

NATIONAL AGRICULTURAL RESEARCH ORGANISATION

NATIONAL FISHERIES RESOURCES RESEARCH INSTITUTE (NAFIRRI) P.O. BOX 343, JINJA, UGANDA.

IMPLEMENTATION OF A FISHERIES MANAGEMENT PLAN (IFMP) PROJECT FOR LAKE VICTORIA

A REPORT OF THE FISHERIES CATCH ASSESSMENT SURVEY IN THE UGANDAN WATERS OF LAKE VICTORIA FOR THE MARCH 2006 SURVEY

PREPARED BY THE CATCH ASSESSMENT NATIONAL WORKING GROUP LED BY: MUHOOZI L.I. (NAFIRRI); KAMANYI J.R. (NAFIRRI); & WADANYA J. (DFR)

CATCH ASSESSMENT SURVEYS ARE JOINTLY CONDUCTED BY THE NATIONAL FISHERIES RESOURCES RESEARCH INSTITUTE (NAFIRRI), THE DEPARTMENT OF FISHERIES RESOURCES (DFR), AND THE DISTRICTS OF BUSIA, BUGIRI, MAYUGE, JINJA, MUKONO, WAKISO, KAMPALA, MPIGI, MASAKA, KALANGALA AND RAKAI.

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1 FOREWORD

The fisheries of Lake Victoria have been characterised by shifts in abundance of different fish species and changes in fishing effort in the recent past. In this dynamic state, monitoring of the fish stocks as well as the magnitude, distribution and trends of fishing effort and fish catches is necessary for sound fisheries resources management. One of the avenues to collect information to support the above process is through conducting regular Catch Assessment Surveys (CASs).

The EU funded Implementation of a Fisheries Management Plan (IFMP) project for Lake Victoria through the Lake Victoria Fisheries Organisation (LVFO) is supporting the implementation of regionally harmonised CASs in Lake Victoria. The CASs under IFMP are following a statistical design laid down in Standard Operating Procedures (SOPs) agreed around the whole lake. In the Ugandan part of the lake, the CASs are carried out at 54 fish landing sites selected in the eleven riparian districts sharing the lake. They are jointly conducted by the National Fisheries Resources Research Institute (NAFIRRI), Jinja; the Department of Fisheries Resources (DFR), Entebbe; and the Districts of Busia, Bugiri, Mayuge, Jinja, Mukono, Wakiso, Kampala, Mpigi, Masaka, Kalangala and Rakai. The CAS enumerators are recruited from the fishing communities and work under direct supervision of subcounty Fisheries Officers. It is planned to involve the recently formed Beach Management Units (BMUs) in fisheries data collection when modalities for their roles have been streamlined.

This report presents findings of the CAS conducted in the Ugandan waters of Lake Victoria in March 2006. The results of the CASs in July, August, September, and November 2005 are also included to show the emerging trends. The findings indicate stable production of Nile perch and tilapia but large fluctuations in the Mukene fishery. The estimates from the March 2006 data show a monthly catch of 12,360.2 t worth shs12.8 billion of direct gross income to the fishers. Out of this, 36% (4479.4 t) of the catch was Nile perch which was worth shs 9.3 billion (73%) of the direct gross revenue of the fishers. The catches of tilapia contributed 19% of the total catch and 18% of the gross revenue from the catches at the beach. The catches of Mukene, a low value fish, contributed 44% of the weight of the total catches but yielded only 8% of the estimated gross income of fishers.

Through CASs, information is building up to show the new picture of fish production in the Ugandan waters of the lake which is based on field observations. Similar surveys are simultaneously conducted in the Kenyan and Tanzanian parts of the lake which provide the lake wide perspective of fisheries production. The continued support for the CAS programme will certainly remove uncertainties about the fish production levels of the lake and provide good basis for planning and management of the fishery.

J.S. Balirwa
Director

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6 SUMMARY

In July - November 2005 and March 2006, Catch Assessment Surveys (CASs) were conducted at 54 pre-selected fish landing sites in the Ugandan part of Lake Victoria. These comprised approximately 10% of all landing sites in each of the 11 districts sharing the lake. Data recording was by enumerators who were selected from the fishing communities and trained centrally in CAS procedures following the approved CAS Standard Operating Procedures (SOPs). Data were captured using regionally harmonised field sheets, collated at the National Fisheries Resources Research Institute (NAFIRRI), and analysed to estimate CAS-based indicators for different effort groups.

The Nile perch catch rates were fairly stable over the period sampled except in gillnetting boats with motor/sail which showed a significant increase in catch rates in November 2005. The Nile perch catch rates of boats using motor/sail were about 3 times higher than those of paddled boats. The Nile perch catch rates of long lining boats were similar for paddle and motorised/sailed boats except in July 2005 and were in the same range as those of gillneting motorised/sailed boats of 24 – 31 kg boat^{-1} day^{-1} compared with 8-9 kg boat^{-1} day^{-1} in gillnetting paddle boats.

In the tilapia fishery the catch rates of parachute boats, using cast nets ranged between 16.9 and 26.kg boat^{-1} day^{-1} compared with 10.9 to 14.8 kg boat^{-1} day^{-1} in gillnetting boats and both effort groups showed a slight peak in September although the peak was not statistically significant. The catch rates of paddled Sesse boats using gillnets showed a gentle declining trend from 10.7 ± 1.8 kg boat^{-1} day^{-1} in July to 6.78 ± 0.8 kg boat^{-1} day^{-1} in November 2005 but those of cast netting boats oscillated between months.

In the mukene fishery the catch rates of boats using small seines were significantly higher than those of scoop nets except in November 2005 when they were similar. The catch rates were apparently highest in September for both small seines (300.7 ± 66.1 kg boat^{-1} day^{-1}) and scoop nets (187.7 ± 33.1 kg boat^{-1} day^{-1}) but these were not statistically different from other months.

The annual total catch estimates for the Ugandan part of the lake deduced from the five month data amount to 163,235.7 t with a gross income to the fishers of 150 billion shillings. Out of this, Nile perch contribute 37% of the catches and up to 71% of the gross income of the fishers. Mukene contributes 42% of the catches but only 7% of gross income to fishers whereas tilapia catches share 18% of both the total catches and the gross income of fishers.

In view of the high beach value of the Nile perch, management of this fishery for increased production through elimination of illegal fishing gears and redirecting fishing effort to far offshore waters should be given priority. The Mukene fishery in the Ugandan waters is underdeveloped and requires adopting technologies that extend fishing into offshore waters and improvement of processing methods to enhance the unit value. The main constraint of the Tilapia fishery appears to be the ease with which this fishery in near shore waters is accessed and would require control of entry.

7 INTRODUCTION

Lake Victoria is the second largest freshwater body in the World. The lake has a surface area of 68,800 km^2 of which 35,088 km^2 (51%) is in Tanzania, 29,584 km^2 (43%) is in Uganda, and 4,128 km^2 (6%) is in Kenya. It has a shoreline length of 3,450 km of which 1,150 km (33%) is in Tanzania, 1,750 km (51%) in Uganda and 550 km (16%) is in Kenya. The lake is very important to the economies of the East African Community (EAC) Partner States through provision of high protein food, employment and income. Fish exports are a major foreign exchange earner of the Partner States. For a long time, the lake's fisheries have been without systematic update of trends of fishing effort, fishing activities and fish catches. Recent efforts have harmonised fisheries data collection around the lake which include fisheries Catch Assessment Surveys (CASs) through which the Partner States are monitoring exploitation of the fisheries resources.

Fisheries Catch Assessment Surveys (CASs) aim at the harvest sector to generate information relating to both fish catches and fishing effort. The data generated by CAS provide Catch per unit effort (CPUE), which is used as a raising factor to estimate total catches and is also an index of stock size. Catch Assessment Surveys typically require frame surveys to help design the survey and to raise samples to give total estimates for the lake. The total catches in this report are estimated using the 2004 Frame survey data.

Catchability varies among gear types according to their attributes and characteristics. The units used for measuring fishing effort are therefore critical. The fish catches also depend upon various characteristics of the fishing boat including its size and mode of propulsion. These characteristics provide a basis for categorising vessels to standardise fishing effort and to provide strata for catch and effort sampling programmes.

Fisheries Catch Assessment Surveys in Lake Victoria aim at providing information on:

(i) The quantities of fish landed monthly, quarterly and annually in the riparian local administrative units and countries;

(ii) The monetary value of the fish landed;
(iii) The contribution of different fish species to the total catches;
(iv) The contribution of different types of gears and boats to the total catches;
(v) The changes of catch rates of different fish species between areas, seasons, gear types and sizes and boat types; and
(vi) The trends of fish catch rates, fish catches and total catches in relation to total fishing effort.

8 METHODOLOGY

8.1 The Catch Assessment Survey Design

The CASs conducted in the Ugandan waters of Lake Victoria follow a design laid out in the approved Standard Operating Procedures for Catch

Assessment Surveys for Lake Victoria (LVFO, 2005a). This is a two-stage stratified sampling design whereby: within each district, a sample of primary sampling units (PSUs) i.e. the fish landing sites were first selected, and then, at each PSU, stratified samples of Secondary Sampling Units (SSUs) i.e. the Vessel gear type, are randomly selected by the field enumerator for sampling.

8.2 Sampling Units

Landing sites are the primary sampling unit (PSU) and the vessel-gear (VG) types landing at each site are the secondary sampling unit (SSU). Within each of the eleven districts sharing the Ugandan part of the lake, 10% of all landing sites (PSUs) were selected for sampling. A total of 54 PSUs (Appendix 1) were selected for sampling in the Ugandan waters of Lake Victoria. The landing sites were selected randomly with Probability Proportional to Size (PPS), where size refers to the total number of vessels landing at the site.

During the sampling period, the enumerators identify the numbers of all Vessel-Gear (VG) types at each landing site that land or are expected to land during the sampling day and allocate sampling effort among the SSUs and VG types in proportion to the number of vessels to be sampled. The maximum sample per day was set at 20 vessels. Sampling is done in four days in the month, staggered to two consecutive days in the first and third weeks of the month.

8.3 Data capture

Regionally harmonised data forms (Appendix 2) were used to record field data. The data forms contain 3 main parts: Document Identification; Active Vessels and Sampling Targets and Fishing Operations and Catches. The enumerators were trained and provided with a *Field Guide* containing the data recording instructions to ensure effective data capture. Provision for close supervision of enumerators by the Sub-county Fisheries Officers and spot checks by District Fisheries Officers and Officers from DFR and FIRRI were also made to ensure that data collection is according to the planned procedures and schedules.

8.4 Estimation of CAS-based Indicators

Data were stored and analysed using Microsoft Excel. The fishing crafts were segregated into effort groups (Vessel-gear combinations) and the CAS indicators estimated for each effort group.

(i) The mean fish catch rates (kg boat^{-1} day-^{1}) were estimated for each effort group by species.

(ii) The total fish catches were estimated using the mean fish catch rates and the 2004 Frame survey data. For each effort group, the Boat activity coefficient (*B),* i.e. the probability that a fishing vessel of each vessel-gear type *g* would be active on any day during the month. This was estimated as the mean number of days boats in each effort group fished in a week divided by the number of days in a week. The total catch (*C)* of each effort group was then estimated.

(iii) The beach value of the catch, i.e. the gross income to the fishers, was estimated by raising the estimated total catch in each effort group by the mean unit price of each fish species landed.

9 RESULTS

9.1 Fish catch rates

9.1.1 Nile perch catch rates

Sesse boats propelled by paddles or motor/sail using gillnets or long lines are the most important fishing units in the Nile perch fishery, i.e. four main vessel gear combinations target the species.

Gillnetting boats

The Nile perch catch rates of paddled Sesse gillnetting boats at 9.7 ± 1.7 kg boat^{-1} day^{-1} in March 2006 were similar to the previous five months sampled (Figure 1). The catch rates of boats with motor/sail which had increased significantly to a record high of 31.0 ± 1.9 kg boat^{-1} day^{-1} in November 2005, decreased to 24.1 ± 1.9 kg boat^{-1} day^{-1} in March 2005, which was similar to the catch rates in July – September 2005. These observations indicate relative stability in the Nile perch fishery over the period so far sampled.

Long lining boats

As in the earlier sampling periods, with the exception of July 2005, the Nile perch catch rates of long lining boats in March 2006 were similar for paddle and motorised/sailed boats at 21.8 ± 2.6 and 23.4 ± 3.3 kg boat^{-1} day^{-1} respectively.

The Nile perch catch rates of long lining boats, irrespective of mode of propulsion were generally in the same range (>20 kg boat^{-1} day^{-1}) as those of motorised/sailed boats using gillnets compared with 8-9 kg boat^{-1} day^{-1} in gillnetting paddle boats.

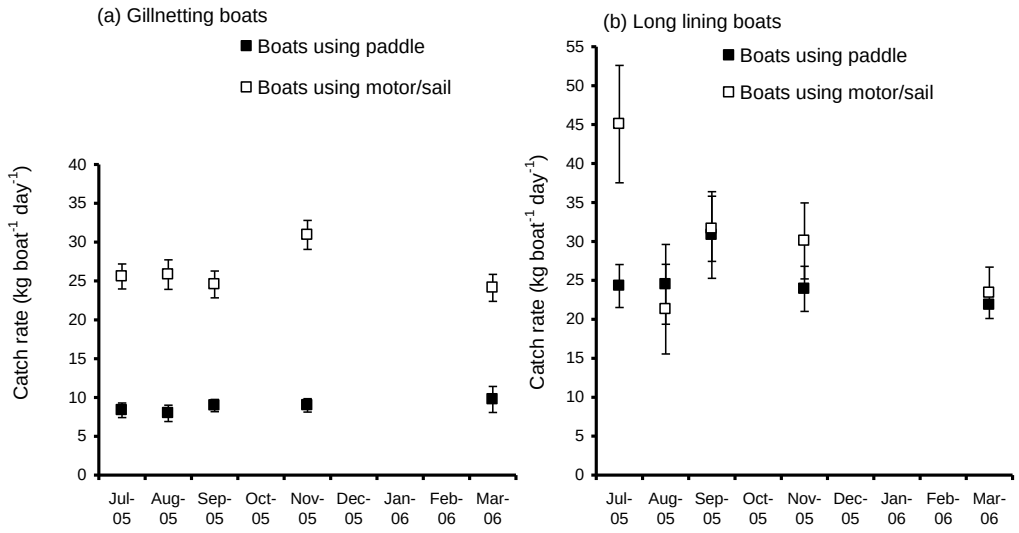


Figure 1. Trends of Nile perch catch rates of the main effort groups targeting the species in the Ugandan part of Lake Victoria in July 2005 - March 2006 (error bars = 95%CL).

9.1.2 Tilapia catch rates

The parachute boats (*bawo tatu*) are the main craft in the tilapia fishery in the Ugandan waters of Lake Victoria. Paddled Sesse boats, to some extent also operate in the Tilapia fishery of the lake. Gillnets and cast nets are the most common gears used to target tilapia. The other gears used in the tilapia fishery that are less common include basket traps and hand line hooks. In March 2006, the tilapia catch rates of parachute boats using cast nets at 16.5 ± 4.1 kg boat^{-1} day^{-1} continued to be higher than those of boats using gillnets which landed 10.9 ± 1.2 kg boat^{-1} day^{-1} (Figure 2). However, the differences in the catch rates were only significant in November 2005 and March 2006.

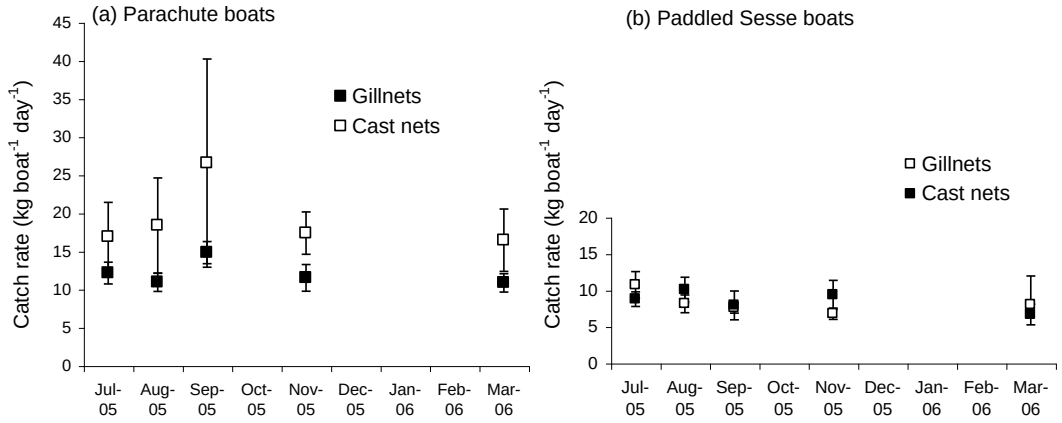


Figure 2. Trends of Tilapia catch rates of the main effort groups targeting the tilapia in the Ugandan part of Lake Victoria in July 2005 – March 2006 (error bars = 95%CL).

The tilapia catch rates of paddle sesse boats using either cast nets or gillnets were generally similar between the two categories of boats. However, the gillnet catch rates showed a gentle declining trend from 10.7 ± 1.8 kg boat^{-1} day^{-1} in July to 8.2 ± 1.2 kg boat^{-1} day^{-1} in August, 7.6 ± 0.7 kg boat^{-1} day^{-1} in September and 6.8 ± 0.8 kg boat^{-1} day^{-1} in November 2005 but an increase to 8.0 ± 3.9 kg boat^{-1} day^{-1} in March 2006. The catch rates of cast netting boats oscillated up and down, between the highest, 10.1 ± 1.7 kg boat^{-1} day^{-1} in August 2005 and the lowest, 6.7 ± 1.4 kg boat^{-1} day^{-1} in March 2006.

9.1.3 Mukene/Dagaa catch rates

The mukene fishery is dominated by paddled Sesse boats using either small seines (Lampala) or scoop nets. The catch rates of boats using small seines were significantly higher than those of scoop nets in August and September 2005 but similar in November 2005 and March 2006 (Figure 3). The catch rates were apparently highest in September 2005 for both small seines (300.7 ± 66.1 kg boat^{-1} day^{-1}) and scoop nets (187.7 ± 33.1 kg boat^{-1} day^{-1}) although these were not statistically different from other months. The catch rates of boats using small seines and scoop nets were 196.0 ± 82.6 and 179.5 ± 48.0 kg boat^{-1} day^{-1} in March 2006.

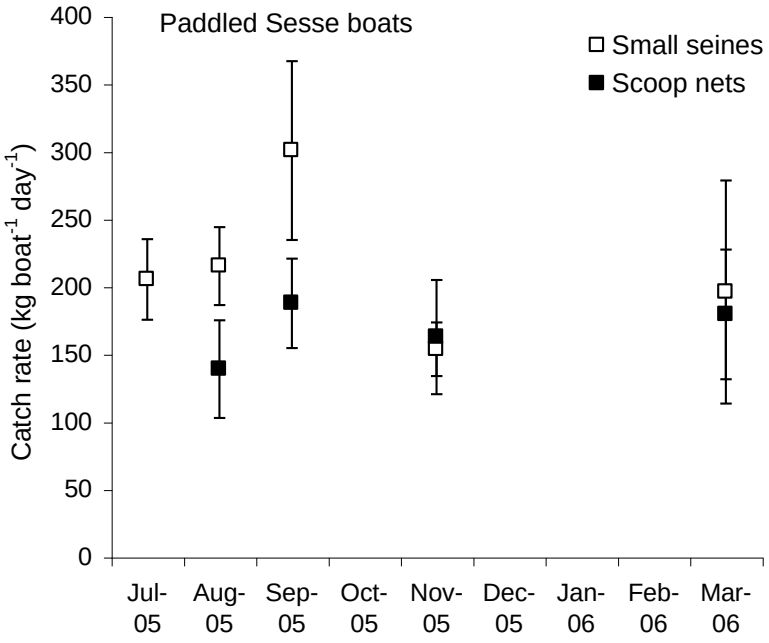


Figure 3. Trends of Mukene/Dagaa catch rates of the main effort groups targeting the species in the Ugandan part of Lake Victoria in July 2005 – March 2006 (error bars = 95%CL).

9.2 National Estimates of total fish catches of the main commercial species

The trends of estimated national total monthly catch for July - November 2005 and March 2006 are shown in Figure 4 and summarised in Appendix 3.

9.2.1 Nile perch

The estimated Nile perch catches were lowest in August 2005 (4421.7 ± 927.6 t); similar in July and September 2005, i.e. 4977.7 ± 832.7 t and 5083.5 ± 767.6 t respectively. There was an apparent increase in November 2005 to 5566.5 ± 780.3 t followed by a decrease to 4,479.4 ± 745.4 t in March 2006. However, the estimated Nile perch total catches were not statistically different between months and were thus stable.

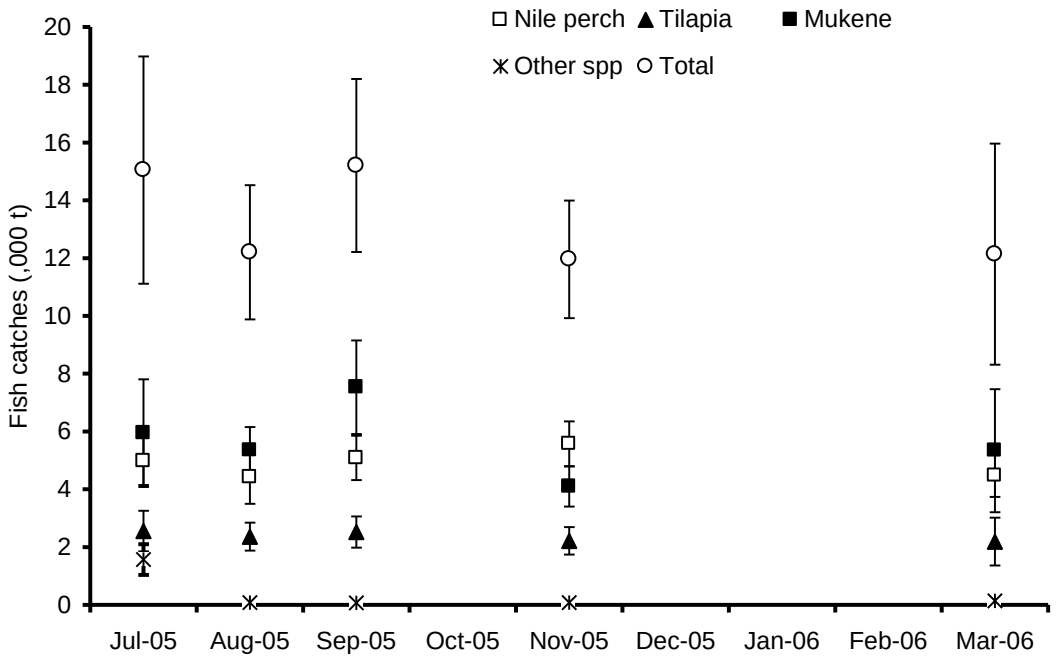


Figure 4. Trends of total monthly catches of the main fish species in the Ugandan part of Lake Victoria in July 2005 - March 2006 (error bars = 95%CL).

9.2.2 Tilapia

The Tilapia total catches were highest in July 2005 (2555.8 ± 700.7 t) and lowest in November 2005 (2212.4 ± 474.5 t). There was an increase to 2,406.6 ± 809.3 t in March 2006 from the lowest estimate of November 2005. Like Nile perch, the tilapia total catches were not statistically different between months and could be considered to have been stable.

9.2.3 Mukene/Dagaa

The highest Mukene total catches increased from 5944.1 ± 1864.2 t and 5346.9 ± 1864.2 t in July and August 2005 respectively to 7315 ± 1617.3 t in September 2005 but decreased significantly to 4100.0 ± 699.1 t in November 2005. The estimate in March 2006 showed an increase in catches to 5335.9 ± 2131.1 t from the lowest estimate of November 2005.

9.2.4 Other fish species

Apart from July 2005 when large quantities of haplochromines (1390.2 ± 357.4 t) were recorded in the catches, probably by error since this was the

first survey, leading to the total catch estimate of 1569.9 ± 533 t. The contribution of fishes other than Nile perch, tilapiines and Mukene was insignificant in other months, ranging between 70 and 80 t. However, there was an increase to 138.2 ± 115.3 t of these species in March 2006 but with large confidence intervals due infrequent occurrence of these fish species in the catches.

9.2.5 All fish species

The total catch estimates for all fish species were highest, 15204.1 ± 2996.9 t in September 2005; and lowest, 11958.4 ± 2035.3 t in November 2005. The March 2006 estimate was 12,360.2 ± 3817.4 t. However, the total catches were not statistically different between the different monthly estimates.

9.3 District Estimates of total fish catches and beach value of the main commercial species

The distribution of the number of fishing crafts in the riparian districts (Table 1) determines the proportional distribution of the total catch estimates for the districts. Further to the number of crafts, the finer details of the craft-gear characteristics, determine the differences in the estimates for each fish species among the districts. Thus Mukono district with 35% of all fishing crafts in the Ugandan part of the lake (Frame survey 2004 data) had the largest share of the total fish catch estimates for all species, followed by Kalangala, Mayuge, and Bugiri and the least in Busia district (Tables 2-5). Likewise, the estimate of the gross income from the sale of fish catches at the beach, i.e. the beach value of the catches is unevenly distributed in the riparian districts.

Table 1. Distribution of fishing crafts in the riparian districts of the Ugandan part of Lake Victoria (Frame survey 2004 data

District	No. fishing crafts	%ge
Busia	136	0.8
Kampala	169	1.0
Rakai	321	1.9
Jinja	340	2.0
Mpigi	819	4.9
Masaka	1057	6.3
Wakiso	1118	6.7
Bugiri	2132	12.8
Mayuge	2226	13.3
Kalangala	2529	15.2
Mukono	5838	35.0
Total	16685	100.0

Table 2. Estimated monthly total catches and beach value of Nile perch in the Ugandan part of Lake Victoria presented by district in July 2005 – March 2006.

	Jul-05		Aug-05		Sep-05		Nov-05		Mar-06	
DISTRICT	Total catch (tonnes)	Beach Value (Mill.shs)	Total catch (tonnes)	Beach Value (Mill.sh s)	Total catch (tonnes)	Beach Value (Mill.shs)	Total catch (tonnes)	Beach Value (Mill.shs)	Total catch (tonnes)	Beach Value (Mill.shs)
Busia	28.1	49.2	20.9	36.5	19.8	34.6	27.1	47.4	20.6	42.8
Bugiri	820.3	1,434.7	591.2	1,034.0	687.4	1,202.2	829.9	1,451.4	603.8	1,256.6
Mayuge	610.3	1,067.4	471.0	823.8	560.6	980.4	649.6	1,136.2	511.6	1,064.6
Jinja	49.0	85.7	38.5	67.3	46.9	82.0	59.5	104.1	42.5	88.4
Mukono	1,992.8	3,485.3	1,882.6	3,292.7	2,207.7	3,861.2	2,296.6	4,016.7	1,896.3	3,946.2
Kampala	40.3	70.5	38.8	67.8	48.0	84.0	44.8	78.4	41.0	85.4
Wakiso	274.9	480.7	278.0	486.3	303.5	530.8	309.7	541.7	260.5	542.1
Mpigi	143.3	250.7	123.9	216.7	143.5	251.0	144.6	252.9	127.1	264.4
Masaka	180.3	315.3	170.2	297.6	180.1	314.9	209.0	365.6	152.9	318.2
Kalangala	719.0	1,257.5	691.5	1,209.4	757.3	1,324.6	848.5	1,484.1	704.5	1,466.1
Rakai	119.4	208.9	114.8	200.8	128.8	225.3	147.1	257.2	118.6	246.9
Total	4,977.7	8,705.9	4,421.4	7,733.0	5,083.5	8,891.0	5,566.5	9,735.8	4,479.4	9,321.7

Table 3. Estimated total catches and beach value of Tilapia in the Ugandan part of Lake Victoria presented by district in July 2005 – March 2006.

	Jul-05		Aug-05		Sep-05		Nov-05		Mar-06	
DISTRICT	Total catch (tonnes)	Beach Value (Mill.shs)	Total catch (tonnes)	Beach Value (Mill.shs)	Total catch (tonnes)	Beach Value (Mill.shs)	Total catch (tonnes)	Beach Value (Mill.shs)	Total catch (tonnes)	Beach Value (Mill.shs)
Busia	28.1	26.9	22.6	21.7	27.4	26.2	24.6	23.6	23.3	22.5
Bugiri	217.8	208.5	193.1	184.8	227.3	217.5	192.4	184.1	192.3	185.7
Mayuge	382.4	365.9	359.3	343.9	387.2	370.6	355.7	340.4	347.8	336.0
Jinja	62.8	60.1	57.7	55.2	56.1	53.7	56.9	54.5	54.9	53.0
Mukono	782.5	748.8	787.0	753.2	770.3	737.2	669.1	640.3	718.9	694.5
Kampala	30.0	28.7	25.8	24.7	22.6	21.6	24.3	23.2	23.0	22.2
Wakiso	210.9	201.9	180.7	172.9	208.2	199.3	175.1	167.6	172.0	166.1
Mpigi	180.3	172.5	135.1	129.3	159.4	152.6	148.8	142.4	134.7	130.1
Masaka	248.9	238.2	203.7	194.9	254.9	243.9	223.2	213.6	374.7	362.0
Kalangala	370.0	354.1	361.9	346.3	371.3	355.3	308.7	295.4	331.9	320.7
Rakai	42.2	40.4	32.8	31.4	36.6	35.1	33.7	32.2	33.2	32.0
Total	**2555.8**	**2445.9**	**2359.8**	**2258.3**	**2521.4**	**2413.0**	**2212.4**	**2117.3**	**2406.6**	**2324.8**

Table 4. Estimated total catches and beach value of Mukene in the Ugandan part of Lake Victoria presented by district in July 2005 – March 2006.

	Jul-05		Aug-05		Sep-05		Nov-05		Mar-06	
DISTRICT	Total catch (tonnes)	Beach Value (Mill. shs)	Total catch (tonnes)	Beach Value (Mill. shs)	Total catch (tonnes)	Beach Value (Mill. shs)	Total catch (tonnes)	Beach Value (Mill. shs)	Total catch (tonnes)	Beach Value (Mill. shs)
Busia	11.4	1.9	12.6	2.1	17.6	2.9	8.6	1.4	11.9	2.3
Bugiri	736.6	120.1	813.5	132.6	1136.8	185.3	554.0	90.3	772.1	150.6
Mayuge	440.4	71.8	486.9	79.4	680.3	110.9	333.1	54.3	459.5	89.6
Jinja	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.0
Mukono	2747.6	447.9	2275.3	370.9	3215.7	524.2	1832.9	298.8	2389.3	465.9
Kampala	3.8	0.6	4.3	0.7	6.1	1.0	3.5	0.6	4.0	0.8
Wakiso	274.2	44.7	281.4	45.9	394.3	64.3	202.7	33.0	270.8	52.8
Mpigi	57.0	9.3	62.9	10.3	88.7	14.5	43.8	7.1	59.3	11.6
Masaka	103.6	16.9	105.6	17.2	147.9	24.1	75.3	12.3	2.4	0.5
Kalangala	1554.4	253.4	1287.7	209.9	1820.1	296.7	1034.4	168.6	1349.3	263.1
Rakai	15.2	2.5	16.8	2.7	23.4	3.8	11.7	1.9	17.4	3.4
Total	**5944.1**	**968.9**	**5346.9**	**871.5**	**7531.0**	**1227.5**	**4100.0**	**668.3**	**5335.9**	**1040.5**

Table 5. Estimated total catches and beach value of other fish species (Haplochromines, *Bagrus*, *Protopterus*, *Clarias* and others) in the Ugandan part of Lake Victoria presented by district in July 2005 – March 2006.

	Jul-05		Aug-05		Sep-05		Nov-05		Mar-06	
DISTRICT	Total catch (tonnes)	Beach Value (Mill. shs)	Total catch (tonnes)	Beach Value (Mill. shs)	Total catch (tonnes)	Beach Value (Mill. shs)	Total catch (tonnes)	Beach Value (Mill.shs)	Total catch (tonnes)	Beach Value (Mill.shs)
Busia	5.5	6.2	1.4	1.4	1.2	1.2	2.0	1.9	2.3	2.0
Bugiri	263.2	313.2	6.9	6.8	8.4	8.5	10.4	9.8	14.0	11.8
Mayuge	164.6	193.5	13.9	14.3	11.1	10.6	12.2	11.4	17.4	14.5
Jinja	2.2	1.9	1.5	1.5	2.0	1.9	2.0	1.8	2.8	2.4
Mukono	616.9	723.2	20.1	19.4	20.9	20.2	21.6	18.8	50.0	42.1
Kampala	3.1	2.9	1.0	0.9	1.3	1.2	1.1	0.9	1.7	1.4
Wakiso	91.3	106.3	4.8	4.5	4.6	4.6	5.4	4.8	9.6	8.2
Mpigi	27.3	29.5	5.4	5.0	4.9	4.9	6.8	6.3	8.8	7.4
Masaka	37.5	42.3	3.1	2.9	3.7	3.6	5.1	4.8	7.3	6.0
Kalangala	348.6	409.1	15.0	13.6	9.1	8.3	11.4	9.8	22.0	17.7
Rakai	9.7	9.3	1.1	1.0	0.9	0.8	1.5	1.3	2.3	1.8
Total	**1,569.9**	**1,837.5**	**74.1**	**71.4**	**68.0**	**65.8**	**79.5**	**71.7**	**138.2**	**115.3**

Table 6. Estimated total catches and beach value of all fish species pooled in the Ugandan part of Lake Victoria presented by district in July 2005 – March 2006.

	Jul-05		Aug-05		Sep-05		Nov-05		Mar-06	
DISTRICT	Total catch (tonnes)	Beach Value (Mill. shs)	Total catch (tonnes)	Beach Value (Mill. shs)	Total catch (tonnes)	Beach Value (Mill. shs)	Total catch (tonnes)	Beach Value (Mill. shs)	Total catch (tonnes)	Beach Value (Mill. shs)
Busia	73.1	84.2	57.5	61.7	66.0	64.9	62.3	74.3	58.0	69.6
Bugiri	2,037.9	2,076.5	1,604.7	1,358.2	2,059.9	1,613.5	1,586.7	1,735.6	1,582.2	1,604.7
Mayuge	1,597.7	1,698.6	1,331.1	1,261.4	1,639.2	1,472.5	1,350.6	1,542.3	1,336.2	1,504.6
Jinja	114.0	147.7	97.7	124.0	105.1	137.6	118.5	160.4	100.2	143.8
Mukono	6,139.8	5,405.2	4,965.0	4,436.2	6,214.6	5,142.8	4,820.2	4,974.6	5,054.5	5,148.7
Kampala	77.2	102.7	69.9	94.1	78.0	107.8	73.7	103.1	69.7	109.7
Wakiso	851.3	833.6	744.9	709.6	910.6	799.0	692.9	747.1	712.9	769.3
Mpigi	407.9	462.0	327.3	361.3	396.5	423.0	344.0	408.7	329.9	413.6
Masaka	570.3	612.7	482.6	512.6	586.6	586.5	512.6	596.3	537.3	686.7
Kalangala	2,992.0	2,274.1	2,356.1	1,779.2	2,957.8	1,984.9	2,203.0	1,957.9	2,407.8	2,067.6
Rakai	186.5	261.1	165.5	235.9	189.7	265.0	194.0	292.6	171.4	284.1
Total	**15,047.5**	**13,958.2**	**12,202.2**	**10,934.2**	**15,203.9**	**12,597.3**	**11,958.4**	**12,593.1**	**12,360.2**	**12,802.2**

9.4 Relative contribution of the main fish species to the monthly total catches and the beach value.

In March 2006, Nile perch contributed 36% of the total catches in the Ugandan part of the lake, but this accounted for 73% of the estimated gross income of the fishers. Mukene contributed 44% of the total catches but only 8% of the estimated income of fishers (Figure 5). The tilapia catches shared 19% of the total catches and 18% of the gross income to fishers.

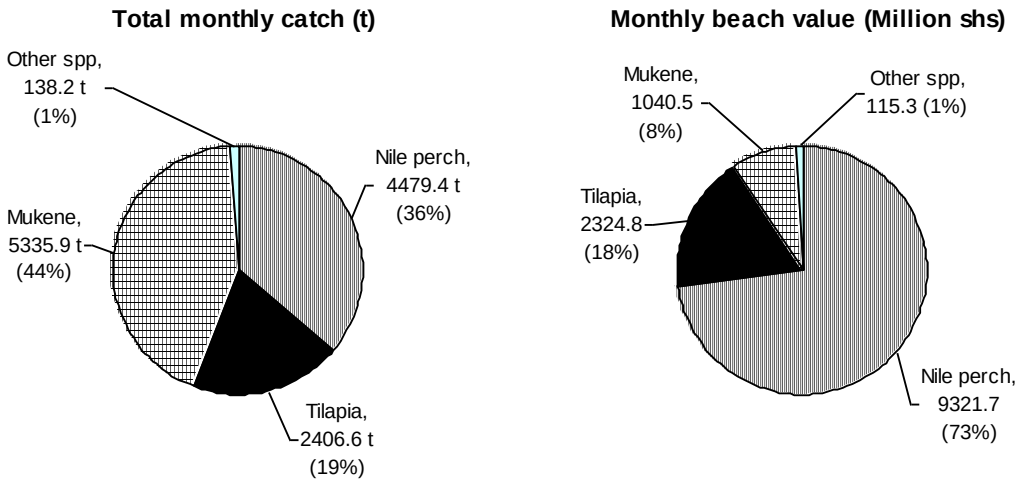


Figure 5. Relative contribution to the total monthly catches and beach value of the main fish species in the Ugandan part of Lake Victoria in March 2006**.**

10 DISCUSSION

The March 2006 catch assessment survey data provide further evidence of a significant drop in catch rates of Nile perch over the years of Sesse boats with motor or sail using gillnets from 53.6 ± 4.7 kg boat^{-1} day^{-1} in 2000 (Muhoozi, 2002) to approximately 24 kg boat^{-1} day^{-1} in the current surveys. A significantly higher catch rate of 32 kg boat^{-1} day^{-1} among these boats was only observed in November 2005 which is evidence of seasonal variations in catch rates of Nile perch. However, the change of sampling frequency from monthly in July – September 2005 to quarterly surveys in November 2005 and March 2005 eliminated the chance of building good data sets to analyse seasonal patterns of catch rates. Generally, the observed catch rates of the main commercial fish species, especially Nile perch and Tilapia, are apparently lower than they were six years ago although the element of seasonality in fish catch rates is not well captured. Notwithstanding the lower catch rates than six years ago, the current data show stability in production of the Nile perch and tilapia fisheries. The Mukene fishery has continued to show large fluctuations between months but this could be partly attributed to poor recording of data. Despite efforts to ensure data collection guidelines were followed, many data recorders still make large errors in capturing Mukene data.

The overall contribution of Nile perch to the total catches decreased from 37% in July to November 2005 to 36% in March 2006. However its contribution to the overall beach value increased from 71% in July to November 2005 to 73% in March 2006. This was a result of significant improvement in the beach price of Nile perch in March 2006. The data show continued presence of beach seines that crop predominantly immature Nile perch. In view of the high beach value of the Nile perch fishery; its management should be given high priority. There is need to increase productivity of the Nile perch fishery to improve catches by allowing fish to grow to the recommended minimum size for harvest of 50 cm Total length through elimination of illegal destructive fishing gears like beach seines and undersized gillnets in the short term and control of overall fishing effort in the long term.

The March 2006 observations in the tilapia fishery indicated an improvement compared with the November 2005 catches but also a generally stable fishery since the beginning of the CAS surveys in July 2005.

The Mukene/Dagaa fishery in the Ugandan waters of Lake Victoria remained a near shore fishery in which paddle sesse boats were the dominant craft. In spite of this, Mukene contributed 44% of the total catches in March 2006. Efforts to explore the potential of this apparently abundant resource in deep offshore waters in Uganda should be speeded up in order to expand this underdeveloped fishery. The catch rates in the Mukene fishery, in terms of biomass, i.e. in excess of 180 kg boat^{-1} day^{-1}, are good only that the value per unit weight is extremely low compared with other fish species. Efforts should be made to improve the processing methods of this low value fish to enhance its contribution to the direct income of the fishers.

There are indications that the sell of either part or whole catch at sea in some parts of the lake is becoming common. This practice threatens the reliability of the information collected in CAS and could lead to grave underestimation of the total catches. The BMUs should as one of their bylaws enforce a ban against the practice. Large quantities of CAS data continue to be analyzed manually in a spreadsheet thus being prone to error. Efforts should be made to complete the Database module for catch assessment surveys to ease data handling.

11 REFERENCES

LVFO (2005a) Standard Operating Procedures for Catch Assessment Surveys. 42 pp

LVFO (2005b) Characteristics of the Lake Victoria Fishery based on Frame surveys conducted in 2000, 2002 and 2004 with recommendations for development and management of the fishery. 30pp

Muhoozi L.I. (2002) Exploitation and Management of the Artisanal Fisheries in the Ugandan waters of Lake Victoria. PhD thesis, University of Hull U.K. 260 pp.

12 APPENDICES

Appendix 1. List of fish landing sites selected and sampled in Catch Assessment surveys in the Ugandan waters of Lake Victoria

District	Laning site
Bugiri	Golofa
	Bumeru A
	Butanila B
	Mwango
	Maruba
	Hama 'B'
Busia	Madwa
Jinja	Owen Falls Dam
	Wanyange
Kampala	Luzira Port Bell
Masaka	Nakigga
	Makonzi
Mayuge	Khaaza
	Maganda
	Malindi
	Nakirimira
	Ntinkalu
Rakai	Kasensero
Wakiso	Kinywante
	Kagulube
	Nsonga-Kava
	Nakiwogo
	Kitubulu
Mukono	Buwagajjo
	Namugambe
	Bukaali
	Kibulwe-Ziiru

District	Laning site
Mukono	Nantwalantya
	Kawunguli-Bulago
	Malija-Wabuziba
	Maala
	Kiruguma
	Lufu
	Kisu
	Gunda
	Kinaggaba
	Kawafu
	Zinga
	Kachanga-Bulago
	Luwero
	Kaziru
	Nambula
	Namugombe
	Kalega
	Nyenda
	Kiyindi
Mpigi	Katebo Lwazi
	Nakaziba
Kalangala	Banda
	Kakyanga
	Kasenyi
	Luku-Nabisukiro
	Mweena
	Kyagalanyi
Total	**54**

Appendix 2. Estimated total monthly fish catches in the Ugandan part of Lake Victoria July - November 2005

Species	Jul-05	±	Aug-05	±	Sep-05	±	Nov-05	±	Mar-06	±
Nile perch	4977.7	832.7	4421.4	927.6	5083.5	767.6	5,566.5	780.3	4479.4	745.4
Tilapia	2555.8	700.7	2359.8	485.1	2521.4	542	2,212.4	474.5	2406.6	809.3
Mukene	5944.1	1864.2	5346.9	809.6	7531	1617.3	4,100.0	699.4	5335.9	2131.1
Other spp	1569.9	533.0	74.0	100.6	68.2	70.01	79.5	81.1	138.2	131.6
Total	15047.5	3930.6	12202.1	2322.9	15204.1	2996.9	11,958.4	2,035.3	12360.2	3817.4

Appendix 3. Estimated total fish landed (tonnes) in the Ugandan part of Lake Victoria presented by district and species for July 2005

DISTRICT	Nile perch	Tilapiines	Mukene/Dagaa	Haplochromines	Bagrus	Protopterus	Clarias	Other spp	TOTAL
Busia	28.1 ±9.2	28.1 ±5.6	11.4 ±1.7	3.8 ±1.1	0.0 ±0.0	1.2 ±1.2	0.1 ±0.1	0.4 ±0.4	73.1 ±19.4
Bugiri	820.3 ±125.8	217.8 ±55.1	736.6 ±110.3	242.8 ±62.7	1.0 ±1.5	4.7 ±5.4	0.3 ±0.5	14.3 ±13.8	**2,037.9 ±375.2**
Mayuge	610.3 ±153.5	382.4 ±126.2	440.4 ±66.0	145.3 ±37.7	0.7 ±1.0	7.1 ±10.0	0.6 ±0.9	10.9 ±10.3	**1,597.6 ±405.5**
Jinja	49.0 ±14.4	62.8 ±15.3	0.0 ±0.0	0.1 ±0.1	0.1 ±0.1	1.0 ±1.1	0.2 ±0.4	0.8 ±0.6	**113.9 ±32.0**
Mukono	1,992.8 ±282.1	782.5 ±227.7	2,747.6 ±1,018.5	551.5 ±142.0	3.1 ±3.9	8.6 ±12.7	1.1 ±1.6	52.5 ±44.2	**6,139.7 ±1,732.8**
Kampala	40.3 ±8.4	30.0 ±22.6	3.8 ±0.6	1.3 ±0.3	0.1 ±0.1	0.4 ±0.5	0.0 ±0.0	1.4 ±1.0	**77.2 ±33.5**
Wakiso	274.9 ±46.4	210.9 ±40.9	274.2 ±58.7	80.1 ±20.7	0.5 ±0.6	1.7 ±2.0	0.2 ±0.3	8.8 ±6.8	**851.3 ±176.5**
Mpigi	143.3 ±31.6	180.3 ±53.6	57.0 ±8.5	18.9 ±5.0	0.3 ±0.3	2.5 ±2.4	0.2 ±0.3	5.4 ±3.9	**407.9 ±105.6**
Masaka	180.3 ±30.9	248.9 ±44.0	103.6 ±22.6	30.1 ±7.8	0.3 ±0.4	1.5 ±2.0	0.2 ±0.3	5.4 ±5.0	**570.2 ±113.1**
Kalangala	719.0 ±117.4	370.0 ±102.7	1,554.4 ±575.1	312.7 ±80.6	1.7 ±2.1	4.9 ±6.4	0.5 ±0.6	28.8 ±24.5	**2,992.0 ±909.4**
Rakai	119.4 ±12.9	42.2 ±6.8	15.2 ±2.3	5.0 ±1.3	0.1 ±0.2	0.4 ±0.3	0.0 ±0.1	4.2 ±3.8	**186.5 ±27.6**
TOTAL	**4,977.7 ±832.7**	**2,555.8 ±700.7**	**5,944.1 ±1,864.2**	**1,391.6 359.2**	**8.0 ±10.3**	**33.8 ±44.0**	**3.5 ±5.2**	**133.0 ±114.3**	**15,047.5 ±3,930.6**

Appendix 4. Estimated total fish landed (tonnes) in the Ugandan part of Lake Victoria presented by district and species for August 2005.

District	NP	±	TL	±	DA	±	HA	±	BD	±	PA	±	CA	±	OT	±	**TOTAL**	±
Busia	20.9	9.2	22.6	4.2	12.6	1.7	0.1	0.2	0.0	0.0	1.0	1.0	0.1	0.3	0.1	0.1	**57.5**	**16.6**
Bugiri	591.2	115.1	193.1	39.5	813.5	108.9	0.5	0.8	0.5	0.6	4.3	4.6	0.7	1.3	0.9	0.8	**1,604.7**	**271.6**
Mayuge	471.0	136.6	359.3	80.0	486.9	66.0	0.6	0.8	0.4	0.6	8.8	15.6	2.7	9.7	1.4	1.3	**1,331.1**	**310.5**
Jinja	38.5	14.9	57.7	16.0	0.0	0.0	0.1	0.1	0.1	0.1	0.9	1.0	0.2	0.4	0.2	0.2	**97.7**	**32.7**
Mukono	1,882.6	361.7	787.0	175.9	2,275.3	362.6	0.5	0.9	2.8	3.6	7.8	9.2	3.2	3.7	5.8	3.9	**4,965.0**	**921.6**
Kampala	38.8	10.2	25.8	5.8	4.3	0.8	0.0	0.0	0.1	0.1	0.5	0.6	0.1	0.1	0.3	0.2	**69.8**	**17.9**
Wakiso	278.0	62.2	180.7	32.5	281.4	40.6	0.2	0.3	0.5	0.6	2.2	2.6	0.6	0.7	1.3	0.9	**745.0**	**140.5**
Mpigi	123.9	36.7	135.1	20.3	62.9	8.5	0.3	0.4	0.3	0.3	3.0	3.5	0.6	0.7	1.2	1.0	**327.3**	**71.3**
Masaka	170.2	42.2	203.7	32.2	105.6	14.8	0.2	0.3	0.2	0.2	1.9	2.7	0.3	0.3	0.6	0.5	**482.6**	**93.4**
Kalangala	691.5	123.1	361.9	72.4	1,287.7	203.5	0.4	0.6	1.0	1.1	5.5	8.6	2.2	5.9	6.0	6.3	**2,356.0**	**421.4**
Rakai	114.8	15.6	32.8	6.3	16.8	2.3	0.0	0.1	0.1	0.1	0.4	0.5	0.1	0.2	0.3	0.2	**165.5**	**25.3**
TOTAL	**4,421.4**	**927.6**	**2,359.8**	**485.1**	**5,346.9**	**809.6**	**2.9**	**4.6**	**5.8**	**7.4**	**36.3**	**50.0**	**11.0**	**23.2**	**18.0**	**15.4**	**12,202.1**	**2,322.8**

Abbreviations: NP= Nile perch, TL=Tilapiines, DA= Mukene/Dagaa, HA=Haplochromines, BD=Bagrus, PA= Protopterus, CA= Clarias, OT=Other spp

Appendix 5. Estimated total fish landed (tonnes) in the Ugandan part of Lake Victoria presented by district and species for September 2005

District	NP	±	TL	±	DA	±	HA	±	BD	±	PA	±	CA	±	OT	±	**TOTAL**	±
Busia	19.8	4.6	27.4	4.7	17.6	3.9	0.1	0.1	0.0	0.1	1.0	0.8	0.1	0.1	0.0	0.0	**66.0**	**14.2**
Bugiri	687.4	85.1	227.3	42.6	1,136.8	250.1	0.2	0.2	2.5	2.9	4.9	4.3	0.5	0.7	0.4	0.4	**2,059.9**	**386.4**
Mayuge	560.6	107.0	387.2	98.3	680.3	150.2	0.2	0.2	1.5	2.0	7.0	7.3	0.9	1.1	1.5	2.7	**1,639.1**	**368.7**
Jinja	46.9	12.0	56.1	18.5	0.1	0.2	0.1	0.1	0.0	0.0	1.5	1.3	0.2	0.2	0.3	0.3	**105.1**	**32.6**
Mukono	2,207.7	327.0	770.3	181.0	3,215.7	682.0	0.1	0.2	3.0	3.8	11.3	11.5	2.5	3.1	3.9	2.2	**6,214.5**	**1,210.8**
Kampala	48.0	8.5	22.6	4.4	6.1	1.5	0.0	0.0	0.0	0.0	0.8	0.7	0.2	0.2	0.3	0.2	**77.9**	**15.5**
Wakiso	303.5	68.3	208.2	65.3	394.3	86.8	0.0	0.0	0.3	0.4	2.5	2.5	0.9	1.2	0.8	0.5	**910.6**	**225.0**
Mpigi	143.5	22.9	159.4	19.9	88.7	20.2	0.1	0.1	0.2	0.1	3.1	3.0	0.8	1.0	0.7	0.4	**396.5**	**67.8**
Masaka	180.1	24.0	254.9	35.4	147.9	32.2	0.0	0.0	0.3	0.5	2.8	3.4	0.3	0.4	0.3	0.3	**586.6**	**96.1**
Kalangala	757.3	94.7	371.3	66.6	1,820.1	385.1	0.1	0.1	1.1	1.4	4.5	4.4	0.7	0.9	2.7	1.6	**2,957.8**	**555.0**
Rakai	128.8	13.5	36.6	5.3	23.4	5.2	0.0	0.0	0.1	0.1	0.5	0.6	0.1	0.1	0.2	0.1	**189.8**	**24.9**
TOTAL	**5,083.5**	**767.6**	**2,521.4**	**542.0**	**7,531.0**	**1,617.3**	**1.0**	**1.2**	**9.1**	**11.3**	**39.9**	**40.0**	**7.1**	**8.9**	**11.0**	**8.6**	**15,203.9**	**2,997.0**

Abbreviations: NP= Nile perch, TL=Tilapiines, DA= Mukene/Dagaa, HA=Haplochromines, BD=Bagrus, PA= Protopterus, CA= Clarias, OT=Other spp

Appendix 6. Estimated total fish landed (tonnes) in the Ugandan part of Lake Victoria presented by district and species for November 2005

District	NP	±	TL	±	DA	±	HA	±	BD	±	PA	±	CA	±	OT	±	**TOTAL**	±
Busia	27.1	8.1	24.6	5.4	8.6	1.2	0.1	0.2	0.0	0.1	1.6	1.2	0.1	0.2	0.2	0.2	**62.3**	**16.5**
Bugiri	829.9	109.2	192.4	46.2	554.0	72.8	0.4	0.8	0.8	1.1	7.1	6.1	0.6	1.1	1.5	1.8	**1,586.6**	**239.1**
Mayuge	649.6	123.5	355.7	87.2	333.1	47.7	0.5	0.9	0.5	0.7	8.6	7.8	0.8	1.8	1.9	1.8	**1,350.6**	**271.3**
Jinja	59.5	18.6	56.9	12.8	0.1	0.3	0.1	0.1	0.0	0.1	1.4	1.1	0.1	0.3	0.4	0.3	**118.5**	**33.6**
Mukono	2,296.6	300.1	669.1	142.8	1,832.9	335.9	0.4	0.8	1.9	2.3	9.8	8.9	1.4	4.3	8.1	6.2	**4,820.1**	**801.4**
Kampala	44.8	8.0	24.3	5.8	3.5	1.8	0.0	0.0	0.0	0.0	0.6	0.5	0.0	0.3	0.4	0.3	**73.7**	**16.7**
Wakiso	309.7	44.4	175.1	33.8	202.7	36.1	0.2	0.4	0.3	0.3	2.7	2.4	0.4	1.5	1.8	1.2	**692.9**	**120.2**
Mpigi	144.6	26.0	148.8	27.9	43.8	8.0	0.3	0.5	0.2	0.2	4.5	3.7	0.5	1.5	1.4	1.0	**344.1**	**68.9**
Masaka	209.0	28.6	223.2	44.0	75.3	11.0	0.4	0.6	0.2	0.2	3.0	2.8	0.5	0.8	1.1	1.1	**512.6**	**89.0**
Kalangala	848.5	99.9	308.7	61.8	1,034.4	182.8	0.3	0.5	0.7	0.8	5.5	4.3	0.7	1.3	4.2	3.1	**2,202.9**	**354.6**
Rakai	147.1	13.9	33.7	6.8	11.7	1.8	0.0	0.1	0.1	0.1	0.8	0.7	0.1	0.1	0.4	0.4	**193.9**	**24.0**
TOTAL	**5,566.5**	**780.3**	**2,212.4**	**474.5**	**4,100.0**	**699.4**	**2.7**	**4.9**	**4.7**	**6.0**	**45.6**	**39.7**	**5.2**	**13.3**	**21.3**	**17.3**	**11,958.4**	**2,035.3**

Abbreviations: NP= Nile perch, TL=Tilapiines, DA= Mukene/Dagaa, HA=Haplochromines, BD=Bagrus, PA= Protopterus, CA= Clarias, OT=Other spp

Appendix 7. Estimated total fish landed (tonnes) in the Ugandan part of Lake Victoria presented by district and species for March 2006

District	NP	±	TL	±	DA	±	HA	±	BD	±	PA	±	CA	±	OT	±	**TOTAL**	±
Busia	20.6	5.3	23.3	6.3	11.9	5.1	0.0	0.1	0.3	0.5	1.7	1.8	0.1	0.2	0.2	0.2	**58.0**	**19.5**
Bugiri	603.8	79.5	192.3	52.1	772.1	333.5	0.2	0.4	1.3	2.2	7.4	7.5	1.3	1.6	3.8	3.9	**1,582.2**	**480.6**
Mayuge	511.6	111.7	347.8	118.0	459.5	197.0	0.2	0.4	1.2	2.1	8.0	8.2	1.9	2.4	6.1	6.4	**1,336.2**	**446.1**
Jinja	42.5	12.8	54.9	16.4	0.1	0.1	0.0	0.1	0.3	0.5	1.5	1.5	0.3	0.4	0.7	0.6	**100.2**	**32.4**
Mukono	1,896.3	294.7	718.9	293.8	2,389.3	923.2	0.6	0.8	3.1	3.2	15.8	13.7	8.8	8.1	21.8	17.2	**5,054.5**	**1,554.7**
Kampala	41.0	11.1	23.0	11.8	4.0	1.7	0.0	0.0	0.1	0.2	0.5	0.5	0.2	0.3	0.9	0.5	**69.7**	**26.0**
Wakiso	260.5	53.0	172.0	59.4	270.8	113.0	0.1	0.2	0.6	0.7	3.5	3.0	1.7	1.6	3.7	2.4	**712.9**	**233.3**
Mpigi	127.1	24.0	134.7	41.3	59.3	25.6	0.1	0.2	0.7	1.1	4.3	4.3	1.0	1.1	2.7	2.0	**329.9**	**99.7**
Masaka	152.9	21.9	374.7	71.3	2.4	3.2	0.1	0.1	0.3	0.6	4.5	4.3	0.4	0.8	1.9	2.0	**537.3**	**104.0**
Kalangala	704.5	119.2	331.9	126.8	1,349.3	519.7	0.3	0.4	1.5	1.8	6.2	6.1	2.7	2.9	11.4	9.0	**2,407.8**	**785.8**
Rakai	118.6	12.3	33.2	12.1	17.4	8.9	0.0	0.0	0.2	0.2	0.7	0.7	0.2	0.2	1.2	0.9	**171.4**	**35.4**
TOTAL	**4,479.4**	**745.4**	**2,406.6**	**809.3**	**5,335.9**	**2,131.1**	**1.6**	**2.7**	**9.5**	**13.0**	**54.0**	**51.4**	**18.6**	**19.6**	**54.5**	**45.0**	**12,360.2**	**3,817.4**

Abbreviations: NP= Nile perch, TL=Tilapiines, DA= Mukene/Dagaa, HA=Haplochromines, BD=Bagrus, PA= Protopterus, CA= Clarias, OT=Other spp