FISHING EFFORT AND FISH YIELD OVER A 15 YEAR PERIOD ON LAKE VICTORIA, UGANDA: Managment Implications

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one of the Mukene landing sites on Lake Victoria

The National Fisheries Resources Research Institute (NaFIRRI), the Directorate of Fisheries Resources (DiFR), the Local Government fisheries staff and those from the Beach Management Units (BMUs) of the riparian districts to Lake Victoria regularly and jointly conduct Frame and Catch Assessment Surveys. The information obtained is used to guide fisheries management and development.

We reveal the trends in the commercial fish catch landings and fishing effort on the Uganda side of Lake Victoria, over a 15 year period (2000-2015) and provide the underlying factors to the observed changes.

The contribution of the high value large size species (Nile perch and Tilapia) to the commercial catch of Lake Victoria has significantly reduced while that of the low value small size species, Mukene has increased over a ten year (2005-2015) period.

The information is intended to update and sensitize the key stakeholders on the status of the Lake Victoria fisheries. In addition, the information provided is expected to guide policy formulation and management planning by the fisheries managers at all levels including the BMUs and Landing Site Management Committees (LSMCs), the Local government fisheries staff and the Directorate of Fisheries Resources. The information is anticipated to create awareness among the lakeside fisher communities to reverse the current trend in fish declines.

Introduction

The fisheries of Lake Victoria have for several decades contributed to the livelihoods and economic development in the riparian states of Kenya, Tanzania and Uganda. The lake supports livelihoods of about four million people who depend on it directly for water, food, and employment and six million people indirectly. The lake fisheries contribute between 3–6% of the national GDPs of the three states (World Bank, 2009).

The demand for reliable and effective management advice for the Lake Victoria fisheries by the national and regional fisheries management bodies is increasing. Key management advice for the fish stocks on Lake Victoria is derived from both fishery independent (e.g. gillnet, trawl and acoustic surveys) and the fishery dependent (Frame and catch assessment surveys) surveys. Frame Surveys (FS) and Catch Assessment Surveys (CAS) have been the most popular fish stock assessment tools used to monitor and generate scientific information to guide decision making and management of the Lake Victoria fisheries resources. About 20 year ago there were many practical and methodological problems involved in obtaining reliable catch and effort data to input in the needed management advice.

However, from 2000, FSs and CASs methodologies were introduced and harmonized on Lake Victoria under the Lake Victoria Fisheries Organization (LVFO); the two methodologies have become popular fish stock assessment tools in the three riparian countries Kenya, Tanzania and Uganda and are regularly used to monitor and generate scientific information (e.g. fishery indicators) to guide decision making and management of the Lake Victoria fisheries resources at planning and policy levels.

Importance of FS & CASs

Frame Surveys involve a complete enumeration of all fishing inputs (fishing effort) at all fish landing sites including the facilities and services. The information generated is used in fisheries management planning and also provides the sampling frame for secondary surveys (CASs). The information recorded in the Frame Survey is used to identify primary and secondary sampling units, and appropriate sampling strata

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for the Catch Assessment Surveys (CASs). The data generated through CASs provides information on the catch per unit of effort (CPUE) and information on fishing effort from FS provides the raising factors used in the estimation of the quantity of fish landed (tonnes) and beach value by species, at temporal and spatial scales (time and space). Besides, both FS and CASs provides information used to guide in determination of appropriate effort and harvesting levels of the exploited fisheries resources and their implications to the sustainable management and utilization of the lake fisheries resource.

Trends of fishing effort on Lake Victoria (2000-2014)

Since 2000, eight biennial FS have been conducted on Lake Victoria and results on the Uganda portion of the lake show trends in fishing effort (indicated as major fishing inputs and facilities at landing sites). These data show how fishing effort has grown: the number of fishers and number of boats have increased approximately by 85% and 82% respectively over the 15 years (Table 1).

Table 1: Trends in the number of landing sites, fishing crafts and landing site facilities on Lake Victoria, Uganda between 2000 and 2014.

Year	2000	2002	2004	2006	2008	2010	2012	2014
No. of landing sites	597	552	554	481	435	503	555	567
Bandas (Fish shades)	56	33	21	54	68	88	78	66
Fish stores	78	6	11	18	34	31	49	22
Electricity supply	16	10	19	17	20	21	30	37
Toilet facilities	--	95	41	171	196	198	267	263
Portable water	--	21	41	55	88	88	165	139
All weather roads	138	108	127	172	161	163	218	236
Boat repair facilities	221	40	23	141	143	189	306	244
Net repair facilities	181	23	4	49	64	101	168	136
No. of fishers	34,889	41,674	37,721	54,148	51,916	56,957	63,921	64,617
No. of fishing crafts	15,544	18,609	16,775	24,148	21,836	23,455	27,971	28,243
Crafts using engines	2,031	3,250	3,173	5,047	5,156	6,334	9,351	9955
Crafts using sails	665	1,074	1,096	1,466	1,078	682	1,125	857
Catamarans	--	--	--	--	3	--	18	44
Dugout	269	164	122	132	163	107	116	152
Foot fishers	--			171	176	173	380	100
Parachute	5,342	5,580	5,450	5,064	4,807	5,356	4,798	5319
Sesse flat at one end	8,107	10,666	9,067	15,883	13,709	14,922	18,969	18929
Sesse pointed at both ends	1,797	2,197	1,979	2,816	3,016	2,901	3,598	3538
Rafts	--	2	149	82	138	169	92	157
No. of transport crafts	910	790	593	966	919	1,040	1021	1445
Fish carriers					668	478	730	659

The noticeable positive aspect from a management perspective was the reduction in proportion of the undersize gillnets from 18% to 7% but this was overshadowed by a general increase in the numbers of all fishing gear categories except scoop nets (Table 2). The gillnets increased by 267%, the beach/boat seines (124%), cast nets (7%) and monofilament nets (2480%).

Table 2: Summary of fishing inputs (Gear types and sizes) on Lake Victoria, Uganda (2000-2014)

	2000	2002	2004	2006	2008	2010	2012	2014
Gillnets by mesh size								
No. of gillnets <5"	54,454	52,846	56,246	91,740	76,908	66,532	59,585	78,571
% of undersize (illegal) gillnets	18.3	12.4	12.3	15..6	19.0	17.8	12.3	7.2
No. of gillnets >5"	243,209	374,642	402,351	498,037	327,098	307,052	423,155	1,015,225
% of legal gillnets	81.7	87.6	87.7	84.4	81.0	82.2	87.7	92.8
Total gillnets	297,663	427,488	458,597	589,777	404,006	373,584	482,740	1,093,796
Mukene fishing gears								
Lift net/Lampara		3	2		3	-	114	37
Small seine, mesh size <5 mm			867	1,467	1,785	2200	8,790	5631
Small seine, mesh size 6-9 mm			273	108	361	436	608	366
Small seine, mesh size 10mm			39	33	188	63	811	230
Total small seines	2,452	1,296	1,181	1,608	2,334	2,699	7,343	6,227
Scoop net		555	292	590	752	302	893	302
Hooks								
No. of Hook and line/Hand line hooks	4,585	6,547	8,335	15,860	19,629	17,071	27,780	27,004
No. Long line hooks	254,453	926,959	968,848	2,285,609	2,763,799	2,576,426	4,403,137	4,564,696
Beach/Boat seine	811	880	954	1,425	1,649	1,451	1,233	1,819
Cast net	1,276	858	659	631	1,000	1,095	1,372	1,359
Monofilament			845	--	11,203	12,115	15,148	21,793
Traps/Baskets	11,349	5,781	5,361	499	7,615	10,331	7,082	9,000

2005 to 2015 trends in the composition of the fish yield on the Uganda portion of Lake Victoria

Lake Victoria remains the main source of fish, contributing about half to the annual capture fisheries production in Uganda. Mukene/ Daaga (Rastrineobola argentea), Nile perch (Lates niloticus) and Tilapia spp dominate the fish catch (Table 3). Overall, there has been a decline in the lake's annual catch from 239,000tones in 2005 to 149,000tones in 2015, with exception of 2014 when the lake registered the record highest (270,000tones) annual catch. Mukene registered a 155% reduction in annual yield between May 2014 and December 2015. Mukene fishing is mainly conducted in the inshore shallow waters (Figure 3) where high proportions of its juveniles and those of the by-catch species are cropped.

Table 3: Trends in annual fish yield ("000" t) and beach value (Billion UGX) of catch of the major commercial fish species on Lake Victoria, Uganda 2005-2015.

	Nile perch		Tilapia		Daaga/Mukene		Other species		Overall	
Year	Catch	value	Catch	value	Catch	value	Catch	value	Catch	value
2005	95	183	29	28	106	21	8	8	239	240
2006	91	175	27	26	96	19	2	2	216	222
2007	87	147	24	26	114	19	3	2	227	194
2008	81	181	20	28	70	19	2	3	173	231
2010	85	297	17	37	59	16	2	4	163	355
2011	70	326	19	54	89	46	4	8	182	435
2014	67	362	21	90	166	93	15	39	270	584
2015	37	220	13	69	65	49	34	78	149	416

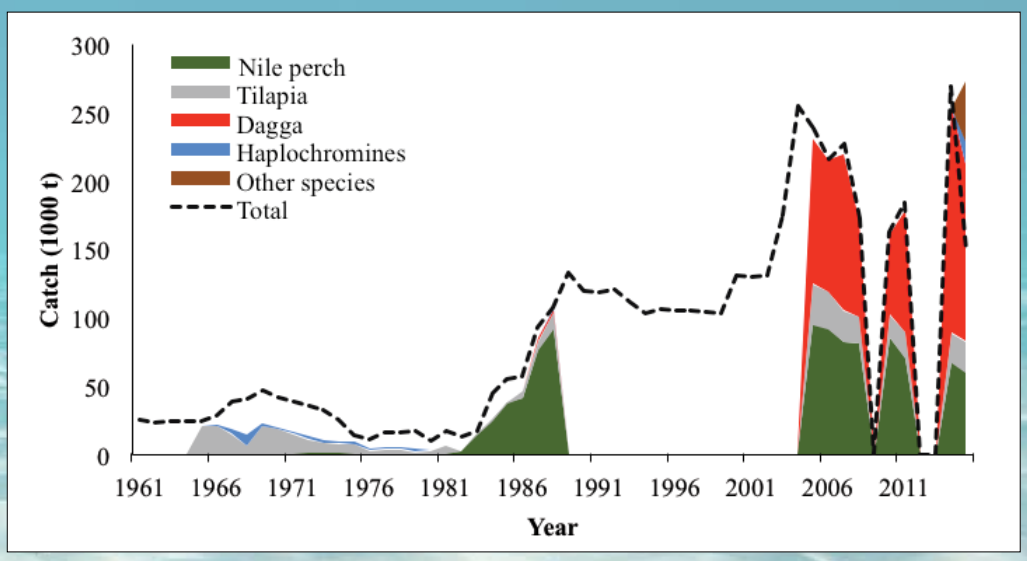
There have been changes in district boundaries resulting from creation of new districts. The originally 11 district sharing the Ugandan part of Lake Victoria have increased to 15; where Buvuma and Buikwe were curved out of Mukono, Kalungu from Masaka and Namayingo from Bugiri district. Based on districts which have remained intact i.e. Busia, Jinja, Mayuge, Kampala, Wakiso, Mpigi, Rakai and Kalangala, there has been a general decrease in the district annual fish yield over the ten year period (Table 4).

Table 4: Estimated annual fish yield ("000" tones) and values (Billion Ug.Shs) of catch at beach level on Lake Victoria, Uganda presented by district (2006 to 2015).

	2006		2007		2008		2010		2011		2014		2015	
DISTRICT	Catch	Value	Catch	Value	Catch	Value	Catch	Value	Catch	Value	Catch	Value	Catch	Value
Bugiri	27.4	34.7	30.0	32.4	25.2	38.4	20.3	44.3	22.9	54.3	0.9	1.9	0.4	1.6
Buikwe	-	-	-	-	-	-	-	-	-	-	14.3	31.0	12.9	26.5
Busia	0.8	1.0	0.6	0.6	0.6	0.8	1.1	2.5	1.3	3.0	1.9	4.1	1.0	3.6
Buvuma	-	-	-	-	-	-	-	-	-	-	53.8	116.6	14.4	47.5
Jinja	1.0	1.5	0.9	1.2	0.9	1.7	2.1	4.6	2.4	5.6	3.1	6.7	0.6	2.7
Kalangala	54.5	44.2	54.6	37.9	40.7	44.1	25.3	55.3	28.6	67.8	44.5	96.5	7.9	30.6
Kalungu	-	-	-	-	-	-	-	-	-	-	1.7	3.8	1.0	5.2
Kampala	0.9	1.4	0.9	1.2	0.7	1.4	1.3	2.8	1.5	3.5	1.4	3.1	1.0	4.6
Masaka	9.9	7.9	11.1	7.3	9.4	9.8	10.4	22.7	11.7	27.8	10.6	23.0	1.0	4.9
Mayuge	17.7	19.8	18.9	17.4	14.6	20.0	18.2	39.7	20.5	48.7	26.1	56.5	51.1	80.3
Mpigi	3.9	5.4	3.8	4.7	3.6	6.0	5.8	12.8	6.6	15.6	7.1	15.4	3.1	9.8
Mukono	82.6	85.0	88.7	73.5	63.5	86.1	59.1	129.0	66.7	158.2	36.9	80.0	32.9	130.5
Namayingo	-	-	-	-	-	-	-	-	-	-	38.2	82.8	11.7	29.5
Rakai	2.9	4.8	2.8	4.2	2.6	5.3	3.9	8.5	4.4	10.4	5.4	11.7	3.1	14.9
Wakiso	14.3	16.0	15.1	14.1	11.3	16.8	14.8	32.3	16.7	39.5	23.5	50.9	7.4	23.7
AAA	-	-	-	-	-	-	4.3	0.1	0.5	0.3	-	-	-	-
Grand total	215.9	221.8	227.5	194.4	173.0	230.6	162.9	354.6	183.8	434.8	269.5	584.0	149.4	415.9

For the last three decades, the commercial catch on the Uganda side of Lake Victoria has been dominated by three species; Mukene, Nile perch and Tilapia spp (Figure 1). Nile perch dominated the commercial catches between the early 1980s and late 1990s, when Mukene started to dominate up to date.

Figure 1: Trends of estimated annual fish catches (tones) by species in the Ugandan portion of Lake Victoria for the years 1961 to 2015.



Relationship between fishing effort (Number of boats), catch and economic value of catch
While fishing effort has been increasing since 2000, the corresponding annual yields have fluctuated between 100 and 200 thousand tonnes (Figure 2). On the other hand, the value from catch more than doubled from 240 billion in 2005 to 584 billion shillings in 2014. However, there was a 28.8% decline in the value of catch in 2015 corresponding to a decline in total catch (Table 4).

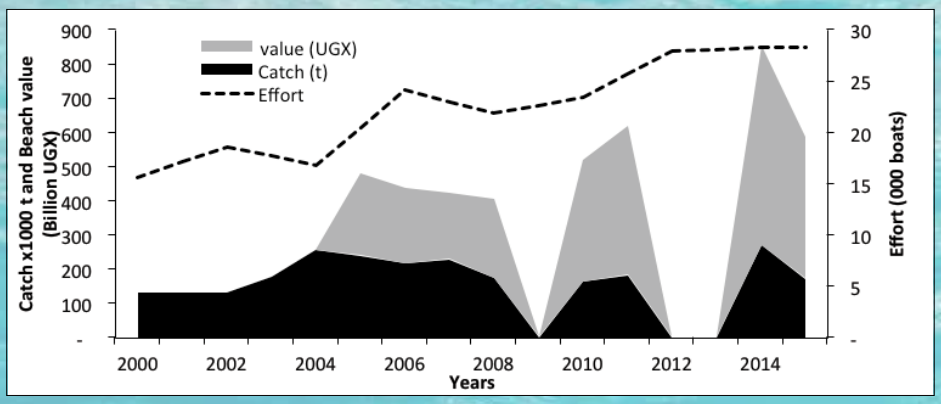
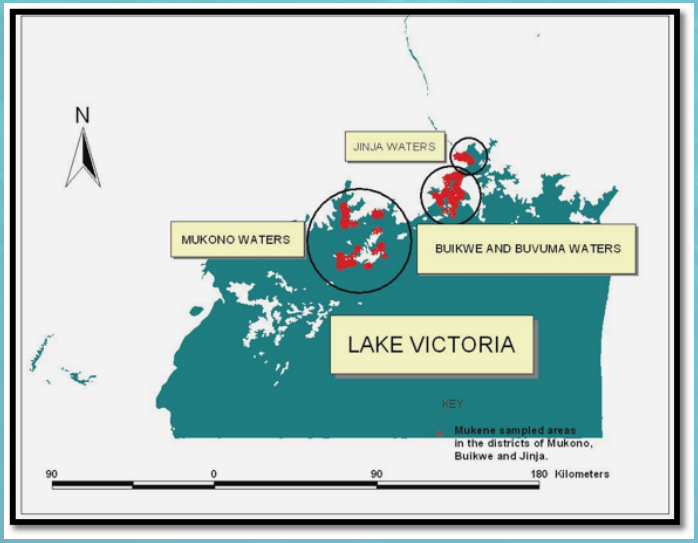


Figure 2. Trends of estimated annual fish catches (tones), value (Billion Uganda shillings) and Effort (boats) in the Ugandan portion of Lake Victoria for the years 2000 to 2015.

Figure 3. Distribution of Mukene fishing grounds in the three districts Jinja, Buikwe and Mukono on Lake Victoria, Uganda.



Conclusion

- Based on the December 2015 CASs, the commercial fishery on the Uganda part of Lake Victoria is currently dominated by three species Mukene (65268.6 MT, 43%), Nile perch (377,219.3 MT, 25%) and Tilapia (13,278.2 MT, 9%).
- The contribution of the high value large size species (Nile perch and Tilapia) to the commercial catch of Lake Victoria has significantly reduced while that of the low value small size species, Mukene has increased over a ten year (2005-2015) period.



Nile perch (Lates niloticus)

- The economic value of Mukene is still very low compared to the Nile perch and Tilapia.
- Mukene fishing on Lake Victoria is majorly conducted in the shallow inshore waters (< 200 meters), cropping high proportions of juvenile Mukene and by-catch of the large species
- The proportion of under size gillnets (< 5 inches) on the lake significantly reduced from 18.3 to 7.2 between 2000 and 2014. The number of key indicators of fishing effort (gears, boats, and crew) and that of illegal gears (beach/boat seines, monofilament gillnets, and cast nets) on the other hand increased to levels considered unsustainable for the Lake fisheries.
- Monofilament gillnets, cast nets and basket traps are the major threats to the tilapia fishery since they are operated in shallow inshore and sheltered waters known to be breeding and nursery grounds for Tilapia and many other species. The beach and boat seines on the other hand mainly threaten the Nile perch fishery.
- Catch Assessment Surveys have been plagued by inconsistencies due to financial logistical constraint and this affects the quality of management advice.

Recommendations.

- Management efforts on Lake Victoria should be directed towards regulating fishing effort to optimum levels suggested by scientific models and elimination of illegal fishing practices.
- Regular scientific fish stock monitoring surveys (e.g. CASs) are required to guide management and development planning for the Lake Victoria fisheries resources.
- Value addition to harness economic benefits of Mukene is highly recommended. Mukene fishing should also be restricted to the deep open (> 400 meters) waters where fisheries studies have recorded high abundances of mature Mukene.
- Suitable fishery stock assessment models are needed facilitate the determination of optimum effort and sustainable harvest levels for the commercial fish species.



Mukene/Daaga (Rastrineobola argentea)



Nile tilapia (Oreochromis niloticus)