ON THE PRESENT FISHERY OF LAKE WAMALA

- *J. O. Okaronon*
- *J. Akumu (Ms.)*

INTRODUCTION

A relatively small (180 km) and shallow (4.3 metres maximum depth in 1974) Lake Wamala, in central Uganda, was in 1956 stocked with the tilapiine species mainly *Oreochromis niloticus (Tilapia nilotica), O. leucostictus (T. leucosticta)* and *Tilapia zillii* (Okaronon 1987). The Lake provided a successful and profitable commercial fishing after it was opened to commercial fishing in 1960. During the 1960s and early 1970s the annual landed catches were estimated at 5000 metric tons on average; over 50% of the landed catch was composed of *O. niloticus.* A maximum of 250 canoes were licensed to operate on the lake annually and each canoe was permitted to use a maximum of 10 gillnets of not less than 127mm mesh. Most of the fish was sold fresh to local communities and also to distant markets including Kampala.

Following increasing number of canoes during the late 1960s and increased use of small mesh-sized (illegal) gillnets - and other illegal fishing practices - the annual fish production from the lake declined by about 93% from 7100 tons in 1967 to 500 tons in 1982 (Okaronon, op. cit). The average weight of the landed individual fish of *O. niloticus* - the predominant commercial fish species - also declined by about 57% from 716g in 1969 to 305g by 1976. During the period 1981/86 the area surrounding the lake was subjected to a guerrilla war and period of drought, resulting in a virtual halt of fishing activity and reductionin the size of the lake, respectively. These, too, inevitably led to stunting in the fishery and, consequently, to almost "no commercial fish production.

In 1988, following the end of the guerrilla war, scientific surveys of the lake's fisheries resources were resumed. The surveys aimed at assessing the status of the lake's fishery following the 1981/86 period of no fishing activity and prolonged dry season. The specific objectives included the determination of (a) catch composition, (b) the size structure of the harvestable fish stocks based on length frequency distribution, and (c) an estimate of abundance of exploited fish stocks based on catch per unit of effort. This paper, therefore, presents some of the results of the surveys during the period 1988-1991.

MATERIALS AND METHODS

A total of five trips were made to Lake Wamala to conduct fisheries resources surveys in February 1988, November 1988, November 1990, March 1991 and December 1991. The surveys were originally planned on a quarterly basis to coincide with the four climatic seasons in the area. A fleet of gillnets ranging from 38.1mm (1.5 inch) stretched mesh (increasing by 12.7mm) to 203.2mm (8 inch) and joined end to end were used for sampling. All the gillnets were 26 meshes deep and 90 metres long before hanging except the 38.1mm to 88.9mm (3.5 inch) stretched mesh nets which were 45 metres long. The areas sampled are marked A to G (Fig.1). The nets were set daily around 14.00 hrs, left set over-night and collected every morning around 08.00 hrs. Fish caught were sorted, measured for length, weighed, dissected, and sexed; the gonad condition was determined using Kesteven's classification (Bagenal and Braum 1971).

Records of commercial catches were also made at the landings and few fish samples selected for biometric data. Oral interviews with the fishermen and fisheries staff on Lake Wamala were conducted; past fisheries data for Lake Wamala was analysed.

RESULTS

Catch Composition

The catch from the experimental gillnets consisted of *O. niloticus, O. leucostictus, Clarias mossambicus, Protopterus aethiopicus* and *Tilapia zillii*. *Oreochromis niloticus* contributed 36.8% of the catch (by weight) from the experimental gillnets during the period of the survey under report - ranking second to *P. aethiopicus* (44%) - although it was evidently the most abundantly caught species, considering a total of 1551 individuals caught during the period compared to only 59 "for *P. aethiopicus* and 26 for *C. mossambicus* (Table 1).

In the commercial fishery, the fishermen who used the 76.2mm (3 inch) and 88.9mm mesh gillnets landed mainly *O. niloticus* while those that used the legal 127mm mesh gillnets and hooks on long-lines landed almost exclusively *Protopterus* and *Clarias* species. The use of the 88.9mm mesh gillnets in the commercial fishery was prevalent up to November 1990 (Table 3b, c), thereafter the fishermen seem to have changed to fishing for *Protopterus* and *Clarias* and/or used smaller meshed gillnets to catch smaller sized *O. niloticus*.

The size structure of the harvestable fish stocks

During the period February 1988 to December 1991 and using a fleet of experimental gillnets ranging from 38.1mm to 203.2mm mesh, a unimodal distribution was indicated for *O. niloticus* with 90.5% of the fish falling within 12.5 - 18.4 cm total length

range (15.0 cm modal TL) (Table 2). Using more or less a similar fleet of experimental gillnets a unimodal distribution for *O. niloticus* was also observed during 1975-78 but with 65.9% of the fish falling within 15.5 - 25.4cm total length range (20.0cm modal TL) (Table 2).

O. niloticus landed from the 88.9mm mesh commercial nets averaged 20.7cm total length (148g body weight) (ranging from 13.9-26.1cm TL) in 1988 and 19.7cm total length (141g) (ranging from 17.0 - 30.3cm TL) in 1990; the biggest fish recorded in February 1988 was 23.5cm total length. By 1991 the commercial fishermen fishing for *O. niloticus* had resorted to even much smaller meshed gillnets, down to 50.8mm (2 inch) mesh; during December 1991 *O. niloticus* averaging 16cm total length were being landed from the 76.2mm mesh commercial nets.

Most of the *O. niloticus* landed during 1988 were in very poor condition - almost flat other than round or robust. The condition improved as the rains continued, the number of fish in poor condition declining and disappearing altogether by March 1991.

Relative abundance of exploited fish stocks

Table 3 presents the catch per unit of effort for *O. niloticus* caught in Lake Wamala during the surveys. During experimental fishing, the best catches were recorded from the 63.5mm (2.5 inch) mesh nets throughout the period 1988-91 with the highest catch of 91 fish (7.1 kg) recorded in November 1988; the highest catch of 18 fish (4.5kg) per net per night was during 1975-78 obtained in the 88.9mm mesh experimental nets (Table 3a).

The commercial fishermen, using an average of two nets of 88.9mm mesh per canoe, landed about 20 kg of *O. niloticus* per canoe per night (Table 3b,c); the waters around Gombe fish landing site (Fig.1, F, G) appeared more productive. By November 1990 most commercial fishermen had switched to fishing for *Protopterus* and *Clarias* using hooks on longlines; during 1991 the fishermen landed on average 5 fish (30kg) of *Protopterus* per canoe per day, ranging from 1 fish of 4 kg to 16 fish (*Protopterus*) weighing 160 kg in total.

DISCUSSION

The 1975-78 fisheries resources surveys revealed the following, among other findings: (1) The decline in the landed commercial catches of fish in Lake Wamala by 93% from 7100 tons in 1967 to 500 tons in 1982 was attributed to the increase in fishing effort during the 1960s. An aerial count in October 1965 gave 450 canoes on the lake and up to 1000 canoes were estimated to be operating on Lake Wamala by May 1967 (Uganda Fisheries Department 1967, Okaronon 1987). (2) The catch of O. niloticus in the 127mm mesh legal gillnets dropped from 15 fish (8kg) per net

night in 1966 to an uneconomically low figure of less than 0.8 kg during the period 1975-78. The drop was most probably due to the scarcity of fish (about 20% of total catch) within the retention range (23.0-33.0 cm total length) of the gear (127mm mesh nets). This is thought to have compelled the commercial fishermen to swift to use of smaller meshed gillnets in order to catch previously unexploited and abundant size groups; fish within 17.0 - 24.00 cm total length, heavily retained by the 63.5 - 88.9 mm mesh gillnets, were abundant (about 60% of total catch) during 1975-78. (3) The retention range of 18.0 - 32.0 cm total length (22.5 cm modal length) for the 101.6mm mesh commercial nets compared to 20.0 - 30.0 cm total length (25.0 cm modal length) for 101.6mm mesh experimental nets was due to the practice of beating the water ("Kikubo") by the fishermen to drive the fish into set nets. In the "Kikubo" method of fishing, the nets are lifted immediately after beating the water such that a number of fish (both too big and too small) which are normally taken "gilled" would probably have escaped through set nets, thus the method is potentially very destructive and continued and/or widespread use of the method would normally result in continued decline in the average size of individual fish landed from a given gear.

On the basis of the above observations a number of recommendation were proposed towards the proper and rational management, exploitation and development of the Lake Wamala fishery. These included the following: (a) The existing minimum mesh regulation of 127mm stretched mesh regulation for Lake Wamala should be maintained and strictly adhered to. This measure was expected to allow the size groups then being exploited by the 88.9, 101.6 and 114.3mm mesh nets to grow to a size retainable by the legal gear. (b) The widespread beating of water to drive the fish into the nets and the use of unlicensed canoes were to be discouraged.

For about 6 years from 1981, during the "Luwero Triangle war", the area was reportedly without rain. This led to reduction in the volume of the lake; in February 1987 the lake was observed to have shrunk by about an average of 10 metres from its 1978 level, rendering the fringing papyrus swamp area dry. Also, during same period, most of the fishermen fled area, resulting in virtually no fishing activity and, consequently, no fishing mortality for the fish. The two events may have led to the suspected stunting of the fish stocks and/or the observed small size and bony condition of the *O. niloticus* landed in 1988. The observation that no catches of *O. niloticus* beyond 23.5 total length were caught in both the commercial and experimental nets during February 1988 - when the rains had just resumed and fishing was also starting to pick up - further points to a stunted fishery.

Following the start of the rains in 1987, the water level in Lake Wamala had by 1989 recovered to the 1978 levels, again covering the fringing papyrus swamp area. The condition of the

landed *O. niloticus* also started to improve, the small bony fish gradually disappeared and the size range of the fish caught in the experimental gillnets of graded mesh sizes increased from a maximum total length of 21.0 cm in February 1988 to 29.0 cm by March 1991 (Table 2); the 114.3mm mesh experimental gillnets also recorded some catches of *O. niloticus* by March 1991 (Table 3). The stunted condition of the fish stocks, especially *O. niloticus*, could probably have been due to:- (a) competition for the reduced space given that the fish continued to reproduce under virtually no fishing mortality during 1981-86; (b)reduction in feeding ground - the papyrus fringe having been rendered dry - and inadequate food supply in the reduced volume of water; and (c) effects of any pollution resulting from reduced volume of water containing ever increasing fish population; the fishermen reported heavy parasitic (especially nematodes) infestation of the fish, also observed during the surveys in 1988.

Since the first visit to Lake Wamala in February 1987 after the "Luwero Triangle war" (the first trip since the last research trip in November 1978), there has been a lot of concern in the Mityana Sub-District over the small sized and bony fish of *O. niloticus* being landed from Lake Wamala. The Sub-District Administration even put a ban on the sale of this fish in the markets, an effort aimed at discouraging fishing for these small sized bony fish. Since about 1990 the Uganda Fisheries Department staff in area in collaboration with Mityana Sub-District Administration embarked on the enforcement of the existing fishing regulation for the lake and persons found catching, landing and/or in possession of small sized fish were being prosecuted. Some stringent measures to even close the fishery had been proposed, in still an effort to enable the fishery to recover.

According to the Fish and Crocodile Act 1964 - thereafter amended from time to time - the minimum mesh regulation of 127 mm for the gillnets for Lake Wamala, was aimed at catching *O. niloticus* of at least 28cm (11 inches) total length. During the period of the survey under report the fish (*O. niloticus*) within the retention range of the legal gear were virtually not there, thus the use of the 127mm mesh nets would not be applicable to O. niloticus. Considering that the fishery was already stunted by 1987, the only remedy was to attempt to reduce the population. This had to inevitably involve the use of smaller meshed gillnets to crop the fish stocks, thus the use (illegally) of the 88.9mm mesh gillnets.

The 88.9mm mesh experimental nets did not record any catches of O. niloticus except for 1 fish (0.1 kg) per net in March 1991. This is because prior to March 1991, the fish within the retention range of this gear (18-31 cm VL) were generally scarce, averaging only 12.4% of total catch during 1988 and 1990 (Table 2); there were hardly any fish (*O. niloticus*) beyond 21cm total length during this period. During the period February 1988 to

November 1990, about 92% of the *O. niloticus* (90.5% during February 1988 to December 1991) fell within 12.5 - 18.4 cm total length (Table 2), a size range retainable mostly by the 50.8, 63.5 and 76.2mm mesh gillnets. The 88.9 mm mesh commercial gillnets were, however, able to retain the *O. niloticus* during the period of the survey, with the catch per unit of effort dropping from about 65 fish (11.5 kg) per net in 1988 to 27 fish (6 kg) in 1990, reflecting the relative population density in the lake. Despite the scarcity of *O. niloticus* within the retention range of the 88.9 mm mesh nets (18 - 31 cm TL) the gear was able to retain the fish (mostly below "that range) most probably through the widespread practice (in the commercial fishery) of beating the water to drive the fish into set nets; the *O. niloticus* retained by the 88.9mm mesh commercial gillnets during the survey period fell within 13.5 - 26.4 cm TL.

After November 1990, the use of the 88.9 mm mesh nets in the commercial fishery appeared to have ceased. This may partly have been due to the prevailing stringent measures to stop capture of small sized *O. niloticus*; it may also be due to declining catches in this gear. The decline in the catches seems to be the more likely explanation for reduced use of the 88.9mm after 1990 as hereafter nets of 76.2 and 63.5 mm mesh became common in the commercial fishery. It is also evident that most fishermen switched to fishing for *Protopterus* and *Clarias* using the 127 mm mesh gillnets and hooks on long-line from about 1990.

Maintaining and strictly adhering to"the existing minimum mesh regulation of 127mm mesh for the gillnets would ideally have been the most appropriate management measure for the recovery of the *O. niloticus* predominated Lake Wamala fishery. However, this regulation would not have rewarded the efforts at the start of fishing in 1987 and 1988 when the population density appeared extremely high and consisted of stunted fish; cropping of the population using smaller meshed gillnets was, therefore, necessary to reduce the population to levels where adequate environmental facilities would enable the stocks to grow to sizes retainable by the legal gear. By 1990, the catch rates indicated that the population density had reduced significantly and it was, therefore, at this that the banning of the use of the nets of mesh sizes less that 127mm would have been most appropriate. Despite stringent measures to this effect, the fishery seems to be deteriorating instead of recovering.

The fishing villages are currently organised in a manner that the fishermen are headed by a leader (known as Gabunga) selected by themselves and the Village Community is headed by a Resistance Council Committee. The Gabunga and almost all the Resistance Committee executive members are fishermen. Law enforcement in Lake Wamala is carried out by the Fisheries Department staff - who are very few - and the Local Defence Unit personnel who are normally controlled by the local Resistance Council Committees. It is, therefore, the common believe around Lake Wamala that the existing regulations have not borne fruit

because both the Gabungas and the Resistance Council Committees, who should have assisted in effective Law enforcement, are themselves fishermen who have to survive through fishing.

REFERENCES

Bagenal, T.B. and E. Braum, 1971. Eggs and Early Life Hisvory, p. 166-9. In W.E. Ricker, 1971: Methods for Assessment of Fish Production in Freshwater (2nd ed.). IBP Handbook No.3, Blackwell Scientific Publication, Oxford and Edinburgh: XIV and 348pp.

Okaronon, J.O., 1987. Development and management of the fisheries in small water bodies in Uganda with particular reference to Lake Wamala. (A paper presented at the Symposium on the "Development and Management of Fisheries in Small Water Bodies", held in Accra, Ghana, 7-8 December 1987). FAO Fish. Rep. (425): 175-190; Rome, FAO. 1989. 190p.

Uganda Fisheries Department. 1969. Uganda Fisheries Department Monthly Reports, Ministry of Animal Industry and Fisheries, Uganda.

Table 1. Catch composition by species from experimental gillnetting on Lake Wamala during 19:8-91. (numbers of fish caught in brackets).

Period	Oreochromis niloticus		Oreochromis leucostic-tus		Clarias mossam-bicus		Protopterus aethiopicus		Other species		Total
	kg	% of	kg	% of	kg	% of	kg	% of	kg	% of	kg
Feb.'88	18.4 (351)		1.4		4.1 (6)		21.9 (9)		0.6		46.4
Nov.'88	57.0 (795)		2.0		21.1 (8)		34.0 (19)		1.2		115.3
Nov.'90	13.4 (269)		0.1		9.6 (5)		20.2 (10)		0.3		43.6
Mar.'91	5.5 (83)		0.3		6.2 (5)		11.8 (6)		0.6		24.4
Dec.'91	3.2 (53)		0.5		2.8" (2)		28.5 (15)		-		35.0
Combined 1988-91	97.5 (1551)	36.8	4.3	1.6	43.8 (26)	16.5	116.4 (59)	44.0	2.7	1.1	264.7
Combined 1975-78	305.5	54.3	11.1	2.0	129.9	23.1	107.2	19.0	9.4	1.7	563.1

Table 2. Length frequency percentage distribution of Oreochromis niloticus caught in 50.8mm - 203.2mm mesh experimental gillnets used in Lake Wamala.

TOTAL LENGTH (CM)	1975-1978	Feb. 1988	Nov. 1988	Nov. 1990	March 1991	Dec. 1991	1988-1991
5							
6	0.3						
7	0.5						
8	0.7						
9	0.4						
10	3.4	0.9		"			0.1
11	3.3	0.9	1.0		0.2		0.5
12	2.7	2.2	1.0		1.9	1.8	1.3
13	5.0	15.4	15.8	2.9	17.1	3.5	14.0
14	3.6	18.9	24.4	18.8	26.4	12.3	23.1
15	2.7	17.1	22.1	44.1	22.8	8.8	24.3
16	4.8	12.7	16.0	23.7	8.7	38.6	14.9
17	5.7	6.6	9.2	6.1	7.7	19.3	8.2
18	6.3	12.3	5.8	2.9	5.0	7.0	6.0
19	6.7	8.8	3.9	0.8	1.7	5.3	3.4
20	8.7	3.1		0.4	2.1	3.5	1.3
21	8.3	1.3			1.4		0.6
22	7.2				1.0		0.3
23	8.1				3.3		1.1
24	5.8				0.3		0.1
25	4.3		1.0		0.2		0.4
26 "	2.9			0.4	0.2		0.1
27	2.4						
28	0.9						
29	0.7				0.2		0.1
30	0.4						
31	0.3						
32	0.2						
33	0.2						
34							
35							
36							
	1835	228	620	245	584	57	1734

Table 3 Catch per unit of effort for Oreochromis niloticus in Lake Wamala

(a) Catch per net per night in the experimental gillnets

Gillnet Mesh Size (mm)	Nov.1978		Feb.1988		Nov.1988		Nov.1990		Mar.1991		Dec 1991	
	No.	Kg	No.	Kg	No.	Kg	No.	Kg	No.	Kg	No.	Kg
25.4	10	0.3	-	-	-	-	-	-	-	-	-	-
38.1	17	0.8	22	0.3	26	1.0	8	0.2	3	0.1	-	-
50.8	21	1.7			10	0.8	30	1.8	4	0.2	4	0.2
63.5	33	4.3	43	2.4	91	7.1	23	0.9	14	0.9	13	0.8
76.2	27	4.3	4	0.8	6	0.6	5	0.3	2	0.3	1	0.1
88.9	18	4.5							1	0.1		
101.6	7	1.7					2	0.2				
114.3	3	0.9							2	0.2		
127.0	1	0.6										

(b) Catch per canoe per night for canoes using the 88.9mm mesh commercial gillnets.

Period	Lusalira		Butebi		Gombe		Whole Lake	
	No.	Kg	No.	Kg	No.	Kg	No.	Kg
Feb. 1988	117	18.6	127	15.7	162	28.7	136	21.4
Nov. 1988	78	12.3	149	20.4	243	38.8	159	23.8
Nov. 1990					67	15.2		

(c) Catch per net per night for the 88.9mm mesh commercial gillnets

Period	Lusalira		Butebi		Gombe		Whole Lake	
	No.	Kg	No.	Kg	No.	Kg	No.	Kg
Feb. 1988	55	8.8	63	7.8	59	9.9	57	9.1
Nov. 1988	78	12.3	62	8.6	79	12.6	71	10.6
Nov. 1990					27	6.0		