EAST AFRICAN COMMUNITY
LAKE VICTORIA FISHERIES ORGANIZATION

NILE PERCH FISHERIES MANAGEMENT PLAN III
for
LAKE VICTORIA
2021 - 2025

July 2021

german cooperation
DEUTSCHE ZUSAMMENARBEIT

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Copyright © Lake Victoria Fisheries Organization

The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of the Lake Victoria Fisheries Organization, concerning the legal or development status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

This publication may be reproduced in whole or in part and in any form for educational or non- profit purposes without special permission from the copyright holder, provided acknowledgement of the source is made. No use of this publication may be made for resale or for any other commercial purpose whatsoever without the prior permission in writing from the Executive Secretary, Lake Victoria Fisheries Organization. Any enquiries can also be addressed to:

Executive Secretary

Lake Victoria Fisheries Organization (LVFO)

P.O. Box 1625, Jinja, **Uganda**

Tel.: +256-434-125000

Email: lvfo-sec@lvfo.org

URL: www.lvfo.org

Citation

For bibliographic purposes this document should be cited as:

LVFO. 2021. The Nile Perch Fisheries Management Plan-III. Lake Victoria Organization, Jinja Uganda. 45 Pp.

ACKNOWLEDGEMENTS

The Lake Victoria Fisheries Organization (LVFO) Secretariat would like to thank all the technical experts from the Partner States who participated in the development process of this Nile Perch Fisheries Management Plan-III which were spearheaded by a consultant. We appreciate the comments provided by Partner States when the draft was circulated and during the validation meetings.

LVFO would like to extend its sincere gratitude and appreciation for the financial support given by Germany Federal Ministry for Economic Cooperation and Development (BMZ) through Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) under the Responsible Fisheries Business Chains Project (RFBCP) to develop this Plan.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS 3
LIST OF FIGURES 6
LIST OF TABLES 7
TERMS, ABBREVIATIONS AND DEFINITIONS 8
1 INTRODUCTION 10
1.1 Preparation of the Management Plan 10
1.2 Guiding Principles Adopted 10
2 THE MANAGEMENT PLAN 11
2.1 The Fishery 11
2.2 Situation Analysis 11
2.2.1 Environmental Context (including status and trends) 11
2.2.2 Fishery characteristics 11
2.2.3 Fishery status and trends 11
2.2.4 Fishing Effort 12
2.2.5 Trends in illegal gear use 12
2.2.6 Catchability 12
2.2.7 Stock abundance/biomass 14
2.2.8 Previous Stock Assessments 15
2.2.9 Ecology including impacts of the fishery on the environment 15
2.2.10 Mushrooming of cage culture and status of environment 16
2.2.11 By-catch 16
2.2.12 Socio-economic factors 16
2.2.13 Post-harvest sector 17
2.2.14 Management arrangements 18
2.2.15 Previous management plans 18
2.2.16 Existing Management Measures (Current Legislation) 18
2.2.17 Monitoring Control and Surveillance (MCS) 18
2.2.18 Key issues (problems) to be addressed by this plan 19
2.2.19 Recommendations from the MSC Pre-Assessment (2008) 21
2.3 Purpose, Goals and Objectives 21
2.3.1 Purpose 21
2.3.2 Goals 21
2.3.3 Objectives 21
2.4 Indicators and Reference Points (management standards) 23
2.5 The Management Strategy 23

2.5.1 Existing management measures 23
2.5.2 New management measures proposed under this plan 23
2.6 Decision Control Rules 24
2.7 Summary of the core elements of the Plan 25
2.8 Monitoring, Control and Surveillance, MCS 29
2.8.1 Monitoring for evaluating and adjusting this Plan 29
2.8.2 Enforcement of the management measures 29
2.9 Fisher Code of Conduct 30
2.10 Research Studies for MSC Certification 30
2.11 Financing 31
2.11.1 Requirements 31
2.11.2 Sources of funds 31
2.12 Procedures for Evaluating, Adjusting and Revising the Management Plan 31
2.13 Priority Action to Implement the Plan 33
2.14 Formal Adoption of this Plan. 37
Annex 38
Nile perch biomass estimates 38
Recovery of stock biomass between 2018 and 2020 39
Fishing Mortality, F 39
Comparison of recent stock assessments 40
Useful formulae 45
Stock assessment 45
Analytically derived reference points based upon yield-per-recruit analysis 45
References 48

LIST OF FIGURES

Figure 1 The yield (solid black line) and exports of Nile perch products (red line) and exports expressed as fresh weight animal equivalent (blue line), 1975-2020. A conversion factor of 2.5 was applied to products to estimate the fresh weight animal equivalent. The value of the exports is shown by solid black circles. Data source: LVFO. 12

Figure 2 Indicators of fishing effort and power, 2000-2020. Data source: LVFO 13

Figure 3 Trends in illegal gear use, 2000-2020. Data source: LVFO. 14

Figure 4 Nile perch biomass estimates for the mixed (open circles) and stratified (solid circles) lake periods, 1999-2020. Data: LVFO (2020). A linear regression model is fitted to the stratified lake period estimates. The biomass estimate for the stratified period in 2007 (2,009,748 t) has been excluded (see notes in Annex that accompany Table 3 in the Annex. 14

Figure 5 Estimates of CPUE expressed as catch per hook per year, 2000-2020. Data: LVFO. 15

Figure 6 Kobe Plot illustrating the status of the Nile perch fishery in 2013 and 2015. Rates of fishing mortality are finite. 16

Figure 7 The Decision Control Rule for Objective 1 that will be used to adjust next years' finite fishing mortality rate according to the estimate of the current stock biomass, B. Note that the value of F_{MSY} and $0.5B_0$ is subject to revision following an updated stock assessment expected to be undertaken in early 2022. 24

Figure 8 Estimates of *F*, 2000-2010 with fitted regression model. R^2=0.84, P<0.03. Source: LVFO (2013). 40

Figure 9 From left to right and top to bottom: Linf, K, length-weight parameters a, length-weight parameter b, age at maturity and age at first capture corresponding to a length at maturity and first capture of 50cm. 46

Figure 10 YPR and SPR as a function of instantaneous fishery mortality rate F. Broken line at F=0.23 corresponding to 30% SPR. 47

LIST OF TABLES

Table 1 The core elements of the management plan 25

Table 2 Types of surveys and their frequencies 29
Table 3 Research Studies for MSC Certification 30
Table 4 Sources of revenue to meet management costs 31
Table 5 Priority Action to Implement the Plan 33
Table 6 Estimates of Nile perch biomass derived from hydroacoustic surveys undertaken during the mixed and stratified lake periods. Data source: LVFO (2020). 38
Table 7 Correlations between NP biomass, measures of fishing effort and biomass of prey species. 39
Table 8 Comparison of parameter estimates and reference points derived from recent Nile perch stock assessments 40
Table 9 Existing management measures applicable to the Nile perch fishery not including post-harvest. 41
Table 10 LVFO Routine Monitoring Surveys: Target and achieved frequency per annum (2005 – 2020). Shading indicates target frequency not achieved. 43
Table 11 The Fisheries Certification Requirements v2.0 (MSC, 2014) 44
Table 12 Parameter estimates 45

TERMS, ABBREVIATIONS AND DEFINITIONS

Term	*Abbreviation*	*Definition*
Adaptive Management		Adaptive management attempts to reduce uncertainties over time in a structured process of 'learning by doing'.
Carrying Capacity		Represents the point of balance between reproduction potential and environmental resistance that is the maximum population of a species that a specific ecosystem can support indefinitely without deterioration of the character and quality of the resource. According to the MSY model, an exploited population reduced in size from its initial carrying capacity will tend to rebuild back towards this level.
Catchability	*q*	A measure of the fishing power of a fishing unit. It is defined as the proportion of the stock biomass, *B,* caught by one unit of fishing effort, *f*: *C*/*Bf*, where *C* = catch.
Catch Assessment Survey	CAS	A routine survey undertaken by the LVFO to estimate catch by species and effort by gear and vessel type.
Economic And Financial Impact Assessment	EFIA	A survey undertaken by the LVFO to estimate earnings and income from the fisheries of Lake Victoria.
Ecosystem Approach to Fisheries Management	EAFM	An Ecosystem Approach to Fisheries Management is an integrated management approach across coastal and marine areas and their natural resources that promotes conservation and sustainable use of the whole ecosystem.
Fishing mortality	*F*	This is, approximately, the proportion of the stock that captured over a unit of time, usually a year.
Fisheries Management Plan	FMP	The FAO Technical Guidelines on Fisheries Management (1997) describe a management plan as "a formal or informal arrangement between a fisheries management authority and interested parties which identifies the partners in the fishery and their respective roles, details the agreed objectives for the fishery and specifies the management rules and regulations which apply to it and provides other details about the fishery which are relevant to the task of the management authority."
Frame Survey	FS	A routine census of vessels, fishers, gears and other fishery characteristics undertaken by the LVFO to provide the sampling frame for the CAS.
Hazard Analysis Critical Control Point	HACCP	Hazard analysis and critical control points is a systematic preventive approach to food safety from biological, chemical, physical hazards in production processes that can cause the finished product to be unsafe and designs measures to reduce these risks to a safe level.
Hydroacoustic Survey	HAS	A routine survey undertaken by the LVFO to estimate the biomass of important fish stocks in Lake Victoria.
Illegal, Unregistered and Unregulated Fishing	IUU Fishing	Covers all illegal fishing activity, such as fishing with illegal gear or in prohibited areas, as well as fishing where catches are not reported.
Lake Victoria Fisheries Organization	LVFO	The regional fisheries management organization of Lake Victoria.
Mortality rates		The rate at which the numbers in a population decrease with time due to various causes. To facilitate calculations, scientists express mortality as an exponential or 'instantaneous' rate, where $Nt/N0 = e^{-Zt} = e^{-(M+F)t}$ in which Nt/N0 is the survival rate; *M* is the natural mortality rate (of deaths due to predation or disease); F is the fishing mortality rate (deaths due to fishing); *Z* is the combined total mortality rate; and *t* is time.
Marine Stewardship Council	MSC	The Marine Stewardship Council (MSC) is an independent non-profit organization that sets a standard for sustainable fishing.

		Fisheries that wish to demonstrate they are well-managed and sustainable compared to the science-based MSC standard are assessed by a team of experts who are independent of both the fishery and the MSC. Seafood products can display the blue MSC ecolabel if that seafood can be traced back through the supply chain to a fishery that has been certified by the MSC.
Maximum Sustainable Yield	MSY	The maximum average annual catch that can be removed from a stock over an indefinite period without having any negative effect on resource potential production under prevailing environmental conditions.
Memorandum of Understanding	MoU	Any written agreement between two parties that might not be binding, but nevertheless defines what both understand and have agreed to do.
Overfished		A stock with biomass sustained below the biomass target reference point.
Overfishing		The removal rate from the stock is above the level which produces the target biomass.
Management unit or Stock		A functionally discrete population of species that is distinct from other populations of the same species. The primary attribute of this unit is that it can be managed, so reducing or increasing fishing activity directed at the unit will increase or decrease its size respectively.
Precautionary approach		One that recognizes the uncertainties in our knowledge of the system (e.g. the natural productivity of the stocks, the true values of reference points, the current size of the stock and the effect of future management actions), and adjusts management actions accordingly.
Regional Working Group	RWG	Regional scientific working group of the LVFO.
Spawner potential ratio	SPR	The spawning potential ratio (SPR) of a stock is defined as the proportion of the unfished reproductive potential left at any given level of fishing pressure (Goodyear, 1993; Walters and Martell, 2004) and is commonly used to set target and limit reference points for fisheries.
Stock Assessment	SA	The process of collecting and analyzing biological and statistical information to determine the changes in the abundance of fishery stocks in response to fishing, and, to the extent possible, to predict future trends of stock abundance depending on alternative management options.

1 INTRODUCTION

1.1 Preparation of the Management Plan

This management plan was prepared under the GIZ-funded Responsible Fisheries Business Chains (RFBC) Project in consultation with the LVFO Secretariat and the fisheries management and research institutions of its Partner States, and representatives from the harvest and the post-harvest sectors during three workshops held between June and October 2021. In addition, key stakeholders from the management and research institutions, harvest and the post-harvest sectors validated the document in November 2021.

The formulation of the plan was guided by the findings of the most recent HAS, CAS and FS, and stock assessment, previous stock assessments reported by the LVFO Hydroacoustic RWG, and published in the literature, as well as the draft Fisheries Management Plan IV and LVFO Strategic Plan 2021/2022-2025-2025. In addition, lessons learnt and challenges encountered during the implementation of the NPFMP-II were used to inform the development of NPFMP-III.

1.2 Guiding Principles Adopted

The following guiding principles and best practice were applied when preparing the plan:

i. Fish stocks and fish communities are finite and biological production constrains the potential yield from a fishery.

ii. Biological production of a stock is a function of the size of the stock and the ecological environment in which it exists. Production is influenced by natural or human-induced changes in the environment.

iii. Management should seek to follow international best practice as described by Code of Conduct for Responsible Fisheries (CCRF).

iv. Management needs to set clear objectives and constraints for the fishery, operationalized through reference points and decision control rules.

v. Adequate resources should be allocated to effectively enforce rules and regulations (management measures).

vi. Action should be taken to avoid an unacceptable risk of recruitment overfishing when insufficient mature fish are left to replenish the stocks.

vii. An Ecosystem Approach to Fisheries Management (EAFM) that advocates:

    a. Due consideration to human well-being, ecosystem health, and good governance through a comprehensive co-management planning process.

    b. Precautionary and adaptive approaches to management to deal with uncertainty that does not delay action because of lack of information and learns through experience gained through regular monitoring and evaluation (assessment) of the fishery and the environment.

    c. Participation of all key stakeholders in the management process, particular in planning and decision-making. Effective participation facilitates identification of acceptable management systems and encourages compliance with laws and regulations through communication.

d. Resource users are responsible to the wider community and future generations who all have an interest in the resources and ecosystem to which users have access rights.

2 THE MANAGEMENT PLAN

2.1 The Fishery

This plan has been prepared for the Nile perch (*Lates niloticus*) fishery – one of the three main commercial fisheries of Lake Victoria. The Nile perch fishery comprises all vessels and gears (permitted or prohibited), and their associated fisher communities that catch Nile perch as their target species.

2.2 Situation Analysis

2.2.1 Environmental Context (including status and trends)

Lake Victoria covers an area of 68 000 km^2 with a catchment area of 193 000 km^2. The lake is split between Uganda (43%), Kenya (6%) and Tanzania (51%). It has a mean depth of 40 m, a maximum depth of 84 m and a shoreline of 3,450 km. The lake is also the source of the River Nile (LVFO, 2013).

The Lake supports Africa's largest freshwater fishery that is dominated by three species: Nile perch (NP), Nile tilapia (*Oreochromis niloticus*), and dagaa (*Rastrineobola argentea*). These three species are also the most commercially important ones, forming up to 90% of the catch. The fishery supports the livelihoods of over 2 million people through income, food and employment generation.

The ecology of Lake Victoria and its catchment is described in detail (LVFO, 2021b). The Lake's hydrology and chemistry have reportedly changed in recent decades in response to climate change and human-related activities in the lakes' basin. Whilst these changes pose potential threats to the Lakes' ecosystem, significant evironmental influences on the Nile perch fishery have yet to be demonstrated. Environmental effects on the fisheries of Lake Victoria is investigated further under the Lake-wide FMP-IV (2021-2026) (LVFO, 2021b).

2.2.2 Fishery characteristics

The fishery that targets Nile perch is characterized by small-scale commercial operations using gillnets (GN), baited longlines (LL) or hand lines (HL) deployed from sesse boats powered by engine, sail or paddle. Illegal beach seines (BS), small mesh (<5" (<6" in Tanzania)) gillnets, small hooks (>size 9); cast nets, traps/baskets, and monofilament gillnets are also used, sometimes also from parachute and dug-out boats.

Nile perch are also caught as by-catch by the nearshore fishery for Tilapia, and by the fishery for *dagaa*. Tilapia and other species are caught as by-catch by the Nile perch fishery. The respective scales of these by-catches are believed to be small but remain to be confirmed by relevant statistics.

For licensing purposes, the NP fishery can be defined as those vessel-gear (V-G) combinations whose catch of NP comprises > 5% of the total catch weight of all species. These V-G combinations are: Sesse pointed-gillnets (SP-GN); sesse pointed longline (SP-LL); sesse motor or sail-gillnets (SMS-GN); and sesse motor or sail-longline (SMS-LL) (Halls, 2019). It excludes Illegal V-G types.

2.2.3 Fishery status and trends

The catch (or yield) of NP peaked in 1990 (338,000 t) and has subsequently varied between 200,000 t and 300,000 t per year (Figure 1). Exports of processed Nile perch (including fillets and maws) have varied between about 40,000t and 60,000t during the last decade, equivalent to about 40%-50% of

the yield of Nile perch when the processed weight is expressed as fresh weight animal equivalent (FWAE). The value of the exports has grown rapidly since 2001 from about $200 million to almost $400 million largely reflecting the growth in trade of fish maws (Figure 1).

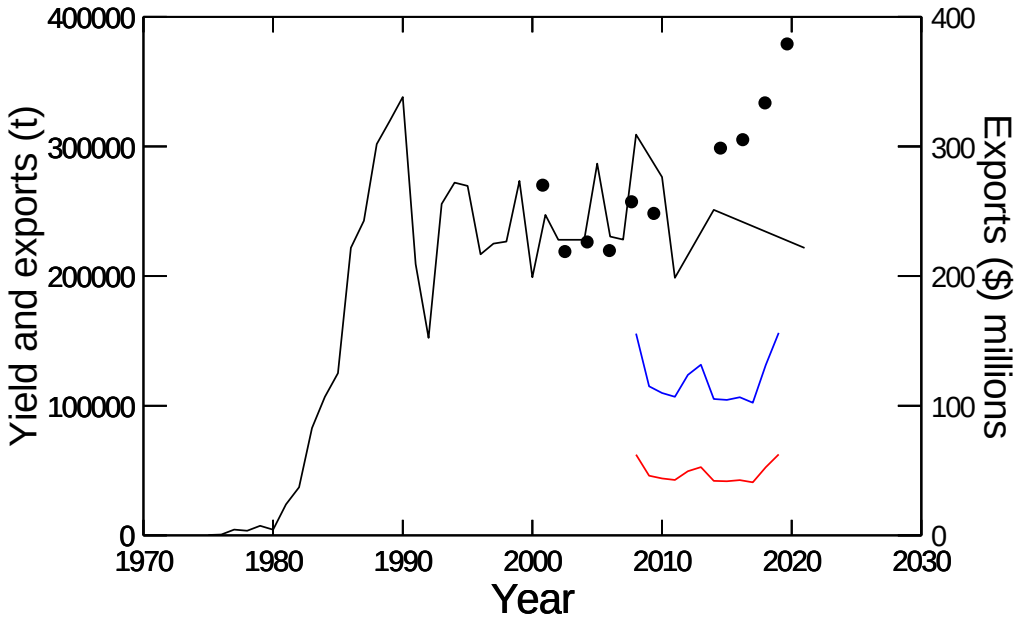

Figure 1 The yield (solid black line) and exports of Nile perch products (red line) and exports expressed as fresh weight animal equivalent (blue line), 1975-2020. A conversion factor of 2.5 was applied to products to estimate the fresh weight animal equivalent. The value of the exports is shown by solid black circles. Data source: LVFO.

2.2.4 Fishing Effort

Since 2000, the number of boats, and hooks (both legal and illegal size) per boat on the lake have both doubled, meaning that the number of hooks used has increased four-fold. The average number of hooks per boat now exceeds 200. The number of fishers per boat has remained approximately equal to three, so the total number of fishers on the lake has also doubled in the past 20 years to reach more than 234,000, equivalent to a growth rate of about 5% per annum. More than one in three boats of the 84,000 fishing boats are now equipped with outboard motors - three times more than in 2000. The number of gillnets (both legal and illegal types combined) has approximately halved since the peak in 2005 (Figure 2) suggesting that hooks are replacing gillnets in the fishery. The increase in number of fishing vessels and fishers have been regarded as "…a blessing to most local level authorities as they increase revenues to support developmental projects within their areas of jurisdiction" (LVFO, 2020a) but threatens the sustainability of the fishery.

2.2.5 Trends in illegal gear use

The number of illegal types of gillnet (<5" mesh or monofilament construction) and hooks (>size 9) counted around the Lake has increased approximately three-fold in the past 20 years. About 30% of the gillnets now operated on the lake have either mesh sizes that are below the legal minimum size or have a monofilament construction. Almost all (95%) hooks used now are below the minimum size (9). The number of reported beach or boat seines show no discernible trend through time (not illustrated) (Figure 3).

2.2.6 Catchability

With increasing engine power and numbers of gears, the catchability (q) of boats operating on the lake is increasing. Using estimates of catch, effort and Nile perch biomass, LVFO (2013) estimated that boat catchability may have doubled in value between 2000 and 2010.

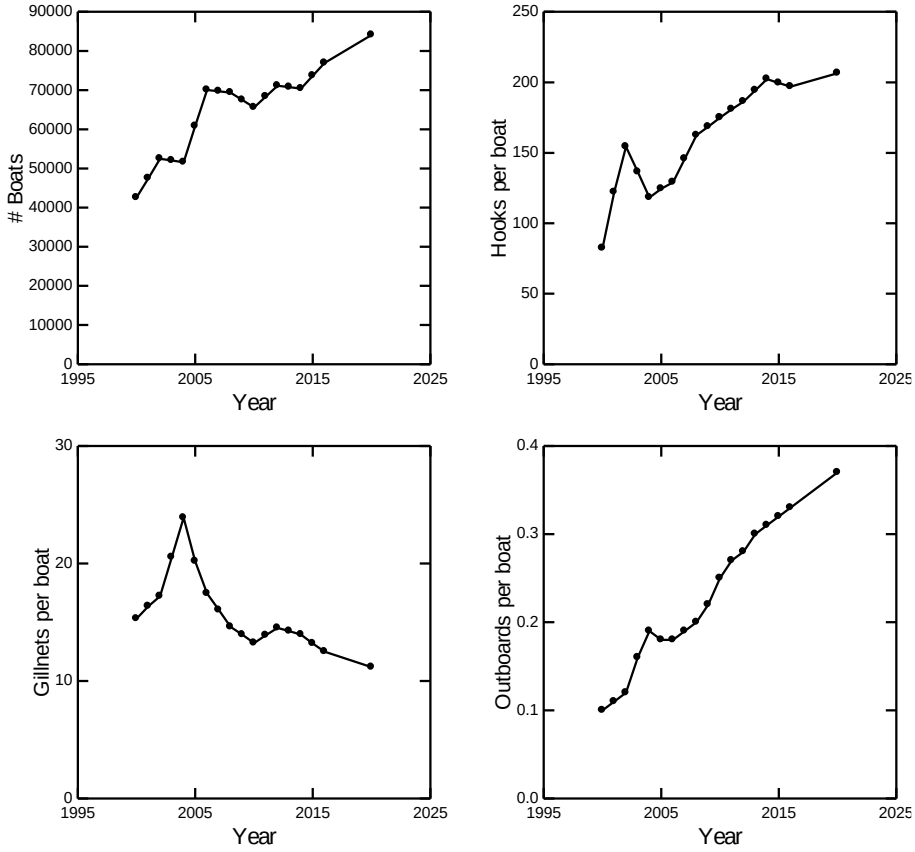

Figure 2 Indicators of fishing effort and power, 2000-2020. Data source: LVFO

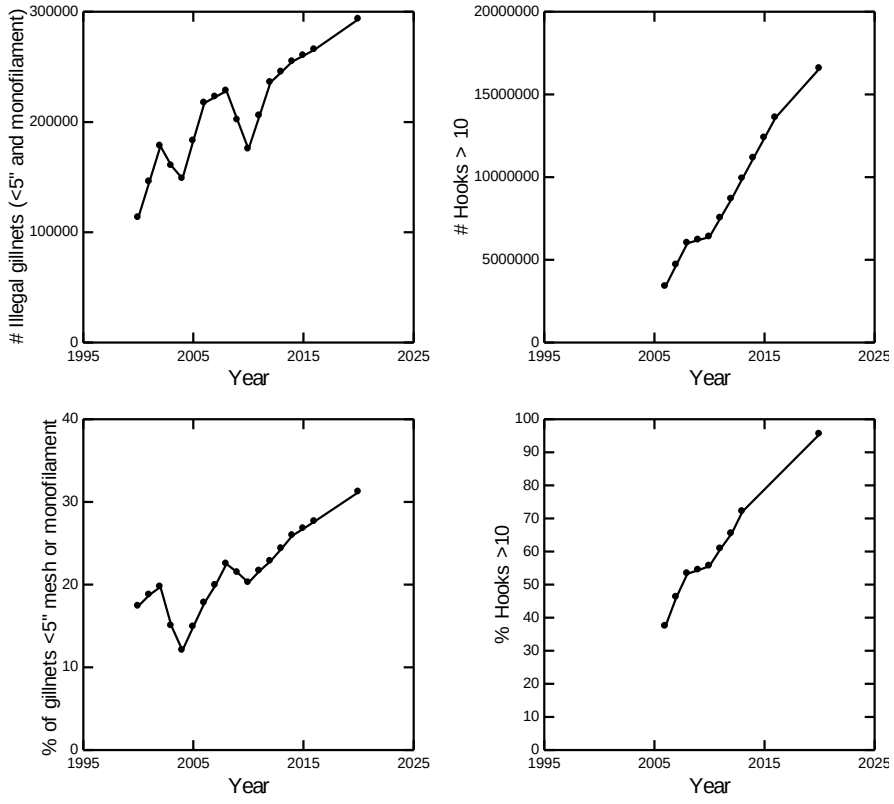

Figure 3 Trends in illegal gear use, 2000-2020. Data source: LVFO.

2.2.7 Stock abundance/biomass

Between 1999 and 2020, 22 hydroacoustic surveys have provided estimates of Nile perch biomass (LVFO, 2020b). Twelve surveys were conducted during the period when the lake is vertically mixed (August - September), whilst 10 surveys were conducted during the period when the lake is vertically stratified (February – March) (Annex **Table**).

Biomass estimates for the stratified period are thought to be more reliable compared to those estimated for the mixed period (see LVFO 2013 and this Annex). Surveys undertaken during the stratified period indicate that NP biomass has declined by almost 70% during the past two decades (Figure 4). The decline is strongly correlated with various measures of fishing effort, but not with the biomass of prey species – *dagaa* and other species (see Annex **Table**).

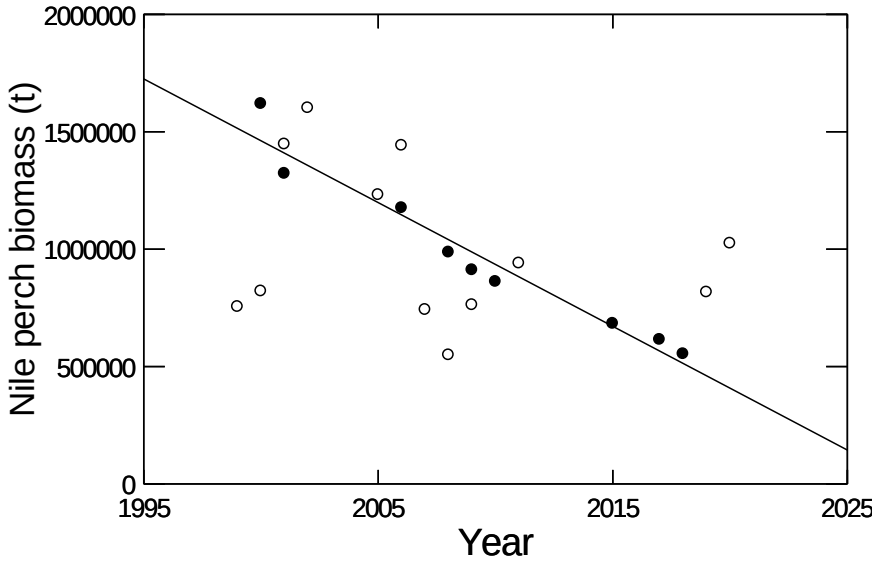

*Figure 4 Nile perch biomass estimates for the mixed (open circles) and stratified (solid circles) lake periods, 1999-2020. Data: LVFO (2020). A linear regression model is fitted to the stratified lake period estimates. The biomass estimate for the stratified period in 2007 (2,009,748 t) has been excluded (see notes in Annex that accompany **Table** in the Annex.*

The most recent surveys (2019 and 2020) - both undertaken during the mixed lake period - suggest that NP biomass recovered to a 'healthy' level (Figure 4). However, the reliability of these estimates is questioned because they suggest that NP biomass increased by more than 100% between 2018 and 2020. To achieve such a rapid recovery would require that the annual intrinsic rate of population growth (*r*) of the stock (the difference between the births and deaths each year) has a value greater than 1 (see Annex) assuming annual catches during the period were 200,000 t. This seems implausible because it would translate to an MSY of more than 500,000 t yr^{-1}. All previous estimates of *r* and MSY range from 0.4 to 0.45, and 200,000 t yr^{-1} to 246,000 t yr^{-1}, respectively (LVFO, 2013, Musinguzi et al., 2020).

Continuing declines in catch per unit of effort (CPUE) indices of NP biomass including catch per hook (Figure 5), and catch per fisher or per boat (not illustrated) suggest that such a recovery has not taken place.

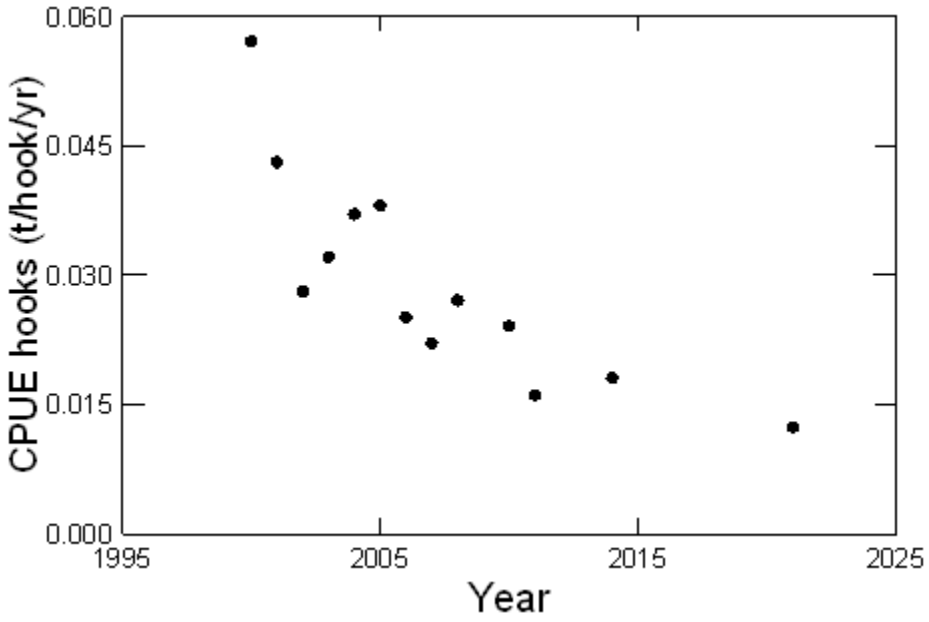

Figure 5 Estimates of CPUE expressed as catch per hook per year, 2000-2020. Data: LVFO.

2.2.8 Previous Stock Assessments

LVFO (2013) undertook a stock assessment for the preparation of the NPFMP-II. It found evidence of increasing fishing effort, vessel catchability, and illegal fishing, and a decline in stock biomass between 1999 and 2012. A biomass dynamics model was fitted to estimates of catch, effort and stock biomass. The assessment concluded that by 2013 the biomass of NP has been reduced to about 35% of its unexploited biomass ($0.35B_0$) equivalent to $0.7B_{MSY}$, and that MSY was approximately 200,000 t yr^{-1} and F_{MSY} = 0.23 yr^{-1}, equivalent to a fishing effort f_{MSY} of about 44,000 vessels (Annex **Table**).

Musinguzi et al (2020) re-estimated the stock status in 2015. Their results indicated that the stock had been further depleted to approximately $0.25B_0$ (or $0.5B_{MSY}$). Most of their parameter and reference point estimates are remarkably consistent to those reported by LVFO (2013) in spite of differences in datasets and estimation methodologies employed by the two assessments (Annex **Table**). The authors concluded that the fishery in 2015 was overexploited and recruitment impaired, and that management efforts should seek to rebuild the stock biomass to levels that would support a precautionary MSY of approximately 200,000 t. The authors proposed that this could be achieved by eliminating illegal fishing practices and reducing catches of Nile perch. They also postulated that the confiscation and destruction of illegal gears was responsible for the increase in stock biomass after 2018 in spite of the significant increase in fishing effort with permitted and illegal gears during this period.

These recent assessments indicate that overfishing for Nile perch was occurring and stocks were overfished in both 2013 and 2015 (Figure 6). A decline in the proportion of 'mega spawners' in the population is reported by LVFO (2016).

2.2.9 Ecology including impacts of the fishery on the environment

There are no reported impacts of the NP fishery on the lake environment. Gears are passive type with no contact with lake substrates. The use of poisons, toxins and explosives is prohibited and not reported as commonly used or as a major threat to the environment or sustainability of fish stocks.

2.2.10 Mushrooming of cage culture and status of environment

Though the main driver of Nile perch stock dynamics is the fishing effort, continued increase in number of cages on the lake and anthropogenic activities may compromise water quality to the level that could affect fisheries productivity. Therefore, continue monitoring using modern technology such as satellite, drones and fixed buoys is important.

2.2.11 By-catch

Tilapia and other species are caught as by-catch by the Nile perch gillnet fishery. Longlines by-catch includes lungfish, *Clarias* spp. and occasionally large Nile tilapia. Hooks are typically baited with wild-caught juvenile *Clarias* and haplochromine species, or *dagaa*. The capture of juvenile *Clarias* and haplochromine species is illegal and threatens the sustainability of their stocks. The use of illegal bait in the NP longline fishery would not meet fisheries certification scheme criteria. Aquaculture-derived supplies of bait are becoming more widely available.

Nile perch are caught as by-catch by the nearshore fishery for Tilapia, and by the fishery for *dagaa*. The respective scales and importance of these by-catches and bait fisheries for the management of the lakes fish stocks requires further investigation as planned and financed under the Lake-wide FMP-IV (LVFO, 2021b).

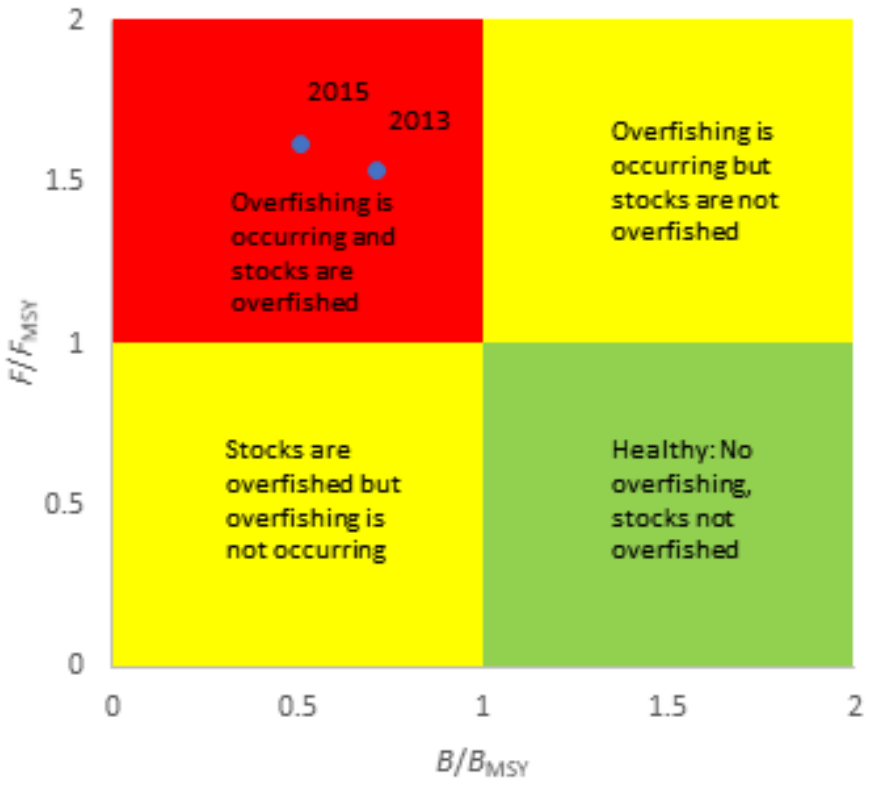

Figure 6 Kobe Plot illustrating the status of the Nile perch fishery in 2013 and 2015. Rates of fishing mortality are finite.

2.2.12 Socio-economic factors

Since the 1990s, Nile perch has supported an extremely valuable export-orientated fishery that generates significant revenue and earnings for the three riparian countries, but that also supports the livelihoods and food security of more than a million people in the region. The fishery is predominantly small-scale commercial with subsistence fishing. There has been a substantial migration into the

fishery, especially in Kenya, by unskilled workers. In 2020, just over half (121,584) of the all the fishers (234,214) on Lake Victoria targeted Nile perch.

A recent study (2020) unexpectedly found that earnings of Nile perch fishers are relatively high and far exceed minimum state thresholds and those of causal labourers. Crew members typically earn between $6,000 and $7,000 pa whilst boat owners earn between $7,000 and $15,000 pa. Fish processors earn between $10,000 - $18,000, whilst traders earn between $17,000 - $19,000 (LVFO, 2020a). Such relatively high earnings probably explain why effort has grown so significantly to date, and will likely encourage further entry into the fishery into the future.

At least a further 300,000 people are employed in the service and post-harvest sectors of the Nile perch fishery based on an employment multiplier of 2.5. Data available for Uganda show that women play a significant role in the post-harvest sector making up 80% of the artisanal processing labour force, 39% of fresh market retailers; 36% in the processing factories and 40% in fish maw processing. Nile perch provide an estimated 7% of the total weight of fish consumed in the Partner States (LVFO, 2015).

2.2.13 Post-harvest sector

The international markets for high-quality white fish meat, particularly in Europe, encouraged the establishment of processing and exporting factories around the lake during the 1980s and early 1990s. In 2005, there were 35 factories. Approximately half (40% - 50 %) of Nile perch are processed at these lake-side factories and exported chilled or as frozen fillets. These markets mostly demand medium-size fillets corresponding to whole fish with length ranging from 50cm to 85cm. Corresponding landing size regulations were therefore set for the fishery to meet this demand – the permitted range referred to as the 'slot size'.

Of the Nile perch consumed locally, and exported to regional markets, most is believed to comprise fish below or above the slot size. An estimated 70,000 t of Nile perch is estimated to be traded "informally". There is also a subsidiary trade in processing factory by-products, including; heads, carcases, meat, fats and skins which are re-processed by smoking, drying or salting and oil extraction. This trade is aimed at both the domestic and regional markets, including; South Sudan, Rwanda, Zambia and the DRC (LVFO, 2013).

The past decade has seen a growing trade in fish maws (swim-bladders) particularly from large Nile perch (mega-spawners) including those above the slot size (>85cm). In Uganda, for which fish maw trade statistics are published, the trade in maws increased from 41 to 740 tonnes between 2011 and 2019 with a value in 2019 of $76m equivalent to 42% of the value of all NP exports from the country. Fishers are paid as much as $100/kg for the maws, compared to about $2.5/kg for the whole fish (LVFO, 2015, LVFO, 2013). The trade targets the larger individuals above the upper limit of slot size due to high price of large fish maws. This increased exploitation pressure to large individuals could impair the ability of the stock to replenish itself. Therefore, Nile perch maws trade should be regulated and adhere to the slot size regulation. Studies in Tanzania and Uganda have given the sizes corresponding to the slot sizes to be ≥12 cm TL and ≥13 g for fresh maws, ≥9 cm TL and ≥5 g for dried maws to ensure that the fisheries and the trade in fish maws are both sustainable. Nevertheless, there is a need of improving technology for processing, handling and storage facilities to ensure good quality of fish maws.

Supplies of whole NP have subsequently diminished to regulated processing factories that only accept slot size fish and/or that do not process fish maws. This coupled with declining NP catches led to the closure of a number of regulated processing factories with those still working now operating at around

1/3 of the plant operating capacity with only one shift/day. By 2014 there were a reported 26 factories still operating compared to 35 in 2005 (LVFO, 2015). In contrast, the supply of NP to unregulated fish processing factories and local markets is believed to have increased in the past decade.

These post-harvest trends prompted the LVFO to commission a comprehensive Value Chain Analysis study for the NP fishery covering local, regional and international markets including the fish maw trade to better understand the contribution of the sector to national economies and for equity in the distribution of benefits (EAC, 2018). Other relevant initiatives conducted under the NPFMP-II included the preparation and adoption of: (i) Self-inspection guidelines for fish processors and exporters; (ii) Harmonized EAC guidelines for traders in fish, fishery and aquaculture products and inputs engaged in regional and international trade; (iii) Code of Good Practice (CoP) for the production, preparation, processing and handling of fish and fish products (including fish maws); (iv) Guidelines for regulating regional trade in fish maws; and (v) a Harmonized Fisheries and Aquaculture Border Inspection Manual for the EAC.

The LVFO are questioning the utility of the upper slot size landing restriction for a number of reasons. Hooks – the main gear type used in the fishery, are not very size-selective and large hook-caught fish suffer high mortality after capture. Fish larger than 85cm may not be reported caught by fishers or not reported to have been purchased/processed by fish processing factories leading to under reporting in the harvest and post-harvest sectors. Fish above 85 cm are more likely to be disposed through unregulated markets and processing factories compromising or diminishing product safety, value and export levies. Uganda does not recognize the upper slot size limit.

2.2.14 Management arrangements

The Lake Victoria Fisheries Organisation (LVFO) was established in 1994 to co-ordinate the management of the shared fishery resources of the lake, including Nile perch. During the past decade, the LVFO has sought to improve the management of the Nile perch fishery by formulating and implementing fishery management plans (FMPs).

2.2.15 Previous management plans

1. LVFO (2009a) NILE PERCH FISHERY MANAGEMENT PLAN FOR LAKE VICTORIA, JULY 2009 - JUNE 2014. LVFO Secretariat, Jinja, Uganda, 24pp.
2. LVFO (2013) Review and Update Nile Perch Fishery Management Plan (NPFMP) for Lake Victoria. ACP Fish II N° EA-1.2-B3, an assignment by SOFRECO under the EU-funded ACP Fish II programme, 82pp.
3. LVFO (2015) Nile Perch Fishery Management Plan II for Lake Victoria, 2015-2019. LVFO, April 2015, 56pp.

A formal evaluation of the implementation progress and performance of the Nile Perch Fishery Management Plan II (NPFMP-II) including recommendations for this plan is reported by LVFO (2021).

2.2.16 Existing Management Measures (Current Legislation)

See Annex **Table** .

2.2.17 Monitoring Control and Surveillance (MCS)

Monitoring

The fishery and post-harvest sector are monitored by means of four routine surveys: Catch Assessment Survey (CAS) (LVFO, 2019a); Frame Survey (FS) (LVFO, 2019b), Hydro Acoustic Survey (LVFO, 2020b); and Factory Reporting. However, the implementation of the CAS has been sporadic and has only been undertaken once since 2014. Furthermore, the FS has only been undertaken once

during the past five years (Annex **Table**) making it very difficult for managers to monitor the health of the fishery. An annual Trawl Survey designed to monitor Nile perch relative abundance ceased in 2008. Factory Sampling of Nile perch occurred in 2009 but not since. The LVFO coordinates the implementation of the surveys of the Partner States and reports its findings through Regional Working Groups formed of technical experts from each partner state.

Control and Surveillance (Enforcement)

Partner States share responsibility for the surveillance (monitoring, patrolling and inspections) of fishing operations and the enforcement of fishery management measures by sanctioning non-compliance in accordance with their state legislation. Harmonisation of management measures among member states, and adequate financial support is necessary for effective MCS.

Whilst some short-term initiatives by Partner States have successfully removed an unknown proportion of illegal gears from the fishery (LVFO, 2021a), the regular use of illegal gears continues to grow as reported in the FS statistics (see above).

2.2.18 Key issues (problems) to be addressed by this plan

1. Overfished (overexploited) resource

There is strong evidence that the Nile perch stock is overexploited. According to the most recent stock assessment, the stock biomass has been reduced to about 25% of its maximum theoretical (unexploited) biomass ($0.25B_0$). At this level recruitment to the stock is impaired and the hence the sustainability of the fishery is at risk. Management should seek to rebuild the stock to biological safe and productive levels without compromising its sustainability. The MSY and B_{MSY} should be treated as limit not target reference points.

2. Overfishing (overexploitation) is still occurring and increasing

Fishing effort (and hence fishing mortality, *F*) is almost twice the level necessary to achieve maximum sustainable yield (MSY) and continues to grow because fishing effort remains unregulated. With unregulated access and driven by the prospect of high earnings from a growing and lucrative market for fish maws, more vessels and fishers are entering the fishery each year equipped with greater numbers of gear and more engines to sustain catches from a depleted resource. Without the necessary mandate and guidance to regulate the licensing of vessels and fishers, District level management authorities are motivated to continue to issue further licenses to raise local revenue for development projects. Measures are urgently needed to regulate access to the fishery and control fishing effort.

3. Illegal gear use

Illegal gear use continues to grow. Their use in the fishery is believed to be a major cause of overfishing and hence a priority for managers control more effectively. However, the contribution made by illegal gears to the overall fishing mortality rate, *F* experienced by the stock remains unknown and hence the subject of speculation. Studies are required to address this uncertainty in order to guide the control of these gears.

4. Technical management measures

There appears to be variation in the *de jure* and *de facto* minimum gillnet mesh size among the Partner States and the LVFO, ranging from 5 to 7 inches. A single minimum mesh size should be agreed among Partner States and adopted into relevant state fisheries legislation to facilitate effective MCS. The minimum size should be established through scientific research. Gillnet selectivity studies combined with yield-per-recruit type analysis are necessary to determine the minimum mesh sizes to achieve

desirable management reference points such as maximum yield (Y_{max}) or adequate spawning potential ratio (SPR>0.3) given the current rates of fishing mortality, *F*. Alternatively, such analyses could be used to identify target or limit fishing mortality rates (e.g. F_{msy}, $F_{0.1}$, $F_{0.3SPR}$) to achieve desirable management targets or to avoid overexploitation of the resource corresponding to the existing minimum landing size (length at first capture, lc). These types of analyses would also help to assess the appropriateness of the existing slot size that appears to have been set on the basis of export market forces rather than sustainability grounds. They would also determine whether the existing minimum mesh sizes catch individuals corresponding the slot size range. The remaining technical measures require review, harmonisation (alignment) and enactment (legislating) by Partner States.

5. Monitoring, Control and Surveillance

a. Monitoring and Evaluation

The ability to effectively monitor and evaluate management performance is significantly affected by the current absence of management standards (i.e. indicators and reference points). The existing management plan contains a number of objectives but these need to be expressed as *operational objectives* making clear reference to targets or limits for the fishery (reference points) corresponding to standard stock assessment models (e.g. B_{MSY}). The existing (NPFMP-II) management plan refers only to a target catch (300,000 t) without any scientific justification for this target or explanation how it was derived. There is no clear indication that the existing plan has adopted a precautionary approach to management. The FMP-IV sets the annual target catch for NP to be 250,000 t but the same comments apply.

As well as lacking management reference points, indicators to monitor each objective have not been defined making it difficult for managers to evaluate the plan performance and to make adjustments to the management strategy.

No decision control rules exist to accompany each operational objective. These rules define pre-agreed actions that will be taken by managers in response to changes to the values of indicators used to monitor the achievement of each objective. These rules are applied during periodic evaluations of the performance of the plan.

Surveys that are required to generate data for stock assessments and to compile the indicators to monitor the objectives set for the fishery have been sporadic in recent years making it impossible to effectively evaluate management performance and to make any necessary adjustments to the plan. Donor-funded projects have been relied upon to provide funds for these routine surveys. Surveys should also be capable of monitoring indicators of (non-) compliance with management measures.

Formal procedures for routinely evaluating management plan performance currently do not exist.

b. Control and Surveillance

Existing control and surveillance operations appear ineffective and require strengthening to reduce IUU fishing activity. A capacity strengthening assessment and plan are required. A strategy for control and surveillance operations should be prepared. Adequate and sustainable funds to strengthen capacity and for routine operations must be secured.

6. Funding

Funds required for core management activities such as MCS are currently sporadic, uncertain and inadequate hindering the sustainable management of the resource. Sustainable and reliable financing mechanisms must be established.

7. Post-harvest Sector

Issues concerning the post-harvest sector are appropriately dealt with under the Lake-wide FMP-IV because they are applicable to three major commercial species, and to avoid duplication of effort and expenditure.

2.2.19 Recommendations from the MSC Pre-Assessment (2008).

The NPFMP-III has been formulated to also address the major obstacles to MSC certification as described in Section 8.2 of Huntingdon & Hough (2008) and summarised in the Annex. At the time the MSC Pre-Assessment Report was published, the MSC would not permit historically introduced species such as Nile perch to proceed to full certification. This situation has now changed and introduced species can now be certified provided that the criteria provided in Table 2 of the Fisheries Certification Requirements v2.0 (MSC, 2014) are met (see Annex). The Nile perch fishery would meet this criteria.

2.3 Purpose, Goals and Objectives

2.3.1 Purpose

To create an ecologically and economically sustainable Nile perch fishery in Lake Victoria.

2.3.2 Goals

Biological:

To maintain the Nile perch stock at or above the level necessary to ensure its continued productivity.

Ecological:

To limit ecological impacts as a result of fishing activity to local, acceptable and reversible change.

Economic:

To increase wealth generated by Nile perch fishing and related activities.

Social:

To sustain the livelihoods and food security of those dependent on the Nile perch fishery.

2.3.3 Objectives

Biological:

1. To maintain the stock at all times above 50% of its mean unexploited level.
2. To strengthen compliance with existing management measures.

Ecological:

1. Reduce the use of juvenile *Clarias* and haplochromine species (& other species?) as bait in the hook fishery.
2. Reduce the by-catch of Tilapia to acceptable levels.
3. Conserve and protect NP spawning and nursery areas (critical habitat).

Economic:

1. To maintain net income per fisher at a level above the national minimum desired income.
2. To increase foreign exchange earnings (proceeds from the export of NP).

Social:

1. To include as many of the existing participants in the fishery as is possible given the biological and economic objectives above.
2. To maintain the supply of fish for local consumption.

The proposed goals and objectives for the plan are summarised in **Table 1** below. Governance related goals and objectives are appropriately dealt with in the Lake-wide FMP-IV.

2.4 Indicators and Reference Points (management standards)

The proposed indicators and reference points for the goals and objectives set for the plan are summarised in **Table 1** below.

2.5 The Management Strategy

The proposed management strategy includes both existing, and new, *technical measures* and new *input* measures.

2.5.1 Existing management measures

The existing measures applied to the NP fishery are summarised in **Table** (Annex). These require review by the Partner States and should be harmonised across the lake. Legislation to enact these regulations should be prepared where it is currently absent.

States will continue to adopt the existing minimum mesh size and landing size restrictions but will, undertake the necessary research and assessments to determine whether the existing minimum landing size (50cm) protects mature fish and would ensure the production of new recruits to the fishery under the existing fishing mortality rates, and fishing mortality rates corresponding to MSY, F_{MSY} estimated by the most recent stock assessments employing biomass dynamics models. The minimum landing size and corresponding minimum gillnet mesh size might be revised if necessary. Relevant legislation should be updated accordingly.

It is noted that hooks are not very size-selective and the fishery is moving towards greater use of hooks so input (fishing effort) controls will become increasingly important for managing fishing mortality to within sustainable limits.

Note also that an important objective of the new Plan is to also strengthen compliance with existing management measures by increasing enforcement effort and effectively sanctioning for non-compliance.

2.5.2 New management measures proposed under this plan

The new management measures for the NPFMP-III summarised in **Table 1** below. The most important new measures seek to control fishing mortality (effort) to rebuild and maintain the stock at safe and productive levels i.e. $0.5B_0$ or $B/B_{MSY}=1$. This level of fishing mortality is referred to as the fishing mortality corresponding to MSY, or F_{MSY}.

Because it will be difficult for the management authority to remove existing boats from the fishery, the plan will seek to restrict further vessels (fishing effort, f) from entering the fishery by means of a moratorium on vessel licensing. The fishing power (or catchability, q) of individual boats will be controlled by restricting the number of gear units (number of hooks or gillnets/panels) that an individual boat may operate, resulting in a fishing mortality rate, F ($F=fq$). The number of permitted gear units per vessel will be adjusted to achieve F_{MSY} according to the agreed Decision Control Rule (DCR) illustrated in Figure 7.

Fisher catch rates and income will be impacted in the short term, but model simulations indicate that they should return to current levels in the medium term (within 4-5 years or by the end of the plan). Given the very high net incomes reported by Nile perch fishers, significant socio-economic impacts are not anticipated as fishers should be able to absorb diminished earnings during the medium term as the stock recovers to more productive levels.

The other new technical measures to be introduced under this plan are new fishing restrictions in shallow waters and in NP spawning and nursery (critical habitat) areas to reduce the by-catch of Tilapia in the fishery, and to protect NP spawners and juvenile fish (**Table 1**).

Combined these measures are expected to meet the biological, ecological, and socio-economic goals and objectives set out in the plan.

2.6 Decision Control Rules

Decision control rules (DCRs) are used to guide decisions on how best to adjust management measures as the plan is implemented and the outcomes are monitored and evaluated.

For this plan, a sliding scale DCR is adopted for **Objective 1** (Biological Goal) to adjust next year's fishing mortality in relation to the current stock biomass, *B* (Figure 7).

Other management measures are to be adjusted using logical "if statements" with reference to threshold values of indicators adopted to monitor the achievement of the remaining objectives (**Table 1**).

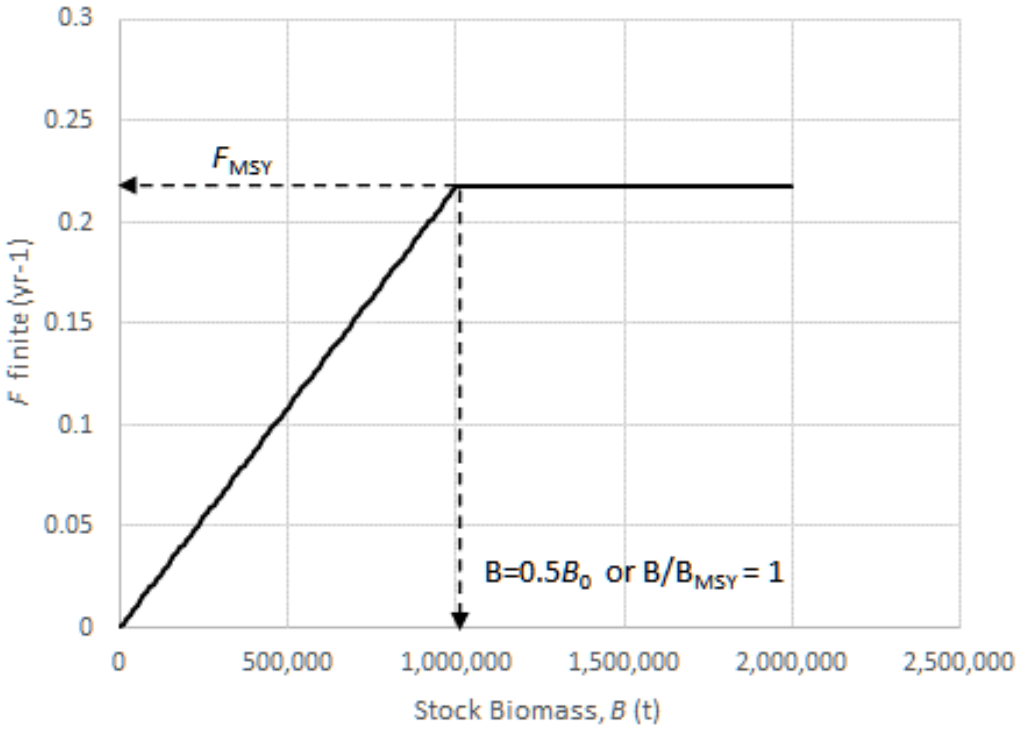

Figure 7 The Decision Control Rule for Objective 1 that will be used to adjust next years' finite fishing mortality rate according to the estimate of the current stock biomass, B. Note that the value of F_{MSY} and $0.5B_0$ is subject to revision following an updated stock assessment expected to be undertaken in early 2022.

2.7 Summary of the core elements of the Plan

Table 1 The core elements of the management plan

		Management Standards		Management Strategy	
Goals	**Objectives**	**Indicators**	**Reference Points**	**Management Measures**	**Decision Control Rules**
Biological To maintain the Nile perch stock at or above the level necessary to ensure its continued productivity.	To maintain the stock at all times above 50% of its mean unexploited level.	Current stock size *B* and the biomass corresponding to MSY, B_{MSY}, estimated using a Schaefer biomass dynamics model fitted to catch and standardised fishing effort (and ancillary HAS data if available) using non-equilibrium assumption fitting method implemented in CEDA or other e.g. R	B / B_{MSY} =>1 (Note: a precautionary alternative might be: B / B_{MSY} =>1.1)	Fishing effort/mortality control: 1.Moratorium on issuance of new NP fishing vessel licenses to control (limit) fishing effort, *f*. 2. Restrict the # of gear units (e.g. hooks or gillnets) permitted per vessel type to control vessel catchability, *q* and thereby the overall finite fishing mortality rate, *F*, where $F=fq$. 3. Regulate trade of fish maws and institute traceability system to monitor the trade	If B / B_{MSY} >1 , fishing mortality, *F*, next year to be set to the value corresponding to MSY, F_{MSY} by adjusting the number of permitted gear units per vessel type. If B / B_{MSY} < 1, fishing mortality next year to be set to the value defined by the sliding scale rule unless $B<0.2B_0$, then *F* is set to zero (see Figure 7).
	To strengthen compliance with existing management measures.	Percentage of vessels sampled during inspections at landing sites and during CAS that landed NP:	< 5% for all indicators in each partner state.	Existing. Ensure all non-compliance is sanctioned.	If indicator is > 5%, partner state to increase enforcement efforts (# of patrols and inspections) and penalties next year by 10%.

		(i) Without a valid fishing vessel licence; (ii) Below 50 cm in length; (iii) Using illegal gear types; (iv) Without licensed crew members; (v) Without required safety equipment or certificate.			If indicator is < 5%, then Partner State to maintain current levels of enforcement and penalties.
Ecological To limit ecological impacts as a result of fishing activity to local, acceptable and reversible change.	Reduce the use of juvenile *Clarias* and haplochromine species as bait in the hook fishery.	Percentage of vessels per 1000 inspected each year that had baited their hooks with juvenile *Clarias* or haplochromine species.	<5%	Vessel inspections. Sanctioning (penalising) non-compliance.	If indicator is > 5%, Partner State to increase enforcement efforts (# of patrols and inspections) and penalties next year by 10%. If indicator is < 5%, then Partner State to maintain current levels of enforcement and penalties.
	Reduce the by-catch of Tilapia to acceptable levels.	% by-catch of Tilapia estimated from CAS.	<5%	Restrict/prohibit NP fishing in water < 20 m deep?	If target not achieved, increase depth during next review of the management plan.
	Conserve and protect NP spawning and nursery areas.	# of reports of fishing activity in each designated spawning and nursery area per 100 hours of surveillance effort.	<5	Restrict/prohibit all fishing activity in known NP spawning and nursery areas (existing closed areas) Create new closed/protected areas if required.	If indicator is > 5, partner state to increase surveillance (# of patrols) and penalties next year by 10%. If indicator is < 5, then Partner State to maintain current levels of surveillance efforts.
Economic	To maintain net income per fisher	Mean fisher (and crew) net income estimated from bi-	> National minimum	See those above. In spite of the necessary medium-	NA

To increase wealth generated by Nile perch fishing and related activities.	at a level above the national minimum desired income.	annual socio-economic studies following the methodology of (LVFO, 2020a).	desired income of Partner States as given in the national income survey.	term reductions to catches and catch rates necessary to rebuild the stock to more productive levels, fisher earnings (net income) are likely to remain well above minimum income thresholds of the Partner States. Reductions in net income may help to discourage further investment in fishing capacity.	
	To increase foreign exchange earnings (proceeds from the export of NP)	% change in the value of exports reported by Partner States.	+10% over five years	The value of exports of NP is expected to increase as the stock recovers and the mean size and unit value of fish landed increases in response to the management measures described above.	NA
Social To sustain the livelihoods and food security of those dependent on the Nile perch fishery.	To include as many of the existing participants in the fishery as is possible given the biological and economic objectives and constraints above.	Percentage change in the number of NP fishers reported in the bi-ennial frame survey. Number change in value added products and diversified Nile perch products	0	See those above.	NA

	To maintain the supply of fish for local consumption.	Percentage change in annual per capita consumption of Nile perch in Partner States estimated from fish consumption surveys.	0	See those above. In addition, consider institute community user rights	NA

2.8 Monitoring, Control and Surveillance, MCS

2.8.1 Monitoring for evaluating and adjusting this Plan.

Data to monitor the plan indicators against targets and to adjust the plan in accordance with the DCRs will be generated by the surveys given on Table 2.

Table 2 Types of surveys and their frequencies

Survey	Existing Survey (Y/N)	Reporting Frequency	Survey/Sampling Frequency
CAS	Y	Annual	Twice-annually
FS[1]	Y	Bi-ennial	Bi-ennial
HAS	Y	Annual	Annual
EFIA (Income/earnings survey)[1]	Y	Annual	Annual
Factory Reporting	Y	Annual	Monthly
Export Records	Y	Annual	Monthly
Fish Consumption Surveys	N	Bi-annual	Bi-annual

[1] This survey could be revised to include questions that can be used to estimate per capita fish consumption in the fishing communities.

2.8.2 Enforcement of the management measures

Existing control and surveillance operations appear currently ineffective and require strengthening to reduce IUU fishing activity. A strategy for control and surveillance operations should be prepared and agreed by the Partner States to be accompanied by a capacity strengthening assessment and plan. The strategy for control and surveillance operations should seek to include the following:

Inspections at landing sites and on the Lake

The strategy should include regular inspections of vessels and gears at landing sites and on the Lake to check that vessels are registered and licensed, and that gear units and gear types used by the vessel are consistent with the agreed management measures and license provisions. The catch should also be inspected to ensure that fish landed exceed the minimum landing size. Non-compliance should be reported and sanctioned in accordance with the appropriate legislation.

Catch sampling and Frame surveys at landing sites

The CAS should also be used as an opportunity to undertake the same checks as those undertaken for regular inspections of vessels and gear. Non-compliance should be reported and sanctioned in accordance with the appropriate legislation. Frame surveys report the number of prohibited gear types in operation in the fishery.

Surveillance of closed areas (NP spawning and nursery areas)

Regular surveillance activities (patrols) around closed areas should be undertaken by the fisheries administrations. Local fisher communities might also be organised to undertake surveillance activities, with support from the states for boats, equipment and operating budgets. Illegal fishing activities in closed areas should be reported to and investigated by the relevant state authorities to sanction non-compliance.

Factory (self-) Inspections

Factory self-inspections should continue with random checks/validation by relevant state authorities.

Boarder Inspections

Inspections of exports of Nile perch should continue and be strengthened at boarders following the guidance already prepared. Networks of operators and their financiers that are involved in the trade of undersized fish should be investigated and sanctioned.

2.9 Fisher Code of Conduct

A Fisher Code of Conduct should be formulated to support this management plan. All stakeholders will be required to familiarize themselves with this Conduct. It should set out the agreed best practice for fishers operating on the Lake. The Code would be voluntary (excepting legal and regulatory requirements identified above), and agreed with stakeholders as good practice. Fishers would be expected to comply with all these provisions. The Code would be issued to fishers on licensing their vessels and training would be organized so fishers are familiar with requirements and have given feedback to ensure all requirements are practical. Provisions could include:

- Safety: Minimum safety equipment and safety procedures.
- Catch quality: treatment of catches - cooling and minimal processing aboard to reduce post-harvest loss.
- Permitted fishing gear: Types and size of nets and hooks that can be used for fishing.
- Illegal and destructive fishing gear. Details of prohibited gears and gear operations.
- Closed areas. Details of closed areas to protect spawning and juvenile fish or to reduce by-catch.
- Co-operation with inspection activities, surveys and scientific studies.
- Disposal of waste: all waste, particularly plastics, are to be brought ashore and disposed of in the designated manner at landing sites.

2.10 Research Studies for MSC Certification

The following research studies and activities will also need to be undertaken to comply with the certification criteria of the MSC (Huntingdon & Hough, 2008) Table 3.

Table 3 Research Studies for MSC Certification

Principal	Description	Required studies / Action
1	Stock Monitoring	The genetic structure of the Nile perch stock needs further investigation in order to determine the impacts of fishing pressure, if any.
	Reproductive Capacity	The potential impact of fishing effort on the observed changes in the age at maturity and fecundity need to be investigated and understood, so appropriate management mechanisms can be put in place.
2	Gear Loss	The rate of gillnet loss, including the illegal monofilament nets used to target Nile perch and Nile tilapia, needs to be quantified and the potential ecosystem impacts (ghost fishing and the pollution effects of lost gear) estimated. This is also an issue for longlines, which although unlikely to ghost fish, have anecdotally high but unquantified rates of loss, which needs to be better understood.
	Ecosystem impacts	Assessment of potential ecosystem impacts of the fishery and confirmation that they are within acceptable limits. Note: Impacts are

		not likely to be major given the nature of the fishery. Preliminary analyses suggests that ecosystem impacts are minor at present.
3	Management measures	Identification (and implementation) of appropriate management measures to address any impacts ecosystem impacts of the fishery.

2.11 Financing

2.11.1 Requirements

Funds required for core management activities such as MCS have, in the past, been sporadic, uncertain and inadequate hindering the sustainable management of the resource. Sustainable and reliable financing mechanisms must be established. Based upon the OECD model, the annual cost of managing the NP fishery is estimated to be around 2.5% of the gross value of production (GVP) of the fishery. The GVP of the fishery was estimated to be $842 million in 2020 (LVFO, 2021a), hence total management costs are likely to be in the order of $21 million per year. This would be allocated across the three management activity categories according to the OECD model as follows:

- MCS: 40% ($8.4 million).
- Management services and administration: 34% ($7.1 million).
- Research: 26% ($5.5 million).

2.11.2 Sources of funds

Fees charged for NP fishing vessel and fisher licences ($250 and $20 per licence, respectively), and a 2% levy on the value of exports of NP fish and fish products will be utilised to meet the costs of implementing the NPFMPIII (Table 4).

Table 4 Sources of revenue to meet management costs

Revenue source	Units (approx.)	Unit revenue (US$)	Total revenue ($)
NP fishing vessel licence	43,000	250	$10,750,000
Fisher licenses	122,000	20	$2,440,000
Exports levy			
	$380,000,000	@2%	$7,600,000
Total			**$21,000,000**

2.12 Procedures for Evaluating, Adjusting and Revising the Management Plan.

The LVFO RWGs will convene each year to estimate the indicators summarised in the plan following the submission of the routine survey reports. Progress towards the achievement of the objectives set out in the plan will be assessed and reported by the RWG for SA. The RWG for SA will also update relevant stock assessments and recommend adjustments to the management measures in accordance with the DCRs. These recommendations should be submitted to the CoM for approval and subsequently implemented by respective Partner States through the issuance of updated relevant legislation and/or guidance.

Fishers and other stakeholders should be made aware of any adjustments to the management measures by means of appropriate media and methods.

After 5 years, more substantive revisions to the plan should be considered by the RWGs in the light of the performance of the plan and lessons learned. Proposals for any revisions will be finalized after broader stakeholder consultations.

2.13 Priority Action to Implement the Plan

Table 5 Priority Action to Implement the Plan

Goals	Objectives	Management Measures	Tasks	Responsible	Completion Date
Biological To maintain the Nile perch stock at or above the level necessary to ensure its continued productivity.	To maintain the stock at all times above 50% of its mean unexploited level.	Fishing effort/mortality control: 1.Moratorium on issuance of new NP fishing vessel licenses to control (limit) fishing effort, *f*.	1. Complete registration of all NP fishing vessels and update vessel registers incl. E-CAS.	Partner states	2023
			2. Prepare Fisher Code of Conduct and accompanying guidance notes.	LVFO	2023
			3. Complete the issuance of NP fishing licences to vessel owners and accompanying Fisher Code of Conduct. Update license registers incl. E-CAS.	Partner States	2023
			4. Prepare an MoU agreeing a moratorium on issuance of new NP fishing vessel licenses. Partner States to sign MoU.	LVFO and Partner States	2024
			5. Partner States to instruct District Level Managers not to issue any further vessel licenses. Evidence of instructions to be shared with LVFO.	Partner States	2024
		2. Restrict the # of gear units (e.g. hooks or gillnets/gillnet panels) permitted per vessel type to control vessel catchability, *q* and thereby the overall finite fishing	1. Update estimates of catch and standardised fishing effort.	LVFO RWGs	2022
			2. Update estimates of *B*, MSY and F_{MSY}. Estimate # of gillnets and hooks corresponding to MSY. Estimate # of gillnets or hooks that can be used per hook- and gillnet-vessel based upon the DCR.	LVFO RWGs	2022

		mortality rate, *F* to target level (F_{MSY}) where *F=fq*.	3. Obtain approval from the FASCoM to implement gear number restrictions through relevant national legislation and stakeholders awareness raising campaigns. Partner States to implement recommendations and campaigns.	LVFO and Partner States	2023
	To strengthen compliance with existing management measures.	Existing. Ensure all non-compliance is sanctioned.	1. Review whether the existing minimum landing size (50cm) protects mature fish and would ensure the production of new recruits to the fishery under the existing fishing mortality rates, and fishing mortality rates corresponding to MSY (F_{MSY})[1]. Recommend changes to the existing minimum landing size if appropriate and seek regional approval. Partner States to update legislation if necessary.	RWG SA, LVFO, and Partner States.	2023
			2. Review, harmonise and update legislation for other existing technical measures.	LVFO and Partner States.	2023
			3. Assess the contribution made by illegal gears to the overall fishing mortality rate, *F* experienced by the stock to guide MCS strategy development and enforcement efforts.	RWG SA	2023
			4. Prepare a strategy for control and surveillance operations including inspections at landing sites, factories and on the Lake, and surveillance operations	LVFO and Partner States.	2023

[1] An initial assessment is provided in the Annex. This should be updated once more complete selectivity studies have been undertaken.

			around closed areas to enforce existing and new management measures in accordance with the legislation. Prepare a capacity strengthening assessment and plan to accompany the strategy. Strengthen capacity and implement the strategy. Report and sanction non-compliance.		
Ecological To limit ecological impacts as a result of fishing activity to local, acceptable and reversible change.	Reduce the use of juvenile *Clarias* or haplochromine as bait in the hook fishery.	Vessel inspections. Sanctioning (penalising) non-compliance.	See above.	Partner States.	2023
	Reduce the by-catch of Tilapia to acceptable levels.	Restrict/prohibit NP fishing in water < 20 m deep (shallow waters)?	1. Undertake research to identify a minimum depth for NP fishing to reduce by-catch of Tilapia to acceptable levels.	RWG SA.	2022
			2. Prepare and update relevant fisheries legislation to control NP fishing in accordance with the minimum depth.	Partner States.	2022
			3. Raise awareness of the new legislation among fishers and other relevant stakeholders.	Partner States.	2022
	Conserve and protect fish spawning and nursery areas, and other critical habitat.	Restrict/prohibit all fishing activity in NP spawning and nursery areas and in other areas of critical habitat	1. Identify and map existing and newly identified NP spawning, nursery and others areas of critical habitat.	LVFO and Partner States.	2023
			2. Prepare and update relevant fisheries legislation to control fishing in existing and newly identified NP spawning, nursery and critical habitat areas.	Partner States.	2023

			3. Raise awareness of the new legislation among fishers and other relevant stakeholders.	LVFO and Partner States	2023
Social To sustain the livelihoods and food security of those dependent on the Nile perch fishery.	To maintain the supply of fish for local consumption.	See above.	Review whether the existing FS or Socio-economic surveys could be revised to provide adequate estimates of per capita fish consumption. If no, then design and implement a bi-annual fish consumption survey capable of providing estimates of consumption by species in member states.	LVFO and Partner States	2024
Research/ Scientific Studies for MSC Certification			1. Genetic structure of Nile perch.	LVFO and Partner States	2025
			2. Impact of fishing effort on age at maturity and fecundity.		2023
			3. Gillnet and longline loss rates and potential ecosystem impacts (ghost fishing and pollution effects).		2023
			4. Ecosystem impacts of the fishery and identification of appropriate management measures to address any impacts.		2024

2.14 Formal Adoption of this Plan.

Add details after plan has been approved.

Annex

Nile perch biomass estimates

Table 6 Estimates of Nile perch biomass derived from hydroacoustic surveys undertaken during the mixed and stratified lake periods. Data source: LVFO (2020).

	Nile perch biomass (t)		
Year	Mixed	Stratified	Mean
1999	754,546		
2000	820,892	1,619,103	1,219,998
2001	1,447,029	1,321,900	1,384,465
2002	1,601,497		1,601,497
2003			
2004			
2005	1,231,355		1,231,355
2006	1,441,636	1,175,980	1,308,808
2007	742,050	2,009,748	1,375,899
2008	549,174	986,711	767,942
2009	762,625	911,406	837,016
2010		861,681	861,681
2011	940,180		940,180
2012			
2013			
2014			
2015		683,180	683,180
2016			
2017		614,694	614,694
2018		553,770	553,770
2019	816,694		816,694
2020	1,024,623		1,024,623

Notes: Biomass estimates for the stratified period (February-March) are thought to be more reliable compared to those estimated for the mixed period (August-September) when fish can inhabit the well oxygenated water column including the lake bed area (Table 6). Distinguishing fish from the lake bed during this period can be problematic hampering the accurate detection of fish. Swimbladder size is also likely to be more variable as fish are distributed at different depths in the water column during this period. Fish size and weight predicted from target strength models may therefore be imprecise during this period when fish could be distributed over a wider range of depths. Fish swimbladder volumes will vary for a fish of the same size/weight depending upon its vertical position in the water column (LVFO 2013). Indeed, in an attempt to reduce survey costs, the LVFO have recommended that the HAS be undertaken only during the stratified period for these reasons (Anthony Taabu-Munyaho pers. comms.).

The LVFO also advised that the NP biomass estimate for 2007 (approximately 2 M t) is unreliable because it suggests that NP biomass approximately doubled between 2006 and 2007, and is three

times larger than the corresponding estimate for the mixed season. It is believed that equipment calibration errors may have been responsible for this apparent bias LVFO (2013).

Table 7 Correlations between NP biomass, measures of fishing effort and biomass of prey species.

Pearson Correlation Matrix			
	r	*p*	*n*
# Fishers	-0.929	0.015	7
# Boats	-0.878	0.056	7
# Outboards	-0.949	<0.001	7
# Hooks	-0.987	<0.001	7
Dagaa biomass (t)	-0.656	0.94	6
Other biomass (t)	-0.579	1	6

Recovery of stock biomass between 2018 and 2020.

The most recent hydroacoustic survey (2020) that was undertaken during the mixed lake period indicated that NP biomass has increased by more than 100% since 2018. Using the following biomass dynamics model and assuming that catch in both 2018 and 2019 was 200,000 t (assuming that about 50% of the catch was exported), and the unexploited biomass is 2,000,000 t (LVFO, 2013, Musinguzi et al., 2020):

$$B_{t+1} = B_t + rB_t\left(1 - \left(\frac{B_t}{K}\right)\right) - C_t$$

It can be shown that such a rapid recovery would require that the annual intrinsic rate of population growth (*r*) of the stock has a value of at least 1. This seems implausible because it would translate to an MSY of more than 500,000 t per annum. All previous estimates of *r* and MSY range from 0.4 to 0.45, and 200,000 t yr^{-1} to 246,000 t yr^{-1}, respectively (LVFO, 2013, Musinguzi et al., 2020).

Fishing Mortality, F

Using estimates of Nile perch catch and biomass, LVFO (2013) reported a significant increase in the instantaneous rate of fishing mortality F from 0.13 yr^{-1} to 0.39 yr^{-1} between 2000 and 2010 (Figure 8). Musinguzi et al (2020) estimated *F* in 2015 to be 0.37 yr^{-1} (95% CI 0.262-0.555). This is close to the value for 2010 estimated by LVFO (2013).

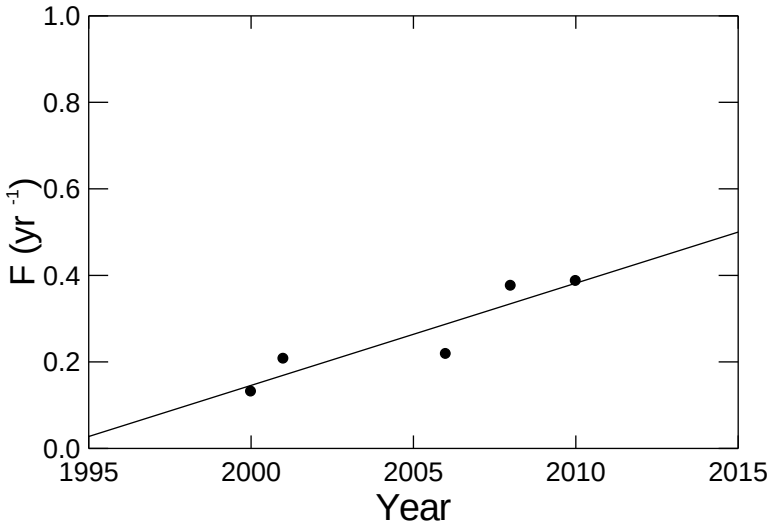

Figure 8 Estimates of *F*, 2000-2010 with fitted regression model. R^2=0.84, P<0.03. Source: LVFO (2013).

Comparison of recent stock assessments

Table 8 Comparison of parameter estimates and reference points derived from recent Nile perch stock assessments

			LVFO (2013)		Musinguzi et al (2020)			
Parameter or Reference Point	**Abbrev.**	**Units**	**Year**	**Estimate**	**Year**	**Estimate**	**95% CI**	
Unexploited biomass	B_0 (or K)	t	LTA	1,904,700	LTA	2,160,000	1,350,000	3,454,000
Intrinsic rate of population growth	r	yr^{-1}	LTA	0.42	LTA	0.46	0.34	0.61
Current biomass	B	t	2013	674,000	2015	547,000	365,000	774,000
Biomass as a proportion of B_0	B/B_0	ratio	2013	0.35	2015	0.25	0.27	0.22
Instantaeous fishing mortality rate	F	yr^{-1}	2013	0.39	2015	0.46	0.30	0.81
Finite fishing mortality rate	F	yr^{-1}	2013	0.32	2015	0.37	0.26	0.56
Instanteous fishing mortality rate range	F range	yr^{-1}	2000-2010	0.13 - 0.39	-	-	-	-
Maximum sustainable yield	MSY	t	LTA	199,313	LTA	246,000	206,000	294,000
Biomass corresponding to MSY	B_{MSY}	t	LTA	952,350	LTA	1,080,000	675,000	1,727,000
Instantaneous fishing mortality rate at MSY	F_{MSY}	yr^{-1}	LTA	0.23	LTA	0.26	0.36	0.19
Finite fishing mortality rate at MSY	F_{MSY}	yr^{-1}	LTA	0.21		0.23	0.31	0.17
Vessel catchabilty	q	per vessel	2013	4.79E-06	-	-	-	-
Number of vessels for MSY	f	vessels	2013	43,692				
Instantaneous natural mortality rate	M	yr^{-1}	LTA	0.3	-	-	-	-
Exploitation ratio	$E=F/Z$	ratio	LTA	0.57	-	-	-	-
Relative stock size	B/B_{MSY}	ratio	2013	0.71	2015	0.51	0.54	0.45
Relative (finite) fishing mortality rate	F/F_{MSY}	ratio	2013	1.54	2015	1.62	1.09	3.65

Table 9 Existing management measures applicable to the Nile perch fishery not including post-harvest.

		Extent of adoption / compliance with reasons		
Regionally Agreed Measure	**Details**	**Kenya**	**Tanzania**	**Uganda**
Nile perch vessel registration	Registration and marking of all vessels targeting Nile Perch.	Adopted	Adopted	Adopted
Nile perch fishing licence	Species specific licensing	Adopted	Adopted	Adopted
Limit fishing capacity	Limit Fishing Capacity to levels observed in 2015.	Not adopted	Not adopted	Not adopted
Closed season	Closed Season for two calendar months per year to reduce overall fishing effort and protect spawning or pre-spawning fish.	Not adopted	Not adopted	Not adopted
Closed areas	Existing national regulations to protect spawning/nursery areas.	Breeding areas gazetted 1 April – 31 July	24 closed areas 1st Jan-30 June	One LPA identified but not gazetted
Minimum and maximum landing size	50-85 cm (LVFO Council of Ministers decision, 2002).	50 cm min size	50 cm min size	50 cm min size
Hook size range for Nile Perch	Size 4-9 (LVFO Council of Ministers decision, 2009)	Not specified	8-11	Minimum size 9
Passive set gillnet minimum mesh size.	7 inch (LVFO Council of Ministers decision, 2009).	5inch (127mm)	6 inch (152.4mm)	7inch (177.8 mm)
Monofilament gill nets	Prohibited	Prohibited	Prohibited	Prohibited
Drifting gill nets	Prohibited (LVFO Council of Ministers decision, 2004)	Prohibited	Prohibited	Prohibited

		Extent of adoption / compliance with reasons		
Regionally Agreed Measure	**Details**	**Kenya**	**Tanzania**	**Uganda**
Vertical extension of gill net depth and number	Not prohibited	Not prohibited	Allowed up to 3 panels	Allowed up to 3 panels
Cast nets	Prohibited	Prohibited	Prohibited	Prohibited
Beach seines	Prohibited	Prohibited	Prohibited	Prohibited
Active gill netting by beating water and driving fish into nets.	Prohibited	Prohibited	Prohibited	Prohibited
Trawling	Prohibited	Prohibited	Prohibited	Prohibited
Purse seining	No regionally agreed measure.	No legislation	No legislation	Prohibited
Fishing with chemicals and herbicides	Prohibited	Prohibited	Prohibited	Prohibited
Traps and weirs across rivers and river mouths	Prohibited	Prohibited	Prohibited	Prohibited
Length of fishing vessels	No regionally agreed measure	Not specified	Not specified	Vessels <7m Prohibited

Table 10 LVFO Routine Monitoring Surveys: Target and achieved frequency per annum (2005 – 2020). Shading indicates target frequency not achieved.

Year	Frame survey		CAS		Acoustic survey		Trawl survey		Factory reporting		Factory sampling	
	Target	Actual	Target	Actual	Target	Actual	Target	Actual	Target	Actual	Target	Actual
2005			3	3	2	1	2	3	12	12	2	0
2006	1	1	3	3	2	2	2	2	12	12	2	0
2007			3	3	2	2	2	2	12	12	2	0
2008	1	1	3	2	2	2	2	1	12	12	2	0
2009			3	0	2	2	2	0	12	12	2	1
2010	1	1	3	1	2	2	2	0	12	12	2	0
2011			3	1	2	1	2	0	12	12	2	0
2012	1	1	3	0	2	0	2	0	12	12	2	0
2013			3	0	2	0	2	0	12	0	2	0
2014	1	1	3	2	2	0	2	0	12	0	2	0
2015			3	1	2	1	2	0	12	0	2	0
2016	1	1	3	0	2	1	2	0	12	0	2	0
2017			3	0	2	1	2	1	12	0	2	0
2018	1	0	3	0	2	1	2	0	12	0	2	0
2019			3	0	2	1	2	0	12	0	2	0
2020	1	1	2	0	2	1	2	0	12	0	2	0
2021			2	2	2	1	2	0	12	1	2	1

MSC Certification requirements – main points to be addressed following the Pre-Assessment undertaken in 2008.

