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FIELD NOTES FOR FISH BIOLOGY

by

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PREFACE

The Research for the Management of the Fisheries on Lake Tanganyika project (Lake Tanganyika Research) became fully operational in January 1992. It is executed by the Food and Agriculture Organization of the United Nations (FAO) and funded by the Finnish International Development Agency (FINNIDA) and the Arab Gulf Programme for United Nations Development Organizations (AGFUND).

This project aims at the determination of the biological basis for fish production on Lake Tanganyika, in order to permit the formulation of a coherent lake—wide fisheries management policy for the four riparian States (Burundi, Tanzania, Zaïre and Zambia).

Particular attention will be also given to the reinforcement of the skills and physical facilities of the fisheries research units in all four beneficiary countries as well as to the buildup of effective coordination mechanisms to ensure full collaboration between the Governments concerned.

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GCP/RAF/271/FIN PUBLICATIONS

Publications of the project are issued in two series:

* Series of **technical documents (GCP/RAF/271/FIN-TD)** related to meetings, missions and research organized by the project.

* Series of **field guides and manuals (GCP/RAF/271/FIN-FM)** related to training and field work activity conducted in the framework of the project.

For both series, reference is further made to the document number **(01)**, and the language in which the document is issued: English **(En)** and/or French **(Fr)**.

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1. INTRODUCTION

The objective of these practical field notes on fish sampling for LTR Fish Biology subcomponent is to improve/achieve the standardization of data collections.

It is known that sampling from commercial fishery is subject to many limitations and biases. On the other hand it is the only possibility, for the moment, to be “in touch” with the exploited fish populations.

This requires to allow for some flexibility in the effort to standardize data collection, as the fishery is quite different around the lake. For instance, Zambian fishery has different characteristics and patterns compared to Burundi fishery. Problems related to different gear selectivity, fishing efficiency, etc., can not be easily solved, but still they can be minimized.

In fisheries science the word **stock** is often used. Stock, *sensu* Sparre and Venema (1992), is to mean “a sub–set of one species having the same growth and mortality parameters, and inhabiting a particular geographical area”. It is quite possible that in Lake Tanganyika a certain population is subdivided in more exploited stocks, i.e. Southern and Northern *Stolothrissa* stocks.

One of the LTR’s main objectives is to identify relevant population parameters from the whole lake as well as estimating the present exploitation level of the main stocks in different areas. These objectives can be achieved only if the collected data are comparable.

Such findings, together with the understanding of the ecosystem as provided by all LTR scientific subcomponents, will make the scientific basis for the management of the lake’s shared fish resources.

2. FIELD SAMPLING

A good sampling can not be set up until something is known about the variability of the data and how the precision and reliability of the results are affected by the sampling deficiencies and other sources of uncertainty. The first stage of any programme in which length data are likely to be important should be concerned merely with collecting as many data as can reasonably be done (limitations: budget and staff availability).

The initial LTR fish sampling scheme can be adjusted on the basis of the assumption that catches are rarely made of prey and predator species both being in large quantity and equally represented. This applies at least for Kigoma area. In most cases, when collecting fish samples from commercial catches, one can face different situations. These are the following:

1) Clupeids are dominant in the catch;

2) *Lates* spp. are dominant (e.g. *L. stappersii*);

3) The catch is a mixture of clupeids and *Lates* (mainly juveniles of *L. stappersii*); and

4) Large *Lates* specimens occur;

2.1 General observations on fish sampling

Most of the quantities involved in fish population work can not be obtained or measured throughout the whole population; e.g. it is virtually impossible to measure all the fish caught. Therefore, a part, or a **sample**, of the population is collected. The critical assumption is that a reasonable estimate can be obtained of the true value of the sampled population.

The fundamental feature of any sampling system is to collect the data in a **random** way. Random sampling can be defined as a sampling from some population where each entry has an equal chance of being drawn. In practical terms this means that any fish from the stock under investigation should have the same probability of being sampled. Indeed, this condition is hardly fulfilled. However, the aim to achieve it should always be present in any sampling action.

Some undesired situations can be easily avoided. For instance, it could happen that the first boats landing in the morning would tend to be from the nearer fishing grounds and viceversa for the last ones to land. Fishing grounds located at different distances off from the coast could be characterized by different size, and age of the fish. Then, constant early or late morning sampling could introduce a **bias** affecting, for example, the analysis of the catch composition. Another typical source of error is the more or less deliberated tendency to sample mainly the medium size and the largest fish neglecting the smallest. This will introduce bias, faking the subsequent analysis of the population structure. Hence, sampling, especially of commercial catch, must be from **mixed**, i.e. unsorted catch.

Finally, it is worth stressing the importance of obtaining the minimum number of sample units (for LTR this is 4 sub-samples per week, i.e. 4 fishing units have to be sampled every week). This is due to the fact that variability between sampling units is generally greater than variability within units. *Two samples of 200 fish each (if correctly collected) will provide more information than one of 400 fish.*

2.2 Artisanal catch sampling (weekly)

In our case the artisanal fishery refers to lift-net fishing practised by catamarans and trimarans. Artisanal catch sampling is carried out at the landing sites and we can foresee the following scenarios and sampling strategies:

A) If clupeids are dominant, subsample’s size between **1 and 2 kg** should be representative enough. If one of the two clupeid species, *Stolothrissa* or *Limnothrissa*, occurs in small quantity compared to the other this does not matter too much. It depends on fishing grounds and fishing fleet behaviour, on species aggregation patterns and habitat preferences. We are sampling commercial catches and their composition can not be “forced” by trying to sample, for example, more *Limnothrissa* from the bulk of *Stolothrissa*.

B) If the sampling day catch is mainly made of *Lates* spp. (e.g. *L. stappersii*), it may happen that if they are of adult size a subsample size of about 2 kg is not sufficient and it does not make much sense. Keeping in mind budget availability and sampling needs, the subsample size should, in this case, be not less than **4 and 5 kg**.

C) In case of a really mixed catch of clupeids and *Lates* (generally young individuals of *L. stappersii*), a subsample size between **1 and 2 kg** should be sufficient. Eventually, the use of **raising factors** will allow to figure out the abundance of the different species in the catch.

D) When large sized *Lates* specimen occur then their Total Length (**TL**) has to be taken at the landing site (always a fish measuring board should be with the data collectors).

Individual total weight (**W**) is collected using portable spring balance.

Consequently, the field routine should proceed as follows:

1) Sample the unsorted catch as from the above points **A, B, C, D.**

2) Record standard additional information i.e. total catch, mesh size, No. of hauls and lamps, etc.

3) Report any other significant observations e.g. weather condition, by–catch when relevant, remarks from fishermen, etc.

2.3 Industrial catch sampling (deck sampling, monthly)

LTR stations will be involved once a month in fish sampling from industrial catch. The logic of this sampling exercise is that there are periods during the year when these units target *Lates* spp. To obtain representative samples of *Lates* species is somehow problematic in some part of the lake. These fish are relatively rare in catamaran catches; to purchase them is expensive and to sample only a few kilos does not make sense. Therefore, it is a good sampling strategy to have a team (three/four persons) once a month embarked on a purse seiner. This will make it possible to carry out good sampling much more meaningfully than to sample few kilos at the landing site.

Sampling routine on board of a purse seiner should proceed as follows:

1) Sample each haul (generally there are not more than two per night);

2) Fill three boxes, of the same capacity (= as those of fishermen) (from the mixed catch when fish have not yet been sorted). The boxes have to be **filled simultaneously**, not one after the other, and it should be made certain that all boxes contain approximately the same weight of fishes. The largest sized specimens of Lates must be removed from the catch and placed in a separate box.

3) Select at random one box out of the three for subsampling. Record the weight of the mixed catch in the selected box (**subsample weight**) as well as the total catch of that haul.

4) Record TL and W (use spring balances) from the largest specimens previously placed in a separate box. Then return the fish back to the fishermen. Make sure to make the required arrangements with the fishermen to open these fish for sexual maturity analysis. There should not be a problem if fish will be processed for fillets.

5) Proceed with the (randomly) selected box (the two left can be given back). Separate catch by species and record the total weight of all specimens (by species). Starting with the most spoilable one (*Stolothrissa*), record length distributions as usual LTR Field Manual 04 (Aro, 1993). The difference is that the weight by 5mm length group cannot be recorded. **Ten specimens for each 5 or 10mm length group, depending on whether clupeid or *Lates* species** (see para 3.3), **are collected**, if necessary purchased, and stored in the cool box to be brought in the lab for further analysis (i.e. sexual maturity stages). To simplify the sorting exercise **forms A and B** must be used (see paragraph 4.1)

6) If *Lates* are abundant and covering an extended range of lengths they should be sexed on board and given back to the fishermen. In case that this is not possible then, in order to avoid to buy a very expensive sample, the subsample to be purchased and brought to the lab can be reduced to five specimens for each 10mm length group.

