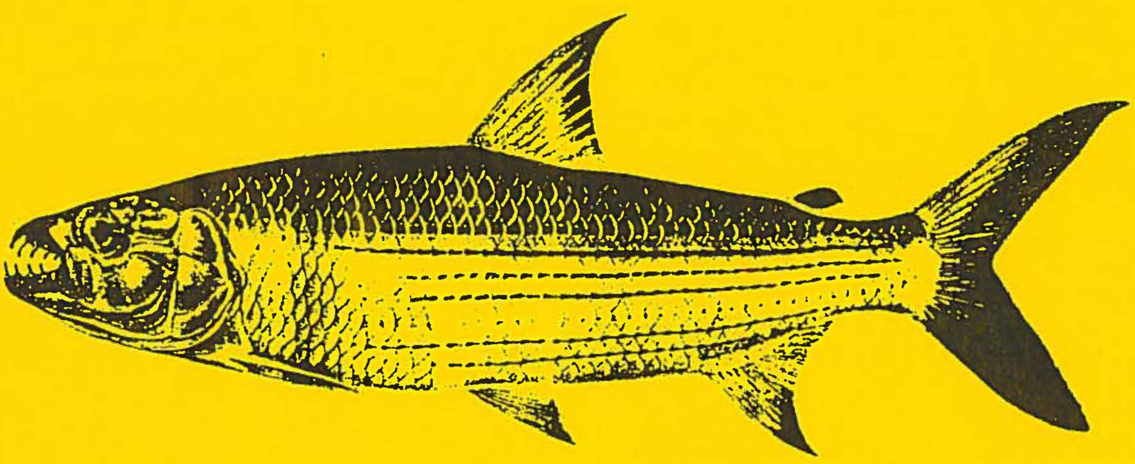
TRIAL FISHERY IN LAKE TURKANA
KENYA

WESTERN SHORES
SEPTEMBER 1986 - MARCH 1987



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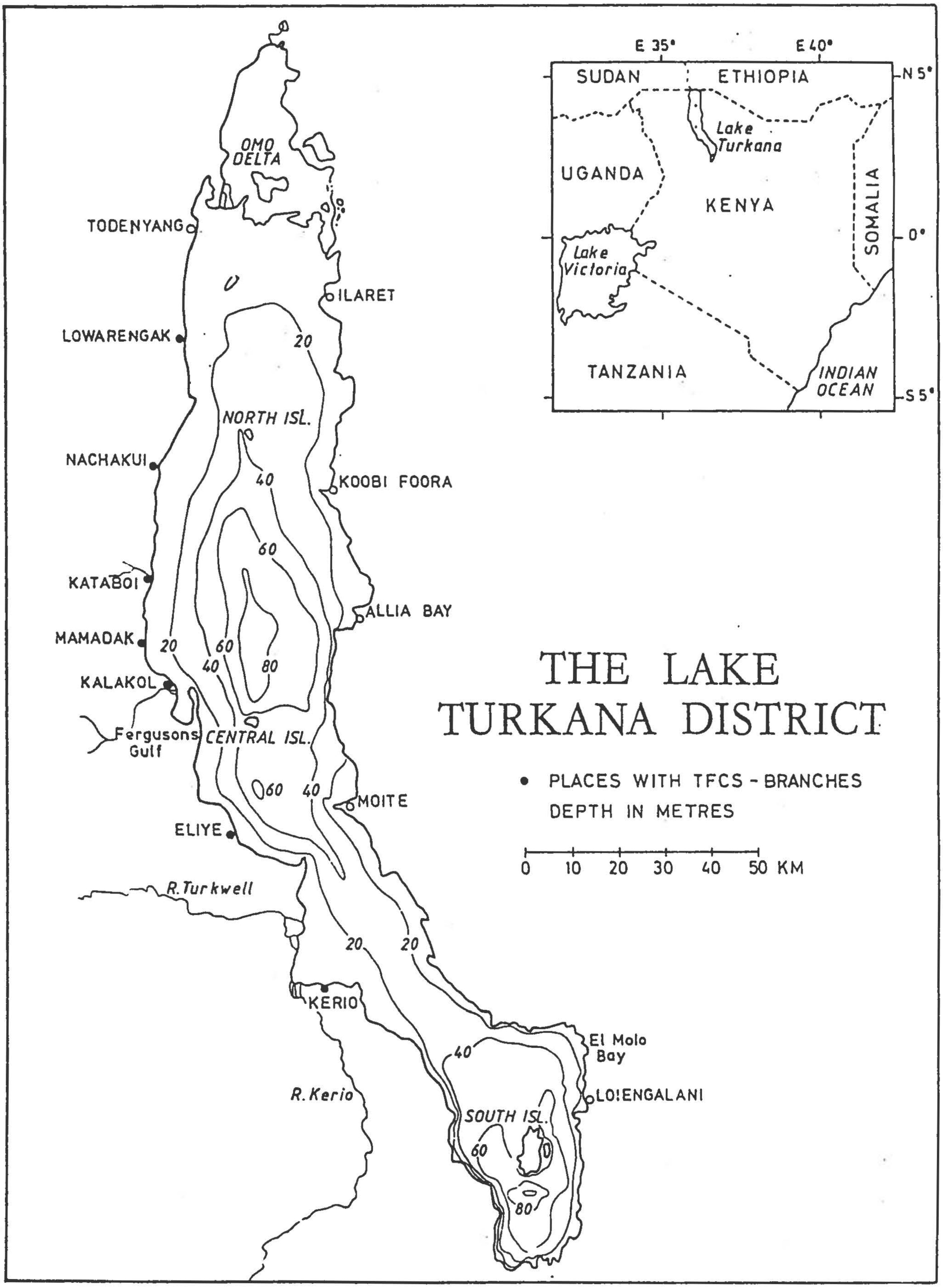
THE LAKE TURKANA DISTRICT



1. INTRODUCTION

A trial fishery for feasibility and stock assesment is presently carried out at lake turkana, Kenya, under project KEN 040 [1]).

From January 1987 the Institute of Marine Research, Bergen (IMR) was appointed to log and process the datas by EDB to faciliate the analyses. To achieve this a separate computer program has been prepared, primarily for the Lake Turkana trial fishery.

This report concerns the datas collected so far, i.e. from September 1986 to March 1987. It should primarily be regarded as an evaluation of the methods and data collecting system. The attempted conclusions are, due to the limited material in terms of numbers of investigations and geographical and seasonal coverage, based on very weak foundations. The main aim of this report is to provide the members of the stock assesment group with an updated reveiw of the latest progress.

2. METHODS AND MATERIAL

2.1. Stations and fishing periods.

The trial fishery has taken place at 7 different locations along the western shore of the lake. These are from north to south: Todenyang, Lowarengak, Nachukwi, Kataboi, Kalokol, Eliye and Kerio. All stations have been covered twice, each period of 4 - 5 days duration, with the following distribution: [2]).

(week/year):	36/86	Kataboi	
	37/-	Nachukwi	
	38/-	Kerio	
	39/-	Eliye spring	
	41/-	Kalokol	(Long lines only)
	47/-	Kataboi	
	48/-	Nachukwi	
	49/-	Lowarengak	
	50/-	Todenyang	
	4/87	Kerio	
	5/-	Eliye spring	
	6/-	Kalokol	
	8/-	Kalokol	
	9/-	Kalokol	
	10/-	Todenyang	
	11/-	Lowarengak	

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[1]). See terms of reference for Trial fishery in Lake Turkana 1986.

[2]) Annex 4, List of recordings.

2.2 Fishing gears.

The types and sizes of mesh and nets are as follows:

MESH SIZE (mm)	TWINE MATERIAL Norwegian No.	MOUNTED LENGTH (m)	FULL DEPTH (m)
58	Knotless nylon 2	28	10
78	- " - 3	37	10
105	Multifilament 3	28	9.5
125	- " - 3	28	10

The gillnets are mounted in fleets consisting of one net of each of the four mesh sizes. On a few occasions a net has been ommitted in a setting when removed for repair. On nearly all occasions the nets have been set in two water depths: "shallow" (10 m. average) and "deep" (25 m. average). On the latter some of the settings was submerged with a floatline depth of 10-15 m [3]).

Longlines have been set on all stations concomitant with the gillnets, predomminantly with hooks no. 4 and baited with Schilbe uranoscopus (nail), Hydrocynus forskalii (lokel) and Alestes baremose. (Lelete). Two lines with each 150 hooks was used.

The fishery is conducted from a 16 feet open aluminium boat with a 40 Hp outboard (the "Big Buster"). But because of sudden and frequent onsets of local storms, this craft is not safe enough to make long journeys or cross the lake.

In order to achieve the ultimate aim of the project, a comprehensive coverage of the whole lake and especially the eastern shores - a 10 years old cabincruiser with two outboard engines was purchased in October 1986. Unfortunately, it was wrecked during a storm in March 1987, before it ever came into full action.

During the trial fishery it was also performed some hydroacoustic monitoring to survey eventual changes in fish densities in the fishing areas. The tapes with these data were lost somewhere in the mail to Norway.

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[3]) For further details see A. Gryttens report to NORAD (1986).

2.3. Fish recordings.

All fish caugth are recorded on data sheets with the following parameters:

Recnr.
species
date
station
gear
meshsize
time out
depth of gear
length (cm.)
weigth (grams)
sex and maturity (only every 6-7th fish)
code (day/nigth or both)
bottomdepth

Length is standard length (SL) or fork length (FL) according to the shape of the tail, to nearest cm. Weigth is nearest 2 gram for fish below 126 gr. and nearest 5 gram up to 2 kg. Above that a bismer scale was used with a precision of probably ± 1-2 %.

Unfortunately the "time out", was in the beginning of the survey recorded as the clock-hour the nets was being set, and not as the number of hours the nets actually sat in the lake. But the catch per unit effort (CPUE) is presently calculated per setting and not per time-unit.

2.4 Data logging and processing.

All the datas collected and sent to Norway have been logged in on EDB by a program provided by T. Lindem (Inst. of physics, Oslo).

The program for processing and analysing the datas as presented in this report has been prepared by J. Kolding (IMR, Bergen).

Catch per unit effort (CPUE) is expressed as catch (kg. of fresh fish or number of fish) per setting by referring to a standard netsize of 45.7 m. long and 4 m. deep, as defined by Bayley,1975. This is for reasons of comparison. The CPUE is calculated as total means for each mesh size (tables 10 - 13) and by stations on basis of mean weekly periods (tables 14 - 28, A - D) also in different meshsizes and split into two bottomdepth and surface/ submerged nets. These are all presented in a separate volume- DATA FILES. The standard deviation per setting and the mean CPUE for the 125 and 105 mm nets from Todenyang, Kalokol and Kerio has been calculated in order to compare the results with Bayley,1973 and are presented in appendix I.

Gear selectivity is counted by mesh size on lengthbasis. Standard deviation for mean weigth is calculated, and must be treated with caution when numbers are low. Tables for gear selectivity of the 10 most important species are presented in DATA FILES, annex 2.

The tables of sexcomposition and maturityindexes are presented as proportions of totals calculated from actual numbers counted. Since only a fraction (1:7-8) of the fish has been examined, these figures are likely to be imprecise when the samples are small.

Along the logging some faults and errors in the recordings have been encountered. These have been corrected and altered if possible or excluded [4]).

So far a total of 10891 fish have been recorded and logged. Of these 73 have been given other species code during logging because of obvious discrepancy in the data sheets (e.g. length/ weigth relation not corresponding with the declared species). 55 fish have been excluded from the processing because of errors, unidentfiable species or assumed double recordings.

2.5 The coverage of the trial fishery.

Hobson (1982) recognises four major fish communities in the main lake, although the degree to which members of a comunity inter-acts with one another varies considerably and during the hours of darkness the boundaries between the various communities tend to break down with a general movement of fish towards the surface and inshore. The four communities are:

a) Littoral
b) Inshore demersal
c) Offshore demersal
d) Pelagic

a) Littoral community: restricted to an inshore belt between the lake margin and the 4 m contour. Here *Sarotherodon niloticus* (tilapia) and *Clarias lazera* (mudfish) occur througout.

b) Inshore demersal community: Bottomliving fish restricted to inshore areas between the 4 m contour and a depth of 10-15 m. Characteristic species on soft substrates are *Labeo horie* (Chubule), *Distichodus niloticus* (Gwolo) and *Citharinus citharis* (Gage). On rocky substrates occurs *Bagrus docmac* (Liis).

c) Offshore demersal community: ranges througout the deeper waters in a narrow layer rising 3-4 m above the lake bed. the inshore limits vary from 8 to 20 m depending on the season and the turbidity. Characteristic is *Bagrus bayad* (Loruk) and some small comercially unimportant species.

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[4]) This is carefully accounted for in Corrections and alterations, annex 4. Althoug this migth not be a statistically correct procedure, I am confident that my alterations are closely accurate, because of the systematic succeeding in the recordings of the data sheets and my accumulating experience during the logging. It is, if necessary, easily done to remove these fish from the records.

d) Pelagic community: spread over the entire water column from the upper limits of the demersal communities to the surface and encompassing both inshore and ofshore regions of the lake. Pelagic fish tend to be stratified by depth and three distinct faunal layers have been recognised:

i) the superficial layer: Hydrocynus forskalii (Lokel) and Alestes baremose (Lelete) are the dominant species with distributions ranging from the fringe of the littoral zone into midlake.

ii) The midwater scattering layer: consisting of pelagic fish which consentrates in a discrete zone several meters in vertical extent. The position varies with transparency from a depth of less than 5 m in the turbid waters of the northern sector to more than 30 m in the southern basin. Small Characidae are the principal species together with smaller numbers of the predators Lates longispinis (Iji) and Schilbe uranoscopus (Nail).

iii) The deep pelagic layer situated between the midwater scattering layer and the the demersal zone, extending over a depth range of up to 60 m in the deeper sections of the lake. Larger fish are scarce but small cyprinidae and prawns are dispersed througout.

A few species: Synodontis schall (tirr), Barbus bynni (Momwara) and Lates niloticus (Nileperch) occur commonly over a wide range of habitats both inshore and offshore and are not restricted to any of the above communities.

This trial fishery covers mainly the inshore demersal communities together with the innermost fringe of the offshore demersal and partly the two upper layers of the pelagic communities.

2.6 On the assumptions underlying the CPUE concept.

To asses the reliability of the attempted comparisons in the CPUE between this survey and the one of Bayley in 1973 the following should be considered:

Catch per unit effort data can be used to estimate changes in stock abundance, but not provide absolute values of abundance in terms of numbers or weigth of fish. It serves as an index.
The presumption is that the abundance is direct proportional to the catch under condition that the catchability coeficient is constant.

Catchability is in practice far from constant and the changes can be related to several factors: (Gulland, 1983).

Cyclical changes in time (day, season etc.)
Changes in the pattern and amount of fishing
Changes in stock abundance
Random variations

The catchability applicable to values of CPUE over longer periods will, so far the cyclical effects are concerned, be the same-provided that the averages are covering the same duration of time and the same cyclical trends in behaviour.

Litle is known about the exact configuration of seasonal migrations and their trigger mechanisms of the different stocks in the lake Turkana. Furthermore the climatic cycles, which are supposed to have the biggest impact on this behaviour, are seldom in fixed patterns in this semi-arid area.

	Bayley 1973		NORAD 1986/87	
Area	Months fished	set.	Months fished	set.
Kerio	Mar-Nov 1973	110	Sep 86, Jan 87	16
Kalokol	Nov 72,Jan-Mar73 May, Aug, Sep 73	27	Feb 87	26
Todenyang (inshore)	Jul-Nov 73	77	Dec 86, Mar 87	8
Todenyang (offshore)	May, Jun 73	5	Dec 86, Mar 87	8

As seen from the above table both the duration and the time of the year of the two surveys at the different locations do not coincide. To assume then, that the two surveys have covered the same seasonal trends and consequently that the same average catcability can be applied, is therefore connected with a fair risk of being wrong. Still this assumption is the only possibility if we are to compare at this stage, since no additional information at present is available. Also it must be presumed that the random variations are equal for the given surveys.

Changes in catchability related to the amount and pattern of fishing is considered to have minor importance since both surveys were trial fisheries without regards to yields or comercial interest and were performed mainly with the same methods. Changes related to stock abundance is considered not to occur with stationary gillnets which is passive gear, not influenced by searching effort or saturation.

Even assuming that the overall catcability coeficient for the two surveys are equal under the circumstances and that the given changes and similarities in the CPUEs are chiefly due to stock abundance this does not exclude the possibility that the results presented are inaccurate since this survey covers only a limited part of the lake and a short duration of time.

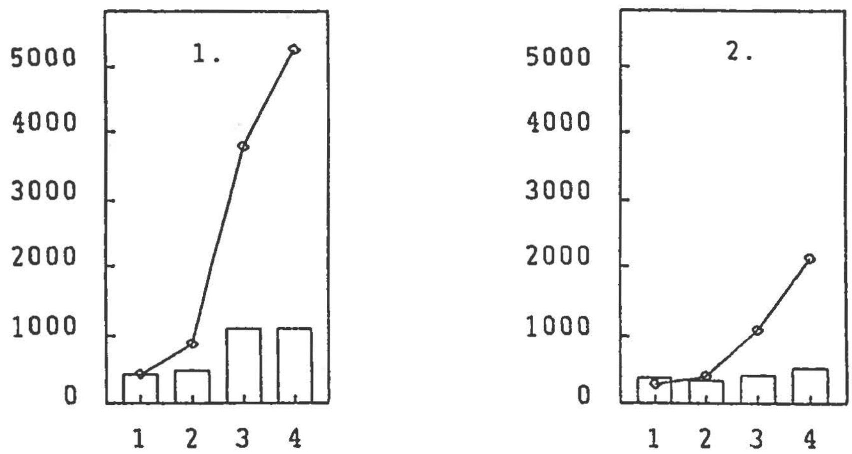
3. RESULTS AND DISCUSSION

Of the 10836 fish contained, 10389 was caugth with nets and 447 with longlines. The distribution in the four meshsizes was:

Nets	Numbers	Weigth (kg)	Settings
125 mm. (5 inches)	449	448	123
105 mm. (4.1 -)	890	500	121
78 mm. (3 -)	3777	1120	123
58 mm. (2.3 -)	5273	1114	123
Total	10389	3182	490

(from table 2)

Fig 1. Total catch in numbers (linegraph) and weigth (bars, kg) 1.) incl. _Synodontis_ and 2.) excl. _Synodontis_.



1 : 125 mm. 3 : 78 mm.
2 : 105 mm. 4 : 58 mm.

(from table 2, annex 1)

3.1 The gillnet fishery. (tables 1-28, annex 1).

In the total catch composition the contribution of one species _Synodontis schall_ (Tirr) is by far the biggest (62 % in no. and 45 % in weigth).

When distributing the total into different mesh sizes this picture is changed for the bigger mesh sizes, 125 and 105 mm, where the dominent species is _Labeo horie_ (Chubule) and where tirr amounts to 9 and 28 % by weigth. (table 2, annex 1)

The abundance of Tirr is well in accordance with previous observations. J.M.Lock,(1974) writes on the biology of Synodontis schall (op.cit): "This species together with Bagrus bayad has proved to be among the most plentiful of all species in the lake and 2 years of sampling obtained good and regular catches every month."

Tirr is exclusively consumed locally and plays an important role in the domestic markets. After the collapse of the Tilapia fishery around Ferguson gulf there has developed a specialized Tirr fishery with "ilegal" undersized nets (Broch-Due, 1986).

Next to Tirr, the most important species by weigth in this survey is Labeo horie (Chubule) with 15.5 % of total. This comercially valuable species totally predominates in the biggest meshsize with 56 % by weigth, but it also contributes significantly in the smaller meshsizes.

Bayley (1975) writes on the status of L.horie (op. cit): "Gillnet yields of Labeo have continued to rise, principally as a result of the continuing reduction of mesh sizes and the consequent capture of an increasingly large proportion of immature fish. Labeo is an andromous species, migrating into the rivers to spawn. This is particularly noticeable in the vicinity of Turkwell and Kerio deltas as demonstrated by seasonal trends. Labeo is still reasonably abundant but strict control of mesh size and restrictions on fishing in or near major rivers are urgently needed if a collapse of the fishery is to be avoided."

There is, at this stage in the present survey, allready a clear trend in the distribution of Labeo to consentrate at the stations with river inlets (fig.2). And the big variation in the weekly CPUE for the two periods at Todenyang and Kerio (fig.5) is almost entirely due to the variation of the Labeo catch, which indicates migrational behaviour. Hopson (1975) writes (op. cit): "Marked increases in CPUE of passive gear on a short time scale of Labeo reflect increases in local migrations. Such behaviour was noted when local storms coloured the water inshore, or when discharge from previously dry rivers stimulated movements."

From the results of the present survey, the feared collapse of the Labeo fishery seems not to have occured. The mean CPUE (5 inch mesh) for this species compared with the results of Bayley are almost identical in Todenyang and Kerio (table 2). Only Kalokol shows an significant reduction, but given the limited time span of the trial fishery in this area (3 weeks during which the river was dry) this can be biased by seasonal fluctuations.

Barbus bynni (Momwara) comes second to Labeo horie in terms of mean CPUE by weigth for 125 mm mesh (table 10, annex 1). Hopson (1975) writes on the biology of Barbus bynni (op. cit): "This species ranges widely both inshore and in deep water ofshore. During the flood season the population tends to move closer inshore, probably as a result of increased turbidity. It has a seasonal spawning migration coincidal with the flooding of the river Omo and spawns within the confines of this river. This species increased in comercial importance from 1972 as a result of decreasing mesh sizes combined with bottom set gillnets in deeper water. Yields and comercial CPUE decrease from north to south along the western shore. Increasing proportions of immature fish have been caugth and restrictions similar to those suggested for Labeo are necessary to conserve this comercially important species. (Bayley, 1975)."

Our data confirmes well with these observations (fig.2). The biggest catches was in Lowarengak (week 49/86) in shallow water, surface nets with 125/105 mm mesh where it predominates with 65 % of the total catch by weigth (tables 16-A,B annex 1). The mean CPUE compared with Bayleys (if the combined results from Toden-yang and Lowarengak is taken as an index of the north) show no marked changes

Lates niloticus (Nileperch) and L. longispinis (Dwarfperch) are not differentiated in the recordings and has consequently been logged under one code as Lates sp. (Iji). This is unfortunate since there is various major differences in the two species, both morfometrically and behavioural. The former is the larger and can reach considerable sizes (up to 190 cm.). It is widely distributed in the lake, with juvenile fish of under ca. 30-40 cm TL confined to the inshore regions, and extending further offshore with increasing size. Thus bigger fish are evenly distributed at all depths as far as the 60 m contour. It is a year round pelagic spawner with a sligth increase during the flood season (Hopson, 1975). Lates longispinis (up to 64 cm) is also widely distributed in the lake but primarily pelagic in the scattering layer and uncommon inshore within the 10-15 m contour. Experimtal gillnet data showed that the species was virtually absent from surface set nets but with peak catches in bottom or midwater set 3 inch nets. L. longispinis was beginning to occur in comercial gillnets during 1975 as a result of reduction of mesh sizes. (McLeod, 1975).

Care is needed to separate the two species in the field, but it must be considered done if we are to determine the individual stocks. From the present recordings it is not possible. The bulk (95 %) of the catches comprises small Lates sp. with a meanweigth of 310 gr. (fig.3). The proportion of each of the two species in these samples would only be questionable calculations.

Gillnetting for Lates niloticus yields very little compared with line fishing. Contrary is the proportion of L. longispinis in the line fishery probably small, only 10 % were under 50 cm SL.

Hydrocynus forskalli (Lokel). Hopson and Bayley (1975) writes about this species (op. cit): "This predatory species occurs abundantly in the open waters of the lake. There is a tendency for the species to range further offshore with increasing size and juvenile fish are restricted chiefly within the 10 m contour. H. forskalii occurs principally in the surface waters during dayligth, and moves into the midwater layers after dark.
Comercial catches were high between September and November in the northern part of the lake, particularly in the Todenyang area.

During the recent years the largest individuals have been caugth increasingly and the annual catch rose considerabbly from 1972 to 1974. There is a possibility that these larger fish, which usually exceeded 50 cm FL, belong to a separate, principally riverine stock. Typically H forskalii matures at ca 30 cm FL in the lake and with high mortality in the post spawners, only a small percentage of fish exceed 40 cm FL. Potential yields are probably very high and a substantial and regular fishery could be maintained offshore with surface nets of 3-4 inches. Experimental gillnets gave an average of 11.7 kg/100 m/nigth for a total of 110 nigths combining data for the whole lake."

From our data, althoug still restricted, it seems that this species has undergone a drastic change since then and is now very little abundant, especially larger fish (< 40 cm FL) which amounts to only 8 specimens total. Even if these larger fish, as suggested above, are regarded as a separate riverine unit stock, the mean catch of smaller fish in 3 inch net (constituting 85 % of the total number caugth and with a marked mode at 32 cm in the length frequency distribution (table 6, annex 2)) amounts to only 1 kg/28 m/setting offshore (i.e. at average bottomdepth 25 m) for a total of 63 settings (table 13, annex 1). This result correspond to a decrease in CPUE of nearly 70 % compared with the survey of Hobson and Bayley.

In contrast to this stands the report from H. Jensen (1986) which describes the trial fishery survey from October to December 1985. here he indicates that "the catch during daytime was dominated by tigerfish (H. forskalii) together with small nileperch and Tirr". Also Lindqvist and Beveridge (1987) "noted the commonness of the tigerfish in the catches at Longech (Kalokol)" during their visit in October-November 1986. So if this latest lack in configuration is a seasonal or permanent feature can only be revealed by continued investigations.

Another, formerly very promising, species is Alestes baremose (lelete). Hopson and Bayley (1974) writes (op. cit): "This shoaling, migratory fish is common and widespread, mainly restricted to the surface waters where it formed a high proportion of the catch in surface set gillnets of 2.5-3.5 inch mesh. Spawning migrations coincided with the flood of the river Omo and the fishes passed probably many miles upstream to spawn. Heavy consentrations of A. baremose were present in the open water during May and June and big catches of up to 120 kg per 100 m of nets were obtained in various localities incl. Ferguson spit area, Central Island, Allia bay and North Island. The mean catch from the 3 inch nets were 26.8 kg/100 m/nigth for a total of 110 nigths." They conclude that a considerable potential lies in this not yet comercially utilized stock.

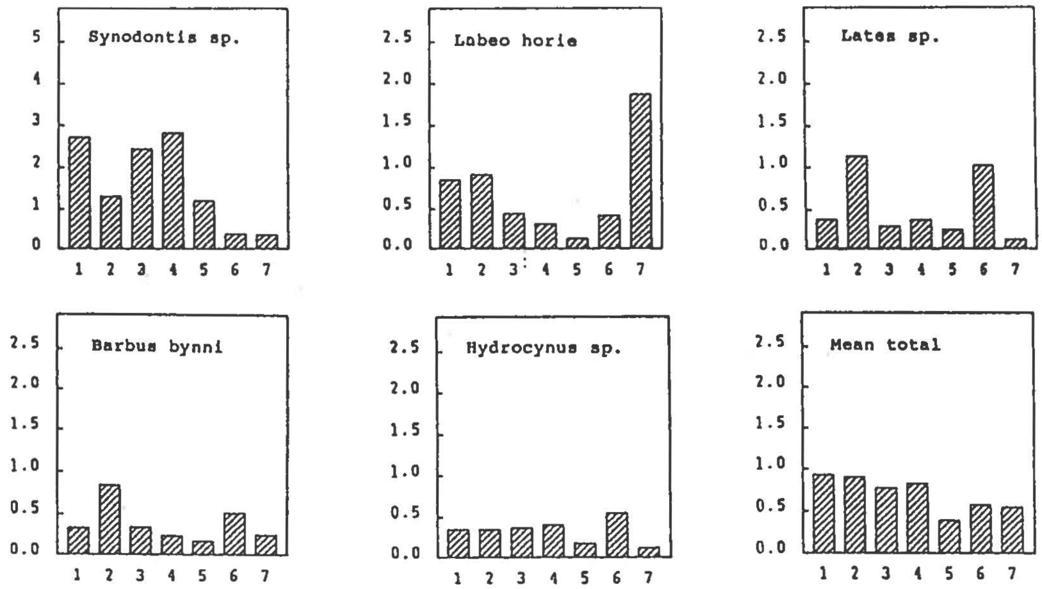
Our data do, unfortunately, not confirm this. During the whole survey a total of only 52 kg was obtained with a mean CPUE of 0.18 kg/28 m/setting (3 inch net) chiefly from the northern stations, corresponding to 2.4 % of the mean CPUE in 1973. Even this survey so far has been conducted relatively close to the shores, there would be a significantly indication if the stock of

A. baremose is only nearly as big as in 1973. Since this stock is not comercially exploited, the only explainations must be a recruitment failure, or ,more speculative, a seasonal migration to parts of the lake not covered by this survey.

The catches of Distichodus niloticus (Gwolo) and Citharinus citharis (Gage) have apparently not changed since the survey of Hobson and Bayley (table 2). They seems to have stabilized (?) on low level, far from their former golden age. They contributed respectively 2.4 and 1.6 % by weigth in the total catch composition of 5 inch net.

Tilapia or Saroterhodon niloticus (Kokine) belongs to the littoral community, which is not covered by this survey. Only one specimen was caugth. They are principally caugth by beach seining.

Fig. 2 Mean catch per unit effort, all mesh sizes combined, for the 5 dominant species, by stations (kg fresh fish/set.)



1: Todenyang 3: Nachukwi 5: Kalokol 7: Kerio
2: Lowarengak 4: Kataboi 6: Eliye
(tables 14-28, annex 1)

Table 1. Comparison of mean catch per unit effort (combined results from the whole period) between this survey and Bayleys survey in 1973. showing the mean catch per effort for 3 areas in kg fresh fish per setting of standard net. The standard deviation appears below each value together with the number of settings in brackets.

	Bayley,1973			NORAD,1986-87	
Area	Streched mesh size (inches)				
	4	4.5	5	4.1	5
Kerio	-	3.86 ±1.52 (14)	5.24 ±4.61 (18)	2.47 ±3.48 (15)	4.92 ±7.68 (16)
Kalokol	10.8 ± 3.1 (2)	-	2.94 ±1.80 (24)	1.56 ±1.38 (26)	0.58 ±0.85 (26)
Todenyang (inshore)	-	-	4.50 ±3.42 (56)	3.15 ±1.46 (8)	2.13 ±1.20 (8)
Todenyang (offshore)	52.5 - (1)	-	15.64 ±7.38 (3)	4.74 ±4.71 (8)	2.93 ±2.69 (8)

Table 2. Comparison of mean catch per effort for individual species of fish in kg fresh fish/standard net/setting between Bayleys survey in 1973 and this present survey in 3 areas. The number of fresh fish/standard net/setting is given in brackets.

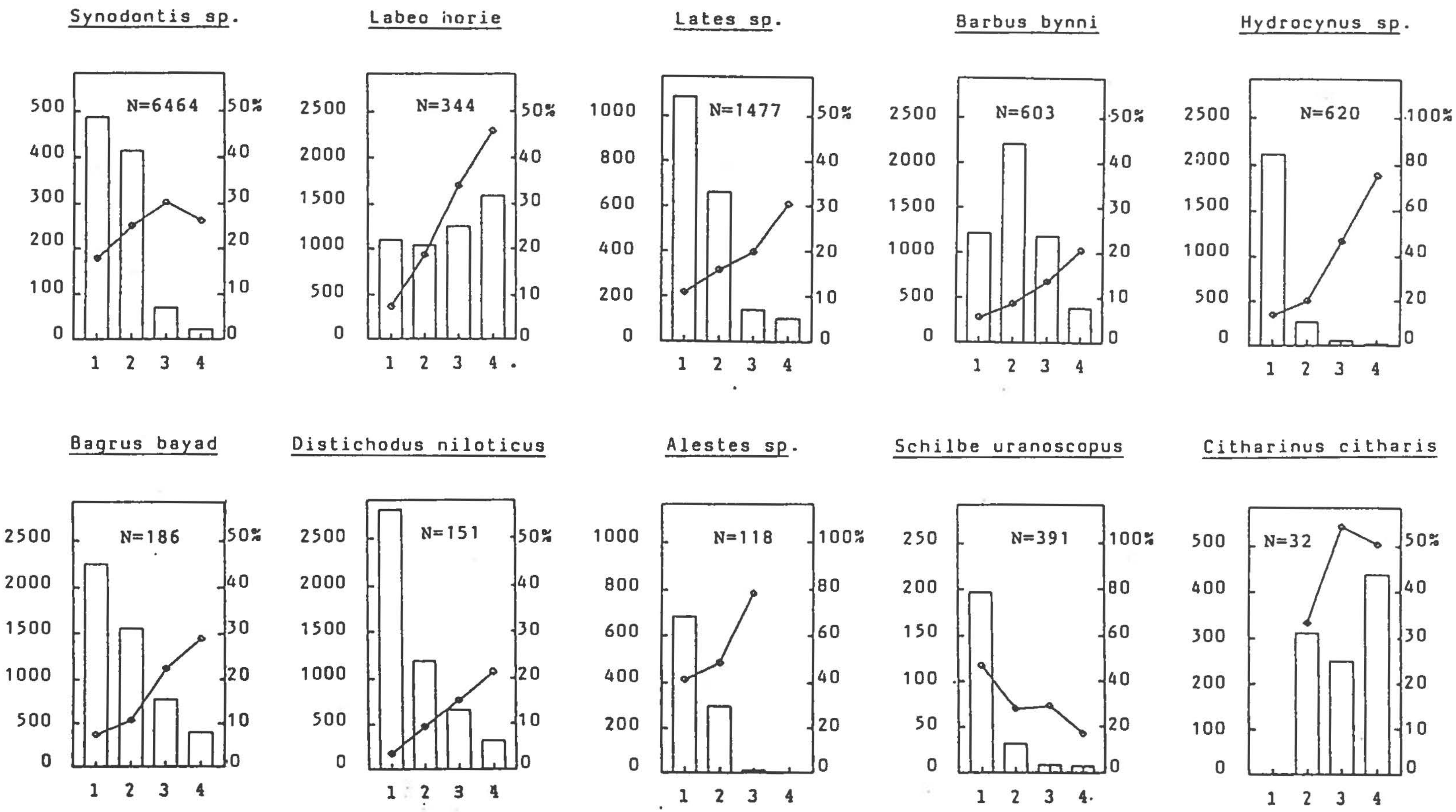
Todenyang	Bayley,1973		NORAD,1986-87	
	Streched mesh size (inches)			
Species	4	5	4.1	5
Labeo	-	1.18(0.55)	1.43(0.64)	1.28(0.49)
Synodontis	-	0.64(1.27)	1.22(3.78)	0.11(0.41)
Barbus bynni	-	1.13(0.71)	0.65(0.73)	0.50(0.45)
Distichodus	-	0.12(0.05)	0.13(0.21)	0.10(0.08)
Hydrocynus	-	1.09(0.50)	0.13(0.04)	0.25(0.08)
Citharinus	-	0.09(0.03)	0.13(0.21)	0.09(0.16)
Lates sp.	-	0.89(0.59)	0.10(0.13)	-
Bagrus bayad	-	0.22(0.24)	0.08(0.17)	0.16(0.16)

Kalokol	Bayley,1973		NORAD,1986-87	
	Streched mesh size (inches)			
Species	4	5	4.1	5
Labeo	1.39(1.00)	1.21(0.59)	0.28(0.26)	0.26(0.15)
Synodontis	5.25(12.5)	0.64(1.58)	0.62(1.77)	0.11(0.43)
Barbus bynni	-	0.05(0.05)	0.26(0.45)	0.05(0.03)
Distichodus	-	+	-	0.02(0.03)
Hydrocynus	3.89(2.75)	0.65(0.36)	0.14(0.08)	-
Citharinus	-	0.32(0.20)	-	-
Lates sp.	0.25(0.25)	0.03(0.02)	0.10(0.32)	0.09(0.33)
Bagrus bayad	-	0.04(0.05)	0.16(0.21)	0.05(0.03)

Kerio	Bayley,1973		NORAD,1986-87	
	Streched mesh size (inches)			
Species	4.5	5	4.1	5
Labeo	3.65(2.46)	4.23(2.41)	1.79(1.01)	4.32(1.71)
Synodontis	-	0.08(0.13)	0.21(0.87)	0.04(0.20)
Barbus bynni	0.21(0.14)	-	0.17(0.37)	0.04(0.04)
Distichodus	-	-	0.21(0.27)	0.21(0.16)
Hydrocynus	-	-	0.02(0.09)	-
Citharinus	-	0.15(0.07)	-	-
Lates sp.	-	0.20(0.04)	0.06(0.09)	0.30(0.12)
Bagrus bayad	-	0.54(0.54)	-	-

MEANWEIGTH (linegraphs) AND PERCENT NUMBERS CAUGTH (bargraphs) OF 10 SPECIES, PLOTTED AGAINST MESHSIZES. (1: 58 mm., 2: 78 mm., 3: 105 mm., 4: 125 mm. - meanweigth in grams).

Fig. 3.



3.2 The Longline fishery. (tables 29-32, annex 1).

The dominent species are Bagrus bayad (Loruk), the mudfish Clarias lazera (Kopito), nileperch Lates niloticus and Bagrus docmac (Liis).

Bagrus bayad contributes with 41 % of total by weigth, 310 specimens with a range from 20 to 85 cm and a meanweigth of 1.2 kg.

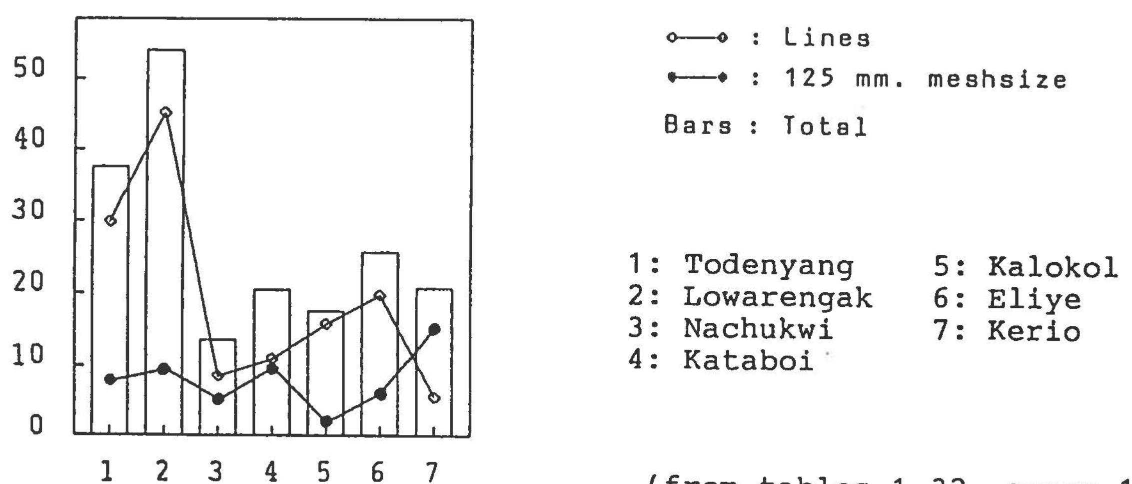
Lates niloticus comprised 33 % by weigth with 26 specimens of range 22 to 120 cm and a meanweigth of 11.7 kg. The biggest individs caugth at the northern stations.

Clarias lazera comprised 21 % by weigth with 37 specimens of range 60 to 100 cm and a meanweigth of 5.3 kg. This species was only caugth by lines.

Bagrus docmac is a deepwater species, preferably on rocky substrata. Bayley (1975) writes: "It appears to be most plentiful in the central and southern sectors and has increased in comercial yields due to the expansion of longlining grounds near the eastern shore and around the islands." Our catch consisted of only 2 specimens caugth at Lowarengak and Nachukwi. It amounted to 2.3 % by weigth with length of 80 and 90 cm and a meanweigth of 11.3 kg.

This fishery has been compared with the 125 mm gillnets on a daily basis. Two lines of 150 hooks gave an average meancatch per day of 20 kg as opposed to 7.2 kg for two settings of the legal 125 mm nets (fig.4).

Fig. 4. Mean catch per day (kg) for "legal gears" (125 mm net + lines). The whole period combined by stations.



(from tables 1-32, annex 1)

It seems that the longline fishery returns very good yields to the effort.

It could be very interesting to know how big a part the line fishery actual plays in the present comercial fishery and to what extend the restrictions such as boat capacity or weather conditions sets limits. Broch-Due (1986) informs of an increased tendency for the fishing population to move north after the Ferguson gulf collapse to participate in the hook fishery but that the majority was conducted from Doum palm rafts and with very few hooks and that it was rather a subsistence fishery for those unable to be members of a boat crew.

3.3 Catch Per Unit Effort.

H. Jensen (NORAD, 1986) finds in his report from October-December 1985, covering the areas from Lowarengak to Eliye spring, that the higest catches and the most dense concentrations of fish were detected outside the Ferguson gulf. Also his later report from May-June 1986, covering the same areas, found the higest CPUE at Kalokol and Kataboi.

The data from this period do not fit into this picture (fig 2,4 and 5), where the higest catches are in the north and the south and where especially Kalokol (Ferguson gulf area) comes out with a minimum. It should be noticed, though, that the 2 periods compared at Kalokol were separated by only one week.

The variance in the CPUE by week is apparently very substantial (fig.5), especially for the bigger mesh sizes. It could indicate the strong migrational pattern for several of the species as discribed by Hopson and Bayley.

Another interesting feature, as already confirmed by H. Jensen (1986), is the tendency for the CPUE to increse with distance from the shore and the deptht for the settings (fig.6). This clearly shows the advantage that the boat fishermen have from the raft fishermen, and why the poorest among the fishing population are "forced" to employ ilegal nets, for which, if caugth, they are either fined or must pay bribes. This is a difficult situation, especially after the Tilapia collapse. [5]).

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[5]) These mechanisms are elaborately accounted for in V. Broch-Due (1986) From Herds to Fish and From Fish to Food Aid draft,(NORAD, under publishing).

Fig. 5. Mean catch per unit effort by station and by mesh size. (2 weeks are compared for the different stations)

Station	crossed bars		black bars
1: Todenyang	50/86	-	10/87
2: Lowarengak	49/86	-	11/87
3: Nachukwi	37/86	-	49/86
4: Kataboi	36/86	-	47/86
5: Kalokol	7/87	-	9/87
6: Eliye	39/86	-	5/87
7: Kerio	38/86	-	4/87

CPUE in kg fresh fish per standard net/setting

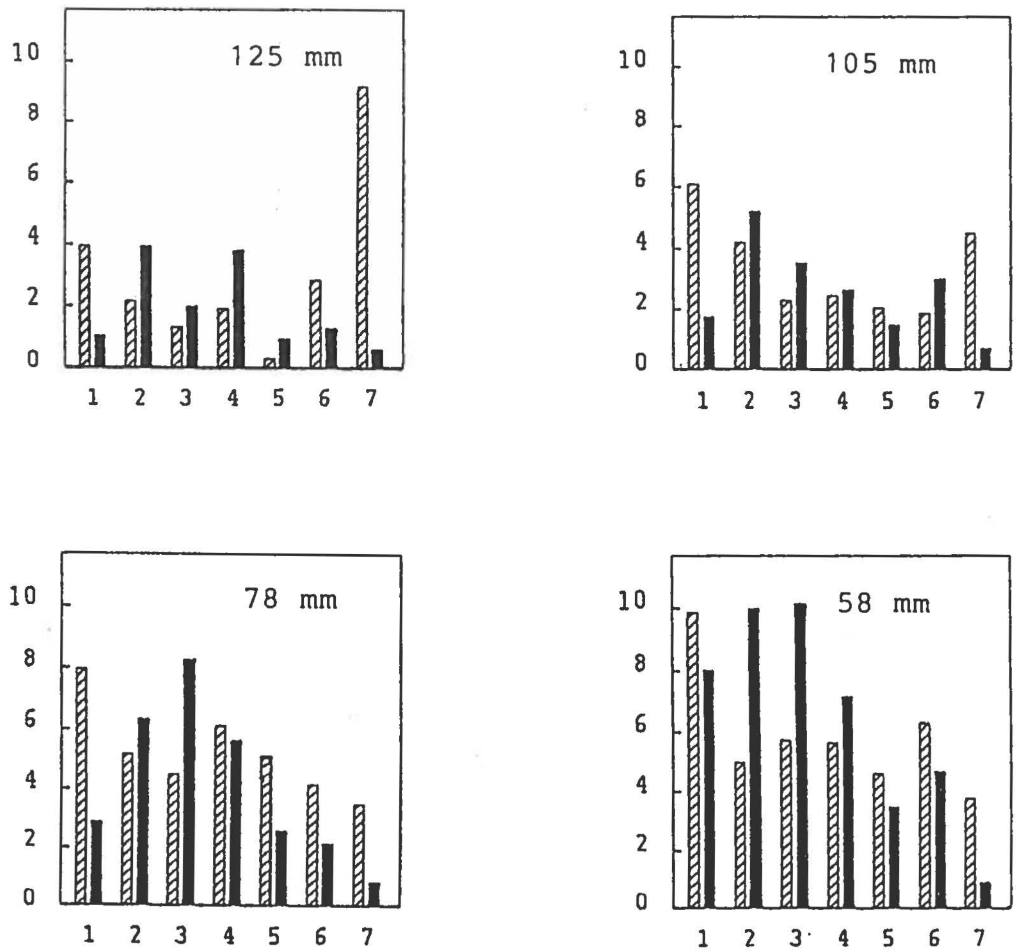
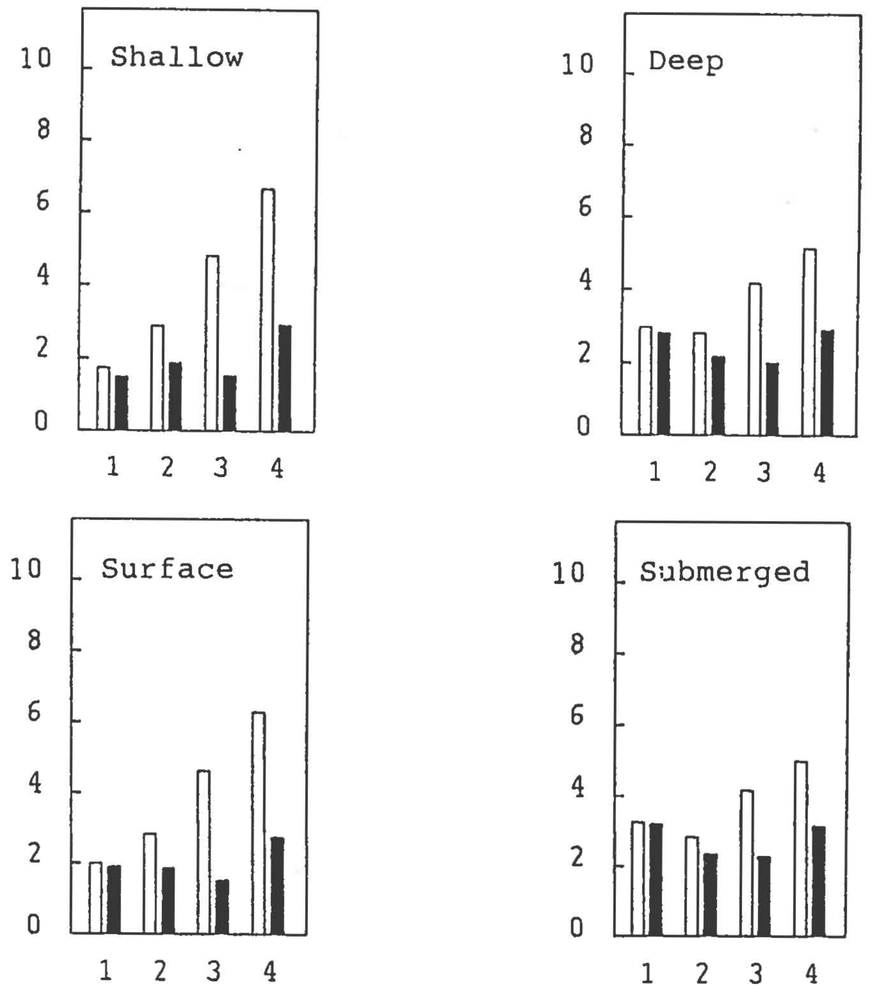
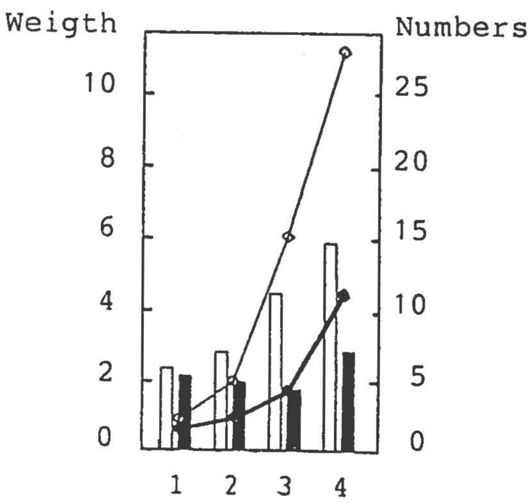


Fig. 6. Mean catch per unit effort, all stations combined, by different depths and by surface/submerged nets. (CPUE incl. Synodontis sp. (open bars) compared without Synodontis (black bars)). In kg fresh fish per standard net/setting.

1: 125 mm 2: 105 mm 3: 78 mm 4: 58mm net





Mean CPUE, all stations and all settings combined, by mesh size. CPUE incl. Synodontis (open bars) compared without (black bars). In kg fresh fish per standard net/setting and in number of fish per satndard net/setting.

(tables 10-13, annex 1).

3.4 Maturity investigations. [6]

Except for Synodontis schall (tirr) our material is still very limited (tables 1-7, annex 3). But to demonstrate the potential value of these investigations, the Tirr datas will be used as a "Case study" (fig.7).

S.schall matures at a FL of 20 cm or more, although some individuals mature at a smaller size than this. S. schall does not have a restricted breeding season and ripe females are caugth in all month of the year. Breeding is controlled by the inflow of river water into the lake and an increase in turbidity, or an decrease in conductivity, or both, may be chief environmental factors to establish time and place of spawning. All females caugth in the shallows adjecent to the outlet of flowing rivers were ripe and running. The ratio of males to females at the spawning sites increased from an average of 2:3 for the lake to 11:1 and all males were ready to spawn. Attempts are perhaps made to migrate up the rivers and Synodontis have been reported some miles up rivers that have contiuned flowing for several days. However, the usual site of spawning is probably at the mouth of these rivers. (J.M. Lock, 1974, op. cit).

In our case there is a marked dominance of mature fish at the north, decreasing southwards until Kerio, (which is one of the bigger rivers, although not perennial). Also there is a noticeable bimodal configuration in the north on the length frequency histograms, indicating the recruitement of a new generation. Taken into account that CPUE of the species was very low at the southern stations, where it formerly was very abundant, and the climatic reports telling of a total failure of the "short rains" last autom (pers inf.), this migth be an indication that a major part of the Synodontis stock has migrated north to the Omo river in order to reproduce. This hypothesis is new in the way that Synodontis formerly was believed to be rather stationary (Lock). But perhaps during his investgations in 1974-75, there was no need for migration due to more regular rains ?

This is perhaps speculative, but it does illustrate the importance of this part of the investigations. Because it is labour intensive, only a fraction of the fish are examined in this way. But because of the vast differences in the species ratios it would be more valuable if this task was distributed accordingly, so that lesser frequent species was measured more often on account of the frequent ones.

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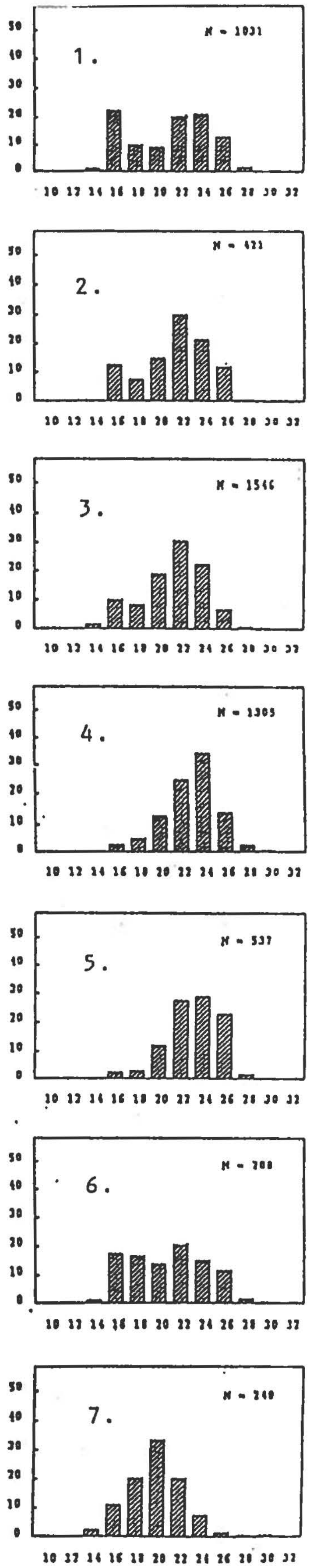
[6] This analysis was prepared at an earlier stage and covers only the first 8344 recording until February 1987.

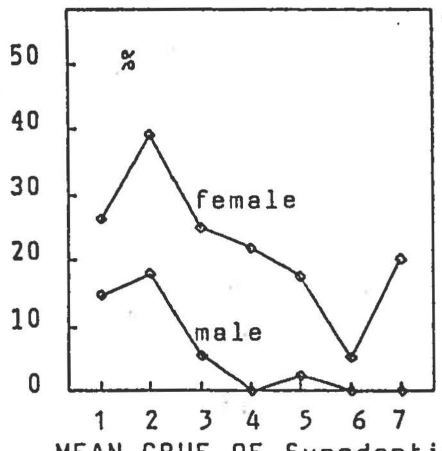
Fig. 7.

LENGTH FREQUENCY DISTRIBUTION
OF Synodontis sp.(2 cm. intervals)
BY STATIONS FROM NORTH TO SOUTH.

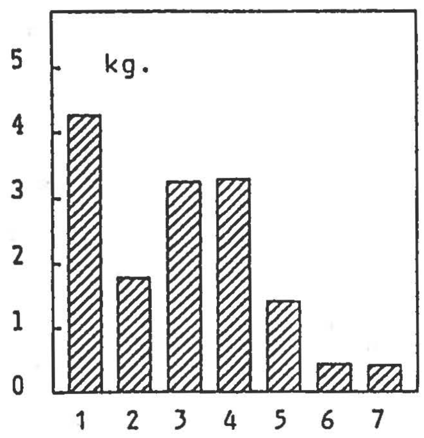
1 : Todenyang
2 : Lowarengak
3 : Nachukwi
4 : Kataboi
5 : kalokol
6 : Eliye spring
7 : Kerio



MATURE (stadium 4) Synodontis sp.
in percent by stations (north to south)



MEAN CPUE OF Synodontis sp. by stations



3.5 Evaluation of the recording system.

The general impression is that the samplings have been performed conscientiuosly in accordance with the lay-out procedure. There has, as mentioned, been misunderstandings and inattentiveness, especially in declaration of the species in the data sheets. The occasional impression of double recording is probably also due to inattention. A few of the mean weigths and standard deviations in the gear selectivity tables (1-10, annex 2) are significantly deviant, indicating either datas from a wrong species or measurement mistakes.

To draw conclusions only from the processing of the data sheets without any additional enviromental information is very little biologically informative. In this aspect the recordings are extremely poor, considering that these additional informations are the least work done compared with the laborious fish measurements and recordings. The local fishing population probably knows more about the behaviour of the fishes just from seasonal and climatic observations, than these data sheets alone can tell us.

It is therefore urgently needed to set up a system that can contain these informations, like index of wind condition, moon fases, rain, clouds, river flows, lakecolour/turbidity etc. Also interresting would be predation of fish caugth in the nets by crocodilles and soft shelled turtles (Egyptian memories). Other valuable information would be parallel sampling of local catches and registrations of changes in the local fishing pattern, and or, movements in the fishing population.

The covverage of the survey area is still very restricted with most stations visited twice. The original intentions were to visit each fishing area about once a month, and later to expand the area to also cover parts of the eastern shores (Jensen, 1986).

Bayley (1975) writes (op. cit): "It is imperative that the collection of statistics continues. Routine data should be collected as follows:....(b) Gillnetting with graded fleets of nets with mesh sizes ranging from 2 to 8 inches in 1 inch intervals should be carried out at inshore and offshore in exploited and unexploited areas. As a general guide, an absolute minimum of 52 sets per annum at each station in exploited areas, and about half that number in unexploited areas should be made."

In order to achieve these intentions, the survey team must be able travel safe and unencumbered. So more the grief when learning that the cabin-cruiser was destroyed.

4.SUMMARY AND CONCLUSIONS

This trial fishery covers the period from 03.09.86 to 12.03.87.

7 stations along the western shore of Lake Turkana have been visited twice during this survey, and a total of 10891 fish have been recorded and processed by EDB.

All conclusions drawn from this still very limited material should be treated with extreme caution. In general questions still preceeds conclusions.

Synodontis sp. (Tirr) comprises the overall majority of the combined total catch with nearly 45 % by weigth. An increasing fishery for this species is develloping with "ilegal" mesh sizes.

The comercially important Labeo horie (Chubule) is second by weigth with 15 %. The stock seems, with reservations, to have remained stable since the 1973 survey.

Also Barbus bynni (Momwara) seems to have preserved its stocks, it comprised nearly 10 % by weigth.

Lates niloticus and L. longispinis (Iji) have not been separated in this survey. This should be considered done in the future. For a predator species they seems relatively numerous. Gillnet yields for L. niloticus with the trial mesh sizes are low compared with longline fishery.

Hydrocynus forskalii (Lokel) and Alestes baremose (Lelete). Much hope has been put into these two, formerly promising species. From these data the stocks seems to have decreased substantially, but this conclusion migth be inaccurate and can only be confirmed by a complete lake coverage.

Distichodus niloticus (Gwolo), has not recovered but is neither completely depleted, the catches seems to have stabilised on a very low level. It contributed with nearly 2 % by weigth.

The Tilapias, belonging to the littoral community, have not been covered by this survey.

Line fishery for Bagrus sp.(Loruk/Liis), Lates sp. and Clarias lazera (Kopito) seems to yield good catches and the general return is high compared with gillnet fishing.

Catch per unit effort in general increases with distance to shore and depth.

There is apparently considerable fluctuations in the fishery at different locations, probably due to migrational behaviour.

The field recordings are generally of a good standard, but a bit more attention and care is needed, especially in species declaration and mistakes like double recordings.

Additional environmental observations and informations should be given serious priority. They are important and needed.

Accurate positions of the fishing stations, especially distance to the shore, should be mapped.

Sex and maturity determinations should be distributed among the species according to their frequencies in catches.

The coverage system do not meet the intensions, with stations only examined twice in half a year. The stations for examination could probably be reduced to 3 : Todenyang, Kalokol and Kerio.

Mobility of the survey team is paramount. To continue the trial fishery until the arrival of a prober boat does not seem necessary. In terms of stock assesment it is now <u>important</u> to cover the whole lake or at least the eastern shores.

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Appendix I. Mean catch per unit effort with standard deviation per setting. Combined results for whole period at 3 stations: Todenyang (inshore/offshore), Kalokol and Kerio.

MEAN CPUE - KALOKOL - 125 mm NET.

```
FROM RECNR.   :        0    STATION      : KALOKOL
TO   RECNR.   :    10891    DIVISION     : 0
GEAR          :  GILLNET    DEPTH (GEAR) : 0
GEARSIZE      :   125mm.    SETTINGS     : 26
```

SPECIES:		NO.	%	WEIGTH	%	CATCH PER UNIT EFFORT NO:	+/-SD	WEIGTH:	+/-SD
CHUBULE	:	6	15.0	10.305	44.8	0.15	0.34	0.26	0.62
TIRR	:	17	42.5	4.224	18.4	0.43	0.78	0.11	0.21
NILEPERCH	:	13	32.5	3.720	16.2	0.33	0.53	0.09	0.16
LORUK	:	1	2.5	1.975	8.6	0.03	0.13	0.05	0.25
MOMWARA	:	2	5.0	1.900	8.3	0.05	0.18	0.05	0.18
GWOLO	:	1	2.5	0.890	3.9	0.03	0.13	0.02	0.11
NAIL	:	10	25.0	0.000	0.0	0.00	0.00	0.00	0.00
TOTAL	:	40	100	23.014	100	1.00	1.19	0.58	0.85

MEAN CPUE - KALOKOL - 105 mm NET.

```
FROM RECNR.   :        0    STATION      : KALOKOL
TO   RECNR.   :    10891    DIVISION     : 0
GEAR          :  GILLNET    DEPTH (GEAR) : 0
GEARSIZE      :   105mm.    SETTINGS     : 26
```

SPECIES:		NO.	%	WEIGTH	%	CATCH PER UNIT EFFORT NO:	+/-SD	WEIGTH:	+/-SD
TIRR	:	67	57.3	23.358	39.6	1.77	2.04	0.62	0.68
CHUBULE	:	10	8.5	10.610	18.0	0.26	0.59	0.28	0.64
MOMWARA	:	17	14.5	9.975	16.9	0.45	0.87	0.26	0.46
LORUK	:	8	6.8	5.900	10.0	0.21	0.42	0.16	0.34
LOKEL	:	3	2.6	5.355	9.1	0.08	0.22	0.14	0.40
NILEPERCH	:	12	10.3	3.719	6.3	0.32	0.68	0.10	0.22
NAIL	:	6	5.1	0.700	1.2	0.00	0.00	0.00	0.00
TOTAL	:	117	100	58.917	100	3.09	2.79	1.56	1.38

MEAN CPUE - KERIO - 125 mm NET.

```
FROM RECNR.   :        0    STATION      : KERIO
TO   RECNR.   :    10891    DIVISION     : 0
GEAR          :  GILLNET    DEPTH (GEAR) : 0
GEARSIZE      :   125mm.    SETTINGS     : 16
```

SPECIES:		NO.	%	WEIGTH	%	CATCH PER UNIT EFFORT NO:	+/-SD	WEIGTH:	+/-SD
CHUBULE	:	42	76.4	105.980	88.0	1.71	2.89	4.32	7.63
NILEPERCH	:	3	5.5	7.315	6.1	0.12	0.26	0.30	0.77
GWOLO	:	4	7.3	5.220	4.3	0.16	0.38	0.21	0.48
MOMWARA	:	1	1.8	1.090	0.9	0.04	0.16	0.04	0.18
TIRR	:	5	9.1	0.866	0.7	0.20	0.52	0.04	0.11
NAIL	:	4	7.3	0.000	0.0	0.00	0.00	0.00	0.00
TOTAL	:	55	100	120.471	100	2.24	3.22	4.92	7.68

MEAN CPUE - KERIO - 105 mm NET.

```
FROM RECNR.   :        0    STATION      : KERIO
TO   RECNR.   :    10891    DIVISION     : 0
GEAR          :  GILLNET    DEPTH (GEAR) : 0
GEARSIZE      :   105mm.    SETTINGS     : 15
```

SPECIES:		NO.	%	WEIGTH	%	CATCH PER UNIT EFFORT NO:	+/-SD	WEIGTH:	+/-SD
CHUBULE	:	22	35.5	39.105	72.5	1.01	1.42	1.79	2.60
GWOLO	:	6	9.7	4.615	8.6	0.27	0.57	0.21	0.44
TIRR	:	19	30.6	4.515	8.4	0.87	1.34	0.21	0.32
MOMWARA	:	8	12.9	3.695	6.9	0.37	0.77	0.17	0.34
NILEPERCH	:	2	3.2	1.230	2.3	0.09	0.24	0.06	0.16
LOKEL	:	2	3.2	0.435	0.8	0.09	0.35	0.02	0.08
NAIL	:	5	8.1	0.275	0.5	0.09	0.24	0.01	0.03
LELETE	:	1	1.6	0.052	0.1	0.05	0.18	0.00	0.01
TOTAL	:	62	100	53.922	100	2.84	3.72	2.47	3.48

MEAN CPUE - TODENYANG (INSHORE) - 125 mm NET.

FROM RECNR.	: 0	STATION	: TODENYANG
TO RECNR.	: 10891	DIVISION	: 10
GEAR	: GILLNET	DEPTH (GEAR)	: 0
GEARSIZE	: 125mm.	SETTINGS	: 8

					CATCH PER UNIT EFFORT			
SPECIES:	NO.	%	WEIGTH	%	NO:	+/-SD	WEIGTH:	+/-SD
CHUBULE :	5	20.8	12.430	47.7	0.41	0.49	1.01	1.28
LORUK :	4	16.7	3.935	15.1	0.33	0.70	0.32	0.59
LOKEL :	1	4.2	3.100	11.9	0.08	0.23	0.25	0.72
GAGE :	3	12.5	1.860	7.1	0.24	0.34	0.15	0.22
MOMWARA :	2	8.3	1.675	6.4	0.16	0.46	0.14	0.39
TIRR :	7	29.2	1.650	6.3	0.57	0.54	0.13	0.15
GWOLO :	1	4.2	1.260	4.8	0.08	0.23	0.10	0.29
NAIL :	1	4.2	0.160	0.6	0.08	0.23	0.01	0.04
TOTAL :	24	100	26.070	100	1.96	1.21	2.13	1.20

MEAN CPUE - TODENYANG (INSHORE) - 105 mm NET.

FROM RECNR.	: 0	STATION	: TODENYANG
TO RECNR.	: 10891	DIVISION	: 10
GEAR	: GILLNET	DEPTH (GEAR)	: 0
GEARSIZE	: 105mm.	SETTINGS	: 8

					CATCH PER UNIT EFFORT			
SPECIES:	NO.	%	WEIGTH	%	NO:	+/-SD	WEIGTH:	+/-SD
TIRR :	56	75.7	18.074	49.3	4.81	3.92	1.55	1.23
CHUBULE :	5	6.8	9.710	26.5	0.43	0.63	0.83	1.18
MOMWARA :	3	4.1	2.345	6.4	0.26	0.51	0.20	0.42
GWOLO :	2	2.7	1.715	4.7	0.17	0.32	0.15	0.28
NILEPERCH :	2	2.7	1.625	4.4	0.17	0.32	0.14	0.27
LIIS :	1	1.4	1.250	3.4	0.09	0.24	0.11	0.30
GAGE :	2	2.7	0.995	2.7	0.17	0.32	0.09	0.16
LORUK :	3	4.1	0.924	2.5	0.26	0.51	0.08	0.16
TOTAL :	74	100	36.638	100	6.36	3.95	3.15	1.46

MEAN CPUE - TODENYANG (OFFSHORE) - 125 mm NET.

FROM RECNR.	: 0	STATION	: TODENYANG
TO RECNR.	: 10891	DIVISION	: 25
GEAR	: GILLNET	DEPTH (GEAR)	: 0
GEARSIZE	: 125mm.	SETTINGS	: 8

					CATCH PER UNIT EFFORT			
SPECIES:	NO.	%	WEIGTH	%	NO:	+/-SD	WEIGTH:	+/-SD
CHUBULE :	7	30.4	19.040	53.0	0.57	0.54	1.55	1.72
MOMWARA :	9	39.1	10.550	29.4	0.73	0.74	0.86	0.88
LOKEL :	1	4.3	3.050	8.5	0.08	0.23	0.25	0.70
TIRR :	3	13.0	1.138	3.2	0.24	0.49	0.09	0.18
GWOLO :	1	4.3	1.110	3.1	0.08	0.23	0.09	0.26
TILAPIA :	1	4.3	0.660	1.8	0.08	0.23	0.05	0.15
GAGE :	1	4.3	0.380	1.1	0.08	0.23	0.03	0.09
NAIL :	3	13.0	1.610	4.5	0.00	0.00	0.00	0.00
TOTAL :	23	100	35.928	100	1.88	1.65	2.93	2.69

MEAN CPUE - TODENYANG (OFFSHORE) - 105 mm NET.

FROM RECNR.	: 0	STATION	: TODENYANG
TO RECNR.	: 10891	DIVISION	: 25
GEAR	: GILLNET	DEPTH (GEAR)	: 0
GEARSIZE	: 105mm.	SETTINGS	: 8

					CATCH PER UNIT EFFORT			
SPECIES:	NO.	%	WEIGTH	%	NO:	+/-SD	WEIGTH:	+/-SD
CHUBULE :	10	15.6	23.570	42.7	0.86	1.09	2.02	2.60
MOMWARA :	14	21.9	12.713	23.0	1.20	1.46	1.09	1.05
TIRR :	32	50.0	10.389	18.8	2.75	1.91	0.89	0.65
LOKEL :	1	1.6	3.050	5.5	0.09	0.24	0.26	0.74
GAGE :	3	4.7	2.025	3.7	0.26	0.51	0.17	0.37
GWOLO :	2	3.1	1.900	3.4	0.17	0.32	0.16	0.30
LORUK :	1	1.6	0.930	1.7	0.09	0.24	0.08	0.23
NILEPERCH :	1	1.6	0.610	1.1	0.09	0.24	0.05	0.15
NAIL :	2	3.1	0.000	0.0	0.00	0.00	0.00	0.00
TOTAL :	64	100	55.187	100	5.50	4.53	4.74	4.71

Appendix II.

FISHES OF LAKE TURKANA:

	FAMILY:		GENUS:	SPECIES:	KITURKANA:
01	CICHLIDAE	0	TILAPIA SP.	(KOKINE)	
		1	TILAPIA	ZILLII	kokine
		2	SAROTHERODON	NILOTICUS	kokine
		3	S.	GALILAEUS	kokine
		4	HAPLOCHROMIS	RUDOLFIANSUS	
		5	H.	TURKANAE	
		6	H.	MACCONELLI	
		7	HEMICHROMIS	BIMACULATUS	
02	CENTROPOMIDAE	0	LATES SP.	(IJI)	
		1	LATES	NILOTICUS	iji
		2	L.	LONGISPINUS	iji
03	CYPRINIDAE	1	LABEO	HORIE	chubule
		2	BARBUS	BYNNI	momwara
		3	B.	TURKANAE	
		4	B.	WERNERI	
		5	BAKILIUS	NILOTICUS	
		6	ENGRAULICYPRIS	STELLAE	
		7	CHELAETHIOPS	BIBIE	
04	CLARIIDAE	1	CLARIAS	LAZERA	kopito
		2	HETEROBRANCHUS	LONGIFILIS	elabe
05	MOCHOKIDAE	0	SYNODONTIS SP.	(TIRR)	
		1	SYNODONTIS	SCHALL	tirr
		3	S.	FRONTOSUS	tirr
		4	MOCHOCUS	NILOTICUS	
06	CHARACIDAE	0	HYDROCYNUS SP.	(LOKEL)	
		1	HYDROCYNUS	FORSKALII	lokel
		2	H.	LINEATUS	lokel
		3	ALESTES SP.	(LELETE)	
		4	ALESTES	BAREMOSE	lelete
		5	A.	DENTEX	lelete
		6	A.	NURSE	
		7	A.	FEROX	
		8	A.	MINUTUS	
		9	A.	MACROLEPIDOTUS	
			MICRALESTES	ACUTIDENS	
07	CITHARINIDAE	1	CITHARINUS	CITHARIS	gage, gech
08	DISTICHODONTIDAE	1	DISTICHODUS	NILOTICUS	gwolo
09	BAGRIDAE	1	BAGRUS	BAYAD	loruk
		2	B.	DOCMAC	liis
		3	CHRYSICHTHYS	AURATUS	
		4	AUCHENOGLANIS	OCCIDENTALIS	
10	SCHILBEIDAE	1	SCHILBE	URANOSCOPUS	nail
11	POLYPTERIDAE	0	POLYPTERUS SP.	(NAGIRI)	
		1	POLYPTERUS	SENEGALUS	nagiri
		2	P.	BICHIR	nagiri

12	OSTEGLOSSIDAE	1	HETEROTIS	NILOTICUS	dese
13	MORMYRIDAE	1	HYPEROPISUS	BEBE	
		2	MORMYRUS	KANNUME	mkale
14	GYMNARCHIDAE	1	GYMNARCHUS	NILOTICUS	lowarayame
15	CYPRINODONTIDAE	1	APLOCHEILICHTYS	RUDOLFIANSUS	
		2	A.	JEANNELI	
16	TETRAODONTIDAE	1	TETRAODON	FAHAKA	lokui
17	MALAPERUIDAE	1	MALAPTERUS	ELECTRICUS	losali
18	AMPHILIIDAE	1	ANDERSONIA	LEPTURA	

CODES:

SECTORS AND STATIONS IN LAKE TURKANA:

	SECTOR:		STATION:
(01)	OMO DELTA	10	TODENYANG
(02)	NOTHERN	20	LOWARENGAK
		21	ILARET
(03)	NOTHERN CENTRAL	30	NACHUKWI
		31	KATABOI
		32	ALLIA BAY
		34	KOOBI FORA
(04)	SOUTHERN CENTRAL	40	NAMADAK
		41	KALOKOL (FERGUSON GULF)
		42	LONGECH SPIT
		43	ELIYE SPRING
		44	MOITE
(05)	TURKWELL	50	TURKWELL RIVER
		51	KERIO
(06)	SOUTHERN	63	LOIENGALANI
		64	EL MOLO BAY

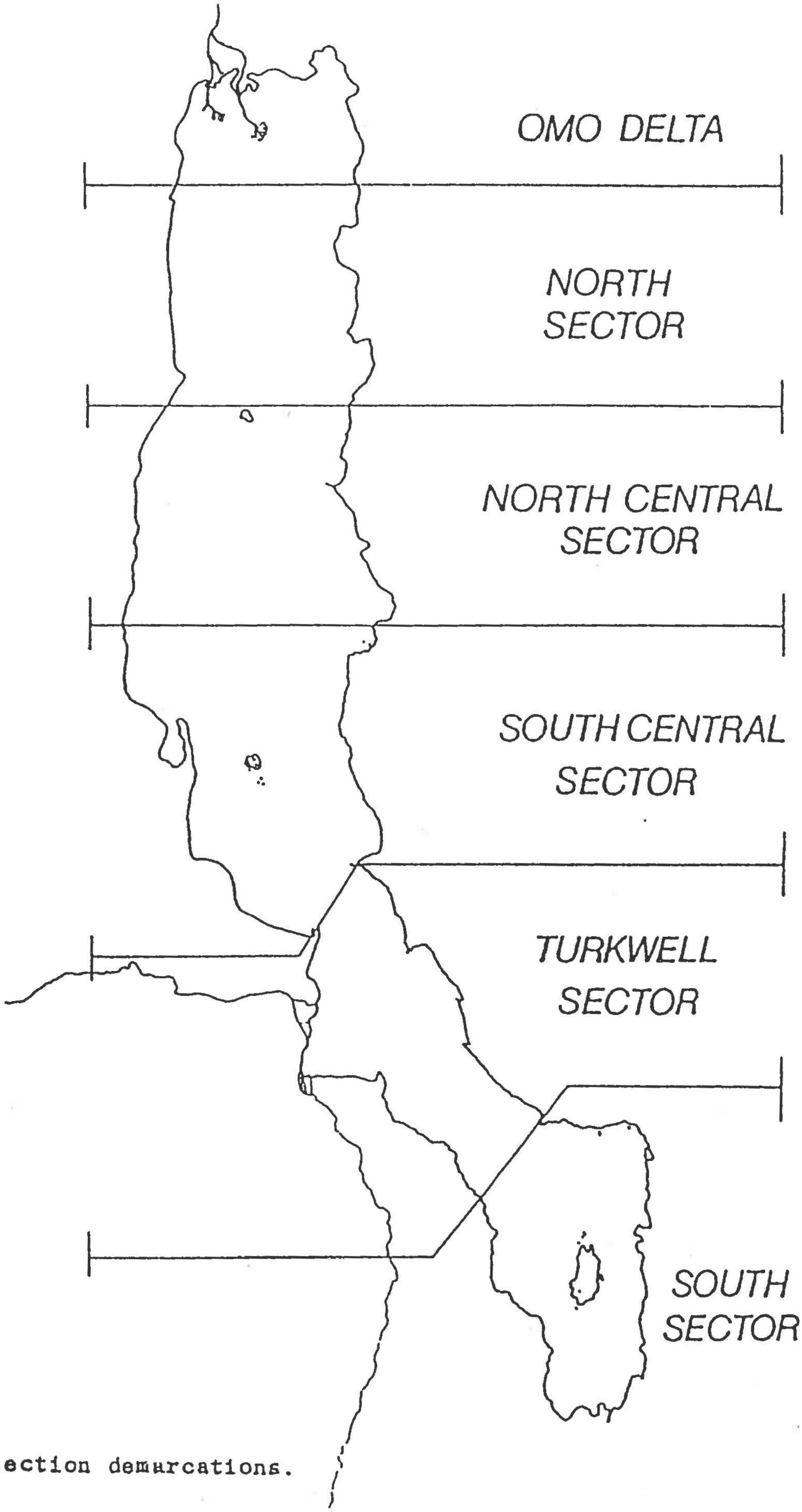
MESHSIZES: (meshsize in mm. transformed to omfar because program demands integer < 100)

CODE (OMFAR):	MESHSIZES (MM.)	MESHSIZES (INCHES)
5	125 mm.	5 "
6	105 -	4.1 -
8	78 -	3 -
10	58 -	2.3 -

SELECTCODE:

1 = DAY
2 = NIGTH
3 = DAY + NIGTH

DIV 1: = DEPTH TO BOTTOM IN METERS.



Map showing section demarcations.

Open-water sectors of Lake Turkana.