

REPORT ON THE 1980/81 ANGLING CENSUS IN
THE SANYATI GORGE, LAKE KARIBA

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by

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PRELIMINARY PHYTOPLANKTON COUNTS IN THE
SANYATI BASIN, LAKE KARIBA.

SUMMARY.

Phytoplankton counts were made on a monthly basis on water samples, taken from one station in the Sanyati Basin. The results show seasonal fluctuations which are probably nutrient dependant. High phytoplankton numbers occur at times of high nutrient levels as was found with the crustacean zooplankton populations (Marshall 1980). Numbers also decreased with depth down to the thermocline. Below the thermocline there was little or no change in numbers.

INTRODUCTION.

Since the formation of Lake Kariba there has been limited research on phytoplankton in comparison with other aspects of the lake's biology, and much of this work remains unpublished.

A number of workers have made phytoplankton collections from various parts of the lake, but their work has been largely restricted to presence versus absence findings, or to taxonomic descriptions (Thomasson 1965). Those who have produced quantitative work have mostly been concerned with the larger phytoplankters and the nannoplankton has largely been neglected, primarily because the collections have been made by using nets (Hancock 1979) rather than by the concentration of water samples by sedimentation or by centrifuging.

The aim of this study was to obtain some idea of the numbers and depth distribution of phytoplankton for a period of one year and at one locality. It was also hoped that the results would complement other studies being conducted concurrently at the same locality as well as elsewhere within the Sanyati Basin.

MATERIALS AND METHODS.

The sampling station was approximately 1 km south of the entrance to Andora Harbour over a depth of 65 m of water. Being some distance from

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This report describes the angling census conducted in the Sanyati Gorge from the beginning of August 1980 to March 1981, and compares the results to those from the 1973 census undertaken by Begg.

1. INTRODUCTION.

The tigerfish, Hydrocymus vittatus, has long been acknowledged as one of the premier fresh-water angling species of Africa. In Lake Kariba it has supported an important recreational fishery since the formation of the lake in 1960. The Sanyati gorge, the narrow lacustrine estuary of the most important secondary river flowing into Lake Kariba (Coche, 1974) has traditionally been the favourite hunting ground of anglers. The river forms the principal route for the migration of spawning tigerfish from the eastern basin of Lake Kariba each year, and from September to November large numbers of them congregate in the gorge. This feature, coupled with its proximity to Kariba township, accounts for the area's popularity with anglers. A detailed description of the Sanyati river and gorge is available in Coche (1974) and Begg (1974) and is beyond the scope of this report.

Angling has traditionally been freely available to the public on Lake Kariba with no restrictions of any kind on the sport. In the past this attitude was understandable since there appeared to be unlimited numbers of the main angling species and furthermore this seemingly vast resource was not being utilized to any great extent. The military activity in the area served to limit the number of anglers visiting Kariba because of the risk associated with travel, and also to concentrate what angling effort there was within the confines of the Sanyati sub-basin. Another contributory factor was fuel rationing from 1974-1979 which put boating out of the reach of many anglers. However, the situation since the last angling census was undertaken in 1973 has changed dramatically, particularly with reference to the tigerfish. Firstly the pelagic fishery which began in 1973 exerted a high mortality on tigerfish and led to the virtual collapse of the limnetic population by 1979. Secondly, poaching was largely

unchecked during the war years (1975-1979) and resulted in severe mortality in the main river systems. Thus by 1980 the level of tigerfish exploitation in the Sanyati sub-basin was probably as high as the population could stand without adverse effect. Since independence for the country has resulted in the easing of security restrictions on the lake, cropping pressure on tigerfish in general may be expected to increase over the next few years. It has therefore become necessary to measure the impact of the different components of mortality on the tigerfish population.

While the 1973 census was designed to monitor catches of all species and to assess the potential of the Sanyati gorge as a recreational resource (Begg, 1974), the 1980 census aimed to quantify tigerfish mortality due to angling and to put this into the perspective of overall tigerfish exploitation.

2. OBJECTIVES.

2.1 To determine the extent of angling mortality on tigerfish thereby quantifying this previously neglected component of total mortality.

2.2 An assessment of the economic importance of tigerfish to the recreational fishery on Lake Kariba.

3. METHODS.

3.1 Sampling area.

The angling census was confined to the Sanyati gorge, from the mouth to Sandy Cove, where the river changes from lotic to lacustrine in character. The river above Sandy Cove is generally unsuitable for angling. This represents a distance of 13,5 km, with a total area of 350 ha.

The census station was established on the western edge of the gorge within 1 km of the mouth (the same site was used in 1973).

3.2 Station and Staffing.

The station consisted of a jetty supporting a large metal umbrella, and a scale weighing to 13,6 kg for the catches. The staff were accommodated in a tented camp on the shore for the first four months, and subsequently in the Sikwazi which was secured alongside the jetty. The staff were supplied with a V.H.F. radio for communication with Kariba, and a dinghy for general use. A

large sign (5m by 3m) requesting the co-operation of anglers in the exercise was erected at the mouth of the gorge, while a smaller sign nearer the camp directed anglers to the weigh bay.

In February, a large buoy constructed from a 200l oil drum was anchored in the centre of the gorge opposite the census camp. This was intended to provide a secure anchor for the dinghy from which the staff could more effectively direct anglers, a measure which became necessary because of the poor angler response to the programme. However, the buoy was dragged away by debris brought down by the exceptional floods in the gorge and thus never served its purpose.

The station was manned at all times by two scouts. The total establishment for the programme was six scouts who were deployed on a rotational basis, each tour being of two weeks duration. A boat was sent from Kariba every week to resupply the camp and change staff.

3.3 Data Collection.

A comprehensive advertising programme preceded the establishment of the census station. The public were informed of our intentions through the National press and the publicity machinery of hotels and marinas. Station personnel were essentially on duty from 0600 to 1800 hours daily, and during this time recorded all boat movement in and out of the gorge. Details of catches, number of boats, number of anglers, and time spent in the gorge by each were recorded on data sheets (Appendix 1). The staff were also required to submit a weekly report giving more generalized information (Appendix 2). A pair of binoculars was issued to facilitate the identification of boats that failed to call in at the weigh bay.

The census was suspended during the International Tigerfishing Tournament (I.T.F.T.) since anglers could not afford the time to call in and have their catches weighed. However, those tigerfish caught in the gorge during the I.T.F.T. were recorded by the Institute staff processing catches at the tournament base at Charara.

4. RESULTS AND DISCUSSION.

4.1 Angling Census

4.1.1 Catches : The 1980 census recorded fourteen species of fish (Table 1) with tigerfish being the predominant representative. This was to be expected since angling in the gorge is strongly selective for tigerfish (Begg, 1974). The list of species is similar to that recorded by Begg in 1973 and ranges from those species more commonly found in the lake to those that are essentially lotic in habit.

Table 1 : Species list of fish recorded in 1973 and 1980 census.

Species	1973	1980
<u>Hydrocynus vittatus</u>	X	X
<u>Tilapia rendalli</u>	X	X
<u>Sarotherodon mossambicus</u>	X	X
<u>Haplochromis codringtoni</u>	X	X
<u>Distichodis schenga</u>	X	X
<u>Distichodis mossambicus</u>	X	-
<u>Labeo altivelis</u>	X	-
<u>Labeo congoro</u>	-	X
<u>Alestes imberi</u>	-	X
<u>Clarias gariepinus</u>	X	X
<u>Heterobranchus longifilis</u>	X	X
<u>Malapterus electricus</u>	X	X
<u>Eutropius depressirostris</u>	X	X
<u>Synodontis zambeziensis</u>	X	X
<u>Mormyrops deliciosus</u>	-	X
<u>Mormyrus longirostris</u>	X	-
<u>Anguilla nebulosa labiata</u>	X	X

Tigerfish catches from the gorge display a marked seasonal trend and this is undoubtedly related to behaviour. Both the 1973 and 1980 censuses show a peak fishing season from September to November inclusive (Fig. 1). Although

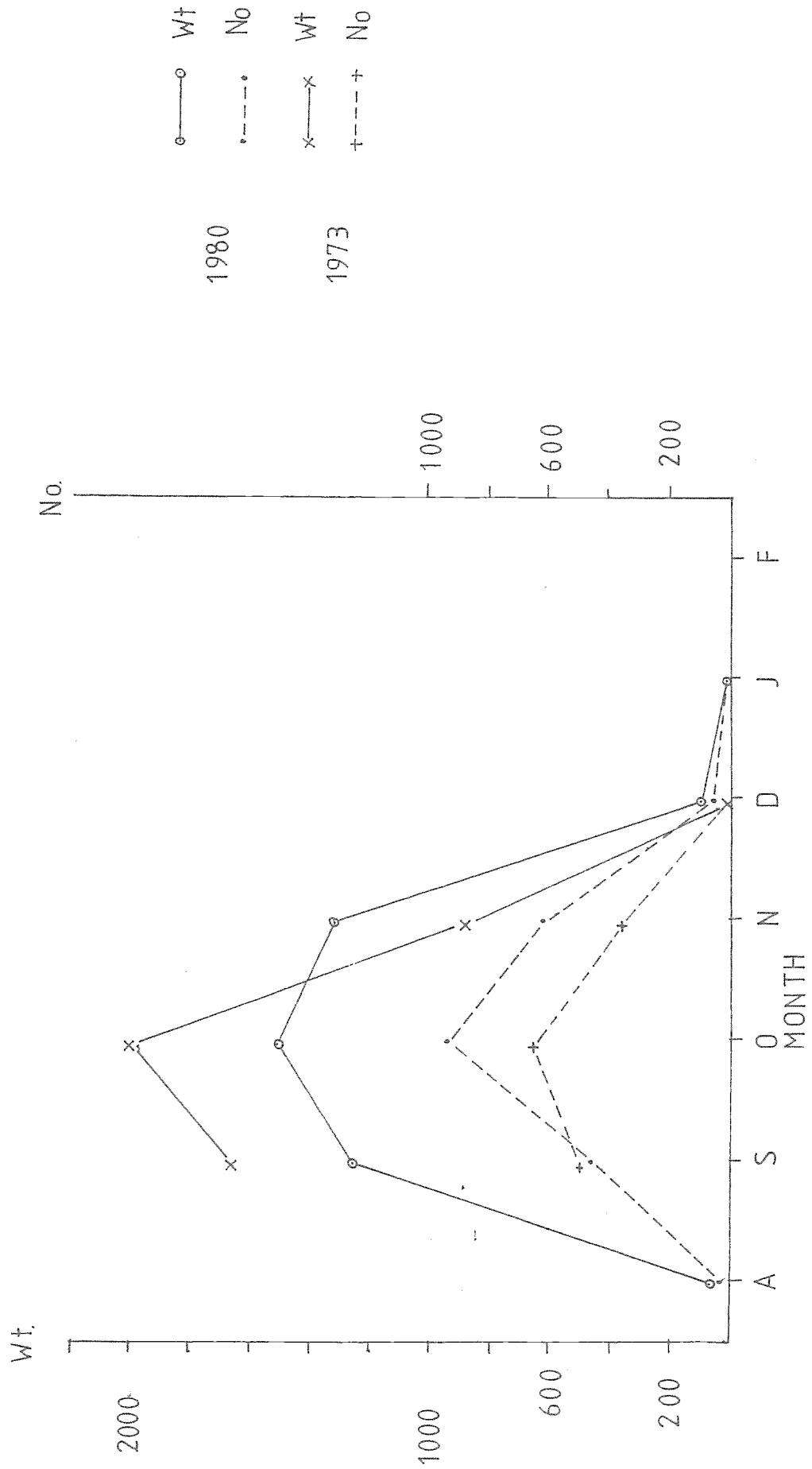
results were not available for the months April to July, it may be postulated that the beginning of the fishing season coincides with the increase in water temperature and pre-breeding activity of tigerfish in September. At this time of the year tigerfish begin congregating in large numbers in the gorge as a prelude to their spawning run (Kenmuir, 1973). The increased water temperature also stimulates feeding activity. Catches reach a peak in late October just prior to the rains, when the pre-spawning concentrations are greatest, and begin to decline with the onset of the rains. In 1980, sexually active fish began moving upstream in response to a very minor increase in water flow in mid-November (Table 2). The fish were barely able to negotiate the river but some pools contained several hundred tigerfish, visible just below the water surface. Mortality of the larger breeding females was observed to be very high with many fish being stranded in tiny isolated pools. Towards the end of November the water had become discoloured as far as the second cross-roads and was completely muddy along its entire length by the first week in December. This effectively marked the end of the angling season for tigerfish in the gorge as the muddy water tended to discourage anglers and most of the tigerfish were probably moving upstream by then. In any case, the reduced visibility would render any tigerfish "bites" chance encounters at best.

Table 2 : Breeding condition of Tigerfish sampled by explosives from the Sanyati River (mid-November).

No. Fish	No. Ripe	No. Ripe	No. Non Ripe	No. Non Ripe
24	5	9	5	5

The total recorded yield of tigerfish from the gorge during the seven months of the census was 4 280 kg, of which 91% were caught in the peak fishing season from September to November. It is doubtful whether more than 25% of the annual yield of tigerfish from angling in the gorge comes from outside the peak fishing season. This suggests, by extrapolation, an annual yield of around six tonnes of tigerfish from angling. This figure would depend, of course, on angling effort and, more importantly as will become evident later, on the degree

Fig. 1 TIGERFISH CATCHES



of co-operation shown by anglers. Begg, on the strength of 4,5 tonnes of tigerfish recorded during his four month census, suggested that "some 15 tons of tiger come from just the Banyati gorge on rod and line" (Begg, 1974). This is probably an overestimate since it disregards the marked decline in catches from December onwards.

The 1980 census results show that, as in 1973, tigerfish dominated the catches to a large extent, constituting over 75% of all species (Table 3).

Table 3 : Proportion of tigerfish caught in the angling censuses of 1973 and 1980.

Month	1980				1973			
	<u>H. vittatus</u> No.	Wt.	Other Spp. No.	Wt.	<u>H. vittatus</u> No.	Wt.	Other Spp. No.	Wt.
August	38	57,7	82	21,3	1 664,7	55	122,9	
September	467	265,3	173	78,7	481	1 664,7	55	122,9
October	942	1 500	55	36,9	647	1 989,3	24	22,4
November	611	1 122	26	9,3	360	883,6	21	22,7
December	53	89	2	2,8	2	3,2	86	1 309,4
January	1	0,2	55	42,4	-	-	-	-
February	1	4,9	0	0	-	-	-	-
Totals	2 216	4 280	393	191,4	1 490	4 540,8	186	1 477,4

Table 4 : Mean weights of tigerfish recorded in the angling censuses of 1973 and 1980.

Month	Mean Wt. Tigerfish (kg)		Tigerfish as % Total Catch (Weight)	
	1980	1973	1980	1973
Sept.	2.7	3.5	95	93
Oct.	1.6	3.1	97.5	98.9
Nov.	1.8	2.5	99.2	97.5
Dec.	1.7	1.6	96.9	0.2
Mean	1.9	3.0	96.9	75.5

* The table excludes catches from the International Tigerfish Tournament.

A striking feature is the difference in the mean size of tigerfish recorded in the two censuses; 1.9 kg in 1980 compared to 3.0 kg in 1973 (Table 4). This trend is consistent with that in the pelagic zone (Langerman, in preparation) and could well be attributed to the high level of exploitation in the sanyati sub-basin over the last few years. The mean sizes imply that angling is selective for tigerfish in the 4-5 year and older age groups, and also that females suffer greater mortality than the males. Conversely, in the pelagic zone tigerfish are recruited to the fishery in their first year and the mean age of fish caught is between 1-2 years (Langerman, in preparation).

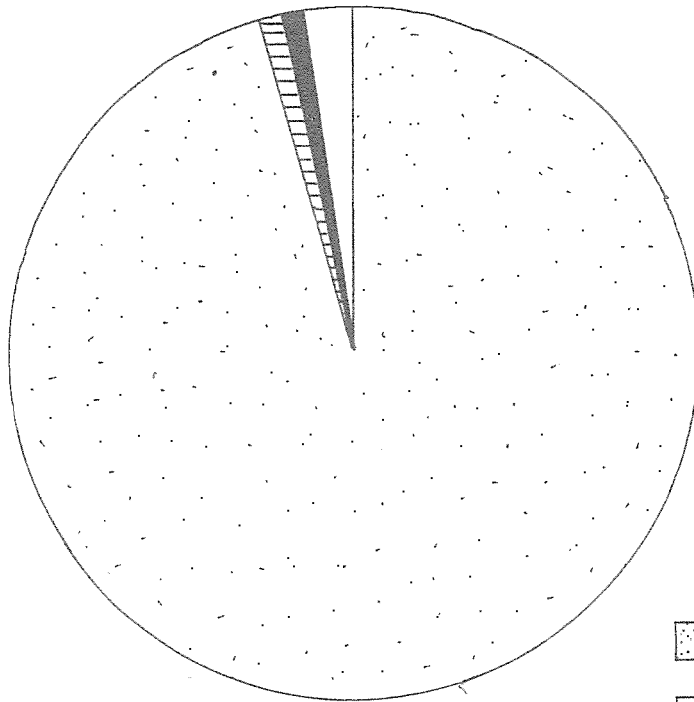
The composition of the catches recorded in the two years differs to some extent (Fig. 2). The percentage of species other than tigerfish was considerably higher in 1973 (24,5% by weight) than in 1980 (4,3%). This was clearly due to the high yield of the Siluriform species, dominated by Vundu, caught in December 1973. Begg reported that, with the advent of the rains, anglers shifted their attentions from tigerfish to vundu, with a resultant yield of 1 300 kg of the latter species. Cichlids on the other hand were poorly represented, making up only 0.2% of the catches and trailing behind the Distichodids at 1.1%. In marked contrast, the Siluriformes formed a negligible part of the 1980 yield, and vundu catches were nowhere near as spectacular as those of 1973. Also, the Cichlids were more strongly represented in the 1980 census, being second only to tigerfish in yield.





4.1.2 Effort and Catch per unit effort.

During the course of the angling census 1 417 boats, carrying a total of 4 856 people, visited the gorge (Table 5). It must be assumed that a fair proportion of these people were not actively engaged in angling since the gorge is also a popular scenic attraction. Nevertheless the public in general presented a dismal record of co-operation in the census programme and 80% of visitors failed to call in at the angling station. It is interesting to speculate on the change in attitude since Begg's day when a mere 75 boats (c.f. 797 for the same period in 1980), or 12% of the total failed to call in at the weigh bay. The poor returns served to negate much of the useful work

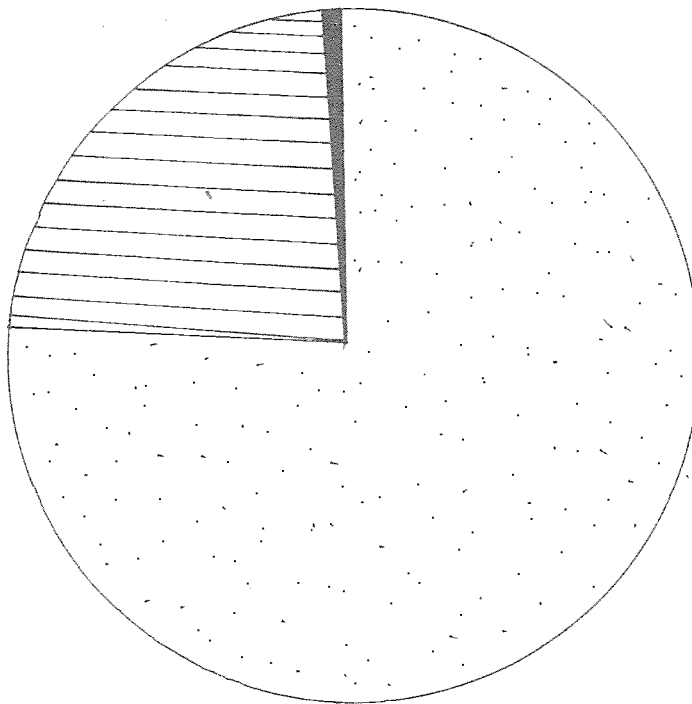
FIG. 2: SPP. COMPOSITION

1980



-  H. VITTATUS
-  CICHLIDS
-  OTHER SPP.
-  SILURIFORMS.

1973



that was undertaken. However, what data was recorded can be considered a sample representative of angling activity in the gorge.

From the data it would seem that at least six to seven thousand people visit the gorge each year, and this graphically illustrates the importance of this area in the context of regional tourism. It is doubtful whether any other single spot in the Sanyati sub-basin is as popular as this. The results show, once again, a peak of activity in October/November when up to an average of 36 people visit the gorge each day (this excludes the I.T.F.T., which had an average of 380 per day). By February 1981 the flood waters, and more particularly floating debris, had discouraged boating in the gorge and activity had declined to a minimum (Table 5).

Table 5 : 1980 census effort data.

Month	Anglers Reporting				Non-callers			
	No. Boats	No. Anglers	Boat Hours	Time/Boat	No. Boats	No. Anglers	Boat Hours	Time/Boat
Aug.	16	64	90	5.6	198	777	786	4.0
Sept.	103	346	592	5.7	195	591	1 064	5.5
Oct.	107	318	780	7.3	205	582	1 138	5.6
Nov.	70	233	553	7.9	261	842	1 709	6.6
Dec.	7	23	53	7.6	136	553	811	6.0
Jan.	4	11	24	6.0	70	314	159	2.3
Feb.	1	4	2	1.5	44	198	50	1.1
Totals	308	999	2 093	6.8	1 109	3 857	5 717	
%	22	20			78	80		

It may be significant that boats which recorded catches spent on average longer in the gorge than those that did not; one would expect sightseers to spend less time in the area than anglers.

A comparison of catch per unit effort data between the two censuses initially suggests that angling was better in 1980 (Fig. 3a). However, the results are misleading since anglers worked harder at their sport in 1980,

spending on average twice as long in the gorge as their contemporaries in 1973 (Fig. 3b : Table 6). When the time factor is incorporated into the catch per unit effort a different picture emerges, showing that anglers were in fact more successful in 1973. This is consistent with the results from the I.T.F.T. and is further emphasised by the catch per day results (Fig. 3d).

The number of boats recorded in the gorge increased by 55% from 700 in 1973 to 1 084 in 1980. This was undoubtedly due to the normalization of the political and security situation, and may be a reflection of future trends.

4.2 The International Tigerfishing Tournament.

The International Tigerfishing Tournament, an annual feature since 1962, is the most popular angling event on Lake Kariba and clearly promotes the tigerfish's status as "king" of the local freshwater fish. In the tournament's 19 year history, a total of 7 480 anglers have landed 42 tonnes of tigerfish giving an annual mean of 2.2 tonnes for the 3-day event. A record number of 664 anglers took part in 1980 and there is no reason to suppose that future events will not grow in strength.

Although the entire Sanyati sub-basin is open to the tournament, the Sanyati gorge has always been one of the favourite haunts of the competition angler. In 1980, an average of 380 anglers (in 97 boats) worked the gorge during the three days of the competition and 20% of the entire tournament catch came from this area alone whilst 50% were taken there in 1973 (Table 7).

Table 7 : I.T.F.T. catches from the Sanyati Gorge.

Year	Tigerfish Catches (kg)	% of Total I.T.F.T. Yield	No. Boats	Catch Per Boat
1973	997.9	50	257	3.9 kg
1980	416.9	19	290	1.4 kg

A disturbing feature has been the considerable decline in yield from the gorge, from 997kg in 1973 to 416kg in 1980. This represents a fall of 60% and, since it is not related to the effort level (C.P.U. confirms the trend), it must be assumed that tigerfish stocks have declined. Angling mortality is

FIG. 3: CATCH AND EFFORT

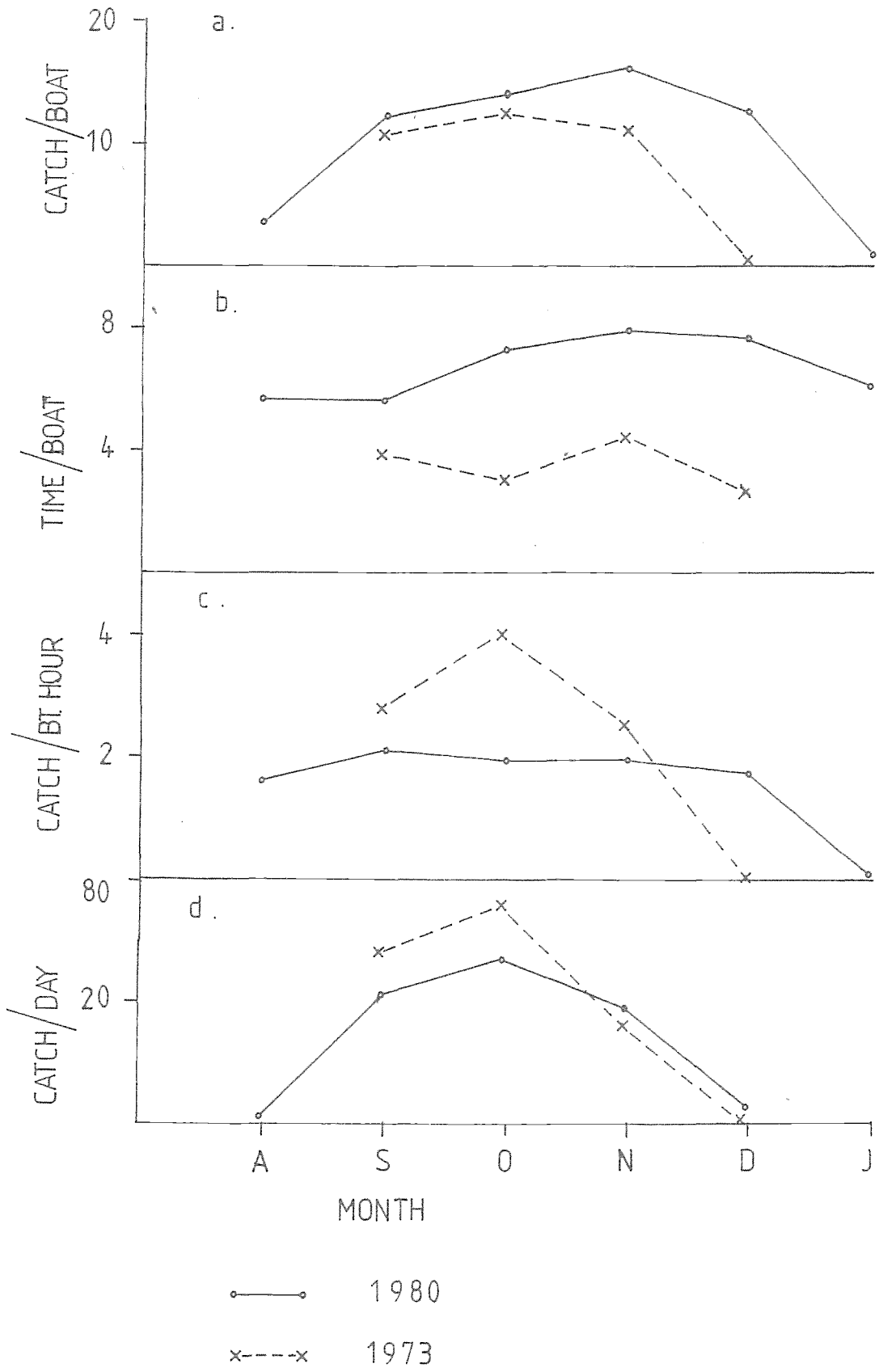


Table 6 : Comparison of Catch and Effort data for 1973 and 1980 Censuses.

	September		October		November		December		Total/Mean	
	1973 *(1)	1980	1973	1980	1973	1980	1973	1980	1973	1980
No. Boats	239	103	225	107	116	70	45	7	625	287
No. Anglers	685	346	935	318	366	233	176	23	2 162	920
No. Boat Hours	900	592	684	780	507	553	116	53	2 206	1 978
Non Callers (Boats)	36	195	23	205	14	261	2	136	75	797
Catch Per Boat	10.7 *(2)	12.3	12.4	14.0	11.0	16.0	0.1	12.7	10.3	13.8
Time Per Boat	3.8	5.7	3.0	7.3	4.4	7.9	2.6	7.6	3.5	7.1
Catch/Boat Hour	2.8 *(3)	2.1	4.1	1.9	2.5	2.0	0.0	1.7	3.0	1.0
Mean Daily Catch	56	42	71	54	33	37	0.1	4	42	36

* (1) : The number of boats in 1973 includes those with nil returns (196 boats). In 1980, no boats called in with nil returns - i.e. only boats which caught tigerfish reported in.

* (2) : Catch per boat for 1973 only includes those boats that recorded tigerfish catches, i.e. does not take into account those boats recording a nil return. This was done to make the results comparable to the 1980 data.

* (3) : The catch per boat hour is once again adjusted, and disregards the boats that recorded a nil return.

extremely severe during the I.T.F.T., particularly in such a confined area as the gorge. This situation is aggravated by pre-tournament practising when pressure on the population is almost as great as that during the tournament itself (Table 8). In 1973, for example, one and a half tonnes of tigerfish were caught in the gorge during the six days encompassing the tournament and pre-tournament practice. In 1980 this figure was almost 900 kg.

Table 8 : Results from Tournament and Pre-Tournament Practice.

Year	Mean Daily Catch - Sept.	Mean Daily Catch - 3 days prior	Mean Daily Catch - I.T.F.T.
1973	56 kg	195	332
1980	42	156	139

It should be remembered that this localized, high-intensity exploitation is being inflicted on the breeding population in the most important breeding area of the Sanyati sub-basin. For this reason alone, attempts to move the tournament dates forward into October should be resisted. While such a move would undoubtedly enhance catches in the short term, the problem would simply become more acute in the long term.

4.3 Angling Mortality.

The 1980 census was obviously of limited value in assessing total angling mortality for the Sanyati sub-basin since it encompassed a very small, albeit important, part of that basin. However, it did serve to place angling into some sort of perspective and to give us some idea of the absolute minimum yields from this source. Tigerfish are caught in the other river systems such as the Naodza and Gache-Gache and along the lakeshore, but it cannot be assessed because of the logistics involved.

The results demonstrated that angling is a significant component of total tigerfish mortality in the Sanyati sub-basin (Table 9).

Table 9 : Tigerfish catches from all sources in Basin 5.

Year	Pelagic	Inshore	I.T.F.T.	Sanyati Gorge Census
1973	0.9 tonnes	37.8 t	1.9 t	15.0 (est.)
1974	18.4	106.4	1.8	-
1975	82.3	66.9	3.2	-
1976	91.3	44.8	2.6	-
1977	136.6	34.1	3.3	-
1978	128.8	57.4	2.3	-
1979	59.9	56.0	3.2	-
1980	39.7	57.5	2.2	6.5 - 7.0 (est.)

The minimum catches of 9-10 t of tigerfish from angling represented 8 to 9% of the catch of this species in 1980. This figure is undoubtedly a considerable underestimate since it disregards the unknown component from the remainder of the sub-basin. In 1973 the known yield from angling accounted for 30% of the total exploitation. This emphasises the need to include some index of angling mortality in any management model or plan designed to manipulate effort strategies for optimum tigerfish production.

While the impact of angling on the tigerfish population as a whole is unknown, the results do point to ominous developments in the Sanyati gorge. The predicted resurgence of tourism, coupled with the popularity of the area among anglers, may necessitate the imposition of some sort of control on angling in the near future. This is particularly so in view of the area's vital importance to the breeding cycle of tigerfish.

5. CONCLUSIONS.

A well developed recreational fishery exists in the Sanyati sub-basin of Lake Kariba, and tigerfish have been shown to be the most important angling species. A substantial amount of money is spent on angling; Begg estimates an expenditure of \$12.00 per kg of fish landed in the 1973 I.T.F.T., and by 1980 this figure had risen to \$40.00. The Sanyati gorge is the most important area for angling, but the breeding stocks of tigerfish are vulnerable to over-

exploitation and it may become necessary to control angling in that area. Finally, the angling census proved no deterrent to poaching and weekly reports of netting bore testimony to the cunning of poachers who simply slipped by the station at night. This remains a thorny problem and needs to be controlled before any realistic plan can be made for the control of angling.

Acknowledgements

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Maxwell	Matende
Peter	Emmanuel
Lloyd	Paul
Shaibu	Obert

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Appendix 1

SANYATI GORGE - ANGLING CENSUS

Date No. of Anglers
 Boat Registration No. Time In
 Time Out

Species	Total Number	Total Weight
		kg.
Tigerfish		
<u>Distichodus</u> - Nkupe		
- Chessa		
Vundu		
Barbel - Clariass		
- Malapterurus		
Squeakers		
Eels		
<u>Labeo</u> - altivelis		
- congoro		
<u>Mormyrids</u> - Bottlenose		
- Cornish Jack		
<u>Cichlids</u> - S. mossamb.		
- T. rendalli		
- H. codring.		
Others : Eutropius		
GRAND TOTAL		

REMARKS

Appendix 2

1. DATES OF TOUR:

2. PERSONNEL ON DUTY:

3. REMARKS:

3.1. ANGLING RETURNS:

3.2. POACHING ACTIVITY (SIGHTINGS OR REPORTS):

3.3. TAG RETURNS:

3.4. WEATHER:

3.5. GENERAL:

4. REQUIREMENTS FOR FOLLOWING WEEK:

