NATIONAL REPORT OF THE CATCH ASSESSMENT SURVEYS ON LAKES EDWARD AND ALBERT, UGANDA

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CLIENT	**Nile Basin Initiative / Nile Equatorial Lakes Subsidiary Action Program (NBI / NELSAP)** **Attention:** Regional Coordinator KN 81 St., Kigali City Tower – 5th Floor P.O. Box 6759 Kigali – Rwanda E-mail: enyabeeya@nilebasin.org&nelsapcu@nilebasin.org
CONSULTANT	**National Fisheries Resources Research Institute (NaFIRRI)** **Attention**: Director, NaFIRRI Nile Crescent, Plot 39/45, Jinja, P.O. Box 343, Jinja, Uganda E-mail: director@firi.go.ug

Authors: Names and affiliation

Nakiyende[1] H.,Olokotum[1] M., Nduwayesu[1] E.,Basooma[1] A., Bassa[1] S., Mangeni[1] R. S, Nansereko[1] F., Mudondo[1] P., Mugeni[1] B., Muhumuza[1] E., Bakunda[2] A., Byamukama[2] P., Mangeni[2] R, Bukirwa[1] S., Kawesi[1] E., Mulowoza[1] A., Ikwaput Nyeko[2] JRukunya[2] E. & W. Nkalubo[1].

[1]National Fisheries Resources Research Institute (NaFIRRI), P.O. Box, 343, Jinja
[2]Directorate of Fisheries Resources (DiFR), P.O. Box 4, Entebbe

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Executive Summary

Monitoring fish stocks in relation to species composition, abundance, distribution, catch, fishing effort and fish population structure is required for sound management of the fisheries resources. Catch Assessment Surveys (CASs) are important tools for monitoring trends in the fish catches, gear selectivity and exploitation patterns to inform development planning and management decisions. Catch Assessment Surveys on lakes Albert and Edward systems have, been characterized with inconsistencies due to inadequate financial and logistical support. This has led to either scarcity or scanty information on trends of the fish catches from the two systems.

CAS activities on lakes Albert and Edward systems were, supported by the Nile Basin Initiative / Nile Equatorial Lakes Subsidiary Action Program (NELSAP) in 2 consecutive years, 2019 and 2020. NELSAP is under the Multinational Lakes Edward and Albert Integrated Fisheries and Water Resources Management (LEAF II) Project. The 2020 studies, 36 landing sites (22 on Albert and 14 on Edward, George and Kazinga channel) were sampled. Data collection from all the systems was, done both the enumerators, Fisheries Officers at the district level in conjunction with both NaFIRRI and DiFR staff following the standard operating procedures for Catch assessment.

Annual production was estimated at 8668.8 tons from the three systems comprising of; Edward (3310.6 t, 40.1%); George (4488.9 t, 54.3%); & Kazinga Channel (869.3 t, 10.5%). The total catch was valued at UGX 51.23 billion shillings (bn) hence; Edward (UGX 19.3 bn; 37.7%); George (UGX 27.19 bn, 53.07%); & Kazinga Channel (UGX 4.75 bn, 9.27%). Lake Albert, recorded an increase in total catches from 335,474.6 t to 348,535.8 t in years 2019 and 2020 respectively hence 3.8% increment.. During the samplings >70% comprised of the two small pelagic species; *Engraulicypris nurse* and *Brycinus nurse*. This was followed by one of the, demersal fishes of Nile perch. Lake Albert recorded an increase in terms of value of the fishes produced as compared to the later years.. Despite dominating the annual catch, the combined contribution of *E. bredoi* and *B. nurse* annual revenue was only 35.3% compared to the 20.1% from Nile perch that constituted < 10% of the lake annual catch production.

Information from the three systems show increase in the annual production in both total catches and value. However, fishes harvested from Lake Albert, the size structure of the commercial fishes indicate to be below the recommended sizes in accordance to Fisheries Act 2020. Then for Lake Edward system the catches were from the recommended gears thus with in the fisheries laws. This was attributed by, the enforcement and fisheries officers in that system. This can be also be applied on Lake Albert that has shown economic importance of the large sized species, particularly Nile perch whose annual beach revenue far superseded that of the dominant small pelagic; *Engraulicypris nurse* and *Brycinus nurse* to curb illegalities.

The low economic returns from the two dominant small sized fish species *E. nurse* and *B. nurse* stresses the need to improve fish handling facilities appropriate for these fishes. This will help in the promotion of the fishes for human consumption in addition to animal feed that has been at the dominant scale.

In the future developments, it would be of value to have , fishery independent stock assessment studies (fisheries trawls and hydro-acoustics) as a backup on the FS and CAS (fishery dependent studies) in these water

bodies to guide management on the stock levels, biomass and the maximum sustainable yield. This information will help us in sustainable utilization of the lake resources in the two shared water systems the through. Co-management systems and legal fisheries framework.

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Acronyms

AFO:	Assistant Fisheries Officer
BMU:	Beach Management Unit
B:	Boat activity coefficient
bn:	Billion
CAS:	Catch Assessment Survey
COVID-19	Corona Virus Disease-2019
CPUE:	Catch per Unit Effort
DFO:	District Fisheries Officer
DiFR:	Directorate of Fisheries Resources
DRC:	Democratic Republic of Congo
FO:	Fisheries Officer
FPU:	Fisheries Protection Unit
FS:	Frame Survey
Kg:	kilogram
LEAF II:	Multinational Lakes Edward and Albert Integrated Fisheries and Water Resources Management
LVFO:	Lake Victoria Fisheries Organization
MoH:	Ministry of Healthy
MUZARD:	Mukono Zonal Agricultural Research and Development
NaFIRRI:	National Fisheries Resources Research Institute
NELSAP:	Nile Basin Initiative / Nile Equatorial Lakes Subsidiary Action Program
NWG:	National Working Group
PSU:	Primary Sampling Units
R:	R programming language
RWG:	Regional Working Group
SENADEP:	Service National de Dévelopment et de Promotion de la Pêche
SOP:	Standard Operating Procedures
t:	Tons
UPDF	Uganda People's Defense Force

INTRODUCTION

1.1 Background

The Nile Equatorial Lakes Subsidiary Action Program (NELSAP) regional implementation unit signed a contract with the National Fisheries Resources Research Institute (NaFIRRI) to undertake lake-wide Frame Surveys (FS) and Catch Assessment Surveys (CAS) on the Uganda sector of lakes Edward and Albert under the Multinational Lakes Edward and Albert Integrated Fisheries and Water Resources Management Project (LEAF II). NaFIRRI on the Ugandan side and *Service National de Dévelopment et de Promotion de la Pêche* (SENADEP) on the Democratic Republic of Congo (DRC) side of the lakes jointly implemented synchronized, FS and CAS activities, following the harmonized Standard Operating Procedures (SOPs) of August 2017. In 2018, FS activities were implemented followed by the first phase CAS in April and July 2019. The second phase of CASs earlier planned for April – June 2020 was, interrupted by the COVID-19 pandemic and therefore, was re-scheduled to November 2020. The FS data of 2018 provided raising factors (RF) that were used to estimate the lake-wide total catches for 2020.

NaFIRRI and Directorate of Fisheries Resources (DiFR), fisheries coordinated the CAS on the Uganda side, in collaboration with staff of the respective District Local Governments, the LEAF II National Implementation Unit, and selected personnel (enumerators) from fisher communities of riparian districts of; Kitagwenda, Kasese, Rukungiri, and Rubirizi on Lake Edward and Pakwach, Buliisa, Hoima, Kikuube, Kagadi and Ntoroko on Lake Albert. During the implementation, the project has built stakeholders capacity for fisheries managers at district, sub-county and landing site management committees' that was used in the fisheries dependent data collection LEAFII project. This to ensure that we build capacity in the fisheries sector right from the grass root.

1.2 The relevance of CASs in fisheries management

Catch Assessment Survey (CAS) is a systematic evaluation of the catch landed by artisanal or commercial fishers (harvest sector) to provide trends in the fisheries harvest from a water body and their economic value. Information generated through CASs, particularly catch-per-unit-effort (CPUE) and annual catch is used to input into fisheries stock assessment models to estimate allowable catch and harvest rates as well as guiding planning, development, and management of the fisheries resources. This 2020, second phase of CAS supplemented the first phase that had been conducted in 2019. After analysis, a comparison on major outputs that include:

i. Fish species composition and the contribution to the total catch;
ii. The catch rates (CPUE) by vessel gear combination (effort);
iii. Information on type and sizes of fishing gears, and harvesting methods used to target the different fish species and their contribution to the catch.
iv. The total monthly and annual catch by species, category of fishing boats, and gears in the riparian local administrative units;
v. The monthly and annual monetary value of the fish landed at beach level;
vi. Trends and changes of different fish species between different areas, seasons, gear types and gear sizes.
vii. Fish population/size structure for the major commercial species.

METHODOLOGY

2.1 Approaches to CASs on lakes Edward and Albert

The previous CASs on lakes Albert and Edward of 2000 to 2016 were *ad-hoc*, however the two surveys of 2019 and 2020 were, implemented in a coordinated and harmonized in the two countries. The 2020 CAS commenced in August, with pre–survey National Working Group (NWG) planning meetings at Mukono Zonal Agricultural Research and Development Institute (MuZARDI), TJ Global Hotel (Kasese district), and Miika Eco-Resort Hotel (Hoima district). The meetings focused mainly on scheduling CAS activities in line with the COVID-19 health guidelines and restrictions. These were followed by the selection and training of enumerators and supervisors as well as updating CAS tools .

2.2 National technical planning meeting

The two NWG pre-survey planning meetings were convened concurrently at two venues: TJ Global Hotel in Kasese District for Lake Edward participants and Miika Eco Resort Hoima District for Lake Albert participants on the 15th August 2020 (**Plates 1 & 2**). The meetings targeted the technical NWG group members (Appendix 6 & 7), comprising of the key experts from NaFIRRI,DiFR, the National LEAF II Fisheries Expert, fisheries staff (District Fisheries Officer (DFOs) and Fisheries Officers (FOs) . The local government officers were from the riparian districts of Kitagwenda, Rukungiri, Kasese, and Rubirizi on Lake Edward and Pakwach, Buliisa, Hoima, Kagadi, Kikuube, and Ntoroko on Lake Albert.

The purpose of the NWG pre-survey meetings were to;- (i) brief participants on progress of fisheries research activities supported by NELSAP-LEAF II Project.(ii) Re-schedule and develop an effective implementation plan for CAS activities (**Appendix 15**) to avoid overlap with other activities involving the key stakeholders. (iii) Interface and train CAS supervisors, enumerators and review the field logistics. (iv) Review and customize data collection tools (**Appendix 2, 3,4 & 5**),. (v) Then update records of landing sites to form the Primary Sampling Units (PSU) for CASs following the incidences of increased water levels and flooding on some landing sites. (v) Identify roles of key stakeholders including fisheries protection unit (FPU), anticipated challenges and mitigation measures for the second phase of data collection.

The five landing sites previously sampled on Lake Edward in 2019 (**Figure 1)** and 22 on Lake Albert (**Figure 2 and Appendix 1**) were maintained. In addition to the field supervisors,70 CAS enumerators were identified for each of the selected CAS landing sites ,trained on the CAS tool from lakes Albert and Edward systems **Appendix 6 and 7**). Additionally, key inputs and logistics for the CASs were also identified and included stationery such as notebooks, clipboards, sharpeners, torches, tonner, paper, pencils, pens, erasers/rubbers, and water-proof bags) and personal protective equipment (PPE) (*e.g.*, life jackets, gumboots, raincoats, umbrellas, gloves) for the field enumerators and supervisors. Data collection equipment provided included: 100 kg weighing scales, 20 meter tape measures and 100 cm measuring boards. At the planning meeting, some adjustments were made onto the CAS field forms and customized to suit the local conditions at the two lakes on the Ugandan side.



Plate 1: Participants at the national pre-survey technical planning meeting for CAS on Lake Albert held in Hoima district (15th August 2020).



Plate 2: Participants at national pre-survey technical planning meeting for November 2020 CAS on Lake Edward at TJ Global Hotel, Kasese, (15thAugust 2020).

2.3 Training of CAS Field Enumerators and Supervisors

Following the pre-survey national technical planning meetings, the Fisheries Technical Staff (fisheries managers) from the riparian districts updated the list of CAS enumerators by filling gaps where the previously trained enumerators were missing. The supervisors were, advised to identify enumerators who were residents of the selected CAS landing sites and interested in the CAS exercise, preferably the fishers and others who had previously participated in the FS and CAS activities. Refresher training were, conducted for both the enumerators and supervisors prior to the data collection. The training was, specifically designed and guided by the following objectives.

i. Review the customized field data collection tools together with the enumerators to ensure they understand data capture;
ii. Re-equip enumerators and field supervisors with techniques in CAS field data collection specifically filling of customized field survey tools;
iii. Identify additional field requirements for CASs that might have been omitted at the national pre-survey planning meetings;

iv. Identify challenges expected during the actual field collection of CAS data and the possible mitigation measures.

NaFIRRI and DiFR used both theoretical and field practical sessions during the training. The theoretical sessions were, conducted at Miika Eco Resort and Hotel Buffalo for Lake Albert participants and TJ Global Hotel for Lake Edward participants. The field practical demonstrations were, conducted at Kaiso and Kyehoro landing sites on Lake Albert, Katunguru landing site on Edward (**Plate 3**). All these trainings and demonstrations were, conducted safely in two separate groups while observing the COVID-19 healthy guidelines. Unlike during the 2019 CAS data collection, the 2020 CAS training also equipped the supervisors and enumerators with skills in measurement and recording of fish length for selected commercial species. The trained supervisors and enumerators were encouraged to build capacity of other members of the fisher community to ensure long-term sustainability of fisheries data collection beyond the LEAF II project.



late 3: Practical demonstration of CAS data collection and recording of the fish length of *Bagrus docmac* (b), and total length of *Protopterus aethiopicus* (c) & *Oreochromis niloticus* Lake Edward, August 2020.

2.4 Publicity of the Catch Assessment Survey activities on lakes Albert and Edward systems

Prior to the actual CAS data collection, radio broadcast announcements were made to increase awareness among fisher communities and other stakeholders. In addition, the trained enumerators communicated to fishers before and during actual CAS field data collection. Information dissemination materials (posters) summarizing the CAS results of

2019 were packaged and distributed at each landing site during the period of publicity. This helped to justify the importance of CAS exercise to all key stakeholders in the fisheries sector.

2.5 Field collection of CAS data on lakes Edward and Albert

Data were collected on the same dates i.e. during the first week (5th – 7th) and third week (16th – 18th) of November 2020 at all the sampled landing sites. The trained enumerators selected from the fishing villages performed the actual data recording while the Technical Staff from DLGs of Kitagwenda, Kasese, Rukungiri, and Rubirizi on Lake Edward and Pakwach, Buliisa, Hoima, Kikuube, Kagadi and Ntoroko on Lake Albert, NaFIRRI, and DiFR provided the supervisory functions. Data collection followed the customized Standard Operating Procedures (SOPs) jointly developed in 2018. This approach provides timely and reliable data collection and promotes participatory management of fisheries resources. Using enumerators from within the fishing villages ensures sustainability of data collection beyond the project life.

On the sampling day, at least 30% of the fishing boats that landed were sampled at each study landing site and their catch recorded in the harmonized and customized CAS field data collection forms (**Appendices 4 & 5**). Enumerators and supervisors ensured that the sampled boats represented all the fishing vessel gear combinations. All the catch of the sampled boats was sorted to species/genus level and weighed and recorded. For each species recorded in the sampled boat, information on the beach value (price) per unit weight(kg) was recorded. In addition, information on the quantity of catch (fish or species) retained by fishers for home or household consumption was obtained. For each boat sampled, additional information such as the type and length of fishing boat, the type and size of gear used, the hours that the boat used in fishing using the same gear in the previous seven days (week) as well as the number of crew on the sampled boats were also recorded. Finally, using the measuring boards, the total lengths or Fork lengths were taken for at least 10 individual fish per species landed in each boat.

2.6 Landing sites sampled for CAS

Despite the increase in water levels and flooding at some landing sites, the five landing sites on Lake Edward (Figure 1) and 22 on Lake Albert (Figure 2) previously sampled for CAS in July 2019 were maintained in 2020.

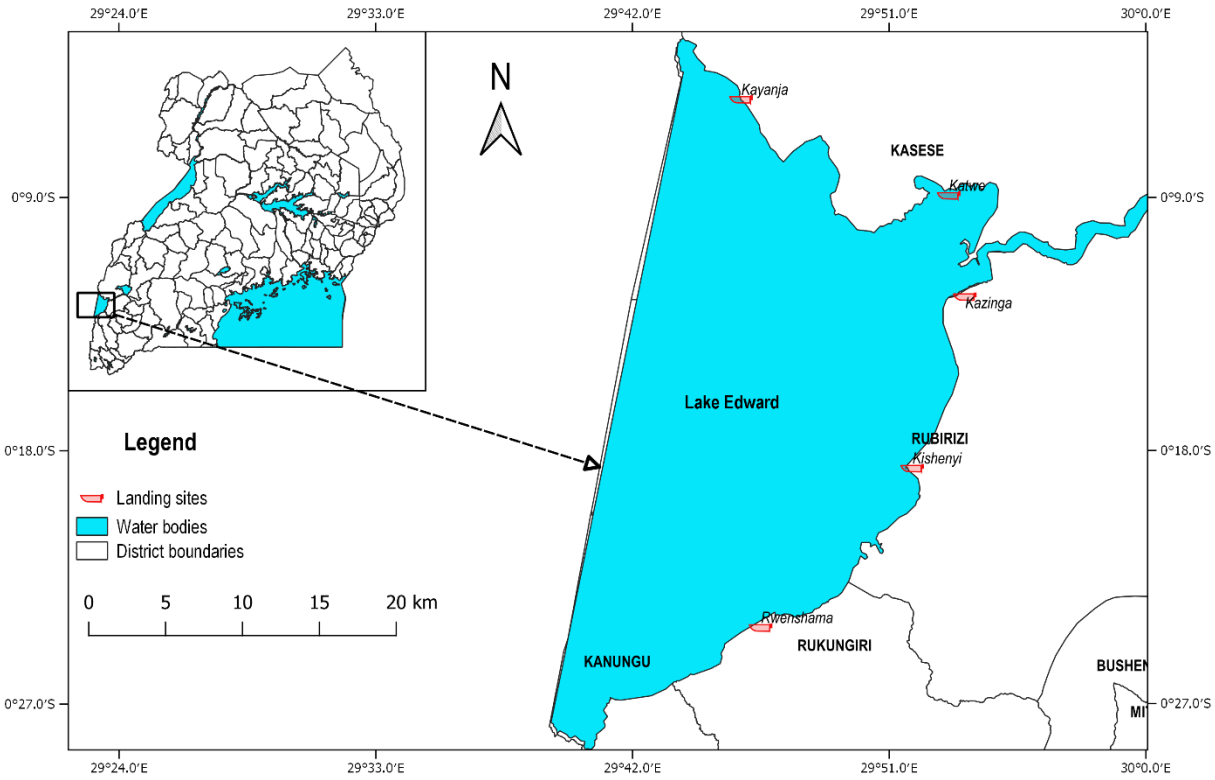

Figure 1: Location of fish landing sites on Lake Edward sampled for CAS in November, 2020.

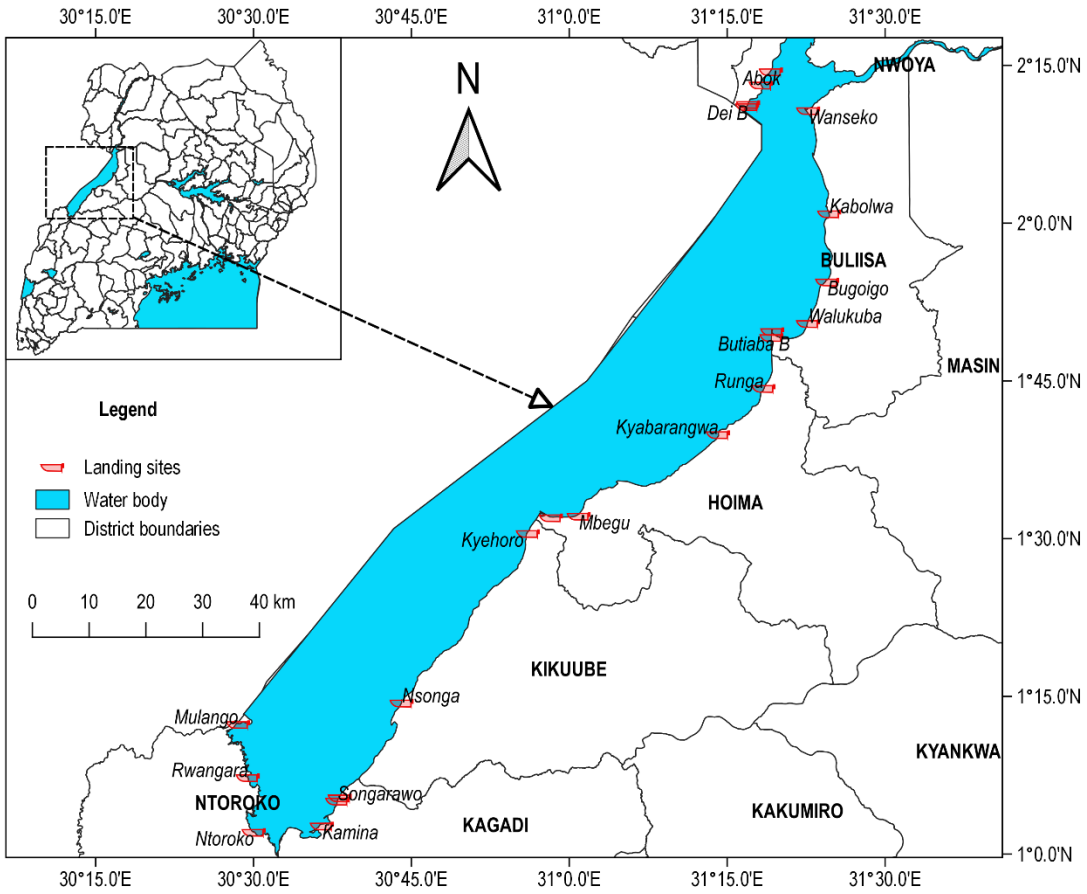

Figure 2: Location of fish landing sites on the Uganda portion of Lake Albert sampled for CAS in November, 2020.



