"	NE	2a
Haplochromine	<i>Astatotilapia</i> "scarlet anal"	NE	2a
Haplochromine	<i>Haplochromis</i> "cylindrical"	NE	2a
Haplochromine	<i>Haplochromis</i> sp. cf. "red back scraper"	NE	2a
Haplochromine	<i>Lithochromis</i> sp.	NE	2a
Haplochromine	<i>Neochromis</i> "lemon britti"	NE	2a
Haplochromine	<i>Neochromis</i> "red simotes"	NE	2a
Haplochromine	<i>Paralabidochromis</i> "yellow"	NE	2a
Haplochromine	<i>Paralabidochromis</i> sp. "red breast new"	NE	2a
Haplochromine	<i>Pundamilia</i> sp. "blue lip"	NE	2a
<b>TIER 2</b>			
Haplochromine	<i>Astatotilapia</i> "flameback"	NE	2b
Haplochromine	<i>Astatotilapia</i> "blue"	NE	2b
Haplochromine	<i>Astatotilapia</i> "elongate"	NE	2b
Gastropods	<i>Ceratophallus concavus</i>	CR	2b
Haplochromine	<i>Haplochromis</i> "silver arrow"	NE	2b
Haplochromine	<i>Haplochromis aelocephalus</i>	CR	2b

Haplochromine	<i>Haplochromis brownae</i>	CR	2b
Haplochromine	<i>Haplochromis crassilabris</i>	CR	2b
Haplochromine	<i>Haplochromis niloticus</i>	DD	2b
Haplochromine	<i>Haplochromis orthostoma</i>	VU	2b
Haplochromine	<i>Haplochromis simotes</i>	DD	2b
Haplochromine	<i>Haplochromis</i> sp. "flameback"	NE	2b
Haplochromine	<i>Haplochromis</i> sp. "thick skin like"	NE	2b
Haplochromine	<i>Mbipia</i> "blue"	NE	2b
Haplochromine	<i>Neochromis</i> "elongate"	NE	2b
Haplochromine	<i>Neochromis</i> "yellow rufocaudalis"	NE	2b
Haplochromine	<i>Neochromis</i> sp. "Labeo new"	NE	2b
Haplochromine	<i>Paralabidochromis</i> "scarlet anal"	NE	2b
Haplochromine	<i>Paralabidochromis</i> sp. 1	NE	2b
Haplochromine	<i>Paralabidochromis</i> sp. "Nile"	NE	2b
Haplochromine	<i>Pundamilia</i> "scarlet anal"	NE	2b
Bivalves	<i>Sphaerium regularis</i>	EN	2b
Haplochromine	<i>Xystichromis</i> "earthquake"	NE	2b
Haplochromine	<i>Xystichromis</i> sp. nov. "Kyoga flameback"	CR	2b

IUCN Red List status: NE – Not Evaluated; DD – Data Deficient; NT – Near Threatened; LC – Least Concern; VU – Vulnerable; EN – Endangered; CR – Critically Endangered

### 4.3 Implications of Criterion 2 for the Project

Species with very small ranges are of concern for both lenders and stakeholders because of the potential for Project operations to affect a large proportion of their habitat and global population. The primary implications for the Project of restricted-range/endemic Critical Habitat-qualifying features in the landscape are the same as those for Criterion 1 species.

## 5 Criterion 3: Migratory species and/or congregatory species

For fish species, spawning and/or breeding sites might be considered as congregatory sites when the individuals move to a specific habitat or area during their reproductive phase. In the case of haplochromines, species are known to live on some specific substrates (e.g. rocky, sand

or mud) and may use a specific substrate to spawn. However, for the purposes of CHA under Criterion 3 this is not considered as congregatory behaviour, since there is no evidence that the use of a specific substrate leads to a congregation of individuals. Migratory/congregatory characterisation has been undertaken based on information available in the IUCN Red List assessment, FishBase, information from NaFIRRI and specialist opinion.

## 5.1 PS6 criteria

The IFC PS6 thresholds and the location-based thresholds for Tier 1 and Tier 2 migratory/congregatory species are as follows:

Tier	PS6 Criterion		Threshold/definition (IFC 2012b)	Location-based threshold/definition (see Section 2.3.2)
Tier 1	Criterion 3: Migratory/ Congregatory species	3a	Habitat known to sustain, on a cyclical or otherwise regular basis, ≥ 95 percent of the global population of a migratory or congregatory species at any point of the species lifecycle where that habitat could be considered a discrete management unit for that species.	i. Species that migrate/congregate <i>only</i> along the Upper Victoria Nile, and therefore the Upper Victoria Nile could contain over 95% of the global population of a migratory species at any one point in time.
Tier 2		3b	Habitat known to sustain, on a cyclical or otherwise regular basis, ≥ 1 percent but < 95 percent of the global population of a migratory or congregatory species at any point of the species lifecycle and where that habitat could be considered a discrete management unit for that species, where data are available and/or based on expert judgement	i. Species that migrate along the Upper Victoria Nile <i>and</i> other rivers within the Lake Victoria drainage, and therefore the Upper Victoria Nile could sustain between 1 and 95% of the global population of a migratory species at anyone point in time.
		3c	For birds, habitat that meets BirdLife International's Criterion A4 for congregations and/or Ramsar Criteria 5 or 6 for Identifying Wetlands of International Importance.	Not applicable here.
		3d	For species with large but clumped distributions, a provisional threshold is set at ≥ 5	Not applicable here.

			percent of the global population for both terrestrial and marine species.	
		3e	Source sites that contribute $\geq 1$ percent of the global population of recruits.	Information is not available to apply this criterion. Migratory species are captured under 3b.

## 5.2 Criterion 3 qualifying species

Criterion 3 Critical Habitat-qualifying features are shown in Table 6. There are:

- **No** Criterion 3, Tier 1 species; and
- **One** Criterion 3, Tier 2 species.

See [Appendix 4](#) for species accounts.

Table 6: Criterion 3, Tier 1 and Tier 2 Critical Habitat-qualifying features

Taxa	Species	IUCN	Location-based Criterion
<b>TIER 1</b>			
Other fishes	<i>Brycinus jacksonii</i>	LC	3b

IUCN Red List status: LC – Least Concern

## 5.3 Implications of Criterion 3 for the Project

Migratory and congregatory species are potentially vulnerable because of their life-history characteristics: a large proportion of the population may be concentrated in (or pass through) a small area at once. The primary implications for the Project of restricted-range/endemic Critical Habitat-qualifying features in the landscape are the same as those for Criterion 1 species. However it should be noted that the primary impact to migratory fish species in the Upper River Nile would have been caused by the earlier construction of dams at Jinja (Nalubaale and Kiira) and not by the Bujagali Project.

# 6 Criterion 4: Highly threatened and/or unique ecosystems

## 6.1 PS6 criteria

Highly threatened and/or unique ecosystems are defined in IFC GN6 (paragraph GN90) as:

- Those at risk of significantly decreasing in area or quality;
- Those with a small spatial extent; and/or
- Those containing unique assemblages of species including assemblages or concentrations of biome-restricted species<sup>14</sup>. See [Appendix 1](#) for a detailed definition of this criterion.

IFC does not provide quantitative thresholds for assessment under this criterion. GN6 recommends the use of the criteria and thresholds developed for the new IUCN Red List of Threatened Ecosystems<sup>15</sup> (Rodríguez-Clark *et al.* 2015):

- Reduction in geographic distribution;
- Restricted geographic distribution;
- Environmental degradation;
- Disruption of biotic processes or interactions; and
- Quantitative analysis that estimates the probability of ecosystem collapse.

However, ecosystems in Uganda have not yet been assessed for the IUCN Red List. Here, we therefore assess the same ecologically contiguous area of freshwater habitat that was used for Criteria 1 to 3 of the species Critical Habitat assessment, see Section 2.1.3, (this includes the shallow areas of lake Victoria and the Upper River Nile to Lake Kyoga). For the purpose of this assessment it is called the Lake Victoria-Upper Victoria Nile ecosystem.

IUCN defines ecosystems as complexes of organisms and their associated physical environment within a specified area (IUCN 2016). They have four essential elements:

- A biotic complex (i.e., the ecosystem is composed by a specific community of living organisms. This native biota is distinguishable between different ecosystems and has a central role in ecosystems dynamics, structure, and functions);
- An abiotic environment (i.e., the ecosystem is characterized by specific physical factors);
- The interactions within and between them, and;
- A physical space in which these operate.

Lake Victoria, the Upper Victoria Nile River, and Lake Kyoga form an ecosystem, characterized by a combination of freshwater habitats (lacustrine and riverine habitats with a variety of substrates and water flows) and inhabited by an especially rich assemblage of species (including the haplochromine fish). Many species found are endemic to the ecosystem and have a very small distribution within it but others are found throughout.

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<sup>14</sup> Such ecosystems/assemblages are usually considered at a relatively fine scale.

<sup>15</sup> IUCN [Red List of Ecosystems](#)

## 6.2 Criterion 4 qualifying features

A qualitative analysis of the Lake Victoria-Upper Victoria Nile ecosystem has been carried out (see Table 7) based on the IUCN Red List of Threatened Ecosystems criteria. This analysis indicates that the Lake Victoria-Upper Victoria Nile ecosystem is likely to be Critical Habitat-qualifying under Criterion 4.

Table 7: High-level qualitative assessment of the Lake Victoria-Upper Victoria Nile ecosystem against Criterion 4

Summary description of the habitat type	Qualitative assessment
<ul style="list-style-type: none"> <li>• <b>Habitat type:</b> Lakes and rivers</li> <li>• <b>Boundaries:</b> Defined by the shallow areas of Lake Victoria, Lake Kyoga and the Upper River Nile</li> <li>• <b>Main rivers:</b> The only outlet from Lake Victoria is the Victoria Nile, the area assessed is the upper section of this river, the Upper Victoria Nile.</li> <li>• <b>Description:</b> Lake Victoria is the largest tropical lake in the world and second largest freshwater lake. It is located within a shallow depression at 1,134 m.a.s.l. The habitat is characterized by lacustrine fauna with cichlid species radiation and Lake Victoria's endemic haplochromine fauna is one of the world's most outstanding examples of species radiation (Kaufman et al. 1997) with over 500 species known from Lake Victoria. Haplochromine biomass is highest in coastal areas of the lake and particularly in depths of 0 to 27m (Seehausen 1996, Van Oijen <i>et al.</i> 1991)</li> <li>• <b>Threats:</b> Lake Victoria and the Upper Victoria Nile are threatened by pollution from farming, industry and urban sewage; by deforestation resulting in erosion and</li> </ul>	<p>IFC GN6 definitions:</p> <ul style="list-style-type: none"> <li>• <b>Risk of significantly decreasing in area or quality:</b> Partial – Lake Victoria is under pressure from increasing pollution, eutrophication and sedimentation as well as the introduction of exotic species such as the Nile perch and overfishing</li> <li>• <b>Small spatial extent:</b> No – Lake Victoria covers a large surface area</li> <li>• <b>Containing unique assemblages of species including assemblages or concentrations of biome-restricted species (fine scale):</b> Yes – Lake Victoria in particular is known for its large number of unique endemic haplochromine cichlid fauna (~500 species) and the Upper Victoria Nile is the main outlet from Lake Victoria, connecting Lake Victoria with lakes lower down the Victoria Nile.</li> </ul> <p>Red List of Threatened Ecosystems</p> <ul style="list-style-type: none"> <li>• <b>Reduction in geographic distribution:</b> No – the lake and river are not declining in extent</li> <li>• <b>Restricted geographic distribution:</b> No - the lake covers a large surface area</li> <li>• <b>Environmental degradation:</b> Yes – pollution, overfishing and introduction of invasive species are amongst the threats to both the lake and the river. For example, it is estimated that Lake Victoria has lost ~60% of the 500+ haplochromine cichlids, mostly endemic species, due to environmental degradation and predation by the introduced Nile perch in the last half a century (Witte et al., 1992; Seehausen et al., 1997; van Zwieten et al., 2016)</li> <li>• <b>Disruption of biotic processes or interactions:</b> Yes – changing water quality (due to eutrophication and increased sedimentation from erosion as a result of deforestation) has decreased water transparency resulting in hybridization of haplochromine species which interferes with mate recognition visual cues and is considered to be one of the main drivers of haplochromine loss (along with the introduction of the Nile perch)</li> <li>• <b>Quantitative analysis that estimates the probability of ecosystem collapse:</b> Not possible</li> </ul> <p>Conclusion:</p> <ul style="list-style-type: none"> <li>• <b>The Lake Victoria-Upper Victoria Nile ecosystem could qualify under Criterion 4 based on</b></li> </ul>

<p>increased sedimentation; overfishing and the introduction of invasive species such as the Nile perch. The fauna of the Upper River Nile is also threatened by changes in water flow velocity and other changes in habitat associated with the development of hydropower projects.</p>	<p><b>environmental degradation and disruption of biotic processes/interactions</b></p>
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## 6.3 Implications of Criterion 4 for the Project

The primary implications for the Project of operating in the Lake Victoria-Upper Victoria Nile ecosystem are related to the potential indirect and cumulative effects of the operational Project on water quality and hydrological processes in an already-stressed ecosystem. See [Section 11.2](#).

## 7 Criterion 5: Areas associated with key evolutionary processes

### 7.1 PS6 criteria

This criterion is defined by the physical features of a landscape that might be associated with particular evolutionary processes, and/or subpopulations of species that are phylogenetically or morpho-genetically distinct and may be of special conservation concern given their distinct evolutionary history (IFC 2012b, paragraph GN95).

Although key evolutionary processes may operate at various spatial scales, in the sense of PS6 these are usually considered at a relatively fine scale rather than broad biogeographic regions (e.g. an individual mountain that may have acted as a glacial refugium and thus hosted the evolution of a suite of endemic species). No quantitative significance thresholds exist for this criterion, so there is a reliance on expert opinion and qualitative value judgement. Areas associated with key evolutionary processes were screened using expert advice.

### 7.2 Criterion 5 qualifying features

Lake Victoria is unique for the rapid speciation of cichlid fish that has occurred. Rapid speciation is attributed to the transparency of the water and the variation of light that penetrates to different depths levels around the lake. Whilst rapid speciation has not occurred along the Upper Victoria Nile, NaFIRRI considers the river to contain unique habitats that have supported the evolution of haplochromine species that do not occur anywhere else in the world, e.g. *Neochromis simotes* (NaFIRRI 2017). Whilst the river is undoubtedly a very important habitat for haplochromine species it is unlikely to meet the Criterion 5 definition of an area associated with key evolutionary process. Criterion 5 would be met by Lake Victoria, not by the Upper Victoria Nile. **The DMU therefore does not qualify for Criterion 5 (an area associated with key evolutionary processes).**

## 8 Natural Habitat and Modified Habitat

### 8.1 PS6 definition

IFC GN6 defines Natural Habitats as '*areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition*'.

IFC GN6 defines Modified Habitats as ‘*areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area’s primary ecological functions and species composition*’.

The objectives of PS6 are to: protect and conserve biodiversity; maintain the benefits from ecosystem services; and promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities.

PS6 identifies three classes of area based on (i) condition (‘quality’ or ‘state’) and (ii) significance for biodiversity (Figure 4). PS6 uses the term ‘habitat’ to refer to these areas, rather than the actual vegetation within them. These classes are:

- Modified Habitat;
- Natural Habitat; and
- Critical Habitat. Critical Habitat is a subset of Modified and Natural Habitat.

Area condition is classified as either **Natural** or **Modified** based on the extent of human modification of the ecosystem. The threshold for classifying habitat as Modified rather than Natural is high: only the most heavily disturbed habitats would be classified as Modified<sup>16</sup>. Identification of Critical Habitat is independent of the state of the habitat: Critical Habitat-qualifying biodiversity may be present even in heavily degraded Modified Habitat.

*Figure 4: Summary of the PS6 scheme for classifying areas*

The three classes of area identified in PS6:		Condition of the area	
		Natural	Modified
Significant types or quantities of Critical Habitat-qualifying biodiversity	Present	Critical Habitat	Critical Habitat
	Absent	Natural Habitat	Modified Habitat

<sup>16</sup> For example, monoculture forestry plantations, arable fields and urban areas show “substantial modification” and would be classed as Modified; selectively logged tropical forest usually retains most original species and ecological processes and so would in most cases still be considered Natural Habitat.

## 8.2 Natural and Modified Habitat in the DMU

Natural and Modified Habitat in both the terrestrial area of analysis and aquatic DMU has been mapped based on likely changes in water flow for aquatic habitat (Figure 5) and the classification of recent satellite imagery ([Uganda Sentinel2 2016](#)) (Figure 6) for terrestrial habitat.

### 8.2.1 Aquatic DMU

The Nalubaale and Kiira dams (upstream) and Isimba dam (downstream) mark the upstream and downstream limits of the aquatic DMU. The aquatic DMU consists of riverine habitat, with sections of fast flowing water and rapids, areas of slower moving water, and the Project reservoir area upstream of the Project.

**Upstream of the HPP:** A report by WS Atkins (2001) estimated that seven rapids in a 4 km section above the Bujagali HPP were impacted by the creation of the reservoir. The change in water flow velocity and quality will have modified the primary ecological function of the river (converting it from a fast flowing river into more lacustrine conditions), which will have affected riverine specialist species in particular. In addition, an increase in Nile perch in the reservoir is likely to have affected all haplochromine species (NaFIRRI 2017). Riverine habitat above the Project HPP and up to the tailrace areas of the Nalubaale and Kirra dams approximately 8 km upstream can be considered **Modified Habitat**. Species qualifying for Critical Habitat (under Criterion 1 to 3) have been recorded within the reservoir. The reservoir section is therefore **riverine Modified Critical Habitat**.

**Downstream of the HPP:** Water level fluctuations due to Project operations may affect shallow inshore areas where fish species feed and spawn in areas immediately downstream of the dam (NaFIRRI 2017). However, the Project has not altered water flow to the extent that sections of downstream fast water and rapids have been altered. The section of the DMU downstream from Bujagali to Isimba (approximately 35 km in length) is therefore considered to be **Natural Habitat**. Species qualifying for Critical Habitat (under Criterion 1 to 3) have been recorded and contain Critical Habitat qualifying species. The section of the river downstream from the HPP is therefore **riverine Natural Critical Habitat**.

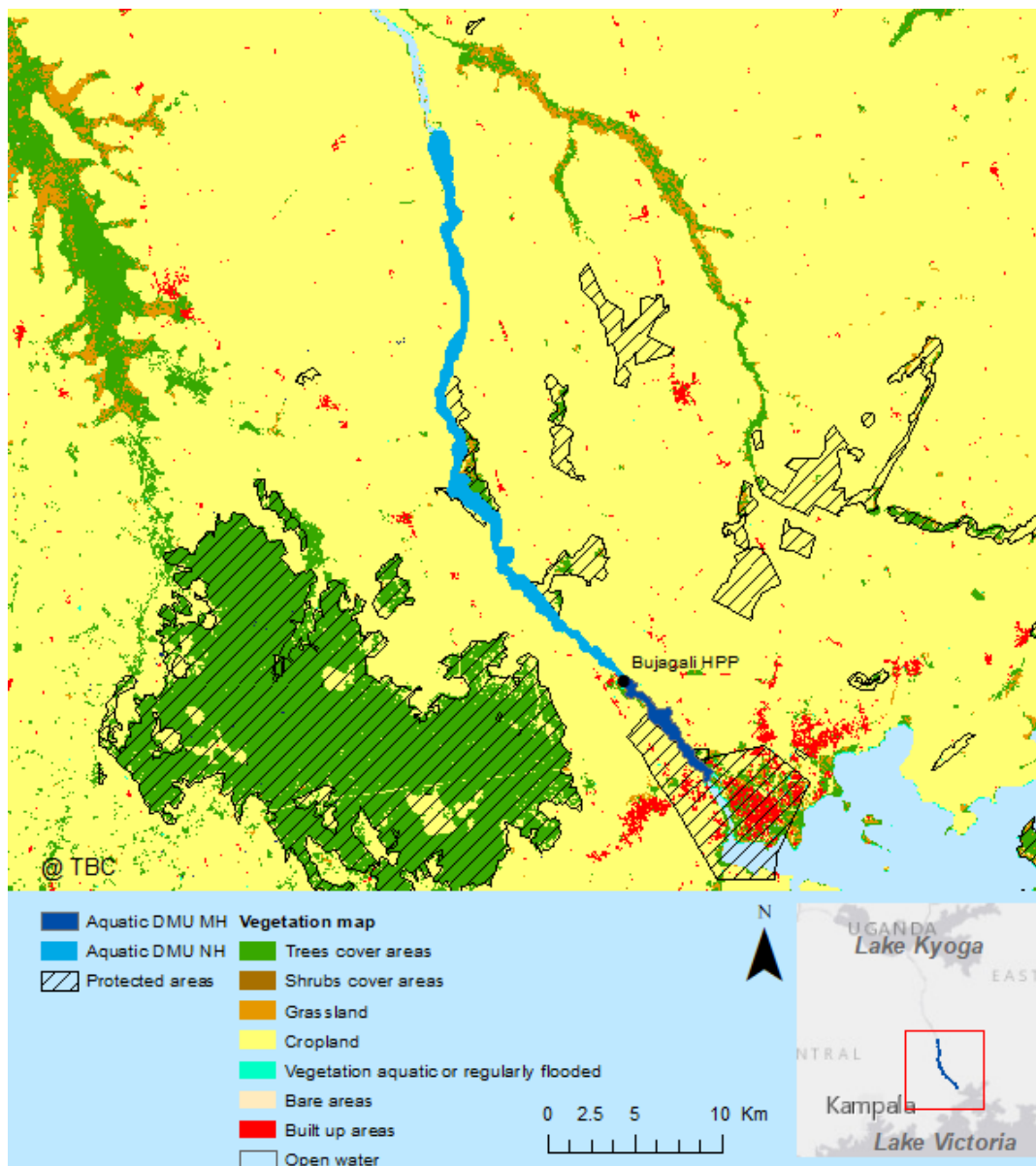


Figure 5: Natural Habitat (NH) and Modified Habitat (MH) in the aquatic DMU; both habitats are Critical Habitat due to the presence of Critical Habitat qualifying species

## 8.2.2 Terrestrial area of analysis

Based on the classification of recent satellite imagery ([Uganda Sentinel2 2016](#)) the terrestrial area of analysis contains a mosaic of croplands, built up areas and patches of trees and shrubs and aquatic vegetation or regularly flooded vegetation (see Figure 6). The patches of trees and shrubs are likely to have experienced a high degree of disturbance due to their proximity to the

Project, farmland and urban areas and are considered to be Modified Habitat<sup>17</sup>. Although these vegetated areas are Modified Habitat, a vegetated shoreline is important for reducing erosion and sedimentation of the river as well as maintaining habitat for aquatic species.

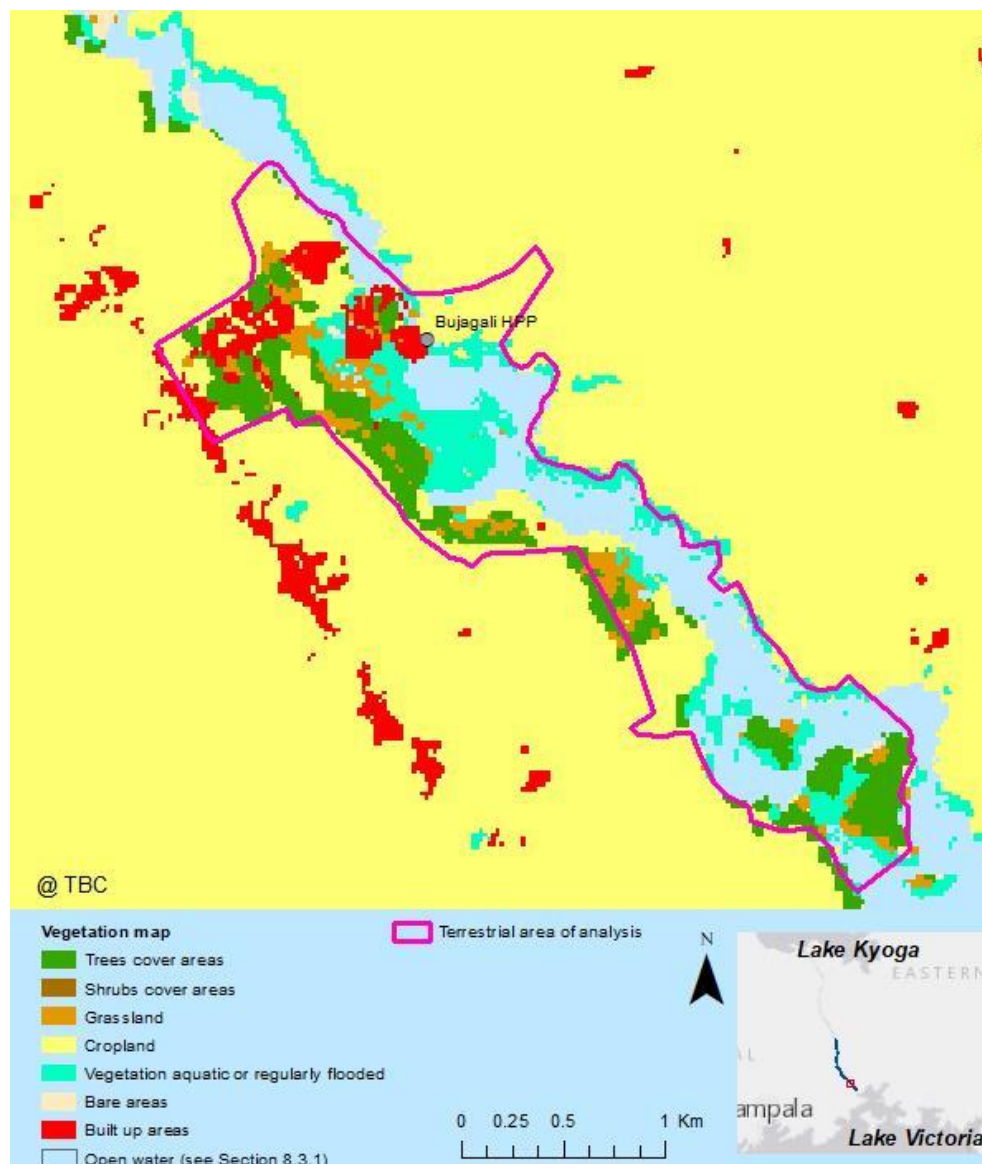


Figure 6: Modified Habitat (MH) in the terrestrial area of analysis

<sup>17</sup> The 2006 SEA reports 75% of land that was part of permanent land take (i.e. land within the area of analysis) was under agricultural production, this equates to approximately 95 ha.

*Table 8: Modified Habitat types in the terrestrial area of analysis*

Modified Habitat type
Tree cover areas (important along the riverbank)
Shrub cover areas (important along the river bank)
Grassland
Aquatic vegetation or regularly flooded
Cropland
Built up areas

## 8.3 Implications for the Project

### 8.3.1 Natural Habitat

PS6 requires that the Project should not significantly convert or degrade Natural Habitats, and that mitigation measures are designed to achieve no net loss of Natural Habitat, where feasible. (IFC 2012a).

Given the operational status of the Project, good stewardship of riverine Natural Habitat within the abilities of the Project is encouraged (Reeman Consulting 2017). See [Section 11.2](#). It should be noted that the inundation of a former section of Natural Habitat (where the reservoir now is and where Bujagali Falls once was) by the Project was deemed addressed through the Kalagala Offset downstream of the Project (and upstream of Isimba) (Reeman Consulting 2017).

### 8.3.2 Modified Habitat

PS6 requires that Projects in Modified Habitats with significant biodiversity value minimise impacts on that biodiversity and implement mitigation measures as appropriate. In the Project landscape, vegetation within the 100m buffer of the river bank is particularly important for reducing erosion and sedimentation of the river as well as maintaining Natural Habitat for aquatic species.

Given the operational status of the Project, good stewardship of riverine and terrestrial Modified Habitat where the Project is operating is recommended (Reeman Consulting 2017). See [Section 11.2](#).

## 9 Protected areas

The Project footprint overlaps with the Jinja Wildlife Sanctuary ([IUCN Category VI Protected Area](#)) and four Forest Reserves lie adjacent to the aquatic DMU (Figure 7). Project impacts to the Jinja Wildlife Sanctuary were addressed via mitigation actions of the Environmental Mitigation and Monitoring Plan in 2006 (Reeman Consulting 2017). As the Project is already operational, no further impacts to any protected area is anticipated. However, the Project should be aware of potential direct and indirect impacts on these protected areas, and apply a mitigation hierarchy



to avoid and minimise them should they occur. Protected areas are not discussed further in this document.

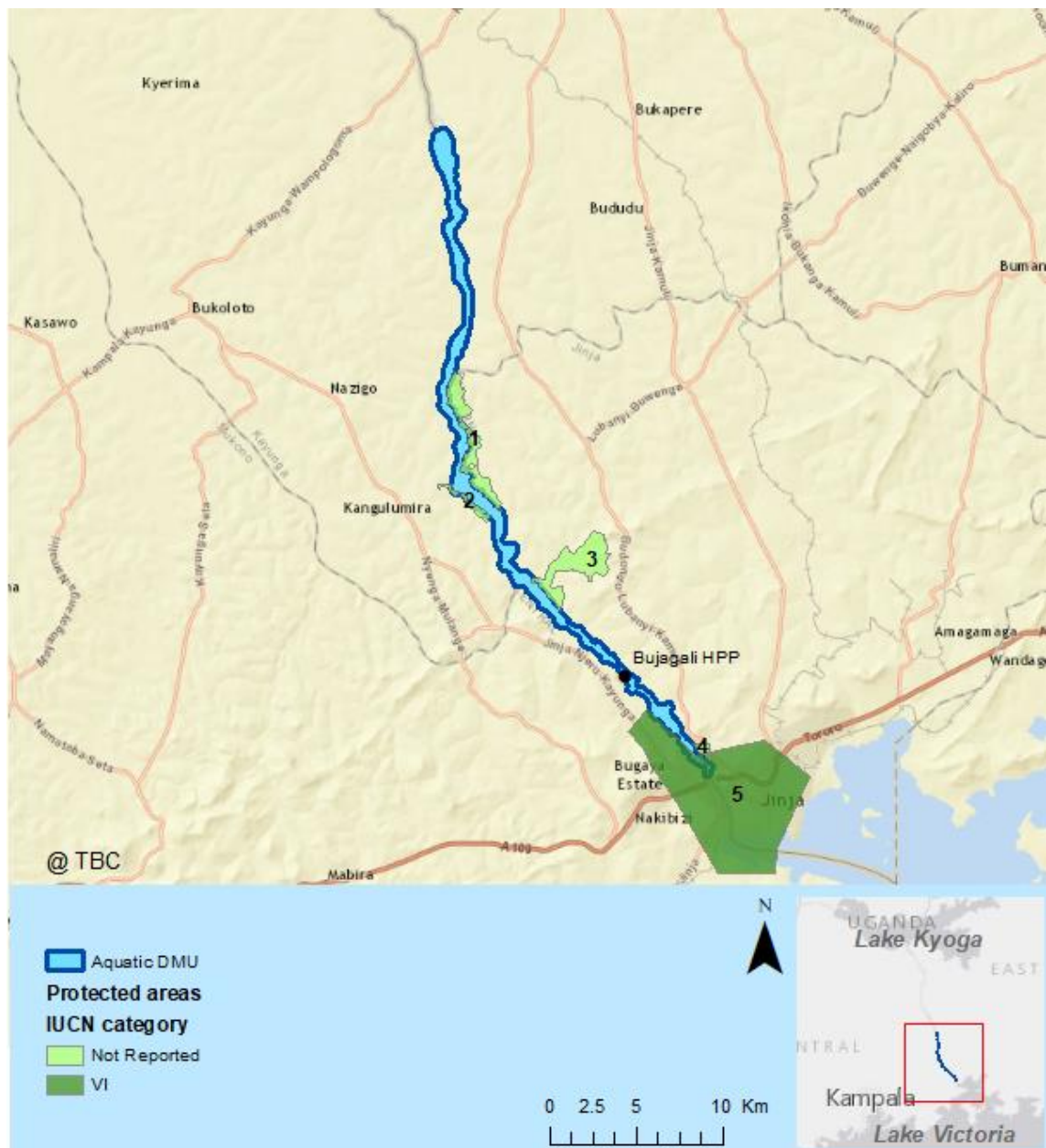


Figure 7: Protected areas adjacent to the Projects aquatic DMU. (Names: 1 = Nile Bank, 2 = Kalagala Falls, 3 = Namavundu, 4 = Kimaka, 5 = Jinja. Numbers 1 to 4 are Forest Reserves and number 5 is a Wildlife Sanctuary and IUCN Management Category VI)

## 10 Robustness of this assessment

### 10.1 Limitations of the information available to date

This assessment was conducted using the best available information, complemented by specialist consultation (see [Section 2.2.2](#)). However, it is acknowledged that new information may change the conservation status of a species and therefore change the assessment.

