

The Fishery Resource of Kisoro Minor Lakes

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Introduction:

Kisoro district (734km²) is located in southwestern Uganda

Altitude : 6000'

Temperature: 15 – 24°C

There are four minor lakes:

Kayumbu	2.2 km ²
Chahafi	1 km ²
Mutanda	26.4 km ²
Mulehe	4.1km ²

Fish production is presently very low e.g the 4 minor lakes produced 16 mt in 1998 which put per capita fish consumption at 0.06kg compared to approximately 12-15 kg for entire Uganda population. These low catches make the fish price very prohibitive (1kg costs 2000/=). Study therefore was conducted November 1998 to August 1999 and included historical, present situation and next line of action to re-activate the fishery resource.

Major objectives

Generate information required for formulation of development and management policies for enhancing and sustaining fish production in Kisoro Minor lakes

Specific Objectives

- a) to collect information on the fishery history
- b) to determine species composition, abundance and distribution in the four lakes
- c) to estimate the prevailing fishing effort, gears, gear sizes, fishing methods and their effect on the fishery
- d) to establish the conditions or means of increasing fish production
- e) to recommend ways and means of developing and managing the fishery

Methodology

Interviews were carried out (opinion leaders, fishing communities, fisheries staff) on the history of the fishery. A map was obtained from Ministry of Lands and Survey Entebbe. Commercial catch statistics were compiled from Fisheries Departments (Entebbe, Kisoro and Kabale)

Experimental fishing (3 fleet of gillnets 1-5"), longline using boiled maize or haplochromines (hooks size 3-10"), local Kisoro traps, wire traps were used. Fishing was conducted day and night. Where possible, commercial catches were analysed.

Biometric measurements were taken for different taxa and stomach contents were analysed in the field or laboratory under a binocular microscope. Preserved eggs were counted both in the field and laboratory

Results

Geographical setting

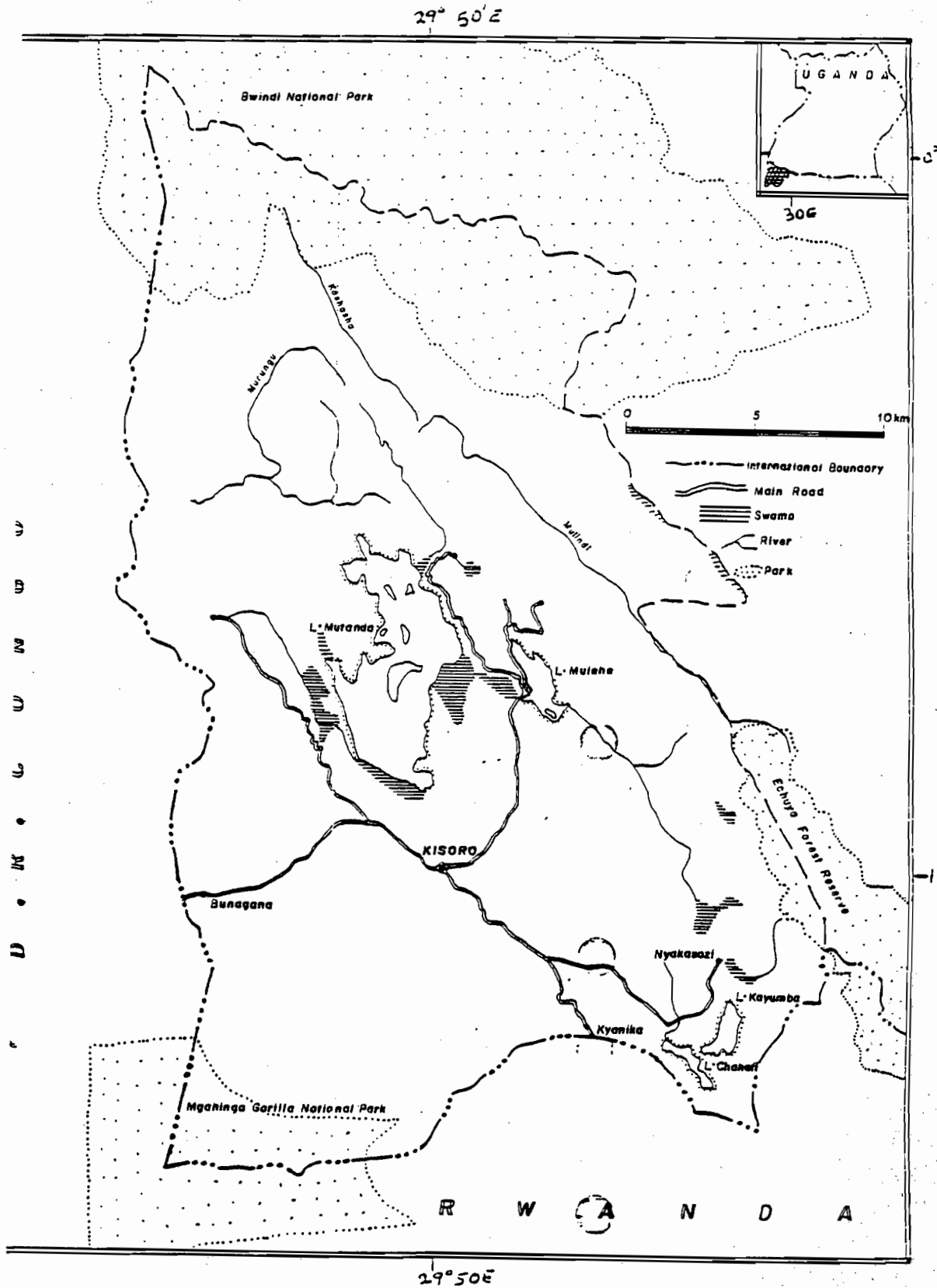


Fig. 1 Map of Kisoro District showing the four Minor lakes

History of the Fishery

Events	L. Chahafi	L. Kayumbu
Fish in the lakes around 1930	<i>C. carsoni</i>	<i>C. carsoni</i>
Mode of harvest	Local basket traps	Local basket traps
Stocking in 1939 and 1960	<i>O. niloticus</i> and common carp respectively <i>O. leucostictus</i> (1960)	<i>O. niloticus</i> and common carp respectively
Gear and gear size	4-5"	4-5"
1960	<i>O. niloticus</i> declined	
1963	Restocking with <i>O. niloticus</i> increased fish production . each canoe 20-30 <i>O. niloticus</i> . Fish sold locally, Kisoro market or smoked	Fish sold locally, Kisoro markets or smoked
1970	2 <i>O. niloticus</i> per net 0.24kg average. Otters appeared angling for carp	Otters appeared, angling for carp
1972 & 1981	Carp restocking	Carp in 1974 restocked
1980	Smoking abandoned due to low catches	Smoking abandoned due to low catches or small size fish
Closure	1983/84	1983/4
Increase in average size of <i>O. niloticus</i> and Carp. Total catch 1985	1982 – 1985 <i>O. niloticus</i> : 0.24 – 1.8kg, carp 0.8 – 4.4kg. 32mt in 4 months	15.4mt in 3 months <i>O. niloticus</i> 0.2 – 0.5kg, carp 0.8kg – 3.6kg.
1987 species exploited	<i>O. niloticus</i> , carp, <i>O. leucostictus</i> , <i>Barbus</i> , <i>C. carsoni</i> , shrimps	<i>O. niloticus</i> , carp, shrimps
Closure	1992/93 due to reduced catches	1992/93 due to reduced catches
Reopening	1994 1994/96 increase in carp and <i>O. niloticus</i> due to 1993 closure	1994 1994 – 1996 <i>C. carsoni</i> , shrimps, carp, <i>O. niloticus</i> increased
Commercial catch 1994 -8	Carp 40% Tilapia 35% Shrimps 17% <i>C. carsoni</i> 13%	Carp 37% Tilapia 35% Shrimps 12% <i>C. carsoni</i> 16%

Events	Lake Mulehe	Lake Mutanda
Stocking	Common Carp 1962	Black bass 1960
Production 1962	125mt Tilapia (mainly <i>O. niloticus</i>)	55mt (Tilapia, Black bass)
Fish in the lake 1963	<i>O. niloticus</i> , Carp, <i>C. mossambicus</i> not harvested	<i>O. niloticus</i> 72%, Black bass 28%, very few <i>C. mossambicus</i>
Gear and gear size	3.75" mesh gillnets	3.0"-4" mesh gillnets
Other stocking	Carp, <i>T. zillii</i> 1964; Carp 1965, 1972	Tilapia 1970, Carp 1973, Tilapia 1984, 85; Black bass 1967; Tilapias 1985
Disappearance	Carp disappeared 1969	Black bass disappeared 1969; Carp 1992
Massive fish kills	1973, 1983	River Mucha 1985
Other predation	1990	1990
Closure to fishing	1990	1990, 1993
Most fishermen abandoned fishing activities due to very low catches	1989 - 93	1989 - 1993
Tilapias and <i>C. mossambicus</i> declined to negligible levels	1994 - 8	1994 - 8
Alternatives for exploitation 1994-8	Haplochromines, frogs, <i>C. carsoni</i> now of the 4 lakes has the lowest production	Haplochromines, <i>C. carsoni</i> , frogs
Commercial catch 1994 - 98	Tilapias 14% <i>C. mossambicus</i> 14% <i>C. carsoni</i> 29% Edible frogs 9% Haplochromines 33%	Tilapias 12% <i>C. mossambicus</i> 30% <i>C. carsoni</i> 17% Edible frogs 9% Haplochromines 32%

Commercial Catch Statistics

There was no constant fishing activities due to constant decline in fish catches. Again due to very low catches fishermen often failed to pay for licenses and were barred from fishing. Several times, the lakes would be closed to fishing after which catches would temporarily increase but soon would decline. There was no regular restocking 1963 – 1998 and at times very few fry would be restocked and usually with no tangible increase in catches. However, whenever 1000 or more fry were restocked, the catches would increase tremendously for a few years. The commercial catch statistical data on the four lakes are indicated in Tables 1-8.

Field Surveys

Only dugouts are used. Gillnets and local traps are the common gears. Angling is carried out using boiled maize grains (Lakes Kayumbu and Chahafi) live haplochromines (lakes Mulehe and Mutanda) Table 9.

Fish species in commercial and experimental catches on the 4 lakes are shown in Table 10.

Fish species distribution, relative abundance

Overall mean catch rates showed more weight of fish being landed offshore than shoreline on all the lakes except Lake Kayumbu. *O. niloticus* and *C. mossambicus* contributed higher mean catch rates on Lake Mutanda and Mulehe while the common Carp and *O. niloticus* contributed highest on lakes Chahafi and Kayumbu respectively. *Barbus* sp, *T. zillii* and *C. carsoni* contributed more along the shoreline and common carp was offshore (Table 11).

Species distribution at the shoreline and offshore in different experimental gillnet mesh size nets 1-5" based on better mean catch rates (g/net/day/night) are shown below

Lake	Shoreline	Offshore >10m
Chahafi	Common Carp (3.5", 5")	Common Carp (4", 4.5", 5")
Kayumbu	<i>C. carsoni</i> (1.5 and 2") <i>O. niloticus</i> (2.5", 3"- 3.5") Common Carp (5")	
Mulehe	Negligible	<i>O. niloticus</i> (3", 4", 5")
Mutanda	Negligible	<i>O. niloticus</i> (4")

Length frequency distribution of species caught in experimental gillnets are shown in Figure 3-9 and contribution by fresh weight in Figure 2a and b.

Traps

Local traps caught mainly *C. carsoni*, few edible frogs and a few haplochromine sp on Lakes Mutanda and Mulehe. Wire traps caught *O. niloticus* on Lake Mulehe Table 12.

Biological Observations

Nematodes were in 11% of *O. leucostictus* on Lake Chahafi (average 4 nematodes/fish), *C. mossambicus* (60%) had nematodes on Lake Mutanda (average 11 per fish). One *C. carsoni* on R. Mucha had over 10 nematodes while 10% were infested on Lake Mutanda. On Lake Mulehe all *C. mossambicus* analysed had nematodes (average 59 per fish) 8% of *C. carsoni* were infested (average 7 nematodes per fish).

Feeding: Summary of various food items from different fish species are shown in Table 13

Fecundity

The average egg count are shown in Table 14 Common Carp produced over 0.5m eggs. But it appears very few eggs hatch due to probably very low temperatures that exist in the waters. The same effect could be applicable to other species.

Size at first maturity

Rough estimation of size at first maturity for some fish species and size at which fish are all mature are shown in Table 15

General observations and recommendations

1. Fishing activities on the Kisoro minor lakes have not been continuous since 1963 due to constant decline in fish catches resulting in failure of the fishermen to pay for fishing licences.
2. Due to low catches of major fish species like Tilapia, Mirror carp, *C. mossambicus*, fishermen have opted to exploit *Caridina* spp, haplochromines, *C. carsoni* (Nsonzi) and edible frogs which presently constitute a good proportion of the commercial catches.
3. Restocking of these lakes was not regular and usually few fry were used for re-stocking.
4. The disappearance of Mirror carp on Lakes Mutanda and Mulehe, Black bass on L. Mutanda can be corrected by further restocking.
5. Black bass did well on L. Mutanda, the restocking of this lake with the species is recommended
6. There is a big decline in the catches of major fish species on all the lakes. It is urgent that these lakes are restocked with species, which can withstand low temperatures, Species like *O. niloticus*, Mirror carp, Black bass, *C. mossambicus*.
7. The rearing of the fry should be done in Kisoro for the fry to acclimatise to the cold temperatures of the district before re-stocking. There should, preferably be establishment of a permanent hatchery in Kisoro to enable regular restocking. Excess fry could be sold to the fish farmers and funds raised to run the hatchery.
8. Preferably stocking density is 2³ fish fry per 1m². Reasonable stocking density is very important to enable increased fish production.
9. From the analysis of monthly catch data statistics *O. niloticus* and Mirror carp when stocked take 6-8 months to appear in the fishery. However, black bass and Mirror carp species started to decline 3-4 years after restocking. Further decline resulted in total disappearance after about 6-7 years of restocking as was the case for Black bass and Mirror carp on Lake Mutanda and Mirror carp on Lake Mulehe. Mirror carp on lakes Kayumbu and Chahafi seems to persist much longer than on the other two lakes. *O. niloticus* though declined to very low levels, it has never disappeared completely since 1963 to 1998 on all the lakes.
10. The present major fisheries can tentatively be exploited using gillnet mesh size nets of 4" and above and hooks of size 9 and bigger.
11. After manipulating the lakes for increased fish production, there should be a strategy of co-management of the resource.

Table 1. Fish Catch Statistics on Lake Chahafi period 1963-1998

Year	Tilapia		Mirror carp		Total weight mt
	Number	Weight (kg)	No.	Wt	
1963	749	337	-		0.3
1964	7668	2537	few caught/not recorded		2.5
1965	12532	2804	3-7		2.8
1966	8572	2180	1-4.5		2.2
1967	7543	1828	2-8.0		1.8
1968	-	-	-		-
1969	-	-	-		-
1970	10899	2621	-		2.6
1971	14948	4046	-		4.1
1972	11509	3114	-		3.1
1973	1058	285	127-413		0.7
1974	3433	887	637-1546		2.4
1975	2070	668	2314-4374		5.0
1976	2524	792	2973-3475		4.3
1977	4207	1232	2255-2749		4.0
1978	6735	1546	1590-1932		3.5
1979	4753	1134	763-700		1.8
1980	3504	759	472-408		1.2
1981	-	-	-		-
1982	9832	1980	4814-3972		6.0
1983	-	-	-		-
1984	-	-	-		-
1985	9466	16927	3373-14698		31.6
1986	-	-	-		-
1987	-	-	-		-
1988	-	-	-		-
	Tilapia	Mirror carp	C. carsoni/ Red shrimps		
1989		32kg (50 in number)	348kg	323kg	0.7
1990	-	-	-		-
1991	216 63kg	47kg (144 in Number)	209kg		0.3
1992	-	-	-		-
1993	-	-	-		-
	Tilapia (kg)	Mirror carp (kg)	C. carsoni/Red shrimps		Mt
1994	570	600	340	- 150	1.7
1995	970	1200	410	- 310	2.9
1996	1220	1130	520	- 460	3.3
1997	540	1080	510	- 330	2.4
1998	764	1469	541	- 211	3.0

Table 2. Average weight of fish (kg) in commercial catches on Lake Chahafi 1963-1998

Year	Tilapia	Mirror carp
1963	0.45	
1964	0.33	-
1965	0.22	2.3
1966	0.25	4.5
1967	0.24	4.0
1968	-	-
1969	-	-
1970	0.24	-
1971	0.27	-
1972	0.27	-
1973	0.27	3.3
1974	0.26	2.4
1975	0.32	1.9
1976	0.31	1.2
1977	0.29	1.2
1978	0.23	1.2
1979	0.24	0.9
1980	0.22	0.9
1981	-	-
1982	0.20	0.82
1983	-	-
1984	-	-
1985	1.8	4.4
1986	-	-
1987	-	-
1988	-	-
1989	-	0.6
1990	-	-
1991	0.29	0.3

Table 3. Lake Kayumbu - Commercial catch statistics 1963 - 1998

Year	Tilapia		Mirror carp		Red shrimps	Total weight
	Number	Weight (kg)	No.	Kg.	kg	Mt
1963		6901	-	-		6.9
1964		7064	-	-		7.1
1965		12910	4	19		12.9
1966		5957	28	142		6.1
1967		2843	-	-		2.8
1968		-	-	-		-
1969		-	-	-		-
1970	39668	14187	-	-		14.2
1971	21290	6033	-	-		6.0
1972	10645	3016	-	-		3.0
1973	11002	5549	-	-		5.6
1974	4227	925	923	2126		3.1
1975	5376	1279	6259	10440		11.7
1976	1196	864	9517	24370		25.2
1977	5370	1469	6739	13074		14.5
1978	8888	1890	3066	6889		8.7
1979	5004	1139	996	1135		2.3
1980	2497	533	635	568		1.1
1981	-	-	-	-		-
1982	7609	1724	7447	6031		7.8
1983	-	-	-	-		-
1984	-	-	-	-		-
1985	7072	3350	3358	12020		15.4
1986	1955	919	86	310		1.2
1987	-	-	-	-		-
1988	-	-	-	-		-
1989	7761	1769	1423	702	995	3.5
1990	7641	1879	486	418	745	3.0
1991	1109	152	117	213	100	0.5
1992/93	-	-	-	-	-	-
	Tilapia - kg	M.carp - kg	Red shrimps- kg	<i>C.carsoni</i> -kg		
1994	750	740	150	270		1.9
1995	960	1660	400	370		3.4
1996	2770	2530	1060	660		7.0
1997	1720	1320	800	630		4.5
1998	2223	2583	578	1529		6.9

Table 4. Average weight (kg) of fish in commercial catches on Lake Kayumbu (1963 – 1998)

Year	Tilapia	Mirror carp
1963	-	-
1964	-	-
1965	0.3	4.6
1966	-	5.1
1967	-	-
1968	-	-
1969	-	-
1970	0.35	-
1971	0.28	-
1972	0.28	-
1973	0.50	-
1974	0.22	2.3
1975	0.24	1.7
1976	0.72	2.6
1977	0.27	1.9
1978	0.21	2.3
1979	0.23	1.1
1980	0.21	0.9
1981	-	-
1982	0.23	0.81
1983	-	-
1984	-	-
1985	0.47	3.6
1986	0.47	3.6
1987	-	-
1988	-	-
1989	0.23	0.50
1990	0.25	0.90
1991	0.14	1.80
1992/93	-	-
1994/98	No data for number of fish	

Table 5. Fish Catch Statistics on Lake Mulehe 1963-1998

Year	Tilapia		Mirror carp		<i>C. mossambicus</i>		Total Mt
	No.	Kg.	No	Kg	No.	Kg.	
1963	287687	66168	-	-			66.2
1964	165146	36748	272	563			37.3
1965	50619	12560	122	511			13.1
1966	201148	58080	181	839			58.9
1967	149490	41224	76	453			41.7
1968	-	-	-	-			-
1969	-	-	-	-			-
1970	130878	36706	-	-			36.7
1971	60495	16211	-	-			16.2
1972	70195	16210	-	-			16.2
1973	4382	1052	409	1754			2.8
1974	1824	519	172	1195	10	34	1.8
1975	2052	493	89	771	14	28	1.3
1976	1543	415	66	548	35	68	1.0
1977	209	71	14	149	78	137	0.4
1978	350	135	8	78	46	109	0.3
1979	829	259	3	29	12	25	0.3
1980	291	94	3	36	11	22	0.2
1981	215	60	1	10	1	1	0.07
1982	631	205	9	91	13	33	0.3
1983	1125	589	-	-	23	45	0.6
1984	290	141	1	12	4	11	0.2
1985	22	13	3	35	46	84	0.1
1986	303	146	12	100	87	135	0.4
1987	256	127	9	72	60	110	0.3
1988	68	27	-	-	20	49	0.1
1989 - 93	-	-	-	-	-	-	-
	Tilapia kg	M/carp kg	<i>C. mossambicus</i>	<i>C. carsoni</i> kg	Edible frogs kg		Hapl. Kg Tot.
1994	150	-	160	120	30		110 - 0.6
1995	152	-	104	244	170		67 - 0.7
1996	140	-	80	280	40		340 - 0.9
1997	120	-	140	300	70		530 - 1.2
1998	141	-	192	497	112		557 - 1.5

Table 6. Average weight of fish (kg) in commercial catches on Lake Mulehe 1963-1998

Year	Tilapia	Mirror carp	<i>C. mossambicus</i>
1963	0.23	-	-
1964	0.22	2.1	-
1965	0.25	4.2	-
1966	0.29	4.6	-
1967	0.28	6.0	-
1968	-	-	-
1969	-	-	-
1970	0.28	-	-
1971	0.27	-	-
1972	0.23	-	-
1973	0.24	4.3	-
1974	0.28	6.9	3.4
1975	0.24	8.7	2.0
1976	0.27	8.3	1.9
1977	0.34	10.6	1.8
1978	0.38	9.8	2.4
1979	0.31	9.6	2.1
1980	0.32	12.0	2.0
1981	0.28	-	1.0
1982	0.32	10.0	2.5
1983	0.52	-	-
1984	0.48	12.0	2.5
1985	0.57	11.7	1.8
1986	0.48	8.3	1.6
1987	0.49	7.9	1.8
1988	0.40	-	2.5
1989 to 1998	No data for number of fish		

Table 7. Catch statistics on Lake Mutanda 1963 to 1998

Year	Species						Total (mt)
	Tilapia		Black bass		<i>C. mossambicus</i>		
	No.	Wt. (kg)	No.	Wt (kg)	No.	Wt (kg)	
1963	30980	13941	8040	3618			17.6
1964	10733	4481	2848	1442			5.9
1965	9909	3581	56	51			3.6
1966	4566	1601	4	8.2			1.6
1967	1639	553	2	3.6	1	3.6	0.6
1968	400	198	-	-	-	-	0.2
1969	322	167	-	-	1	5	0.17
1970	247	95	-	-	5	6	0.1
1971	58	26	-	-	3	5.4	0.03
1972	168	117	1 M/carp	2.7	58	65.0	0.18
	Tilapia		Mirror carp		<i>C. mossambicus</i>		
	No.	Wt. (kg)	No.	Wt (kg)	No.	Wt (kg)	
1973	237	139	35	56.5	222	407	0.60
1974	51	47	240	708	132	478	1.23
1975	47	44	201	1174	148	646	1.86
1976	74	82	228	1217	236	737	2.04
1977	5	5	12	99	170	534	0.64
1978	24	13.2	30	191	135	94	0.67
1979	12	6.0	17	62	94	383	0.46
1980	4	1.9	19	113	40	93	0.21
1981	4	6	9	38	10	10	0.05
1982	16	7	26	172	54	151	0.33
1983	33	26.5	3	20	89	242	0.29
1984	-	-	-	-	71	152	0.15
1985	913	539	8	77	1855	3876	4.49
1986	1636	815	2	23	1225	2321	3.16
1987	881	437	-	-	709	1215	1.65
1988	488	245	4	25	397	728	1.00
1989	1172	623	1	12.5	550	1210	1.85
	Tilapia		Mirror carp		<i>C. mossambicus</i>		<i>C. carsoni</i>
	No.	Wt. (kg)	No.	Wt (kg)	No.	Wt (kg)	
1990	1078	559kg	2	25kg	703	1811kg	178kg
1991	1088	602	7	72	652	1716	105 Hap 5 Frogs 2.5
1992					196	526	
1993	-	-	-	-	-	-	-
	Tilapia kg		C.moss kg		<i>C. carsoni</i> kg	Hapl. kg	Frogs kg
1994	560		1460		530	980	430
1995	680		1920		340	880	260
1996	640		1210		560	1260	330
1997	430		880		870	1280	430
1998	174		692		1216	2048	392

Table 8. Average weight of commercial fish species (kg) on Lake Mutanda 1963-1998

Year	Tilapia	Black bass	Mirror carp	<i>C. mossambicus</i>
1963	0.45	0.45	-	-
1964	0.42	0.51	-	-
1965	0.36	0.91	-	-
1966	0.35	2.1	-	-
1967	0.34	1.8	-	-
1968	0.49	-	-	-
1969	0.52	-	-	-
1970	0.39	-	-	-
1971	0.45	-	-	-
1972	0.70	-	-	-
1973	0.59	-	1.6	1.8
1974	0.92	-	3.0	3.6
1975	0.94	-	5.8	4.4
1976	1.10	-	5.3	3.1
1977	1.0	-	8.2	3.1
1978	0.55	-	6.4	3.7
1979	0.50	-	3.6	4.1
1980	0.48	-	5.9	2.3
1981	1.50	-	4.2	1.0
1982	0.40	-	6.6	2.8
1983	0.8	-	6.7	2.7
1984	-	-	-	2.1
1985	0.59	-	9.6	2.1
1986	0.50	-	11.5	1.9
1987	0.50	-	-	1.7
1988	0.50	-	6.3	1.8
1989	0.53	-	12.5	2.2
1990	0.52	-	8.3	2.6
1991	0.55	-	10.3	2.6
1992	0.55	-	-	4.2
1993	No data - closed fishing			
1994 - 1998	Data did not have number of fish caught only total weight was available			

Table 9. Fishing effort and fishing methods on Kisoro Minor lakes (1999)

	LAKES			
	Chahafi	Kayumbu	Mutanda	Mulehe
No. of fish landings	1	1	4	1
Dugout canoes (fishing)	16	46	51	12
Av. Size of canoes (m)	6.6	6.5	8.1	7.8
Dugout canoes (transport)	0	5	0	30
Av. nets/canoe	2-3	2-3	2-3	2-3
Common gill net mesh sizes inches (passive fishing)	2.5- 4	2.5- 4	2.5- 4	2.5- 4
Hooks (angling)	Size 8	Size 8	Size 8	Size 8
Local traps	Present	present	present	present

Table 10. Observed species within and among the Kisoro minor lakes during the period 1998/99

Species	Lakes			
	Mutanda	Mulehe	Chahafi	Kayumbu
<i>O.niloticus</i>	x	x	x	X
<i>O.leucostictus</i>	x		x	X
<i>T.zillii</i>			x	X
<i>Barbus spp</i>	x	x	x	X
<i>C.carsoni</i>	x	x	x	X
<i>C.mossambicus</i>	x	x	x	X
Haplochromines	x	X		
Mirror carp			x	X
Edible frogs	x	x	x	X
Red shrimps			x	X
Otters	x	x	x	X
Cray fish	x	X		
Mosquito fish		X		

Table 11. Relative abundance (mean catch rates – g/net/night-day) by species in the shoreline compared to offshore for experimental gillnet catches of 1-5" during 1998/99

Taxa	Lakes							
	Chahafi		Kayumbu		Mutanda		Mulehe	
	shoreline	offshore	shoreline	offshore	shoreline	offshore	shoreline	offshore
<i>C.carsoni</i>	7.3	5.4	13.5	9.3	-	0.5	2.4	-
<i>Barbus spp</i>	4.0	2.1	9.3	6.2	0.8	0.2	-	-
<i>O. leucostictus</i>	9.3	22.7	-	0.4	0.2	0.9	-	-
<i>T. zillii</i>	6.3	3.6	2.7	0.8	-	-	-	-
<i>Mirror carp</i>	47.4	87.7	9.0	19.5	-	-	-	-
<i>O. niloticus</i>	-	11.4	57.8	20.5	10.1	31.8	9.9	51.4
<i>C. mossambicus</i>	-	3.3	1.4	0.6	9.6	22.8	43.5	18.2
Haplochrominis	-	-	-	-	7.3	4.6	6.4	7.9
Total	74.3	136.2	93.7	57.3	28.0	60.8	62.2	77.7

Table 13

Summary of various food items ingested by different fish species on Kisoro Minor lakes.

Lake	Fish species	Food items
Kayumbu	<i>C. carsoni</i>	Chironomid larvae and pupae, <i>Caridina</i> spp, <i>Chaoborus</i> larvae, <i>Povilla</i> , <i>Odonata</i> , detrital material
Chahafi	<i>C. carsoni</i>	Chironomid larvae and pupae, <i>Caridina</i> spp, <i>Chaoborus</i> larvae, <i>Povilla</i> , <i>Odonata</i> , detrital material, small fish, molluscs, and tadpoles
Mulehe	<i>C. carsoni</i>	<i>Chaoborus</i> larvae, <i>Ephemeroptera</i> , Insect remains, Haplochromines
Mutanda	<i>C. mossambicus</i>	Insect remains, fish remains, Mayfly, <i>Odonata</i> , Haplochromines
Chahafi	<i>C. mossambicus</i>	<i>Caridina</i> spp, <i>Odonata</i> , <i>Barbus</i> spp
Kayumbu and Chahafi	<i>T. zillii</i>	Macrophyte remains, algae (<i>Nitzschia</i> spp, <i>Synedra</i> spp), detritus
Mulehe	<i>O. niloticus</i>	Algae (blue-greens, mainly <i>Mycrocystis</i> spp, <i>Anabaena</i> spp. Others were <i>Ceratium</i> spp, <i>Scenedesmus</i> spp, and <i>Melosira</i> spp., and Rotifers).
Mutanda	<i>O. niloticus</i>	Brown algae (<i>Ceratium</i> spp), plant material and Insect remains.
Mutanda	<i>A. allaudi</i>	<i>Barbus</i> spp, fish eggs, snails and fish remains.

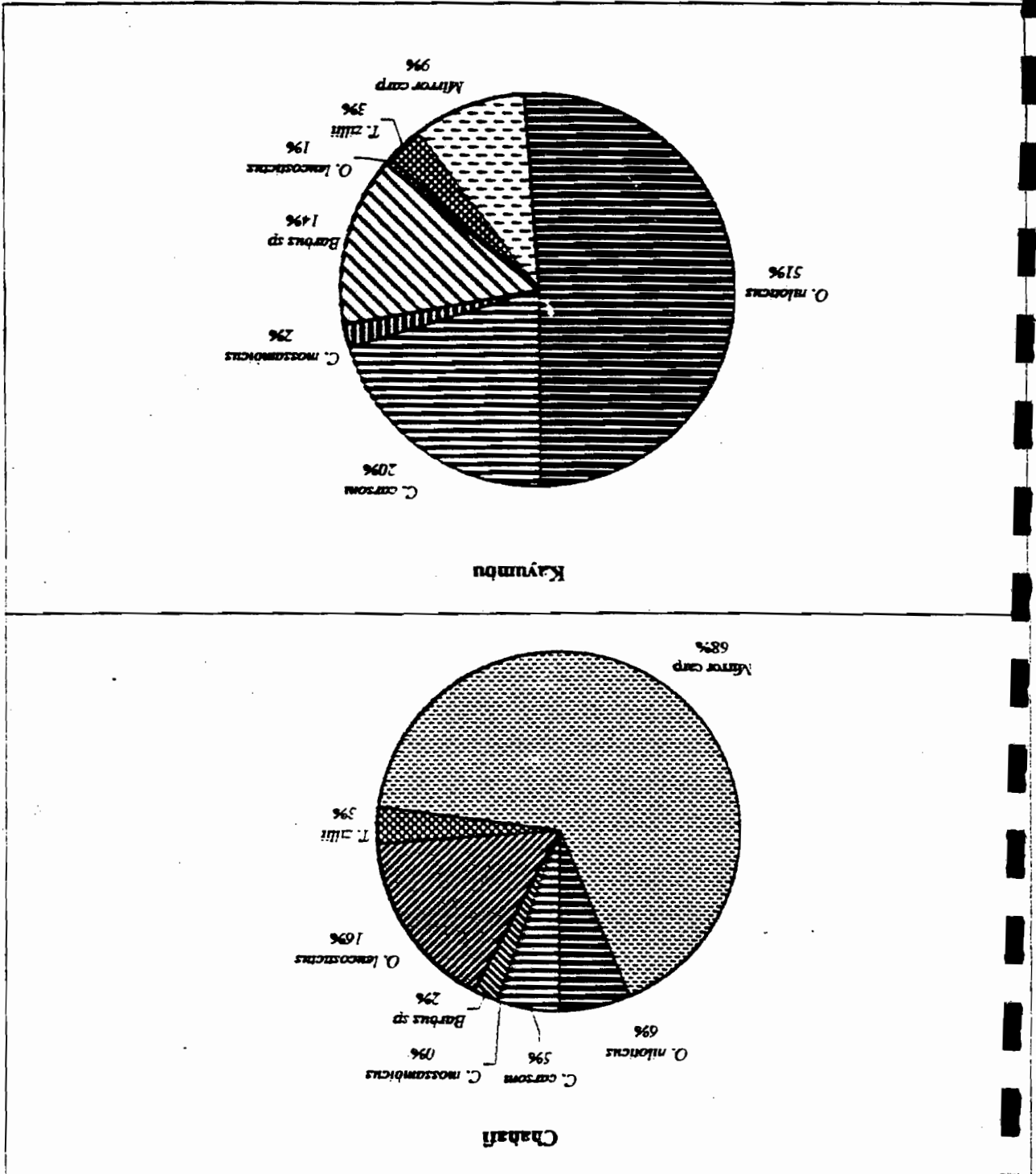
Table 14 The average egg count of the fish species on Kisoro Minor Lakes.

Fish	Lake	No of fish	Average egg count
<i>Oreochromis niloticus</i>	Kayumbu	6	603
<i>Oreochromis niloticus</i>	Mutanda	3	633
<i>Oreochromis niloticus</i>	Mulehe	3	519
<i>Oreochromis niloticus</i>	Chahafi	1	962
<i>Oreochromis leucostictus</i>	Chahafi	5	148
<i>Clarias carsoni</i>	Mulehe	3	602
<i>C. carsoni</i>	Mutanda	1	298
<i>C. Carsoni</i>	Chahafi	2	949
<i>C. Carsoni</i>	Kayumbu	4	635
Mirror carp	Chahafi	3	546,047
Mirror carp	Kayumbu	2	3,844,425
<i>Barbus sp</i>	Kayumbu	11	883
<i>Barbus sp</i>	Chahafi	4	449

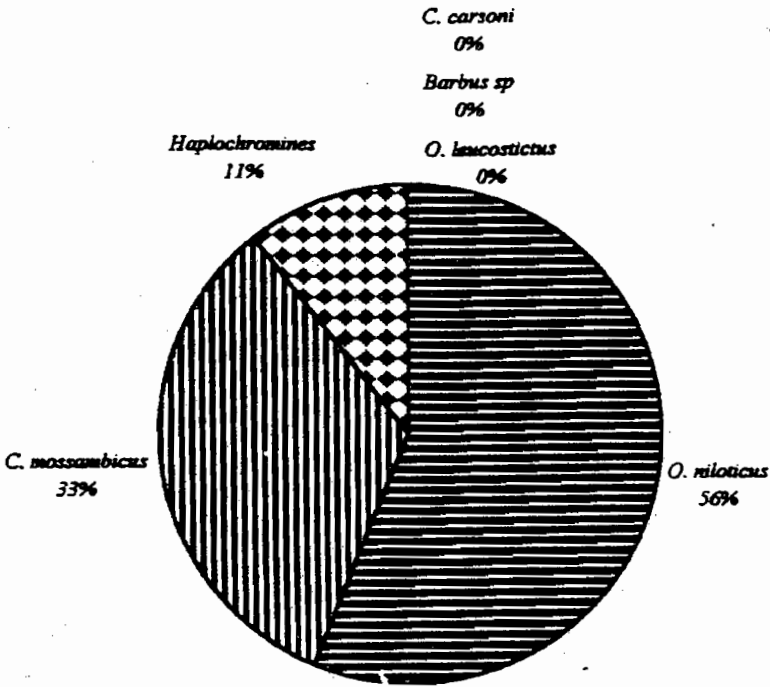
Rough estimates of size at first maturity and size at which different fish species are mature on Kisoro Minor Lakes.

Lake	Species	Size at first maturity cm TL	Size at which all fish are mature cm TL
Chahafi	Mirror carp	26 - 27	34
	Bambala (<i>O. leucostictus</i>)	15 - 16	19
	<i>C. carsoni</i>	12 - 13	16
Kayumbu	Nile tilapia (<i>O. niloticus</i>)	17 - 18	20
Mulehe	Nile tilapia (<i>O. niloticus</i>)	17	18 - 20
	<i>C. carsoni</i>	15 - 16	18
Mutanda	<i>Astetoreochromis alluaudi</i> (Nkejje)	-	14

Fig. 2a. Percentage Contribution of different Fish species by Fresh weight in Experimental gill net catches of 1" - 5" mesh size on lakes Chahafi and Kayumba period 1998/9.



Mulehe



Mutanda

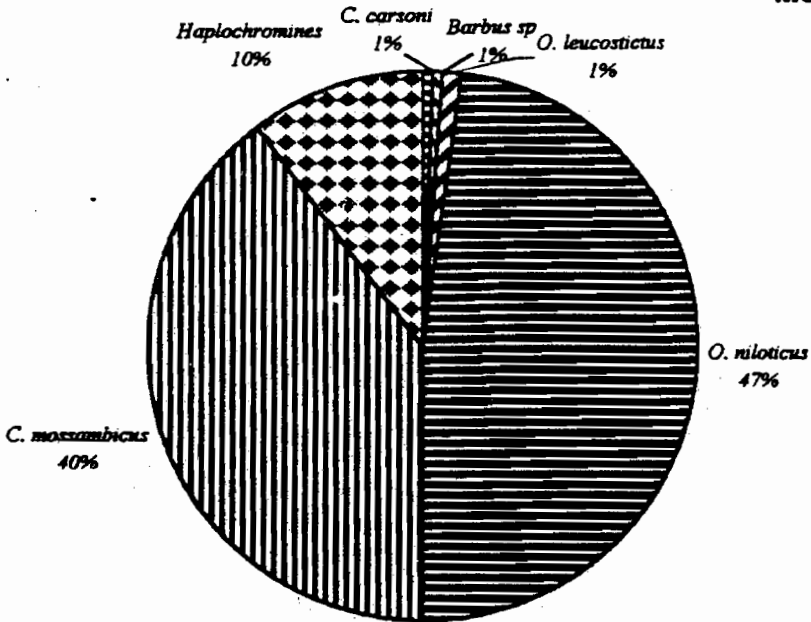


Fig. 2b. Percentage Contribution of different Fish species by Fresh weight in Experimental gill net catches of 1" - 5" mesh size on lakes Chahafi and Kayumba period 1998/9.

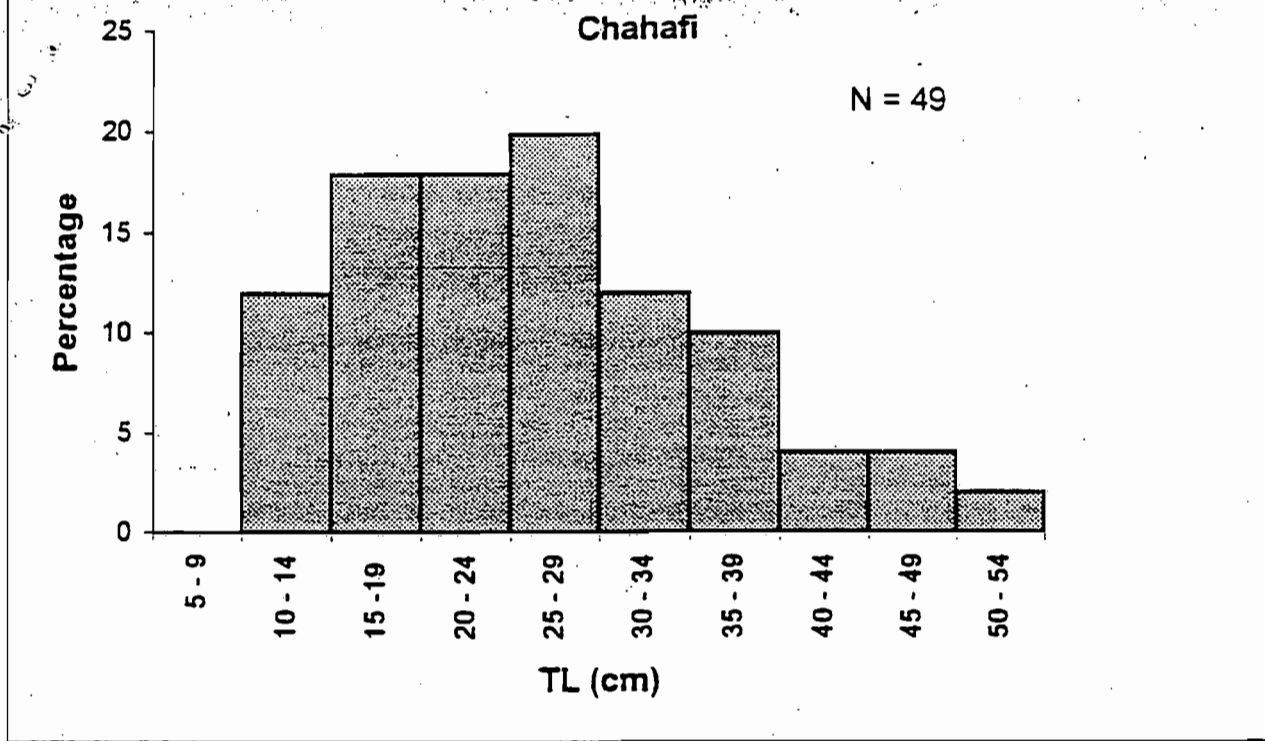


Fig. 3 Length Frequency Distribution of *Cyprinus carpio* (common carp) on Lake Chahafi 1998/9 using 5 cm groups

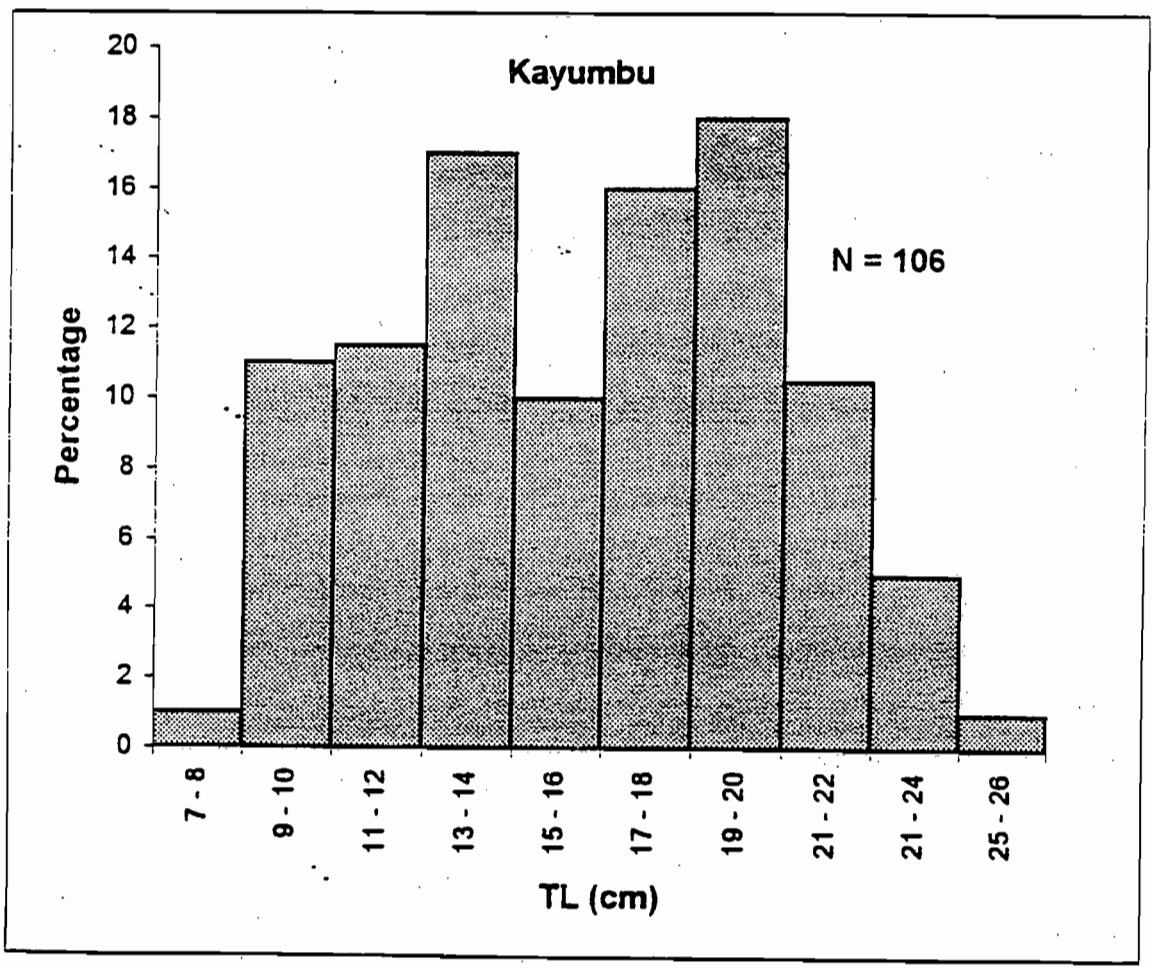


Fig. 4 Length Frequency Distribution of Nile Tilapia (*Oreochromis niloticus*) on Lake Kayumbu 1998/9 using 2 cm groups

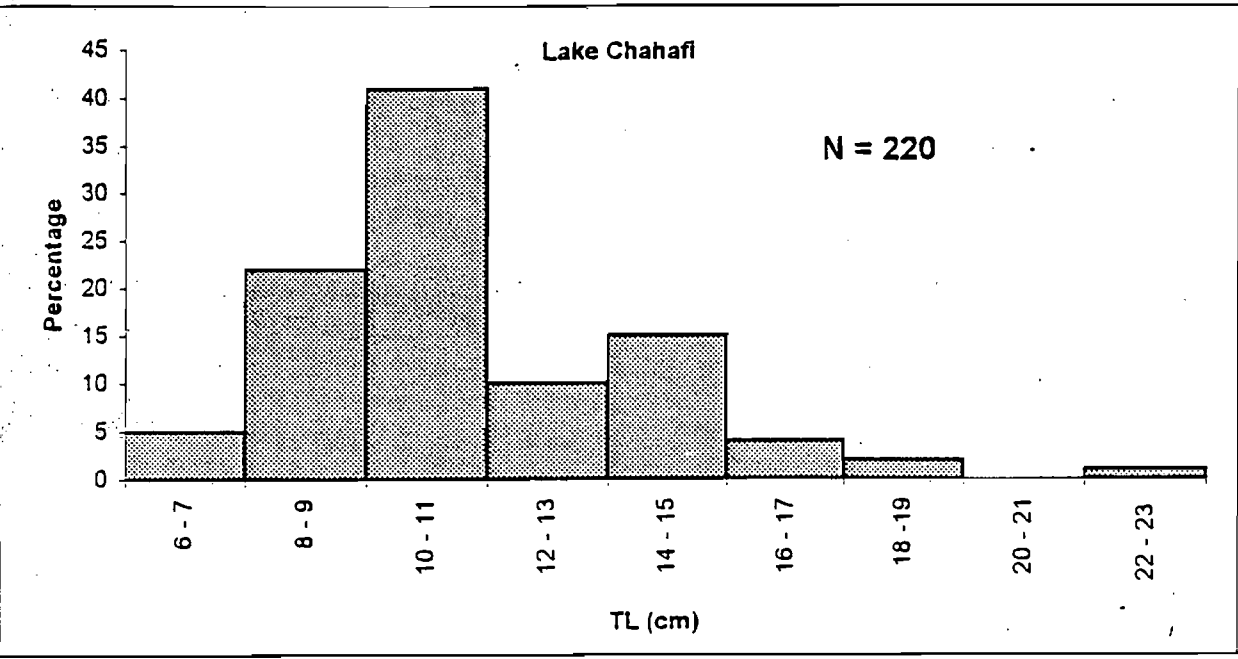


Fig. 5. Length Frequency Distribution of Bambala (*Oreochromis leucostictus*) on Lake Chahafi 1998/9 using 2 cm groups

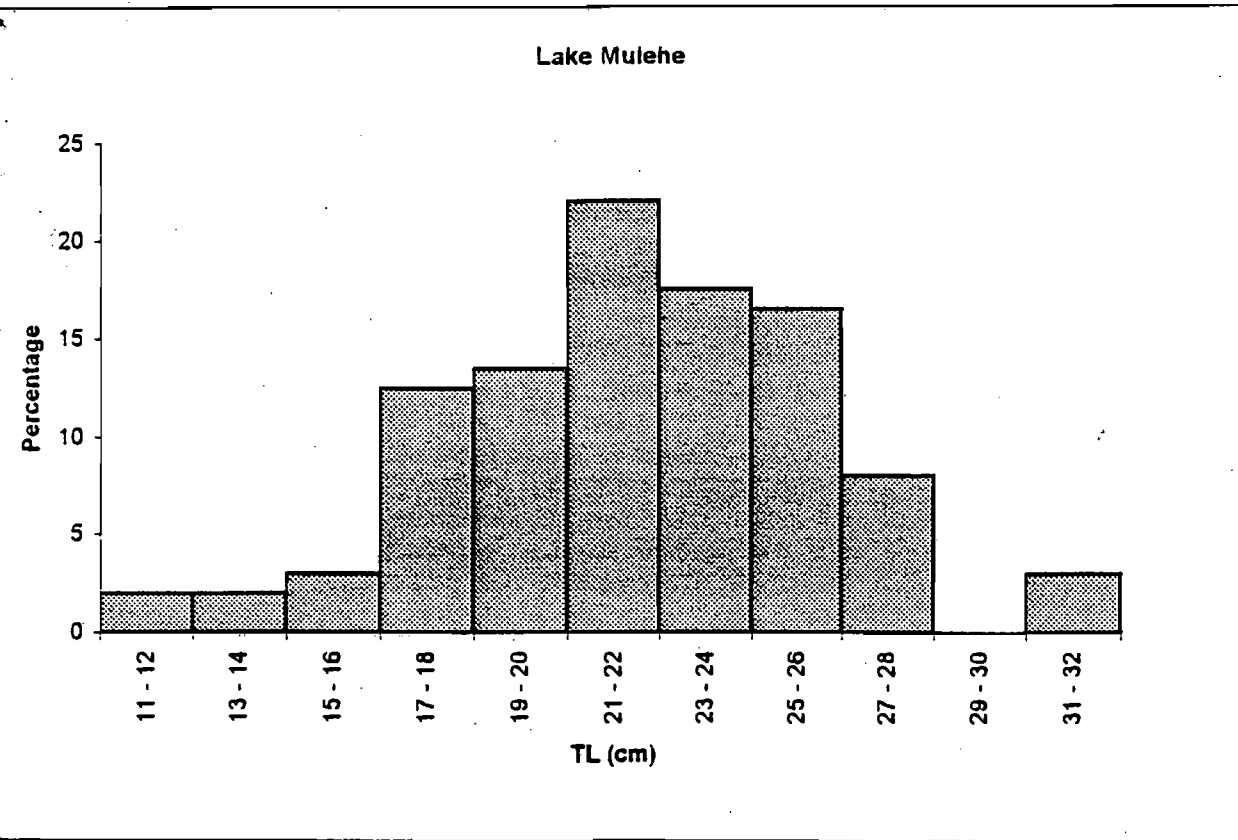


Fig. 6. Length Frequency Distribution of Nile Tilapia (*Oreochromis niloticus*) on Lake Mulehe 1998/9 using 2 cm groups

Lake Kayumbu

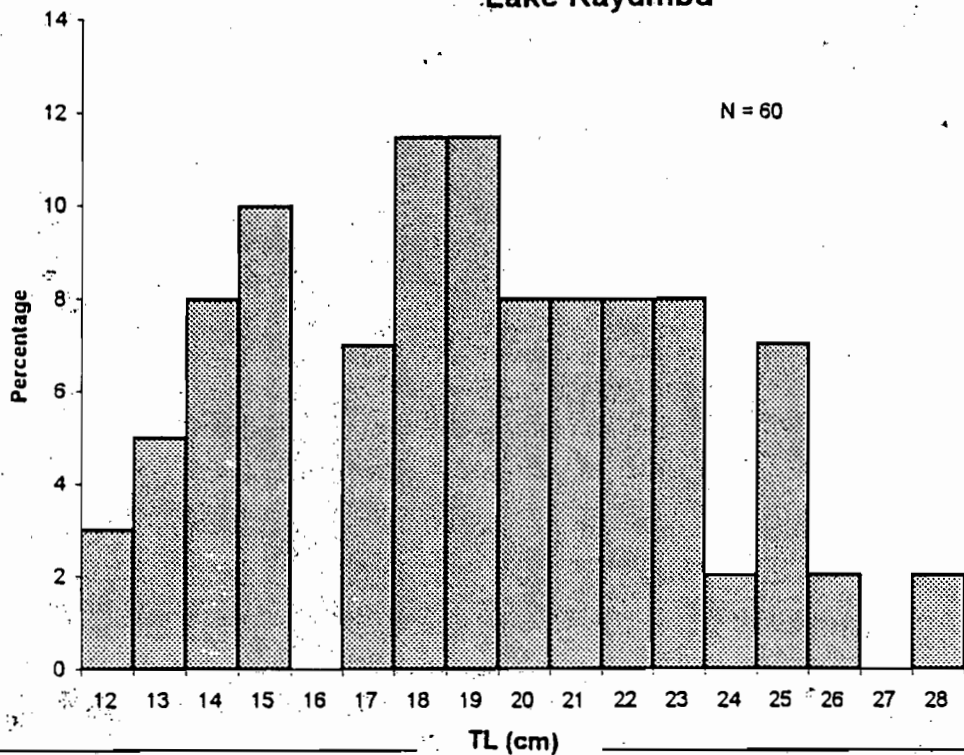


Fig. 7 Length Frequency Distribution of Nsonzi (*clarias carsoni*) caught by experimental gillnets of 1-5" mesh size on Lake Kayumbu 1998/9

Lake Mutanda

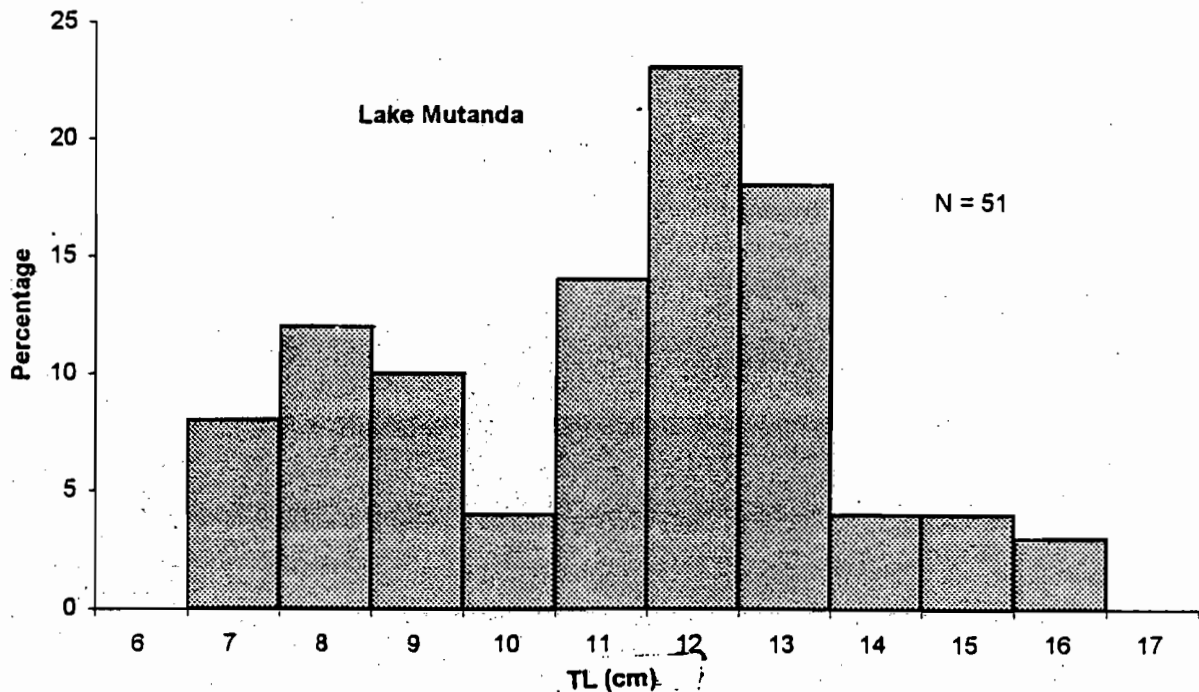


Fig. 8 Length Frequency Distribution of Nkeje (*Astatoreochromis alluaudi*) caught by experimental gillnets of 1" - 2" mesh size on Lake Mutanda 1998/9

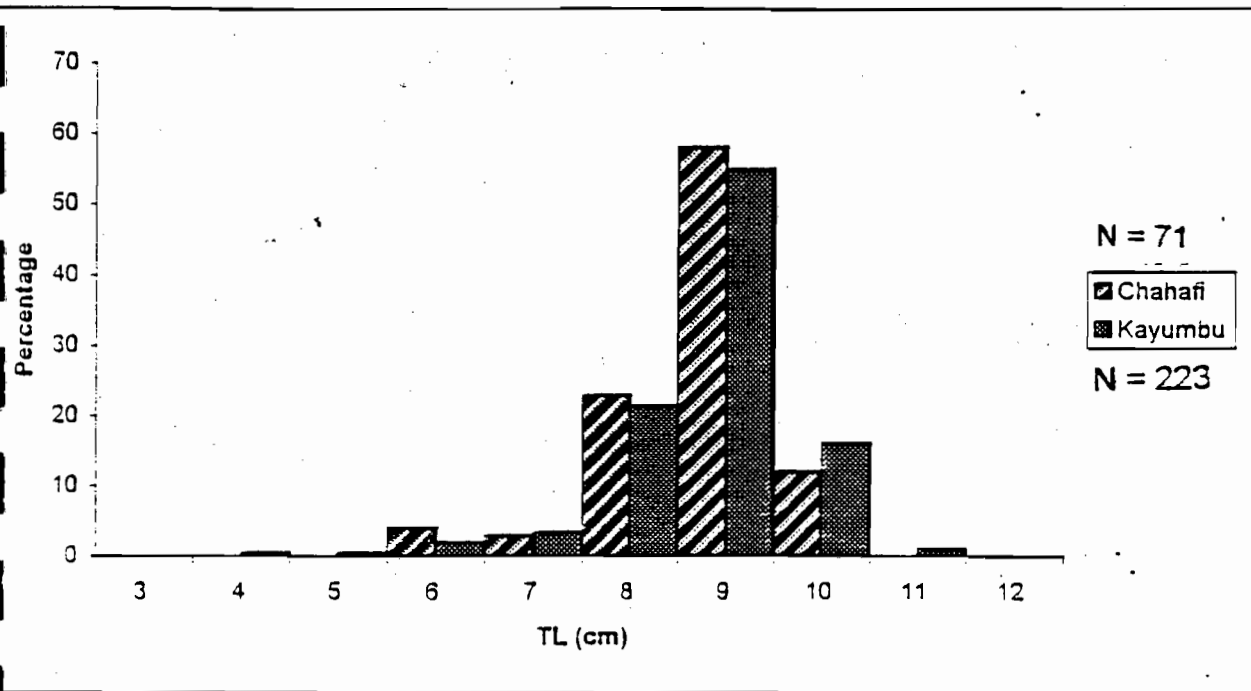


Fig. 9 Length Frequency distribution of *Barbus* sp caught by experimental gillnet
 mesh size nets of 1" - 1.5" on Lakes Chahafi and Kayumbu 1998/99