Plate 4: Enumerators weighing and recording the total catch landed at Katwe landing site (a) on Lake Edward and Ntoroko landing site (d) on Lake Albert, b) A fisher's catch of mainly *Engraulicypris bredoi*, and Fish measurement of fish length during the 2020 CAS.

2.7 Estimation of CAS-based Indicators

The completed CAS field data collection forms were retrieved by the field supervisors, validated, and submitted to NaFIRRI for further management. Data were then entered, cleaned, validated, and analyzed using Excel and R programming language. During the analysis, fishing crafts were segregated into effort groups (Vessel-Gear Combinations) and the following CAS indicators were estimated for each effort group.

i. The mean fish catch rates (kg boat^{-1} day^{-1}) (CPUE) were estimated for each effort group by species.
ii. The fish catches were estimated using the mean fish catch rates. For each effort group, the Boat activity coefficient (B), *i.e*., the probability that a fishing vessel of each Vessel-Gear (V-G) type would be active on any day during the month was estimated as the mean number of days the boats in each effort group fished in a week divided by the number of days in a week. The catch (C) of each effort group was then estimated.
iii. The mean monthly estimates for each effort group and species were then raised through 12 months to obtain the annual catches.
iv. The beach value of the catch, i.e. the gross income to the fishers, was estimated by raising the estimated catch in each effort group by the mean unit price of each fish species landed.

The monthly gross value of catch estimated for the major commercial fish species recorded was calculated using the average price per unit (kilogram) of fish species. The outputs from the 2020 CAS data were compared with the July 2019 and the details of the results *i.e.*, fish catch rates and the estimated fish catches were presented in both tabular and graphical forms. The section of results presented in two sub-sections with the first one on Lake Albert and the second on Lake Edward system.

PRESENTATION OF RESULTS, DISCUSSION, AND RECOMMENDATIONS

3.1 LAKE ALBERT

3.1.1 Fish catch rates (kg boat^{-1}day^{-1})

A total of 20 vessel-gear (V-G) categories were observed in the commercial fishery of Lake Albert during the November 2020 Catch Assessment Surveys (Figure 3; **Table 1**), similar to the July 2019 survey. The School Kabalega and the Dugout Canoes were not encountered during the November 2020 survey. The catch per unit effort (CPUE) calculated for each of the 20 V-G categories show great variation for all the 17 fish species groups, but dominated by about 10 species (Figure 3).

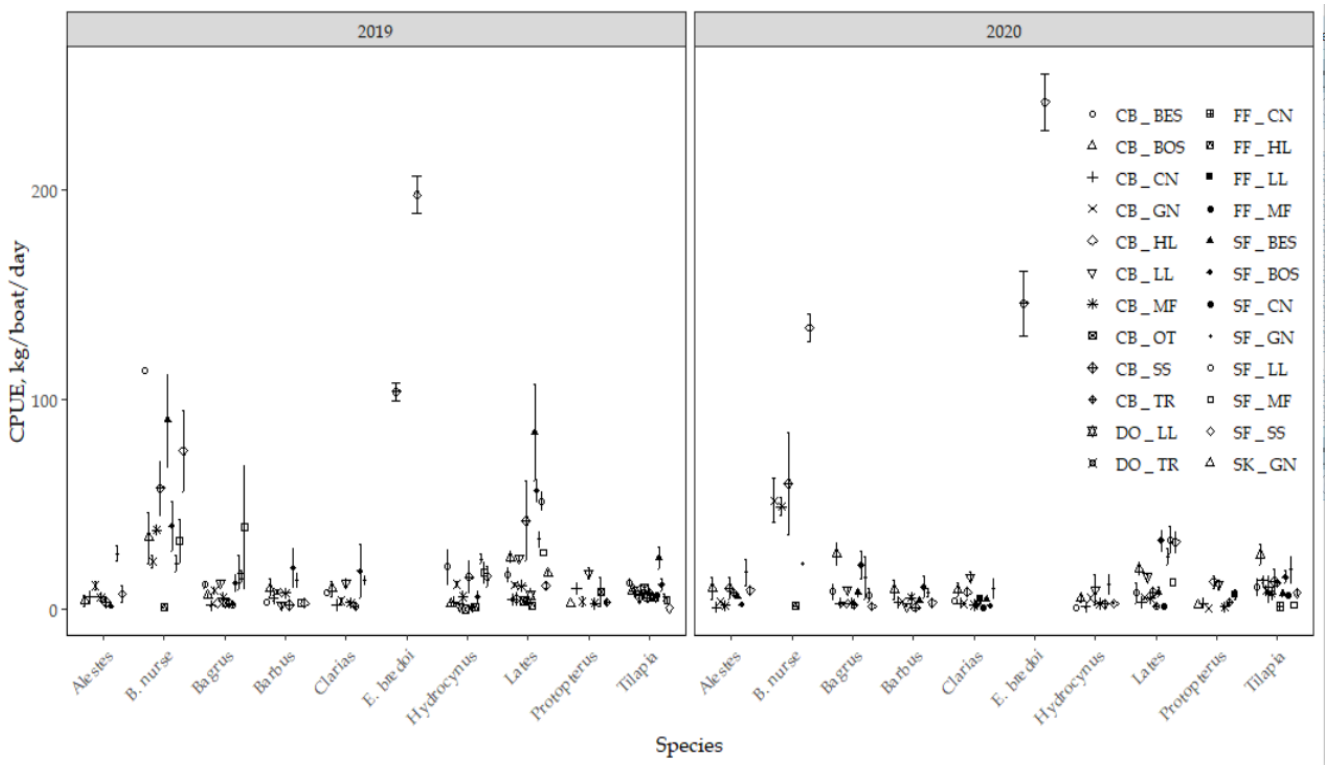

Figure 3: CPUE for key commercial fish species on Lake Albert recorded in different V-G categories *(*CB=Congo barque boats, FF=Foot fishers, SF=Sesse flat at one end boats, BES=Beach seine, BOS=Boat seine, CN=Cast nets, GN=Gill nets, HL=Hand line hooks, LL=Long line hooks, MF=Monofilament gill nets, SS=Small seine (Lampara) nets, TR=Basket traps).



Plate 5: Major fish species landed in commercial catch on Lake Albert in November,2020

Overall, the CPUE of the small pelagic fish species increased during the November 2020 survey, while that of the other species declined. The highest CPUE was recorded for *Engraulicypris bredoi* in SF-SS (241.7 kg boat^{-1} day^{-1}) and CB-SS (145.7 kg boat^{-1} day^{-1}) categories and *Brycinus nurse* in SF-SS (134.2 kg boat^{-1} day^{-1}), while the least CPUE was for Schilbe in SF-GN (0.2 kg boat^{-1} day^{-1}). The CPUE for E. bredoi in November represent a 22% increment from the 197.6 kg boat^{-1} day^{-1} recorded in July 2019. In terms of the fishing gears, *E. bredoi* was the only fish species targeted using a single gear (small seine nets) operated in two boats types i.e., Congo barque (CB) and Sesse flat at one end (SF). The CPUE of *B. nurse* in Congo barque boats using boat seines and beach seines drastically reduced from 114 kg boat^{-1} day^{-1} in July 2019 to zero in November 2020 (**Table 1**). For Nile perch (*Lates spp*), the highest catch rates were recorded in Sesse flat boats using long lines (33.1 kg boat^{-1} day^{-1}), representing a 60% from the 84.5 kg boat^{-1} day^{-1} registered in July 2021. The species recorded a 41% decline Sesse flat boats using boat seines from 56.8 kg boat^{-1} day^{-1} in July 2019 CAS to 33 kg boat^{-1} day^{-1} in November 2020. Other species also registered substantial declines in CPUE; *Alestes baremose* from 26.5 boat^{-1} day^{-1} to 7.6 kg boat^{-1} day^{-1} (30%), and *Hydrocynus forskhalii* from 23.9 kg boat^{-1} day^{-1} to 11.7 kg boat^{-1} day^{-1} (51%) in Sesse flat boats using gill nets. Unlike in July 2019 where the foot fishers targeted only Tilapia species using monofilament gill nets, they were found to use other gears (Cast nets, hand lines, and long lines) to target additional species including *B. nurse, Clarias spp,* and *Protopterus aethiopicus* in November 2020. The CPUE for the rest of the fish species varied greatly between V-G categories as summarized in **Table 1** below.

Table 1: Catch per unit effort (kg/boat/day) presented by main vessel gear (V-G) combinations on Lake Albert, Uganda in November 2020

Vessel Gear categories	*Alestes baremose*	*B. nurse*	*Bagrus bajad*	*Labeobarbus bynnii*	*Clarias spp*	*E. bredoi*	*Haplochromines*	*Hydrocynus forskahlii*	*Labeo spp*	*Lates spp*	*Malapterurus electricus*	*Mormyrus spp*	*Other species*	*Protopterus aethiopicus*	*Schilbe sp*	*Synodontis spp*	*Tilapia spp*
CB _ BES			8.4		4.0			1.0	1.0	7.8						2.0	10.9
CB _ BOS	10.2		26.2	9.4	9.4		0.5	5.2	4.6	19.4	3.2	5.4	2.0	2.0		15.9	26.1
CB _ CN	1.0		2.9	3.5	3.0			1.3	2.7	3.4				3.0		12.5	13.7
CB _ GN	3.5	52.0	2.7	3.8	2.8			5.3	2.8	5.6	2.5	2.5	2.0	0.5	3.0	2.4	9.0
CB _ HL					8.3									13.1			
CB _ LL			9.6	1.8	15.3			9.5		15.6	18.7	0.1	0.5	11.7		8.4	9.5
CB _ MF	2.0	48.9	3.0	5.5	2.1			2.7	2.5	5.1	1.0	2.6	2.4	1.3	1.0	3.6	7.4
CB _ SS	10.1	59.9		1.0		145.7		2.6	3.0	8.0							13.3
CB _ TR	8.0		2.1		2.5					1.7	3.3	3.3		3.5			12.4
FF _ CN																	1.5
FF _ HL		1.6											-				
FF _ LL					5.0									7.0			
FF _ MF					0.5												
SF _ BES	6.0		7.9	4.0	5.0				0.6	8.1			1.0			2.0	7.6
SF _ BOS	2.3		21.2	10.7	2.0				2.2	33.0	2.5		4.9			36.9	15.5
SF _ CN										1.5							7.0
SF _ GN	17.6	22.0	15.0	8.1	10.0			11.7	3.5	25.2					0.2	9.8	19.0
SF _ LL			6.8							33.1						0.5	
SF _ MF										13.0						3.0	2.0
SF _ SS	9.2	134.2	1.6	3.2		241.7		2.9	2.0	32.1	2.0					19.5	7.7

** CB=Congo barque boats, FF=Foot fishers, SF=Sesse flat at one end boats, BES=Beach seine, BOS=Boat seine, CN=Cast nets, GN=Gill nets, HL=Hand line hooks, LL=Long line hooks, MF=Monofilament gill nets, SS=Small seine (Lampara) nets, TR=Basket traps.

3.1.2 Estimation of monthly and annual fish catches of the main commercial species

Similar to the CPUE, monthly catch estimates species varied greatly across the species and districts (Table 2). Overall, the monthly catch increased by a 3.8% margin from 27,956.3 ± 5134.2 t in July 2019 to 29,045.2 ± 6019.9 t in November 2020. Similar to the July 2019 survey, monthly catches were highest for the two dominant small pelagic species; *E. bredoi* (12,871.8±22,65.2 t; 44.3%) from 10,092.2 ± 793.6 t (36.1% in 2019 and *B. nurse* (7,681.7 ± 1,646.73 t; 26.4%) from 5,610.9 ± 1302.3 t (20.1%) in 2019. *Synodontis spp* recorded the least monthly catch estimate of 1.1±0.6 in 2020 from the 27.0 t in 2019.

In terms of district contributions, Kikuube registered highest monthly catch estimated at 8,222.3 ± 2121.2 t (28.3%), followed by Hoima (7,805.8 ± 1336.1 t, 26.9 %), while Kagadi registered the least (1,408.4 ± 277.9 t, 4%). There was a general increase in monthly catches for both Kikuube and Hoima in November 2020 by 29% and 27% respectively, while the rest of the districts registered slight declines. The estimated annual catches followed a pattern similar to the monthly catches, with the small pelagic species (*E. bredoi* and *B. nurse*) dominating (>70%) the lake annual catches (**Figure 2; Appendix 8)**. The 348,535.8 ± 72,242.2 t estimated in 2020 represent a 3.8% increase of the 335,474.6 ± 61,613.3 t estimated in 2019. Similarly, the highest annual catch was estimated from Kikuube and Hoima districts while Kagadi district recorded the least annual catch (**Figure 3**).

Table 2: Estimated monthly catch (tons ± SE) landed on Lake Albert in November 2020 CAS presented by species for the riparian districts

Species	**Buliisa**	**Hoima**	**Kagadi**	**Kikuube**	**Ntoroko**	**Pakwach**	**Total**
Alestes	114.6±29.9	76.2±29.1	115.5±2.8	144.4±5	112.4±22.8	243.4±76.4	806.5±166
B. nurse	1898.6±248.2	2406.1±744	245±48.7	1421.4±400.3	492.2±91.7	1218.4±113.8	7681.7±1646.7
Bagrus	127.1±37.2	66.9±18.6	65±15	72.3±23.5	138.1±34	16.8±1.9	486.2±130.2
Barbus	233.5±76.7	3.4±0	32±24.3	35.6±14.5	5.5±2	26.6±6.1	336.6±123.6
Clarias	206±94.4	34.8±12.5	13.7±2.2	64.3±35.2	90.7±10.5	18.5±2.2	428±157
E. bredoi	1121.1±291.4	4492±382.9	502.6±54.1	5188.9±1182.1	58.8±14.4	1508.4±340.3	12871.8±2265.2
*Haplos**	1.1±0.6	-	-	-	-	-	1.1±0.6
Hydrocynus	252.8±57	45.9±13.6	225.1±49.9	95.7±24.4	148.6±0	24±3.9	792.1±148.8
Labeo	110.7±39.2	22.5±5.1	5.8±0	9.2±0	3.3±1.9	14.9±2.7	166.4±48.9
Lates	479.2±104.6	403.4±63.2	110.5±62.3	755.1±344	272.8±84.8	584.2±97.3	2605.2±756.2
Malapterurus	160±21.3	0.5±0	0.2±0.1	22.2±0	5.9±0	10.2±0.2	199±21.6
Mormyrus	208±82.8	3.7±1.9	-	3.8±1.5	-	9.1±2	224.6±88.2
Protopterus	80±22.6	24.2±0	13.4±1.4	138.3±55	22.9±4.2	2.6±0.6	281.4±83.8
Schilbe	17.6±0	-	-	-	22.9±0	3±0	43.5±0
Synodontis	152±46.3	21.5±14.3	18.3±4.1	27.5±2.3	162.4±14.3	253.8±3.2	635.5±84.5
Tilapia	324±47	195.1±49.9	61±13	235.3±31.9	454±73.9	95±39.4	1364.4±255.1
Others	93.5±36	9.6±1	0.3±0	8.3±1.5	-	9.5±5	121.2±43.5
Total	**5579.8±1235.2**	**7805.8±1336.1**	**1408.4±277.9**	**8222.3±2121.2**	**1990.5±354.5**	**4038.4±695**	**29045.2±6019.9**

Other species include *Auchinoglanis occidentalis*, *Citharinus latus,* and *Polypterus senegalus*

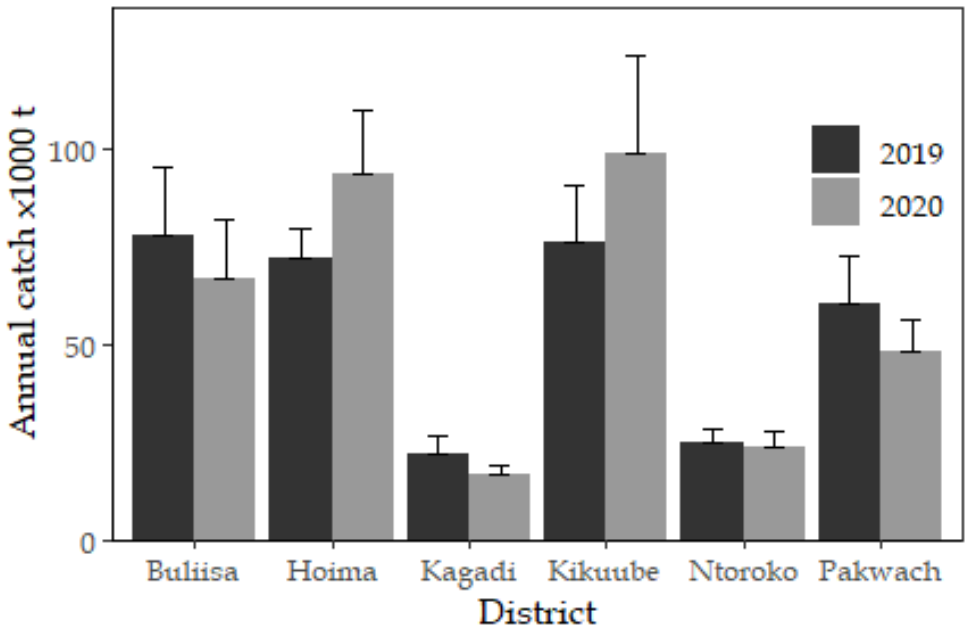

Figure 4: The estimated total annual catch (tons ± SE) for the respectively riparian districts on Lake Albert based on July 2019 and November 2020 CAS data.

3.1.3 Monthly and annual gross value of the main commercial fish species at beach level

The unit price of each fish species forms the basis for calculating the economic revenue of catch at beach level. The unit mean price varied for the different species across the six riparian districts. Generally, the small-sized e.g. *B. nurse*, *E. bredoi*, and *Haplochromine* cichlids recorded generally lower price values compared to the large-sized species such as *Lates niloticus*, *A. baremose*, *L. bynnii*, and *H. forskhalii* (**Table 3, Appendix 10 & 11**). During the November 2020 survey, Pakwach district registered the highest prices for the large-sized species, with *A. baremose* attracting the highest value (UGX 8,325). The lowest unit price recorded was for the Haplochromine species (UGX 945) in Buliisa district (**Table 3**). The Haplochromine species group similarly recorded the lowest unit price (UGX 389) in July 2019 in Kikuube district.

Table 3: The average unit price (UGX) of the different fish species landed from Lake Albert for the respective riparian districts during the 2020 CAS

Species	Buliisa	Hoima	Kagadi	Kikuube	Ntoroko	Pakwach
Alestes spp	7,128	5,250	2,500	3,205	3,788	8,325
Brycinus nurse	872	1,120	859	955	2,043	1,485
Bagrus bajad	3,573	3,722	3,931	3,226	4,196	3,205
Labeobarbus bynnii	5,214	2,000	6,000	3,976	3,750	6,535
Clarias sp	3,434	3,770	4,250	2,441	3,368	5,752
Engraulicyris bredoi	1,058	824	516	739	1,284	1,177
Haplochromines	945	-	-	-	-	-
Hydrocynus forskahlii	3,945	4,177	2,760	2,900	3,500	7,566
Labeo spp	4,232	3,375	4,000	3,333	3,250	5,192
Lates spp	5,188	4,261	3,920	4,252	4,279	5,214
Malapterurus electricus	3,524	1,000	2,500	4,500	4,000	3,125
Mormyrus spp	2,160	2,250	-	2,167	-	3,863
Protopterus aethiopicus	4,316	3,000	3,625	2,750	3,393	4,200
Schilbe sp	1,000	-	-	-	3,000	2,000
Synodontis spp	2,211	2,563	2,795	2,417	3,130	2,320
Tilapia spp	5,407	4,114	4,924	3,672	4,631	4,558
Other species	3,929	3,522	3,750	3,000	-	3,722

Using the average price per kilogram of individual species, the monthly and annual gross value of catch was determined by multiplying the unit price by the species annual catch as summarized in **Tables 4 & 5 and Appendix 10**. The estimated monthly catch of 29,045 t on Lake Albert (**Table 2**) fetched a monthly gross beach revenue of UGX 54.2 billion (bn) in November 2020 in comparison to the UGX 63.46 bn from 27,956.3 t in July 2019 (**Table 4 and Appendix 10**). The highest revenue was recorded in Buliisa district (13.4 bn; 24.8.1%) while Kagadi registered the least monthly revenue of (3.1 bn; 5.7%)Nile perch (*Lates* spp) contributed the highest monthly gross revenue (UGX 10.9 bn; 23.8.2%) despite constituting only 9 % (2605.2 t), of the monthly catch. The two small pelagics *E. bredoi* and *B. nurse* despite dominating the catches (>70%), registered UGX 10.79 bn and UGX 8.36 bn, respectively.

Table 4: The monthly beach revenue (million UGX) of catch estimated based on November 2020 survey presented by species and district.

