8. Past history and present state of the Lake Kyoga fishery

While some of the information in this section of the review reflects events in the other lakes in the Kyoga Catchment, notably Lakes Kwania and Bisina, the major focus is on Lake Kyoga where most data was collected.

From the time of Worthington's survey to the early 1950s the lake supported a rich fish fauna. The major commercial fish species were, in order of importance, *Oreochromis variabilis*, *Oreochromis esculentus Protopterus aethiopicus, Bagrus docmac, Clarias gariepinus, Barbus* spp and *Schilbe intermedius.* The lake also supported representatives of the families *Mormyridae, Cyprinidae, Claridae, Characidae, Cyprinodontidae, Machochidae, Anabantidae,* and *Mastercembalidae.* Haplochromines were abundant in the lake for Worthington (1929), who accompanied Graham (1927) on the Lake Victoria survey, observed that haplochromines were as numerous in Lake Kyoga as they were in Lake Victoria.

Worthington, 1929 divided Lake Kyoga into three main environments; the open water deeper than 3 m, the water less than 3 m deep, which was covered with water lilies and emergent vegetation dominated by fringes, papyrus. Most of the fish species smaller than about 30 m were confined to the area of the lake that was covered with water lilies while the larger ones were found in the open water zone. Among the *Haplochromis* spp, only the larger ones ventured into open waters. Of the smaller fish species, only *Rastrineobola argentea* was common in the open water zone. A few of the larger predatory species particularly C. *gariepinus* and *Barbus* spp were occasionally encountered in the water lily zone where they could have gone to hunt for the smaller fish prey. Most of the fish species in the lake were predatory and fed either on invertebrates or fish. The aquatic macrophytes therefore provide refugia for the smaller fish species.

At the time of Worthington's survey, only natives tribes around Kyoga lakes fished. The fishing gears consisted of locally made basket traps, hooks and seine nets of papyrus. Fishing was spasmodic in that people mainly fished during the dry season and reverted to the land to grow cash crops during the rains. The fishing effort was therefore low and caused little damage to the fishery.

The catch statistics recorded on the lake since 1937 provide information on the changes in the fishery. The information prior to 1960 and after 1970 is available in Annual Reports of the Uganda Game and Fisheries Department (later Uganda Fisheries Department), that for 1958 to 1962 is available in Gee (1969) and that from 1963 to 1969 in Stoneman and Rogers, (1970). In these data, the catch of 0. *variabilis* and 0. *esculentus* were combined because, for most of the time, fishermen did not distinguish between them and referred to them by one local

name. However, 0. *variabilis* lived among aquatic vegetation inshore and was the species normally taken in basket traps while the larger 0. *esculentus* was found in open waters and was normally caught in gill nets. From 1937 until 1950's, Tilapiines and P. *aethiopicus* were the most important commercial species and contributed over 95% to the total landings until the early 1950's when their proportions started to change as a consequence of changes in fishing techniques (Table 2). Prior to the early 1950's fishing was mainly by basket traps which caught Tilapiine species while subsequently hooks were set for P. *aethiopicus.*

Fluctuations in fishing effort attributed to various factors occurred between 1937 and 1950. The annual effort increased from 1940 and had almost doubled by 1945 but dropped again by almost 50% in 1946. This fall in effort after 1945 was attributed to the high price offered for crocodile skins, which made many fishermen shift to crocodile trapping (Game and Fish. Dept. Ann. Rep. 1940 - 1946). In 1949, there was a slight increase in fishing effort due to the arrival on the lake of a company of Kavirondo fishermen from Kenya (Game and Fish. Ann. Rep. 1949). But in 1951 and 1952, the effort continued to fall partly due to prolonged rains and subsequent high lake levels which prevented basket fishing (Game and Fish. Ann. Rep 1951). Basket trapping was also becoming less popular at this time.

Before 1944, the average weight of *Oreochromis* spp. landed had decreased possibly due to increased effort. But following a decline in effort after 1945, the weight of fish landed increased. Similarly, the catch rates initially decreased along with increasing effort before 1945, but when there was a fall in effort, the catch rates increased. By the time basket trapping was declining there was therefore no indication that this fishing method which flourished on the lake before 1950 had depleted the fish stocks.

After 1949, as the proportion of Tilapiines in the catch decreased, that of P. *aethiopicus* increased (Table 2). This was because, high lake levels prevented the use of basket traps. Long-lines were also more profitable and easier to operate. In fact long-lines became so popular in 1950s that by 1957, 70% of the catch on the lake was by long lines, 20% by gill nets and only 10% by basket traps. B. *docmac* and C. *gariepinus*, in addition to P. *aethiopicus* formed an important component of the long-line fishery. By 1957 - 58, C. *gariepinus* and B. *docmac* had increased in importance to contribute 8% and 6% of the total catch respectively.

Before 1950, successful use of gill nets on Lake Kyoga was difficult because of the abundance of crocodiles, which destroyed the nets. The other set-back had been the larger expanses of aquatic vegetation and floating islands. Following a rigorous anti-crocodile campaign, which had been prosecuted in an endeavour to increase the export of crocodile skins, interference with gill-net fishing declined. This enabled gill-nets to be used on a scale which had not been previously possible. The major problem with the gill net fishery was that there was no limit to the size of nets used on the lake. Nets of 2.5 inches to 4 inches were freely used. The 4 to 3.5 inch nets were most suitable for the native Tilapiines. Although the 2.5-inch nets were aimed at small species particularly S. *intermedius,* and *Labeo*

victorianus, they were harmful to the native tilapiine fishery and the other large species by cropping their juveniles. The actual effort due to gill nets was not available but it must have increased as the annual sale of nets in the region increased over ten times in nine years (Game and Fish. Dept. Ann. Rep. 1955).

The gill net effort increased particularly in the late 1940s due to arrival on the lake of immigrant fishermen from Kenya and Tanganyika. Unlike the local fishermen who only fished during certain times of the year, the immigrants fished throughout the year and in many places seven days a week. There were indications of a fall in catch rates of the gill nets as early as 1950. Initially it had been possible to catch up to 30 fish per net per night (Game and Fish. Dept. Ann. Rep. 1940 - 46). This catch rate had dropped as low as 7.7 fish per net by 1950 (Game and Fish. Dept. Ann. Rep. 1950).

Apart from fishing, another factor that affected the populations of fish in Lake Kyoga, were the large colonies of fish eating birds notable; pelicans, cormorants and herons. From a study of the feeding habits of the Purple Herons on the lake, each of these birds was observed to feed on three or more 0. *variabilis* of 18 - 20 cm a day (Game and Fish. Dept. Ann. Rep. 1952). Thus a colony of 300 Herons studied were estimated to consume up to 27,000 fish a month, a number in excess of the normal recorded monthly catches in the Bugondo area of the lake at that time.

9. 2. Introduction of non-indigenous fishes

A major event, which upset the fish species balance in Lake Kyoga, was the introduction of new fish species. Following the success of *Tilapia zillii, Oreochromis niloticus* and *Oreochromis leucostictus* in cattle dams around the lake, it was decided to stock those fish in the main lake. **In** 1954 considerable numbers of these species were introduced into various parts of the lake. At this time, introduction of Nile perch in Lake Victoria was being considered. **It** was therefore introduced into the lake to provide some information on the effects of such an introduction on another cichlid dominated fauna of Lake Victoria.

By 1958 *Oreochromis* spp were so numerous at some landings that fishermen found it more profitable to set nets specifically for them. As a result some fishermen discarded their traditional 2 inches to 3.5 inches in favour of those of 4 to 5 inch mesh gill nets in order to catch the larger size O. *niloticus* which grew up to 2 kg compared to the native *Oreochromis* spp which rarely exceeded 0.3 kg. This could have favoured a recovery in the populations of the native species. Unfortunately this did not happen. As the population of the introduced species increased, that of the native species continued to decline.

9.3. **Impact of introduced fish species on yield to the fishers**

The population of *L. niloticus* increased steadily from 1964 onwards and stabilised at about half of the total commercial catches by 1967 (Table 3). The native Tilapiines species declined in importance to less than 5.0% of the total catch by 1968 and later became completely absent. Catches of the introduced 0. *niloticus* increased to contribute over 20% of the commercial landings by 1968. During the same period, the catch of B. *docmac* fell from 233 tons in 1961 to only 4.8 tons in 1965 (Stoneman and Rogers, 1970). The native Tilapiines, B. *docmac,* P. *aethiopicus,* and C. *gariepinus,* which dominated the scene before 1960, were no longer prominent among commercial catches. This marked the end in dominance of native species.

The increase in stocks of the introduced species resulted in an increase in the fishery yield from 18,261 tones in 1964 to a peak of 167,200 tones in 1978 (Figure 2). These increase were due to to a rise in the contribution of Nile perch from 657 tonnes in 1964 to 71,000 tones in 1978 and that of the introduced tilapiines especially Nile tilapia from 589 tonnes in 1964 to 80,960 tonnes by 1985. However total fishery yield declined from the peak recorded in 1978 to about 54,706 tonnes by 1989. During this period, the yield of the Nile perch decreased from 71,000 tones recorded in 1977 to a mere 15,000 tonnes in 1989. This decline seems to have been caused by a collapse in the Nile perch fishery. From that time onwards, Nile tilapia became the most important component of the fishery in Lake Kyoga.

Experimental fishing was conducted by the Fisheries Resources Research Institute between 1988 and 1993 to determine fish species composition in Lake Kyoga using a 5 mm seine net, a 51 mm seine net and gill nets of various sizes (Table 3). Nile perch and Nile tilapia dominated the catch and contributed 80% and 19% to total catch by weight in the gill nets. The composition in the 5 mm seine net was 59% Nile perch, 35% Nile tilapia and 5% Mukene. These results showed that these three were the dominant fish species in Lake Kyoga. A survey carried out on lakes Victoria and Nabugabo which had a native fish fauna similar to that of Lake Kyoga and to which the same fish species had been introduced also showed that the same three species became dominant following establishment of introduced specles.

Figure. 2

Table 2. Percentage composition of fish catches in Lake KyoCia -1937 to 1953

Year	Nat-T	*Prot.*	*Bagrus*	*Barbus*	*Clarius*	*Morm.*	*Labeo*	*Schi/be*	Haplo	Others	Total
1937	85.8	I 1.41	1.0 I	0.43	1.24	O	0.08	O	0.02	2.78	99.99
1938	93.45	3.1	1.39	1.44	0.4 1	0.06	0.03	0.14	0.02	3.49	100.04
1939	98.1	0.63	0.78	0.15	0.26	0.01	0.0 1	0.01	0.02	1.24	99.97
1940	97.5	1.01	0.71	0.24	0.37	0.02	O	0.08	0.04	1.46	99.97
1941	94.6	1.91	1.25	0.9	0.8	0.04	0.05	0.14	0.3	3.48	99.99
1942	72.46	22.3	1.08	1.16	2.04	0.28	0.03	0.03	0.62	5.24	100
1943	97.88	0.73	0.48	0.52	0.36	0.02	0.01	0.01	0.01	1.41	100.02
1944	96.63	0.82	0.76	1.15	0.54	0.02	0.01	0.03	0.02	2.53	99.98
1945	96.27	1.81	0.39	0.72	0.42	0.04	0.02	0.07	0.26	1.92	100
1946	93.34	5.21	0.62	0.32	0.34	O	O	0.01	0.17	1.46	100.01
1947	87.52	10	0.27	0.31	1.65	0.02	0.03	0.03	0.17	2.48	100
1948	93.49	3.92	0.28	0.26	1.81	0.01	0.1 9	0.03	0.01	2.59	100
1949	96.76	0.99	0.27	0.98	0.61	0.33	0.04	0.02	O	2.25	100
1950	76.09	16.26	0.95	2.47	2.68	1.02	0.25	0.15	0.1 2	7.64	99.99
1951	79.1 3	15.2	0.81	1.81	1.08	1.4 1	0.15	0.34	0.07	5.67	100
1952	44.55	34.08	9.78	1.7 1	5.0 I	2.18	1.93	0.49	0.27	21.37	100
1953	60.03	23.8	3.87	1.84	2.53	3.75	3.2	0.72	0.28	16.19	100.02

Table 3. Estimated fish prnrllJctinn of Lake Kyoga 1963 - 89 (1000 tonnes)

Year	1	T-Nat	Other-Nat.	T-Intro	Lates	Total
1963	I	60021	98071	742		16551
1964	1	59291	110861	589	657	18261
1965	1	35951	95391	517	4374	18025
1966	1	25901	86181	947	7422	19577
1967	I	21721	57161	5017	13000	25905
1968	1	1617/	59941	7644	17725	32980
1969	1	21581	66961	13166	26920	48940
1970	1	25451	91861	16511	33828	62070
1971	I	I	82001	35900	44000	88100
1972						
1973			5100	33200	59300	97600
1974			4300	39100	59400	102800
1975			9300	52000	57300	118600
1976			21600	50200	70900	142800
1977			20300	73800	71000	165100
1978			20400	73800	71000	165200
1979						
1980						
1981						
1982						
1983						
1984						
1985			4950	80960	17090	103000
1986						
1987			3590	40840	13271	57701
1988			6144	66281	14322	86747
1989			2447	37148	15111	54706

Compiled from Uganda Fisheries Department Statistics.