For example, 25 species qualifying under Criteria 2 have not been formally described. Most of these have been assigned a temporary moniker e.g. *Astatotilapia* "flameback", whilst others are only recorded to the genus level (e.g. *Lithochromis* sp.). The haplochromine specialist considers these species to be new species and many of them are likely to be only found in the Upper Victoria Nile. They were therefore assessed in this CHA based on the information available and opinion from Vianny Natugonza, the haplochromine specialist consulted by the Project. Further research may extend their known range, such that the significance of the Project DMU for these species is reduced. It should also be noted that some species have not been recently recorded in the Project's DMU, this is not necessarily an indication the species is no longer present, it may also be due to the sampling approach used to collect the data.

However, it should be noted that whilst further research may affect individual species currently identified as Critical Habitat-qualifying, the overall assessment of Critical Habitat status will not change. This is because Critical Habitat is identified on a weakest link approach, whereby qualifying biodiversity under any criterion confirms the Project as Critical Habitat.

## 11 Conclusions

### 11.1 CHA summary

- The CHA has confirmed that the Project is operating in aquatic Critical Habitat
- A total of **forty** species qualify under Criteria 1-3 (see Table 9). Some species qualify under more than one criterion. Of these species, 25 remain undescribed species. They are included in the assessment based on the opinion of the Haplochromine specialist, Vianny Natugonza, and should be viewed with this in consideration until further information is available, particularly confirmation of their status as full species. These are **Project priority biodiversity**;
- Criterion 1:
  - Tier 1: **No species**
  - Tier 2: **Ten species**
- Criterion 2:
  - Tier 1: **Ten species** (of which 10 are yet to be described)
  - Tier 2: **Twenty-Four species** (of which 15 are yet to be described)
- Criterion 3:
  - Tier 1: **No species**
  - Tier 2: **One species**



- The terrestrial area of analysis does not qualify for Critical Habitat but contains important areas of Natural Habitat (tree cover and shrub cover areas) along the river bank.
- Criterion 4: **Lake Victoria-Upper Victoria Nile ecosystem** could qualify under Criterion 4 as a highly threatened and unique ecosystem.  
Criterion 5: The DMU is not considered to be an area associated with key evolutionary process and therefore does not qualify for Criterion 5.

Table 9: Summary of Project Critical Habitat-qualifying species under Criteria 1-3

IUCN status: CR = Critically Endangered, EN = Endangered, NT = Near Threatened, VU = Vulnerable, LC = Least Concern, DD = Data Deficient, NE = Not Evaluated

Group	Scientific name	IUCN status	Critical Habitat criteria	Tier 1 or 2
Haplochromines	<i>Astatotilapia</i> "flameback"	NE	2	Tier 2
	<i>Astatotilapia</i> "blue"	NE	2	Tier 2
	<i>Astatotilapia</i> "elongate"	NE	2	Tier 2
	<i>Astatotilapia</i> "red tail"	NE	2	Tier 1
	<i>Astatotilapia</i> "scarlet anal"	NE	2	Tier 1
	<i>Haplochromis</i> "cylindrical"	NE	2	Tier 1
	<i>Haplochromis</i> "silver arrow"	NE	2	Tier 2
	<i>Haplochromis aelocephalus</i>	CR	1&2	Tier 2
	<i>Haplochromis brownae</i>	CR	1&2	Tier 2
	<i>Haplochromis crassilabris</i>	CR	1&2	Tier 2
	<i>Haplochromis guarti</i>	CR	1	Tier 2
	<i>Haplochromis microdon</i>	CR	1	Tier 2
	<i>Haplochromis niloticus</i>	DD	2	Tier 2
	<i>Haplochromis orthostoma</i>	VU	2	Tier 2
	<i>Haplochromis parvidens</i>	CR	1	Tier 2
	<i>Haplochromis simotes</i>	DD	2	Tier 2
	<i>Haplochromis</i> sp. cf. "red back scraper"	NE	2	Tier 1
	<i>Haplochromis</i> sp. "flameback"	NE	2	Tier 2
	<i>Haplochromis</i> sp. "thick skin like"	NE	2	Tier 2
	<i>Labeo victorianus</i>	CR	1	Tier 2
	<i>Lithochromis</i> sp	NE	2	Tier 1
	<i>Mbipia</i> "blue"	NE	2	Tier 2
	<i>Neochromis</i> "elongate"	NE	2	Tier 2
	<i>Neochromis</i> "lemon britti"	NE	2	Tier 1
	<i>Neochromis</i> "red simotes"	NE	2	Tier 1
	<i>Neochromis</i> "yellow rufocaudalis"	NE	2	Tier 2
	<i>Neochromis</i> sp. Labeo new	NE	2	Tier 2
	<i>Paralabidochromis</i> "scarlet anal"	NE	2	Tier 2
	<i>Paralabidochromis</i> "yellow"	NE	2	Tier 1
	<i>Paralabidochromis</i> sp 1	NE	2	Tier 2
	<i>Paralabidochromis</i> sp "Nile"	NE	2	Tier 2
	<i>Paralabidochromis</i> sp. "red breast new"	NE	2	Tier 1
	<i>Pundamilia</i> "scarlet anal"	NE	2	Tier 2
	<i>Pundamilia</i> sp. "blue lip"	NE	2	Tier 1
	<i>Xystichromis</i> "earthquake"	NE	2	Tier 2
	<i>Xystichromis</i> sp. nov. 'Kyoga flameback'	CR	1&2	Tier 2
Other Fishes	<i>Brycinus jacksonii</i>	LC	3	Tier 2
	<i>Oreochromis variabilis</i>	CR	1	Tier 2
Gastropods	<i>Ceratophallus concavus</i>	CR	1&2	Tier 2
Bivalves	<i>Sphaerium regularis</i>	EN	2	Tier 2

## 11.2 Implications of Critical Habitat for the Project

CHA was undertaken to comply with the ESDD requirements of Project re-financing to confirm the suite of species that qualify for Critical Habitat and if found to be Critical Habitat to perform a Biodiversity Action Plan (BAP) and to identify additional management and/or reasonable monitoring actions within the Project's control that are appropriate to the context of the Project (Reeman Consulting 2017).

The CHA confirms that the Project is operating within aquatic Critical Habitat and in accordance with the ESAP, the Project shall prepare a Biodiversity Action Plan. This plan shall contribute toward net gain in the protection of the species that qualified for Critical Habitat via reasonable actions within the Project's control (Reeman Consulting 2017). An overview of the requirements of PS6 (2012) for Projects located in Critical Habitat and recommendations to support alignment are found in Table 10. These follow the framework of recommendations provided by the ESDD (Reeman Consulting 2017) and the ESAP and agreed to by all Parties involved in re-financing.

The operational nature of the Project and the history of Project development frame the practical implementation of the requirements of PS6 (2012), specifically:

- The 2006 SEA (Burnside International Ltd 2006) was carried out according to the newly emerging IFC PS6 (2006), which contained an early approach to assessing Critical Habitat;
- The 2006 SEA (Burnside International Ltd 2006) concluded that the Project was not located in Critical Habitat and therefore predicted that minimal biodiversity impacts would occur;
- The 2006 SEA (Burnside International Ltd 2006) committed to a monitoring approach that has been continuously performed by the Project to confirm the accuracy of the predictions but no further biodiversity mitigation commitments were made.

*Table 10: Summary of the requirements of IFC PS6 (paragraph 17 and 18) (2012a) and recommended Project actions*

PS6 reference	PS6 text	Recommended actions
PS6 paragraph 17	In areas of critical habitat, the client will not implement any project activities unless all of the following are demonstrated:	
PS6 paragraph 17	<ul style="list-style-type: none"> <li><b>No other viable alternatives</b> in the region exist for development of the project on Modified or Natural Habitats that are not Critical;</li> </ul>	<p>This action was completed in the 2006 SEA</p> <p><b>Action:</b> No further actions required</p>
	<ul style="list-style-type: none"> <li>The project <b>does not lead to measurable adverse impacts</b> on those biodiversity values for which the Critical Habitat was designated, and on the ecological processes supporting those biodiversity values;</li> </ul>	<p>CHA identifies species that qualify for Critical Habitat, it is not an assessment of impact and not all the species identified will necessarily be adversely impacted by a project. Understanding the likelihood of an impact risk and the consequence for the species of any impact is a useful way of prioritizing CH species. Specific mitigation and monitoring actions can then be developed to support the Project demonstrate alignment with PS6.</p> <p><b>Action:</b> Undertake a risk screening assessment to prioritize species and then target any further mitigation actions and monitoring activities within the BAP to demonstrate the Project does not lead to measurable adverse impacts on CH-qualifying species or to a net reduction in CR and EN species.</p>
	<ul style="list-style-type: none"> <li>The project <b>does not lead to a net reduction</b> in the global and/or national/regional population of any Critically Endangered or Endangered species over a reasonable period of time;</li> </ul>	<p>Risk screening (above action) will support the identification of CR or EN species that may be at risk in the area of the Project and enable specific mitigation and monitoring actions to be developed to align with PS6.</p> <p><b>Action:</b> As above.</p>
	<ul style="list-style-type: none"> <li>A robust, appropriately designed, and <b>long-term biodiversity monitoring and evaluation program</b> is</li> </ul>	<p>The ongoing NaFIRRI monitoring program provides a basis for a long-term monitoring and evaluation program that should be adapted to appropriately address CH species and enable the Project to confirm</p>

	integrated into the client's management program'.	<p>if SEA conclusions are correct.</p> <p><b>Action:</b> Review the NaFIRRI monitoring program and where appropriate update the sampling approach to enable the Project to track changes in distribution and presence/absence of CH qualifying species (based on the risk screening outcomes) and confirm if SEA conclusions are correct.</p>
PS6 paragraph 18	<p>'In such cases where a client is able to meet the requirements defined in paragraph 17, the project's mitigation strategy will be described in a <b>Biodiversity Action Plan (BAP)</b> and will be designed to achieve <b>net gains</b> of those biodiversity values for which the critical habitat was designated'.</p>	<p>As the Project is in Critical Habitat, a BAP is required to demonstrate how the Project will contribute towards net gain in the protection of Critical Habitat qualifying features via reasonable actions within the Projects control (IFC ESAP).</p> <p><b>Action:</b> Based on the results of the CHA and risk screening identify mitigation actions that will support the ESAP requirements. These actions could include for example working with stakeholders to re-vegetate along the river bank to reduce sedimentation in the river and improve water quality and support to NaFIRRI to adjust sampling procedures to more effectively locate and monitor Critical Habitat qualifying species.</p>

## 12 References

- Burnside International Ltd (2006) Bujagali Hydropower Project Social and Environmental Assessment Main Report (Report for Bujagali Energy Ltd).
- Coulter, G.W. (1991) *Lake Tanganyika and its life*. British Museum (Natural History) and Oxford University Press, Oxford, U.K.
- Danley, P.D., Husemann, M., Ding, B., DiPietro, L.M., Beverly, E.J. & Peppe, D.J. (2012) The Impact of the Geologic History and Paleoclimate on the Diversification of East African Cichlids. *International Journal of Evolutionary Biology* 2012: 20.
- ERMC (2017) ADDENDUM ENVIRONMENTAL AND SOCIAL IMPACT OF THE ISIMBA HYDROPOWER PROJECT ON THE KALAGALA OFFSET AREA (Report to MEMD Uganda).
- FishBase team RMCA & Geelhand, D. (2016) *Brycinus jacksonii*. *IUCN Red List of Threatened Species version 2016*. <http://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T60748A47213317.en>
- FishBase team RMCA & Geelhand, D. (2017) *Labeo victorianus*. *IUCN Red List of Threatened Species version 2016*.
- Froese, R. & Pauly, D. (2017) FishBase. *FishBase version 02/2017*. <http://fishbase.org/search.php>
- Fryer, G. & Iles, T.D. (1972) *The Cichlids fishes of the great lakes of Africa*. Oliver & Boyd, Edinburgh, Scotland.
- IFC (2012a) Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources. International Finance Corporation, Washington DC, USA.
- IFC (2012b) Guidance Note 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources. International Finance Corporation, Washington DC, USA.
- Kaufman, L. (1996) *Xystichromis sp. nov. 'Kyoga flameback'*. *The IUCN Red List of Threatened Species 1996*.
- Kaufman, L. (2016) *Haplochromis orthostoma*. *The IUCN Red List of Threatened Species 2016*.
- NaFIRRI (2017) Characterization of Habitats and Haplochromine Diversity to Guide Conservation of Biodiversity amidst Hydropower Developments along the Upper Victoria Nile (Report to MEMD Uganda).
- Olson, D.M. & Dinerstein, E. (2002) The Global 200: Priority Ecoregions for Global Conservation. *Annals of the Missouri Botanical Garden* 89: 199–224.
- Reeman Consulting (2017) Environmental and Social Due Diligence (ESDD) Audit of the Bujagali Hydropower Project.
- Rodríguez-Clark, Kathryn M., Keith, D.A., Rodríguez-Clark, Katheryn M., Murray, N.J., Nicholson, E., Regan, T.J., Miller, R.M., Barrow, E.G., Bland, L.M., Boe, K., Brooks, T.M., Oliveira-Miranda, M.A., Spalding, M. & Wit, P. (2015) A practical guide to the application of the

- IUCN Red List of Ecosystems criteria. *Philosophical Transactions of the Royal Society B* 370.
- Seddon, M.B., Van Damme, D. & Lange, C. (2017) *Sphaerium regularis*. *The IUCN Red List of Threatened Species 2017*.
- Seehausen O, van Alphen JJM, Witte F (1997). Cichlid Fish Diversity Threatened by Eutrophication That Curbs Sexual Selection. *Science* 277, 1808-1811
- Twongo, T.K., Bayona, J.D.R. & Hanssens, M. (2006) *Oreochromis variabilis*. *The IUCN Red List of Threatened Species 2006*.
- Van Damme, D. & Lange, C. (2017) *Ceratophallus concavus*(errata version published in 2017) (amended version of 2016 assessment). *The IUCN Red List of Threatened Species 2017*. <http://www.iucnredlist.org/details/biblio/184516/0>
- Van Zwieten PAM, Kolding J, Plank MJ, Hecky RE, Bridgeman TB, MacIntyre S, Seehausen O, Silsbe GM. (2016). The Nile perch invasion in Lake Victoria: cause or consequence of the haplochromine decline. *Can. J. Fish. Aquat. Sci.* 73:622-643.
- Witte, F. & de Zeeuw, M.P. (2010a) *Haplochromis guiarti*.
- Witte, F. & de Zeeuw, M.P. (2010b) *Haplochromis niloticus*. *The IUCN Red List of Threatened Species 2010*.
- Witte, F. & de Zeeuw, M.P. (2016) *Haplochromis simotes*. *The IUCN Red List of Threatened Species 2016*.
- Witte, F., de Zeeuw, M.P. & Brooks, E. (2010a) *Haplochromis aacephalus*. *The IUCN Red List of Threatened Species 2010*.
- Witte, F., de Zeeuw, M.P. & Brooks, E. (2010b) *Haplochromis brownae*. *The IUCN Red List of Threatened Species 2010*.
- Witte, F., de Zeeuw, M.P. & Brooks, E. (2010c) *Haplochromis crassilabris*. *The IUCN Red List of Threatened Species 2010*.
- Witte, F., de Zeeuw, M.P. & Brooks, E. (2010d) *Haplochromis microdon*. *The IUCN Red List of Threatened Species 2010*.
- Witte, F., de Zeeuw, M.P. & Brooks, E. (2010e) *Haplochromis parvidens*. *The IUCN Red List of Threatened Species 2010*.
- Witte F, Goldschmidt T, Goudswaard PC, Ligtoet W, van Oijen MJP, Wanink JH (1992) Species extinction and concomitant ecological changes in Lake Victoria. *Netherlands Journal of Zoology* 42: 214-232
- Witte, F., Wanink, J.H. & Kische-Machumu, M. (2007) Species Distinction and the Biodiversity Crisis in Lake Victoria. *Transactions of the American Fisheries Society* 136: 1146–1159.
- WS Atkins, F. (2001) Haplochromine habitat study (Report for AES Nile Power).





## Appendix 1: IFC PS6 Critical Habitat criteria and thresholds

Criteria	Tier 1	Tier 2
<b>Criterion 1:</b> Critically Endangered (CR)/ Endangered (EN) Species	<p>(a) Habitat required to sustain <math>\geq 10</math> percent of the global population of a CR or EN species/subspecies where there are known, regular occurrences of the species and where that habitat could be considered a discrete management unit for that species.</p> <p>(b) Habitat with known, regular occurrences of CR or EN species where that habitat is one of 10 or fewer discrete management sites globally for that species.</p>	<p>(c) Habitat that supports the regular occurrence of a single individual of a CR species and/or habitat containing regionally- important concentrations of a Red-listed EN species where that habitat could be considered a discrete management unit for that species/ subspecies.</p> <p>(d) Habitat of significant importance to CR or EN species that are wide-ranging and/or whose population distribution is not well understood and where the loss of such a habitat could potentially impact the long-term survivability of the species.</p> <p>(e) As appropriate, habitat containing nationally/regionally important concentrations of an EN, CR or equivalent national/regional listing.</p>
<b>Criterion 2:</b> Endemic/ Restricted Range Species	<p>(a) Habitat known to sustain <math>\geq 95</math> percent of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species (e.g., a single-site endemic).</p>	<p>(b) Habitat known to sustain <math>\geq 1</math> percent but <math>&lt; 95</math> percent of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species, where data are available and/or based on expert judgment.</p>
	<p>IFC GN6 provides the following guidance on Criterion 2:</p> <ul style="list-style-type: none"> <li>An endemic species is defined as one that has <math>\geq 95</math> percent of its global range inside the country or region of analysis</li> <li>A restricted-range species is defined as:               <ul style="list-style-type: none"> <li><b>For terrestrial vertebrates</b>, extent of occurrence of 50,000 km<sup>2</sup> or less.</li> <li><b>For marine systems</b>, extent of occurrence of 100,000 km<sup>2</sup> or less.</li> <li><b>For freshwater systems</b>, standardized thresholds have not been set at the global level. However, an IUCN study of African freshwater biodiversity applied thresholds of 20,000 km<sup>2</sup> for crabs, fish, and molluscs and 50,000 km<sup>2</sup> for odonates (dragonflies and damselflies). These can be taken as approximate guidance, although the extent to which they are applicable to other taxa and in other regions is not yet known.</li> </ul> </li> </ul>	

	<ul style="list-style-type: none"> <li>○ <b>For plants</b>, restricted-range species may be listed as part of national legislation. Plants are more commonly referred to as “endemic,” and the definition provided in paragraph GN79 would apply. Particular attention should therefore be paid to endemic plants of smaller countries which are likely, by definition, to be globally rarer and therefore of higher overall priority</li> </ul>	
<b>Criterion 3:</b> Migratory/ Congregatory Species	<p>(a) Habitat known to sustain, on a cyclical or otherwise regular basis, <math>\geq 95</math> percent of the global population of a migratory or congregatory species at any point of the species’ lifecycle where that habitat could be considered a discrete management unit for that species.</p>	<p>(b) Habitat known to sustain, on a cyclical or otherwise regular basis, <math>\geq 1</math> percent but <math>&lt; 95</math> percent of the global population of a migratory or congregatory species at any point of the species’ lifecycle and where that habitat could be considered a discrete management unit for that species, where adequate data are available and/or based on expert judgment.</p> <p>(c) For birds, habitat that meets BirdLife International’s Criterion A4 for congregations and/or Ramsar Criteria 5 or 6 for Identifying Wetlands of International Importance.</p> <p>(d) For species with large but clumped distributions, a provisional threshold is set at <math>\geq 5</math> percent of the global population for both terrestrial and marine species.</p> <p>(e) Source sites that contribute <math>\geq 1</math> percent of the global population of recruits.</p>
<b>Criterion 4:</b> Highly Threatened and/or Unique Ecosystems	<p>IFC GN6 (paragraph 90-93):</p> <ul style="list-style-type: none"> <li>• Those at risk of significantly decreasing in area or quality;</li> <li>• Those with a small spatial extent; and/or</li> <li>• Those containing unique assemblages of species including assemblages or concentrations of biome-restricted species.</li> <li>• Areas determined to be irreplaceable or of high priority/significance based on systematic conservation planning techniques carried out at the landscape and/or regional scale by governmental bodies, recognized academic institutions and/or other relevant qualified organizations (including internationally-recognized NGOs) or that are recognized as such in existing regional or national plans, such as the National Biodiversity Strategy and Action Plan (NBSAP), also qualify as critical habitat per Criterion 4 (IFC 2012b, paragraph GN90).</li> </ul>	
	<p>IUCN Red List of Threatened Ecosystems:</p> <ul style="list-style-type: none"> <li>• Eight criteria:</li> </ul>	

	<ul style="list-style-type: none"> <li>○ <b>Collapsed (CO):</b> An ecosystem is Collapsed when it is virtually certain (Table 3) that its defining biotic or abiotic features are lost from all occurrences, and the characteristic native biota are no longer sustained. Collapse may occur when most of the diagnostic components of the characteristic native biota are lost from the system, or when functional components (biota that perform key roles in ecosystem organisation) are greatly reduced in abundance and lose the ability to recruit</li> <li>○ <b>Critically Endangered (CR):</b> An ecosystem is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered. It is therefore considered to be at an extremely high risk of collapse.</li> <li>○ <b>Endangered (EN):</b> An ecosystem is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered. It is therefore considered to be at a very high risk of collapse</li> <li>○ <b>Vulnerable (VU):</b> An ecosystem is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable. It is therefore considered to be at a high risk of collapse.</li> <li>○ <b>Near Threatened (NT):</b> An ecosystem is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.</li> <li>○ <b>Least Concern (LC):</b> An ecosystem is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widely distributed and relatively undegraded ecosystems are included in this category.</li> <li>○ <b>Data Deficient (DD):</b> An ecosystem is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of collapse based on decline in distribution, disruption of ecological function or degradation of the physical environment. Data Deficient is not a category of threat, and does not imply any level of collapse risk. Listing of ecosystems in this category indicates that their situation has been reviewed, but that more information is required to determine their risk status.</li> <li>○ <b>Not Evaluated (NE):</b> An ecosystem is Not Evaluated when it is has not yet been evaluated against the criteria.</li> </ul> <ul style="list-style-type: none"> <li>• CR, EN and VU are nested categories, so that a CR ecosystem also meets the criteria for EN and NT</li> <li>• Methodology for applying these criteria is given in Rodriguez <i>et al.</i> (2015)</li> </ul>
<b>Criterion 5:</b> Key evolutionary processes	<p>This criterion is defined by the physical features of a landscape that might be associated with particular evolutionary processes, and/or subpopulations of species that are phylogenetically or morpho-genetically distinct and may be of special conservation concern given their distinct evolutionary history (IFC 2012b, paragraph GN95). Although in West Africa, the</p>

	presence of evolutionarily important forest refugia has been postulated for humid mountainous zones, it is unlikely in the lower regions where the Project is located. Therefore, no features qualifying under Criterion 5 have been identified for the Project.
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## Appendix 2: Candidate list of species for CHA

Species that do not qualify for Critical Habitat either have never been recorded in the Projects DMU or, if recorded in the DMU, do not meet the Criterion thresholds established for Critical Habitat. For example, 38 CR species in the screening list below have not been recorded in the Project's DMU (or in the Upper Victoria Nile) and therefore have not included into the CHA. Two of the 38 species have been recorded in both Lake Victoria and Lake Kyoga (*Haplochromis obesus* and *Oreochromis esculentus*) and therefore might be found in the Upper Victoria Nile but it has yet to be recorded (and therefore is not part of the CHA, if recorded in the DMU it would qualify under Criterion 1, Tier 2).

IUCN Red List status: NE – Not Evaluated; DD – Data Deficient; NT – Near Threatened; LC – Least Concern; VU – Vulnerable; EN – Endangered; CR – Critically Endangered

Critical Habitat-qualifying species shaded grey

Group	Name (as recorded in IUCN or preferred by the specialist for the undescribed species)	Described?	IUCN Red List status	CH criterion
Other fishes	<i>Aplocheilichthys pumilus</i>	Yes	LC	no
Haplochromine	<i>Astatoreochromis alluaudi</i>	Yes	LC	no
Haplochromine	<i>Astatotilapia</i> "purple dorsum"	No	NE	no
Haplochromine	<i>Astatotilapia</i> "flameback"	No	NE	2
Haplochromine	<i>Astatotilapia</i> "blue"	No	NE	2
Haplochromine	<i>Astatotilapia</i> "elongate"	No	NE	2
Haplochromine	<i>Astatotilapia</i> "kyogaastato"	No	NE	no
Haplochromine	<i>Astatotilapia</i> "red tail"	No	NE	2
Haplochromine	<i>Astatotilapia</i> "scarlet anal"	No	NE	2
Haplochromine	<i>Bagrus docmak</i>	Yes	LC	no
Other fishes	<i>Barbus altianalis</i>	Yes	LC	no
Other fishes	<i>Barbus paludinosus</i>	Yes	LC	no
Fishes	<i>Brycinus jacksonii</i>	Yes	LC	3
Other fishes	<i>Brycinus sadleri</i>	Yes	LC	no
Gastropods	<i>Burnupia stuhlmanni</i>	Yes	NT	no
Gastropods	<i>Ceratophallus concavus</i>	Yes	CR	1&2
Other fishes	<i>Clariallabes petricola</i>	Yes	DD	no
Other fishes	<i>Clarias gariepinus</i>	Yes	LC	no
Other fishes	<i>Gnathonemus longibarbis</i>	Yes	LC	no
Haplochromine	<i>Haplochromis</i> "cylindrical"	No	NE	2
Haplochromine	<i>Haplochromis</i> "silver arrow"	No	NE	2
Haplochromine	<i>Haplochromis acidens</i>	Yes	DD	no
Haplochromine	<i>Haplochromis aelocephalus</i>	Yes	CR	1&2
Haplochromine	<i>Haplochromis altigenis</i>	Yes	DD	no
Haplochromine	<i>Haplochromis apogonoides</i>	Yes	CR	no
Haplochromine	<i>Haplochromis arcanus</i>	Yes	DD	no
Haplochromine	<i>Haplochromis argenteus</i>	Yes	CR	no
Haplochromine	<i>Haplochromis artaxerxes</i>	Yes	DD	no

Group	Name (as recorded in IUCN or preferred by the specialist for the undescribed species)	Described?	IUCN Red List status	CH criterion
Haplochromine	<i>Haplochromis azureus</i>	Yes	VU	no
Haplochromine	<i>Haplochromis barbarae</i>	Yes	CR	no
Haplochromine	<i>Haplochromis bareli</i>	Yes	CR	no
Haplochromine	<i>Haplochromis bartoni</i>	Yes	DD	no
Haplochromine	<i>Haplochromis bayoni</i>	Yes	DD	no
Haplochromine	<i>Haplochromis boops</i>	Yes	DD	no
Haplochromine	<i>Haplochromis brownae</i>	Yes	CR	1&2
Haplochromine	<i>Haplochromis cassius</i>	Yes	CR	no
Haplochromine	<i>Haplochromis cavifrons</i>	Yes	DD	no
Haplochromine	<i>Haplochromis chlorochrous</i>	Yes	DD	no
Haplochromine	<i>Haplochromis chrysogynaion</i>	Yes	DD	no
Haplochromine	<i>Haplochromis cinctus</i>	Yes	CR	no
Haplochromine	<i>Haplochromis cinereus</i>	Yes	DD	no
Haplochromine	<i>Haplochromis cnester</i>	Yes	CR	no
Haplochromine	<i>Haplochromis crassilabris</i>	Yes	CR	1&2
Haplochromine	<i>Haplochromis crocopeplus</i>	Yes	CR	no
Haplochromine	<i>Haplochromis cronus</i>	Yes	DD	no
Haplochromine	<i>Haplochromis cryptodon</i>	Yes	DD	no
Haplochromine	<i>Haplochromis cryptogramma</i>	Yes	DD	no
Haplochromine	<i>Haplochromis decticostoma</i>	Yes	DD	no
Haplochromine	<i>Haplochromis dentex</i>	Yes	CR	no
Haplochromine	<i>Haplochromis dichrourus</i>	Yes	CR	no
Haplochromine	<i>Haplochromis diplotaenia</i>	Yes	DD	no
Haplochromine	<i>Haplochromis dolichorhynchus</i>	Yes	DD	no
Haplochromine	<i>Haplochromis empodisma</i>	Yes	DD	no
Haplochromine	<i>Haplochromis erythrocephalus</i>	Yes	DD	no
Haplochromine	<i>Haplochromis estor</i>	Yes	DD	no
Haplochromine	<i>Haplochromis eutaenia</i>	Yes	DD	no
Haplochromine	<i>Haplochromis flavipinnis</i>	Yes	CR	no
Haplochromine	<i>Haplochromis flavus</i>	Yes	LC	no
Haplochromine	<i>Haplochromis gigas</i>	Yes	VU	no
Haplochromine	<i>Haplochromis gilberti</i>	Yes	DD	no
Haplochromine	<i>Haplochromis gowersii</i>	Yes	DD	no
Haplochromine	<i>Haplochromis granti</i>	Yes	CR	no
Haplochromine	<i>Haplochromis greenwoodi</i>	Yes	LC	no
Haplochromine	<i>Haplochromis guiarti</i>	Yes	CR	1
Haplochromine	<i>Haplochromis harpakteridion</i>	Yes	DD	no
Haplochromine	<i>Haplochromis heusinkveldi</i>	Yes	CR	no
Haplochromine	<i>Haplochromis hiatus</i>	Yes	CR	no
Haplochromine	<i>Haplochromis humilior</i>	Yes	DD	no
Haplochromine	<i>Haplochromis igneopinnis</i>	Yes	EN	no
Haplochromine	<i>Haplochromis iris</i>	Yes	CR	no
Haplochromine	<i>Haplochromis ishmaeli</i>	Yes	CR	no

Group	Name (as recorded in IUCN or preferred by the specialist for the undescribed species)	Described?	IUCN Red List status	CH criterion
Haplochromine	<i>Haplochromis kujunju</i>	Yes	DD	no
Haplochromine	<i>Haplochromis labriformis</i>	Yes	DD	no
Haplochromine	<i>Haplochromis lacrimosus</i>	Yes	DD	no
Haplochromine	<i>Haplochromis lividus</i>	Yes	DD	no
Haplochromine	<i>Haplochromis longirostris</i>	Yes	CR	no
Haplochromine	<i>Haplochromis macrocephalus</i>	Yes	VU	no
Haplochromine	<i>Haplochromis macrognathus</i>	Yes	CR	no
Haplochromine	<i>Haplochromis macrops</i>	Yes	DD	no
Haplochromine	<i>Haplochromis maculipinna</i>	Yes	DD	no
Haplochromine	<i>Haplochromis maisomei</i>	Yes	DD	no
Haplochromine	<i>Haplochromis mandibularis</i>	Yes	DD	no
Haplochromine	<i>Haplochromis martini</i>	Yes	CR	no
Haplochromine	<i>Haplochromis mbipi</i>	Yes	LC	no
Haplochromine	<i>Haplochromis melanopus</i>	Yes	DD	no
Haplochromine	<i>Haplochromis melichrous</i>	Yes	DD	no
Haplochromine	<i>Haplochromis mento</i>	Yes	DD	no
Haplochromine	<i>Haplochromis michaeli</i>	Yes	CR	no
Haplochromine	<i>Haplochromis microdon</i>	Yes	CR	1
Haplochromine	<i>Haplochromis mylergates</i>	Yes	CR	no
Haplochromine	<i>Haplochromis nanoserranus</i>	Yes	CR	no
Haplochromine	<i>Haplochromis nigrescens</i>	Yes	DD	no
Haplochromine	<i>Haplochromis nigricans</i>	Yes	DD	no
Haplochromine	<i>Haplochromis niloticus</i>	Yes	DD	2
Haplochromine	<i>Haplochromis nubilus</i>	Yes	VU	no
Haplochromine	<i>Haplochromis nuchisquamulatus</i>	Yes	DD	no
Haplochromine	<i>Haplochromis nyanzae</i>	Yes	DD	no
Haplochromine	<i>Haplochromis obesus</i>	Yes	CR	no
Haplochromine	<i>Haplochromis obtusidens</i>	Yes	DD	no
Haplochromine	<i>Haplochromis omnicaeruleus</i>	Yes	LC	no
Haplochromine	<i>Haplochromis orthostoma</i>	Yes	VU	2
Haplochromine	<i>Haplochromis pachycephalus</i>	Yes	DD	no
Haplochromine	<i>Haplochromis pallidus</i>	Yes	DD	no
Haplochromine	<i>Haplochromis paraguayarti</i>	Yes	DD	no
Haplochromine	<i>Haplochromis paraplagiostoma</i>	Yes	DD	no
Haplochromine	<i>Haplochromis parorthostoma</i>	Yes	DD	no
Haplochromine	<i>Haplochromis parvidens</i>	Yes	CR	1
Haplochromine	<i>Haplochromis pellegrini</i>	Yes	DD	no
Haplochromine	<i>Haplochromis percoides</i>	Yes	CR	no
Haplochromine	<i>Haplochromis perrieri</i>	Yes	CR	no
Haplochromine	<i>Haplochromis pharyngomylus</i>	Yes	DD	no
Haplochromine	<i>Haplochromis phytophagus</i>	Yes	DD	no
Haplochromine	<i>Haplochromis pitmani</i>	Yes	DD	no
Haplochromine	<i>Haplochromis plagiostoma</i>	Yes	DD	no



Group	Name (as recorded in IUCN or preferred by the specialist for the undescribed species)	Described?	IUCN Red List status	CH criterion
Haplochromine	<i>Haplochromis plutonius</i>	Yes	CR	no
Haplochromine	<i>Haplochromis prodomus</i>	Yes	DD	no
Haplochromine	<i>Haplochromis prognathus</i>	Yes	DD	no
Haplochromine	<i>Haplochromis pseudopellegrini</i>	Yes	DD	no
Haplochromine	<i>Haplochromis ptistes</i>	Yes	CR	no
Haplochromine	<i>Haplochromis pundamilia</i>	Yes	LC	no
Haplochromine	<i>Haplochromis pyrrhopteryx</i>	Yes	CR	no
Haplochromine	<i>Haplochromis riponianus</i>	Yes	LC	no
Haplochromine	<i>Haplochromis rubripinnis</i>	Yes	LC	no
Haplochromine	<i>Haplochromis rufocaudalis</i>	Yes	LC	no
Haplochromine	<i>Haplochromis sauvagei</i>	Yes	VU	no
Haplochromine	<i>Haplochromis saxicola</i>	Yes	DD	no
Haplochromine	<i>Haplochromis serranus</i>	Yes	DD	no
Haplochromine	<i>Haplochromis simotes</i>	Yes	DD	2
Haplochromine	<i>Haplochromis</i> sp. cf. "red back scraper"	No	NE	2
Haplochromine	<i>Haplochromis</i> sp. "flameback"	No	NE	2
Haplochromine	<i>Haplochromis</i> sp. nov. "Blue Rockpicker"	Yes	EN	no
Haplochromine	<i>Haplochromis</i> sp. "purple yellow"	No	NE	no
Haplochromine	<i>Haplochromis</i> sp. "thick skin like"	No	NE	2
Haplochromine	<i>Haplochromis spekii</i>	Yes	DD	no
Haplochromine	<i>Haplochromis squamulatus</i>	Yes	DD	no
Haplochromine	<i>Haplochromis sulphureus</i>	Yes	CR	no
Haplochromine	<i>Haplochromis teegelaari</i>	Yes	CR	no
Haplochromine	<i>Haplochromis teunisrasi</i>	Yes	CR	no
Haplochromine	<i>Haplochromis theliodon</i>	Yes	CR	no
Haplochromine	<i>Haplochromis thereuterion</i>	Yes	VU	no
Haplochromine	<i>Haplochromis thuragnathus</i>	Yes	DD	no
Haplochromine	<i>Haplochromis tridens</i>	Yes	DD	no
Haplochromine	<i>Haplochromis tyrianthinus</i>	Yes	DD	no
Haplochromine	<i>Haplochromis ushindi</i>	Yes	CR	no
Haplochromine	<i>Haplochromis vanoijeni</i>	Yes	VU	no
Haplochromine	<i>Haplochromis victoriae</i>	Yes	DD	no
Haplochromine	<i>Haplochromis victorianus</i>	Yes	CR	no
Haplochromine	<i>Haplochromis vonlinnei</i>	Yes	CR	no
Haplochromine	<i>Haplochromis welcommei</i>	Yes	VU	no
Haplochromine	<i>Haplochromis xanthopteryx</i>	Yes	VU	no
Haplochromine	<i>Haplochromis xenognathus</i>	Yes	LC	no
Haplochromine	<i>Haplochromis xenostoma</i>	Yes	CR	no
Haplochromine	<i>Harpagochromis</i> sp. <i>guiarti</i> complex	No	NE	no
Haplochromine	<i>Hippopotamyrus grahami</i>	Yes	LC	no
Haplochromine	<i>Labeo victorianus</i>	Yes	CR	1
Other fishes	<i>Lates niloticus</i>	Yes	LC	no
Haplochromine	<i>Lipochromis</i> sp	No	NE	no

Group	Name (as recorded in IUCN or preferred by the specialist for the undescribed species)	Described?	IUCN Red List status	CH criterion
Haplochromine	<i>Lithochromis</i> sp	No	NE	2
Other fishes	<i>Marcusenius rheni</i>	Yes	DD	no
Other fishes	<i>Marcusenius victoriae</i>	Yes	LC	no
Haplochromine	<i>Mbipia</i> "blue"	No	NE	2
Haplochromine	<i>Mbipia</i> "red pelvics"	No	NE	no
Haplochromine	<i>Mbipia</i> "red"	No	NE	no
Haplochromine	<i>Mbipia</i> "yellowfin"	No	NE	no
Haplochromine	<i>Mbipia</i> sp. "golden"	No	NE	no
Other fishes	<i>Microphis fluviatilis</i>	Yes	DD	no
Other fishes	<i>Mormyrus kannume</i>	Yes	LC	no
Other fishes	<i>Mormyrus macrocephalus</i>	yes	LC	no
Haplochromine	<i>Neochromis</i> "elongate"	No	NE	2
Haplochromine	<i>Neochromis</i> "lemon britti"	No	NE	2
Haplochromine	<i>Neochromis</i> "red simotes"	No	NE	2
Haplochromine	<i>Neochromis</i> "yellow rufocaudalis"	No	NE	2
Haplochromine	<i>Neochromis</i> cf. "large scale nigricans"	No	NE	no
Haplochromine	<i>Neochromis</i> sp. "Labeo new"	No	NE	2
Haplochromine	<i>Neochromis</i> sp. "Uganda blue scraper"	No	NE	no
Other fishes	<i>Oreochromis esculentus</i>	Yes	CR	no
Other fishes	<i>Oreochromis leucostictus</i>	Yes	LC	no
Other fishes	<i>Oreochromis niloticus</i>	Yes	NE	no
Other fishes	<i>Oreochromis variabilis</i>	Yes	CR	1
Haplochromine	<i>P. mpamanus</i>	No	NE	no
Haplochromine	<i>Paralabidochromis</i> "black para"	No	NE	no
Haplochromine	<i>Paralabidochromis</i> "earthquake"	No	NE	no
Haplochromine	<i>Paralabidochromis</i> "scarlet anal"	No	NE	2
Haplochromine	<i>Paralabidochromis</i> "yellow"	No	NE	2
Haplochromine	<i>Paralabidochromis</i> "short snout scraper"	No	NE	no
Haplochromine	<i>Paralabidochromis</i> sp 1	No	NE	2
Haplochromine	<i>Paralabidochromis</i> sp "Nile"	No	NE	2
Haplochromine	<i>Paralabidochromis</i> sp. "red breast new"	No	NE	2
Haplochromine	<i>Paralabidochromis</i> sp. "yellow multisport"	No	NE	no
Haplochromine	<i>Prognathochromis</i> "tridens complex"	No	NE	no
Haplochromine	<i>Prognathochromis</i> "shovel mouth"	No	NE	no
Other fishes	<i>Protopterus aethiopicus</i> ssp. <i>aethiopicus</i>	Yes	LC	no
Haplochromine	<i>Psammochromis liocephalus</i>	Yes	NE	no
Haplochromine	<i>Psammochromis mpibiunus</i>	Yes	NE	no
Haplochromine	<i>Ptyochromis xenognathus</i> "red pelvic"	No	NE	no
Haplochromine	<i>Pundamilia</i> "black"	No	NE	no
Haplochromine	<i>Pundamilia</i> "orange anal"	No	NE	no
Haplochromine	<i>Pundamilia</i> "orange tail"	No	NE	no
Haplochromine	<i>Pundamilia</i> "red tail"	No	NE	no

Group	Name (as recorded in IUCN or preferred by the specialist for the undescribed species)	Described?	IUCN Red List status	CH criterion
Haplochromine	<i>Pundamilia</i> "scarlet anal"	No	NE	2
Haplochromine	<i>Pundamilia</i> sp. "big blue"	No	NE	no
Haplochromine	<i>Pundamilia</i> sp. "blue lip"	No	NE	2
Haplochromine	<i>Pundamilia</i> sp. "Redrim anal fin"	No	NE	no
Haplochromine	<i>Pundamilia</i> "yellowfin"	No	NE	no
Other fishes	<i>Rastrineobola argentea</i>	Yes	LC	no
Other fishes	<i>Schilbe intermedius</i>	Yes	LC	no
Bivalves	<i>Sphaerium regularis</i>	Yes	EN	2
Other fishes	<i>Synodontis afrofischeri</i>	Yes	LC	no
Other fishes	<i>Synodontis victoriae</i>	Yes	LC	no
Other fishes	<i>Tilapia guineensis</i>	Yes	LC	no
Other fishes	<i>Xenoclaras eupogon</i>	Yes	CR	no
Haplochromine	<i>Xystichromis</i> "earthquake"	No	NE	2
Haplochromine	<i>Xystichromis</i> "flameback"	No	NE	no
Haplochromine	<i>Xystichromis</i> sp. nov. 'Kyoga flameback'	Yes	CR	1&2

## Appendix 3: Haplochromine suitable habitat in Lake Victoria

Suitable habitat for haplochromine species is estimated to be between 0 and 27m water depth (Seehausen 1996, Van Oijen *et al.* 1991), which covers approximately one third of the lake area. This is considered to be a precautionary approach to estimating a haplochromine EOO as recent surveys undertaken by NaFIRRI indicate that haplochromines are found from inshore areas (0-20 m), coastal waters (21-40 m) and from deep waters (40+m) with highest haplochromine biomass in coastal waters. Coastal waters cover an area of 21,038 km<sup>2</sup> (pers. comm. Vianny Natugonza, March 2018).

### Lake Victoria, Bathymetry

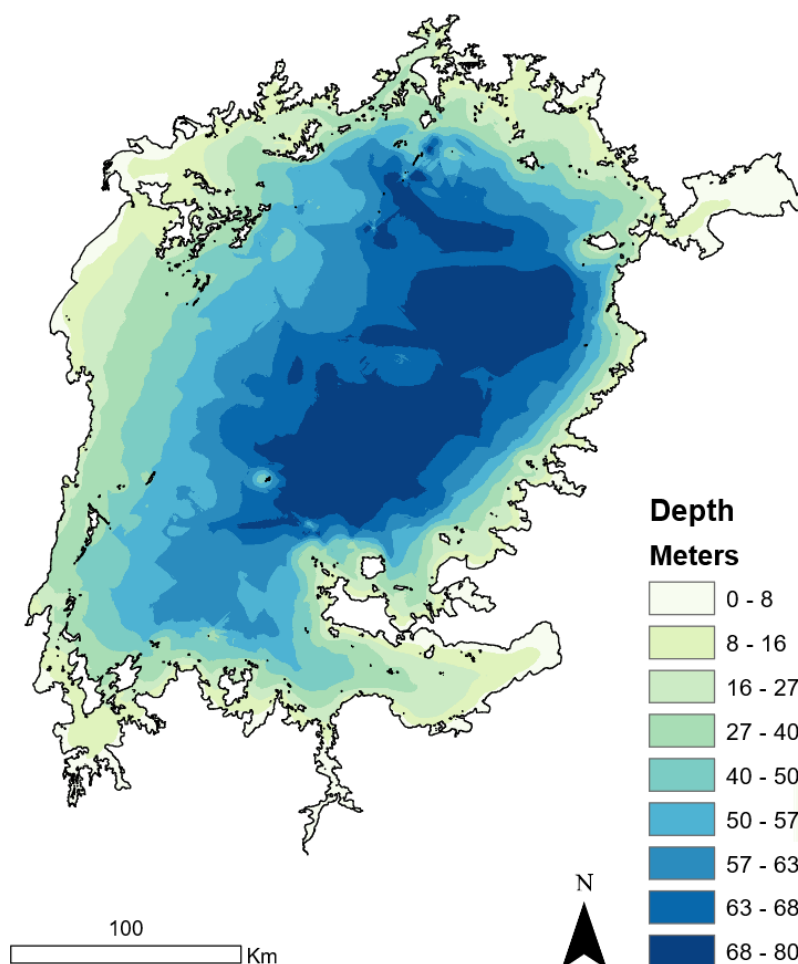


Figure 8: Lake Victoria, bathymetry (Hamilton 2016: *Creation of a Bathymetric Map of Lake Victoria, Africa*. <http://dx.doi.org/10.7910/DVN/SOEKNR>.)

## Appendix 4: Species accounts

IUCN status: CR = Critically Endangered, EN = Endangered, NT = Near Threatened, VU = Vulnerable, LC = Least Concern, DD = Data Deficient, NE = Not Evaluated

### Haplochromine species

#### Tier 1

<b>Species</b>	<i>Astatotilapia</i> "red tail"
<b>Status (IUCN)</b>	NE
<b>Location-based sub-criterion</b>	Criterion 2a
<b>Critical Habitat tier</b>	Tier 1
<b>Last seen date (NaFiRRI data)</b>	2017
<b>Justification</b>	<p>Based on information from the haplochromine specialist, this species is only likely to be found in the Upper Victoria Nile as it is a riverine fish, preferring very slow-moving water and is encountered on muddy and sandy substrates, near vegetated shorelines. Because of its preference for a vegetated shoreline it may be present in lakes but this is not confirmed from records. It is not a specialist of fast flowing waters/rapids. The species is only incidentally fished and is the prey of the Nile perch.</p> <p>The species is undescribed and therefore not evaluated by the IUCN Red List. Based on information from the haplochromine specialist, the species is only known from between the Upper Victoria Nile and currently only from the area of Bujagali (location 2 and 3), making it restricted-range and qualifying for Criterion 2, Tier 1. There is no evidence to suggest that the species might be migratory or congregatory. Therefore, it does not qualify for Criterion 3.</p>

<b>Species</b>	<i>Astatotilapia</i> "scarlet anal"
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<b>Status (IUCN)</b>	NE
<b>Location-based sub-criterion</b>	Criterion 2a
<b>Critical Habitat tier</b>	Tier 1
<b>Last seen date (NaFiRRI data)</b>	2015
<b>Justification</b>	<p>Based on information from the haplochromine specialist, this species is only likely to be found in the Upper Victoria Nile as it is a riverine fish, preferring very slow-moving water and is encountered on muddy and sandy substrates, near vegetated shoreline. Because of its preference for a vegetated shoreline it may be present in lakes but this is not confirmed from records. It is not a specialist of fast flowing waters/rapids. The species is only incidentally fished and is the prey of the Nile perch.</p> <p>The species is undescribed and new to science and therefore not evaluated by the IUCN Red List. Based on the haplochromine specialist, the species is only known from the Upper Victoria Nile and currently only from the area of Bujagali (location 2 and 3), making it Restricted Range and qualifying for Criterion 2, Tier 1. There is no evidence to suggest that the species might be migratory or congregatory. Therefore, it does not qualify for Criterion 3.</p>

<b>Species</b>	<i>Haplochromis "cylindrical"</i>
<b>Status (IUCN)</b>	NE
<b>Location-based sub-criterion</b>	Criterion 2a
<b>Critical Habitat tier</b>	Tier 1
<b>Last seen date</b>	2006

<b>(NaFiRRI data)</b>	
<b>Justification</b>	<p>Based on information from the haplochromine specialist, this species is only likely to be found in the Upper Victoria Nile and is considered to be very rare. It is a riverine fish, encountered in areas with a sandy substrate and clear water in slow moving sections of the river. The species is only incidentally fished and is the prey of the Nile perch.</p> <p>The species is undescribed and new to science and therefore not evaluated by the IUCN Red List. Based on information from the haplochromine specialist, the species is only likely to be found in the Upper Victoria Nile River. As the species has only been recorded in the DMU, its EOO is below 20,000km<sup>2</sup> and so the species is a restricted range species, qualifying for Criterion 2, Tier 1. There is no evidence to suggest that the species might be migratory or congregatory. Therefore, it does not qualify for Criterion 3.</p>

<b>Species</b>	<i>Haplochromis</i> sp. cf. "red back scraper"
<b>Status (IUCN)</b>	NE
<b>Location-based sub-criterion</b>	Criterion 2a
<b>Critical Habitat tier</b>	Tier 1
<b>Last seen date (NaFiRRI data)</b>	2017
<b>Justification</b>	<p>Based on information from the haplochromine expert, this species is only known from the Upper Victoria Nile. It resembles fish assemblages from the wider Victoria-Nile-Kyoga system and therefore might also be found in lakes. However, until the species is recorded within a lake, this assessment considers it to be a riverine fish. This species lives on rocky substrate, scrapes algae from underwater stones, it prefers slow moving water. The species is incidentally caught by artisanal fishers and is prey of the Nile perch.</p> <p>The species is undescribed and new to science and therefore not evaluated by the IUCN Red List. As the species is currently only known from the Upper</p>



	Victoria Nile its EOO is under 20,000km <sup>2</sup> and would therefore qualify as Criterion 2. As it is so far only recorded from in the DMU (upstream of Bujagali), it qualifies as Tier 1. There is no evidence to suggest that the species might be migratory or congregatory. Therefore it does not qualify for Criterion 3.
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<b>Species</b>	<i>Lithochromis</i> sp
<b>Status (IUCN)</b>	NE
<b>Location-based sub-criterion</b>	Criterion 2a
<b>Critical Habitat tier</b>	Tier 1
<b>Last seen date (NaFiRRI data)</b>	2015
<b>Justification</b>	<p>Based on information from the haplochromine expert, this species is currently only known from the Upper Victoria Nile. However, there are many undescribed <i>Lithochromis</i> species in Lake Victoria and therefore it is considered highly likely that this species is also lives in lakes. This species lives on a sandy substrate, is caught incidentally and used as bait and is preyed on by the Nile perch.</p> <p>The species is undescribed and new to science and therefore not evaluated by the IUCN Red List. As the species is currently only known from the Upper Victoria Nile its EOO is under 20,000km<sup>2</sup>, it is currently only known from within the DMU (location 2, upstream and location 3, downstream of the dam) and would therefore qualify as Criterion 2 Tier 1. There is no evidence to suggest that the species might be migratory or congregatory. Therefore, it does not qualify for Criterion 3.</p>

<b>Species</b>	<i>Neochromis</i> "lemon britti"
<b>Status (IUCN)</b>	NE

<b>Location-based sub-criterion</b>	Criterion 2a
<b>Critical Habitat tier</b>	Tier 1
<b>Last seen date (NaFiRRI data)</b>	2001
<b>Justification</b>	<p>Likely to be an extinct species as only recorded once in 2001. No information is available on the type of habitat the species was found in.</p> <p>The species is undescribed and new to science and therefore not evaluated by the IUCN Red List. It is only known from a single record from within the DMU. Based on this information it would be a restricted Range fish and qualify for Critical Habitat, Tier 1.</p>

<b>Species</b>	<i>Neochromis "red simotes"</i>
<b>Status (IUCN)</b>	NE
<b>Location-based sub-criterion</b>	Criterion 2a
<b>Critical Habitat tier</b>	Tier 1
<b>Last seen date (NaFiRRI data)</b>	2001
<b>Justification</b>	<p>Based on information from the haplochromine specialist, this species is only likely to be found in the Upper Victoria Nile. It is a riverine fish, encountered on rocky substrates and in rapids and is a specialized algae browser, feeding on rocks within rapids. The species is incidentally caught and is a prey of the Nile perch.</p> <p>The species is undescribed and new to science and therefore not evaluated by the IUCN Red List. Based on information from the haplochromine specialist, the</p>

	species is only likely to be found in the Upper Victoria Nile River. As the species has only been recorded in the DMU, its EOO is below 20,000km <sup>2</sup> and so the species is a restricted range species, qualifying for Criterion 2, Tier 1. There is no evidence to suggest that the species might be migratory or congregatory. Therefore, it does not qualify for Criterion 3.
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<b>Species</b>	<i>Paralabidochromis</i> "yellow"
<b>Status (IUCN)</b>	NE
<b>Location-based sub-criterion</b>	Criterion 2a
<b>Critical Habitat tier</b>	Tier 1
<b>Last seen date (NaFiRRI data)</b>	2006
<b>Justification</b>	<p>Based on information from the haplochromine specialist the species is found in the Upper Victoria Nile and is possibly found in the southern section of the Lake Victoria (the Mwanza Gulf in Tanzania) but this record is not confirmed. This species lives on rocky substrates and is incidental catch and prey of the Nile perch. It is likely that this species is adapted to both river and lake conditions.</p> <p>The species is undescribed and new to science and therefore not evaluated by the IUCN Red List. Based on current information the species is only known from the DMU (the location in Lake Victoria is unconfirmed); it therefore is Restricted Range and qualifies for Criterion 2 Tier 1. There is no evidence to suggest that the species might be migratory or congregatory, it therefore does not qualify for Criterion 3.</p>

<b>Species</b>	<i>Paralabidochromis</i> sp. "red breast new"
<b>Status (IUCN)</b>	NE

<b>Location-based sub-criterion</b>	Criterion 2a
<b>Critical Habitat tier</b>	Tier 1
<b>Last seen date (NaFiRRI data)</b>	2017
<b>Justification</b>	<p>Based on information from the haplochromine specialist, this species is only likely to be found in the Upper Victoria Nile only. It is reported as 'abundant' in one area above Kalagala falls (at the Busowoko monitoring station, location 3) but is only known from this one area. This species lives on rocky substrates in fast flowing waters i.e. it is a rapids specialist. It is fished at an artisanal scale and is prey of the Nile perch.</p> <p>The species is undescribed and new to science and therefore not evaluated by the IUCN Red List. Based on information from the haplochromine specialist, the species is only likely to be found in the Upper Victoria Nile River (and potentially only in 1 location within the Upper Victoria Nile). As the species has only been recorded in the DMU, its EOO is below 20,000km<sup>2</sup> and so the species is a restricted range species, qualifying for Criterion 2, Tier 1. There is no evidence to suggest that the species might be migratory or congregatory. Therefore, it does not qualify for Criterion 3.</p>

<b>Species</b>	<i>Pundamilia</i> sp. "blue lip"
<b>Status (IUCN)</b>	NE
<b>Location-based sub-criterion</b>	Criterion 2a
<b>Critical Habitat tier</b>	Tier 1
<b>Last seen date (NaFiRRI data)</b>	2017

<b>Justification</b>	<p>Based on information from the haplochromine specialist, this species is found in the Upper Victoria Nile, it may occur in Lake Victoria but its presence is not confirmed. This species prefers rocky substrates, is caught incidentally by artisanal fishing and is prey of the Nile perch. There is not enough information to understand if this species is a riverine species or is adaptable to lake conditions.</p> <p>The species is undescribed and new to science. It has not been evaluated yet by the IUCN Red List. Based on information from the haplochromine specialist, the species is found in the Upper Victoria Nile River. It might be present in Lake Victoria but it hasn't been confirmed yet. Since the species has only been recorded and confirmed in the river, its EOO is below 20,000km<sup>2</sup> and so the species is a restricted range species. Therefore, it qualifies for Criterion 2 Tier 1. There is no evidence to suggest that the species might be migratory or congregatory. Therefore, it does not qualify for Criterion 3.</p>
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## Tier 2

<b>Species</b>	<i>Haplochromis aelocephalus</i>
<b>Status (IUCN)</b>	CR
<b>Location-based sub-criterion</b>	Criteria 1c & 2b
<b>Critical Habitat tier</b>	Tier 2
<b>Last seen date (NaFIRRI data)</b>	2010
<b>Justification</b>	<p>This CR species is recorded as rare in the IUCN Red List assessment and possibly extinct due to predation by the Nile perch and hybridization due to decreased transparency. It was recorded in Lake Victoria in Tanzania and Uganda in the early 1980's but has not subsequently been reported (Witte <i>et al.</i> 2010a). It has been recorded by NaFIRRI in the Upper Victoria Nile River in 2007 and 2010 (NaFIRRI data). This species is restricted to areas in the littoral and sub-littoral zone where the substrate is firm (sand, rock). It is classified as an insectivore.</p> <p>The species is listed an endemic species to Lake Victoria (Witte <i>et al.</i> 2010a), recorded in Tanzania and Uganda, it has also been recorded by NaFIRRI in the</p>

	Upper Victoria Nile within the Bujagali DMU. As a CR species known from inside and outside the DMU it would qualify under Criterion 1, Tier 2. The species is only known from 1 location Lake Victoria (and the DMU) and so is considered Restricted Range and would qualify under Criterion 2, Tier 2. There is no evidence to suggest the species is migratory or congregatory, it therefore does not qualify for Criterion 3.
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<b>Species</b>	<i>Haplochromis brownae</i>
<b>Status (IUCN)</b>	CR
<b>Location-based sub-criterion</b>	Criteria 1c & 2b
<b>Critical Habitat tier</b>	Tier 2
<b>Last seen date (NaFIRRI data)</b>	2017
<b>Justification</b>	<p>This CR species is listed as endemic to Lake Victoria in the IUCN Red List assessment. It was recorded in the Ugandan and Tanzanian sections of Lake Victoria but is now possibly extinct in the Lake due to predation by the Nile perch and due to declining water quality resulting in species hybridization (Witte <i>et al.</i> 2010b). It has been recorded by NaFIRRI in the Upper Victoria Nile River within the DMU (locations 1 to 4). The species has been found over sandy substrate in the littoral zone (sandy or shingle beaches which are relatively or completely exposed to wave action). It feeds on small fishes and is classified as an insectivore. This species is fished, although not targeted specifically.</p> <p>The species is listed an endemic species to Lake Victoria, recorded in Tanzania and Uganda (Witte <i>et al.</i> 2010b), it has also been recorded by NaFIRRI in the Upper Victoria Nile within the Bujagali DMU. As a CR species known from inside and outside the DMU it would qualify under Criterion 1, Tier 2. The species is only known from 1 location Lake Victoria (and the DMU) and so is considered Restricted Range and would qualify under Criterion 2, Tier 2. There is no evidence to suggest the species is migratory or congregatory, it therefore does not qualify for Criterion 3.</p>

<b>Species</b>	<i>Haplochromis crassilabris</i>
<b>Status (IUCN)</b>	CR
<b>Location-based sub-criterion</b>	Criteria 1c & 2b
<b>Critical Habitat tier</b>	Tier 2
<b>Last seen date (NaFIRRI data)</b>	2015
<b>Justification</b>	<p>This CR species is listed as endemic to Lake Victoria in the IUCN Red List assessment. It was recorded in the Ugandan and Tanzanian sections of Lake Victoria but is now possibly extinct in the Lake due to predation by the Nile perch and due to declining water quality resulting in species hybridization (Witte <i>et al.</i> 2010c). It has been recorded by NaFIRRI in the Upper Victoria Nile River within the DMU (location 2). The species has been found over sandy substrate in the littoral zone. It feeds on small fishes and is classified as an insectivore. This species is fished, although not targeted specifically.</p> <p>The species is listed an endemic species to Lake Victoria, recorded in Tanzania and Uganda (Witte <i>et al.</i> 2010c), it has also been recorded by NaFIRRI in the Upper Victoria Nile within the Bujagali DMU. As a CR species known from inside and outside the DMU it would qualify under Criterion 1, Tier 2. The species is only known from 1 location Lake Victoria (and the DMU) and so is considered Restricted Range and would qualify under Criterion 2, Tier 2. There is no evidence to suggest the species is migratory or congregatory, it therefore does not qualify for Criterion 3.</p>

<b>Species</b>	<i>Haplochromis guiarti</i>
<b>Status (IUCN)</b>	CR
<b>Location-based sub-criterion</b>	Criterion 1c



<b>Critical Habitat tier</b>	Tier 2
<b>Last seen date (NaFiRRI data)</b>	2017
<b>Justification</b>	<p>This CR species is listed as endemic to Lake Victoria in the IUCN Red List assessment. It was recorded in the Ugandan, Tanzanian and Kenyan sections of Lake Victoria but is now possibly extinct in the Lake due to predation by the Nile perch and due to declining water quality resulting in species hybridization (Witte &amp; de Zeeuw 2010a). It has been recorded by NaFiRRI in the Upper Victoria Nile River within the DMU (locations 2, 3 and 4) and in Lake Victoria close to the river (location 1) on several occasions.</p> <p>This species is restricted to areas in the littoral zone where the substrate is firm (sand, rock). It is classified as a piscivore (<i>sensu stricto</i>). It is captured as bait for long line fisheries.</p> <p>The species is listed an endemic species to Lake Victoria, recorded in Tanzania, Uganda and Kenya (Witte &amp; de Zeeuw 2010a), it has also been recorded by NaFiRRI in the Upper Victoria Nile within the Bujagali DMU. As a CR species known from inside and outside the DMU it would qualify under Criterion 1, Tier 2. As the species has been recorded in 3 different sections of the lake (Tanzania, Uganda and Kenya) it would not qualify as Restricted Range. There is also no evidence to suggest the species is migratory or congregatory, it therefore does not qualify for Criterion 3.</p>

<b>Species</b>	<i>Haplochromis microdon</i>
<b>Status (IUCN)</b>	CR
<b>Location-based sub-criterion</b>	Criterion 1c
<b>Critical Habitat tier</b>	Tier 2
<b>Last seen date (NaFiRRI data)</b>	2009

<b>Justification</b>	<p>This CR species is listed as endemic to Lake Victoria in the IUCN Red List assessment. It was recorded in the Ugandan and Tanzanian sections of Lake Victoria but is now possibly extinct in the Lake due to predation by the Nile perch and due to declining water quality resulting in species hybridization (Witte <i>et al.</i> 2010d). It has been recorded by NaFIRRI in the Upper Victoria Nile River within the DMU (location 2, prior to construction only). The species has been found over sand and mud in the littoral and sub-littoral zone. The species is a peadophage (piscivores sensu lato). This species is fished, although not targeted specifically.</p> <p>This CR species is known from the Lake Victoria (Witte <i>et al.</i> 2010d) and NaFIRRI has recorded specimens within the Upper Victoria Nile river (location 2) before dam construction. Because CR, it qualifies for Criterion 1, Tier 2 as the species is also found outside the DMU, i.e. in Lake Victoria. As the species is known from several locations of Lake Victoria, its EOO is considered to be higher than 20,000km<sup>2</sup> and therefore is not Restricted Range. There is no evidence to suggest that the species might be congregatory or migratory. Therefore, it does not qualify for Criterion 3.</p>
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<b>Species</b>	<i>Haplochromis parvidens</i>
<b>Status (IUCN)</b>	CR
<b>Location-based sub-criterion</b>	Criterion 1c
<b>Critical Habitat tier</b>	Tier 2
<b>Last seen date (NaFiRRI data)</b>	2017
<b>Justification</b>	<p>This CR species is listed as endemic to Lake Victoria in the IUCN Red List assessment. It was recorded in the Ugandan, Tanzanian and Kenyan sections of Lake Victoria but is now possibly extinct in the Lake due to predation by the Nile perch and due to declining water quality resulting in species hybridization (Witte <i>et al.</i> 2010e). It has been recorded by NaFIRRI in the Upper Victoria Nile River within the DMU (locations 2 and 3, before construction only). The species has been found over sand and mud in the littoral and sub-littoral zone as it is</p>

	<p>known to live in lake conditions it is not a river specialist. The species is a peadophage (piscivores sensu lato) and it also feeds on cichlid embryos or larvae. This species is fished, although not targeted specifically.</p> <p>This CR species is known from the Lake Victoria (Witte <i>et al.</i> 2010e) and NaFIRRI has recorded specimens within the Upper Victoria Nile river (locations 2 and 3) before dam construction. Because CR, it qualifies for Criterion 1. It is classified as Tier 2 as the species is also known from outside the DMU, i.e. in Lake Victoria. As the species was recorded in several locations in Lake Victoria, its EOO is considered to be higher than 20,000km<sup>2</sup> and therefore is not Restricted Range and does not qualify for Criterion 2. There is no evidence to suggest that the species might be congregatory or migratory. Therefore, it does not qualify for Criterion 3.</p>
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<b>Species</b>	<i>Labeo victorianus</i>
<b>Status (IUCN)</b>	CR
<b>Location-based sub-criterion</b>	Criterion 1d
<b>Critical Habitat tier</b>	Tier 2
<b>Last seen date (NaFiRRI data)</b>	2010
<b>Justification</b>	<p>This CR species is listed as endemic to the Lake Victoria basin in the IUCN Red List assessment (FishBase team RMCA &amp; Geelhand 2017), this includes records in multiple rivers and lakes in Uganda, Tanzania, Rwanda and Burundi. It is a potamodromous species and spends most of its life span in lakes (Eccles 1992), ascending both large rivers and streams in fairly compact shoals (Whitehead 1959) during the rainy season (Fryer and Whitehead 1959) to spawn. Spawning grounds are flooded grasslands beside both permanent and temporary streams (Eccles 1992). Submerged rocky cliffs and shelves near the river mouths are favoured by non-reproducing fish prior to migrating upstream to spawn (Rutaisire and Booth 2005). However, Oweke Ojwang et al. (2007) indicate that upstream migrations are virtually gone and reports that this once-migratory species is now possibly a sedentary riverine resident. Permanent river populations indeed exist (Whitehead 1959, Oweke Ojwang et al. 2007). In Lake</p>

	<p>Victoria this Labeo occurs in shallow, inshore waters and influent rivers (Witte and Winter 1995) and in Lake Kyoga it lives in open waters away from water-lily zones (Greenwood 1966). Labeo victorianus is a specialized feeder on epilithic and epiphytic algae (Corbet 1961), but mud, plant debris (Greenwood 1966) and rotifers growing on the bodies of other fishes are also taken (Fryer et al. 1955).</p> <p>Intensive and unregulated gill-netting of gravid fishes across rivers or river mouths during the seasonal spawning migration is a threat.</p> <p>In the 1950s Ningu was one of the most abundant fish landed in the Lake Victoria basin. A flourishing, seasonal fishery based on this species existed in the mouths of several affluent rivers. Fish with ripe eggs were regarded as a delicacy.</p> <p>This CR species is known from multiple locations in the Lake Victoria basin in lakes and rivers (FishBase team RMCA &amp; Geelhand 2017). NaFIRRI has recorded specimens within the Upper Victoria Nile river (locations 3, 4 and 5) before dam construction. Because CR, it qualifies for Criterion 1. It is classified as Tier 2 as the species is also found in many locations outside the DMU (i.e. in Lake Victoria and other lakes and rivers). As the species was recorded in several locations in Lake Victoria and other lakes and rivers, its EOO is considered to be higher than 20,000km<sup>2</sup> and therefore is not Restricted Range and does not qualify for Criterion 2. The species is reported as 'once-migratory' and now possibly a sedentary species (FishBase team RMCA &amp; Geelhand 2017), it therefore would not qualify for Criterion 3.</p>
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<b>Species</b>	<i>Xystichromis</i> sp. nov. 'Kyoga flameback'
<b>Status (IUCN)</b>	CR
<b>Location-based sub-criterion</b>	Criteria 1c & 2b
<b>Critical Habitat tier</b>	Tier 2
<b>Last seen date (NaFiRRI data)</b>	2017

<b>Justification</b>	<p>This CR species is currently only known from the Lake Nawampasa, a small lake of Kyoga river system (Kaufman 1996). The recordings in the Upper Victoria Nile River (NaFIRRI data), are an extension to its known range and habitat preference.</p> <p>This CR species is known from both within the DMU and outside (from Lake Nawampasa, a small lake of Kyoga river system (Kaufman 1996)). It qualifies for Criterion 1, Tier 2. The species also qualifies for Criterion 2 as it is currently only known from the Upper Victoria Nile and parts since the species is probably only found in Kyoga lake and its river system, which represents an area of c. 1,720km<sup>2</sup>. This is below the threshold of restricted range freshwater species (20,000km<sup>2</sup>). There is no information that suggests that the species might be migratory or congregatory. For this reason, it does not qualify for Criterion 3.</p>
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<b>Species</b>	<i>Astatotilapia "flameback"</i>
<b>Status (IUCN)</b>	NE
<b>Location-based sub-criterion</b>	Criterion 2b
<b>Critical Habitat tier</b>	Tier 2
<b>Last seen date (NaFIRRI data)</b>	2012
<b>Justification</b>	<p>Based on information from the haplochromine specialist, this species is only likely to be found in the Upper Victoria Nile as it's a riverine fish, encountered on a muddy substrate, near vegetated shoreline. Records of the species are from both inside and outside of the projects DMU. Whilst this species is a riverine species it does not require habitat in rapids. The species is fished at an artisanal scale and is the prey of the Nile perch.</p> <p>The species is undescribed and new to science and therefore not evaluated by the IUCN Red List. Based on information from the haplochromine specialist, the species is only likely to be found in the Upper Victoria Nile River. The species has been recorded inside and outside the DMU. Its EOO is below 20,000km<sup>2</sup> and so the species is a restricted range species, qualifying for Criterion 2, Tier 2.</p>

	There is no evidence to suggest that the species might be migratory or congregatory. Therefore, it does not qualify for Criterion 3.
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<b>Species</b>	<i>Astatotilapia "blue"</i>
<b>Status (IUCN)</b>	NE
<b>Location-based sub-criterion</b>	Criterion 2b
<b>Critical Habitat tier</b>	Tier 2
<b>Last seen date (NaFiRRI data)</b>	2007
<b>Justification</b>	<p>Based on information from the haplochromine specialist, this species is only likely to be found in the Upper Victoria Nile as it's a riverine fish, encountered on a muddy substrate, near vegetated shoreline (it is not a rapids specialist). Although only recorded in location 3, the haplochromine specialist considers it is likely to be more widespread in the river as are other <i>Astatotilapia</i> species. The species is only caught incidentally as by catch from artisanal fishing and is the prey of the Nile perch.</p> <p>The species is undescribed and new to science and therefore not evaluated by the IUCN Red List. Based on information from the haplochromine specialist, the species is only likely to be found in the Upper Victoria Nile River but is likely to be found inside and outside the DMU. It would qualify for Criterion 2, Tier 2. There is no evidence to suggest that the species might be migratory or congregatory. Therefore it does not qualify for Criterion 3.</p>

<b>Species</b>	<i>Astatotilapia "elongate"</i>
<b>Status (IUCN)</b>	NE

<b>Location-based sub-criterion</b>	Criterion 2b
<b>Critical Habitat tier</b>	Tier 2
<b>Last seen date (NaFiRRI data)</b>	2012
<b>Justification</b>	<p>Based on information from the haplochromine specialist, this species is found in both the Upper Victoria Nile river and Lake Victoria (so far recorded at 1 location in Lake Victoria), and therefore would not be considered a river specialist. It prefers muddy and/or rocky substrates, is fished at an artisanal scale and is prey of the Nile perch.</p> <p>The species is undescribed and new to science and therefore not evaluated by the IUCN Red List. Based on information from the haplochromine specialist, the species is known from the Upper Victoria Nile River and one location in Lake Victoria (but potentially present in other areas), making it a potentially Restricted Range species. It qualifies for Criterion 2, Tier 2 as it is known from inside and outside the DMU. There is no evidence to suggest that the species might be migratory or congregatory. Therefore it does not qualify for Criterion 3.</p>

<b>Species</b>	<i>Haplochromis</i> "silver arrow"
<b>Status (IUCN)</b>	NE
<b>Location-based sub-criterion</b>	Criterion 2b
<b>Critical Habitat tier</b>	Tier 2
<b>Last seen date (NaFiRRI data)</b>	2001

<b>Justification</b>	<p>Based on information from the haplochromine specialist, this species is currently only known from the Upper Victoria Nile. It is a riverine fish preferring slow flowing waters on sandy substrates. It is known from outside and inside the DMU area (location 4 and 5). It is rarely observed.</p> <p>The species is undescribed and new to science and therefore not evaluated by the IUCN Red List.</p>
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<b>Species</b>	<i>Haplochromis niloticus</i>
<b>Status (IUCN)</b>	DD
<b>Location-based sub-criterion</b>	Criterion 2b
<b>Critical Habitat tier</b>	Tier 2
<b>Last seen date (NaFiRRI data)</b>	2001
<b>Justification</b>	<p>Based on IUCN Red List assessment, this species is DD and endemic to Lake Victoria, where it has been recorded in surveys carried out in Uganda (Greenwood 1981) and would therefore be classed as a lake species (Witte &amp; de Zeeuw 2010b). However, the Ugandan haplochromine specialist indicates that this species prefers a riverine habitat i.e. moving water, and a sandy substrate and is only found in the Upper Victoria Nile River (where it is recorded in 2006, 2007 and 2008 in locations 4 and 5) and it is not found in Lake Victoria. The species is predated by the Nile perch but is not a target of fisheries as it is very rare. We have based the Critical Habitat assessment on the information provided by the national haplochromine expert.</p> <p>Based on information from the haplochromine specialist, the species is only found in the Upper Victoria Nile River. As the species is known from 2 locations (1 inside the DMU and 1 in Lake Victoria), its EOO will be below 20,000km<sup>2</sup> and the species is Restricted Range qualifying for Criterion 2 Tier 2. There is no evidence to suggest that the species might be congregatory or migratory. Therefore, it does not qualify for Criterion 3.</p>



<b>Species</b>	<i>Haplochromis orthostoma</i>
<b>Status (IUCN)</b>	VU
<b>Location-based sub-criterion</b>	Criterion 2b
<b>Critical Habitat tier</b>	Tier 2
<b>Last seen date (NaFIRRI data)</b>	2001
<b>Justification</b>	<p>This mouth brooder species is only known from Lake Nawampasa and Lake Kyoga, based on IUCN Red List Assessment (lakes downstream of the DMU) (Kaufman 2016). However, NaFIRRI has also recorded the species in the Upper Victoria Nile river, downstream of Kalagala falls (Locations 4 and 5). Not much is known about the species ecology and habitat use but based on locations found would be a lake and riverine species. The species may spawn on rocks (<a href="http://www.borstein.info/profiles/victoria/pyxiort.html">http://www.borstein.info/profiles/victoria/pyxiort.html</a>).</p> <p>As a VU species, it does not qualify for Criterion 1. This species is only known from the Lake Kyoga and a satellite lake of Kyoga (Nawampasa), the EOO is therefore under the 20,000km<sup>2</sup> and the species is Restricted Range, qualifying as Tier 2. There is no evidence to suggest that the species might be congregatory or migratory. Therefore, it does not qualify for Criterion 3.</p>

<b>Species</b>	<i>Haplochromis simotes</i>
<b>Status (IUCN)</b>	DD
<b>Location-based sub-criterion</b>	Criterion 2b

<b>Critical Habitat tier</b>	Tier 2
<b>Last seen date (NaFIRRI data)</b>	2017
<b>Justification</b>	<p>This DD species inhabits only rocky habitats within sections of rapids in the middle sections of the Upper Victoria Nile. It is a specialised algal grazer, requiring sediment-free rocks to feed on the algae. It is only known from the Rippon falls and Kakindu on the Upper Victoria Nile River (Witte &amp; de Zeeuw 2016) and is reported as 'rare'. NaFIRRI records confirm its limited distribution (recorded only in locations 4 and 5) and the haplochromine specialist confirms that it is unlikely that the species range extends beyond this ~20 km stretch of river; results of recent surveys suggest the species may be close to extinction.</p> <p>The species has only been recorded in the Upper Victoria Nile River (locations 4 and 5) and at the mouth of Lake Victoria and the Upper Victoria Nile at Rippon Falls, (location 1). The EOO for this species is therefore likely to be under 20,000 km<sup>2</sup> and therefore the species is restricted range. It qualifies as Tier 2 as it has been recorded both inside and outside of the DMU for the project. There is no evidence to suggest the species is migratory or congregatory and therefore would not qualify for Criterion 3.</p> <p>(Note: Even if more information was collected on this species and it was re-classified as CR, as the species is known from both inside and outside the projects DMU it would qualify under Criterion 1, Tier 2 as it is known from outside the DMU).</p>

<b>Species</b>	<i>Haplochromis</i> sp. "flameback"
<b>Status (IUCN)</b>	NE
<b>Location-based sub-criterion</b>	Criterion 2b
<b>Critical Habitat tier</b>	Tier 2
<b>Last seen date</b>	2017

<b>(NaFiRRI data)</b>	
<b>Justification</b>	<p>Based on information from the haplochromine expert, this species is found in the Upper Victoria Nile and in Lake Kyoga, it isn't dependent on riverine habitat. NaFiRRI have recorded the species as locations 2, 3, 4 and 5 after the dam was constructed. It has never been recorded in Lake Victoria. The species is associated with muddy and sandy substrates. It fished at artisanal scale and is a prey of the Nile perch.</p> <p>The species is undescribed and new to science and therefore not evaluated by the IUCN Red List. As the species is known only from the Upper Victoria Nile River and in Lake Kyoga its EOO is below 20,000km<sup>2</sup> and therefore qualifies as Criterion 2, Tier 2. There is no evidence to suggest that the species might be migratory or congregatory. Therefore it does not qualify for Criterion 3.</p>

<b>Species</b>	<i>Haplochromis</i> sp. "thick skin like"
<b>Status (IUCN)</b>	NE
<b>Location-based sub-criterion</b>	Criterion 2b
<b>Critical Habitat tier</b>	Tier 2
<b>Last seen date (NaFiRRI data)</b>	2017
<b>Justification</b>	<p>Based on information from the haplochromine expert, this species is found in the Upper Victoria Nile and from 1 location in Lake Victoria and is therefore adaptable to lake and riverine conditions. This species lives on sandy and rocky substrates, is caught incidentally is predated by the Nile perch.</p> <p>The species is undescribed and new to science and therefore not evaluated by the IUCN Red List. Based on current information the species is only known from the DMU and one location in Lake Victoria, it therefore is considered Restricted Range and qualifies for Criterion 2 Tier 2. There is no evidence to suggest that the species might be migratory or congregatory, it therefore does not qualify for Criterion 3.</p>

<b>Species</b>	<i>Mbipia</i> "blue"
<b>Status (IUCN)</b>	NE
<b>Location-based sub-criterion</b>	Criterion 2b
<b>Critical Habitat tier</b>	Tier 2
<b>Last seen date (NaFiRRI data)</b>	2012
<b>Justification</b>	<p>Based on information from the haplochromine expert, this species is known from the Upper Victoria Nile and in two locations in the Lake Victoria (it may have a wider distribution but this is unconfirmed) and is therefore not a riverine specialist. This species lives on rocky substrate and is fished at an artisanal scale and used as bait, it is the prey of the Nile perch.</p> <p>The species is undescribed and new to science and therefore not evaluated by the IUCN Red List. As it is currently only known from the Upper Victoria Nile and two locations in Lake Victoria it is considered to be Restricted Range and qualifies as Criterion 2, Tier 2. There is no evidence to suggest that the species might be migratory or congregatory, it therefore it does not qualify for Criterion 3.</p>

<b>Species</b>	<i>Neochromis</i> "elongate"
<b>Status (IUCN)</b>	NE
<b>Location-based sub-criterion</b>	Criterion 2b
<b>Critical Habitat tier</b>	Tier 2

<b>Last seen date (NaFiRRI data)</b>	2012
<b>Justification</b>	<p>Based on the fish expert, the species has been recorded in the Upper Victoria Nile and at 1 location of Lake Victoria (but it might be present elsewhere) and is therefore adaptable to lake and riverine conditions. This species lives on rocky substrates, is fished at an artisanal scale and is prey of the Nile perch.</p> <p>The species is undescribed and new to science and therefore not evaluated by the IUCN Red List. Based on current information the species is only known from the DMU and one location in lake Victoria, it therefore is considered Restricted Range and qualifies for Criterion 2 Tier 2. There is no evidence to suggest that the species might be migratory or congregatory, it therefore does not qualify for Criterion 3.</p>

<b>Species</b>	<i>Neochromis "yellow rufocaudalis"</i>
<b>Status (IUCN)</b>	NE
<b>Location-based sub-criterion</b>	Criterion 2b
<b>Critical Habitat tier</b>	Tier 2
<b>Last seen date (NaFiRRI data)</b>	2001
<b>Justification</b>	<p>Based on information from the haplochromine specialist, this species is currently only known from the Upper Victoria Nile. It prefers slow flowing waters on rocky substrates. It has been recorded in the DMU (location 4) and outside the DMU (location 5)</p> <p>The species is undescribed and new to science and therefore isn't evaluated by the IUCN Red List. Based on information from the haplochromine specialist, the species is currently only known from the Upper Victoria Nile River in slow waters. It qualifies for Criterion 2, Tier 2 (as it's known from inside and outside the DMU). There is no evidence to suggest that the species might be migratory or congregatory. Therefore it does not qualify for Criterion 3.</p>

<b>Species</b>	<i>Neochromis</i> sp. "Labeo new"
<b>Status (IUCN)</b>	NE
<b>Location-based sub-criterion</b>	Criterion 2b
<b>Critical Habitat tier</b>	Tier 2
<b>Last seen date (NaFiRRI data)</b>	2017
<b>Justification</b>	<p>Based on information from the haplochromine specialist, this species is only likely to be found in the Upper Victoria Nile (it was previously called <i>Neochromis</i> thick lips). This species lives on rocky substrates and in fast flowing waters. It is caught incidentally and is prey of the Nile perch.</p> <p>The species is undescribed and new to science and therefore not evaluated by the IUCN Red List. Based on information from the haplochromine specialist, the species is only likely to be found in the Upper Victoria Nile River. As it's only likely to be found on the Upper Victoria Nile it has a Restricted Range and would qualify for Criterion 2, Tier 2 (as it's known from inside and outside the DMU). There is no evidence to suggest that the species might be migratory or congregatory. Therefore it does not qualify for Criterion 3.</p>

<b>Species</b>	<i>Paralabidochromis</i> "scarlet anal"
<b>Status (IUCN)</b>	NE
<b>Location-based sub-criterion</b>	Criterion 2b
<b>Critical Habitat tier</b>	Tier 2

<b>Last seen date (NaFiRRI data)</b>	2011
<b>Justification</b>	<p>Based on information from the haplochromine specialist, the species has been recorded in the Upper Victoria Nile and at 1 location of Lake Victoria (but it might be present elsewhere) and is therefore considered to be adaptable to lake and riverine conditions. This species lives on rocky substrates, is fished at an artisanal scale and is prey of the Nile perch.</p> <p>The species is undescribed and new to science and therefore not evaluated by the IUCN Red List. Based on current information the species is known from the DMU and one location in lake Victoria, it would therefore be Restricted Range and qualify for Criterion 2 Tier 2. There is no evidence to suggest that the species might be migratory or congregatory, it therefore does not qualify for Criterion 3.</p>

<b>Species</b>	<i>Paralabidochromis</i> sp 1
<b>Status (IUCN)</b>	NE
<b>Location-based sub-criterion</b>	Criterion 2b
<b>Critical Habitat tier</b>	Tier 2
<b>Last seen date (NaFiRRI data)</b>	2017
<b>Justification</b>	<p>Based on information from the haplochromine specialist, the species has been recorded at the mouth of Lake Victoria, at the source of the Upper Victoria Nile. As it has not been recorded more widely in the lake it is likely to be a riverine species, preferring moving water conditions. This species lives on rocky substrates, is fished at an artisanal scale and is prey of the Nile perch.</p> <p>The species is undescribed and new to science and therefore not evaluated by the IUCN Red List. Based on current information the species is known from the DMU and the mouth of Lake Victoria making it a Restricted Range species and qualifying for Criterion 2 Tier 2. There is no evidence to suggest that the</p>

	species might be migratory or congregatory, it therefore does not qualify for Criterion 3.
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<b>Species</b>	<i>Paralabidochromis</i> sp "Nile"
<b>Status (IUCN)</b>	NE
<b>Location-based sub-criterion</b>	Criterion 2b
<b>Critical Habitat tier</b>	Tier 2
<b>Last seen date (NaFiRRI data)</b>	2017
<b>Justification</b>	<p>Based on information from the haplochromine specialist, the species has been recorded at the mouth of Lake Victoria, at the source of the Upper Victoria Nile. It has not yet been recorded more widely in Lake Victoria and therefore it is unclear if it is a river specialist or adaptable to lake conditions. This species lives on rocky substrates, is fished at an artisanal scale and is prey of the Nile perch.</p> <p>The species is undescribed and new to science and therefore not evaluated by the IUCN Red List. Based on current information the species is known from the DMU and the mouth of Lake Victoria making it a Restricted Range species and qualifying for Criterion 2 Tier 2. There is no evidence to suggest that the species might be migratory or congregatory, it therefore does not qualify for Criterion 3.</p>

<b>Species</b>	<i>Pundamilia</i> "scarlet anal"
<b>Status (IUCN)</b>	NE
<b>Location-based sub-</b>	Criterion 2b



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<b>Critical Habitat tier</b>	Tier 2
<b>Last seen date (NaFiRRI data)</b>	2006
<b>Justification</b>	<p>Based on information from the haplochromine specialist, this species is only likely to be found in the Upper Victoria Nile and is known from area inside and outside the DMU. It is a riverine species preferring fast flowing waters over rocky substrates. It is prey of the Nile perch.</p> <p>The species is undescribed and new to science and therefore not evaluated by the IUCN Red List. Based on information from the haplochromine specialist, the species is only likely to be found in the Upper Victoria Nile River. The species is therefore Restricted Range, qualifying for Criterion 2, Tier 2 (as it's known from inside and outside the DMU). There is no evidence to suggest that the species might be migratory or congregatory. Therefore it does not qualify for Criterion 3.</p>

<b>Species</b>	<i>Xystichromis</i> "earthquake"
<b>Status (IUCN)</b>	NE
<b>Location-based sub-criterion</b>	Criterion 2b
<b>Critical Habitat tier</b>	Tier 2
<b>Last seen date (NaFiRRI data)</b>	2011
<b>Justification</b>	<p>Based on information from the haplochromine specialist this species is found in the Upper Victoria Nile and in Lake Kyoga. This species lives on sandy and muddy substrates, it is incidental by catch and is prey of the Nile perch.</p> <p>The species is undescribed and new to science and therefore not evaluated by</p>

	the IUCN Red List. Based on current information it is known from Lake Kyoga and the Upper Victoria Nile within the DMU. It would therefore qualify as Restricted Range Under Criterion 2, Tier 2. There is no evidence to suggest that the species might be migratory or congregatory, it therefore does not qualify for Criterion 3.
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## Other fishes

### Tier 2

<b>Species</b>	<i>Oreochromis variabilis</i>
<b>Status (IUCN)</b>	CR
<b>Location-based sub-criterion</b>	Criteria 1d
<b>Critical Habitat tier</b>	Tier 2
<b>Last seen date (NaFiRRI data)</b>	2017
<b>Justification</b>	<p>This CR species is listed as endemic to the Lake Victoria drainage and has been recorded at a number of sites in the lake and in satellite lakes (Twongo <i>et al.</i> 2006), however recent surveys in Lake Victoria have not recorded the species and its population is considered to be highly fragmented. It is most abundant on exposed and sandy shores where there is considerable water movement. It also occurs in the calm waters of water lily swamps (Lowe McConnell 1956). Found at a depth range of 0–40 m but most commonly in water less than 10 m deep (Witte and de Winter, 1995). The young fish feed on planktonic algae and may ingest small copepods. The adults feed predominantly on bottom algae but they also feed directly on plankton (Trewavas, 1983) and may graze algae from rocks and aquatic plants (Witte and de Winter 1995). It spawns on firm or sand habitats and breeding males may occasionally be seen guarding their circular nests in water a few feet deep at the edge of the lake. The main threats to the species are from over-fishing, particularly using illegal methods and gear, competition for habitats and food with exotic species (introduced Nile tilapia), and predation by the introduced Nile perch.</p>

	<p>This CR species is known from the Lake Victoria drainage (Twongo <i>et al.</i> 2006). It qualifies for Criterion 1 and Tier 2 as it's a CR species found inside and outside the DMU in multiple locations (although fragmented). The species does not qualify for Criterion 2 since it is found in multiple locations in Lake Victoria, Lake Kyoga and satellite lakes and therefore would have an EOO is greater than 20,000km<sup>2</sup>. There is no information to suggest that the species is migratory or congregatory and it therefore does not qualify for Criterion 3.</p>
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<b>Species</b>	<i>Brycinus jacksonii</i>
<b>Status (IUCN)</b>	LC
<b>Location-based sub-criterion</b>	Criterion 3b
<b>Critical Habitat tier</b>	Tier 2
<b>Last seen date (NaFiRRI data)</b>	2006
<b>Justification</b>	<p>The species is known from Lake Victoria drainage basin. In Lake Victoria it is confined to shallow coastal areas (Greenwood 1959, Van Oijen 1995), in water less than 20 m deep (Corbet 1961, Van Oijen 1995). It is found in inshore areas of the lake and quiet parts of rivers. It is known to run up rivers and streams into Lake Victoria during the rainy season (Greenwood 1966).</p> <p>Possible threats include increased water turbidity and siltation, as a consequence of erosion and farming extension on the watersheds and floodplains, eutrophication, loss of riverine migratory routes, fishing pressure and illegal fishing practices. The fish is caught by artisanal fisheries (FishBase team RMCA &amp; Geelhand 2016).</p> <p>This species is LC and does not qualify for Criterion 1. As the species is known from many rivers and lakes within the Lake Victoria drainage (184,000 km<sup>2</sup>), the species distribution range is higher than the threshold of restricted-range freshwater species (20,000km<sup>2</sup>) and it does not qualify for Criterion 2. The species is known to be a migrant species, running up the rivers and streams during the rainy seasons. The Upper Victoria Nile River is an important outflow</p>

	of Lake Victoria, the Upper Victoria Nile is considered to sustain between 1 and 95% of the global population of a migratory species. Therefore, the species qualify for Criterion 3, Tier 2.
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## Gastropods and Bivalves

### Tier 2

<b>Species</b>	<i>Ceratophallus concavus</i>
<b>Status (IUCN)</b>	CR
<b>Location-based sub-criterion</b>	Criteria 1c & 2b
<b>Critical Habitat tier</b>	Tier 2
<b>Last date seen</b>	Not surveyed
<b>Justification</b>	<p>This species has only been recorded from 2 sites - the Upper Victoria Nile near Bujagali (Uganda) and from Hippo Bay, Entebbe (Uganda). Both records date from 1954 (Mandahl-Barth) and the subpopulation at Bujagali may now be extinct (Van Damme &amp; Lange 2017).</p> <p>This CR species was recorded inside the DMU and outside the DMU but only in one location in Lake Victoria - Hippo Bay (Entebbe), both records are only from 1954. The species has not been recorded by NaFIRRI but monitoring may not have included suitable habitats for this species (NaFIRRI pers. comm.). Its presence is therefore still possible. It qualifies for CH under Criterion 1, Tier 2 as it's known from both the DMU and outside the DMU. The EOO for the species is assumed to be under 20,000 km<sup>2</sup> and is therefore Restricted Range and qualifies for Criterion 2, Tier 2. There is no information about a migratory or congregatory behavior, but it is unlikely for a gastropod. It therefore does not qualify for Criterion 3.</p>

<b>Species</b>	<i>Sphaerium regularis</i>
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<b>Status (IUCN)</b>	EN
<b>Location-based sub-criterion</b>	Criterion 2b
<b>Critical Habitat tier</b>	Tier 2
<b>Last date seen</b>	Not surveyed
<b>Justification</b>	<p>This species is reported as endemic to the northern part of Lake Victoria; it has been recorded from Entebbe, the Upper Victoria Nile at Jinja, Bujagali, Mengo Bay, Bugaia Island and Buvuma Island, all in Uganda. It might also occur in Kenyan and Tanzanian waters but there are no records at present. The species has been recorded by NaFIRRI in locations 2 and 3 (not as part of Bujagali monitoring). This species lives on muddy sediments in Lake Victoria (D. Van Damme pers. comm. 2016). There is no use or trade information for this species. Sedimentation is a potential threat (Seddon <i>et al.</i> 2017).</p> <p>The species does not qualify for Criterion 1 as the Lake Victoria represents the regionally important population for this EN species, rather than the Upper Victoria Nile river. As the species has an EOO of less than 20,000 km<sup>2</sup>, it is Restricted Range and qualifies under 2b (habitat sustaining 1-95% of a Restricted Range species). There is no information about a migratory or congregatory behavior, but it is unlikely for a bivalve and therefore it does not qualify for Criterion 3.</p>