Species	Buliisa	Hoima	Kagadi	Kikuube	Ntoroko	Pakwach	Total
Alestes spp	838.9	399.8	451.1	1,295.4	380.9	1,219.9	4,586.0
Brycinus nurse	1,590.0	2,792.7	200.0	922.7	1,075.1	1,780.2	8,360.7
Bagrus bajad	450.3	225.5	253.8	232.5	560.3	53.7	1,776.1
Labeobarbus bynnii	1,238.2	6.8	242.3	146.7	22.4	162.7	1,819.1
Clarias sp	698.4	132.9	55.6	153.0	286.4	91.1	1,417.4
Engraulicyris bredoi	1,214.0	3,713.9	259.5	3,755.5	69.7	1,774.7	10,787.3
Haplochromines	1.1	-	-	-	-	-	1.1
Hydrocynus forskahlii	1,016.5	183.4	830.9	327.7	449.2	159.1	2,966.8
Labeo spp	453.4	76.1	15.4	35.0	10.3	71.0	661.2
Lates spp	2,247.7	1,410.4	434.1	2,785.7	1,070.8	2,942.6	10,891.3
Malapterurus electricus	533.2	0.5	0.4	110.7	23.7	53.8	722.3
Mormyrus spp	454.5	5.7	-	9.3	-	34.1	503.6
Protopterus aethiopicus	336.8	72.7	45.5	472.0	85.0	10.2	1,022.2
Schilbe sp	17.6	-	-	-	68.8	5.9	92.3
Synodontis spp	265.9	47.9	62.4	54.3	511.0	895.1	1,836.6
Tilapia spp	1,688.8	958.9	280.3	914.8	1,883.3	555.0	6,281.1
Other species	363.0	35.7	0.9	29.5	-	44.0	473.1
Total	**13,408.3**	**10,062.9**	**3,132.2**	**11,244.8**	**6,496.9**	**9,853.1**	**54,198.2**

Since the annual revenue is raised from the monthly revenue, a pattern similar to monthly beach revenue was observed for the different species across the respective riparian districts (Table 5). The 348,535.8 t of fish (Figure 4; **Appendix 10**) estimated for the year 2020 on the Uganda section of Lake Albert fetched a total annual gross revenue of UGX 650.3 bn. This observation represents a 14.6% reduction in beach revenue form the UGX 761.5 bn recorded in the 2019 CAS (**Table 5, Appendix 11**). The highest annual gross revenue from catches were recorded from Buliisa district (UGX 160.9, 24.7%) and the least from Kagadi district (**37,587.6**).

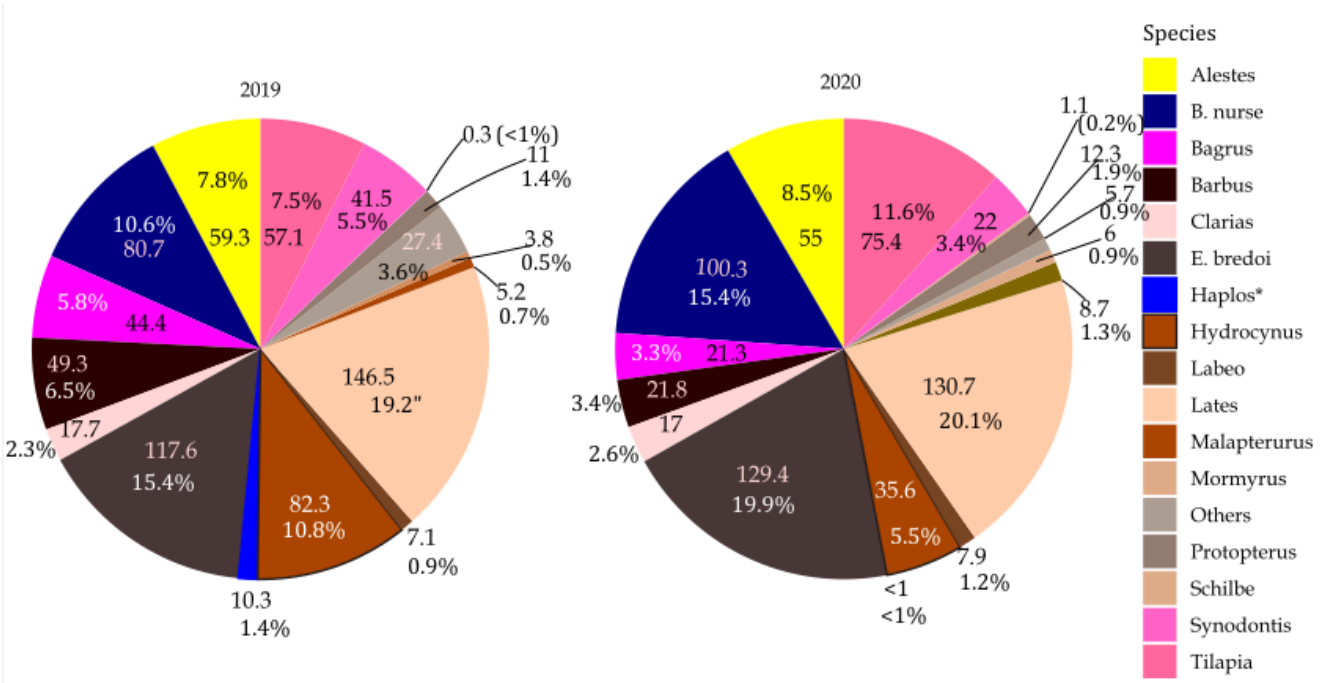

Figure 5: Estimated annual revenue (million) landed on Lake Albert in 2019 and 2020 presented by species

Table 5: The estimated annual revenue (million) from the different fish catch at the beach level landed from Lake Albert for the respective riparian districts during the 2020 CAS

Species	**Buliisa**	**Hoima**	**Kagadi**	**Kikuube**	**Ntoroko**	**Pakwach**	**Total**
Alestes	10,068.7	4,797.8	5,412.9	15,544.4	4,571.1	14,638.1	55,033.0
B. nurse	19,079.9	33,512.4	2,400.6	11,072.4	12,901.3	21,363.1	100,329.7
Bagrus	5,403.5	2,707.2	3,045.4	2,790.7	6,720.6	643.8	21,311.2
Barbus	14,857.5	81.1	2,908.0	1,760.2	268.4	1,952.6	21,827.8
Clarias	8,381.3	1,594.5	667.3	1,834.8	3,435.6	1,092.7	17,006.2
E. bredoi	14,567.2	44,566.5	3,113.6	45,066.6	837.2	21,296.3	129,447.4
*Haplos**	12.7	-	-	-	-	-	12.7
Hydrocynus	12,198.0	2,201.0	9,971.1	3,933.3	5,390.7	1,909.3	35,603.4
Labeo	5,440.9	913.7	184.2	419.4	122.8	852.3	7,933.3
Lates	26,973.3	16,926.3	5,209.8	33,428.2	12,849.7	35,311.9	130,699.2
Malapterurus	6,398.7	6.4	4.9	1,328.6	284.6	646.5	8,669.7
Mormyrus	5,454.6	67.2	-	111.5	-	409.4	6,042.7
Protopterus	4,042.9	871.9	546.0	5,664.3	1,020.0	123.1	12,268.2
Schilbe	211.3	-	-	-	826.1	70.8	1,108.2
Synodontis	3,190.1	575.2	749.8	652.5	6,132.9	10,742.1	22,042.6
Tilapia	20,263.7	11,508.3	3,363.3	10,977.6	22,598.6	6,661.2	75,372.7
Others	4,356.2	426.8	10.7	354.1	-	527.0	5,674.8
Total	**160,900.5**	**120,756.3**	**37,587.6**	**134,938.6**	**77,959.6**	**118,240.2**	**650,382.8**

3.1.4 Estimates of fish retained for household consumption at beach level

All the 17 fish species recorded in the commercial catches of Lake Albert in November 2020 contributed to the quantity of fish for domestic consumption. Of the estimated annual catch of 348,535.8 t, 11.2 t (0.003%) was retained by fishers for direct domestic consumption by their families. The quantity is lower than the 18.5 t (0.005%) retained for the same purpose in 2019. Generally, Buliisa registered the highest quantity retained for the fishers' domestic consumption (2.68 t) followed by Hoima (2.51 t) and least domestic consumption was observed in Ntoroko (0.76 t) districts (**Figure 5**). The most preferred fish species for domestic consumption were *Lates spp*, *H. forskhalii*, *B. nurse, A. baremose*, *Synodontis spp*, *Tilapia spp*, and *Labeobarbus bynnii* (**Figure 7**).

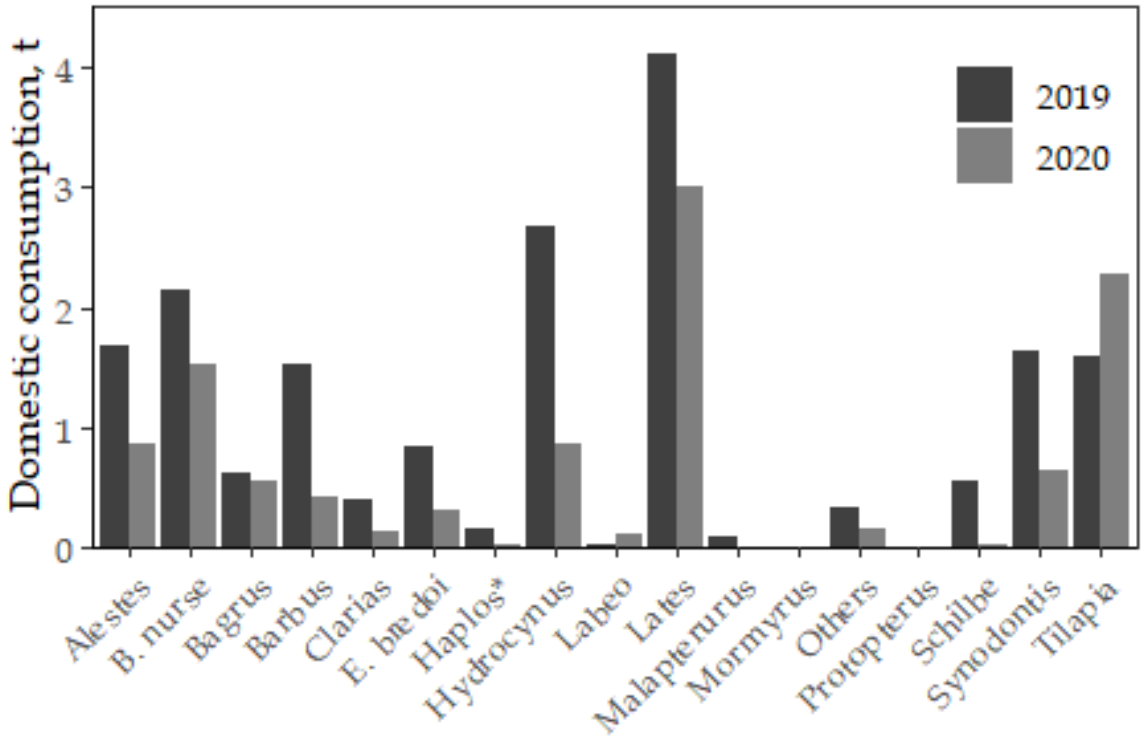

Figure 6: Estimated quantities of fresh fish retained annually by fishers for immediate domestic consumption in 2019 and 2020.

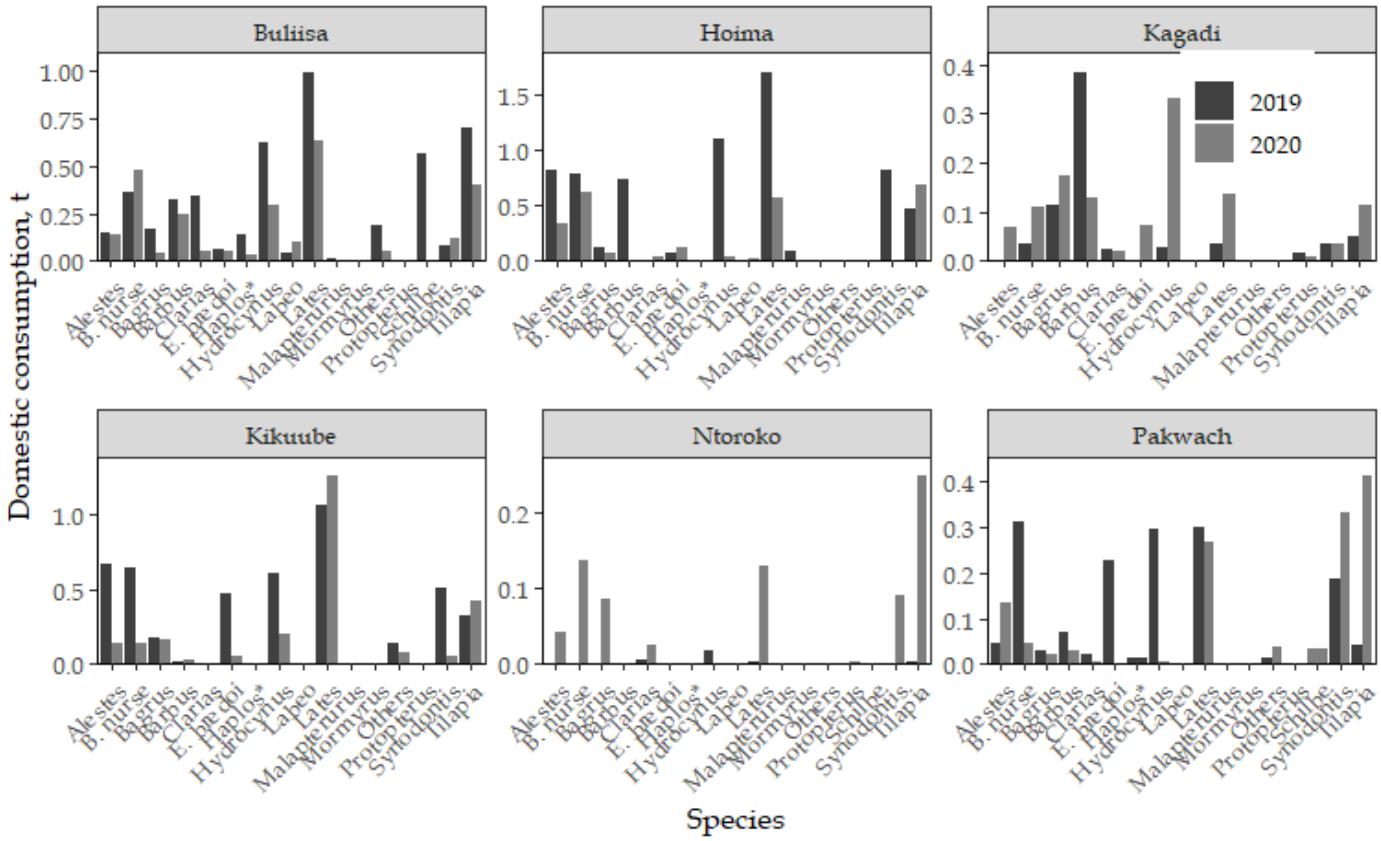

Figure 7: Estimated annual quantities of fish catch (fresh weight) retained in the riparian districts for domestic consumption by fishers in 2019 and 2020.

3.1.5 Size structure of the dominant fish species from Lake Albert

Following the first set of CAS in July 2019, it was recommended to take measurement of the size structure for the dominant commercial fish species. During the November 2020 survey, length measurements were taken for six species; *Lates spp*, *Tilapia spp*, *H. forskhalii*, *A. baremose, B. bajad,* and *L. bynnii*. The length for *Lates* spp ranged from 20 – 119 cm TL (Mean±SD, 24.8±8.8), *tilapia spp* from 5 – 54 (25.1 ±7.9 cm TL), *H. forskhalii* from 11 – 57 cm FL, with a mean of 24.9±7.9, and *A. baremose* from 10 – 55 (24.6±7.4 cm TL) (**Figure 7**).

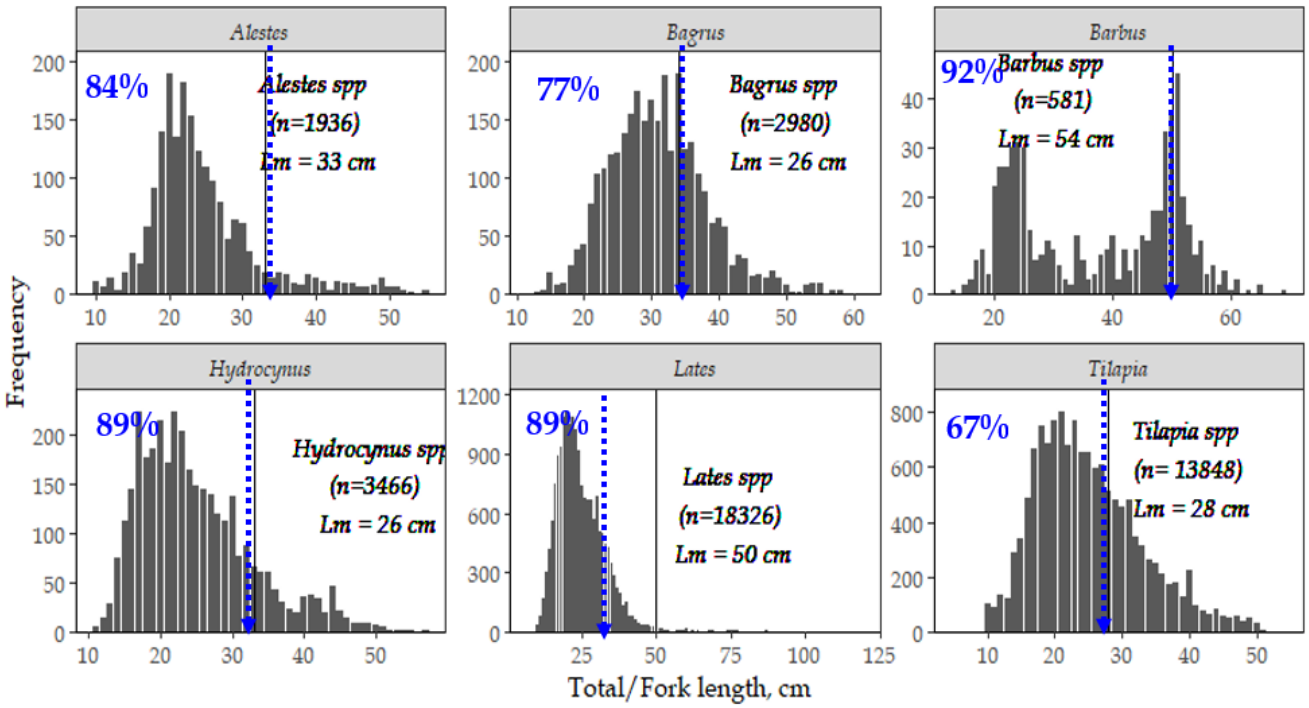

Figure 8: Size structure of dominant fish species recorded in the commercial catches on Lake Albert in November 2020. The dotted vertical blue lines denote the presumed slot sizes, corresponding to the size at first maturity based on literature and selected studies: *H. forskhalii* (L50% = 32cm) and *A. baremose* (L50% = 32cm), *Lates spp* (L50% = 50cm), and *Tilapia* (L50% = 28 cm) (Nakiyende et al., 2012)

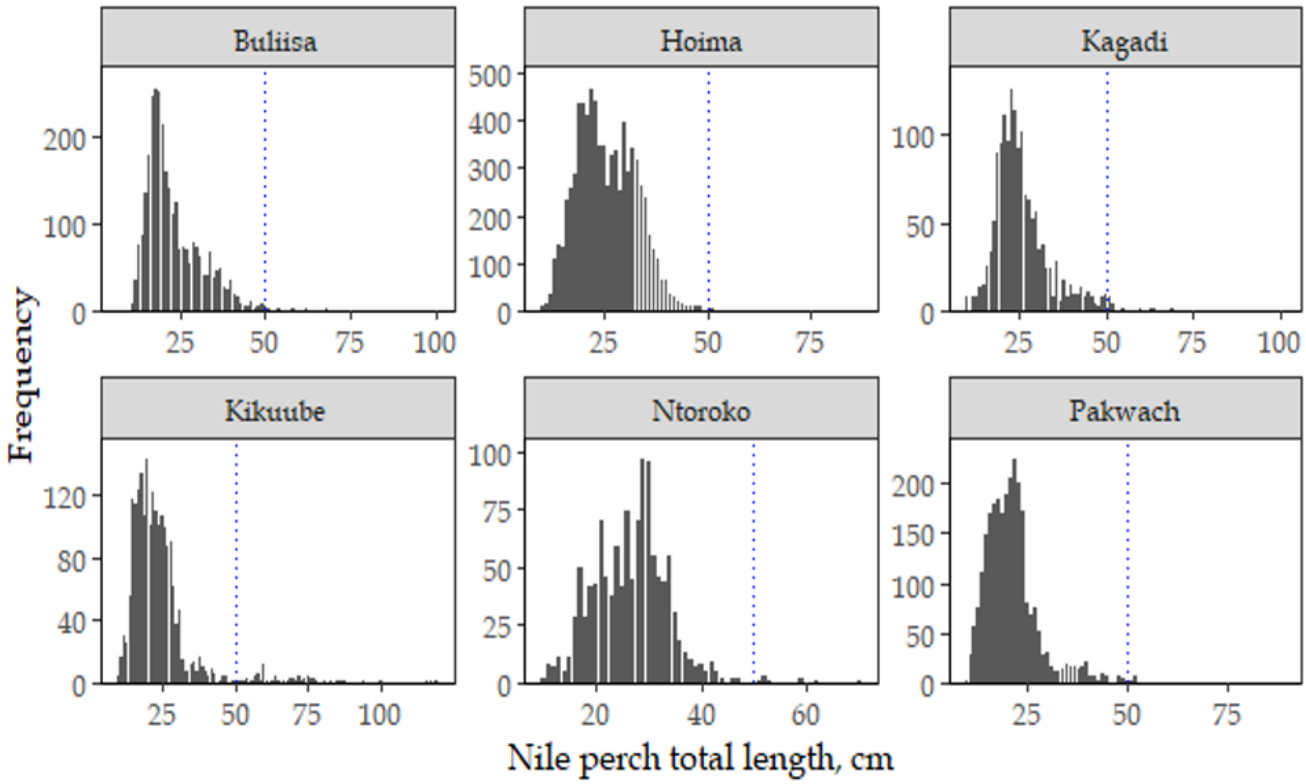

Figure 9: Size structure of Nile perch landed on Lake Albert in November 2020, presented by district. Blue dotted vertical line denotes the presumed slot sizes (L50% = 50cm), corresponding to the size at first maturity based on literature and selected studies.

3.1.6 Discussion of CAS results on Lake Albert

3.1.6.1. CPUE, monthly, and annual catch estimates

Except for the small pelagic fish species; *E. bredoi* and *B. nurse*, the CPUE for the large-sized species including Nile perch, *B. bajad*, *Tilapia spp*, *A. baremose*, and *H. forskahlii* declined in the respective V-G combinations (Figure 3). Majority of the fishing effort observed in the commercial fisheries of Lake Albert comprised of the illegal destructive gears (Monofilament gillnets, Beach seines, Boat Seines, Basket Traps, Cast Nets, and undersize gillnets and longlines). This observation concurs with the earlier in the 2018 FS, where most indicators of fish effort, particularly the legal effort registered substantial increases (Table 7). These gears are non-selective, cropping large proportions of juveniles and adults including the breeding stocks, and are usually operated in habitats considered vital for fish breeding and nursery. The decline in the CPUE could therefore be attributed to the excessive fishing effort on the already constrained large-sized fish species.

Despite the reduction in CPUE for the majority of the large-sized species, both the monthly and corresponding annual catches increased by a margin from 335,280 t in 2019 to 348,535.8±72,242.2 in 2020. Compared to the catch records of 2014 when the lake recorded the lowest catches estimated at 59,599 t (Table 6) in a decade, the current record represents a six-fold increase in the lake catch. The observed increase in monthly and annual catches is mainly due to the corresponding increments in the CPUE of the two small pelagic species; currently the backbone of the Lake Albert commercial fishery. Both species constituted 70.8% of estimated annual catch in

2020 and > 50% in 2019. Of concern is the unregulated fishing effort (Plate 6 A & B), exerted on the two species; comprising of solar light bulbs and multi-panel (up to 20) small seines) and the associated impacts on the stocks of large-sized species. The fishing effort targeting the small pelagic species in Lake Albert. The use of solar light on Lake Albert has continually attracted conflicts with fishers targeting the large species. The center of conflict is the unregulated light fishing effort and substantial bycatch of juveniles of the larger species in the light fisheries catch. Indeed, the November 2020 survey recorded substantial quantities of immature Nile perch in the light fisheries catch (Plate 6C). Studies dedicated towards understanding the light fisheries dynamics on Lake Albert are urgently required. Another issue requiring urgent attention in the light fisheries catch is the poor post-harvest handling and associated loss. The catch is usually mixed and dried in sand (Plate 6D), presumably to facilitative quick drying but the resulting loss are enormous and should form the focus for management attention. In some instances, the catch is dried on bare ground from where they are eaten and contaminated by the grazing animals and birds as well as being washed away in the rainy weather thus resulting into spoilage, wastage, and loss.

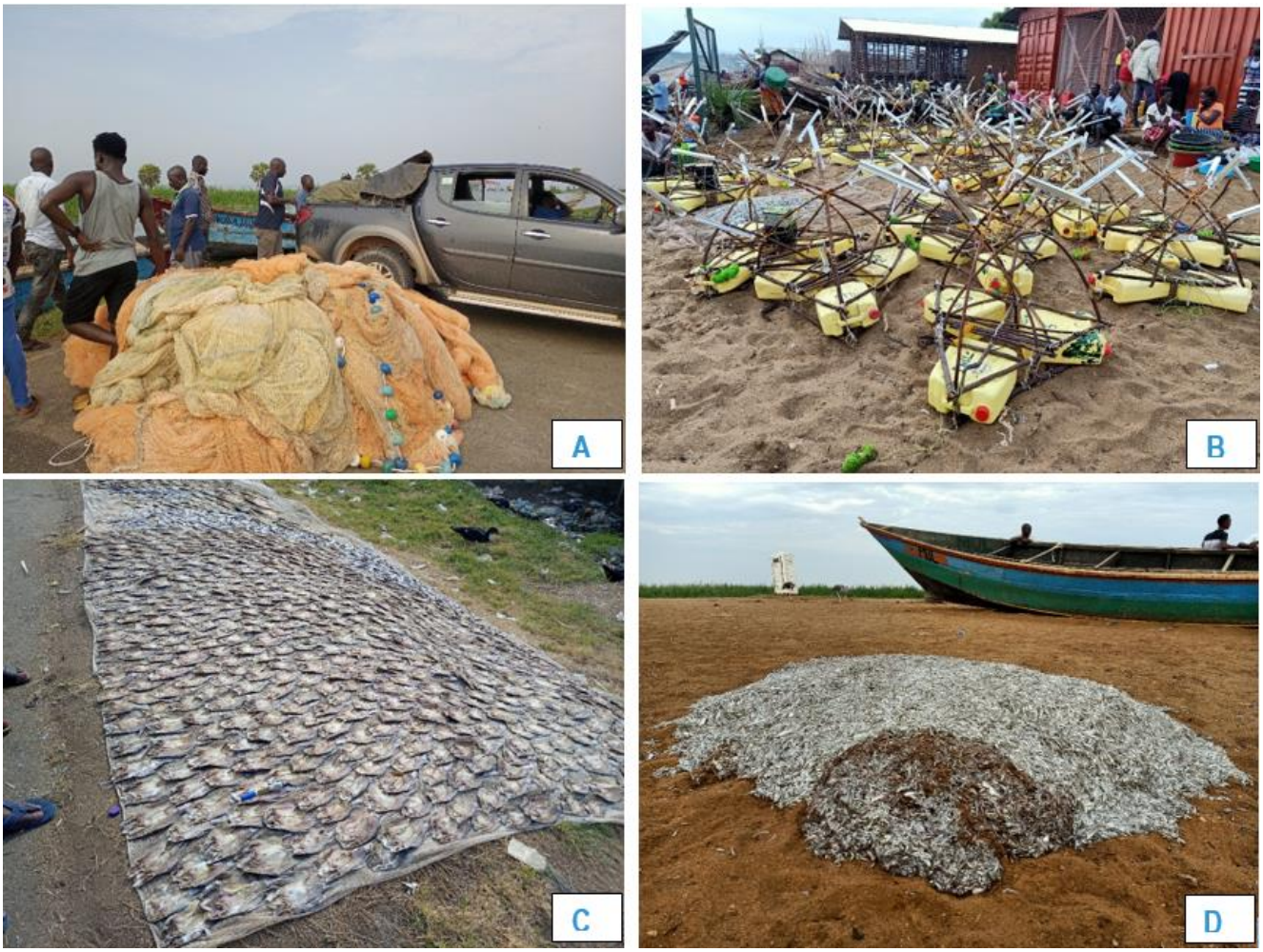

Plate 6: Fishing targeting small pelagic species (A & B), Nile perch bycatch sorted from light fisheries catch on Lake Albert, and poor post-harvest handling of small pelagic species catch (D).

Table 6: Changes in fishing effort indicators on Lake Albert for the period 2007 – 2018 (Extracted from 2018 FS report, NaFIRRI, 2018)

Fishing effort indicator	2007	2012	2016	2018	% change
Fishing crafts	5764	6216	8672	9781	69.7
Number of fishers	15364	15424	23722	27944	81.9
Mono-filaments gillnets		3774	6075	22886	506.4
Total Gillnets <4 inches	54350	102457	84206	57237	5.3
Total Gillnets >4 inches	42365	42374	13184	16325	- 61.5
Total Gillnets	96715	144831	97390	73562	- 23.9
Total LL	1965576	745706	1699380	1854706	- 5.6
Beach Seine	44	22	73	291	561.4
Boat Seines			94	338	259.6
Cast nets	81	125	429	453	459.3
Long and hand-line hooks	746	447	13266	310	- 58.4
Basket Traps	655	745	2037	7771	1,086.4
Total SS (boats)	1619	2297	3406	3079	90.2

The noticeable increase in the Tilapia fishery can be associated to the rise in water levels on the lake and the subsequent creation of "new" fishing habitats, specifically in the shallow vegetation along the lake shores. These observations for example were evident at Kyehoro and Ntoroko landing sites in Kikuube and Ntoroko districts respectively; where fishers were found fishing in the newly created habitats and noticeable increases in Tilapia catches were also observed.

Table 7: Changes in catch (t) and corresponding annual revenue (million UGX) at beach level for the period 2007 – 2020 (Modified based on information in NaFIRRI, 20219 CAS Technical report).

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Annual catch	178,873					150,465	148,853	59,599					335,280	348,536
Revenue	64,170					122,492	160,002	70,392					761,382	650,383

3.1.6.2. Fisheries economics

Despite the small pelagic species dominating the commercial fishery of Lake Albert by over 70%, their contribution to the catch revenue was lower (35.3%) compared to the larger species whose catch contribution of < 30% fetched over 65% of the beach revenue (Figure 5). The largest contributors among the large-sized species were Nile perch (20.1%), Tilapia spp (11.6%), and A. baremose (8.5%). Thee low contribution of the two dominant small pelagic species to the monthly and annual catch revenue is due to their very unit prices attributed to the poor post-harvesting handling which renders the species unfit for human consumption. This emphasizes the need for management to improve post-harvest handling and processing facilities, in addition to enforcing the existing fisheries regulations, particularly the standards for fish and food safety.

While the large-sized species contributed substantially to the annual catch revenue, the overall revenue of catch on the lake reduced by 14.6% from UGX 761.4 in 2019 bn to UGX 650.4 (Figure 5; Appendix 11). This mainly due to the composition of their catch by the mature individuals (Plate 6C), which are cropped in the illegal fishing effort and hence fetch low unit price values. This is evidenced by the size structure of the commercial catch for all the large-sized species (Figures 10 & 11). Over 90% of the Nile perch landed on Lake Albert were immature, while proportion of immature individuals for the rest of the large sized species; *Tilapia spp*, *H. forskahlii*, *A. baremose*, *B. bajad*, and *B. bynnii* ranged between 60% - 90%. The non-selective fishing by illegal gears is detrimental lake fisheries because it does not only result into stock collapse of the target species but also a reduction in economic yield, thus the need to eradicate such effort from the lake. The increase in catch on the lake therefore seems to be driven by increase in both total and illegal fishing effort.

3.1.6.3. Domestic fish consumption by fishers

Among the many benefits of the fisheries resources to the dependent populations is protein nutrition. Overall, the quantity of fisher retained by fishers as part of the catch for their home consumption reduced from 18.5 t (0.005) in 2019 to 11.2 t in 2020 (0.002%), suggesting a 39.5% reduction. With the exception of Tilapia which registered increase in fish retained, all the species recorded declines. The decline in retained catch could be due to a reduction in catch landings of the large-sized species, coupled by large quantities of the immature individuals. In addition, the catch was dominated by the small pelagic species which are less preferred for human consumption due to poor post-harvest handling and processing. In instances of low fish supply, fishers opt for income to human diet.

3.1.6.4. Size structure of the major commercial species

Limited data exists on the slot size and size at maturity of the majority of the exploited species, information key to informing management on appropriate harvestable sizes. Nonetheless, information was obtained on the size structure for a few large-sized species in the commercial fishery of the lake, and using literature on FishBase site and from studies of similar species on other water bodies, inferences were made on the probable slot and maturity sizes. Generally, majority of the catch for the large-sized species whose size structure was measured constituted of individuals below the presumed slot size and size at maturity for the respective species (Figures 10 & 11). Over 90% of the Nile perch catch were below the 50 cm, TL mark (Figure 11), recommended as lower slot size limit based on studies on Lake Victoria. Similarly, the other species; *Tilapia spp*, *H. forskahlii*, *A. baremose*, *B. bajad*, and *L. bynnii* constituted 67% - 92% of immature individuals. This observation is mainly due to the use of illegal non-selective gears such as beach seines, boat seines, cast nets, and basket traps as well as undersize gillnets and long line hooks. The continued harvest of immature individuals hampers with the recruitment and growth patterns of the target species, and may result into their stock collapse if no action is made to eradicate illegal fishing gears.

3.1.7 Recommendations for Lake Albert

The following recommendations are proposed based on the findings of the November 2020 CAS on the Uganda sector of Lake Albert.

i. We propose the strengthening of enforcement of existing fisheries regulations on the illegal fishing gears and practices to curb illegal fishing effort from all corners of the lake. This can only be realistically and sustainably attained by reviving lower level co-management structures, building their capacity, and integrating them into the management frameworks of the Lake. This will help to curb illegal effort and cropping of under sized fish.
ii. In addition, detailed studies on biology & Ecology of the exploited stocks are required to generate key scientific information needed in informing management decisions for the diverse fish species.
iii. Given the emergence and current dominance of the commercial fishery by the two small pelagic species; *E. Bredoi* and *B. nurse*, there is need to undertake biological and ecological studies to understand their interactions with the large species as well as their exploitation patterns including gear selectivity to guide on appropriate harvesting gears & sizes.
iv. In addition, we propose a comprehensive value chain analysis of both the small pelagic and large-sized species to fully understand their socio-economics including marketing so as to identify external constraints and barriers to their fisheries.
v. There is need to continue monitoring the commercial fishery through collection of CAS & FS data for incorporation into models to determine fisheries reference points such as allowable catch, allowable effort, Maximum Sustainable Yield (MSY), and sustainable biomass.
vi. Development planning for the lake fisheries should focus on improving facilities for post-harvest handling and processing of the small pelagic species; *E. nurse* and *B. nurse* to mitigate wastage, loss, and enhance acceptability and palatability for human consumption.
vii. More capacity building for enumerators and supervisors, particularly in fish identification and measurement of fish length is needed to ensure sustainability in data collection. This can be achieved through development of simplified fish identification guides for field use.

3.2 LAKES EDWARD, GEORGE AND KAZINGA CHANNEL

3.2.1 Fish catch rates (kg boat-1day-1) by vessel gear (V-G) combinations

Catch rates in each V-G combinations were calculated for each target species. On Lake Edward and the Kazinga channel, two main V-G combinations involved in the commercial fisheries in November 2020 and July 2019 i.e. Sesse Flat boats using gillnets (SF-GN) and Sesse Flat boats using Long line hooks (SF-LL) as indicated in figures 12 & 13. Unlike in July 2019 when only three V-G combinations were recorded on Lake George (SF-GN, SF-LL, and PA-LL), the November 2020 survey recorded seven combinations. In addition to V-G combinations recorded on Lake Edward and the Kazinga Channel, other five V-G combinations were found on Lake George in November 2020, they include Parachute boats operating gillnets (PA-GN), Parachute boats operating long line hooks (PA-LL), Sesse pointed boats using gillnets (SP-GN), Sesse pointed boats using long line hooks (SP-LL), and Sesse Flat boats using Basket Traps ((SF-TR) as detailed in figure 14. Seven species groups were landed in the above V-G combinations and they include; *Tilapia spp, Clarias spp, Mormyrus spp, Haplochromine spp, Barbus spp, Labeo spp, Bagras docmak*, and *Protopterus aethiopicus*.



Plate 7: Some of the major commercial fish species of Lake Edward whose lengths were measured

Generally, the CPUE for the different species across V-G combinations. On Lake Edward, the highest catch rates in November 2020 were recorded for *P. aethiopicus* (25.8 kg boat^{-1} day^{-1}) in SF-LL and *Tilapia spp* (24.8 kg boat^{-1} day^{-1}) in SF-GN, followed by *Claris spp* (17.3 kg boat^{-1} day^{-1}) in SF-LL and *B. docmak* (13.0 kg boat^{-1} day^{-1}) in SF-GN boats, with the least observed in *Haplochromine spp* (0.1 kg boat^{-1} day^{-1}) in both SF-GN and SF-LL V-G combinations (Figure 12, Appendix 12). The riverine cyprinid *Labeo spp* recorded in July 2019 was not encountered in the November 2020 catches.

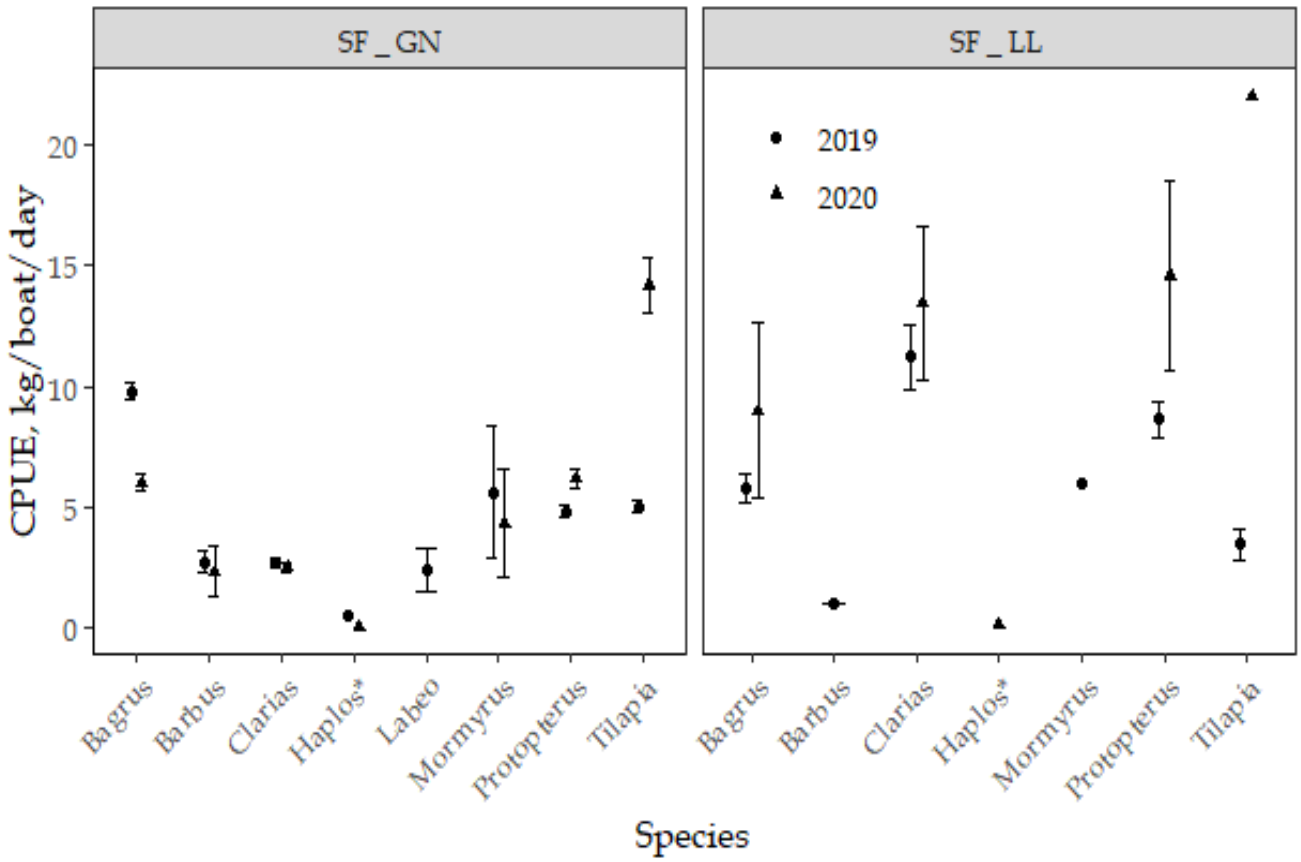

Figure 10: CPUE (kg/boat/day) in the main vessel gear (V-G) combinations on Lake Edward in November 2020 and July 2019

On Kazinga Channel in November 2020, the highest catch rates were recorded for *B. docmak* (17.4 kg boat^{-1} day^{-1}) in SF-LL boats and *Tilapia spp* (12.5 kg boat^{-1} day^{-1}) in SF-GN boats, followed by *B. dockmak* (10.4 kg boat^{-1} day^{-1}) in SF-GN, *Clarias sp* (9.5 kg boat^{-1} day^{-1}) and *P. aethiopicus* in both SF-LL (8.8 kg boat^{-1} day^{-1}) and SF-GN (8.5 kg boat^{-1} day^{-1}) boats, with the rest of the species recording relatively lower CPUEs (Figure 13, Appendix 12). Similar to Lake Edward, the riverine cyprinid *Labeo spp* recorded in July 2019 was not encountered in the November 2020 catches.

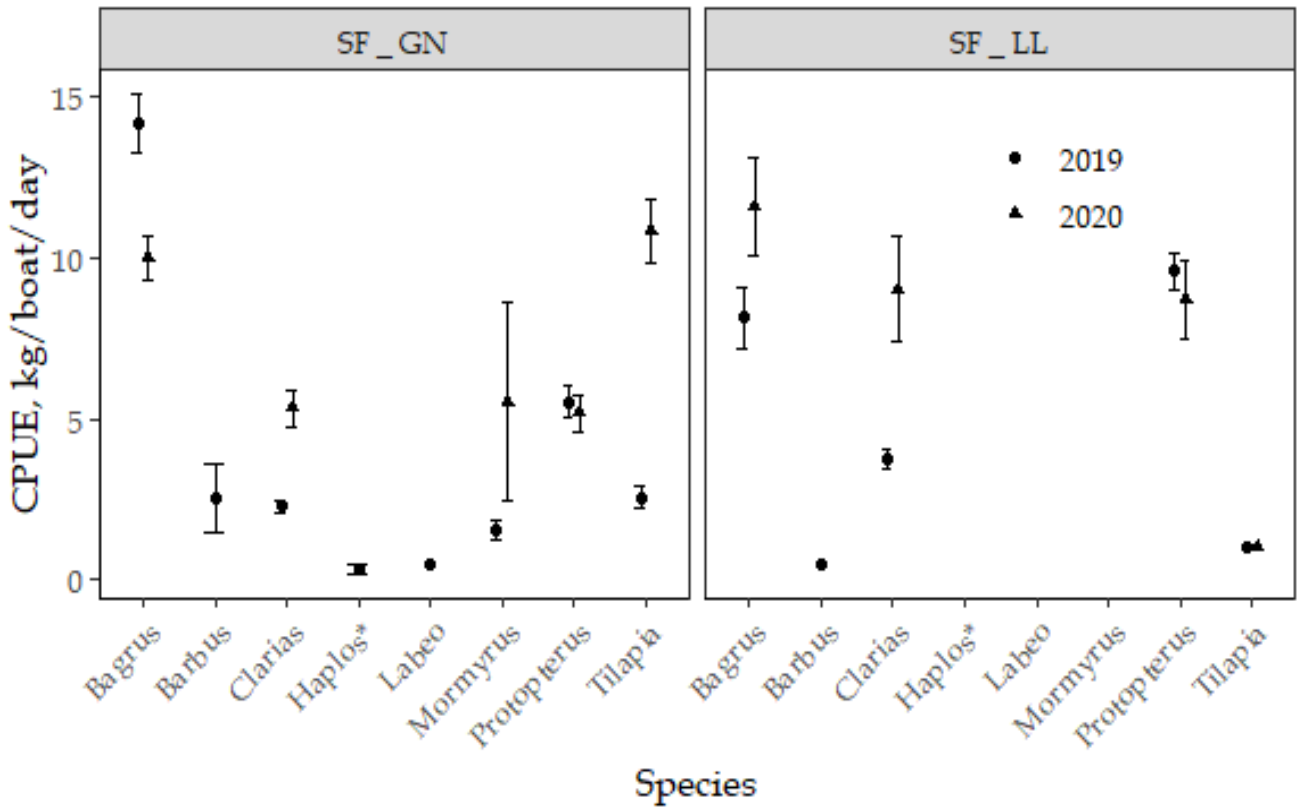

Figure 11: CPUE (kg/boat/day) in the main vessel gear (V-G) combinations on Kazinga Channel in November 2020 and July 2019

In November 2020, the CPUE for the seven species recorded on Lake George varied across the different V-G combinations, with *P. aethiopicus* registering the highest in PA-LL (36.2 kg boat^{-1} day^{-1}), followed by *B. docmak* (19.9 kg boat^{-1} day^{-1}) in SP-GN boats, and *Clarias spp* (19.1 kg boat^{-1} day^{-1}) in PA-GN boats (Figure 14, Appendix 12). The CPUE for all rest of the species recorded in the commercial catch on the three lakes greatly varied across the riparian districts from the recorded maximum to the minimum (0.1 kg boat^{-1} day^{-1}) recorded for the Haplochromines in SF-GN boats (Appendix 12).

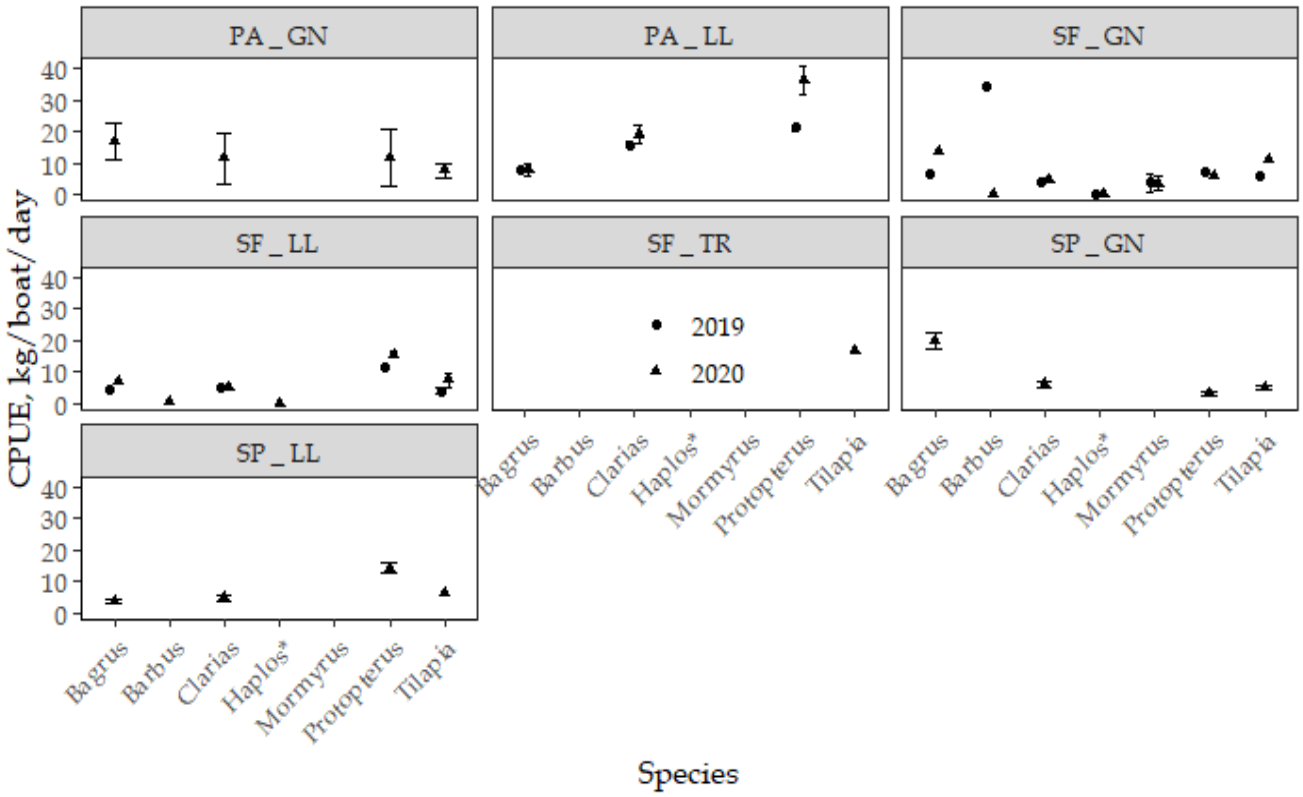

Figure 12: CPUE (kg/boat/day) in the main vessel gear (V-G) combinations on Lake George in November 2020 and July 2019

3.2.2 Estimated fish catches (t) on lakes Edward, George, and Kazinga Channel for the month of November 2020

The monthly catches for November 2020 were estimated for each species by multiplying the catch rates in the different vessel gear combination by the average days fished in a month and total effort by V-G category. The monthly catch estimated for all the species were summed to give the lake-wide monthly catch estimates. The estimates for the month of November 2020 varied across species, district, and water body (Table 8). Overall, the combined total catch for the three systems; lakes Edward, George, and Kazinga in November 2020 was estimated at (722.3±132.1). Lake George posted the largest monthly catch of 373.9±76.5 t (51.7%), followed by Edward (275.9±42.7 t; 38.2%), and Kazinga Channel (72.5±12.9; 10.1%). In comparison to the 2019 CAS, there was an increase of 86.8 % from Kazinga channel, 20.7% from Lake Edward compared to the estimated catches in July 2019. On Lake Edward, the commercial catches were dominated by the *Tilapines* (105.3±11.9 t), followed by *P. aethiopicus* (58.4±8.6 t), and *B. docmac* (55.2±6.9 t). The noticeable absentee in the monthly catches of Lake Edward was *Labeo Victorianus,* recorded in the 2019 CAS at Rwenshama landing site. On Lake George, *P. aethiopicus* dominated the monthly commercial catch (133.8±21.2 t), followed by *B. docmak* (98.8±16.3 t), with the *Haplochromines* contributing the least (0.1±0.0 t). The monthly catches on the Kazinga channel comprised mainly of the large-sized species; *B. docmak* (22.4±2.7 t) and *P. aethiopicus* (15±2.6 t). The riverine cyprinid *Barbus sp*. were only present in the commercial catches of lakes George (Rubirizi district) and Edward (Rukungiri district).

Table 8: Estimated catch (tons ± SE) landed in November 2020 on lakes Edward, George, and Kazinga Channel

Water body	*District*	*Bagrus sp*	*Barbus sp*	*Clarias spp*	*Haplochromine spp*	*Labeo spp*	*Mormyrus sp*	*Protopterus sp*	*Tilapia spp*	*Total*
Kazinga	Kasese	11.9±1.4	-	8.7±2.1	-	-	0.9±0.3	9.1±1.5	6.6±0.7	56.8±6
Channel	Rubirizi	10.5±1.3	-	7±1.3	-	-	5.7±2.4	5.9±1.1	6.2±0.8	95.6±6.9
Total		**22.4±2.7**	**0±0**	**15.7±3.4**	**0±0**	**0±0**	**6.6±2.7**	**15±2.6**	**12.8±1.5**	**72.5±12.9**
	Kasese	24.3±2.3	-	14.1±1.8	-	-	0.9±0.2	32.2±3.2	14.2±0.7	85.7±8.2
George	Kitagwenda	52.5±9.9	-	36.6±11.2	-	-	-	77.4±15.4	34.1±10.7	200.6±47.2
	Rubirizi	22±4.1	0.8±0	12.7±3.7	0.1±0	-	8.2±6	24.2±2.6	19.6±4.7	87.6±21.1
Total		**98.8±16.3**	**0.8±0**	**63.4±16.7**	**0.1±0**	**0±0**	**9.1±6.2**	**133.8±21.2**	**67.9±16.1**	**373.9±76.5**
	Kasese	19±1.4	6.5±3.3	10.8±1.2	0.1±0	-	11.4±0	22.9±1.6	45.9±2.4	116.6±9.9
Edward	Rubirizi	12±1	2±0	5.8±1.4	-	-	-	13.5±2.1	50.7±8.1	345.2±12.6
	Rukungiri	24.2±4.5	4.7±2.8	7.7±2	0.1±0	-	7.9±4.6	22±4.9	8.7±1.4	75.3±20.2
Total		**55.2±6.9**	**13.2±6.1**	**24.3±4.6**	**0.2±0**	**0±0**	**19.3±4.6**	**58.4±8.6**	**105.3±11.9**	**275.9±42.7**

3.2.3 Estimated annual fish catches on lakes Edward, George, and Kazinga Channel in 2020

The catch estimates for the month of November 2020 were raised through the 12 months in a year to provide an indication of annual estimates. A combined total of 8261.3 t (Figure 15) was estimated as annual catch for the three water bodies; Edward (3,310.6±511 t; 40.1%), George (4,488.9±917.1 t; 54.3%), and Kazinga Channel (869.3±154.7 t; 10.5%). This observation in annual catches represents an increase of 24.5% from the 6,636.2 t in 2019. Since the annual catches were derived from monthly estimates, they exhibited a similar pattern with respect to species and district contributions.

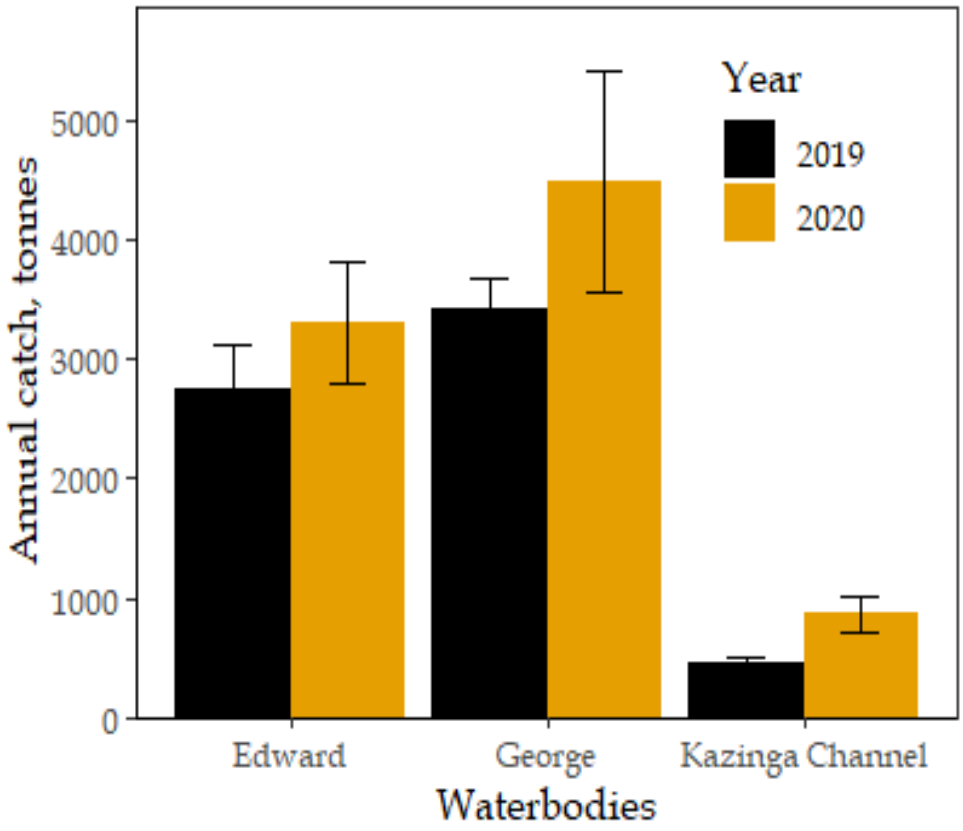

Figure 13: Annual catch estimates (tons ± SE) for lakes Edward, George and Kazinga Channel based on July 2019 and November 2020 CAS data

3.2.4 Mean unit price, monthly value of catch, and annual gross revenue estimated for the commercial fish species on lakes Edward, George, and the Kazinga Channel

3.2.4.1. Mean unit prices

The mean unit price for each fish species slightly varied between water bodies and across species. Generally, the large-sized species e.g. *B. docmak* and *P. aethiopicus* recorded higher unit prices than the small sized species such as Haplochromine cichlids (Table 9). Similarly, the unit prices for majority of the commercial species were generally lower in November 2020 than in July 2019. On Lake Edward, *Barbus sp* was the most valued species at UGX 6700, followed by *P. aethiopicus* (UGX 6434), and *B. docmak* (UGX 6208), while Haplochromines registered the least unit price (UGX 1000). On Lake George, the highly priced species were *B. docmak* (UGX 6384), *P. aethiopicus* (UGX 6277), and *Mormyrus spp* (UGX 6077), with the *Haplochromines* fetching the lowest value (UGX 2000). On the Kazinga Channel, the *Tilapines* fetched the highest unit value (UGX 7353) followed by *P.athiopicus* (UGX 5630), and *B. docmak* (UGX 5185). Similar to the two lakes, the *Haplochromines* were the least valued species on Kazinga Channel (UGX 1000). The variations in unit prices for the rest of the species between years on the three water bodies are presented in Table 9.

Table 9: *Average unit price (UGX) of fish species landed on lakes Edward, George and Kazinga channel in July 2019 and November 2020.*

Water Body	Edward		George		Kazinga Channel	
Species	**2019**	**2020**	**2019**	**2020**	**2019**	**2020**
Bagrus docmak	7136	6208	7026	6384	6767	5185
Barbus spp	7467	6700	7100	3000	6690	
Clarias spp	6564	5489	6661	5712	6577	4892
Haplochromine spp	3000	1000	3750	2000	3000	1,000
Labeo Spp	10900				2264	
Mormyrus spp	3121	5750	8525	6077	3963	4322
Protopterus aethiopicus	6689	6434	6447	6277	6221	5630
Tilapia spp	9502	5515	8213	5779	7799	7353

3.2.4.2. Monthly value of catch

The contribution of individual fish species to the monthly value of catch was estimated per district and water body by multiplying the species mean unit price by the total monthly catch of the species. The lake-wide monthly revenue was determined by summing up the monthly revenue of the different species landed per water body. Generally, monthly revenue of catch varied across districts, water bodies, and species (Table 10). The combined monthly catch of 722.3 t from the three water bodies (Table 8) was estimated to fetch monthly gross revenue of UGX 4.27 bn (Table 10). Considering water bodies, Lake George recorded the highest monthly revenue estimated at UGX 2.27 bn (53.0%), followed by Edward (1.61 bn; 37.7%), and Kazinga Channel recorded the least (0.396 bn; 9.3%).

On Lake George, the highest monthly revenue was obtained from *P. aethiopicus* (0.83 bn; 36.6%) and the least from *Haplochromines* (0.3 million; 0.01%), with the rest of the species contributing moderately (Table 10). In terms of district contribution, Kitagwenda contributed the highest monthly revenue on Lake George valued at 1.29 bn (57.1%) while Rubirizi contributed the least (0.46 bn; 20.5%).

On Lake Edward, the tilapines contributed highest to the monthly gross revenue (0.575 bn; 35.8%), followed by *P. aethiopicus* (0.367 bn; 22.8%), and *B. docmak* (0.346 bn; 21.5%), with the least contribution from the haplochromine cichlids (0.2 million, 0.01%). Kasese district contributed highest to the monthly revenue (0.688 bn; 42.8%), followed by Rubirizi (0.501 bn; 31.2%), while Rukungiri posted the least (0.419 bn; 26.0%).

The monthly revenue of catch from Kazinga Channel was largely contributed by *B. docmak* (0.112 bn; 28.3%), with the rest of the species contributing relatively lower revenues (Table 10). Of the two districts sharing Kazinga Channel, Kasese retained the highest revenue (0.221 bn; 55.8%).

Table 10: Monthly gross revenue of catch (million UGX) from lakes Edward, George and Kazinga

Water body	District	Bagrus	Barbus	Clarias	Haplochromine spp	Labeo	Mormyrus	Protopterus sp	Tilapia	Total
Kazinga Channel	Kasese	61.7	-	50.5	-	-	3.4	53.6	52	221.2
	Rubirizi	50.4	-	31.8	-	-	20.1	29.6	43	174.9
	Total	112.1	0	82.3	0	0	23.5	83.2	95	396.1
George	Kasese	166	-	93.8	-	-	4.2	158.2	85.4	507.6
	Kitagwenda	360.9	-	193.8	-	-	-	539.1	199.7	1,293.50
	Rubirizi	118.8	2.4	62.6	0.3	-	46.3	131.1	103	464.5
	Total	645.7	2.4	350.2	0.3	0	50.5	828.4	388.1	2,265.60
Edward	Kasese	113.9	41.6	66.5	0.1	-	64.7	146	255	687.8
	Rubirizi	73.1	14.3	30.8	-	-	-	102.5	280.4	501.1
	Rukungiri	158.7	17	38.6	0.1	-	45.6	118.8	40	418.8
	Total	345.7	72.9	135.9	0.2	0	110.3	367.3	575.4	1,607.70

3.2.4.3. Annual Gross Value of Catch

Using the monthly revenue of catch for November 2020, annual revenue from the annual catch was projected by multiplying the monthly revenue over a twelve-months period. The estimated annual catch of 8261.3 t (Figure 15) for the three water bodies was estimated at UGX 51.2 billion (Table 11), shared among lakes Edward (19.292 bn; 53.1%), George (27.187 bn; 37.7%), and Kazinga Channel (4.751 bn; 9.3%). Because the annual revenue was raised based on monthly values, the percentage composition by species and water body showed a similar pattern described for the monthly revenue above.

Table 11: Estimated annual gross revenue of catch (million UGX) from lakes Edward, George and Kazinga channel for 2020 presented by species

Species group	Lake Edward	Lake George	Kazinga Channel	Total
Bagrus bajad	4,149.1	7,747.9	1,345.2	13,242.2
Barbus sp	874.9	29.4		904.3
Clarias spp	1,630.3	4,201.6	986.5	6,818.4
Haplochromine spp	2.6	3.7		6.3
Mormyrus spp	1,323.7	606.0	281.9	2,211.6
Protopterus aethiopicus	4,407.4	9,940.5	997.5	15,345.4
Tilapia spp	6,904.4	4,658.2	1,139.9	12,702.5
Total	**19,292.4**	**27,187.3**	**4,751.0**	**51,230.7**

3.2.5 Estimates of fish retained for household consumption

The quantity of fish retained by fisher on the three water bodies, as part of the fresh catch for home consumption increased by a 35.85% margin from 505 t in July 2019 to 681 t in November 2020 (Table 12). The largest quantity retained was recorded on Lake George (362 t), followed by Edward (216 t) and the least domestic consumption was observed on the Kazinga Channel (103 t). On all the three water bodies, the most preferred species retained for domestic consumption in November 2020 was *Tilapia*; 112 t (51.85%) on Edward, 125 t (34.53%) on George, and 36.1 t (35.05%) on the Kazinga Channel. Overall, *Tilapia* spp accounted for 40.1% (273.1 t) of the total quantity (681 t) retained for domestic consumption on the three systems (Table 12).

Table 12: Quantity of fish (t) retained on by fishers for domestic consumption on lakes Edward, George, and Kazinga channel in 2019 and 2020

Water body	**Lake Edward**		**Lake George**		**Kazinga Channel**	
Species	**2019**	**2020**	**2019**	**2020**	**2019**	**2020**
Bagras docmak	62.3	33.5	27.1	61.4	10.3	28.1
Barbus sp	30.5	25.4	0	0	20.3	
Clarias spp	33.3	11.9	67.1	63.7	5.7	11.2
Mormyrus spp			26.1		2.7	7.1
Protopterus aethiopicus	10.4	32.7	65.5	112	10.6	20.9
Tilapia spp	53.5	112	74.9	125	5	36.1
Total	**190**	**216**	**260.7**	**362**	**54.6**	**103**

3.2.6 Population structure of the dominant fish species from lakes Edward, George, and Kazinga Channel

Following the first set of CAS in July 2019, it was recommended to take measurement of the size structure for the dominant commercial fish species. During the November 2020 survey, length measurements were taken for the four dominant commercial fish species; *B. docmak*., *Tilapia (Oreochromis niloticus)*, *Clarias sp (Clarias gariepinus)*, and *P. aethiopicus* (Figures 16 – 18). Generally, the largest portion of the catch comprised of mature individuals based on the literature for size at 50% maturity (L_{50}) for the species whose length measurements were recorded.

On all the three water bodies, >90% of the *B. docmak* were mature (≥26 cm, Fork Length (FL). Similarly, majority of the catch for *C. gariepinus* on the three water bodies constituted of mature individuals (≥30.4 cm, TL); Edward (80.2%), George (95.7%), and Kazinga Channel (94.2%). For *O. niloticus*, 62% of the catch on Lake Edward were mature (≥28cm, TL) while George and Kazinga Channel constituted 72% and 88% respectively of the mature fish. Except on Lake Edward were 50.1% of the catch for *P. aethiopicus* were mature (≥76 cm, TL), the species catch was dominated by immature individuals on Lake George (66.7%) and Kazinga Channel (68.9%). Specially, *B. bajad* on Lake Edward, ranged from 18 – 94 (Mean±SD, 48±8 cm TL), *C. gariepinus* (24 – 105 cm, TL; mean = 51±15 cm TL), *P. aethiopicus* (23 – 110 cm, TL; mean = 74±13 cm TL) and *O. niloticus* (18 – 55 cm, TL; mean = 28±2 cm TL) (**Figure 16**). On Lake George, similar observations were made for the species, *B.*

docmak (15 – 90 cm, TL; mean = 48±8 cm), *C. gariepinus* (8 – 124 cm, TL; mean = 57±15 cm), P. aethiopicus (31 – 130 cm, TL; mean = 71±11 cm) and *O. niloticus* (16 – 63 cm, TL; mean = 28±2 c) (**Figure 17**). On the Kazinga Channel, *B. bajad* ranged from 26 – 85 cm, TL (mean = 45±8 cm), *C. gariepinus* (20 – 121 cm, TL; mean = 55±11 cm), *P. aethiopicus* (29 – 100 cm, TL; mean = 71±12 cm) and *O. niloticus* (20 – 65 cm, TL; mean = 30±4 cm) (**Figure 18**).

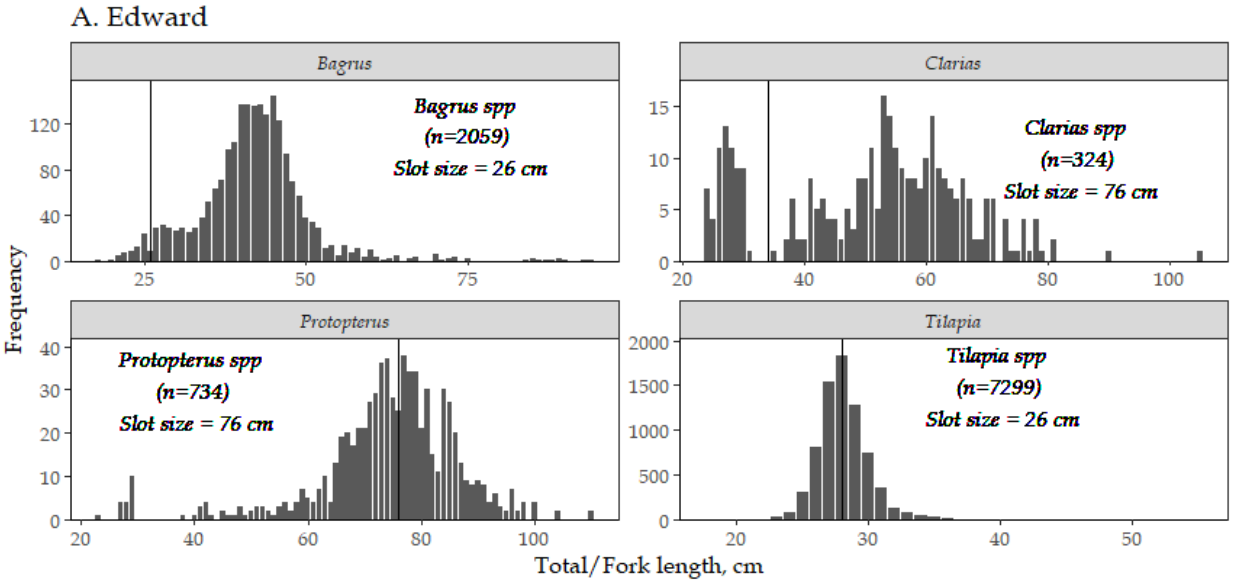

Figure 14: Size structure of dominant fish species recorded in commercial catches on Lake Edward in November 2020. The vertical lines indicate the presumed slot sizes based on literature.

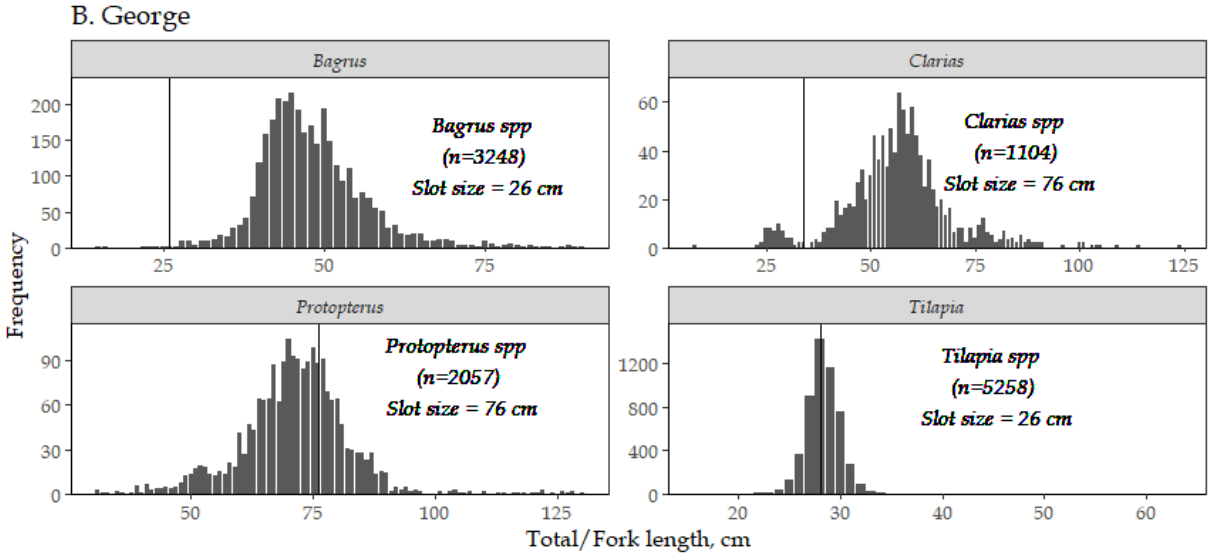

Figure 15: Size structure of dominant fish species recorded in commercial catches on Lake George in November 2020. The vertical lines indicate the presumed slot sizes based on literature.

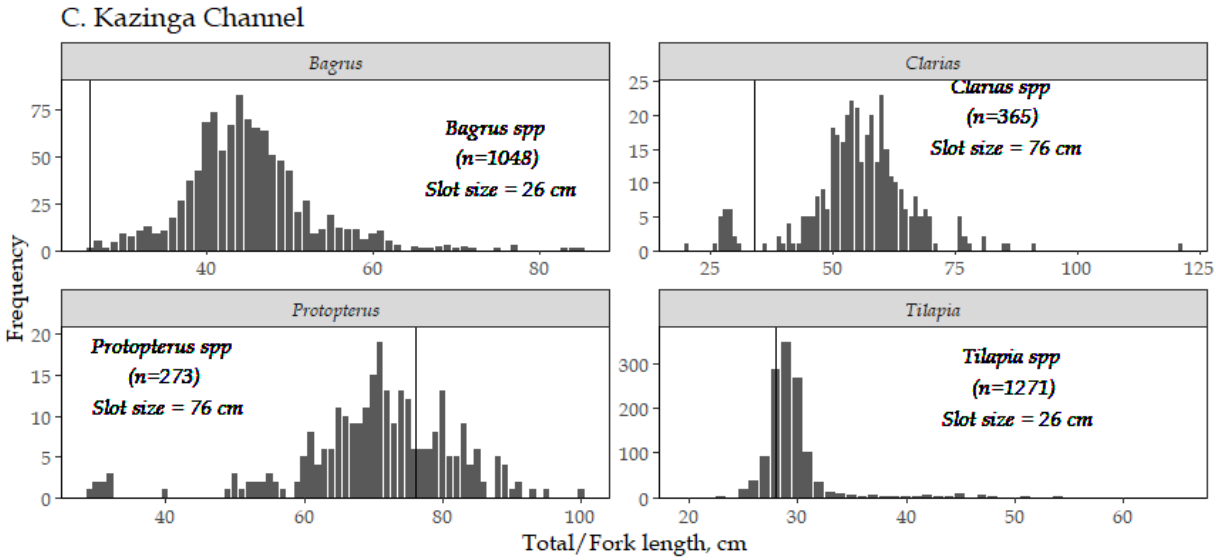

Figure 16: Size structure of dominant fish species recorded in commercial catches on Kazinga Channel in November 2020. The vertical lines indicate the presumed slot sizes based on literature.

3.2.7 Discussion of results for Lake Edward

3.2.7.1. Changes in fish catches

The annual catches on the three systems have fluctuated since 2006, with the highest record catch (9,096.9 t) observed in 2013 and the least catch (2,381.9 t) registered in 2017 (Table 13). Compared to the July 2019 survey, the November 2020 survey observed a general increase in the CPUE, and estimated monthly and annual catches for the major commercial fish species increased. On Lake Edward, the projected monthly and annual catches increased by 20.7% while on George and Kazinga channel, it increased by 30.8% & and 88.2% respectively. The increase in catch rates could be attributed to a combination of factors; i). increase in V-G combination targeting the commercial species and ii). Continued enforcement of the minimum legal sizes by the Fisheries Protection Unit (FPU) as well as compliance by the fishers. The marked increase in V-G combinations were observed on Lake George where up to seven V-G combinations were recorded in the commercial fishery up from the three (SF-GN, SF-LL, and PA-LL) recorded during the July 2019 survey. Of major concern is the emergence of the illegal V-G combinations (PA-TR, PA-GN, SP-GN, and PA-LL) on Lake George. Such effort is usually associated with illegal fishing practices including harvest of immature fish. Particularly, Parachute and Sesse pointed boats are usually operated without engines, majorly confined in the shallow inshore habitats which have been proven to provide refuge for the breeding stocks and their juveniles, thereby disrupting recruitment and breeding patterns for the diverse fish species.

It should be noted that unlike on Lake Edward and Kazinga Channel, where enforcement efforts by FPU are concentrated, little management interventions exist on Lake George, hence the resurgence of illegal fishing effort. There is need to strengthen enforcement of fisheries regulations on the lake to remove the destructive illegal fishing effort (gears and boats) to ensure sustainable fisheries production and productivity. Specifically, all the parachute boats, Basket traps, and undersize gillnets should be eliminated from the lakes. To strengthen enforcement, there will be need to revive the lower level co-management structures, strengthen their capacity and integrate them into the management of the fisheries resources since they directly benefit from the resource management efforts. Besides, the rise in water levels and flooding of lakes observed across the country could have contributed to the increase in catches. The floods, which occasionally among others bring in nutrients and

food resources could have caused fish migrations from the deeper waters to the inshore areas where they are easily accessible to the fishers.

3.2.7.2. Fisheries economics

As observed in table 9, the mean unit price for the majority of the harvestable species declined across the three water bodies. Fish prices are usually determined by individual size of fish, the quantity of fish supply, and market demand. The observed decrease in mean unit price could be attributed to the increase in fish supply against the low demand, and a decrease in size of fish. The smaller the fish size, the lower the unit value and vice versa. Generally, due to the COVID-19 pandemic, demand for fish seem to have reduced due to restricted movements to the local and regional markets, especially the DRC and Southern Sudan. The two countries offer a good market for fish from Uganda, including that from lakes Albert, Edward, George, and Kazinga Channel. Despite the decrease in Unit price, there was a slight increment (8.9%) in the estimated annual revenue of catch from 47.03 bn in 2019 to 51.23 bn in 2020 (Table 11). The increase in annual revenue is attributed to the increase in annual catch.

3.2.7.3. Domestic fish consumption by fishers

The November 2020 survey saw an increase in quantity of fish retained by fishers as part of the catch for their immediate home consumption to provide fish protein nutrition. The 35.85% increase from 505 t in July 2019 to 681 (Table 11) is mainly attribute to the increase in catches of the large bodied species; *B. docmak, Tilapia spp, Barbus sp, Clarias spp*, and *P. aethiopicus* which are preferred for home consumption. When there is enough catch, fishers have enough fish for sell and retain a portion for their home use, unlike when the catches are meager that fishers prioritize income to food nutrition. The increase in quantities retained for home use is a good indicator of improved nutrition among fishers and fisher communities and should be encouraged.

3.2.7.4. Size structure of the major commercial species

Information on size structure of the exploited species helps in monitoring the stock responses to exploitation and other environmental disturbances. It also helps managers to monitor compliance of fishers to the set fisheries regulations especially the gear and slot size restrictions. The size structure of fish landed for the dominant large-sized species in three water bodies indicate that majority of the catch conform to the recommended slot size or L_{50} for the species, with the exception of *P. aethiopicus* (Figures 16, 17, & 18). Despite this observation, limited data exists on the biology and ecology including size at first maturity of the commercial fisheries in the study lakes. This information is very key in determining and guiding on the legal slot size as well as appropriate harvesting gears. In the current study, the inferences on size structure in relation to slot size and size at maturity were based on literature on the FishBase site and studies on these species in other water bodies. There is hence need for comprehensive biological and ecological studies for the diverse fish species in the Lake to inform management decisions including gear size and slot size restrictions.

Table 13: Trends in commercial catches landed on lakes Edward, George, and Kazinga Channel for the period 2006 – 2020 (Table modified based on results of previous CAS Reports by NaFIRRI & DiFR).

Water Body	2006	2007	2008	2011	2012	2013	2017	2019	2020
Edward	1,835.0	1,411.1	914.6	1,385.7	1,734.9	3,193.0	937.9	2,744.0	3,310.6
George				2,508.9	2,253.7	5,347.3	1,265.0	3,431.2	4,488.9
Kazinga				154.4	203.7	556.6	179.0	461.8	869.3
Total				**4,049.0**	**4,192.3**	**9,096.9**	**2,381.9**	**6,637.0**	**8,261.3**

In conclusion, the catch landings on the three water bodies have increased, which is good for income, employment, and livelihoods for the dependent communities. In addition, there are improvements in the portion of the catch retained by fishers for direct home consumption which translates into improved protein nutrition and food security among fishers. However, the three main concerns should revolve around the resurgence of illegal fishing effort, especially on Lake George; the low unit prices of the catch and subsequent revenue which could be due to small sizes of fish landed; and the absence of information on the biology and ecology of the commercial species to guide their exploitation and management.

3.2.8 Recommendations for Lake Edward, George, and Kazinga Channel

Based on the above observations, the following recommendations are proposed to aid the sustainable management of the fisheries resources in lakes Edward, George, and Kazinga Channel.

1. Enforcement of fisheries regulations should be strengthened particularly on Lake George to eliminate all the illegal fishing effort. To achieve on this realistically and sustainably, the lower level co-management structures should be revived and their capacity fully developed to participate in the management of their resources.
2. Detailed studies on biology & Ecology of the exploited stocks to generate key scientific information required to inform management decisions for the diverse fish species.
3. Given the emerging small fisheries of Haplochromines, there is need to undertake biological and ecological studies to understand their interactions with the large species as well as gear selectivity studies to guide on appropriate harvesting gears & sizes.
4. Fishers were found using artificial bait types (pancakes) as a substitute to the previously dominant live bait of haplochromine cichlids. Research should focus on exploring the most appropriate live bait for the longline fishery and alternatives for supply such as aquaculture to ensure sustainability.
5. We propose a detailed socio-economic study including a value chain analysis to collect information that would guide the identification of external constraints on the fisheries.

3.3 General recommendations

1. The emerging issues associated with the rising water levels, flooding, and COVID-19 should be studied to understand their impacts on the fisheries and the dependent fisher communities as a basis for providing mitigations and adaptive measures;
2. There is need for continued stock monitoring through the fisheries dependent (CAS & FS) and fishery independent studies, taking into account the seasonal variations (i.e. long dry, short rain, short dry and long rain) and climate change and variability to generate data required to model the lake stocks and guide on species- specific allowable effort & catch.
3. Future funding from NELSAP and other development partners should consider lakes Edward, George, and Kazinga Channel as a single system because the three are inseparable as they are interconnected and share similar biodiversity and associated challenges. Specifically, the impacts in Lake George and Kazinga Channel which do not share boarder with DRC can have far reaching influence on the DRC side. Similarly, Lake Albert and the Albert Nile should be handled as a single system given the interconnectivity and the implications in relation to their environment and biodiversity. Currently, funding from the NELSAP LEAF II budget covers

only the two shared Lakes Edward and Albert. It was therefore recommended at the NWG planning and validation meetings that NaFIRRI as the lead agency presents this anomaly both the NELSAP coordination unit for future considerations.

4. Studies on fish biology, ecology, fish species identification and taxonomy are recommended under the subsequent LEAF projects to clearly understand the species dynamics and interactions for sound management decisions.
5. There is need for production of information dissemination materials targeting the different stakeholder (fishers and managers) to enable mass dissemination and use of the CAS results.
6. Continued CAS data collection in four seasons of the year, i.e. long dry, short rain, short dry and long rain periods, is recommended in next CAS activities to justify the significant changes in catch rates of 2019 and 2020 CASs.
7. In future, the departments, directorates, agencies, and ministries responsible for fisheries management should consider conducting mass training for every fisher on the lake in basic fisheries information capture. This should then be followed by introduction standardized logbooks where every fisher is required to record details of his boat and catch on a daily basis and regularly submit the records to the responsible departments for analysis and generation of the desired statistics. This will in the long run cut costs for fishery dependent data collection.

Lessons learnt

Because the fisheries staff and enumerators are not permanent i.e. rotate, retire, migrate, and in the worst case scenario die, there is need for continuous capacity building especially among the fisher communities.

Acknowledgement

NaFIRRI is grateful to the financial and logistical support from NBI's NELSAP and the national LEAF II coordination office that enabled the collection of lake-wide catch and effort data on the four water bodies; Albert, Edward, George, and Kazinga Channel. These data will contribute to aiding the sustainable management of the fisheries resources in these systems. The Directorate of Fisheries Resources (DiFR) is acknowledged for the long-term collaboration and support towards fisheries research and management; specifically, under LEAF II, DiFR has continued to play a pivotal role in ensuring the successful implementation of CASs and FSs. The District Fisheries Staff from the riparian districts of Kasese, Rubirizi, and Rukungiri (on Lake Edward); and Pakwach, Buliisa, Hoima, Kikuube, Kagadi, and Ntoroko (on Lake Albert) are equally appreciated for the contributions towards the planning, recruitment and training of enumerators, mobilization of fisher communities, and supervision of field data collection to ensure acquisition of quality data. Without the high level of commitment and dedication of the trained enumerators towards the CAS exercise, it would not have been possible to generate the information contained in this report. Your contributions are highly appreciated.

Lastly, we appreciate and commend the good job done by the media; Spice FM-Hoima, Pakwach FM, and Voice of Kamwenge to create mass awareness and publicity of the CAS & FS exercises as well as that of hotel fraternity; MuZARDI (Mukono), TJ Global Hotel (Kasese), Hotel Buffalo and Miika Eco Resort (Hoima) to provide conference facilities and catering services amidst the COVID-19 restrictions.

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APPENDICES

Appendix 1: List of CAS landing sites on lakes Edward and Albert during November, 2020 CAS activities

SN	Lake	District name	Sub-county	Landing site name
	Albert	Buliisa		Bugoigo
				Butiaba A
				Butiaba B
				Kabolwa
				Walukuba
				Wanseko
		Hoima		Kaiso
				Mbegu
				Runga
				Kyabarangwa
		Kikuube		Nsonga
				Kyehooro
		Kagadi		Kamina
				Kitebere
				Songaraho
		Pakwach		Abok
				Angumu
				Dei A
				Dei B
		Ntoroko		Ntoroko
				Rwangara
				Mulango
	Edward	Kasese	Katwe-Kabatoro TC	Katwe
			Nyakiyumbu	Kayanja
			Muhokya	Kahendero
			Lake Katwe	Hamukungu
				Kasenyi
				Katunguru-K
		Rubirizi	Katunguru	Kisenyi
				Kazinga
			Katunguru	Katunguru-R
				Kashaka
		Rukungiri	Bwambara	Rwenshama
		Kamwenge	Mahyoro	Mahyoro
				Kayinja
				Nyakera

Appendix 2: Customized CAS code sheet for Lake Albert

EXPLAINATION OF CODING

Serial Number: The sequence in which the fishing boats are being recorded on the data collection forms

Reg. No. Refers to the registration (identification) number for those boats that are registered.

Vessel type code: The type of vessel whose catch is recorded

- Ssese flat at one end (SF)
- Ssese pointed at both ends (SP)
- Parachute (PA)
- Dugout (DO)
- Rafts (RA)
- Congo Barque (CB)
- Foot fishers (FF)
- School Kabalega (SK)

Length: Measured in meters using a tape measure or a rope with knots tied at 1 meter intervals

Mode of propulsion: The mode by which the fishing craft is propelled

- Outboard engine (O)
- Paddles (P)
- Sail (S)
- Towed by Motorized boat (T)

Number of Crew/fishers: Number of crew who were on the craft on the fishing exercise

Days fished: The number of days the particular boat went on fishing trips during the previous seven days (week)

Gear type code: The type of gear used to catch the fish in the craft examined

GN Gill Net: State number per mesh size in inches
LL Long Lines: State number of hooks by sizes
BES Beach seine: State a complete set
BOS Boat seine: State a complete set
CN Cast net: State the complete set
HL Hand Line: State number of lines by size
TR Traps: State number
LN Lift net: State number
SN Scoop net: State number
SS Small seine: Targeting Dagaa/Omena/ Mukene: State number per mesh size in mm
MF Monofilament: State the number
OT Other gear not specified above: State type and number

Gear operation mode: The mode by which the fishing gear is operated during fishing

1. Active (A)
2. Passive (P)
3. Drift/ Tembea (D)

Number of panels: Applies to gillnet and small seine nets. State the number of vertical panels for the vertically joined nets.

Number of gear units: Refers to the total number of units of the fishing gear used to catch fish landed in the craft examined

Size of gear: Refers to the size of gear(s) used to catch fish landed in the craft examined; recorded in inches for gillnets, millimeters (mm) for small seine nets and number for longline/hand line hooks.

Species name or Code: Refers to the different fish species landed in the craft sampled
1. Lates (Mputa/ Gurr/Kaputen/Petè)
2. *Engraulicypris bredoi* (Mziri)
3. Tilapiines (Engege/Ozogoro/Nzogoro)
4.Clarias sp (Male/Nyai/Bissa/Losso)
5. Protopterus (Mamba/Lut/Bamba)
6. Synodontis sp (Nkolongo/Gologolo/Agor/Okwoki/ Kamadulu)
7. Haplochromine sp (Nkejje/Mpomo/ Kituba/Tuba/Mbeere/ Upok)
8. Labeo sp (Karuka)
9. Barbus sp (Kisinja)
10.Schilbe sp (Taitai/Ulike/Pendakuli)
11. Malapterurus sp (Ntiira/Adinga)
12.Alestes (Angara)
13.*Brycinus nurse* (Ragoogi/ Doloi)
14. Hydrocynus (Ngasia)
15. Bagrus sp (Munama/ Lanya/Semutundu)
16.Mormyrus sp (Kasulubana/Kasulu)
17. Other (Specify name)

Hours fished: Refers to the total number of hours the gear spent fishing.

