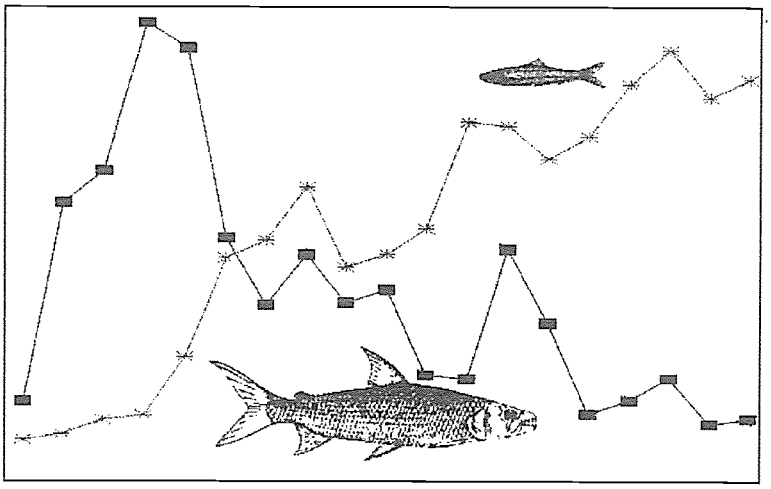
ISSN 1024-8188

DEPARTMENT OF NATIONAL PARKS AND WILDLIFE MANAGEMENT

1998 FISHERIES STATISTICS LAKE KARIBA - ZIMBABWE SHORE



PROJECT REPORT No. 95

By :

N. SONGORE, A. MOYO & M. MUGWAGWA
Lake Kariba Fisheries Research Institute
P. Bag 2075
Kariba
email: lkfri@id.co.zw

June 1999

Table Of Contents **Page**

1.0 Foreword iv

2.0 Introduction v

3.0 Landings Summary (Tons) vi

4.0 The Pelagic (Kapenta) Fishery Structure vii

5.0 The Artisanal (Inshore) Fishery Structure ix

6.0 Sampling In The Pelagic Fishery 10

7.0 Sampling In The Inshore Fishery 11

Part One - The Pelagic (Kapenta) Fishery 12

Part Two - The Inshore (Artisanal) Fishery 25

List Of Tables

Page

Table 1: The Pelagic (Kapenta) Fishery vi

Table 2: The Inshore Fishery vi

Table 3: Distribution Of Fishing Units (Permits) By Basin, 1998 vii

Table 4: Fishing Vessels By Basin, 1998 vii

Table 5: Distribution Of Pelagic (Kapenta) Operators By Basin, 1998 vii

Table 6: Distribution Of Pelagic (Kapenta) Registered Vessels By Basin, 1998 viii

Table 7: Distribution Of Fishers By Basin (1990,1993 & 1998) ix

Table 8: Distribution Of Nets And Mesh Sizes By Basin, 1998 ix

Table 9: Distribution Of Boat Types By Basin, 1998 ix

Table 10: Pelagic (Kapenta) Landings (Tons) By Basin, 1974 - 1998 18

Table 11: Pelagic Fishery Fishing Effort (Boat-Night) By Basin, 1974-1998 20

Table 12: Monthly Pelagic (Kapenta) Catches (Tons) By Basin, 1998 21

Table 13: Pelagic Fishery Mean Cpue (Tons/Boat/Night) By Basin, 1974 -1998 22

Table 14: Monthly Pelagic (Kapenta) Fishing Effort (Boat- Night) Basin, 1998 23

Table 15: Monthly Tigerfish By-Catch (Kgs) From Kapenta Rigs By Basin, 1998 23

Table 16: Tigerfish By-Catch (Tons) By Basin, 1974 - 1998 24

Table 17: Illustration Of Estimated Data In Enumerated Villages (Inshore Fishery) 27

Table 18: Estimated Catch And Effort Summary For Enumerated Villages, 1998 28

Table 19: Estimated Catch Composition For Enumerated Villages (Tons), 1998 28

Table 20: Gatche - Gatche Co-Operative Society Catch And Effort, 1985-1998 31

Table 21: Nyaodza Co-Operative Society Catch And Effort, 1987 –1998 31

Table 22: Area C1 Catch And Effort, 1973 -1998 32

Table 23: Area C2 Estimated Catch And Effort, 1973 -1998 33

Table 24: Area C3 Catch And Effort, 1973 -1998 34

Table 25: Area C4 Estimated Catch And Effort, 1973 -1998 35

Table 26: Area C5 Estimated Catch And Effort, 1973 - 1998 36

Table 27: Area C6 And C7 Catch and Effort, 1973 - 1998 36

Table 28: Inshore Fishery Mean CPUE (Kg/100m) By fishing Area 36

List Of Figures **Page**

Figure 1: Pelagic (Kapenta) Fishery Vessels Mobility, 1998 v

Figure 2: Inshore (Artisanal) Fishery Boats Motorisation, 1998..... vi

Figure 3: Map Of Lake Kariba Showing Pelagic (Kapenta) Fishing Bases 13

Figure 4: Map Of Lake Kariba Showing Kapenta Fishing Zones (Basins)..... 14

Figure 5: Distribution Of Pelagic Fishing Operators By Basin, 1998 15

Figure 6: Distribution Of Fishing Units By Basin, 1998 15

Figure 7: Pelagic And Inshore Fishery Landings (Tons), 1998 15

Figure 8: Pelagic (Kapenta) Landings (Tons) And Percentages By Basin, 1998 16

Figure 9: Number And Percentage Of Fishing Vessels By Basin, 1998 16

Figure 10: Pelagic (Kapenta) Fishery Trends (Cpue; Catch & Effort), 1974 -1998 17

Figure 11: Pelagic (Kapenta) Fishery Catch Trends (Tons) By Basin, 1974-1998..... 17

Figure 12: Pelagic (Kapenta) Monthly Catch Trends (Tonnes), 1998..... 19

Figure 13: Monthly Tigerfish By-Catch Trends (Kgs), 1998..... 19

Figure 14: Map Of Lake Kariba Showing Location Of Inshore (Artisanal) Fishing Villages 26

Figure 15: Inshore (Artisanal) Fishery Landings Percentage Catch Per Area, 1998..... 29

Figure 16: Species Composition Of Inshore Landings (%Kg) Byrea, 1998 29

Figure 17: Inshore (Artisanal) Fishery (Species) Catch Proportions, 1998..... 30

Figure 18: Catch And Effort Trends In The Inshore Fishery, 1983 –1998 30

1.0 FOREWORD

Several changes have been incorporated in this statistical report in order to improve the information provided and its presentation.

Firstly, Kapenta catches have been extracted according to location fished so that catches can be allocated to the actual basin fished. This also enables fishing effort applied to a particular basin and ultimately means catch per unit of effort of a particular basin to be known.

Secondly, new summary tables have been included on inter-basin fishing.

Thirdly, graphic summaries have been increased to assist in the interpretation of the statistics and provision of some additional information.

In order to improve the quality of statistics and to ensure that the statistics provided are appropriate, users of this statistics report are encouraged to communicate any comments, suggestions for improvement or additional information to the Database Manager (address on cover page).

The assistance and co-operation of all involved in data collection is gratefully acknowledged.

2.0 INTRODUCTION

This report contains data, statistics and information for both the Pelagic and Inshore fisheries for the 1998 calendar year. Data from the sport fishery is not included. Time series data and notes for the two fisheries (Inshore 1973-1998 and Pelagic 1974-1998) are also included to facilitate the use of this report.

In this report the term "Pelagic fishery" refers to the fishery that exploits the freshwater sardine (*Limnothrissa miodon)*, locally known as the Kapenta which was introduced in Lake Kariba to utilise the vacant pelagic waters. There is an occasional by-catch of Tigerfish (*Hydrocynus Vittatus)* within this fishery. The pelagic fishery is all year round using light for attracting fish. The type of gear used is the lift net which ranges from 5 to 9 metres in diameter and 12 to 26 metres in depth. Two types of fishing vessel-designs are in use; these are the pontoon- catamarans and the displacement monohulls. The majority of vessels (78%) are fitted with an engine (motorised), by either inboard or outboard) for propulsion and 22% are immobile rigs that have to be towed (nonmotorised) to the fishing ground by other rigs (Figure 1).