1. Fishing effort to be recorded by species, gear type and size (mesh/hook).
2. Reference points should be adopted in a fisheries management plan.
3. Regular evaluations (stock assessments) to be performed against these reference points.
4. Harvest (decision) control rules are required to control harvests by means of effort controls.
5. Stock biomass to be rebuilt to acceptable levels.
6. Stock size shown to be recovering.
7. Clear management objectives should be formulated.
8. Identification and protection of NP critical habitat.
9. Specific research studies (as listed in the proposed plan).

Table 11 The Fisheries Certification Requirements v2.0 (MSC, 2014)

A	Irreversibility of the introduction in the new location
i	The introduced species has a large population size (comparable to or larger than the population sizes of other native species occupying similar ecological niches in the new location).
ii	The species has spread to a range beyond that of its initial introduction in the new location.
iii	There is evidence to demonstrate that the species cannot be eradicated from the location by known mechanisms without serious ecological, economic and/or social consequences.
B	**History of the introduction**
i	The species was introduced to the new location prior to 1993; this being the year that the Convention on Biological Diversity (CBD), which includes provisions on introduced species was ratified.
ii	If the introduction occurred after the CBD was ratified such fisheries shall only potentially be in scope if the introduction was non-deliberate and occurred at least 20 years prior to the date the application is made for assessment against the MSC standard.
C	**No further introductions**
i	There is no continuing introduction of the introduced species being considered for certification to the location (i.e., the species is now entirely self-sustaining in its new location).

Useful formulae

Finite Rate of *F*: $F\ (finite) = fq$

Finite Rate of *F*: $F\ (finite) = 1 - \exp(-F)$

Instantaneous rate of *F:* $F = -\ln(1 - fq)$

Instantaneous rate *F*: $F = -\ln(1 - \frac{C}{B})$

Catch, *C*: $C = Bfq$

Catchability, q:

$q = \frac{C}{Bf}$

Stock assessment

Analytically derived reference points based upon yield-per-recruit analysis.

'Yield' software (Hoggarth *et al.*, 2006) was used to estimate two important reference points for the fishery for the current length at first capture (50cm): (i) the fishing mortality that would maximise yield-per-recruit (F_{maxYPR}), and the fishing mortality that would give rise to a spawning potential ratio (SPR) of 0.3 ($F_{30\%SPR}$) – a common limit reference point used to protect the stock from recruitment overfishing.

Input parameters

Mean estimates and coefficients of variation (cv) of VBGF and mortality parameters were derived from estimates given in (LVFO, 2013) . All parameter values were assumed to be normally distributed. In the absence of data, it was assumed that the cv for the age at first capture was 0.2 (Figure 9).

Table 12 Parameter estimates

Parameter	**mean**	**cv**
Asymptotic length, $L\infty$ (cm)	195	0.2
VBGF parameter, *K* (yr^{-1})	0.19	0.25
Age at zero length, t_0 (years)	0	0
L-W constant, *a*	0.008	0.15
L-W exponent, *b*	3.12	0.009
Length (age) at maturity, Lm_{50} (cm)	50 (1.5 years)	0.2
Length (age) at first capture, t_c (cm)	50 (1.5 years)	0.2
Natural mortality, *M* (yr^{-1})	0.3	-

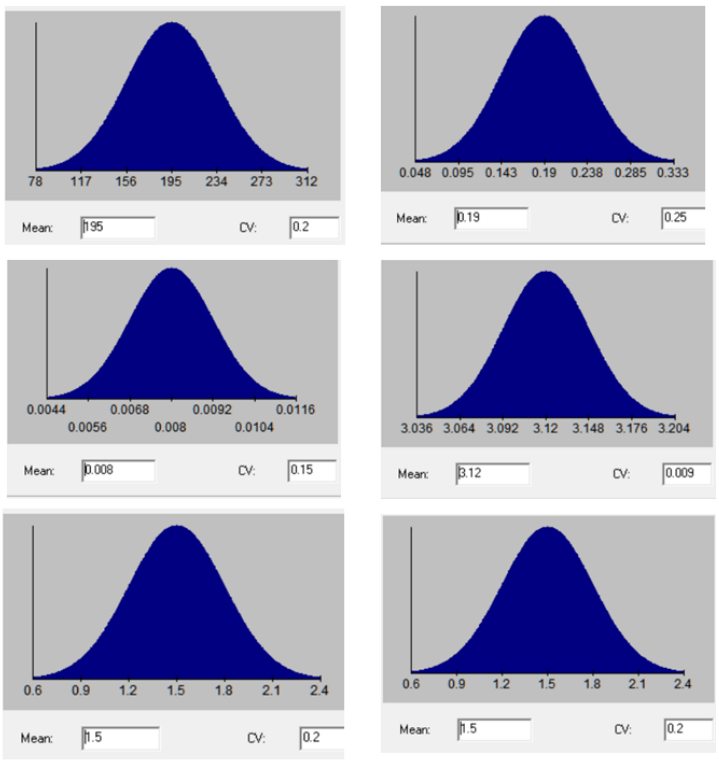

Figure 9 From left to right and top to bottom: Linf, K, length-weight parameters a, length-weight parameter b, age at maturity and age at first capture corresponding to a length at maturity and first capture of 50cm.

Results

The instantaneous mortality rate that would maximum yield-per-recruit is estimated to be about 0.25 yr^{-1} (**Table**). To maintain a SPR above 30%, *F* should not exceed 0.23 yr^{-1}. These rates are high consistent with those corresponding to maximum sustainable yield estimated during previous assessments using biomass dynamics models (**Table**). The more precautionary rate ($F_{0.1}$) was estimated to be 0.15 yr^{-1} (**Table**). Assuming that the unexploited biomass is around 2 million tonnes, this rate would yield about 140,000 t yr^{-1}, compared to the maximum yield of 200,000 – 220,000 t yr^{-1}.

Table 13 Estimates of YRP reference points for the NP fishery

Reference Point	Estimate yr^{-1}	
	Instantaneous rate	Finite rate
F_{maxYPR}	0.25	0.22
$F_{30\%SPR}$	0.23	0.20
$F_{0.1}$	0.15	0.14

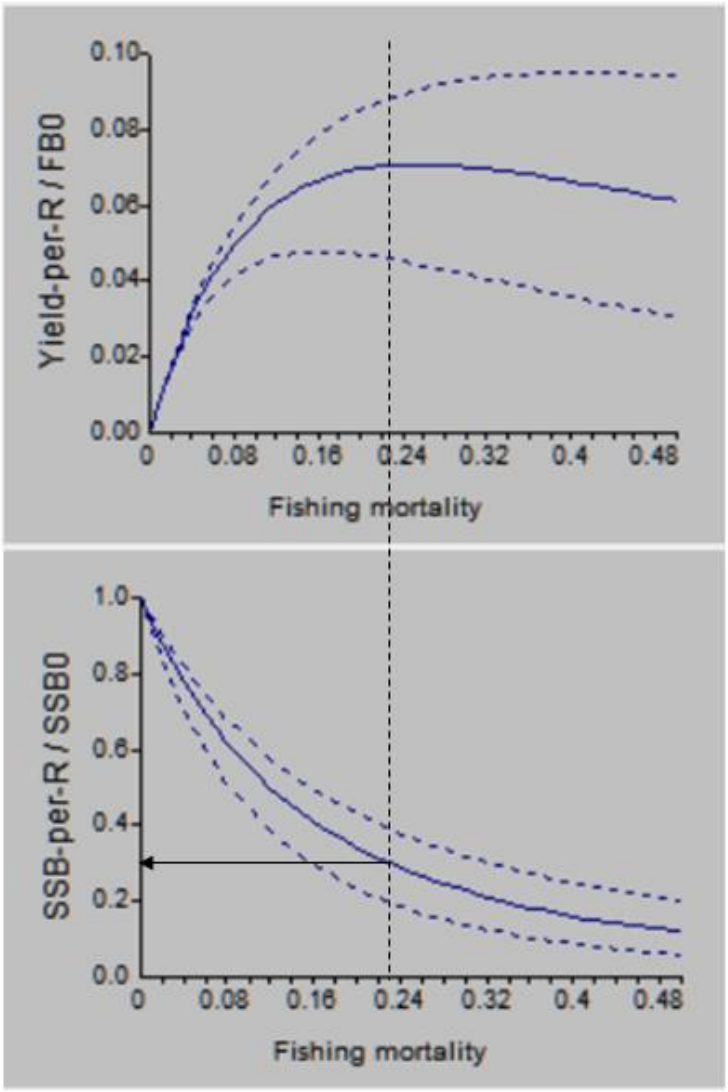

Figure 10 YPR and SPR as a function of instantaneous fishery mortality rate F. Broken line at F=0.23 corresponding to 30% SPR.

References

Halls, A.S. (2019) Review And Update Of Standard Operating Procedures For Conducting Catch Assessment And Frame Surveys On Lake Victoria. Consultation workshop with members of the RWG for CAS, FS and SA. Nairobi, Kenya, September 23-27, 2019.

Hoggarth, D.D., Abeyasekera, S., Arthur, R., Beddington, J.R., Burn, R.W., HALLS, A.S., Kirkwood, G.P., McAllister, M.K., Medley, P., Mees, C.C., Parkes, G., Pilling, G.M., Wakeford, R.C. & Welcomme, R. (2006) Stock assessment for fishery management *FAO Fisheries Technical Paper***,** 261.

Huntingdon, T. & Hough, A. (2008) Pre Assessment Report for: The Nile Perch Fishery on Lake Victoria. MOODY MARINE LTD May 2008, Ref: 82069, 93pp.

LVFO (2013) Review and Update Nile Perch Fishery Management Plan (NPFMP) for Lake Victoria. ACP Fish II N° EA-1.2-B3, an assignment by SOFRECO under the EU-funded ACP Fish II programme, 82pp.

LVFO (2015) Nile Perch Fishery Management Plan for Lake Victoria, 2015-2019. LVFO, April 2015, 56pp.

LVFO (2016) STOCK ASSESSMENT REPORT. REPORT ON REGIONAL STOCK ASSESSMENT MEETING, LAKE VICTORIA ENVIRONMENTAL MANAGEMENT PROJECT-PHASE TWO (LVEMP-II), ENTEBBE, UGANDA, 7TH - 9TH APRIL, 2016, 50pp.

LVFO (2019a) The Standard Operating Procedures for Catch Assessment Surveys. December 2019, 54pp.

LVFO (2019b) The Standard Operating Procedures for Frame Surveys. December 2019, 25pp.

LVFO (2020a) REGIONAL SYNTHESIS REPORT ON THE ECONOMIC AND FINANCIAL IMPACT ASSESSMENT OF LAKE VICTORIA FISHERIES. LVFO Secretariat, December 2020, 28 pp.

LVFO (2020b) A REPORT OF THE LAKE VICTORIA HYDRO-ACOUSTIC SURVEY, 20th October - 25th November 2020, Hydro-acoustics Regional Working Group, 105pp.

LVFO (2021a) Evaluation of the status of the implementation of the Nile Perch Fisheries Management Plan Two (NPFMP-II) and the development of the NPFMP-III. September 2021, xxpp.

LVFO (2021b) FISHERIES MANAGEMENT PLAN IV (FMP IV): 2021-2026. Increasing and Sustaining Production and Value of the Fisheries of Lake Victoria Basin and Aquaculture Resources to contribute to Blue Economy growth in the EAC, 80pp.

MSC (2014) MSC Fisheries Certification Requirements and Guidance v2.0, 1st October 2014. Marine Stewardship Council 2014, 528pp.

Musinguzi, L., Olokotum, M. & Natugonza, V. (2020) Status and targets for rebuilding the three major fish stocks in Lake Victoria, 23pp.

LAKE VICTORIA FISHERIES ORGANIZATION SECRETARIAT

Plot 7B/E Busoga Square, Bell Avenue

P. O. Box 1625, Jinja-Uganda

Tel: +256 434 125000

email: lvfo-sec@lvfo.org, Website: www.lvfo.org

Printed with support from:

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH