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DEPARTMENT OF NATIONAL PARKS AND WILDLIFE MANAGEMENT

1995 FISHERIES STATISTICS LAKE KARIBA - ZIMBABWE SHORE

PROJECT REPORT NO. 88

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1995 FISHERIES STATISTICS

LAKE KARIBA FISHERIES RESEARCH INSTITUTE

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30 June 1997.

RE: ERRATA: FISHERIES STATISTICS REPORT No. 88

Please find enclosed corrections on pages (ii) and 14 of the above report.

Mugwagwa

M. Mugwagwa
for: Officer In Charge

(A) Attach to report

LANDINGS SUMMARY

1. The Pelagic Fishery (Kapenta)

Basin	1994	1995
Sanyati	10216	7713
Bumi / Chalala	4961	3568
Sengwa	2295	1825
Binga & Mlibizi	1760	2174
Total	**19232**	**15280**

2. The Inshore Fishery

Area	Catch in tonnes	
	1994	1995
C1	48.10	50.65
C2	73.22	114.20
C3	14.35	8.60
C4	124.10	157.34
C5	91.73	92.13
C6	21.65	combined with C7
C7	15.10	29.55
Total enumerated	325.81	393.20
Total estimate	**986.94**	**1 175**

Grand total for Zimbabwe

15 280 (Kapenta) + 1 175 (inshore) + 7 816 (tigerfish bycatch) = 24 271 **tonnes**

Table 7 : Tigerfish by-catch (tonnes), 1974 - 1995

YEAR	AREA					TOTAL
	Sanyati	Bumi	Chalala	Sengwa	Binga / Mlibizi	
1974	18					18
1975	81					81
1976	91					91
1977	138					138
1978	129			1		130
1979	64	1		3	2	70
1980	41	1		2	5	49
1981	54	6	2	1	2	65
1982	44	3	1	1	1	50
1983	45	4	3	1	1	54
1984	22	2	2	-	1	27
1985	22	1	2	1	-	26
1986	40	2	19	3	3	67
1987	31	2	6	3	2	44
1988	8	1	3	1	2	15
1989	11	0.5	4	1	3	19.5
1990	14	0.5	4	3	5	26.5
1991	8	0	2	1	1	12
1992	8	1.4	1.1	1.1	2.8	13.7
1993	4.8	1.2		1.3	3	10.3
1994	12.1	3.2		2.1	1.8	19.2
1995	4	0.3		0.6	2.9	7.8

CONTENTS

THE PELAGIC (KAPENTA) FISHERY

Introduction

This section of the statistical report covers Kapenta catch records from the Zimbabwean part of Lake Kariba. Data are compiled from returns which the Kapenta fishing companies submit to Lake Kariba Fisheries Research Institute every month. Tiger fish landings are not accurate because the fishermen rarely submit all their catches to their employers. However, the recorded landings give a general trend.

Kapenta usually constitute about 90% of the total catch from Lake Kariba. However, within the last few years there has been a substantial increase in the incidence of theft and illegal sales from rigs. The scale of such illegal activities is difficult to quantify but we estimate that at least 20% of the total Kapenta catch is illegally sold before landing and thus not recorded. The figures of the Kapenta landings presented in the report must therefore be viewed as an underestimate of the total catch.

Kapenta fishing operations are based at 11 sites (Figure 1b). Of the 298 rigs registered to 72 companies in 1995, returns were received from 235 rigs which are assumed to have been operating. For statistical purposes, catches are recorded for the 5 hydrological basins namely Mlibizi, Binga, Sengwa, Bumi and Kariba (also known as Sanyati). The catches from Binga and Mlibizi are combined as the operators in these regions share common fishing grounds. Bumi and Chalala also use the same fishing grounds.

Operators are restricted to fishing in areas where water depth is greater than 20 metres and 3 km from developed areas along the shoreline. Fishing is not allowed in Leisure Bay, Charara Bay, Masango Bay, Gache Gache Bay and also in river mouths (Figure 1a).

There is a need for Kapenta operators to step up control and management of their employees in order to limit the scale of illegal sales and theft from rigs. Since the Kapenta fishermen, are fully responsible for their employees, they should consider coming together to form an independent Kapenta guard unit which operate at night to prevent thefts. The Department of National Parks and Wildlife Management could provide assistance to such a unit.

Figure 1a : Kapenta Fishing Zones (basins) on Lake Kariba

B1 & B2	- Binga / Mlibizi	:- from Mlibizi to Chete Gorge
B3	- Sengwa	:- from Chete Gorge to Sibilobilo Narrows
B4	- Bumi / Chalala	:- from Sibilobilo Narrows to a straight line joining Forthergill & Msambakaruma Islands
B5	- Sanyati	:- from a straight line joining Forthergill & Msambakaruma Islands to the Dam Wall
	- No fishing areas	

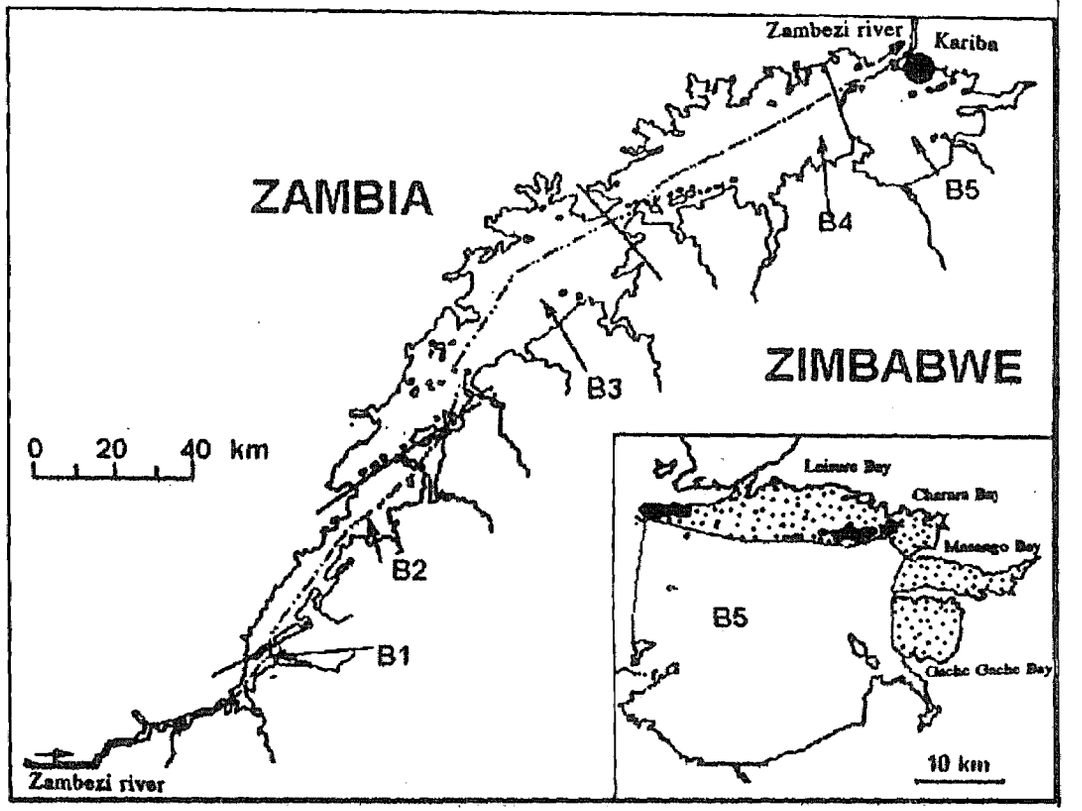

Figure 1b : Location of Kapenta fishing bases on Lake Kariba

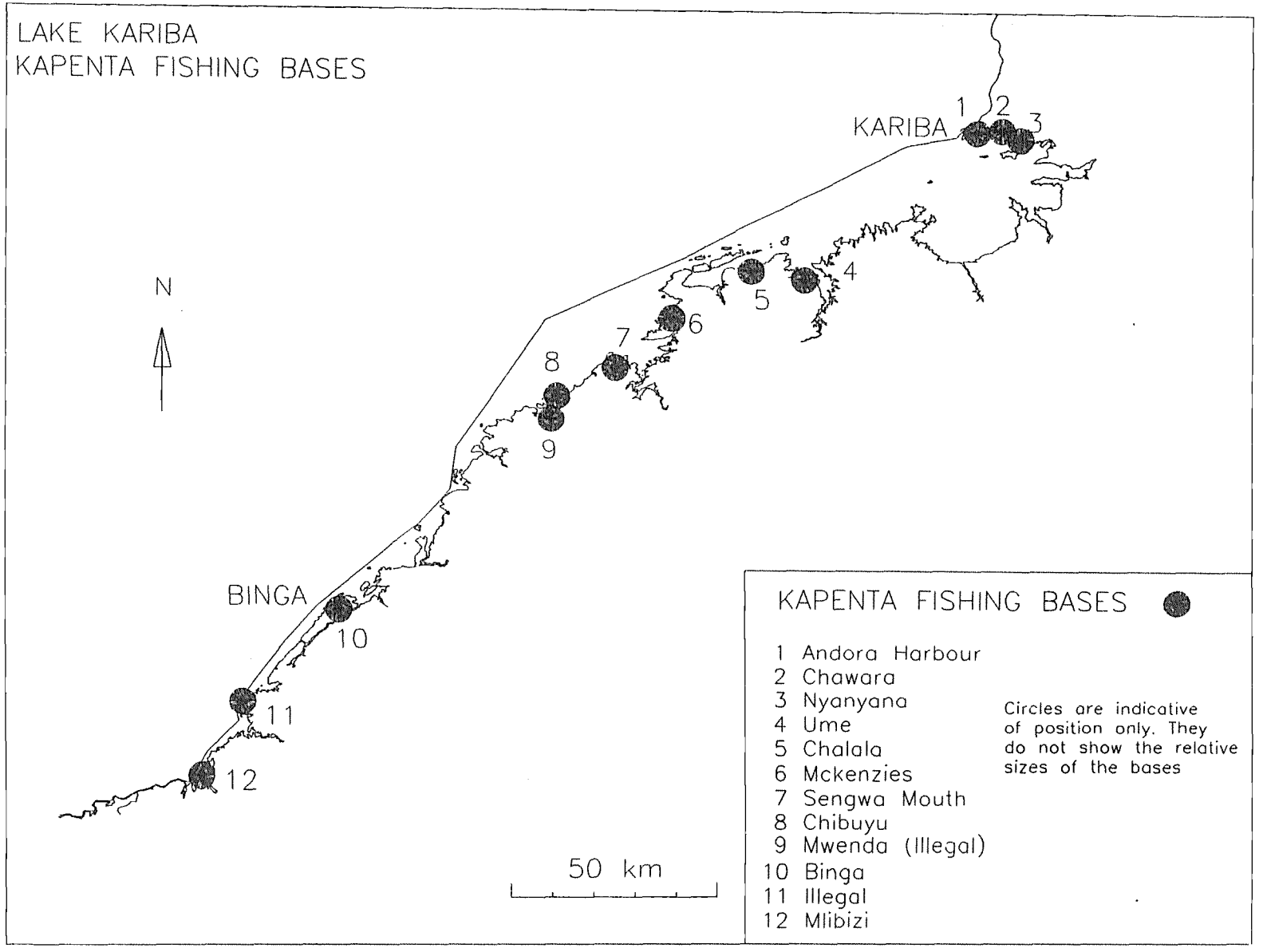

Figure 2a : Percentage of total Kapenta landings for each basin, 1995

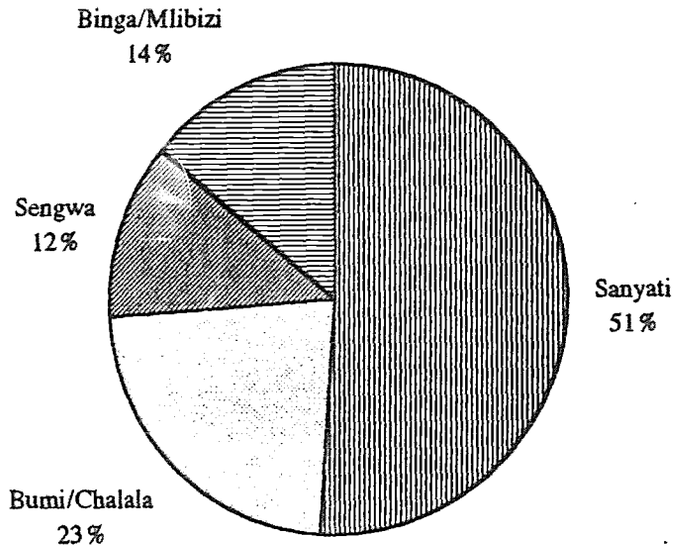

Figure 2b : Percentage of total number of rigs per basin, 1995

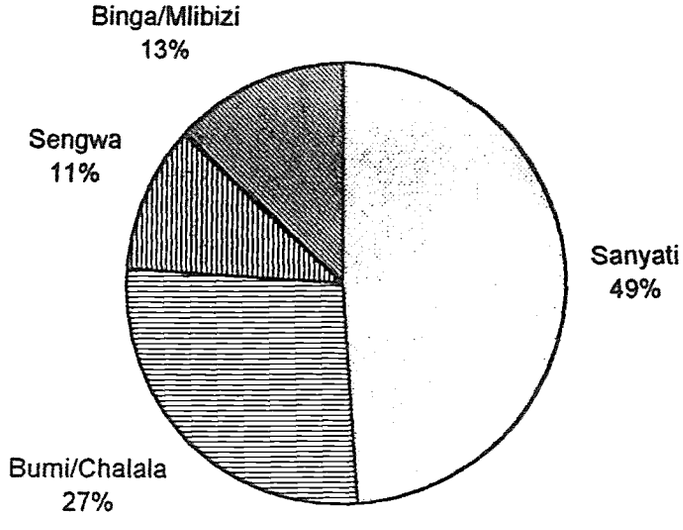

Figure 3 : Trends in the Kapenta fishery, 1974 - 1995 (CPUE; Catch; Effort)

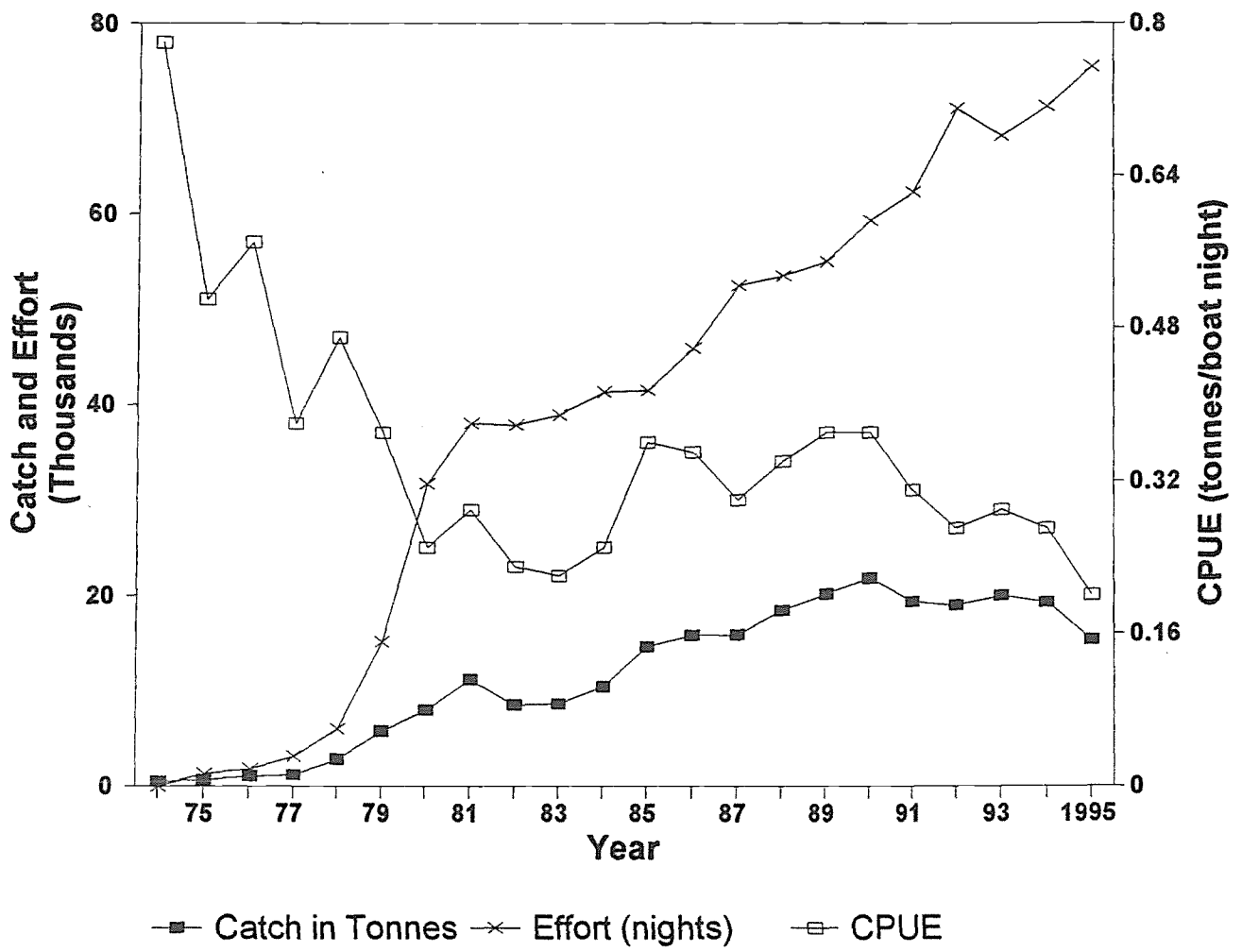

Table 1 : Landings (tonnes) of Kapenta, 1974 - 1995

YEAR	AREA					TOTAL
	Sanyati	Bumi	Chalala	Sengwa	Binga / Mlibizi	
1974	488					488
1975	656					656
1976	1050					1050
1977	1172					1172
1978	2770			35		2805
1979	5475	78	8	75	96	5732
1980	5938	173	1261	115	465	7952
1981	7408	285	2879	175	390	11137
1982	5249	234	2544	113	310	8450
1983	5590	170	2516	96	176	8548
1984	6286	305	3417	74	312	10394
1985	9179	338	4658	105	306	14586
1986	9077	369	4912	944	445	15747
1987	8194	288	4847	1832	662	15823
1988	8799	186	5975	2513	893	18366
1989	10199	146	6036	2438	1293	20112
1990	11143	194	5977	2692	1752	21758
1991	9867	92	4893	2714	1740	19306
1992	10371	4620		2279	1660	18937
1993	10690	5330		2139	1794	19958
1994	10216	4961		2295	1760	19232
1995	7713	3568		1825	2174	15280

Figure 4 : Trends in the Kapenta fishery by basin, 1979 to 1995

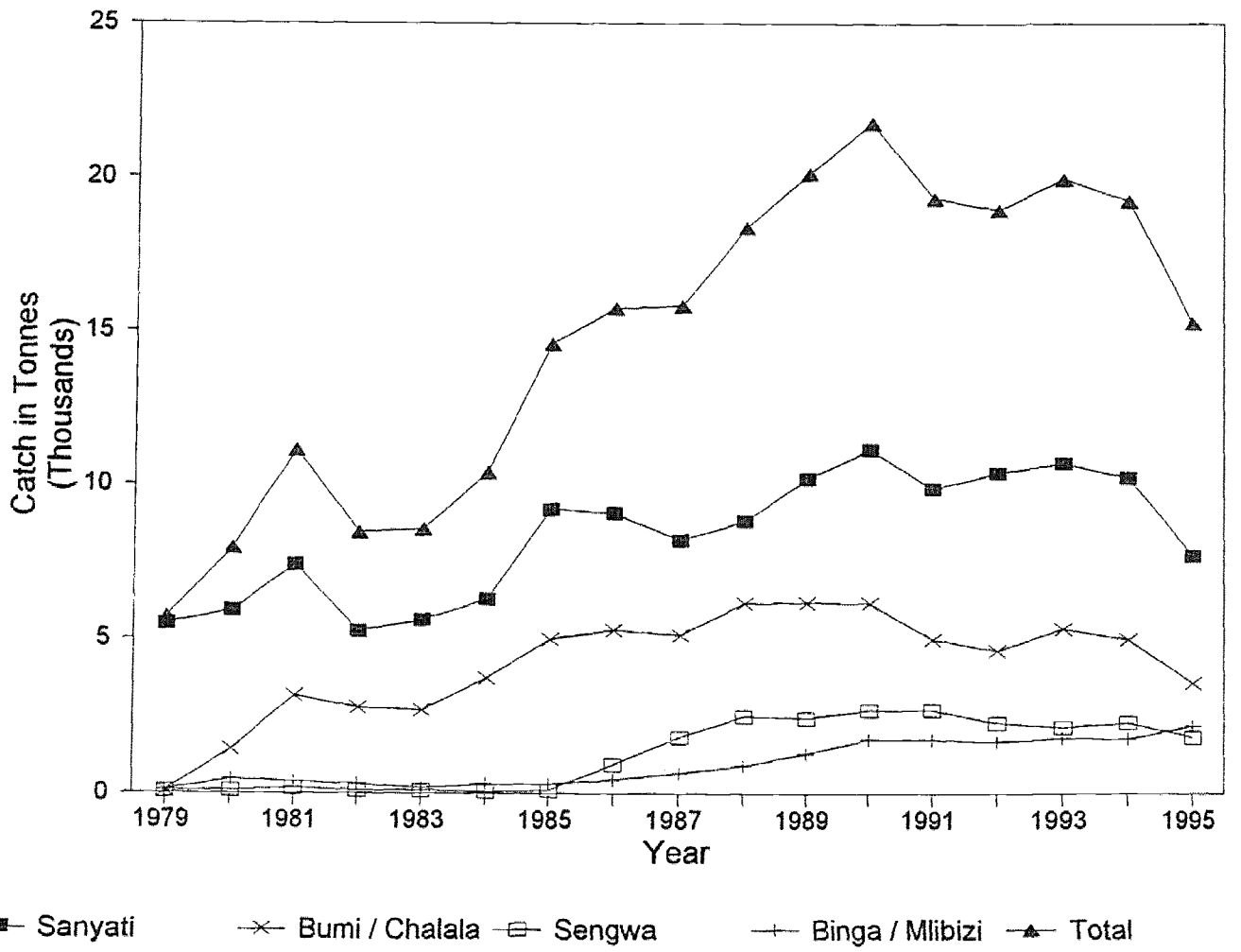

Table 2 : Total effort (unit night) in the Kapenta fishery, 1974 - 1995

YEAR	AREA					TOTAL
	Sanyati	Bumi	Chalala	Sengwa	Binga / Mlibizi	
1974	616					616
1975	1298					1298
1976	1833					1833
1977	3114					3114
1978	5877			96		5973
1979	14003	195	43	324	543	15108
1980	22775	789	6046	586	1551	31747
1981	24393	1770	9953	668	1188	37972
1982	23816	1467	10560	539	1394	37776
1983	24481	1036	11643	642	1063	38865
1984	25112	1077	13253	499	1293	41234
1985	24245	1155	14319	449	1235	41403
1986	26153	1245	15140	1688	1564	45790
1987	29702	1410	15966	3544	1792	52414
1988	29501	1002	16120	4356	2424	53403
1989	28670	887	16716	4957	3689	45919
1990	31160	952	16854	5396	4831	59193
1991	33133	666	17255	6314	4840	62208
1992	37544	20053		7359	6109	71066
1993	37533	18883		5880	5859	68155
1994	36926	20395		8308	5620	71249
1995	37613	18678		9114	10038	75443

Table 3 : Monthly Kapenta catches (tonnes), 1995

YEAR	AREA				TOTAL
	Sanyati	Bumi / Chalala	Sengwa	Binga / Mlibizi	
January	668	299	134	143	1244
February	602	318	114	207	1241
March	727	275	86	265	1353
April	598	233	117	236	1184
May	505	243	149	186	1083
June	416	170	223	164	973
July	635	567	295	228	1725
August	942	474	253	249	1918
September	771	321	184	146	1422
October	718	243	114	106	1181
November	686	227	82	97	1092
December	445	198	74	147	864
Total	**7713**	**3568**	**1825**	**2174**	**15280**

Figure 5 : Monthly trends in Kapenta catches, 1995

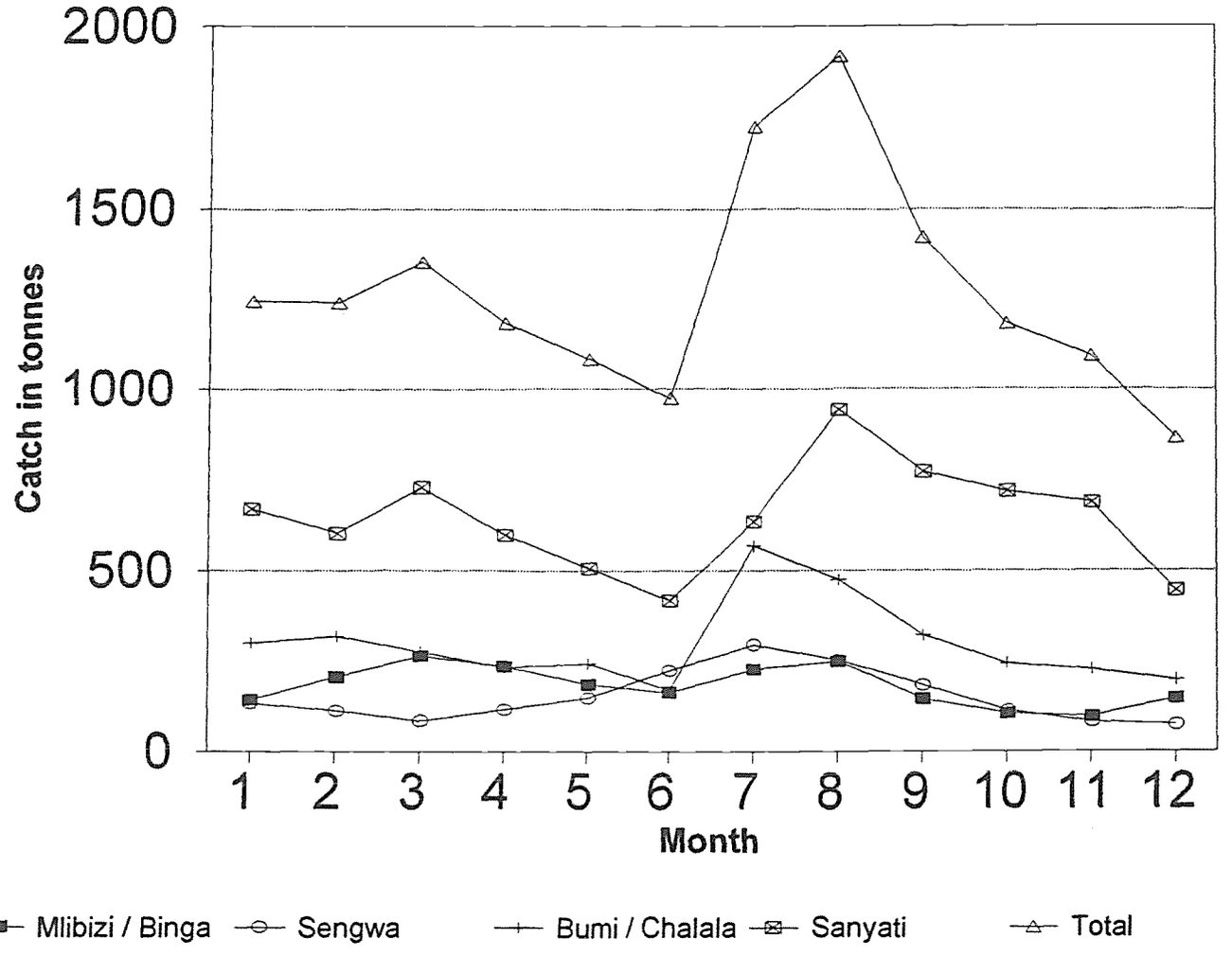

Table 4 : Mean catch per unit effort (tonnes/boat/night) of Kapenta, 1974 -1995

YEAR	AREA					TOTAL
	Sanyati	Bumi	Chalala	Sengwa	Binga / Mlibizi	
1974	0.78					0.78
1975	0.51					0.51
1976	0.57					0.57
1977	0.38					0.38
1978	0.47				0.36	0.47
1979	0.34	0.40	0.19	0.26	0.18	0.37
1980	0.26	0.22	0.21	0.20	0.31	0.25
1981	0.30	0.17	0.29	0.26	0.23	0.29
1982	0.22	0.16	0.25	0.21	0.24	0.23
1983	0.23	0.16	0.22	0.18	0.17	0.22
1984	0.25	0.28	0.26	0.17	0.24	0.25
1985	0.40	0.36	0.30	0.23	0.27	0.36
1986	0.35	0.26	0.36	0.53	0.30	0.35
1987	0.26	0.15	0.30	0.50	0.36	0.30
1988	0.29	0.19	0.37	0.58	0.37	0.34
1989	0.36	0.16	0.36	0.49	0.35	0.37
1990	0.36	0.20	0.35	0.50	0.36	0.37
1991	0.29	0.13	0.28	0.43	0.35	0.31
1992	0.27	0.23		0.36	0.27	0.27
1993	0.28	0.28		0.36	0.30	0.29
1994	0.28	0.24		0.28	0.31	0.27
1995	0.22	0.19		0.2	0.22	0.2

Table 5 : Monthly fishing effort (boat night) for Kapenta, 1995

MONTH	AREA					TOTAL
	Mlibizi	Binga	Sengwa	Bumi / Chalala	Sanyati	
January	117	551	827	1702	3116	6313
February	113	578	765	1660	2929	6045
March	154	623	741	1713	3374	6605
April	143	663	777	1538	3105	6226
May	150	749	768	1665	3182	6514
June	141	749	732	1815	3104	6541
July	156	724	805	1815	3236	6736
August	149	831	805	1670	3265	6720
September	150	710	768	1597	3269	6494
October	145	773	780	1462	3397	6557
November	147	721	661	1304	2912	5745
December	84	835	707	1244	2724	5594
Total	1649	8507	9136	19185	37613	76090

Table 6 : Monthly tigerfish by-catch in kilograms (from Kapenta rigs), 1995

MONTH	AREA				TOTAL
	Sanyati	Bumi / Chalala	Sengwa	Binga / Mlibizi	
January	776	44	56	219	1095
February	771	20	77	323	1191
March	338	41	43	319	741
April	458	45	25	256	784
May	224	32	29	538	823
June	111	13	22	275	421
July	148	11	41	124	324
August	277	12	85	145	519
September	303	7	145	109	564
October	321	53	74	219	667
November	194	5	41	252	492
December	98	3	20	74	195
Total	**4019**	**286**	**658**	**2853**	**7816**

Figure 6 : Monthly trends in tigerfish by-catch, 1995

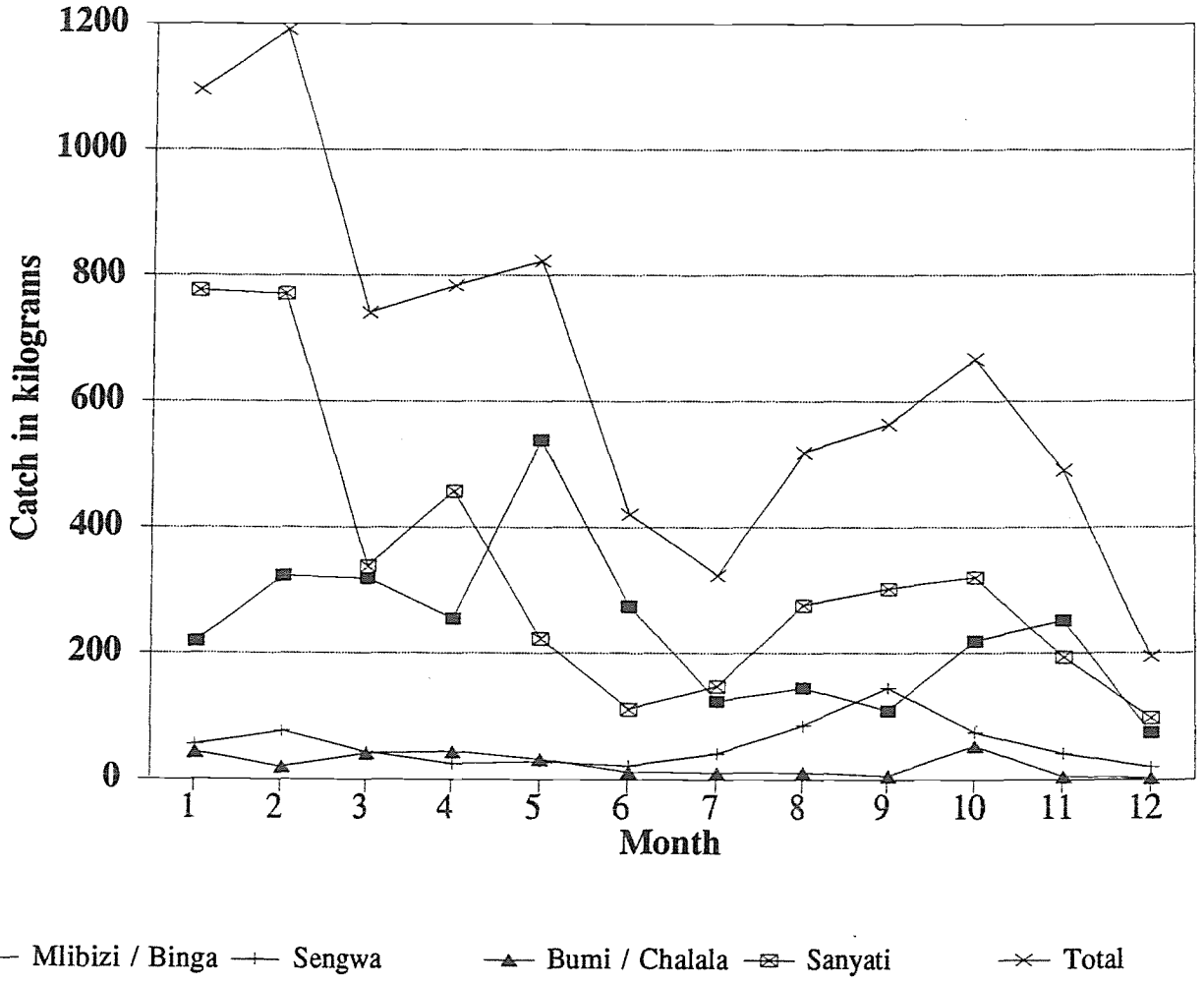

Table 7 : Tigerfish by-catch (tonnes) , 1974 - 1995

YEAR	AREA					TOTAL
	Sanyati	Bumi	Chalala	Sengwa	Binga / Mlibizi	
1974	18					18
1975	81					81
1976	91					91
1977	138					138
1978	129			1		130
1979	64	1		3	2	70
1980	41	1		2	5	49
1981	54	6	2	1	2	65
1982	44	3	1	1	1	50
1983	45	4	3	1	1	54
1984	22	2	2	-	1	27
1985	22	1	2	1	-	26
1986	40	2	19	3	3	67
1987	31	2	6	3	2	44
1988	8	1	3	1	2	15
1989	11	0.5	4	1	3	19.5
1990	14	0.5	4	3	5	26.5
1991	8	0	2	1	1	12
1992	8	1.4	1.1	1.1	2.8	13.7
1993	4.8	1.2		1.3	3	10.3
1994	12.1	3.2		2.1	1.8	19.2
1995	4	0.3		0.6	3	7.9

THE INSHORE FISHERY

Sampling in the Inshore Fishery

The sampling system in use has been designed to provide a statistically valid catch estimation for the whole of the Zimbabwe inshore fishery on Lake Kariba. Whereas the Kapenta data represent total actual landed catches. Data from the artisanal fishery are from sampled catches. Thus all figures presented for the artisanal fishery are estimates. The exceptions are the data from Nyaodza , Gache Gache and Luyando co-operatives which submit returns for the whole year reflecting the actual total landings. The fishing areas are divided into 7 zones, C1 to C7 (Figure 7) thus all areas and all basins are represented. The fishing activities are simplified because there is only one type of gear (gill-nets) used throughout the whole inshore fishery of Zimbabwe.

The Kapenta, which occupy the open pelagic waters of the lake represent a unit stock which is harvested by both Zimbabwe and Zambia; whereas the artisanal fishery exploits inshore species which, in general , occupy water less than 10m deep along the shoreline. The Zambian and Zimbabwean inshore fisheries may therefore be considered to be exploiting two separate stocks. The inshore fishery of Zambia therefore has no influence upon the inshore fishery of Zimbabwe and vice versa.

As it is not possible to sample all villages nor the total landings for any particular village for the whole year, 10 representative villages are enumerated for 10 days every month. The sampled catch is raised to an estimate of the total catch per village by multiplying by the ratio between total number of days sampled and days in the year. To estimate the total catch for the Zimbabwean side of the lake, the ratio between the number of fishermen in the villages sampled and the total number of fishermen on the Zimbabwean side of the lake is used.

The above calculations make the assumption that fishing takes place on 360 days and that the catchability of the species is the same throughout the whole lake. It is also assumed that the number of active fishermen per village is approximately the same through out the year.

National Parks regulations state that each fisherman is allowed a maximum of 5 gill-nets with a minimum mesh size of 100mm, and conformation to this regulation is assumed for catch effort calculations.

The main species in the inshore fishery are the breams *Oreochromis mortimeri, Sargochromis codringtonii, Tilapia rendalli;* the carp *Labeo altivelis;* the tigerfish *Hydrocynus vittatus;* the mormyrid *Mormyrus longirostris*; the barbel *Clarius gariepinus* and the squeaker *Synodontis zambezensis.*

Figure 7 : Location of Artisanal Fishing Villages

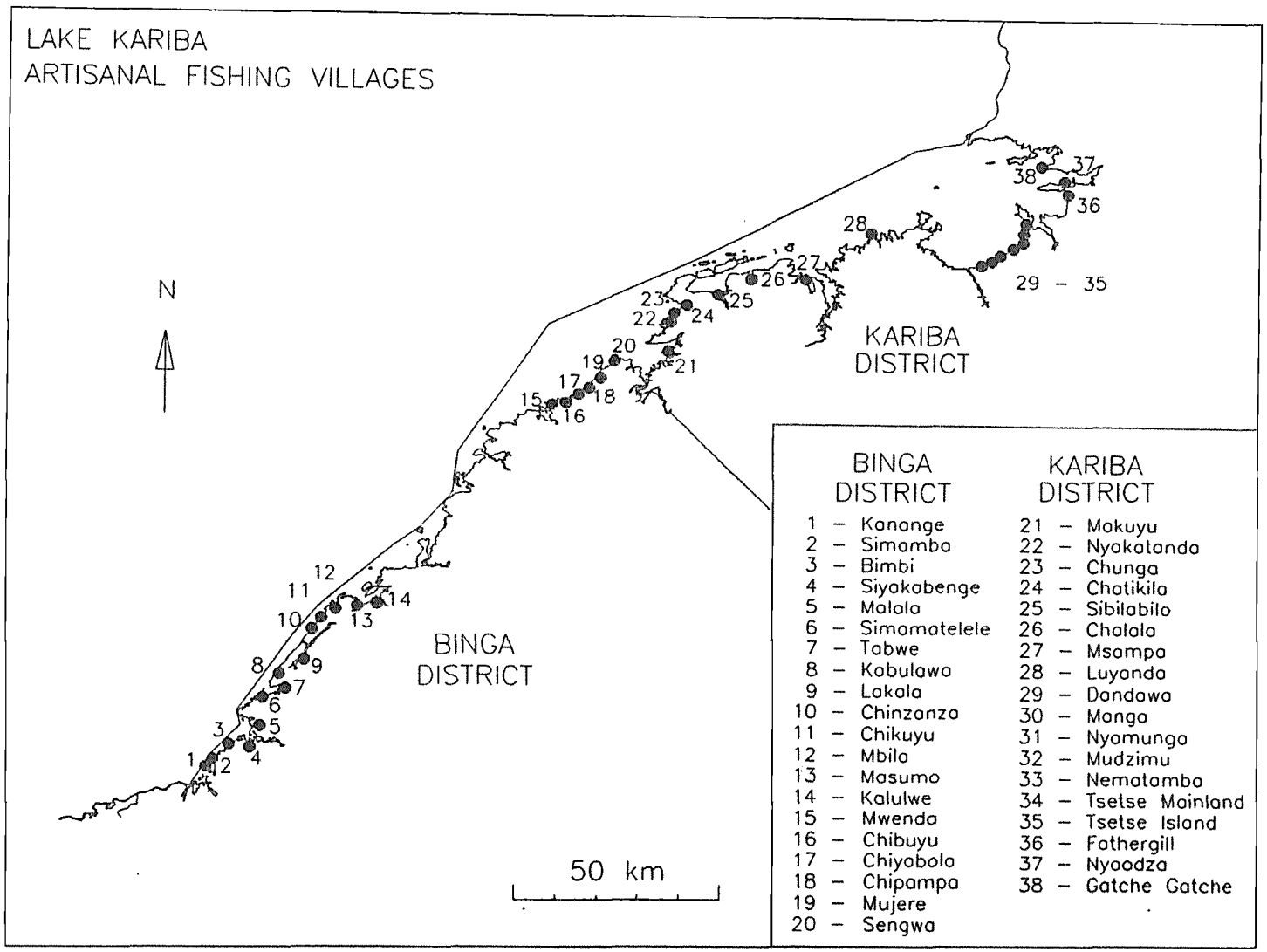

Table 8: Illustration of estimation of data in enumerated villages in Inshore Fishery

AREA A	CAMPCODE B	CAMPNAME	TOTAL SAMPLED CATCH in tonnes C	TOTAL SAMPLED EFFORT *(no of nets x 45m)* D	CPUE for sample (c/d) kg/100m E	TOTAL FISHERMEN (FROM FRAME SURVEY 1993) F	TOTAL SAMPLED DAYS G	ESTIMATED TOTAL CATCH (C X 360/G)	ESTIMATED TOTAL EFFORT (D X 360/G)
C2	6	Nematombo	6.07	84 150	7.2	38	70	31.2	432 771
	7	Mudzimu	2.13	31 905	6.7	11	60	12.8	191 430
	10	Dandawa	21.44	358 875	6.0	79	110	70.2	1 174 500
C4	12	Musamba	43.53	310 095	14.0	68	120	130.6	930 285
	14	Sibilobilo	3.72	112 905	3.3	55	50	26.8	812 916
C5	19	Makuyu	10.78	448 650	2.4	31	80	48.5	2 018 925
	22	Mujere	12.11	355 725	3.4	58	100	43.6	1 280 610
C6	43	Kalulwe	3.54	181 215	2.0	38	70	18.2	499 284
C7	39	Simambo	1.57	69 345	2.3	22	50	11.3	931 963
TOTAL			104.90	3 189 960	5.4	400	710	393.2	8 272 984

The actual total catch for co-op returns in area C1 & C3 is 59.25t and estimated total catch for enumerated villages is 393.20 tonnes. The total estimate for the whole lake is $393.20 \times \frac{\text{Total fishermen for the whole lake + (co-op Catches)}}{\text{Number of fishermern in the above villages}} = 393.20 \times \frac{1135}{400} + 59.25 = 1175\text{t}$

Table 9 : Estimated Catch and effort summary for enumerated villages, 1995

Village	Effort (metres)	Catch (tonnes)	CPUE (KG/100M)
Gache Gache co-op	665 820	43.96	6.60
Nyaodza co-op	299 700	6.69	2.23
Nematombo	432 771	31.24	7.22
Mudzimu	191 430	12.81	6.69
Dandawa	1 174 500	70.16	5.97
Luyando co-op	271 575	8.60	3.17
Musamba	930 285	13.06	14.04
Sibilobilo	812 916	26.75	3.29
Makuyu	2 018 925	48.53	2.40
Mujere	1 280 610	43.60	3.40
Kalulwe	931 963	18.23	1.96
Simambo	499 284	11.33	2.27
Total	**9 509 779**	**452.48**	**4.76**

All co-operatives in the above table are showing the actual sampled catch and effort data.

Table 10 : Estimated catch composition for 1995 based on enumerated villages

Species Name	Percentage %	Estimated catch in tonnes
O. mortimeri	11	43.30
H. vittatus	38	149.40
C. gariepenus	4	15.70
M. longirostris	8	31.50
S. codringtonii	11	43.30
T. rendalli	2	7.90
L. altivelis	17	66.80
S. macrocephalus	1	3.90
M. anguilloides	3	11.8
Others	5	19.70
Total	**100**	**393.20**

Figure 8a : Percentage catch per area of total landings in the Inshore Fishery, 1995

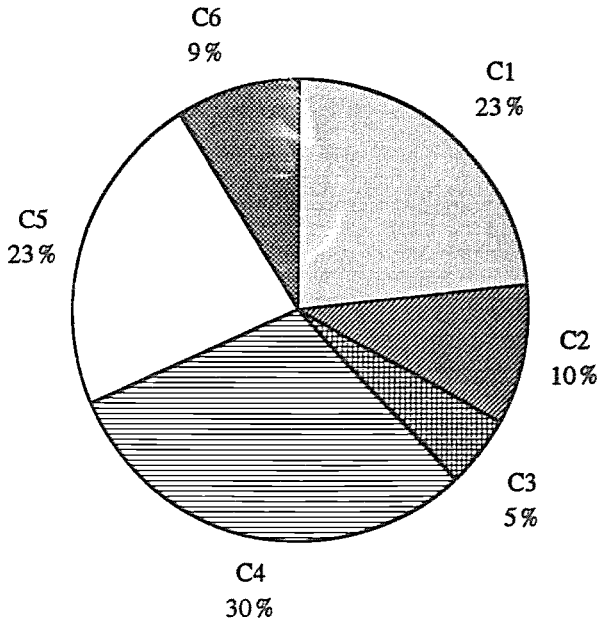

Figure 8b : Catch proportions of different species caught in the Inshore area

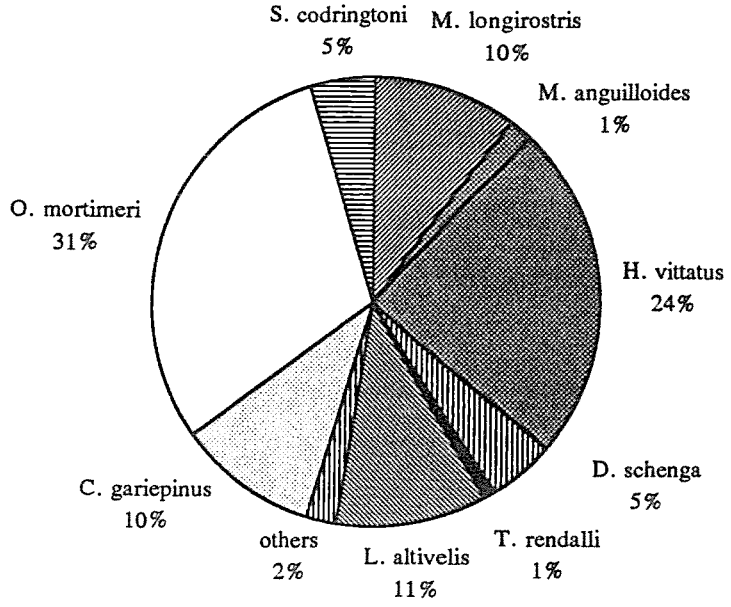

Figure 9 : Species composition of Inshore landings (%kg) by area

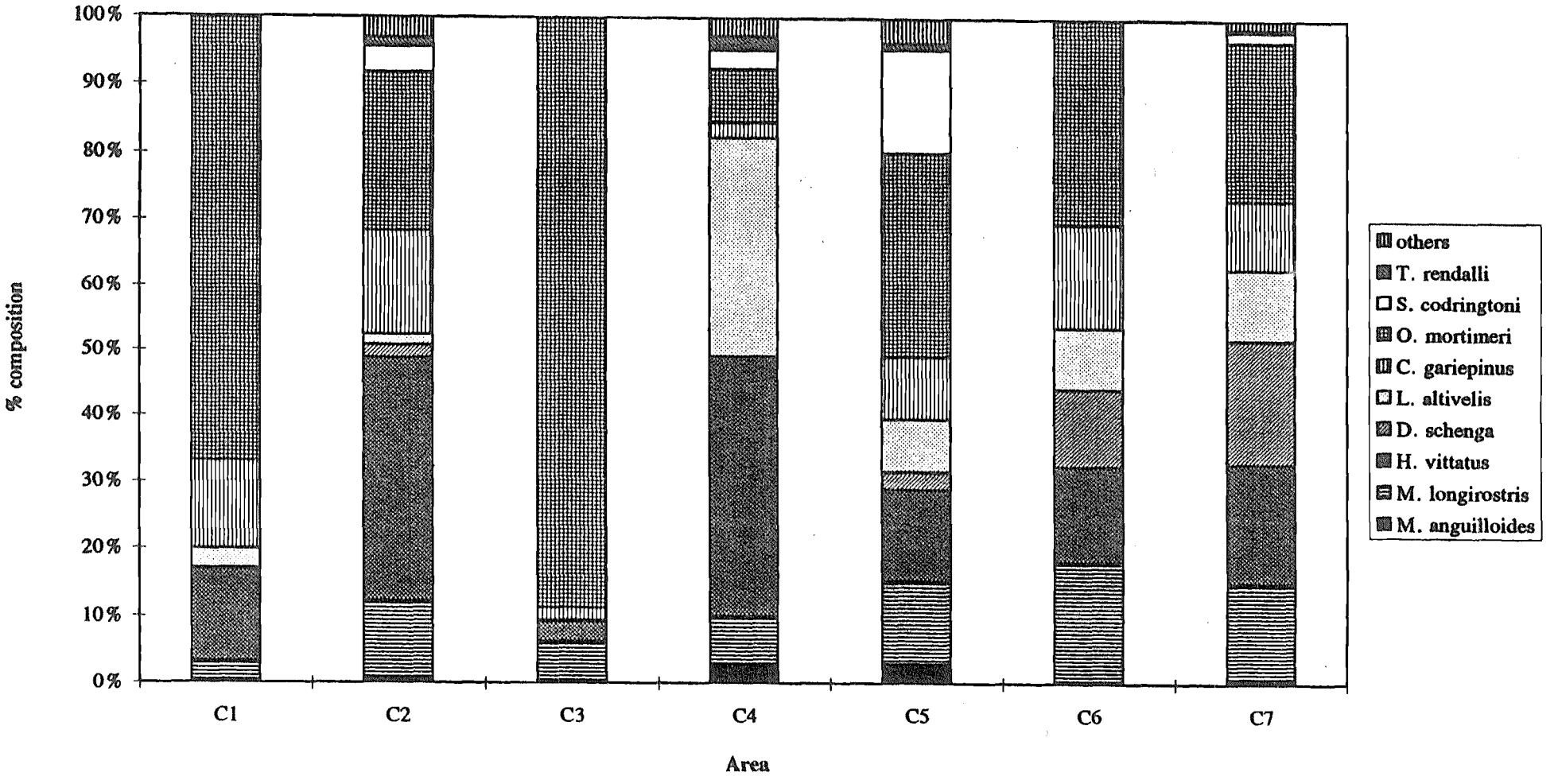

Table 11 : Catch and Effort for Gache Gache Co-operative Society, 1985-1995

Year	Total catch (tonnes)	Effort (metres)	CPUE (kg/100m)
1985	71.70	2591639	2.76
1986	69.46	1636286	4.24
1987	66.68	3884326	1.71
1988	56.41	1526070	3.69
1989	63.74	125206	5.09
1990	57.63	973573	5.91
1991	38.15	1143188	3.33
1992	27.37	821730	3.33
1993	37.56	669150	5.61
1994	26.82	852480	3.15
1995	43.97	665820	6.60

Table 12 : Catch and Effort for Nyaodza Co-operative Society, 1987 to 1995

Year	Total catch (tonnes)	Effort (metres)	CPUE (kg/100m)
1987	44.31	2198277	2.01
1988	16.88	4312950	3.91
1989	21.21	591000	3.58
1990	28.92	449587	6.43
1991	31.19	393120	7.93
1992	16.77	594559	2.82
1993	14.29	609820	2.34
1994	21.28	505575	4.21
1995*	6.69	299700	2.23

* Recorded up to May only.

Table 13 : Catch and Effort for Area C1, 1973 to 1995

Year	Effort (metres)	Total catch (tonnes)	CPUE (kg/100m)
1973	4245514	87.77	2.07
1974	4067000	171.12	4.21
1975	5823454	216.14	3.71
1976	4693325	184.89	3.94
1977	2585583	100.17	3.87
1978	4232470	178.57	4.22
1979	3604010	168.15	4.67
1980	3435068	97.37	2.83
1981	2919457	72.17	2.47
1982	2614889	86.99	3.33
1983	3553053	77.73	2.19
1984	4459223	51.55	1.16
1985	2690008	29.9	1.11
1986	1730367	26.11	1.51
1987	2005549	129.15	6.44
1988	2420193	143.35	5.92
1989	2236510	112.77	5.04
1990	1890355	112.55	5.95
1991	1958094	96.91	4.95
1992	1723204	62.91	3.65
1993	1278970	51.85	4.05
1994	1358055	48.1	3.54
1995	965520	50.65	5.25

Table 14 : Catch and Effort for Area C2, 1973 to 1995

Year	Effort (metres)	Total catch (tonnes)	CPUE (kg/100m)
1973	6054815	199.04	3.29
1974	8699007	277.67	3.19
1975	9012427	311.97	3.46
1976	6745253	20.79	3.42
1977	8235006	234.84	2.85
1978	9856397	340.51	3.45
1979	no records	no records	no records
1980	5433118	187.98	3.46
1981	6050384	168.6	2.79
1982	5436199	164.06	3.02
1983	2540788	170.18	6.7
1984	4703577	417.03	8.87
1985	3321195	226.01	6.81
1986	2671602	255.45	9.56
1987	323340	274.01	8.5
1988	2443409	242.02	9.91
1989	2691484	257.55	9.57
1990	1545481	244.46	15.82
1991	1794358	203.81	11.36
1992	1265580	87.64	6.92
1993	1760936	124.9	7.09
1994	1104300	73.22	6.63
1995	1798701	114.20	6.35

Table 15 : Catch and Effort for Area C3, 1973 to 1995

Year	Effort (metres)	Total catch (tonnes)	CPUE (kg/100m)
1973	3456725	97.18	2.81
1974	3473470	124.48	3.58
1975	3389575	78.13	2.3
1976	3079440	80.2	2.6
1977	2489851	75.35	3.03
1978	2616114	120	4.59
1979	2000135	119.73	5.99
1980	2452951	101.11	4.12
1981	2091404	66.77	3.19
1982	1642321	50.4	3.06
1983	1530166	37.43	2.44
1984	11503152	21.85	0.19
1985	13333335	16.3	1.22
1986	1180508	22.73	1.93
1987	599099	26.39	4.41
1988	2256450	193.08	8.56
1989	384749	34.93	9.07
1990	510048	30.63	6.01
1991	444296	35.35	7.73
1992	475476	31.83	6.69
1993	332317	20.74	6.24
1994	533475	14.5	2.69
1995*	271575	8.60	3.17

* Recorded up to July only.

Table 16 : Catch and Effort for Area C4, 1973 to 1995

Year	Effort (metres)	Total catch (tonnes)	CPUE (kg/100m)
1973	1551514	77.15	4.97
1974	1535458	84.21	5.48
1975	736212	58.29	7.92
1976	429982	31.92	7.42
1977	no records	no records	no records
1978	1291114	63.86	4.95
1979	no records	no records	no records
1980	1090772	66.59	6.1
1981	2063793	99.72	4.83
1982	1928563	78.58	4.07
1983	1001906	71.48	7.13
1984	1058426	54.03	5.1
1985	701275	110.01	15.69
1986	619018	709.28	17.65
1987	958678	143.52	14.97
1988	2256450	193.09	8.56
1989	1587782	198.33	12.49
1990	1108323	159.83	14.42
1991	1690667	152.98	9.04
1992	1594995	139.59	8.75
1993	1399595	159	11.36
1994	1768961	124.1	7.02
1995	1743201	157.34	9.03

Table 17 : Catch and Effort for Area C5, 1973 to 1995

Year	Effort (metres)	Total catch (tonnes)	CPUE (kg/100m)
1973	3840473	94	2.45
1974	3961230	107	2.7
1975	no records	no records	no records
1976	1094730	70	6.39
1977	no records	no records	no records
1978	no records	no records	no records
1979	no records	no records	no records
1980	574756	100	17.4
1981	21224842	177	8.33
1982	2131082	106	4.97
1983	3078396	83	2.7
1984	7385335	75	1.02
1985	2572756	80	3.11
1986	3985620	94	2.36
1987	1006188	41	4.07
1988	135117	42	3.12
1989	3078394	112	3.64
1990	718900	88	12.24
1991	1112908	78	7.01
1992	2285092	140.98	6.17
1993	935972	96.9	10.35
1994	1512998	91.73	6.06
1995	3299535	92.13	2.79

Table 18 : Catch and Effort for Area C6 and C7, 1973 to 1995

Year	Effort (metres)	Total catch (tonnes)	CPUE (kg/100m)
1989	176021	25.54	14.51
1990	no records	no records	no records
1991	219490	22.71	10.35
1992	306604	18.99	6.19
1993	953951	42.1	4.41
1994	1170612	36.75	3.14
1995	1431247	29.56	2.07