The term "Inshore fishery" is used to distinguish the fishery that utilises gillnets and exploits the indigenous Zambezi River fish species (Riverine fish species). This fishery is restricted to the lakeshore. Three types of boat-types are in use; these are Dugout canoe, Fibreglass and Metal boats. Of the total boats (663), 99% are nonmotorised and (5) 1% are motorised (Figure 2).

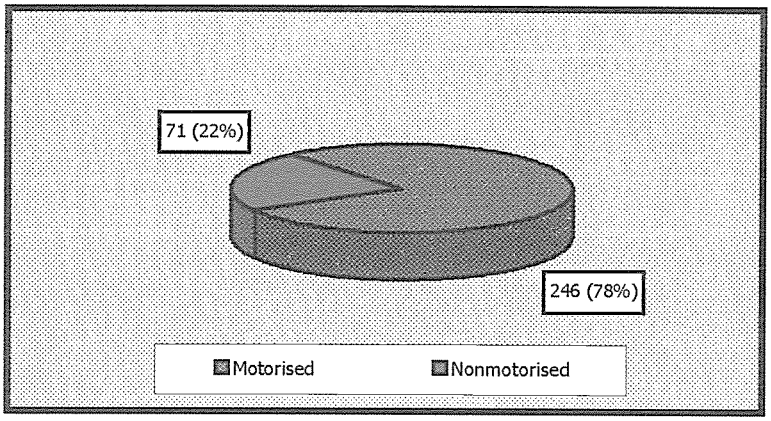


Figure 1: Pelagic (Kapenta) Fishery Vessels Mobility, 1998

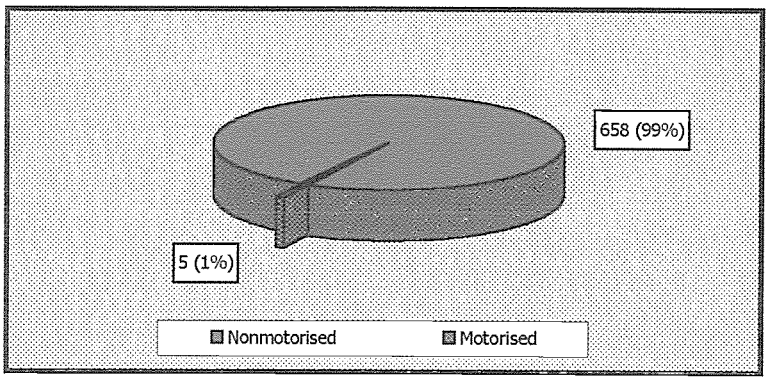


Figure 2: Inshore (Artisanal) Fishery Boats Motorisation, 1998

3.0 LANDINGS SUMMARY (TONS)

Table 1: The Pelagic (Kapenta) Fishery

Basin	1997	1998
Sanyati	8132	6844
Bumi/Chalala	5265	4711
Sengwa	2053	1690
Binga & Mlibizi	1584	2043
Total	**17034**	**15288**

The 1998 landed catch have declined by 10.3% as compared to 1997. There was an overall decrease of landed catches in all basins with the exemption of Binga and Mlibizi where there was an increase of 29%.

Table 2: The Inshore Fishery

AREA	Catch in Tons	
	1997	1998
C1	72.39	41.60
C2	166.18	32.76
C3	37.49	54.30
C4	120.86	150.02
C5	111.49	115.58
C6	14.04	18.67
Total for enumerated villages (only)	362.57	317.03
* Total estimate	1115.11	1083.18

* Refer to Table 17

The areas C1 and C3 show co-operatives landings data that reflects the total annual catches. The 1998 Inshore catch has declined by 2.9% compared to 1997 and area C7 was not recorded in both 1997 and 1998.

The lakewide catch for the Pelagic (Kapenta and Tigerfish by-catch) and Inshore fishery is 16400 Tonnes **(15300t** (*Kapenta*) **+1083t** (*Inshore*) **+ 15t** (*Tigerfish by-catch*) **= 16400 Tons)**

4.0 THE PELAGIC (KAPENTA) FISHERY STRUCTURE

Table 3: Distribution Of Fishing Units (Permits) By Basin, 1998

Basin	No. Of Units	Percentage
Sanyati	136	49
Bumi/Chalala	73	26
Sengwa	34	12
Binga & Mlibizi	37	13
Total	**280**	**100**

Table 4: Fishing Vessels By Basin, 1998

Basin	No. Of Vessels	Percentage
Sanyati	141	48
Bumi/Chalala	80	27
Sengwa	35	12
Binga & Mlibizi	36	13
Total	**292***	**100**

* This table shows vessels fished in the 1998 calendar year, including spares

Table 5: Distribution Of Pelagic (Kapenta) Operators By Basin, 1998

Basin	No. Of Operators	Percentage
Sanyati	31	42
Bumi/Chalala	15	21
Sengwa	12	16
Binga & Mlibizi	15	21
Total	**73**	**100**

Table 6: Distribution Of Pelagic (Kapenta) Registered Vessels By Basin, 1998

Basin	No. Of Registered Vessels	Percentage
Sanyati	150	48
Bumi/Chalala	83	27
Sengwa	39	13
Binga	29	9
Mlibizi	10	3
Total	**311***	**100**

* This table shows all registered vessels including spares for the 1998 calendar year

5.0 THE ARTISANAL (INSHORE) FISHERY STRUCTURE

Table 7: Distribution Of Fishers By Basin (1990,1993 & 1998)

BASIN	NUMBER OF FISHERS			EVOULUTION
	1990	1993	1998	1998/1993 (%)
Sanyati	239	340	353	-3.8
Bumi/Chalala	123	274	216	213.8
Sengwa	218	312	402	28.8
Binga	463	65	204	-21.2
Mlibizi	120	238	229	3.8
Total	**746**	**1229**	**1404**	**14.2**

Table 8: Distribution Of Nets And Mesh Sizes By Basin, 1998

BASIN	MESH SIZES									TOTAL
	3"	3.5"	4"	4.5"	5"	5.5"	6"	6.5"	7"	
Sanyati			269	584	195	66	10	1		1125
Bumi/Chalala			219	269	127	38	25	1	8	682
Sengwa	17	2	392	291	204	156	39	4		1105
Binga			194	139	178	26	13		1	551
Mlibizi		7	235	110	82	10	4			448
Total	**17**	**9**	**1309**	**1393**	**786**	**296**	**91**	**6**	**9**	**3916**

Table 9: Distribution Of Boat Types By Basin, 1998

BASIN	BOAT TYPE			TOTAL
	DUGOUT CANOE	FIBRE GLASS	METAL BOAT	
Sanyati	5	53	172	230
Bumi/Chalala	2	24	99	125
Sengwa	16	20	100	136
Binga	39	23	18	80
Mlibizi	40	27	25	92
Total	**102**	**147**	**414**	**663**

6.0 SAMPLING IN THE PELAGIC FISHERY

The data for the Pelagic fishery were collected principally by means of catch return forms filled in by the fishing operators and submitted monthly to the Lake Kariba Fisheries Research Institute.

The Kapenta (*Limnonthrissa miodon*) constitutes about 93% of the total catch from Lake Kariba on Zimambabwean side. Illegal sales of Kapenta before landing are still continuing. The scale of such illegal activities is difficult to quantify but we estimate that at least 30% 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.

Of the 311 rigs registered to 73 companies in 1998, returns were received from 292 rigs (including spares) that were operating. A logbook system is used for collection of daily catch per boat. The current measure of fishing effort is (1) one unit of effort, which is normally referred to as (1) one boat-night.

Kapenta fishing operations are based at 12 sites (Figure 3). Kapenta fishing Operations are restricted to areas where water depth is greater than 20 metres and a radius of 3 km from developed areas along the shoreline.

7.0 SAMPLING IN THE INSHORE FISHERY

The sampling system in use has been designed to provide statistically valid catch estimation for the whole of the Zimbabwe Inshore Fishery on Lake Kariba. Whereas the Kapenta data represent total #1landed 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 that submit catch returns for the whole year reflecting the actual total landings. The fishing areas are divided into 7 zones, C1 to C7 (Figure 9) 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 Zimbabwean Inshore Fishery. Three types of fishing crafts are used within this fishery and are described as follows;

Dugout Canoe
These are built up by digging out a tree trunk usually measuring between three to four metres in length with a few exceptions measuring up to five metres. They are very durable with one encountered having been first registered in 1964 and is still in use and in good shape.

Fibreglass
These are fishing crafts made out of glass reinforced plastic (GRP). The majority are three meters long and are not very strong considering the environment in which they operate (submerged tree stumps and boulders).

Metal Boats
They are very similar in design to the GRP vessels but the hull is made out of steel. The average length is three metres. Stronger than the GRP vessels but require constant maintenance such as welding of which materials and skills are lacking in this fishery.

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 the lake, the ratio between the number of fishers in the villages sampled and the total number of fishers is used.

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

Formal regulations state that each fisher 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 cyprinid (*Labeo altivelis);* the tigerfish (*Hydrocynus vittatus);* the mormyrids (*Mormyrus longirostris, Mormyrops anguilloides)*; and the barbel (*Clarius gariepinus).*

PART ONE

THE PELAGIC (KAPENTA) FISHERY

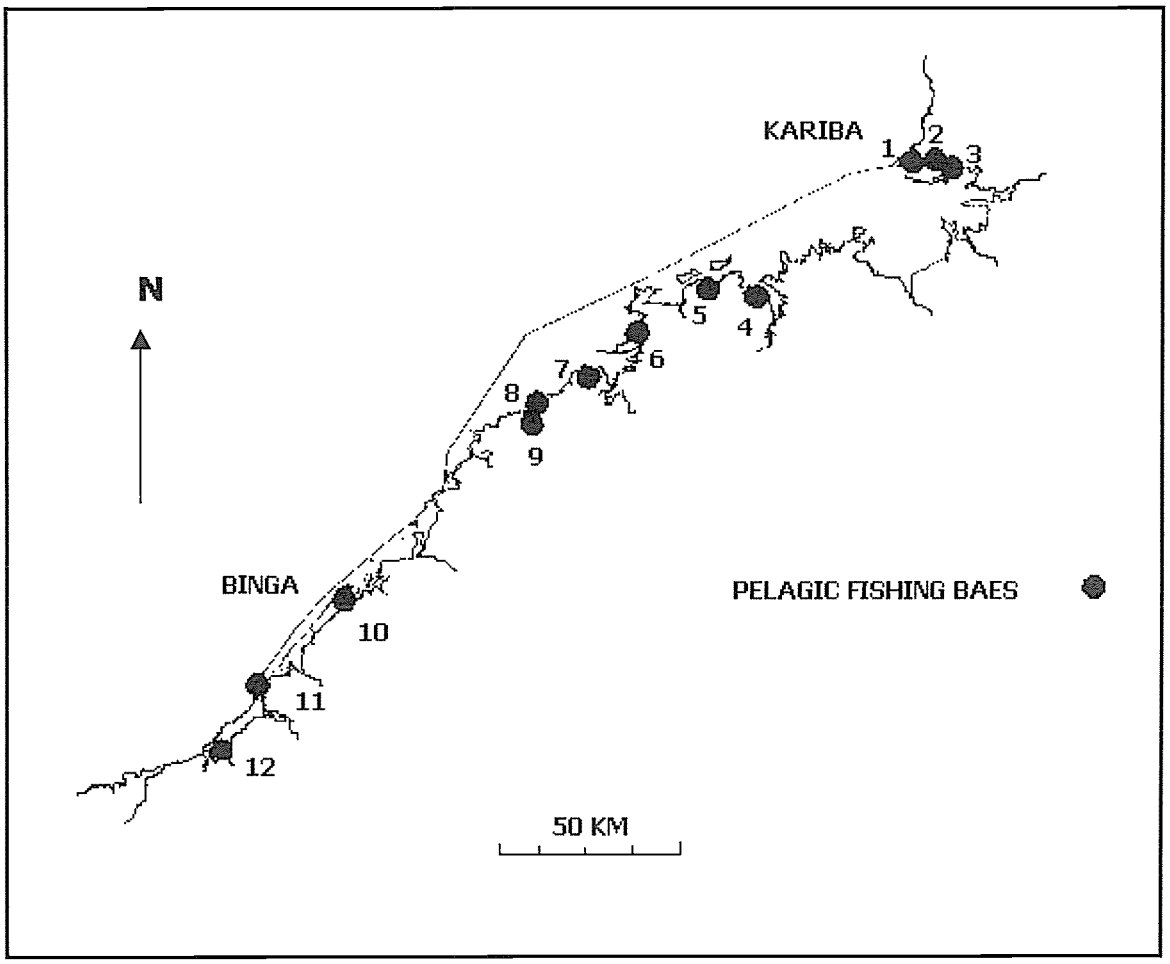


Figure 3: Map Of Lake Kariba Showing Pelagic (Kapenta) Fishing Bases

1. Andora Harbour
2. Chawara
3. Nyanyana
4. Ume
5. Chalala
6. Mackenzie
7. Sengwa Mouth
8. Chibuyu
9. Mwenda
10. Binga
11. Simatelele
12. Mlibizi

NB; Circles are indicative of pelagic fishing sites only. They do not show the bases' relative sizes.

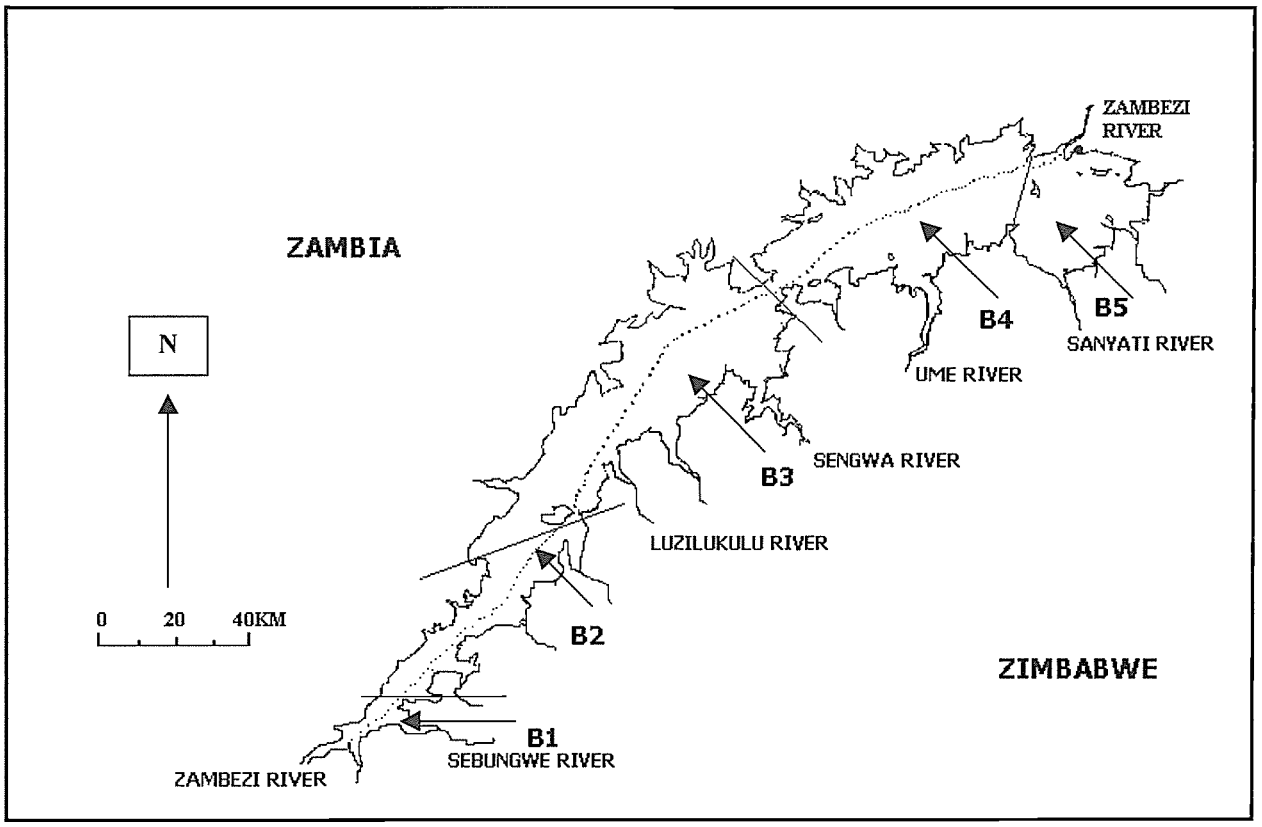


Figure 4: Map Of Lake Kariba Showing Kapenta Fishing Zones (Basins)

- B1 & B2 (Binga & Mlibizi Basin), stretches from Mlibizi to Chete Gorge

- B3 (Sengwa Basin), stretches from Chete Gorge to Sibilobilo Narrows

- B4 (Bumi/Chalala Basin), stretches from from Sibilobilo Narrows to a straight line joining Forthergill & Msambakaruma Islands

- B5 (Sanyati Basin), stretches from a straight line joining Forthergill & Msambakaruma Islands to the Dam Wall.

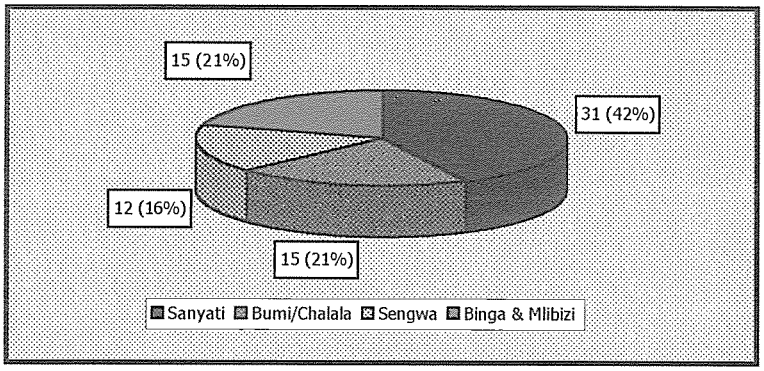


Figure 5: Distribution Of Pelagic Fishing Operators By Basin, 1998

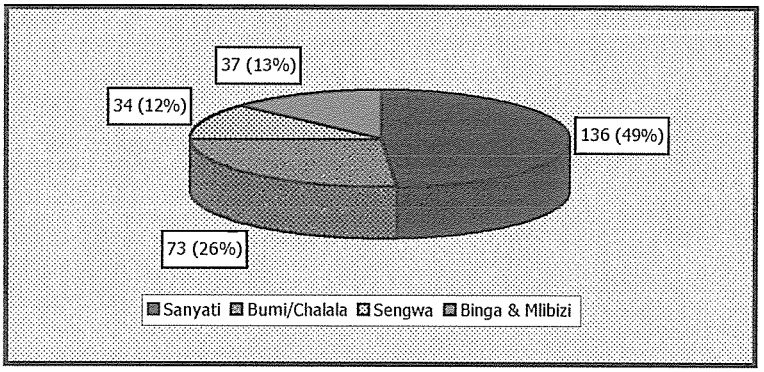


Figure 6: Distribution Of Fishing Operators By Basin, 1998

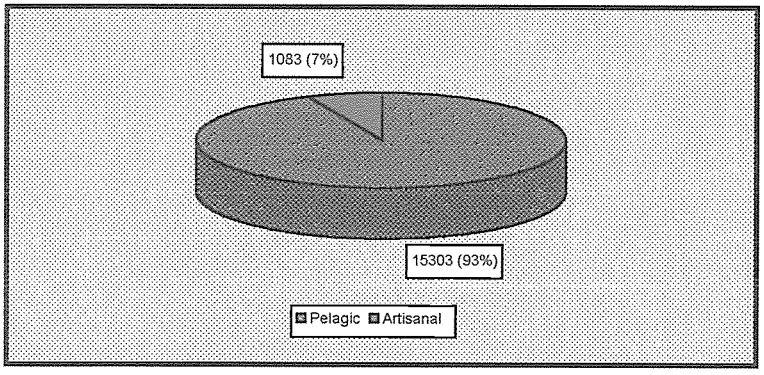


Figure 7: Pelagic And Inshore Landings (Tons), 1998

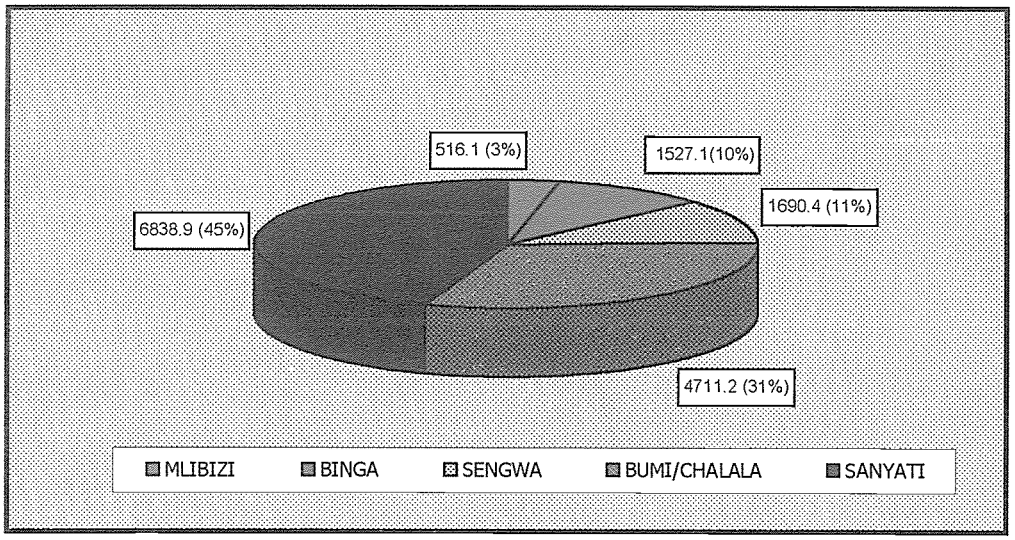


Figure 8: Pelagic (Kapenta) Landings (Tons) and Percentages By Basin, 1998

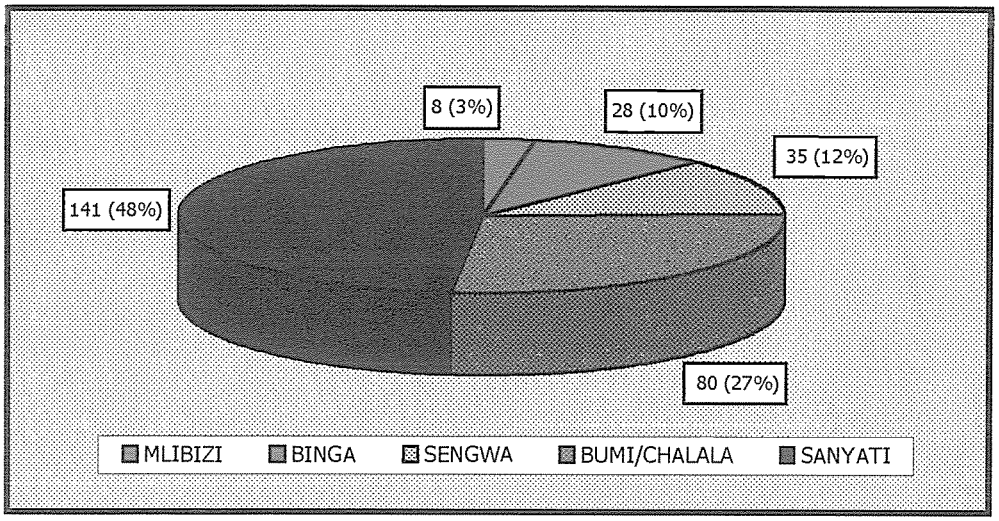


Figure 9: Number and Percentage Of Fishing Vessels By Basin, 1998

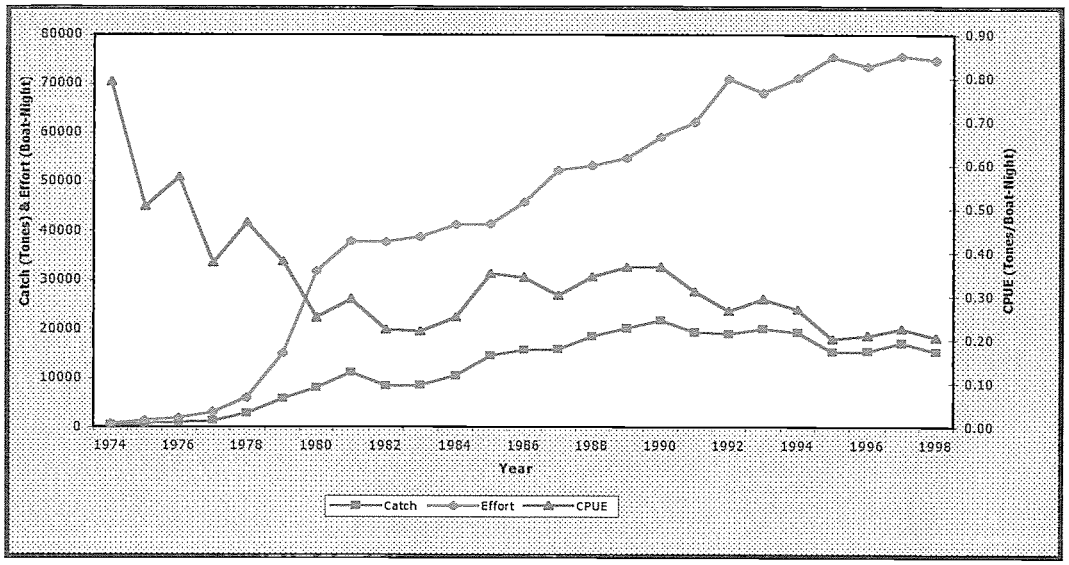


Figure 10: Pelagic (Kapenta) Fishery Trends (CPUE; Catch & Effort), 1974 -1998

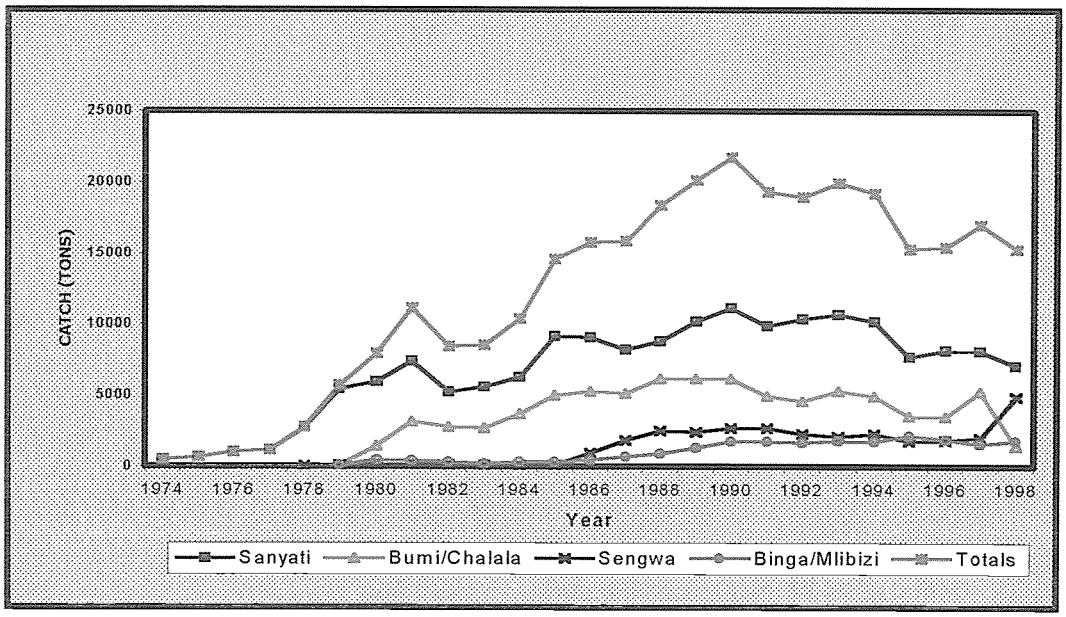


Figure 11: Pelagic (Kapenta) Fishery Catch Trends (Tons) By Basin, 1974-1998

Table 10: Pelagic (Kapenta) Landings (Tons) By Basin, 1974 - 1998

YEAR	BASIN					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
1996	8183	3516		1839	1885	15423
1997	8132	5265		2053	1584	17034
1998	6844	4711		1690	2043	15288

The total landings (Tons) have declined by 10.3%, compared to the 1997 landings. There is an overall decrease within the Sanyati, Bumi/Chalala and Sengwa basins. Binga and Mlibizi basin shows an increase of 29% in landings.

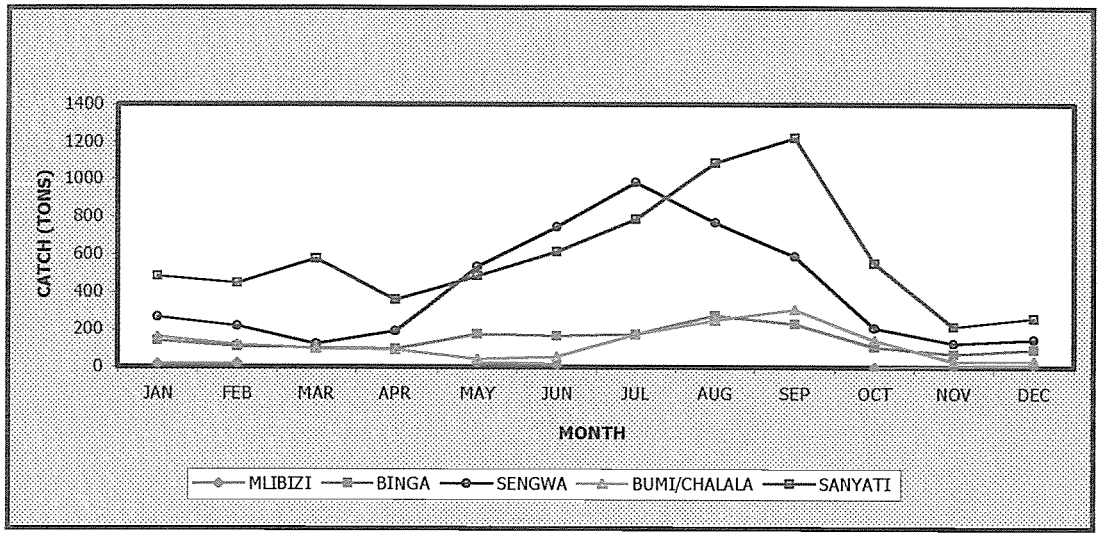


Figure 12: Pelagic (Kapenta) Monthly Catch Trends (Tons), 1998

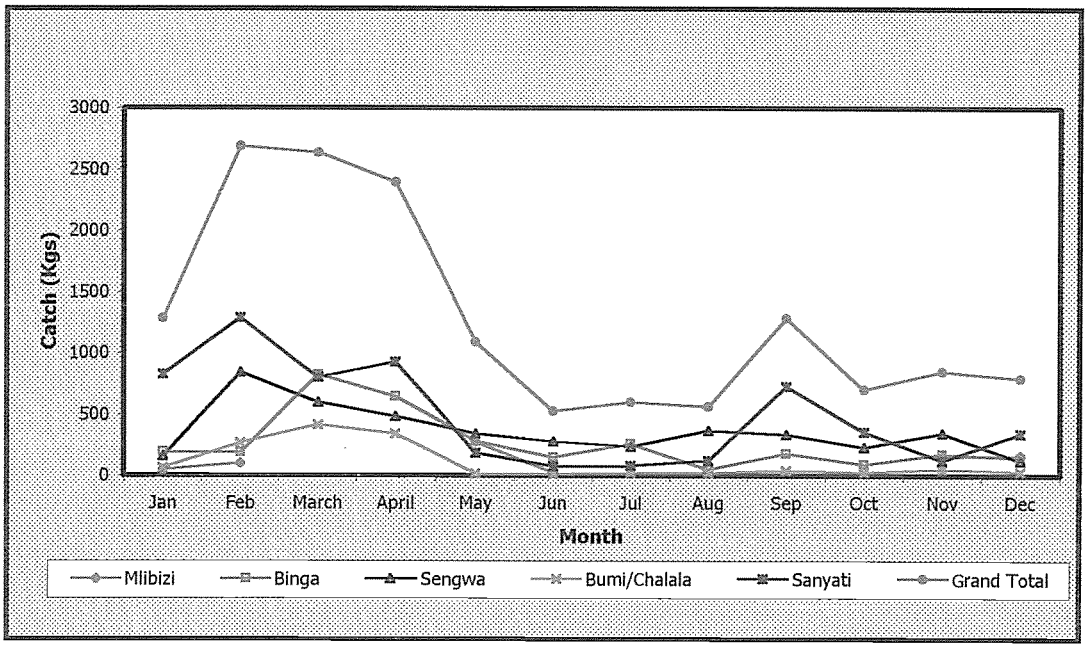


Figure 13: Monthly Tigerfish By-Catch Trends (Kgs), 1998

Table 11: Pelagic Fishery Fishing Effort (Boat-Night) By Basin, 1974-1998

YEAR	BASIN					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
1996	38079	16536		8441	10468	73524
1997	39410	18546		8607	9070	75633
1998	39022	8564		18126	9058	74770

The 1998 lakewide effort has declined by 1.1% compared to 1997. The Sanyati basin has the highest total effort followed by Sengwa, Binga/Mlibizi and lastly Bumi/Chalala.

Table 12: Monthly Pelagic (Kapenta) Catches (Tons) By Basin, 1998

YEAR	BASIN				TOTAL
	Sanyati	Bumi/Chalala	Sengwa	Binga/Mlibizi	
January	482	159	265	155	1061
February	445	120	217	127	909
March	575	97	123	102	897
April	359	91	192	95	737
May	487	41	535	197	1260
June	614	54	747	177	1592
July	785	175	983	172	2115
August	1086	250	769	271	2376
September	1220	306	588	227	2341
October	553	143	208	106	1010
November	215	29	126	74	444
December	260	34	147	106	546
Total	**7079**	**1499**	**4900**	**1810**	**15288**

Table 13: Pelagic Fishery Mean CPUE (Tons/Boat-night) By Basin, 1974 –1998

YEAR	BASIN					Lakewide mean CPUE
	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	0.20
1996	0.21	0.11		0.22	0.34	0.21
1997	0.21	0.28		0.24	0.17	0.23
1998	0.18	0.17		0.27	0.23	0.20

The 1998 mean catch per unit of effort has declined by 13% compared to 1997. There is a considerable decline in all basins with the exception of Binga/Mlibizi basin with an increase of 23.5%. The greatest decline was in Sengwa with 16.7% followed by Bumi/Chalala and Sanyati with 15% and 14.3% respectively.

Table 14: Monthly Pelagic (Kapenta) Fishing Effort (Boat- Night) Basin, 1998

MONTH	BASIN				TOTAL
	Sanyati	Bumi/Chalala	Sengwa	Binga/Mlibizi	
January	3370	951	1528	731	6580
February	3289	1097	1561	656	6603
March	3574	1042	1080	708	6404
April	3115	1004	1230	721	6070
May	3507	309	1747	784	6347
June	3400	273	2071	727	6471
July	3494	511	2220	645	6870
August	3385	708	1778	805	6676
September	3541	897	1599	853	6890
October	3578	1014	1190	860	6642
November	2633	395	1141	776	4945
December	2136	363	981	792	4272
Total	**39022**	**8564**	**18126**	**9058**	**74770**

There is an overall decrease in the monthly fishing effort (boat-night) lakewide. The variations in the monthly effort were due to inter-basin fishing.

Table 15: Monthly Tigerfish By-Catch (Kgs) From Kapenta Rigs By Basin, 1998

MONTH	BASIN				TOTAL
	Sanyati	Bumi/Chalala	Sengwa	Binga/Mlibizi	
January	828	62	156	239	1285
February	1286	265	845	290	2686
March	802	416	595	822	2635
April	925	343	483	643	2394
May	182	17	340	550	1089
June	71	9	275	168	523
July	77	23	237	258	595
August	122	22	369	49	562
September	730	41	334	179	1284
October	358	27	230	87	702
November	121	54	348	324	847
December	339	30	118	302	789
Total	**5841**	**1309**	**4330**	**3911**	**15391**

The lakewide Tigerfish by-catch has increased by 118% as compared to 1997 where the total Tiger-fish lakewide by-catch was 7030 Kilograms.

Table 16: Tigerfish By-Catch (Tons) By Basin, 1974 - 1998

YEAR	BASIN					TOTAL
	Sanyati	Bumi	Chalala	Sengwa	Binga / Mlibizi	
1974	18					18.0
1975	81					81.0
1976	91					91.0
1977	138					138.0
1978	129			1		130.0
1979	64	1		3	2	70.0
1980	41	1		2	5	49.0
1981	54	6	2	1	2	65.0
1982	44	3	1	1	1	50.0
1983	45	4	3	1	1	54.0
1984	22	2	2	-	1	27.0
1985	22	1	2	1	-	26.0
1986	40	2	19	3	3	67.0
1987	31	2	6	3	2	44.0
1988	8	1	3	1	2	15.0
1989	11	0.5	4	1	3	19.5
1990	14	0.5	4	3	5	26.5
1991	8	0	2	1	1	12.0
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	7.9
1996	1.9	0.1		0.5	3.9	6.4
1997	3.2	0.8		0.2	2.8	7.0
1998	5.8	1.4		4.3	3.9	15.4

The lakewide by-catch tonnage has increased considerably (by 114%) from seven (7) Tons to fifteen (15) Tons in 1997 and 1998 respectively.

PART TWO

THE INSHORE (ARTISANAL) FISHERY

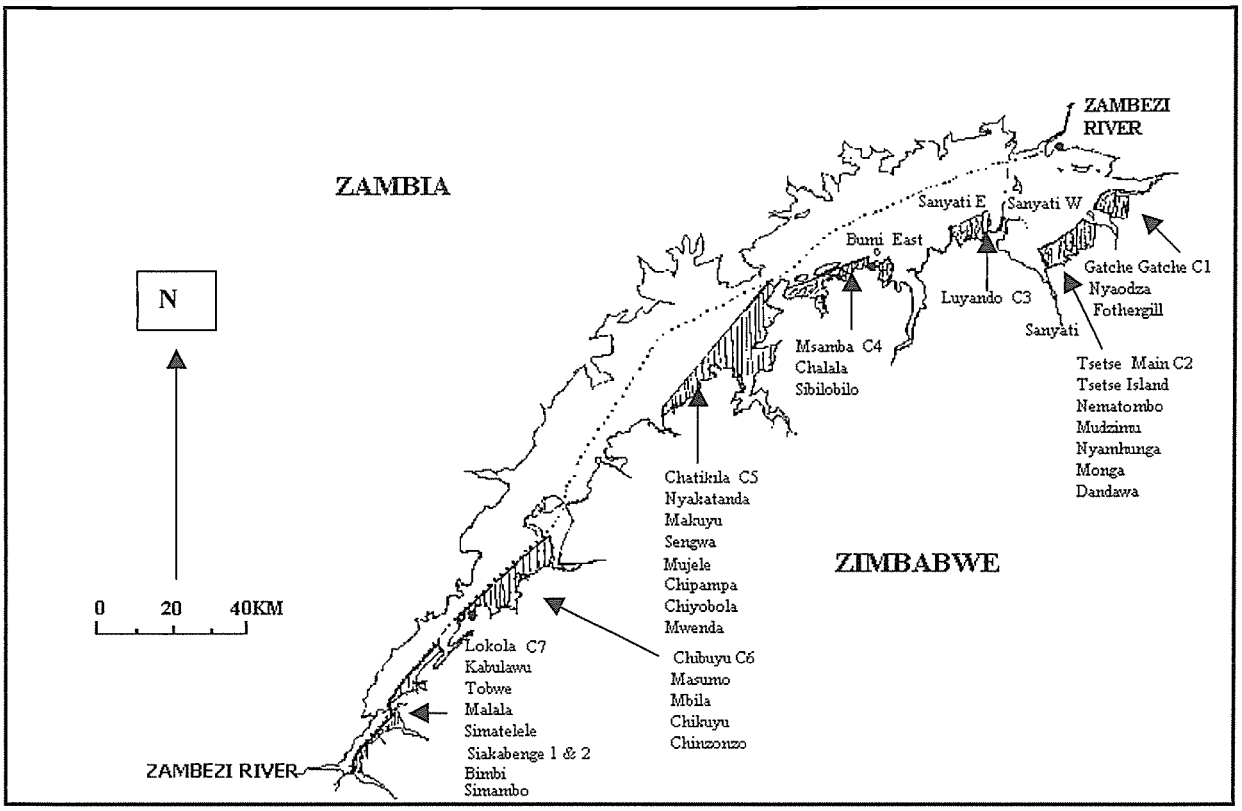


Figure 14: Map Of Lake Kariba Showing Location Of Inshore (Artisanal) Fishing Villages

Table 17: Illustration Of Estimated Data In Enumerated Villages (Inshore Fishery)

CAMPNAME/ VILLAGE	Area	Campcode	Total sampled catch (Tons)	Total sampled effort (no of nets x 45m)	CPUE (c/d) kg/100m	Total Fishers (From 1998 Frame survey)	Days sampled	Est. Total Catch (C X 360) G	Est. total effort (D X 360) G
	A	**B**	**C**	**D**	**E**	**F**	**G**		
Dandawa	C2	10	4.55	84150	5.41	68	50	32.76	605880
Musamba	C4	12	17.07	74700	22.85	90	50	122.83	537840
Sibilobilo	C4	14	4.52	109890	4.11	40	60	27.12	864270
Makuyu	C5	19	6.41	180225	3.56	50	60	38.58	876420
Mujele	C5	22	19.28	199755	9.65	120	90	77.12	799020
Kalulwe	C6	43	3.63	91620	3.96	70	70	18.67	471189
TOTALS			**55.46**	**740340**	**7.49**	**438**	**380**	**317.08**	**4154619**

Comparing to 1997, the total catch for co-operatives has decreased by 12.7%. The estimated total effort, catch, sampled catch, sampled effort and cpue has also decreased by 24.4%, 28.9%, 56.8%, 6% and 53.6% respectively. The total number of fishers sampled from the 1998 frame survey has increased by 2.8%. The actual total catch for co-op returns in Areas C1 & C3 is 95.90t and estimated total catch for enumerated villages is 362.57 tons.

The total Lake-wide estimate is 317.08 x $\frac{\text{Total fishers Lake-wide + (co-op Catches)}}{\text{Number of fishers in the above villages}}$ = 317.08 x $\frac{1404}{438}$ X 76.68 = 1083.18 Tons

Table 18: Estimated Catch And Effort Summary For Enumerated Villages, 1998

Village	Effort (metres)	Catch (tons)	CPUE (KG/100M)
Gache Gache co-op	275310	23.85	8.66
Nyaodza co-op	192780	17.75	9.21
Dandawa	605880	32.76	5.41
Luyando co-op	295650	54.30	18.37
Musamba	537840	122.90	22.85
Sibilobilo	659340	27.12	4.11
Makuyu	1081350	38.46	3.56
Mujele	799020	77.12	9.65
Kalulwe	471189	18.67	3.96
Total	**4918359**	**412.93**	**8.40**

The co-operatives above show the actual sampled catch and effort data. Compared to 1997, 1998 effort and catch has decreased by 27.6% and 12.6% respectively, whilst the CPUE has increased by 27.7%.

NB; Three fishing villages (Nematombo, Nyamhunga and Simambo) were not enumerated in 1998.

Table 19: Estimated Catch Composition For Enumerated Villages (Tons), 1998

Species Name	Percentage	Estimated Catch (Tons)
O. mortimeri	23.81	75.48
H. vittatus	16.79	53.24
H. longifilis	0.32	1.00
C. gariepinus	12.22	38.73
M. longirostris	9.06	28.71
S. codringtonii	6.21	19.68
T. rendalli	7.01	22.24
L. altivelis	15.09	47.85
S. macrocephalus	1.60	5.08
M. anguilloides	5.63	17.84
D. schenga	0.53	1.64
L. congoro	0.10	0.33
Others	1.64	5.21
Total	**100**	**317.03**

The estimated catch has decreased by 12.6% as compared to 1997 and there are two additional fish species (*Labeo congoro and Heterobrunchus longifilis*) in 1998.

Figure 15: Inshore (Artisanal) Fishery Landings Percentage Catch Per Area, 1998

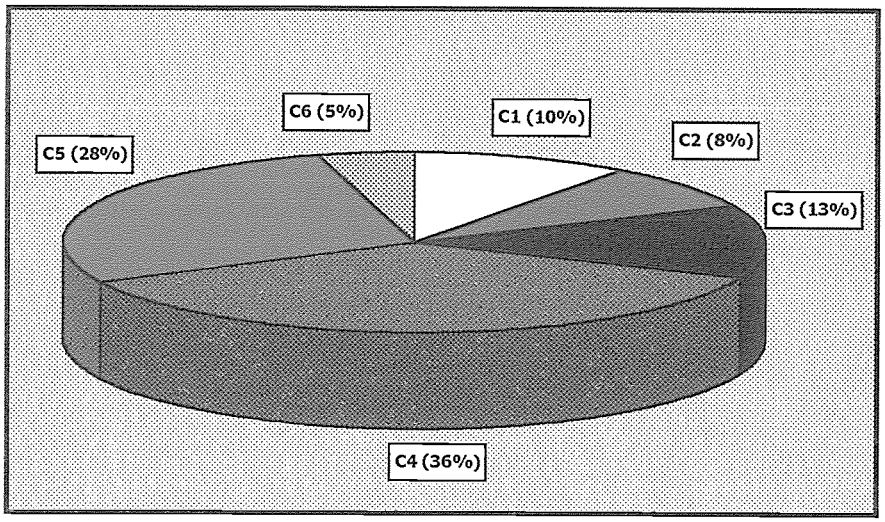


Figure 16: Species Composition Of Inshore Landings (%Kg) Byrea, 1998

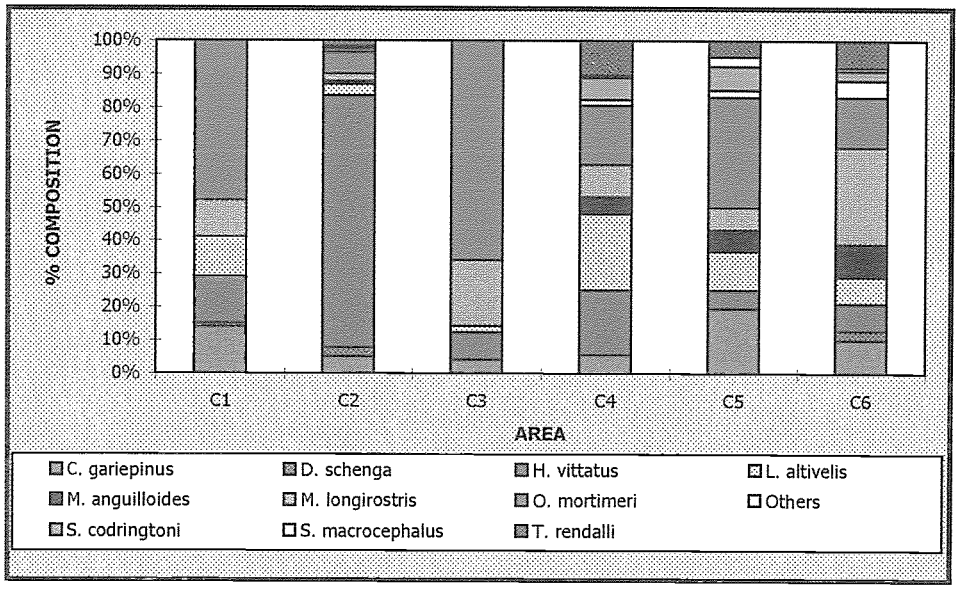
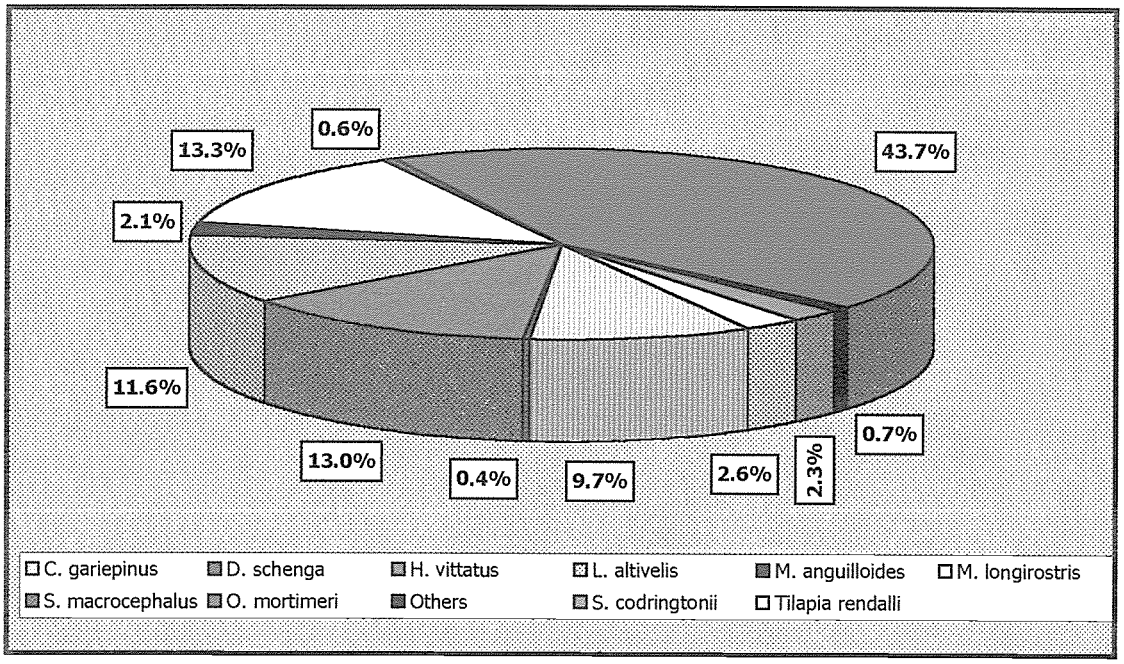


Figure 17: Inshore (Artisanal) Fishery (Species) Catch Proportions, 1998



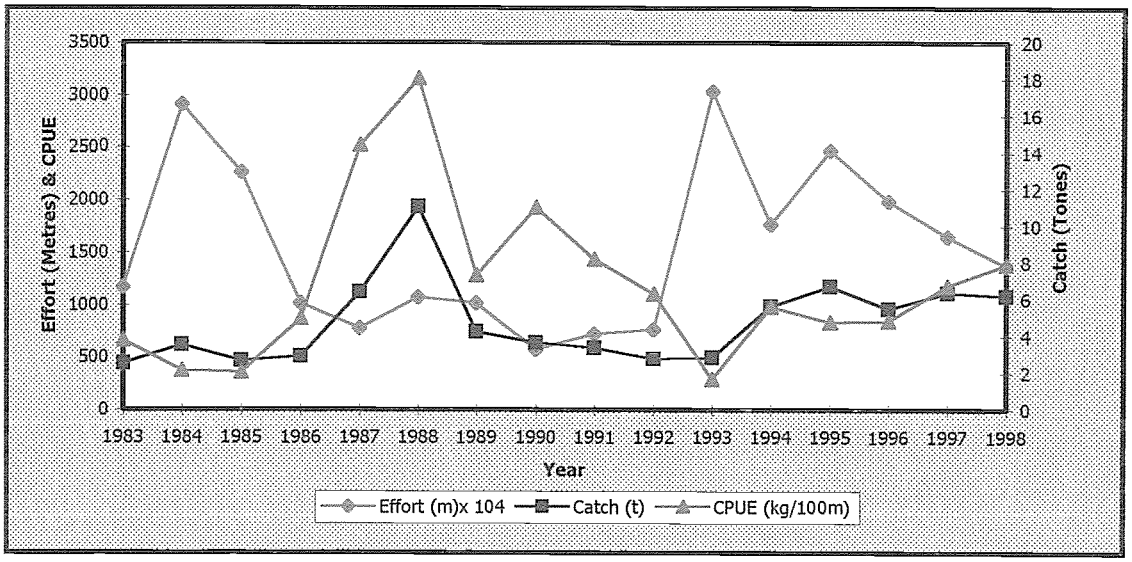


Figure 18: Catch And Effort Trends In The Inshore Fishery, 1983 –1998

Table 20: Gatche-Gatche Co-Operative Society Catch And Effort, 1985-1998

Year	Total Catch (Tons)	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
1996	8.73	295200	2.96
1997	53.90	340200	15.84
1998	23.85	275310	8.66

Compared with 1997, the 1998 total catch, effort and CPUE has decreased by 53.8%, 19.1% and 45.3% respectively. The 1996 data were recorded from January to May.

Table 21: Nyaodza Co-Operative Society Catch And Effort, 1987 –1998

Year	Total catch (tons)	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
1996	28.11	521055	5.39
1997	18.49	305325	6.06
1998	17.75	192780	9.21

Compared to 1997, the 1998 total catch, effort have decreased by 4% and 36.9% respectively. The catch per unit of effort (CPUE) has increased by 52%. The 1995 data was only recorded from January to May.

Table 22: Area C1 Catch And Effort, 1973 -1998

Year	Effort (metres)	Total catch (Tons)	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	29.90	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	48.10	3.54
1995	965520	50.65	5.25
1996	816255	36.85	4.51
1997	645525	72.39	11.21
1998	468090	41.60	8.89

Table 23: Area C2 Estimated Catch And Effort, 1973 -1998

Year	Effort (metres)	Total catch (tons)	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
1996	2383055	88.20	3.70
1997	1748864	116.18	6.64
1998	605880	32.76	5.41

Table 24: Area C3 Catch And Effort, 1973 -1998

Year	Effort (metres)	Total catch (tons)	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
1996	325125	17.71	5.45
1997	646425	37.49	5.80
1998	295650	54.30	18.37

This area is fished by one co-operative (Luyando co-op) and 1995 data was recorded up to May.

Table 25: Area C4 Estimated Catch And Effort, 1973 -1998

Year	Effort (metres)	Total catch (tons)	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	159.00	11.36
1994	1768961	124.10	7.02
1995	1743201	157.34	9.03
1996	1725624	116.54	6.75
1997	1796040	120.86	6.73
1998	1197180	150.02	12.53

This area is made up of three fishing camps (Musamba, Chalala and Sibilobilo). Only two fishing camps (Musamba and Sibilobilo) were enumerated and the 1998 data shows a decrease of 33.3% in effort and an increase of 24.1% and 73.8% in catch and CPUE respectively.

Table 26: Area C5 Estimated Catch And Effort, 1973 - 1998

Year	Effort (metres)	Total catch (tons)	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
1996	1512594	69.47	4.50
1997	1529064	111.49	7.29
1998	1880370	115.58	6.15

In this area, only two fishing villages (Makuyu and Mujele) were enumerated. The 1998 shows an increase of 23%, 3.7% and 7.3% in effort, catch and CPUE respectively, compared to 1997.

Table 27: Area C6 And C7 Catch And Effort, 1973 - 1998

Year	Effort (metres)	Total catch (tons)	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
1996	511110	15.13	3.00
1997	423283	14.04	3.32
1998	471189	18.67	3.96

This area is made up of two fishing camps (Kalulwe and Simambo). In 1996 and 1998, only area C6 was recorded. Although area C7 was not recorded in 1998, there is an increase of 11.3%, 33% and 19.3% in total effort, catch and CPUE respectivelym, for both area C6 and C7 as compared to 1997.

Table 23: Inshore Fishery Mean CPUE (Kg/100m) By fishing area, 1970 -1998

YEAR	AREA						
	C1	C2	C3	C4	C5	C6	C7
1970	5.94	3.24		7.92	6.03	7.86	13.19
1971	6.39	2.71		7.25	12.96	10.31	28.15
1972	6.30	6.82	*	7.98	13.50	7.21	8.74
1973	2.07	3.29	2.81	5.00	2.45	*	*
1974	4.21	3.19	3.58	5.48	2.70	*	*
1975	3.71	3.46	2.30	8.05	*	4.41	2.83
1976	3.94	3.42	2.60	7.53	6.39	4.25	5.38
1977	3.87	2.85	3.03	*	*	8.64	*
1978	4.22	*	4.59	4.94	*	*	*
1979	4.67	3.46	5.99	*	*	*	*
1980	2.83	2.79	4.12	6.10	17.47	*	3.80
1981	2.47	3.02	3.19	4.83	8.34	*	*
1982	2.33	6.69	3.06	4.07	4.98	*	*
1983	2.19	8.87	2.44	7.13	3.97	2.41	5.71
1984	1.16	6.81	0.19	5.10	1.02	*	*
1985	1.11	9.56	1.22	15.69	30.90	*	*
1986	1.51	8.50	1.93	17.65	2.365	*	*
1987	6.44	9.91	4.41	14.97	4.07	6.43	3.12
1988	5.92	9.57	8.56	8.56	3.12	12.47	7.05
1989	5.04	15.82	9.07	12.49	3.64	7.24	7.26
1990	5.95	11.36	6.01	14.42	12.24	*	*
1991	4.95	6.92	7.73	9.04	7.01	5.10	5.25
1992	3.65	7.09	6.69	8.75	6.17	6.19	1.50
1993	4.05	6.63	6.24	11.36	10.35	4.41	5.17
1994	3.54	6.63	2.69	7.02	6.06	3.14	*
1995	5.25	6.35	3.17	9.03	2.79	2.07	1.87
1996	4.51	3.70	5.45	6.75	4.50	3.00	*
1997	11.21	6.64	5.80	6.73	7.29	3.32	*
1998	8.89	5.41	18.37	11.70	6.76	3.95	*

* No data