Number of lamps/bulbs: This applies to fish species targeted using artificial light attraction sources e.g. *Brycinus nurse* (Ragoogi) and *Engraulicypris bredoi* (Mziri). Record the number of lamps or bulbs used in each boat.

Bait type code for Long line and hand line hooks
1. Haplochromines
2. Fish parts of tilapia
3. Offals
4. Clarias spp
5. Synodontis spp
6. Mormyrus
7. Engraulicypris bredoi
8. Earth Worms
9. Algae
10. Other (Specify name)

Note: Translate species names into local languages as appropriate

Appendix 3: Customized code sheet for Lake Edward

EXPLANATION OF CODING

Serial Number: The sequence in which the fishing boats are being recorded on the data collection forms
Reg. No.: Refers to the registration (identification) number for those boats that are registered.
Vessel type code: The type of vessel whose catch is recorded

- Ssese flat at one end (SF)
- Ssese pointed at both ends (SP)
- Parachute (PA)
- Dugout (DO)
- Rafts (RA)
- Foot fishers (FF)

Length: Measured in meters using a tape measure or a rope with knots tied at 1 meter intervals
Mode of propulsion: The mode by which the fishing craft is propelled

- Outboard motor (O)
- Paddles (P)
- Sail (S)
- Towed by Motorized boat (T)

Number of Crew/barias. Number of crew who were on the craft on the fishing exercise
Days fished: The number of days the particular boat went on fishing trips during the previous seven days (week)
Gear type code: The type of gear used to catch the fish in the craft examined

GN Gill Net: State number per mesh size in inches
LL Long Lines: State number of hooks by sizes
BES Beach seine
BOS Boat seine
CN Cast net: State number
HL Hand Line: State number of lines
TR Traps: State number
LN Lift net: State number
SN Scoop net: State number
MF Monofilament: State the number
OT Other gears not specified above: State type and number

Gear operation mode: The mode by which the fishing gear is operated during fishing

- Active (A)
- Passive (P)
- Drift/Tembea (D)

Number of panels: Applies to gillnet and small seine nets. State the number of vertical panels for the vertically joined nets.
Number of gear units: Refers to the total number of units of the fishing gear used to catch fish landed in the craft examined
Size of gear: Refers to the size of gear(s) used to catch fish landed in the craft examined; recorded in inches for gillnets, millimeters (mm) for small seine nets and number for longline/hand line hooks.
Species name or Code: Refers to the different fish species landed in the craft sampled
1.Tilapiines (Engege,Erihere)

2.Clarias sp (Male,Eyisombi)
3.Protopterus (Mamba,ehondwe,ehondo)
4.Haplochromines *sp*(*Nkejje,Enyamuroro/ Nyamuroro*)
5.Labeosp (Eningu)
6.Barbussp (Kisinja,Enzuguli)
7.Bagrus sp (Semutundu/Omukolho)
8.Mormyrus (Kasulubana,Kasulubani)
9.Other (Specify name)

Hours fished: Refers to the total number of hours the gear spent fishing.

Bait type code for Long line and hand line hooks

1. Haplochromines
2. Fish parts(Specify)
3. Pan cakes
4. Pieces of matooke
5. Termites
6. Earth Worms
7. Algae
8. Other (Specify name)

Note: Translate species names into local languages as appropriate

Appendix 4: Customized CAS field record form for lakes Edward and Albert

Part C – Fishing Operations: Note: Use separate rows for each gear size and species. Ensure that hours fished with each gear type is recorded

Form Number		Sub-county/Sector	
Date		Village Name	
Country Name		Landing site Name	
District/Territory Name		Enumerators' Name & Telephone contact	
GPS coordinates	Latitudes:	Longitudes:	
Boats fished on sampling day		Boats sampled	

VESSEL DETAILS							GEAR AND EFFORT DETAILS							FISH CATCH DETAILS					
Serial Number	Reg. No.	Vessel type code	Length (m)	Propulsion code	Number of Crew	Days fished in the last one week	Gear type code	Number of panels	Number of gear units	Size of gear: GN mesh (inches) SS mesh (mm) or Hook size No.	Mode of gear operation Code	Hours fished	Number of lamps/bulbs (for light fisheries)	Species name or Code	No. of fish (large spp)/ No. basins/buckets (Ragoogi/Muziri and Nkejje/Furu)	Catch wt (kg) large spp Wt (kg) 1 basin/ bucket (Ragoogi/Muziri & Nkejje/Furu)	Price (shs/kg) large spp Price 1 basin/bucket Dagaa& Nkejje	Quantity retained for domestic consumption (kg)	Bait type

Explanatory notes: ……

Appendix 5: Customized Tally sheet for lakes Edward and Albert

FISH LENGTH FREQUENCY FORM

Date… ……Water Body: ……Landing……

Boat S/No……Fish species: ……

TL/FL (cm)	Tally	Total
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
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15		
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26		
27		
28		
29		
30		
31		
32		
33		
34		
35		
36		
37		
38		
39		
40		

TL/FL (cm)	Tally	Total
41		
42		
43		
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Appendix 6: List of CAS enumerators and supervisors trained on Lake Edward

Sno.	Name	Title	District/Institution	Tel. No
1	BASOOMA ANTHONY	Research Technician	Jinja NaFIRRI	256783222734
2	AKOL JOHN MICHEAL	Driver	Jinja NaFIRRI	256772878363
3	NATUGONZA VIANNY	Research Officer	Jinja NaFIRRI	256775241454
4	MUDONDO PHELISITER	Research Technician	Jinja NaFIRRI	256774980880
5	LEON AGNES NAMUYONJA	Accounts Assistant	Jinja NaFIRRI	256702151206
6	MUGYENYI DAN	District Fisheries Officer	Rukungiri	256784833284
7	NAKIYENDE HERBERT	Research Officer	Jinja NaFIRRI	256782168887
8	BAKUNDA AVENTINO	Principle Fisheries Officer	MAAIF/DiFR	256772592547
9	EMILY ARAYO	D. Communications Officer	Jinja NaFIRRI	256753605621
10	NABUUFU AGNES	Information Technology	Jinja NaFIRRI	256772189378
11	MUHUMUZA ELIAS	Senior Research Technician	Jinja NaFIRRI	256772633827
12	BYAMUKAMA PATRICK	Senior Fisheries Officer	MAAIF/DiFR	256772613388
13	WATYEKERE LEO	Driver	MAAIF/DiFR	256779251046
14	NDUWAYESU EVEREST	Research Assistant	Jinja NaFIRRI	256782441195
15	GEOFFREY DHEYONGERA	Principle Fisheries Officer	MAAIF/DiFR	256772658354
16	MUKASA K MAGEZI	Driver	Jinja NaFIRRI	256772629071
17	MUKIIBI THADIUS	Driver	MAAIF/DiFR	256703899836
18	NABBONGO HENRY	AC/COMMISSIONER	MAAIF/DiFR	256772656004
19	MUTABAZI ANANIA	Fisheries Officer	Rukungiri	256773924932
20	AMEN ACKLAM	Enumerator	Rukungiri	256783548570
21	MWESIGWA ASIIMWE	Enumerator	Rukungiri	256799333300
22	ATUHAIRE EVERLYNE	District Fisheries Officer	Kitagwenda	256781635762
23	MPUMWIRE DIDAS	Fisheries Officer	Kitagwenda	256775633736
24	NSEKANABO ANASTORI	Enumerator	Kitagwenda	256782174545
25	SEBULIBA MICKDARD	Enumerator	Kitagwenda	256781303693
26	MWESIGYE DEOGRATIUS	Enumerator	Kitagwenda	256789041045
27	TUMUSIIME GEORGE	Enumerator	Kitagwenda	256775613159
28	RUBEIHAYO ANTHONY	District Fisheries Officer	Rubirizi	256774392047
29	MUBANGIZI JULIUS	Senior Fisheries Officer	Rubirizi	256781761859
30	ARINAITWE AUGUCTINE	Fisheries Officer	Rubirizi	256775582922
31	ZIIWA DAVID	Enumerator	Rubirizi	256701856049
32	ZIMBE JOSEPH	Enumerator	Rubirizi	256702443410
33	BYAMUKAMA ROBERT	Enumerator	Rubirizi	256702170116
34	GUMISIRIZA SILAGI	Enumerator	Rubirizi	256754346573
35	KAMUGISHA JULIUS	Enumerator	Rubirizi	256700495974
36	MWESIGYE AMOSI	Enumerator	Rubirizi	256700525162
37	KYEBWIZE YONAH	Enumerator	Rubirizi	256700123249
38	TUGUME JAMILU	Enumerator	Rubirizi	256754737603
39	BWAMBALE ERISANIA	District Fisheries Officer	Kasese	256777292959
40	MASIKA SYLIVIA	Fisheries Officer	Kasese	256782866765
41	ITHUNGA GERTRUDE	Fisheries Officer	Kasese	256772359975

42	KIIZA NGAGHALE WILSON	Fisheries Officer	Kasese	256783886267
43	AGABA CHARLES	Fisheries Officer	Kasese	256772446248
44	JOHNSON MASEREKA	Fisheries Officer	Kasese	256774734206
45	BALUKU PATRICK	Enumerator	Kasese	256782496981
46	MAYORA KASIMU	Enumerator	Kasese	256781830923
47	KABAGAMBE GABSON	Enumerator	Kasese	256775678250
48	WASSWA B LEONARD	Enumerator	Kasese	256753146301
49	MUMBERE IBRAHIM	Enumerator	Kasese	256785120769
50	NKESIGA RONALD	Enumerator	Kasese	256751871265
51	SANDE WILLIAM	Enumerator	Kasese	256700286239
52	KASILIVE ALEX	Enumerator	Kasese	256702880628
53	KAIJA SELLY	Enumerator	Kasese	256776695568
54	TWINAMATSIKO DEOGRATIUS	Enumerator	Kasese	256704824136
55	SSEBANJA YASIN	Enumerator	Kasese	256751450532
56	MUNABA PAULINE	Enumerator	Kasese	256780867785

Appendix 7: List of CAS enumerators and supervisors trained on Lake Albert

SN	Name	Title	Institution	Telephone No.
1	Philp Kutegeka Ngongaha	District Fisheries Officer	Buliisa	256772487542
2	Balikenda Naphitali	Fisheries Officer	Buliisa	256771850338
3	Akello Polly	Fisheries Officer	Buliisa	256779727205
4	Kabarole Felex	Enumerator	Buliisa	256776548573
5	Wathum David	Enumerator	Buliisa	256777699082
6	Kibaro Francis	Enumerator	Buliisa	256776548573
7	Mwesigwa Gilbert	Enumerator	Buliisa	256775440822
8	Orombi Santos	Enumerator	Buliisa	256779872631
9	Katusabe Godfrey	Enumerator	Buliisa	256787665577
10	Asiimwe Robert	Enumerator	Buliisa	256773189711
11	Bagonza Nebart Beacon	Enumerator	Buliisa	256779048143
12	Babihe John	Enumerator	Buliisa	256783031528
13	Kumakechi Goffin	Enumerator	Buliisa	256774461980
14	Juma Said	Enumerator	Buliisa	256773586554
15	Musinguzi K Wiliam	Enumerator	Buliisa	256752931211
16	Nanyonga Debora	Ag. District Fisheries Officer	Hoima	256779130636
17	Rubaizira David	Fisheries Officer	Hoima	256772514068
18	Alinaitwe Jimuris Ivan	Assistant Fisheries Officer	Hoima	256785172654
19	Kagambe Fred	Enumerator	Hoima	256771817410
20	Ofoi Ismail	Enumerator	Hoima	256772761368
21	Kiiza Godfrey	Enumerator	Hoima	256783488848
22	Tumusiime Cohen	Enumerator	Hoima	256771204403
23	Ageno Moses	Enumerator	Hoima	256777742789
24	Onen Moses	Enumerator	Hoima	256784047205
25	Jakwach Isaiah	Enumerator	Hoima	256778826808
26	Gwazo Fransis Xavieer	Distict Fisheries Officer	Kagadi	256772527178
27	Mutengu Isaac	Fisheries Officer	Kagadi	256785695581
28	Opio Isingoma Esau	Enumerator	Kagadi	256775621135
29	Angeno B Patrick	Enumerator	Kagadi	256778962605
30	Leonard Onenichan	Enumerator	Kagadi	256788628370
31	Okecha Angello	Enumerator	Kagadi	256785519927
32	Kaheru Nelson	Enumerator	Kagadi	256784722546
33	Mulungi Rogers	Enumerator	Kagadi	256786544188
34	Muwanga Christopher	District Fisheries Officer	Kikuube	256781363940
35	Kiburara John	Fisheries Officer	Kikuube	256772916167
36	Ogwal George	Enumerator	Kikuube	256779722500
37	Omar Rwoth Emmanuel	Enumerator	Kikuube	256780516681
38	Tumusime Stephen	Enumerator	Kikuube	256774041985
39	Odongo Milliton	Enumerator	Kikuube	256782903823
40	Oweka Francis	Enumerator	Kikuube	256788318367
41	Kule B Zephania	District Fisheries Officer	Ntoroko	256774346422
42	Anyoro Micheal	Fisheries Officer	Ntoroko	256788641235

43	Lubega Isaac Ntumwa	Enumerator	Ntoroko	256778464564
44	Mercy Betty Tembe	Enumerator	Ntoroko	256772848247
45	Mugisa Friday	Enumerator	Ntoroko	256787229817
46	Mumbere Natulinda	Enumerator	Ntoroko	256787652079
47	Baguma Andrew	Enumerator	Ntoroko	256781820597
48	Kapalaya Frank	Enumerator	Ntoroko	256772751570
49	Oloya Micheal	Distict Fisheries Officer	Pakwach	256773363313
50	Nyeko Osman	Fisheries Officer	Pakwach	256773144831
51	Muhammed Ocalanon	Enumerator	Pakwach	256782294631
52	John Kennedy Giramanya	Enumerator	Pakwach	256785794838
53	Otyeku Lenox	Enumerator	Pakwach	256774587788
54	Owila Kennedy	Enumerator	Pakwach	256775948577
55	Mugisa Ronald	Enumerator	Pakwach	256773788381
56	Onyuthi Joshua	Enumerator	Pakwach	256788216780
57	Munguriek Edison	Enumerator	Pakwach	256786312247
58	Juma Ivan	Enumerator	Pakwach	256772591018
59	Mangeni Rechard	Senior Research Officer	DiFR	256772608227
60	Rugadya Richard	Fisheries Expert	LEAF II	256773808251
61	Wabuzibu Frank	Transport Officer	LEAF II	256702010417
62	Winnie Nkalubo	Director Of Research	NaFIRRI	256772671216
63	Mark Olokotum	Research Officer	NaFIRRI	256701722750
64	Samuel Bassa	Senior Laboratory Technician	NaFIRRI	256701648717
65	Richard Sande Mangeni	Research Assistant	NaFIRRI	256772845652
66	Frank Nansereko	Research Assistant	NaFIRRI	256783614392
67	Alice Endra	Senior Information Communication Officer	NaFIRRI	256772313446
68	Ian Wakuta	Accounts Assistant	NaFIRRI	256704647033
69	Chris Hanny Okello	Information Technolog Officer	NaFIRRI	256773760236
70	Shamim Waibuga	Procurement Assistant	NaFIRRI	256704376201
71	Rogers Kalyowa	Transport Officer	NaFIRRI	256782307226
72	Henry Ssemakula	Transport Officer	NaFIRRI	256751895837
73	Rogers Kyangwa	Transport Officer	NaFIRRI	256783614392

Appendix 8: The total annual catch (tons) for Lake Albert Catch Assessment Survey in 2019 and 2020 per district

First phase, 2019							
Species	Buliisa	Hoima	Kagadi	Kikuube	Ntoroko	Pakwach	Total
Alestes	3072.2±788.4	1951.8±938.9	3177.2±656.3	3117.3±205.1	804.4±289.8	469.3±149	12592.2±3027.5
B. nurse	21146.1±4855.1	1760.7±358.4	4798.3±1241.7	5970.6±990.5	4088.8±867.1	29567±7314.6	67331.5±15627.4
Bagrus	2720.5±788.3	2770.5±857.3	1361.3±212.8	2060.5±653.3	2580.3±441.8	621±147.7	12114.1±3101.2
Barbus	3562.8±610.5	824.4±29.7	1848.3±21.5	4020.7±3182.4	-	880.5±201.8	11136.7±4045.9
Clarias	1165.8±261.8	19.5±0	375.1±132.2	-	3271.2±189.9	252±138.6	5083.6±722.5
E. bredoi	9414.3±1223.2	51725.1±2560.8	2492.2±703.5	33943.5±2084.7	3243.3±473.7	20287.2±2478.8	121105.6±9524.7
*Haplos**	5180.5±1312.1	20.2±4.8	-	7657.7±1978.2	1276.8±236.4	637±104.7	14772.2±3636.2
Hydrocynus	5358.7±1397.9	2513.8±827.6	3161.8±535.3	2961.4±660.4	1748±278.4	1835.7±541.4	17579.4±4241
Labeo	872.9±157.3	89.2±0	244.6±0	123.7±0	225.4±0	221.5±11.9	1777.3±169.2
Lates	9883.6±2970.4	5915.9±1240	2700.7±436.4	8890.8±2649.9	1528±258.1	4420.6±1203.4	33339.6±8758.2
Malapterurus	931.5±159.9	43.9±0	25.8±0	504.6±0	-	-	1505.8±159.9
Mormyrus	1069.6±305.3	-	-	-	119.4±0	11.3±0	1200.3±305.3
Others	4854±1431.6	-	242.3±0	1303.6±103.6	989±0	165.7±66.5	7554.6±1601.7
Protopterus	941.2±202.5	-	192±42.9	1047.3±448.5	743.9±39.8	-	2924.4±733.7
Schilbe	323.9±0	-	-	-	-	-	323.9±0
Synodontis	2531.3±855.1	3575.5±859.5	703.1±110	2737±1430.8	2673.7±658.3	769.8±85.3	12990.4±3999
Tilapia	4569.2±898.3	1455.6±108.2	1230.1±242.9	1776±391.3	2495.7±197.2	616.4±122	12143±1959.9
Total	77598.1±18217.7	72666.1±7785.2	22552.8±4335.5	76114.7±14778.7	25787.9±393.0.5	60755±12565.7	335474.6±61613.3
							2020
Alestes	1375.9±358	913.9±349.2	1386.8±33.9	1731±60.1	1348.3±273.2	2920.7±916.5	9676.6±1990.9
B. nurse	22782.7±2979	28873.6±8927.4	2940.3±584.6	17055.9±4803.7	5905.6±1100.9	14622.4±1365.3	92180.5±19760.9
Bagrus	1524.8±446.5	803.1±223.5	780.4±180.1	868.1±283.1	1657.6±408.5	202.3±22.8	5836.3±1564.5
Barbus	2802.5±920.9	40.5±0	383.7±291.9	427±173.9	65.9±23.3	318.9±73.1	4038.5±1483.1
Clarias	2473.6±1133.1	417.7±150.3	163±27.2	771.7±420.7	1087.8±126	221.9±25.9	5135.7±1883.2
E. bredoi	13453.5±3496.1	53904.4±4594.6	6031.1±649.4	62266.2±1418.5.4	706±173.5	18101.4±408.3.9	154462.6±2718.2.9
*Haplos**	13.5±6.6	-	-	-	-	-	13.5±6.6
Hydrocynus	3034.3±684.2	551±162.8	2701.4±598.1	1149.1±292.6	1782.8±0	288±46.4	9506.6±1784.1
Labeo	1327.7±472	271.4±60.8	69.2±0.9	109.8±0	38.6±22.3	178.8±31.3	1995.5±587.3
Lates	5750.1±1256.5	4839.5±758.9	1324.3±745	9061.5±4129.6	3273.9±1018.7	7009±1166.8	31258.3±9075.5
Malapterurus	1921.7±256.2	6.4±0	1.9±1.4	266.1±0	71.1±0	123.5±3	2390.7±260.6
Mormyrus	2495.3±994.6	44.2±22.2	-	45.4±18.6	-	108.5±24.4	2693.4±1059.8
Others	1121.9±433.1	114.4±11.6	3±0.3	99.1±17.5	-	113.6±59.8	1452±522.3
Protopteru	959.8±271.6	290.6±0	160.3±16.3	1659.2±658.9	274±49.9	30.9±7.1	3374.8±1003.8

s							
Schilbe	211.3±0	-	-	-	275.4±0.3	35.4±0	522.1±0.3
Synodontis	1824.1±555.4	258.6±171.5	220.1±50.4	329.8±27.2	1948.2±172.4	3044.6±38.5	7625.4±1015.4
Tilapia	3887.4±563.7	2341.4±598.6	734±156	2822.6±384.2	5446.7±885.6	1141.2±472.9	16373.3±3061
	66960.1±1482	93670.7±1603	16899.5±333	98662.5±2545	23881.9±425	48461.1±833	348535.8±7224
Total	7.5	1.4	5.5	5.5	4.6	7.7	2.2

Appendix 9: Average unit price (Ug.shs) of fish landed on Lake Albert in July 2019 and November 2020 presented by species

Species	**Year**	**Buliisa**	**Hoima**	**Kagadi**	**Kikuube**	**Ntoroko**	**Pakwach**
Alestes	2019	6,104	5,200	3,935	4,000	3,167	8,598
B. nurse	2019	1,003	2,670	1,505	1,400	2,064	1,733
Bagrus	2019	3,149	3,293	4,050	3,176	3,971	3,437
Barbus	2019	4,923	3,500	4,402	4,063	-	6,333
Clarias	2019	3,129	3,000	3,917	-	3,982	4,088
E. bredoi	2019	1,089	996	1,293	823	1,567	1,018
*Haplos**	2019	812	852	-	389	1,475	1,678
Hydrocynus	2019	3,844	4,450	3,635	5,167	4,180	6,412
Labeo	2019	3,795	6,000	3,667	2,500	4,000	4,921
Lates	2019	5,059	4,036	4,468	4,578	3,911	5,633
Malapterurus	2019	3,087	4,000	5,000	4,000	-	-
Mormyrus	2019	3,412	-	-	-	4,000	3,000
Others	2019	3,127	-	3,000	4,000	3,500	4,130
Protopterus	2019	3,200	-	3,944	4,333	4,038	-
Schilbe	2019	1,000	-	-	-	-	-
Synodontis	2019	3,443	3,019	3,333	2,518	3,141	2,945
Tilapia	2019	4,910	4,079	4,240	4,925	4,666	4,863
Species	**Year**	**Buliisa**	**Hoima**	**Kagadi**	**Kikuube**	**Ntoroko**	**Pakwach**
Alestes	2020	7,128	5,250	2,500	3,205	3,788	8,325
B. nurse	2020	872	1,120	859	955	2,043	1,485
Bagrus	2020	3,573	3,722	3,931	3,226	4,196	3,205
Barbus	2020	5,214	2,000	6,000	3,976	3,750	6,535
Clarias	2020	3,434	3,770	4,250	2,441	3,368	5,752
E. bredoi	2020	1,058	824	516	739	1,284	1,177
*Haplos**	2020	945	-	-	-	-	-
Hydrocynus	2020	3,945	4,177	2,760	2,900	3,500	7,566
Labeo	2020	4,232	3,375	4,000	3,333	3,250	5,192
Lates	2020	5,188	4,261	3,920	4,252	4,279	5,214
Malapterurus	2020	3,524	1,000	2,500	4,500	4,000	3,125
Mormyrus	2020	2,160	2,250	-	2,167	-	3,863
Others	2020	3,929	3,522	3,750	3,000	-	3,722
Protopterus	2020	4,316	3,000	3,625	2,750	3,393	4,200
Schilbe	2020	1,000	-	-	-	3,000	2,000
Synodontis	2020	2,211	2,563	2,795	2,417	3,130	2,320
Tilapia	2020	5,407	4,114	4,924	3,672	4,631	4,558

Appendix 10: Monthly revenue (Million Ug.shs) of fish landed catch on Lake Albert in July 2019 and November 2020 presented by species

Species	Buliisa	Hoima	Kagadi	Kikuube	Ntoroko	Pakwach	Total
July 2019							
Alestes	1,477.8	833.4	1,015.4	1,101.2	232.7	277.6	4,938.1
B. nurse	1,717.0	388.6	611.0	709.2	702.8	2,598.3	6,726.9
Bagrus	907.3	730.0	436.7	588.4	824.4	213.7	3,700.5
Barbus	1,465.8	219.3	752.5	1,209.0	-	464.9	4,111.5
Clarias	354.3	4.9	123.8	-	895.4	95.7	1,474.1
E. bredoi	732.9	4,296.2	260.6	2,356.3	428.9	1,721.5	9,796.4
*Haplos**	355.8	1.4	-	246.5	225.6	28.4	857.7
Hydrocynus	1,893.1	1,004.3	935.0	1,662.1	571.5	794.3	6,860.3
Labeo	277.4	44.6	79.9	25.2	75.1	91.4	593.6
Lates	3,066.2	1,828.8	791.9	3,922.6	485.5	2,117.0	12,212.0
Malapterurus	236.3	14.6	10.7	168.2	-	-	429.8
Mormyrus	279.3	-	-	-	31.1	2.8	313.2
Protopterus	231.3	-	63.0	342.7	278.8	-	915.8
Schilbe	27.0	-	-	-	-	-	27.0
Synodontis	854.1	898.8	193.4	596.2	728.5	190.5	3,461.5
Tilapia	1,945.4	451.7	393.9	706.3	1,010.4	251.5	4,759.2
Others	1,399.7	-	60.6	477.6	281.6	63.0	2,282.5
Total	**17,220.7**	**10,716.6**	**5,728.4**	**14,111.5**	**6,772.3**	**8,910.6**	**63,460.1**
November 2020							
Alestes	838.9	399.8	451.1	1,295.4	380.9	1,219.9	4,586.0
B. nurse	1,590.0	2,792.7	200.0	922.7	1,075.1	1,780.2	8,360.7
Bagrus	450.3	225.5	253.8	232.5	560.3	53.7	1,776.1
Barbus	1,238.2	6.8	242.3	146.7	22.4	162.7	1,819.1
Clarias	698.4	132.9	55.6	153.0	286.4	91.1	1,417.4
E. bredoi	1,214.0	3,713.9	259.5	3,755.5	69.7	1,774.7	10,787.3
*Haplos**	1.1	-	-	-	-	-	1.1
Hydrocynus	1,016.5	183.4	830.9	327.7	449.2	159.1	2,966.8
Labeo	453.4	76.1	15.4	35.0	10.3	71.0	661.2
Lates	2,247.7	1,410.4	434.1	2,785.7	1,070.8	2,942.6	10,891.3
Malapterurus	533.2	0.5	0.4	110.7	23.7	53.8	722.3
Mormyrus	454.5	5.7	-	9.3	-	34.1	503.6
Others	363.0	35.7	0.9	29.5	-	44.0	473.1
Protopterus	336.8	72.7	45.5	472.0	85.0	10.2	1,022.2
Schilbe	17.6	-	-	-	68.8	5.9	92.3
Synodontis	265.9	47.9	62.4	54.3	511.0	895.1	1,836.6
Tilapia	1,688.8	958.9	280.3	914.8	1,883.3	555.0	6,281.1
Total	**13,408.3**	**10,062.9**	**3,132.2**	**11,244.8**	**6,496.9**	**9,853.1**	**54,198.2**

Appendix 11: Annual revenue (Million Ug.shs) of fish landed catch on Lake Albert in July 2019 and November 2020 presented by species

Species	Buliisa	Hoima	Kagadi	Kikuube	Ntoroko	Pakwach	Total

July 2019							
Alestes	17,732.7	10,000.4	12,185.2	13,213.6	2,792.3	3,331.9	59,256.1
B. nurse	20,604.3	4,662.7	7,330.6	8,510.9	8,433.7	31,180.3	80,722.5
Bagrus	10,886.5	8,758.3	5,240.0	7,061.6	9,893.1	2,564.1	44,403.6
Barbus	17,588.9	2,631.9	9,030.0	14,507.7	-	5,579.5	49,338.0
Clarias	4,252.3	58.6	1,485.6	-	10,744.4	1,148.1	17,689.0
E. bredoi	8,794.3	51,554.6	3,126.6	28,275.4	5,147.6	20,658.6	117,557.1
*Haplos**	4,270.0	16.8	-	2,958.2	2,707.5	340.4	10,292.9
Hydrocynus	22,717.0	12,051.3	11,220.1	19,945.2	6,857.6	9,532.1	82,323.3
Labeo	3,329.4	535.3	958.0	302.4	901.7	1,097.8	7,124.6
Lates	36,794.7	21,945.0	9,504.2	47,071.9	5,824.6	25,404.0	146,544.4
Malapterurus	2,836.7	175.6	128.9	2,018.6	-	-	5,159.8
Mormyrus	3,351.9	-	-	-	373.7	33.9	3,759.5
Others	16,795.8	-	727.0	5,730.9	3,379.2	755.5	27,388.4
Protopterus	2,773.8	-	755.8	4,112.6	3,345.7	-	10,987.9
Schilbe	323.9	-	-	-	-	-	323.9
Synodontis	10,248.7	10,785.9	2,321.0	7,155.5	8,743.1	2,285.0	41,539.2
Tilapia	23,343.0	5,422.2	4,727.7	8,476.4	12,123.4	3,018.2	57,110.9
Total	**206,643.9**	**128,598.6**	**68,740.7**	**169,340.9**	**81,267.6**	**106,929.4**	**761,521.1**
November 2020							
Alestes	10,068.7	4,797.8	5,412.9	15,544.4	4,571.1	14,638.1	55,033.0
B. nurse	19,079.9	33,512.4	2,400.6	11,072.4	12,901.3	21,363.1	100,329.7
Bagrus	5,403.5	2,707.2	3,045.4	2,790.7	6,720.6	643.8	21,311.2
Barbus	14,857.5	81.1	2,908.0	1,760.2	268.4	1,952.6	21,827.8
Clarias	8,381.3	1,594.5	667.3	1,834.8	3,435.6	1,092.7	17,006.2
E. bredoi	14,567.2	44,566.5	3,113.6	45,066.6	837.2	21,296.3	129,447.4
*Haplos**	12.7	-	-	-	-	-	12.7
Hydrocynus	12,198.0	2,201.0	9,971.1	3,933.3	5,390.7	1,909.3	35,603.4
Labeo	5,440.9	913.7	184.2	419.4	122.8	852.3	7,933.3
Lates	26,973.3	16,926.3	5,209.8	33,428.2	12,849.7	35,311.9	130,699.2
Malapterurus	6,398.7	6.4	4.9	1,328.6	284.6	646.5	8,669.7
Mormyrus	5,454.6	67.2	-	111.5	-	409.4	6,042.7
Others	4,356.2	426.8	10.7	354.1	-	527.0	5,674.8
Protopterus	4,042.9	871.9	546.0	5,664.3	1,020.0	123.1	12,268.2
Schilbe	211.3	-	-	-	826.1	70.8	1,108.2
Synodontis	3,190.1	575.2	749.8	652.5	6,132.9	10,742.1	22,042.6
Tilapia	20,263.7	11,508.3	3,363.3	10,977.6	22,598.6	6,661.2	75,372.7
Total	**160,900.5**	**120,756.3**	**37,587.6**	**134,938.6**	**77,959.6**	**118,240.2**	**650,382.8**

Appendix 12:Catch Per Unit Effort (CPUE kg-1boat-1day-1) for Lakes Edward, George and Kazinga Channel

Water body	Year	District	Vessel Gear category	*Bagrus*	*Barbus*	*Clarias*	*Haplos**	*Labeo*	*Mormyrus*	*Protopterus*	*Tilapia*
Kazinga Channel	2019	Kasese	SF _ GN	11.2	10.5	2.8	-	-	2.1	6.8	2.9
Kazinga Channel	2019	Kasese	SF _ LL	6.4	-	3.6	-	-	-	10.5	-
Kazinga Channel	2019	Rubirizi	SF _ GN	17	1.8	1.9	0.3	0.5	1.3	4.5	2.4
Kazinga Channel	2019	Rubirizi	SF _ LL	9.8	0.5	3.9	-	-	-	8	1
Kazinga Channel	2020	Kasese	SF _ GN	10.4	-	3.8	-	-	1.2	4.1	9.3
Kazinga Channel	2020	Kasese	SF _ LL	6.5	-	8.6	-	-	-	8.8	-
Kazinga Channel	2020	Rubirizi	SF _ GN	9.6	-	7.8	-	-	12	6.1	12.5
Kazinga Channel	2020	Rubirizi	SF _ LL	17.4	-	9.5	-	-	-	8.5	1
George	2019	Kasese	SF _ GN	6.8	-	3.9	-	-	6.5	7.1	4.1
George	2019	Kasese	SF _ LL	5.1	-	5.4	-	-	-	11.9	2.4
George	2019	Kitagwenda	PA _ LL	7.8	-	15.7	-	-	-	21.2	-
George	2019	Kitagwenda	SF _ GN	5.4	-	4.4	-	-	1	7	4.8
George	2019	Kitagwenda	SF _ LL	4	-	5.6	-	-	-	12	6.1
George	2019	Rubirizi	SF _ GN	8.6	34	2.3	0.1	-	-	6.5	8.5
George	2019	Rubirizi	SF _ LL	3.7	-	3	-	-	-	11.1	2.5
George	2020	Kasese	SF _ GN	8.7	-	5.2	-	-	1.1	6.5	11.1
George	2020	Kasese	SF _ LL	7.6	-	4.4	-	-	-	12	2
George	2020	Kasese	SF _ TR	-	-	-	-	-	-	-	16.5
George	2020	Kitagwenda	PA _ GN	16.9	-	11.5	-	-	-	11.8	7.6
George	2020	Kitagwenda	PA _ LL	7.9	-	19.1	-	-	-	36.2	-
George	2020	Kitagwenda	SF _ GN	19.2	-	4.1	-	-	-	4.5	11.2
George	2020	Kitagwenda	SF _ LL	6.8	-	4.1	-	-	-	23	10
George	2020	Kitagwenda	SP _ GN	19.9	-	6.2	-	-	-	3.1	5.1
George	2020	Kitagwenda	SP _ LL	3.5	-	4.9	-	-	-	14.2	6.5
George	2020	Rubirizi	SF _ GN	13.3	0.3	3.5	0.1	-	6.7	8	9
George	2020	Rubirizi	SF _ LL	5.1	0.4	7.5	0	-	-	12.8	7.5
Edward	2019	Kasese	SF _ GN	8.6	2.2	2.3	-	2.4	-	4	4.6
Edward	2019	Kasese	SF _ LL	6.3	1	7.2	-	-	-	8.1	4
Edward	2019	Rubirizi	SF _ GN	9.8	2.2	2.2	0.5	-	5.6	5.7	5.7
Edward	2019	Rubirizi	SF _ LL	4	-	9.1	-	-	-	9.9	3
Edward	2019	Rukungiri	SF _ GN	13.2	5	5.3	-	-	-	5.6	4.9
Edward	2019	Rukungiri	SF _ LL	3	1	31.1	-	-	6	9.6	2
Edward	2020	Kasese	SF _ GN	4.6	1.7	2.4	0	-	3	5.7	11.1
Edward	2020	Kasese	SF _ LL	7.6	-	9.9	-	-	-	6.4	22
Edward	2020	Rubirizi	SF _ GN	5.9	1	2.8	-	-	-	6.6	24.8
Edward	2020	Rukungiri	SF _ GN	13	2.8	2.7	0.1	-	4.6	10.1	5.1
Edward	2020	Rukungiri	SF _ LL	11.4	-	17.3	0.1	-	-	25.8	-

Appendix 13:Annual catch (tons) for lakes Edward, George and Kazinga Channel

Year	District	Water body	*Bagrus*	*Barbus*	*Clarias*	*Haplos**	*Labeo*	*Mormyrus*	*Protopterus*	*Tilapia*	*Total*
2019	Kasese	Kazinga C.	77.1±7.8	42.7±0	29.4±4.1	-	-	8.4±2.3	78.9±7.3	11.8±3.1	248.3±24.6
2019	Rubirizi	Kazinga C.	108.5±12.	9.4±3.4	23.1±2.5	1.4±0.7	2.1±0	5.5±1.7	49.7±5.3	13.8±1.1	213.5±26.8
		Total	**185.6±19.**	**52.1±3.4**	**52.5±6.6**	**1.4±0.7**	**2.1±0**	**13.9±4**	**128.6±12.6**	**25.6±4.2**	**461.8±51.4**
2020	Kasese	Kazinga C.	143.2±16.	-	104.2±25.8	-	-	10.3±4	109.2±17.9	79.6±8.5	446.5±72.3
2020	Rubirizi	Kazinga C.	126.6±15.	-	83.8±15.5	-	-	67.8±28.3	70±12.9	74.6±9.9	422.8±82.4
		Total	**269.8±31.**	**0±0**	**188±41.3**	**0±0**	**0±0**	**78.1±32.3**	**179.2±30.8**	**154.2±18.4**	**869.3±154.7**
2019	Kasese	George	228.4±12.	-	207.1±12.4	-	-	68±0	442.2±18.5	116.7±36.1	1062.4±79.4
2019	Kitagwenda	George	223.5±18.	-	314.3±18.2	-	-	13.6±0	526.8±17.7	182.1±31.8	1260.3±86.2
2019	Rubirizi	George	168.5±15.	473.6±0	73±9.5	1.4±0	-	-	239.1±15.9	152.2±33.4	1107.8±74.2
		Total	**620.4±46.**	**473.6±0**	**594.4±40.1**	**1.4±0**	**0±0**	**81.6±0**	**1208.1±52.1**	**451±101.3**	**3430.5±239.8**
2020	Kasese	George	291.4±27.	-	169.7±21.6	-	-	11.2±3	385.7±38	170.9±7.8	1028.9±97.7
2020	Kitagwenda	George	630.7±11	-	439.2±133.2	-	-	-	929.5±185.3	408.9±127.9	2408.3±565.5
2020	Rubirizi	George	264.5±49.	9.8±0	152.8±44.5	1.7±0	-	98±72.3	290.4±31.1	234.5±56.7	1051.7±253.9
		Total	**1186.6±1**	**9.8±0**	**761.7±199.3**	**1.7±0**	**0±0**	**109.2±75.3**	**1605.6±254.4**	**814.3±192.4**	**4488.9±917.1**
2019	Kasese	Edward	405.6±24.	99.3±14.5	127.2±11.9	-	105.5±39.9	-	208±14.5	219.7±15.5	1165.3±120.8
2019	Rubirizi	Edward	241.4±12.	53.1±13.3	68.8±12.5	11.6±2.4	-	135.1±65.2	152.1±14.2	141±13.7	803.1±134.2
2019	Rukungiri	Edward	272.3±16.	101.8±38.8	159.6±27.4	-	-	10.2±0	129.2±17.5	102.4±15.6	775.5±115.9
		Total	**919.3±54**	**254.2±66.6**	**355.6±51.8**	**11.6±2.4**	**105.5±39.9**	**145.3±65.2**	**489.3±46.2**	**463.1±44.8**	**2743.9±370.9**
2020	Kasese	Edward	227.3±17.	77.9±39.5	129.8±13.8	0.9±0	-	136.2±0	275±18.6	550.9±28.8	1398±117.9
2020	Rubirizi	Edward	144.3±12.	24.5±0	69.6±16.2	-	-	-	162.3±25	607.9±96.9	1008.6±150.3
2020	Rukungiri	Edward	290.5±53.	56.9±33.9	92.4±22.8	1.7±0.4	-	94.4±55.7	263.4±59.4	104.7±17.1	904±242.8

Total	**662.1±82.**	**159.3±73.4**	**291.8±52.8**	**2.6±0.4**	**0±0**	**230.6±55.7**	**700.7±103**	**1263.5±142.8**	**3310.6±511**

Appendix 14: Annual revenue (millions) for lakes Edward, George and Kazinga Channel

Year	District	Waterbody	*Bagrus*	*Barbus*	*Clarias*	*Haplos**	*Labeo*	*Mormyrus*	*Protopterus*	*Tilapia*	*Total*
2019	Kasese	Kazinga C.	591.6	341.2	230.3	-	-	42.5	574.4	115.7	1895.7
2019	Rubirizi	Kazinga C.	625.6	52.7	122.3	4.1	4.7	15.7	260.5	70.8	1156.4
		Total	**1217.2**	**393.9**	**352.6**	**4.1**	**4.7**	**58.2**	**834.9**	**186.5**	**3052.1**
2020	Kasese	Kazinga C.	740.4	-	605.2	-	-	41.1	642.8	623.8	2653.3
2020	Rubirizi	Kazinga C.	604.8	-	381.3	-	-	240.8	354.7	516.1	2097.7
		Total	**1345.2**	**0**	**986.5**	**0**	**0**	**281.9**	**997.5**	**1139.9**	**4751**
2019	Kasese	George	1686.3	-	1473.7	-	-	615.1	2810.2	909.2	7494.5
2019	Kitagwenda	George	1637.9	-	2315.8	-	-	108.7	3569.9	1349.9	8982.2
2019	Rubirizi	George	1019.6	3362.5	412.1	5.2	-	-	1496.3	1109.5	7405.2
		Total	**4343.8**	**3362.5**	**4201.6**	**5.2**	**0**	**723.8**	**7876.4**	**3368.6**	**23881.9**
2020	Kasese	George	1991.2	-	1125.3	-	-	50.9	1897.6	1025.3	6090.3
2020	Kitagwenda	George	4331	-	2325.9	-	-	-	6470.3	2396.7	15523.9
2020	Rubirizi	George	1425.7	29.4	750.4	3.7	-	555.1	1572.6	1236.2	5573.1
		Total	**7747.9**	**29.4**	**4201.6**	**3.7**	**0**	**606**	**9940.5**	**4658.2**	**27187.3**
2019	Kasese	Edward	2710.7	979.4	886.1	-	1150.4	-	1458.5	2236.1	9421.2
2019	Rubirizi	Edward	1864.9	311.9	435.9	34.8	-	347.9	1054.6	1422.7	5472.7
2019	Rukungiri	Edward	1903.4	650.5	1006.9	-	-	37.4	807.5	801.1	5206.8
		Total	**6479**	**1941.8**	**2328.9**	**34.8**	**1150.4**	**385.3**	**3320.6**	**4459.9**	**20100.7**
2020	Kasese	Edward	1367.5	498.8	797.8	0.9	-	776.4	1751.1	3060.2	8252.7
2020	Rubirizi	Edward	877.4	171.8	369.3	-	-	-	1230	3364.2	6012.7
2020	Rukungiri	Edward	1904.2	204.3	463.2	1.7	-	547.3	1426.3	480	5027
		Total	**4149.1**	**874.9**	**1630.3**	**2.6**	**0**	**1323.7**	**4407.4**	**6904.4**	**19292.4**

Appendix 15: CAS implementation schedule agreed upon at the RWG planning meeting of December 2020 Gisenyi, Rwanda

	Activity		Aug	Sept	Oct	Nov	Dec
1	Procurement of CAS inputs and materials	1month	01-30				
2	National working group planning meetings	2 weeks	03-14				
3	Recruitment and training of field data collectors and supervisors including pre-testing of the survey tools	2 weeks	16-28				
4	Submission of Pre-survey report to NELSAP		30				
5	CAS field data collection(1st and 3rd weeks) to capture the new and dark moon phases)	3 weeks		01-21			
6	Submission of field data forms by supervisors to National Working Group (NWG) persons	3 days		22-25			
7	Training of data entrants/personnel/data entry/ground trothing and data cleaning	2 weeks			01-14		
8	Data analysis and draft report preparations	2 weeks			15-30		
9	National stakeholders/ NWG validation workshop	1 week				03-06	
10	Preparation of final national CAS technical reports for lakes Edward and Albert	1 week				07-14	
11	Submission of final national CAS technical reports to NELSAP					15	
12	Consolidation regional lake-wide report, including re-analysis of national data sets (NELSAP)	1 week					1-10
13	Submission of the final lake-wide CAS report to NELSAP LEAF	5 Days					15
14	Dissemination of CAS results to stakeholders at national and regional levels						Dec-2020