This kind of deck sampling on board of industrial fishing units can be easily implemented when considering its relatively low frequency (once a month). Routine data collection work on board is easy to establish. A team on board of 3 or 4 researchers can be sufficient to perform the work. Moreover, the collected data should have good reliability and thus a very useful information can be obtained on *Lates* species.

2.4 Beach seine sampling (monthly)

Data collected from different gears as lift—net, purse seine and beach seine are affected by the specific characteristics of each fishing method. These data are not fully compatible and, quite often, they are not suitable to be pooled together to obtain, for example, a single set of L/F data. Nevertheless, some of the LTR target species as *L. mariae* are not truly pelagic throughout their life cycle, thus they are not always vulnerable to the same gear.

To gather more information on such species determines the need of sampling from gear, such as the beach seine, which do not operate in pelagic waters.

Beach seine sampling has monthly frequency, except in Zambia where this gear makes a significant contribution to clupeids catch. Sampling strategy is similar to that described in 2.2.

It has to be observed that the catch composition in beach seining is highly multispecific; sampling work will address to that part of the beach seine catch made of the 6 project target species and not of all the species caught.

1) When clupeids and juveniles of *Lates* occur and are the bulk of the beach seine’s catch a subsample of **3—5 kg** is collected.

2) Adult and large size specimens of *Lates* must be recorded directly on the beach by measuring their TL and W using measuring board and spring balances.

3) The amount of the catch made of the unsorted target species as well as the amount of all the other species are estimated and recorded **separately**, for example in the space left for observations in the data collection form. Therefore, the beach seine's total catch should be split in two components, the first of project target species, the second of other species **(i.e. target species plus other species should be equivalent to the estimate of the gear's total catch).**

Unlike lift-net sampling where the work is carried out during quick and somehow messy landing operations, in the case of sampling from beach seines, as it is from purse seine, on—the—field data collection can be performed. A consistent part of the catch can be measured for L/F purposes directly at the landing beach. If fishermen and time allow the same routine as reported in para 2.3, at points 4 and 5, can be followed by using sorting forms A and B. If this is not possible then samples have to be taken as indicated at points 1 and 2 of this paragraph.

Overall, the sampling from beach seine will allow to gather information on the temporal patterns of the population structure of same species in shallow coastal waters and on the impact of such gear on them.

The list of the field equipment that has to be always with the sampling teams is presented in Appendix I.

3. LABORATORY ANALYSIS

Fish samples previously collected at the landing sites or on the purse seiner, and stored in the cool box in separate plastic bags, should be analyzed preferably as soon as possible i.e. the same day. This is almost compulsory for *Stolothrissa* and *Limnothrissa*, as these spoil easily, to facilitate the collection of data such as sexual maturity stages. Laboratory routine on how to process subsamples is reported in paragraph 2.3 of the LTR Field Manual 04 (Aro, 1993). Some modifications and completion concerning the standard measurements has been introduced and is reported hereafter.

3.1 Length measurements

Individual Total Length (TL) measurements - from the tip of the snout to the tips of the largest caudal fin rays - are made with the fish placed on its right side, snout to the left, on the measuring board, against the headboard the snout of the fish with its mouth closed is gently pressed. Holding the fish in position with the left hand, its body and tail are straightened along the midline with a single stroke movement using the right hand, and the reading is taken from the measuring ruler.

3.2 Weight measurements

There are no modification to the instructions given in paragraph 3.1 of the LTR Field Manual 04 (Aro, 1993).

3.3 Sexual maturity analysis

Identification of five maturity stages is carried out as described in the LTR Field Manual 04 (Aro, 1993), paragraph 3.2. In case of *S. tanganicae* and *L. miodon* sexual identification is particularly easy in fresh specimens, however table magnifying lenses with ring neon glow lamp have to be used to make the analysis less tiring and time demanding. Initially, when uncertainty arises because of the small size of the specimens and their gonads, then there is only one thing to do to determine the sex: examine the gonads using dissecting microscope’

With regard to <u>Lates</u> spp. some modification to the LTR Field MAnual 04 (Aro, 1993) is now introduced. It was not clear from the field guide if this analysis has to be carried out or not. <u>It is necessary to carry out sexual maturity analysis on predator species as it is supposed to be for prey species</u>.

<u>Lates</u> sexual maturity stages are the same as for clupeids (five maturity stages) and they are reported in the field manual. *The only difference is that ten specimens from each 10 mm length group (not 5 mm length group as it is for clupeids) are taken by random selection.* This means that, after the weight measurements by 5 mm length group, two consecutive length groups are combined, the specimens mixed and randomly sampled. Length groups start always at full 10 mm, e.g. from 30 to 39.9 mm, from 210 to 219.9 mm.

3.4 Data from individual fish

Only a few data are collected at the individual fish level. The improvement of this activity (e.g. otoliths, gonadal weight, individual body weight, egg counting etc.) is taken into consideration and it will be proposed and discussed with the scientific coordinator for fish biology. Therefore, some new adjustments in data collection work might soon be introduced.

However, the collection of these data will not be implemented as routine work until the already established common sampling programme is not satisfactorily carried out and sustained in all LTR stations.

4. DATA RECORDS AND FILES

A set of data recording forms and tables is used in the Fish Biology subcomponent of LTR scientific programme.

Forms are the paper sheets used to collect the data either in the field and in the laboratory, while **tables** are the computer spreadsheet used for data input. Thus data are first collected and recorded on the forms and later inputed into the computer.

Clarification of the terminology:

Total catch weight: the estimated weight of the total catch obtained during that day (or night) by the sampled fishing unit.

Sample weight: is the weight of the **unsorted sample**, all species mixed.

Sampled species weight: is the weight in the sample made by that species alone. It means the summation of the length group total weights.

Mesh size: stretched mesh size.

Sample number: see para 4.3 of this document.

4.1 Data collection forms

Modified data recording forms for fish biology work have been prepared. The kind and quantity of data to be collected remain unchanged, the purpose of the modified forms is to make data collection work quicker and simpler. On the basis of the experience gained during the initial weeks of sampling the introduced adjustments aim to make available forms more user—friendly and handy to avoid confusing and messy hand-writing wherever some space is available within the data sheets.

The forms have to be filled as originally agreed, further noting that:

a) **Form A** for clupeids and **Form B** for *Lates* spp. have been prepared to simplify and rationalize the sorting work -when deck sampling on board of purse seiner or when sampling at the landing beach (beach seine) - of the specimens to be used for laboratory analysis. Their function is to facilitate the data recorder by providing him real time information on the sorting operation.

The procedure is the following: each fish length is **first** recorded as usual in L/F forms (forms 1 to 7 depending on the species) and **also** in form A or B within the proper length interval to which it belongs, then the fish is put apart to be brought in the laboratory. Once a length group is completed - i.e. filled with the required 10 specimens -

the other fish falling within that length interval do not necessitate any more to be put apart for the laboratory **but** only have to be recorded on the L/F form.

b) **Form 1** (previously Table 1 in the LTR Field Manual 04 (Aro, 1993)) is continued on its backside with a table reporting the 5mm length groups to be completed with the corresponding number of specimens and length group weight. Some space for observations is also provided.

c) **Form 2** (ex Table 2) is also continued backside to allow the increase of the lower and upper limits of the specific length range. As in Form 1 a table to record weight data by 5 mm length groups and space for observations has been arranged.

d) **Form 3** (ex Table 3) has been improved to cover all the possible length records from *Lates* species. Again, a table to record length/weight data has been added.

e) **Forms 4, 5, 6 and 7** represent the already modified data collection forms for sexual maturity stages. In Form 6 two blank length classes have been added to record data for very large specimens.

The full set of data recording forms is shown in Appendix II.

4.2 Data input tables

There are two main types of spreadsheets for the input of the data collected from the six LTR target species: tables for L/F and Weight data and tables for maturity stages.

Tables numbering and contents are arranged as follows:

Table 1:	Input of L. miodon L/F and weight data.		
Table 2:	"	*S. tanganicae*	"
Table 3:	"	*L. stappersii*	"
Table 4:	"	*L. mariae*	"
Table 5:	"	*L. microlepis*	"
Table 6:	"	*L. angustifrons*	"
Table 7:	Input of *L. miodon* sexual maturity stages data.		
Table 8:	"	*S. tanganicae*	"
Table 9:	"	*L. stappersii*	"
Table 10:	"	*Lates* spp.	"
Tables:	n.a.	Monthly summary files	

In Table 10 the species name has to be introduced everytime depending on the sampled *Lates* species.

Some of the tables (Table 1 to 6) have been subject to some adjustments, while others (Table 7 to 10) have been just prepared in order to have a complete transfer of all the collected data from paper sheets to computer files (spreadsheet).

All the Excel files are arranged to hold several weekly samples by moving rightwards within the spreadsheet. A useful hint is to “freeze” the first columns on the left side of the table to facilitate the input while shifting among the different sections of the file.

Because of the large size of these files, once the monthly data entry is completed the remaining unused columns have to be deleted to economize space on diskette.

While these tables contain mainly weekly data, it is likely that the analysis work will be carried out on monthly basis.

Thus, simple monthly summary tables are under preparation.[1]

Using Excel facilities these tables do not need to be filled by hand—input, the summarization of the data for each month can be performed automatically using one of the several possibilities offered by the software (for instance, the “consolidate” option).

4.3 Numbering of samples

The numbering system of the samples from the field must follow the following simple method. Each sampling day the collected samples are numbered, always starting from the first one (i.e. sample no. 1). It means that, for example, on the sampling day 22 July 1993 sample no. 1, no.2, no. 3, etc, were collected. The following week, on 29 July 1993, again sample no. 1, no. 2, etc will be collected.

Therefore, **<u>within the sampling day</u>** the discrimination is due to the sequential numbers from no. 1 and upwards, **<u>among sampling days</u>** the discriminating criterion is, obviously, the date of the day (dd/mo/yr).

4.4 Filenames

Some care has to be used when naming data files. A huge amount of data will be collected, in the order of tens of thousands, thus it is important to maintain well ordered data file archives. The procedure to be followed in filenaming is reported hereafter.

[1] At present, monthly summary tables are being tested to be circulated as soon as they are finalized.

L/F. weight and sexual maturity data (Tables 1 to 10):

- Filename starts with 3 letters indicating the fish species;
  - *S. tanganicae* = **STA**
  - *L. miodon* = **LMI**
  - *L. stappersii* = **LST**
  - *L. mariae* = **LMA**
  - *L. angustifrons* = **LAN**
  - *L. microlepis* = **LMC**

- and is followed by 1 number indicating the year (e.g. 1993 = **3**, 1994 = **4**);

— by two numbers referring to the month (January = **01** December = **12**);

- by two letters, the first to mean the kind of data (length and weight data = **L**, sexual maturity stage data = **5**), and the last letter is the country code (Burundi = **A**, Tanzania = **B**, Zambia = **C**, Zaire = **D**).

Example: the name of L/F and W data file for *S. tanganicae* collected during the month of July 1993 in Burundi is **STA3O7LA.** The same kind of data but from *L. stappersii* collected in Zambia in September 1993: **LST3O9LC**.

Maturity stages data file: **STA3O7SA** and **LST3O9SC**.

Monthly summary files:

Due to the need of compressing as much information as possible within 8 characters, the main difference in the filename is that the 3 letters code for the species name is reduced to the use of the first and third:

STA = **SA**
LMI = **LI**
LST = **LT**
LMA = **LA**
LAN = **LN**
LMC = **LC**

and the now available space is replaced by **M** (= monthly).

From the previous examples filename will be: **SA3O7LMA, LT3O9LMC**
SA3O7SMA, LT3O9SMC

4.5 Summary of laboratory and data input routine

1) The weight of the still unsorted sample is recorded.

2) Sample is sorted by species.

Now, suppose we are dealing with *Stolothrissa*

3) TL is recorded on Form 2

4) Fish are divided by 5mm length groups.

5) Once L/F data collection is concluded then the backside of Form 2 (number and weight by length group) is filled.

6) At random 10 specimens are subsampled from each 5mm length group and maturity data recorded in Form 5.

In case that the samples have already been prepared on board of the purse seiner or at the landing site – by using Form A –then, as L/F form has already been filled, only the operation outlined in point 6 has to be performed in the laboratory.

7) Data from Form 2 are entered in Table 2.

8) Records from Form 5 are entered into Table 8.

9) At the end of each month, data from *Stolothrissa* weekly samples (Tables 2 and 8) are joined together into the respective monthly summary tables.

While performing the work it is <u>very important</u> to check the data. Total number of specimens collected or analyzed must always be the same. Few unreported individuals, especially if they belong to the tails of the sample distribution, can affect very much the results of the analysis work. Mean weights are supposed to increase as the length increases, if not there could be something wrong in the frequency or weight data.

Also, the data must be forwarded to the field coordinator including a memorandum with all other relevant information not reported in the data files.

Finally, it is worth stressing that, in LTR's Fish Biology scientific subcomponent, each month, from all around the lake, several thousands of data are collected, stored in proper files and they have to be managed by the field coordinator. To keep such a work within human limits the cooperation of the research teams involved in Fish Biology is essential.

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APPENDIX I

Field equipment

<u>At the landing sites</u>:

Pencils

Labels

Plastic bags

Cool box with frozen cooling elements

Measuring board

Spring balances

Scissor and scalpel

Notebook

<u>On board of the fishing unit</u>:

Pencils

Labels

Plastic bags

Cool box with frozen cooling elements

Measuring board

Spring balances

Scissor and scalpel

Sampling boxes

Recording Forms

Notebook

Light (kerosene pressure lamp or similar)

Form A

Research for the Management of the Fisheries on Lake Tanganyika

Sample number: Date: Station:

Species:

Fishing vessel category: Total catch (kg):

Gear and mesh size: Sample (kg):

Biological samples Area:

Length classes (mm)	Sorted specimens (10 ind. per length class)	Total
20-24		
25-29		
30-34		
35-39		
40-44		
45-49		
50-54		
55-59		
60-64		
65-69		
70-74		
75-79		
80-84		
85-89		
90-94		
95-99		
100-104		
105-109		
110-114		
115-119		
120-124		
125-129		
130-134		
135-139		
140-144		
145-149		
150-154		
155-159		

Total

Observations:

Form B

Research for the Management of the Fisheries on Lake Tanganyika

Sample number: Date: Station:

Species: Lates

Fishing vessel category: Total catch (kg):

Gear and mesh size: Sample (kg):

Biological samples Area:

Length classes (mm)	Sorted specimens (optimum: 10 ind. per length class)	Total
100-109		
110-119		
120-129		
130-139		
140-149		
150-159		
160-169		
170-179		
180-189		
190-199		
200-209		
210-219		
220-229		
230-239		
240-249		
250-259		
260-269		
270-279		
280-289		
290-299		
300-309		
310-319		
320-329		
330-339		
340-349		
350-359		
360-369		
370-379		
380-389		
390-399		
400-409		
410-419		
420-429		

Total

Observations:

continued backside

Form B continued

Length classes (mm)	Sorted specimens	Total
430-439		
440-449		
450-459		
460-469		
470-479		
480-489		
490-499		
500-509		
510-519		
520-529		
530-539		
540-549		
550-559		
560-569		
570-579		
580-589		
590-599		
600-609		
610-619		
620-629		
630-639		
640-649		
650-659		
660-669		
670-679		
680-689		
690-699		
700-709		
710-719		
720-729		
730-739		
740-749		
750-759		
760-769		
770-779		
780-789		
790-799		

Total

Observations:

Form 1

Research for the Management of the Fisheries on Lake Tanganyika

Sample number: **Date:** **Station:**

Species: Limnothrissa miodon **Area:**

Fishing vessel category: **Total catch (kg):**

Gear and mesh size: **Sample (kg):**

No. hauls: **No. lamps:**

Length (mm)													Total														Total
30														95													
1														6													
2														7													
3														8													
4														9													
35														100													
6														1													
7														2													
8														3													
9														4													
40														105													
1														6													
2														7													
3														8													
4														9													
45														110													
6														1													
7														2													
8														3													
9														4													
50														115													
1														6													
2														7													
3														8													
4														9													
55														120													
6														1													
7														2													
8														3													
9														4													
60														125													
1														6													
2														7													
3														8													
4														9													
65														130													
6														1													
7														2													
8														3													
9														4													
70														135													
1														6													
2														7													
3														8													
4														9													
75														140													
6														1													
7														2													
8														3													
9														4													
80														145													
1														6													
2														7													
3														8													
4														9													
85														150													
6														1													
7														2													
8														3													
9														4													
90														155													
1														6													
2														7													
3														8													
4														9													

continued backside

Form 1 continued

Length group (mm)	No.	Weight (g)
30-34		
35-39		
40-44		
45-49		
50-54		
55-59		
60-64		
65-69		
70-74		
75-79		
80-84		
85-89		
90-94		
95-99		
100-104		
105-109		
110-114		
115-119		
120-124		
125-129		
130-134		
135-139		
140-144		
145-149		
150-154		
155-159		

Observations:

Form 2

Research for the Management of the Fisheries on Lake Tanganyika

Sample number: Date: Station:

Species: Stolothrissa tanganicae Area:

Fishing vessel category: Total catch (kg):

Gear and mesh size: Sample (kg):

No. Hauls: No. Lamps:

Length (mm)																													Total
20																													
1																													
2																													
3																													
4																													
25																													
6																													
7																													
8																													
9																													
30																													
1																													
2																													
3																													
4																													
35																													
6																													
7																													
8																													
9																													
40																													
1																													
2																													
3																													
4																													
45																													
6																													
7																													
8																													
9																													
50																													
1																													
2																													
3																													
4																													
55																													
6																													
7																													
8																													
9																													
60																													
1																													
2																													
3																													
4																													
65																													
6																													
7																													
8																													
9																													
70																													
1																													
2																													
3																													
4																													
75																													
6																													
7																													
8																													
9																													
80																													
1																													
2																													
3																													
4																													

continued backside

Form 2 continued

Length (mm)																													Total
85																													
6																													
7																													
8																													
9																													
90																													
1																													
2																													
3																													
4																													
95																													
6																													
7																													
8																													
9																													
100																													
1																													
2																													
3																													
4																													
105																													
6																													
7																													
8																													
9																													
110																													
1																													
2																													
3																													
4																													

Length group	No.	Weight (g)
20-24		
25-29		
30-34		
35-39		
40-44		
45-49		
50-54		
55-59		
60-64		
65-69		
70-74		
75-79		
80-84		
85-89		
90-94		
95-99		
100-104		
105-109		
110-114		

Observations: ______________________________

Form 3

Research for the Management of the Fisheries on Lake Tanganyika

Sample number: Date: Station:

Species: **Lates** Area:

Fishing vessel category: Total catch (kg):

Gear and mesh size: Sample (kg):

No. Hauls: No. Lamps:

Length (mm)

30						95						160				225				290				355			420		
1						6						1				6				1				6			1		
2						7						2				7				2				7			2		
3						8						3				8				3				8			3		
4						9						4				9				4				9			4		
35						100						165				230				295				360			425		
6						1						6				1				6				1			6		
7						2						7				2				7				2			7		
8						3						8				3				8				3			8		
9						4						9				4				9				4			9		
40						105						170				235				300				365			430		
1						6						1				6				1				6			1		
2						7						2				7				2				7			2		
3						8						3				8				3				8			3		
4						9						4				9				4				9			4		
45						110						175				240				305				370			435		
6						1						6				1				6				1			6		
7						2						7				2				7				2			7		
8						3						8				3				8				3			8		
9						4						9				4				9				4			9		
50						115						180				245				310				375			440		
1						6						1				6				1				6			1		
2						7						2				7				2				7			2		
3						8						3				8				3				8			3		
4						9						4				9				4				9			4		
55						120						185				250				315				380			445		
6						1						6				1				6				1			6		
7						2						7				2				7				2			7		
8						3						8				3				8				3			8		
9						4						9				4				9				4			9		
60						125						190				255				320				385			450		
1						6						1				6				1				6			1		
2						7						2				7				2				7			2		
3						8						3				8				3				8			3		
4						9						4				9				4				9			4		
65						130						195				260				325				390			455		
6						1						6				1				6				1			6		
7						2						7				2				7				2			7		
8						3						8				3				8				3			8		
9						4						9				4				9				4			9		
70						135						200				265				330				395			460		
1						6						1				6				1				6			1		
2						7						2				7				2				7			2		
3						8						3				8				3				8			3		
4						9						4				9				4				9			4		
75						140						205				270				335				400			465		
6						1						6				1				6				1			6		
7						2						7				2				7				2			7		
8						3						8				3				8				3			8		
9						4						9				4				9				4			9		
80						145						210				275				340				405			470		
1						6						1				6				1				6			1		
2						7						2				7				2				7			2		
3						8						3				8				3				8			3		
4						9						4				9				4				9			4		
85						150						215				280				345				410			475		
6						1						6				1				6				1			6		
7						2						7				2				7				2			7		
8						3						8				3				8				3			8		
9						4						9				4				9				4			9		
90						155						220				285				350				415			480		
1						6						1				6				1				6			1		
2						7						2				7				2				7			2		
3						8						3				8				3				8			3		
4						9						4				9				4				9			4		

continued backside

Form 3 continued

Length (mm)

485			505			525			545			565			585		
6			6			6			6			6			6		
7			7			7			7			7			7		
8			8			8			8			8			8		
9			9			9			9			9			9		
490			510			530			550			570			590		
1			1			1			1			1			1		
2			2			2			2			2			2		
3			3			3			3			3			3		
4			4			4			4			4			4		
495			515			535			555			575			595		
6			6			6			6			6			6		
7			7			7			7			7			7		
8			8			8			8			8			8		
9			9			9			9			9			9		
500			520			540			560			580			600		
1			1			1			1			1			1		
2			2			2			2			2			2		
3			3			3			3			3			3		
4			4			4			4			4			4		

L. G (mm)	No.	W (g)	L. G (mm)	No.	W (g)	L. G (mm)	No.	W (g)
30			235			440		
35			240			445		
40			245			450		
45			250			455		
50			255			460		
55			260			465		
60			265			470		
65			270			475		
70			275			480		
75			280			485		
80			285			490		
85			290			495		
90			295			500		
95			300			505		
100			305			510		
105			310			515		
110			315			520		
115			320			525		
120			325			530		
125			330			535		
130			335			540		
135			340			545		
140			345			550		
145			350			555		
150			355			560		
155			360			565		
160			365			570		
165			370			575		
170			375			580		
175			380			585		
180			385			590		
185			390			595		
190			395			600		
195			400					
200			405					
205			410					
210			415					
215			420					
220			425					
225			430					
230			435					

Observations:

Form 4

Research for the Management of the Fisheries on Lake Tanganyika

Sample number: Date: Station:

Species: Limnothrissa miodon

Fishing vessel category: Total catch (kg):

Gear and mesh size: Sample (kg):

Maturity samples Area:

Length classes (mm)	Immatures (unidentified)		Females					Males				
	1	Total	2	3	4	5	Total	2	3	4	5	Total
20-24												
25-29												
30-34												
35-39												
40-44												
45-49												
50-54												
55-59												
60-64												
65-69												
70-74												
75-79												
80-84												
85-89												
90-94												
95-99												
100-104												
105-109												
110-114												
115-119												
120-124												
125-129												
130-134												
135-139												
140-144												
145-149												
150-154												
155-159												
Total												

Observations:

Form 5

Research for the Management of the Fisheries on Lake Tanganyika

Sample number: Date: Station:

Species: Stolothrissa tanganicae

Fishing vessel category: Total catch (kg):

Gear and mesh size: Sample (kg):

Maturity samples Area:

Length classes (mm)	Immatures (unidentified)		Females					Males				
	1	Total	2	3	4	5	Total	2	3	4	5	Total
20-24												
25-29												
30-34												
35-39												
40-44												
45-49												
50-54												
55-59												
60-64												
65-69												
70-74												
75-79												
80-84												
85-89												
90-94												
95-99												
100-104												
105-109												
110-114												
115-119												
120-124												
125-129												
130-134												
135-139												
140-144												
145-149												
150-154												
155-159												
Total												

Observations:

Form 6

Research for the Management of the Fisheries on Lake Tanganyika

Sample number: Date: Station:

Species: Lates stappersi

Fishing vessel category: Total catch (kg):

Gear and mesh size: Sample (kg):

Maturity samples Area:

Length classes	Immatures (unidentified)		Females					Males				
(mm)	1	Total	2	3	4	5	Total	2	3	4	5	Total
100-109												
110-119												
120-129												
130-139												
140-149												
150-159												
160-169												
170-179												
180-189												
190-199												
200-209												
210-219												
220-229												
230-239												
240-249												
250-259												
260-269												
270-279												
280-289												
290-299												
300-309												
310-319												
320-329												
330-339												
340-349												
350-359												
360-369												
370-379												
380-389												
390-399												
400-409												
410-419												
420-429												
430-439												
440-449												
Total												

Observations:

Form 7

Research for the Management of the Fisheries on Lake Tanganyika

Sample number: Date: Station:

Species: Lates

Fishing vessel category: Total catch (kg):

Gear and mesh size: Sample (kg):

Maturity samples Area:

Length classes (mm)	Immatures (unidentified)		Females					Males				
	1	Total	2	3	4	5	Total	2	3	4	5	Total
100-109												
110-119												
120-129												
130-139												
140-149												
150-159												
160-169												
170-179												
180-189												
190-199												
200-209												
210-219												
220-229												
230-239												
240-249												
250-259												
260-269												
270-279												
280-289												
290-299												
300-309												
310-319												
320-329												
330-339												
340-349												
350-359												
360-369												
370-379												
380-389												
390-399												
400-409												
410-419												
420-429												
Total												

Observations:

continued backside

Form 7 continued

Length classes (mm)	Immatures (unidentified)		Females					Males				
	1	Total	2	3	4	5	Total	2	3	4	5	Total
430-439												
440-449												
450-459												
460-469												
470-479												
480-489												
490-499												
500-509												
510-519												
520-529												
530-539												
540-549												
550-559												
560-569												
570-579												
580-589												
590-599												
600-609												
610-619												
620-629												
630-639												
640-649												
650-659												
660-669												
670-679												
680-689												
690-699												
700-709												
710-719												
720-729												
730-739												
740-749												
750-759												
760-769												
770-779												
780-789												
790-799												
Total												

Observations: