NATIONAL FISHERIES RESOURCES RESEARCH INSTITUTE (NaFIRRI) AND DEPARTMENT OF FISHERIES RESOURCES (DFR)

THEME 3:
ENHANCING INTEGRATED MANAGEMENT OF NATURAL RESOURCES

PROJECT:
DETERMINATION OF APPROPRIATE TECHNOLOGIES AND METHODS FOR HARVESTING AND CONSERVATION OF FISH SPECIES AND STOCKS IN LAKE ALBERT/ALBERT NILE AND KYOGA BASIN LAKES

ARTP II (Extension)

REPORT OF FRAME SURVEY OF THE KYOGA BASIN LAKES 2008

THEME 3: Enhancing Integrated Management of Natural Resources

PROJECT: Determination of appropriate technologies and methods for harvesting and conservation of fish species and stocks in Lakes Albert/Albert Nile and Kyoga Basin Lakes

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PROJECT LEADER: Dismas Mbabazi
Senior Research Officer, NaFIRRI.

Background

The project objective is to generate, package, and disseminate information/technologies/methods and policy advice for increasing and sustaining fisheries resources and development of options for optimizing socio-economic benefits from the aquatic systems. The activities were conducted on Lakes Albert Kyoga, Kwania, Bisina, Nakuwa and a few other selected Kyoga minor lakes. The scope of the project was intended to cover the Albert Nile and the several Kyoga Minor lakes, however due to limited funds; work was not extended to Albert Nile and many other Kyoga basin lakes. The separate final report was prepared for Lake Albert and forwarded to Department of Fisheries Resources.

There were three studies/experiments/activities in the project namely:

1. The Biology and Ecology of fish stocks (composition, distribution, abundance population structure, food and reproduction).
2. Fish catch assessment (catch rates) and estimation of annual commercial catch
3. The Participatory Lake Kyoga Basin Frame survey study

STUDY TITLE: Frame survey of the Kyoga basin lakes 2008

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STUDY LEADER: Levi I. Muhoozi
Senior Research Officer, NaFIRRI.

INTRODUCTION:

A comprehensive Frame survey was carried out on lakes Kwania, Bisina, Nakuwa, Kyoga and other minor lakes in the Lake Kyoga Basin in June 2008 (Figure 1). The Frame survey was coordinated by the Department of Fisheries Resources (DFR) in collaboration with the National Fisheries Resources Research Institute (NaFIRRI) in terms of technical support. The riparian districts through the sub-county fisheries offices and the BMUs provided the enumerators and supervisors. The frame survey captured all the important characteristics of the fisheries and facilities supporting the fisheries and thus provides a strong baseline for future reference of management interventions in the basin.

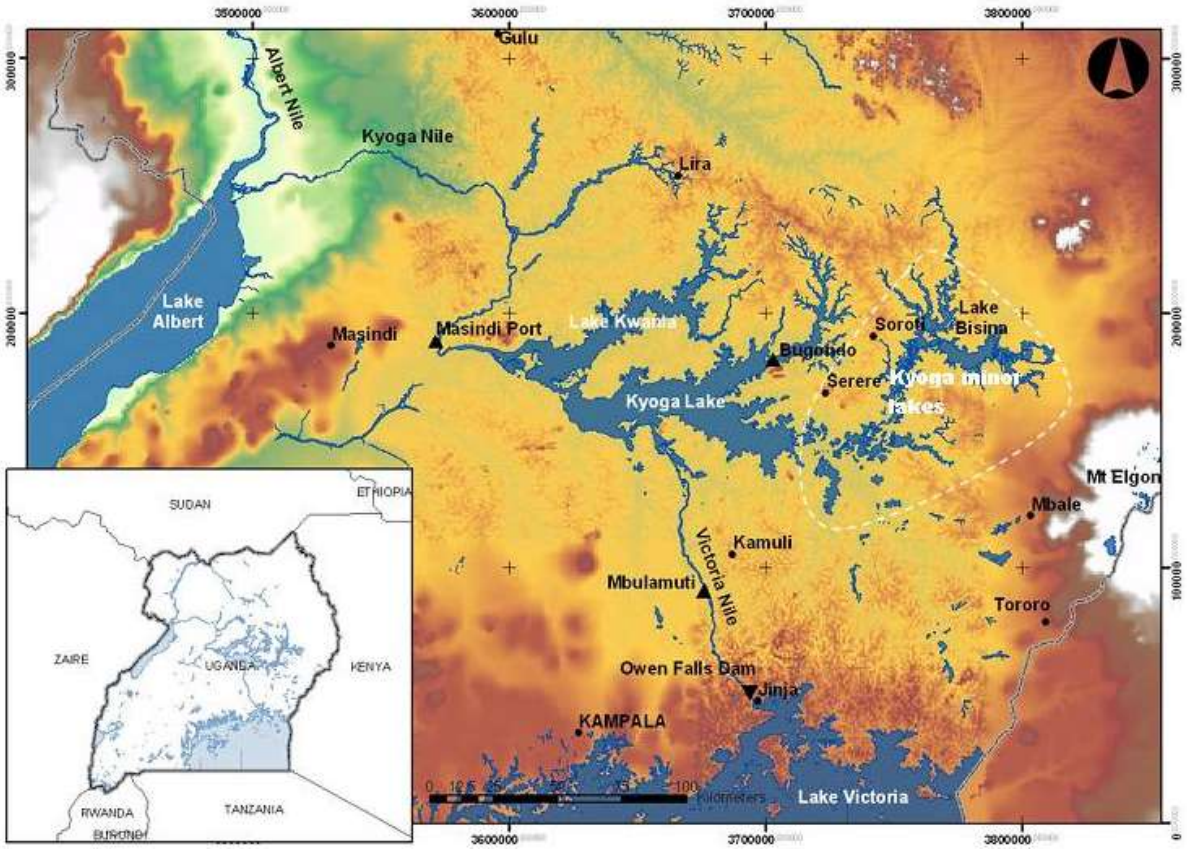


Figure 1. The location of the Kyoga basin lakes

There was inadequate financial provision for handling and analysis of the large data sets immediately after the Frame survey. Like in the previous Frame survey of 2002, in view of the importance of the information in these data, NaFIRRI sought to intervene through ARTP II (Extension) funding and have the data input and analysed. Thus through ARTP II funding the raw data files were obtained from DFR, input and analysed. This report is one of the final stages of this process.

The data sets captured did not indicate specific landing sites but instead were lamped together as BMUs in some lakes. This was a major drawback during data analysis because the landing site is the sampling unit in our sampling design. To overcome this constraint, secondary data specifically on mapping of landing sites were collected from all the sampled lakes. This helped to distinguish clearly between landing sites and BMUs located on the different lakes.

Below are details of the generic objectives pursued in undertaking the Frame surveys which were also pursued by the survey under report, the methodology and procedures followed in the survey and the results from the analysis undertaken by NaFIRRI.

Objectives of the Frame Surveys

The overall objective of the Frame Surveys was to provide information on the facilities and services at landing sites and the composition, magnitude and distribution of fishing effort to guide development and management of the fisheries resources of the Kyoga basin lakes.

The specific objectives were to provide information on:

a) The number of fish landing sites;
b) The facilities available at the fish landing sites to service the sector including accessibility;
c) The service providers especially fisheries staff at fish landing sites
d) The number of fishers;
e) The number and types of fishing crafts and their mode of propulsion;
f) The number, types and sizes of fishing gears used on the lakes and their mode of operation.

Expected Outputs

The outputs expected from the frame surveys were as follows:

a) Information on the number of fish landing sites on the basin lakes;
b) Information on the facilities available at the fish landing sites to service the fisheries sector ;
c) Information on the number of fishers;
d) Information on the number and types of fishing crafts;
e) Information on the modes of propulsion of the fishing crafts;
f) Information on the number types and sizes of fishing gears including the number of illegal fishing gears in the fishery; and
g) Recommendations on development and management of the fisheries of the Kyoga basin lakes.

METHODOLOGY

Preparation and Conducting of the Frame Survey

The Frame survey covered Lakes Kyoga, Kwania, Bisina, Nakuwa and a few other selected Kyoga minor lakes. It involved a complete enumeration (count) of all landing sites and the facilities available, fishers, fishing crafts and fishing gears by type and size. The Frame survey was conducted with financial and technical support from Uganda Government through the Department of Fisheries Resources (DFR) and World Bank (ARTP II) through the National Fisheries Resources Research Institute (NaFIRRI), National Agricultural Research Organisation. The riparian districts through the sub-county fisheries offices and the BMUs provided the enumerators and supervisors.

Before conducting the survey, supervisors and enumerators were identified among the key stakeholders including BMUs. Training sessions were conducted for the field supervisors and enumerators in the various districts using standard field guides.

Staff from DFR and NaFIRRI coordinated the exercise at regional level (more than one districts) while the DFOs were senior supervisors at the district level and sub county FOs were supervisors located at the lower administrative units. Each supervisor was in charge of several enumerators at the BMU level

Data Capture

The Enumerators collected the data by filling the Frame Survey Recording Form (Annex 1) that included Details of the Operational Fishing Crafts and Gears.
The information recorded on the landing site facilities included availability of a fish shade (banda), cold rooms, pontoon or jetty, fish store, electricity supply, accessibility by roads, toilets, potable water, facilities for repair of boats and nets, presence of resident fisheries staff and availability of nearby fish market.

The information recorded on crafts included both fishing and non fishing crafts. The craft categories includes: operational fishing crafts that were actively fishing; derelict crafts (that were damaged and not operational) and transport crafts that were used to transport fish and other purposes. The craft types were classified in four categories namely: Sesse; Parachute, Dugout, and Others, where other referred to any craft that was not covered by the first three categories. The length of individual crafts was recorded in metres. The method of propulsion of the craft, i.e. outboard motor, Paddles and sails, and the number of crew of each craft were also recorded.

The type and size of fishing gear, which included Gillnets, Small seines used for Mukene, Long line hooks, Boat/beach seines, Cast nets, Monofilament nets, Traps and Others (not classified in the above categories) were recorded. The main fish species targeted by the fishing craft and gear were also recorded.

3. DATA ENTRY, STORAGE AND ANALYSIS

The field data forms were collected by the supervisors who compiled returns to the regional coordinators. The raw data forms were later submitted to the Department of Fisheries Resources (DFR) for analysis. Due to difficulties in securing funding to support data input, analysis and reporting, DFR was unable to finalise the process. In November 2008 NaFIRRI, through NARO-ARTPII (extension) funding, initiated the above process and worked closely with DFR in carrying out the above activity to conclusion. The initial process identified some draw backs in the data and was followed by targeted surveys to address them.

5. RESULTS

The findings of the Frame Survey of the Kyoga basin lakes June 2008 are summarized in Table 1.

5.1. Landing Sites

A total of 354 landing sites were recorded in all the Kyoga basin lakes sampled, out of which 36 were on Bisina, 20 were on Nakuwa, 77 were on Lake Kwania, 168 on Lake Kyoga and 53 on the other minor lakes in the basin.

5.2. Facilities Available at the Fish Landings on the Lake

The facilities examined included landing shades (*bandas)*, cold rooms, pontoons/ jetties, fish stores, potable water, toilet facilities, boat and net repair facilities, access to the fish landing site by all-weather roads and electricity supply. The facilities at the landing sites were quite inadequate.

On Lake Kyoga main, only 25 (15%) of the landing sites had fish shade (bandas), and 2 (<1%) had Jetties or pontoons. No landing site on Kyoga main had a cold room, electricity supply and had only 2 (<1%) permanent fish stores. 42 (9%) landing sites had public toilets, 24 (14%) had portable (safe) water; 37 (22%) were accessible by all weather roads; and 15 (9%) had resident fisheries staff. 92 (55%) landing sites were privately tendered with respect to tax collection. A total of 5 (9%) landing sites on Kyoga were temporary, i.e. operating for less than 5 months in a year. Details of the landing site facilities are given in Table 1.

On Lake Kwania, none of the landing sites had a cold room, jetty, pontoon, permanent fish store and a facility designated for net repair. However 2 (2%) had electricity; 9 (5%) had public toilets; 17 (22%) were accessible by all weather roads; 8 (10%) had portable (safe) water; and 8 (10%) had resident fisheries staff. 39 (50%) lf the landing sites were privately tendered with respect to tax collection. Only 4 (6%) of the landing sites on Lake Kwania were temporary, i.e. operating for less than 5 months in a year. Details of the landing site facilities are given in Table 1.

On both lakes Bisina and Nakuwa, no landing site had cold room, drying racks, permanent fish stores, electricity, portable (safe) water but 3 (8%) on Lake Bisina had jetties and 3 (15%) had public toilet; 1 (5%) landing site had a smoking kiln on Lake Nakuwa. There was no resident fisheries staff for Lake Nakuwa while Bisina had 8 (22%) (Table 2).

Table 1. Summary of the results on lakes Kyoga and Kwania Frame Surveys (June 2008); LS = Landing site; GN= Gill net, SS= Small seines, CN = Cast nets, MF= Monofilament gillnets; BS= Boat seines, TR= Traps; HL = Hand line; LL = Long line.

Water body	Kyoga						Kyoga Total	Kwania			Kwania Total
Name of District	Amolatar	Kaberamaido	Kamuli	Kayunga	Nakasongola	Soroti		Amolatar	Apac	Dokolo	
Number of landing sites	17	16	15	10	20	30	108	20	23	20	63
Number of BMUs	17	14	14	7	18	30	100	20	23	10	53
Landing site on Island		1					1			1	1
Primary school within 2 km	11	9	10	10	17	22	79	13	12	15	40
Health clinic within 2 km	5	3	4	8	15	16	51	6	6	1	13
HIV awareness raising at LS	6	5	8	10	10	6	45	9	6	7	22
HIV/AIDS voluntary counselling and testing	5	2	9	7	10	19	52	9	6	7	22
Provision of ARVs	1	1	2	5	5	15	29	6	5	5	16
Help to orphans and widows	6			2	11	13	32	10	2	6	18
No. of derelict/ irreparable fishing crafts	316	138	141	81	425	233	1,334	181	165	354	700
No. of transport crafts (Fish only)	16	1	89	1	14	15	136	3	34	46	83
No. of transport crafts general purpose	15	11	35	3	16	10	90	18	22	-	40
Cell phone network	14	15	9	10	18	26	92	20	20	16	56
Banda	2	4	1	1	10	7	25	3	2		5
Cold room								-			
Drying racks	2	4	1	1	11	3	22	2	5		7
Smoking kilns	12	11	8	8	16	10	65	10	16	11	37
Fish store	1		1				2				
Jetty					2		2				
Pontoon					2		2				
Electricity at LS										2	2
Electricity <1km						1	1				
Electricity 1-5 km					3	1	4			3	3
Electricity 6-10 km	1				5	2	8	2	3		5
Electricity >10 km	16	16	15	10	12	23	92	16	20	10	46
Public toilet	6	8	3	6	11	8	42	4	4	1	9
Portable water	4		4	5	11		24	2	5	1	8

Water body	Kyoga						Kyoga Total	Kwania			Kwania Total
Name of District	Amolatar	Kaberamaido	Kamuli	Kayunga	Nakasongola	Soroti		Amolatar	Apac	Dokolo	
All weather road	4	8	5	2	7	11	37	6	5	6	17
All-weather road <1 km	1			3	2	3	9	1	2	1	4
All-weather road 1-5 km	8	3	3	1	2	11	28	4	3	12	19
All-weather road 6-10 km	1	2	3	1	3	2	12	5	4		9
All-weather road >10 km	4	3	4	1	9	2	23	4	10		14
Net repair facility	8	1	2			6	17	8	9		17
A shop selling fishing gears	5	4	1	2	4	9	25	4	7		11
Boat repair facility	10	6	2	1	4	6	29	13	15	1	29
Engine repair facility			1	1	2		4	3	5		8
Fisheries Staff resident	4			1	8	2	15	4	3	1	8
BMU office	6	6	4	1	15	2	34	7	8		15
LS fenced					1		1				
Land at LS privately owned	4	4	7	7	3	7	32	5	1	5	11
Fish factory agents at LS	7	3	12	5	6	14	47	5	8		13
Tax collection tendered	17	12	15	10	18	20	92	13	19	7	39
Fish movement permits issued at LS	13	10	7	10	18	13	71	6	9		15
Fish landed at LS for <5 months a year	1		1		1	2	5	1	3		4
Fish landed at LS >5 months a year	8	2	2		4		16	6	4		10
Fish landed at LS all year round	36	45	39	30	51	84	285	48	54	60	162
No. of Craft by type											
Sesse flat at one end	520	517	351	76	188	567	2,219	322	482	235	1039
Sesse pointed at both ends	4	1			4	1	10	1	3		4
Parachute	564	270	974	351	1,108	893	4,160	241	472	74	787
Dugout	12	74	31	2	1	107	227	13	11	45	69
Raft			5	1	1	2	9	5	4		9
Total Number of crafts	1,100	862	1,361	430	1,302	1,570	6,625	582	972	354	1,908
No. crafts by propulsion method											
Outboard	1			10	19	3	33		14		14
Paddles	1,099	862	1,356	418	1,264	1,546	6,545	577	934	354	1,865
Foot fishers					3		3				

Water body	Kyoga						Kyoga Total	Kwania			Kwania Total
Name of District	Amolatar	Kaberamaido	Kamuli	Kayunga	Nakasongola	Soroti		Amolatar	Apac	Dokolo	
Grand Total	1,100	862	1,356	428	1,286	1,549	6,581	577	948	354	1,879
No. of gillnets by mesh size											
GN < 2½"	81	148	12	213	394	581	1,429	19	625		644
GN 2½"	1,340	2,494	646	3	210	767	5,460	629	584	123	1,336
GN 3"	698	683	486	88	360	1,193	3,508	68	502	311	881
GN 3½"	1,216	774	992	81	568	2,168	5,798	223	860	363	1,446
GN 4"	6,318	840	5,474	1,062	3,465	4,854	22,013	756	1,011	530	2,297
GN 4½"	2,870	1,754	5,153	1,067	2,982	2,768	16,594	432	1,018	36	1,486
GN 5"	2,677	9,908	2,891	72	1,434	6,163	23,145	777	1,335		2,112
GN 5½"	576	2,028	355	58	394	4,232	7,643	32	411		443
GN 6"	1,412	1,500	1,180	45	300	1,212	5,649	523	728	10	1,261
GN 6½"	159	385	25	45	31	119	764	37	157		194
GN 7"	809	180	517	47	84	815	2,452	547	183	18	748
GN 7½"	20	117	55	25	49	448	714	118	83		201
GN 8"	198	339	53	14	22	335	961	210	65		275
GN 9"	32	15	26		47	47	167	77	64		141
GN 10"	430	340	152		200	291	1,413	75	97		172
GN> 10	40	14					54	30			30
Total number of gillnets	**18,876**	**21,519**	**18,017**	**2,820**	**10,540**	**25,993**	**97,764**	**4,553**	**7,723**	**1,391**	**13,667**
Crafts using each main gear type											
BS	114	49	172	30	61	187	613	94	221	70	385
CN	12	9	54	2	71	43	191	3	41	9	53
GN	576	571	628	160	706	832	3,473	194	409	90	693
HL	5	20	31			44	100	19	7	4	30
LL	79	114	54	41	114	152	554	60	82	70	212
MF	165	39	315	82	234	168	1,003	170	105	100	375
SS	114	17	75	33	2	103	344	18	30	8	56
TR	15	43	31	76	57	28	250	6	64	3	73

Table 2. Summary of results of the Frame survey on Kyoga minor lakes (June 2008) LS = Landing site GN= Gill net, SS= Small seines, CN = Cast nets, MF= Monofilament gillnets; BS= Boat seines, TR= Traps; HL = Hand line; LL = Long line.

Water body	Bisina		Gawa	Gigati	Kawi	Komunuo	Lemwa	Meito	Nakuwa			Nyaguo		Nyasala	Opeta		R.Nile	Grand Total
Name of District	Katakwi	Kumi	Kumi	Paliisa	Paliisa	Paliisa	Paliisa	Paliisa	Kaliro	Kamuli	Paliisa	Kumi	Paliisa	Paliisa	Katakwi	Kumi	Kamuli	
Number of landing sites	5	13	2	2	5	2	3	1	11	1	1	4	3	1	2	4	1	61
Number of BMUs	5	9	1	1	4	2	1	1	11	1	1	1	3	1	1	3	1	47
Landing site on island		1		1												4		6
Primary school within 2 km	4	10	2	1	3	2	3	1	10		1	3	3		2		1	46
Health clinic within 2 km	3	4	1	1	3		3	1	3				2					21
HIV awareness raising at LS	3	2			1				5						1			12
HIV/AIDS voluntary counselling and testing	1	6	1		1				4									13
Provision of ARVs	1	4			1								1					7
Help to orphans and widows	1				1													2
No. of derelict/ irreparable fishing crafts	21	42	6	-	7	-	-	-	70	13	10	4	9	-	25	11		218
No. of transport crafts (Fish only)		-	-	-	-	-	-	-	-	-	-	-	-	-		-		-
No. of transport crafts general purpose	23	8	2	1	-	-	-	1	1	-	-	-	18	-	6	-		60
Cell phone network	3	9		1	5	2	3	1	11	1	1		3	1		3		44
Banda		1																1
Cold room																		-
Drying racks																		-
Smoking kilns									1							1		2
Fish store																		-
Jetty		3																3
Pontoon																		-
Electricity at LS							1											1
Electricity <1km								1										1
Electricity 1-5 km		5	2		3		1				1							12
Electricity 6-10 km		4		1		1						4	1					11
Electricity >10 km	5	4			1	1			10	1			2	1	2	4	1	32
Public toilet									2		1							3

Water body	Bisina		Gawa	Gigati	Kawi	Komunuo	Lemwa	Meito	Nakuwa			Nyaguo		Nyasala	Opeta		R.Nile	Grand Total
Name of District	Katakwi	Kumi	Kumi	Paliisa	Paliisa	Paliisa	Paliisa	Paliisa	Kaliro	Kamuli	Paliisa	Kumi	Paliisa	Paliisa	Katakwi	Kumi	Kamuli	
Portable water							1					2						3
All weather road	2	8							4		1	1	1					17
All-weather road <1 km	1			1								1	1					4
All-weather road 1-5 km		3	1		5	2	3		5	1		2	1					23
All-weather road 6-10 km	1	1		1										1		1	1	6
All-weather road >10 km	1	1						1	1							3		7
Net repair facility										1								1
A shop selling fishing gears									1	1								2
Boat repair facility									2	1		1						4
Engine repair facility																		-
Fisheries Staff resident	1	7																8
BMU office	1												2					3
LS fenced																		-
Land at LS privately owned		3			4	1	2		2				2			1	1	16
Fish factory agents at LS																		-
Tax collection tendered				2	1	1		1	11	1							1	18
Fish movement permits issued at LS				1					11		1					1		14
Fish landed at LS for <5 months a year			1		3	1				1		4	1					11
Fish landed at LS >5 months a year		4	2		2											2		10
Fish landed at LS all year round	15	33		6	3	3	9	3	33		3		6	3	6	9	3	135
No. of Craft by type																		-
Sesse flat at one end	1															1		2
Sesse pointed at both ends	43	2																45
Parachute	14	254	46	14	75	18	22	14	676	68	141	37	62	28	2	122	137	1,730
Dugout	115	163	57	24	18	13	38	12	3	20		9	11	20	62	70	52	687
Raft															1			1
Total Number of crafts	173	419	103	38	93	31	60	26	679	88	141	46	73	48	65	193	189	2,465
No. crafts by propulsion method																		-
Outboard																		-
Paddles	173	419	102	38	93	31	60	26	679	88	141	46	73	48	64	193	189	2,463

Water body	Bisina		Gawa	Gigati	Kawi	Komunuo	Lemwa	Meito	Nakuwa			Nyaguo		Nyasala	Opeta		R.Nile	Grand Total
Name of District	Katakwi	Kumi	Kumi	Paliisa	Paliisa	Paliisa	Paliisa	Paliisa	Kaliro	Kamuli	Paliisa	Kumi	Paliisa	Paliisa	Katakwi	Kumi	Kamuli	
Foot fishers																		-
Grand Total	173	419	102	38	93	31	60	26	679	88	141	46	73	48	64	193	189	2,463
No. of gillnets by mesh size																		-
GN < 2½"	120	661	222	50	117	4	48	20	-	49		592	60	25		1,009		2,977
GN 2½"	939	2,865	145	168	374	18	271	231	1,208	74			451	78	106	3,393	283	10,604
GN 3"	1,894	2,374	102	169	230	118	69	110	3,115	27			3	412	286	3,254	217	12,843
GN 3½"	387	879		60	369	150		122	5,439	121	453	10		133	85	1,140	15	9,309
GN 4"	80	226		160	198	66	36	197	744	133	409			20		560	48	3,611
GN 4½"	73	444		220	86	71		94	13	64	1,080	63				60	25	1,496
GN 5"		22	100	60	74			10	11		346						70	347
GN 5½"									170	10					28			208
GN 6"									225	13								238
GN 6½"																		-
GN 7"										2								2
GN 7½"																		-
GN 8"																		-
GN 9"																		-
GN 10"									280									280
GN> 10																		-
Total number of gillnets	**3,493**	**7,471**	**569**	**887**	**1,448**	**427**	**424**	**784**	**11,205**	**493**	**2,288**	**665**	**514**	**668**	**505**	**9,416**	**658**	41,915
																		-
Crafts using each main gear type																		-
BS									5			1						6
CN					5		1		21	22		3						52
GN	108	192	22	17	58	16	49	15	578	17	120	23	49	28	22	116	118	1,548
HL		32	22		2				8									64
LL	65	189	53	21	22	15	8	11	49	18	21	12	24	20	43	77	70	718
MF									3									3

Water body	Bisina		Gawa	Gigati	Kawi	Komunuo	Lemwa	Meito	Nakuwa			Nyaguo		Nyasala	Opeta		R.Nile	Grand Total
Name of District	Katakwi	Kumi	Kumi	Paliisa	Paliisa	Paliisa	Paliisa	Paliisa	Kaliro	Kamuli	Paliisa	Kumi	Paliisa	Paliisa	Katakwi	Kumi	Kamuli	
SS												3						3
TR		6	6		6		2		15	31		2					1	69
Grand Total	**173**	**419**	**103**	**38**	**93**	**31**	**60**	**26**	**679**	**88**	**141**	**44**	**73**	**48**	**65**	**193**	**189**	2,463
Hook numbers by size																		-
<4	2,188	272	270	920				1,000	314	8	180					750		5,902
7-4	2,525	14,993	714	2,671	308	1,515	290	1,300	617	234	4,840	30	671	1,685	953	11,840	5,290	50,476
10-8	10,066	19,817	2,810	1,830	551	295	420	300	1,470	838	707		1,495	230	13,447	10,320	2,640	67,236
>10		24,629	8,435	1,330	2,137	1,003		200	100	20	1,755		1,344	4,210		8,070	340	53,573
	14,779	59711	12,229	6,751	2,996	2,813	710	2,800	2,501	1,100	5,020	2,492	3,510	6,125	14,400	30980	8,270	177,187

5.3. Fishing crafts and Fishers

The total number of fishing crafts operating on the Kyoga basin lakes was 11,765 distributed as follows: Lake Kyoga main, 6625 (56%); Lake Kwania, 1908 (16%), Bisina, 592 (5%), Nakuwa, 767 (7%) and other Kyoga minor lakes 1873 (16%) (Figure 2a).

The total number of fishers operating on the Kyoga basin lakes was 20,640, distributed as follows: Lake Kyoga, 12774 (62%); Lake Kwania 3919 (19%), Bisina 846 (4%), Nakuwa 1885 (9%) and other Kyoga minor lakes 1216 (6%) (Figure 2b).

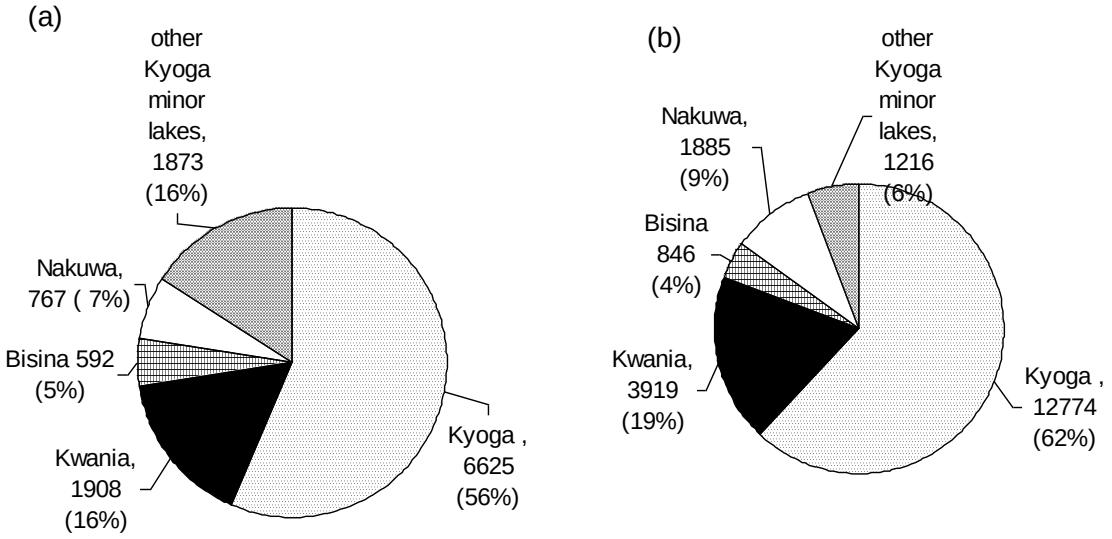


Figure 2. The distribution of (a) fishing crafts and (b) fishers (number; % proportion) in the Kyoga basin lakes in June 2008.

The fishing crafts in most of the sampled lakes were dominated by parachute boats which ranged from 44% in Lake Bisina to 97 % in Lake Nakuwa while the fishing crafts were dominated by Sesse flat at one end in Lake Kwania and constituted 87%. The dugout boats contributed only 2-6 % of fishing crafts in lakes Kwania, Kyoga and Nakuwa but 48% and 40% in lakes Bisina and other minor lakes respectively. No Sesse boats were reported in Lake Nakuwa and the other Kyoga Minor lakes. Out of the 973 fishing crafts operating on other minor lakes, 587 (60%) were Parachute boats and 386 (40%) were dugout boats.

The distribution of fishing craft types is influenced by the stability requirements, manoeuvrability and the capacity to carry the right quantities of fishing gears for the fishing operations in the different waters bodies. The Sesse boats are the most stable and can be constructed to the size required for particular fishing operations. This explains the large proportion of these boats in lakes Kyoga, Kwania, and Bisina which have large expanses of open waters compared with Lake Nakuwa and other minor lakes. On the other hand, the small unstable Parachute and dugout boats are easy to manoeuvre in the shallow and often vegetated waters, which are a common feature of Lake Nakuwa and other Kyoga minor lakes.

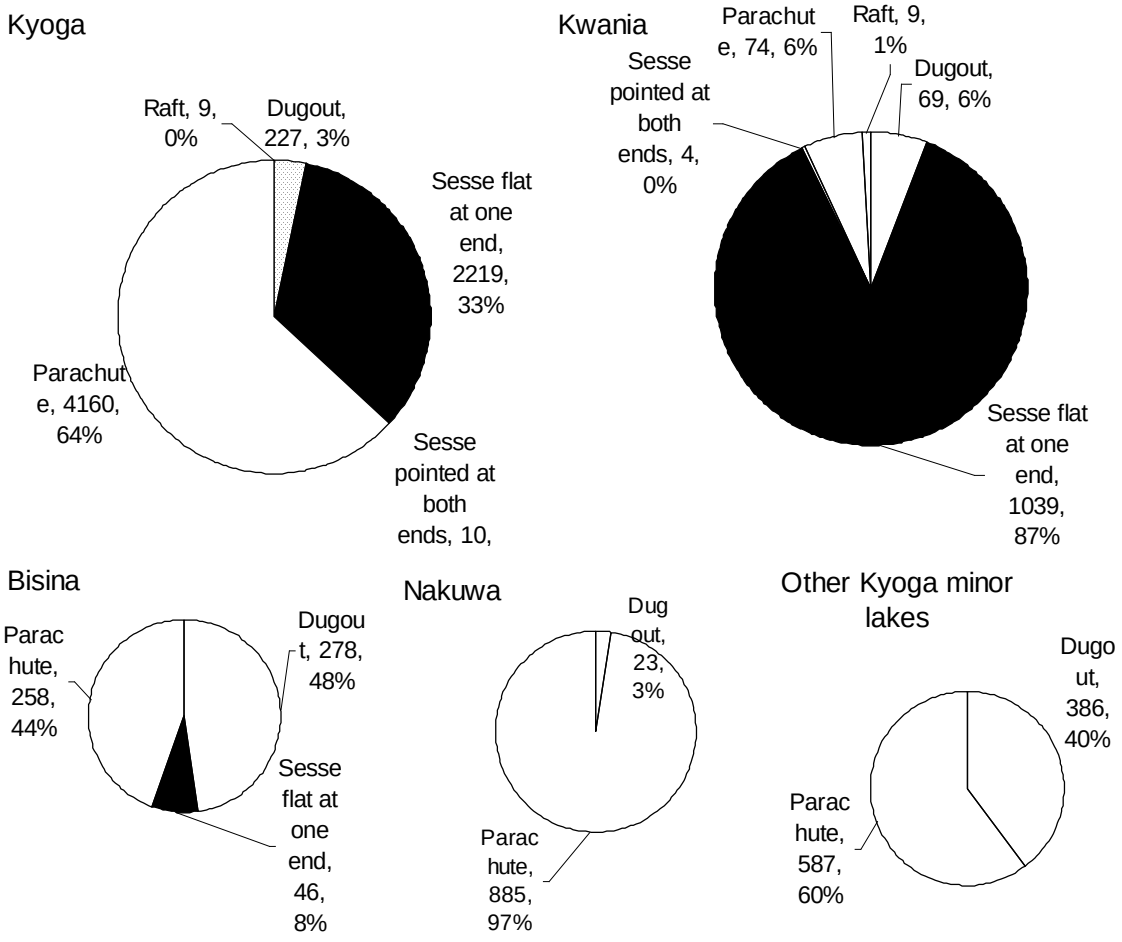


Figure 3. The distribution of fishing crafts by craft type (number; % proportion) in the Kyoga basin lakes June 2008.

In Lake Kyoga, the majority of fishing crafts (23%) were landing in Soroti district and the least (6%) in Kayunga district, while Lake Kwania recorded the majority of fishing crafts in Apac district (50%) and the least in Dokolo (19%). In Lake Bisina, Kumi district had the largest proportion of fishing crafts (71%) and only

(29%) were for Katakwi. Lake Nakuwa had the majority of fishing crafts in Kaliro district (74%) and lest in Kamuli district (10%). Pallisa district had the majority of fishing crafts (48%), followed by Kumi (44%) and the least were recorded in Katakwi district for the other minor lakes (Figure 3).

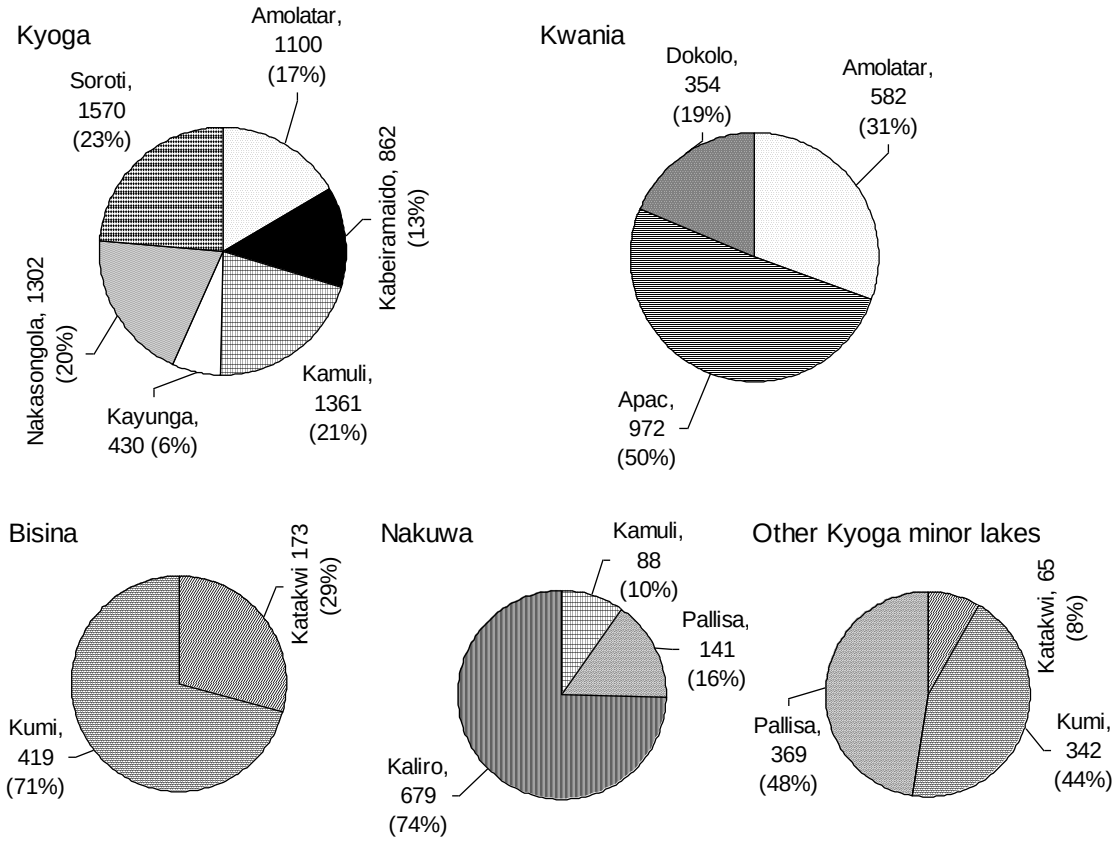


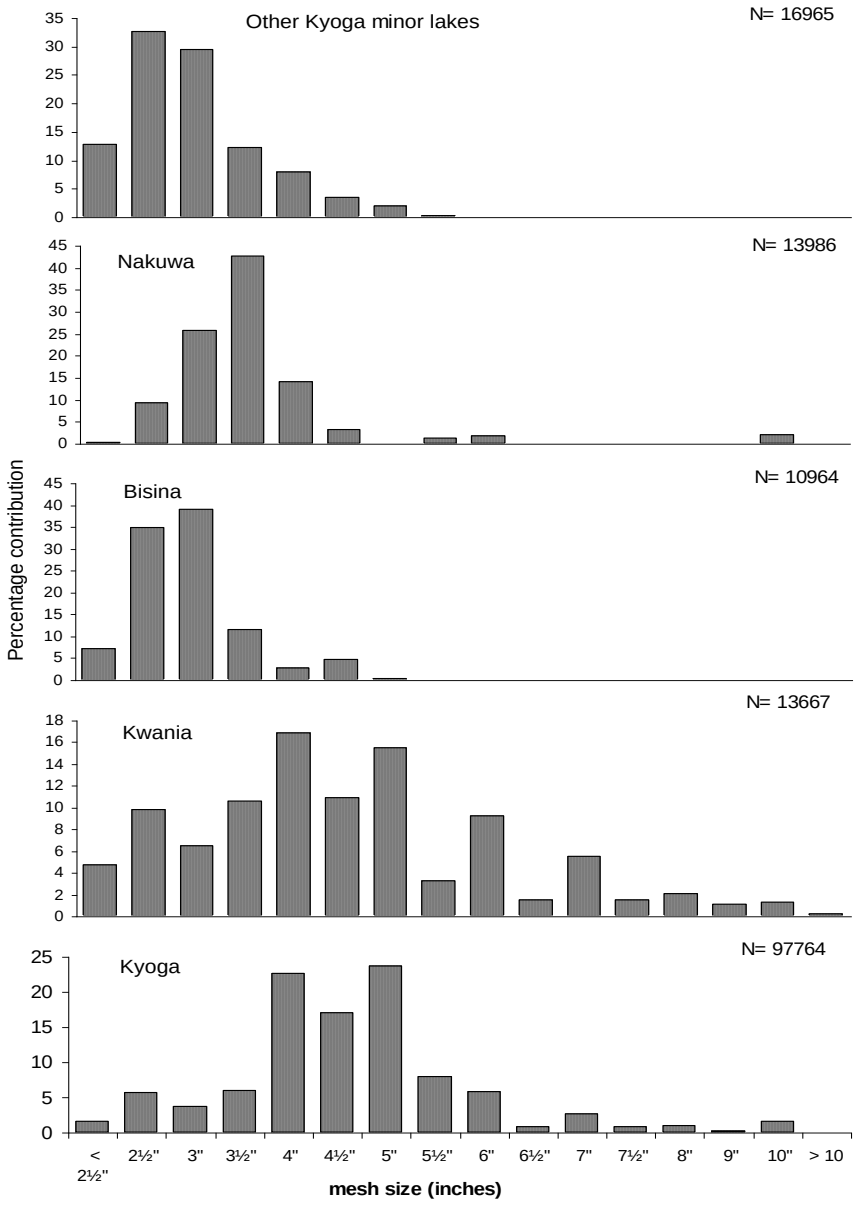
Figure 4. The distribution of fishing crafts (number; % proportion) by district in the Kyoga basin lakes June 2008.

5.5. Fishing Gears

The fishing gears recorded during the Frame survey included gillnets, long line hooks, beach/boat seines, cast nets, hand lines, traps, mosquito nets for mukene, and scoop nets.

5.5.1. Gill nets

A total of 153,346 gillnets were recorded in all the Kyoga basin lakes distributed as follows: 97,764 (64%) in Lake Kyoga, 16,965 (11%) in other Kyoga minor lakes, 13,986 (9%) Lake Nakuwa, 13,667 (9%) Lake Kwania and 10,964 (7%) Bisina. The undersized gillnets (< 5 inch mesh size) predominantly used in lakes Bisina , Nakuwa and other minor lakes compare with lakes Kwania and Kyoga where the recommended mesh sizes are ≥5 inch (Figure 6). However mesh sizes of < 4.5 were in use in lakes Kwania and Kyoga. The targeted study on size structure of the fish stock of the Kyoga minor lakes should be undertaken to determine the appropriate mesh size suitable for harvesting fish stocks in lakes Bisina, Nakuwa and other Kyoga minor lakes.



· **Figure 6.** The distribution of gillnet mesh sizes (proportion by number) in the Kyoga basin lakes June 2008.

5.5.2 Beach seines

The beach/boat seines, which are illegal in all Ugandan water bodies, were quite common in the Kyoga basin lakes. Lake Kyoga, with 613 (62%) recorded the highest number of beach/boat seines and Lake Nakuwa the least 5 (<1%). No beach seines were recorded on Lake Bisina and other minor lakes (Figure 6a). The highest number of beach/boat seines range (172-221) was recorded in Apac, Amolatar, Soroti and Kamuli districts. Katakwi, Kumi and Pallisa hardly used beach/boat seines. There is need for deliberate efforts to remove these illegal gears from the lakes.

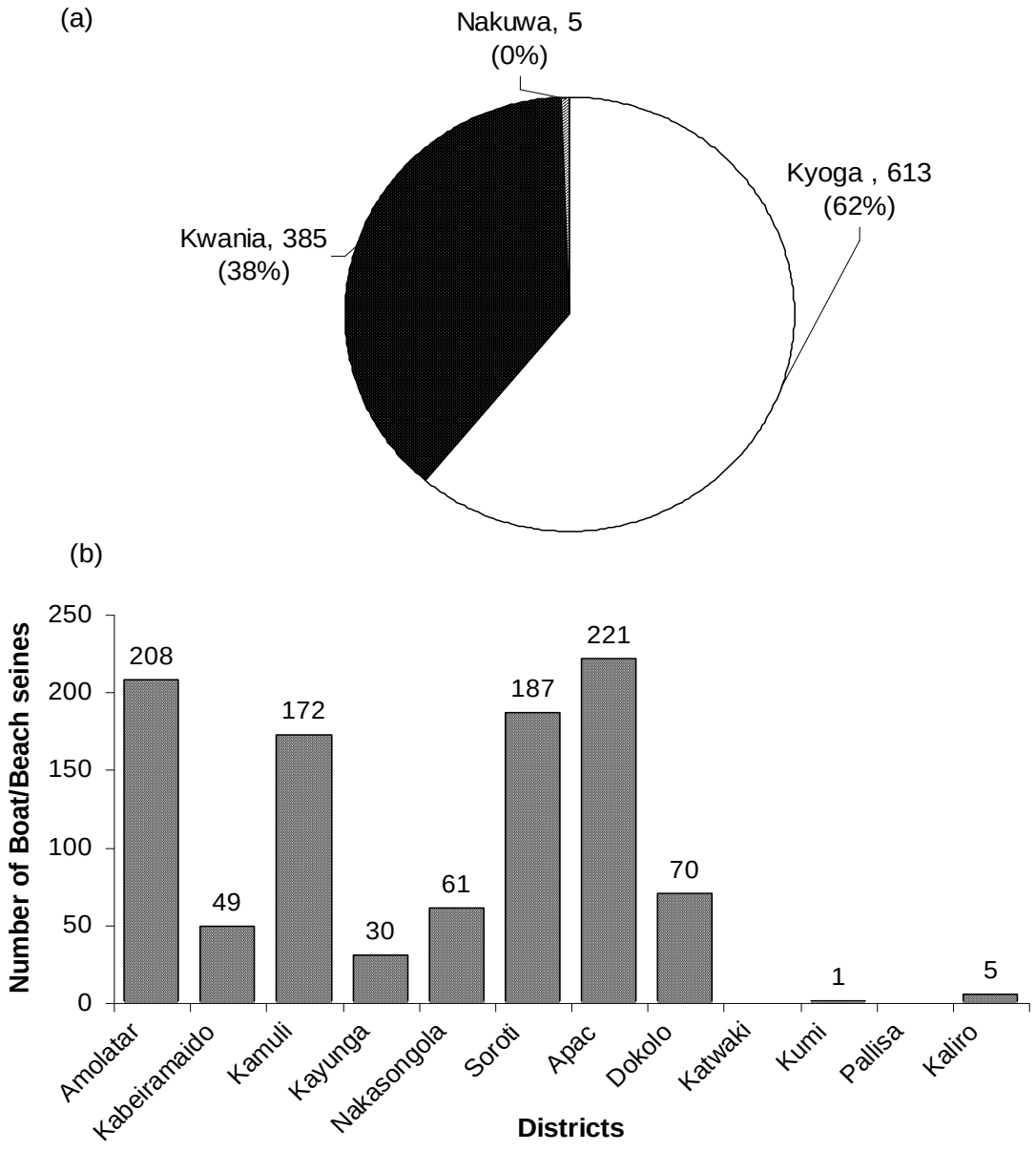


Figure 6. The distribution of beach/boat seines by (a) lake and (b) district in the Kyoga basin lakes (June 2008)

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5.5.3 Hooks

Hooks were quite an important gear in all the lakes but were most common in the minor lakes. Out of 277,345 hooks, 85806 (31%) were in the other minor lakes 81,980 (30%) in Lake Kyoga, 74,490 (27%) in Lake Bisina and the least were recorded in lakes Kwania and Nakuwa, 26,448 (10%) and 8,621 (3%) respectively. In all the sampled lakes hooks targeted either *Protopterus* spp or Nile perch.

5.5.4 Mukene gears

Mukene was fished with mainly Mosquito seines. This fishery was absent in lakes Bisina, Nakuwa and most of other minor lakes except in Lake Nyaguo where 3 (<1%) mosquito nets were encountered. Lake Kyoga recorded the highest number 344 (85%) mosquito seines and Lake Kwania had only 56 (14%) of the mosquito seines. The Mukene fishery was predominantly in Amolatar, Soroti, Kamuli, Kayunga, and Apac districts and more or less absent in Dokolo and Nakasongola districts.

5.5.5 Other gears

As expected in lakes with abundant marginal vegetation including papyrus fringes, high numbers of Traps were recorded. There were 73 fishing crafts using traps in Lake Kwania, 344 in Lake Kyoga, 46 in Lake Nakuwa, 6 in Lake Bisina and 17 for the other minor lakes. Cast nets were spreading in the Kyoga basin lakes as 191 were recorded on Lake Kyoga, 53 on Lake Kwania, 43 in Lake Nakuwa and were not popular in the other minor lakes with only 9.

5.6 Comparison of 2008 Frame survey results with previous surveys

Some patchy records are available from the surveys conducted in lakes Kyoga and Kwania in 1991, 1997 and 2002 (Table 2). The number of landing sites on the two lakes increased from 266 in 1997 to 289 in 2002 but decreased to 245 in 2008. Despite the reduction in number of landing sites, the total number of fishing crafts operating on the two lakes continued to be on the increase with 4,045 in 1991 increasing to 6501 in 1997; decreased slightly to 6,462 in 2002 but has increased to 8,405 in 2008. Overtime, there had been some qualitative changes in the gear usage, e.g. the number of crafts using gillnets had been declining from 2,924 in 1991 to 2,567 in 1997 and 1,647 in 2002 however the number increased to about four fold 4166 in 2008. Conversely, the number of crafts using beach/boat seines increased from 885 in 1997 to 983 in 2002 but remained almost the same in 2008 except that the number decreased for Lake Kwania while it increased for Lake Kyoga (Figure 6a); the crafts using hooks (long line and hand lines) increased from approximately 180 in 1991 and 1997 to 976 in 2002 but reduced slightly to 896 in 2008. The number of crafts using Mukene nets and as well as those operating traps decreased, while cast nets increased from 116 in 2002 to 244 in 2008 (Table 3). This trend of diversifying from the

traditionally gillnet dominated fishery to other fishing gears and methods could be a response of fishers to the decline in returns from the gillnet fishery.

Table 3: Comparison of 1991, 1997, 2002 and 2008 Frame survey data for lakes Kyoga and Kwania

Parameter measured	**1991**	**1997**	**2002**	**2008**
Number of landing sites		266	289	245
Total number of fishing crafts	4,045	6,501	6,462	8,405
Number crafts using gillnets	2,924	2,567	1,647	4,166
Number of crafts using beach/boat seines		885	983	998
Number of crafts using hooks	186	180	976	896
Number of crafts using Mukene nets		109	619	400
Number of crafts using basket traps	118	161	389	323
Number of crafts using cast nets			116	244

6. CONCLUSIONS AND RECOMMENDATIONS

The frame surveys carried out on the Kyoga basin lakes in 2008 went into great depth of the characteristics of the fisheries and facilities supporting the fisheries including looking at the individual minor lake unlike the previous surveys and provides a strong baseline for future reference of management interventions in the basin: the results show that:

a) There is acute shortage of facilities servicing the fisheries sector at the fish landings and deliberate efforts should be made to improve them.

b) There was lack of basic sanitation facilities, especially public toilets and portable (safe) water, at most landing sites in the basin. The local leadership at BMUs, local government and Community Based Organisations levels should strive to provide these amenities.

c) There was a large number of illegal gill net mesh sizes and illegal beach/boat seines on the lakes. Efforts should be made to remove illegal sizes of gill nets and beach/boat seines from the lakes.

d) There were indications that the fishery was shifting from the traditional use of gillnets to a diversity of other fishing gears. The driving forces to these changes and their impacts in the fishery should be evaluated.

7. ACKNOWLEDGEMENTS

Uganda Government through Department of Fisheries Resources (DFR) and World Bank through the National Fisheries Resources Resarch Institute (NaFIRRI), National Agricultural Research Organisation (NARO, ARTP II

(Extension) financially supported this activity. Department of Fisheries Resources assisted by the National Fisheries Resources Research Institute (NaFIRRI) coordinated activities of the survey and the District Fisheries Officers in the riparian districts mobilised the communities through the Beach Management Units (BMUs) and supervised enumeration. The BMUs participated in the exercise.