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LTR'S FISHERIES STATISTICS SUBCOMPONENT MARCH 1995 UPDATE 0F RESULTS FOR LAKE TANGANYIKA

by
E.J. COENEN

FINNISH INTERNATIONAL DEVELOPMENT AGENCY

FOOD AND AGRICULTURE ORGANIZATION 0F THE UNITED NATIONS

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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 0f 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 build— up of effective coordination mechanisms to ensure full collaboration between tha Governments concerned.

Prof. O.V. LINDQVIST
Project Scientific Coordinator

Dr. George HANEK
Projeot Coordinator

LARE TANGANYIKA RESEARCH
FAO
B.P. 1250
BUJUMBURA
BURUNDI

Telex: FOODAGRI BDI 5092

Tel.: (257) 229760

Fax.: (257) 229761

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1. INTRODUCTION

This report presents, in brief, the status of findings and activities of the LTR fisheries statistics subcomponent up to March 1995 and constitutes an update of the presentation on the findings of the fisheries statistics subcomponent, presented during LTRs Third Joint Meeting in Kigoma, November 1994 (Hanek & Coenen, 1994). Figures and tables were updated and additional tables on new results included. More details on findings of LTR fisheries statistics activities can be found in several Technical Documents, published earlier and mentioned in this report.

The immediate objective of the fisheries statistics subcomponent is the following: to improve/standardize/coordinate the existing fishery statistics data collection systems of the 4 riparian countries, but especially to standardize and coordinate the (timely) reporting on annual Frame (FS) and Catch Assessment Surveys (CAS) results and to provide additional information for the medium and long run objective.

In the medium and long run, and in order to obtain the necessary information for the formulation of a future fishery management plan for Lake Tanganyika, these results, comprising reliable estimates of local and lake-wide catch/effort and CPUE figures (fishing mortality or effective fishing effort) should complement and be integrated with especially the results of the hydroacoustics subcomponent (determination of the temporal and spatial distribution and abundance of pelagic resources) and also those from the fish biology (biological production patterns) and other subcomponents.

At the end of this report, some recommendations are given concerning Lake Tanganyika fisheries statistics, in general, and concerning the proposed future LTR activities to monitor and improve these statistics.

2. MATERIALS AND METHODS

Regarding the fisheries statistics subcomponent, two different kinds of activities have to be discerned:

- assistance (logistic, financial, technical, organizational) to ongoing surveys in the four riparian countries (although LTR activities in Zaïre are limited to prevailing unstable political situation);

– organisation of extra activities to collect supplementary information not covered by the ongoing surveys.

Concerning the first kind of activities, they cover:

(1) assistance to the organisation and execution of ongoing FS and CAS data collection, analysis and reporting;
(2) logistic and technical assistance to national fisheries statistical units;
(3) local staff training, etc.

Regarding the second kind of activities, these comprise mainly the following:

(4) gathering, checking, and compilation of past and present data concerning fisheries statistics in project data bank/documentation center;
(5) regular additional census (ground and aerial FS) on the numbers of fishermen, boats, etc. (nominal fishing effort), including a lake wide simultaneous FS in February-March 1995;
(6) organisation of a Workshop on Fisheries Statistical Coordination and Standardization and of regular meetings of the fishery statistical coordinators of the 4 riparian countries;
(7) coordination of standardized reporting on annual FS and CAS results to enable the compilation of overall Lake Tanganyika fisheries statistics;
(8) collection and reporting on supplementary fishery statistics (e.g. industrial statistics in Kalemie and Moba, Zaïre; continuous monitoring of fish landing site(s) and daily kapenta (clupeid) splitting in Mpulungu, Zambia);
(9) extraction of fishery statistical data from the fish biology subcomponent sampling;
(10) reporting, through Technical Documents, on national and lake wide aspects of Lake Tanganyika fisheries statistics;
(11) field missions to national and local fisheries statistical offices and field stations to discuss, organize, collect data, etc. regarding fisheries statistics activities mentioned above.

3. RESULTS

While detailed analyses for several topics still have to be finalized, the following overall and country results/trends were noted:

3.1 Assistance to the organisation and execution of ongoing FS and CAB data collection, analysis and reporting

– Burundi, October 92 FS: 604 catamarans, 67 Apollo's, 298 canoes; since mid–sixties about 80 % increase in total fishing effort while total catches only increased by 50 % (Coenen, 1994c);

– Burundi. CAS 92–93: 1992 – ~24,560 tonnes; 1993 – 15,565 tonnes; this decline, and also for CPUEs, was apparent for all types of fishing due to reduction in total fishing effort; catch dominated by Clupeids (67-69.1 %) and *Lates stappersii* (28.7–31.6 %); probable local overfishing, catch level for 1992 close to minimum potential yield estimate (92 versus 90 kg/ha/year, respectively) (Coenen & Nikomeze, 1994a,b);

- Burundi, CAS 94: total catch 21,825 tonnes; this recovery of total catch, but also of CPUEs, was apparent for all types of fishing except for the industrial fishery (see Tables 1–4); for the latter, only 9 units remained operational on an irregular base, and the total industrial effort, expressed as the number of fishing trips, was almost reduced by half (1992: 3677 trips; 1994: 1964 trips); the artisanal fishery (catamarans and Apollo's)

contributed for 94.8 % of the total catch, and especially the Apollo fishery is booming (representing already 20.9 % of the total catch) and competing with and exploiting the same fishing grounds as the industrial fishery; also, the traditional fishery, although not very productive (16 kg/unit/trip), regained importance and exceeded in total catch and number of fishing trips the statistics of 1992 (1994: 795 tonnes, 49777 fishing trips; 1992: 662 tonnes and 40663 trips). For the total catch, the average species composition is still dominated by clupeids (67.8 %) and *L. stappersii* (29.5 %);

- Tanzania. CAS 93: LTR Kigoma assisting first decentralized CAS data input by Kigoma Region/District Fisheries Officers; final results still being compiled in Dar es Salaam Fisheries Headquarters;

- Zambia. FS/CAS June-July 94: LTR/DOF Mpulungu execution; for results, see 3.5;

- Zaïre: no ongoing standardized lake wide FS/CAS activities, only some localized data collection; incomplete historical data; assistance to MECNT staff for collection of fisheries statistics from industrial units in Kalemie and Moba (see also 3.8);

3.2 Logistic and technical assistance to national fisheries statistical units

Apart from Bujumbura, main assistance was given to Lake based field stations:

– Burundi: unit based in Fisheries Department Headquarters, Bujumbura; FAO developed software (using dBaseIII) for data processing;

– Tanzania: unit based in Fisheries Division Headquarters, Dar es Salaam using FAO developed TANFISH software for FS and CAS data analysis; decentralized CAS data input (using laptops) in Lake Tanganyika Regions since 1993 (see also 3.1);

– Zambia: unit based in Fisheries Department Headquarters, Chilanga (Lusaka); Mpulungu is main station on Lake Tanganyika (see also 3.1);

– Zaïre: unit based in Fisheries Department Headquarters, Kinshasa; support to Kalemie and Moba MECNT staff (see also 3.1) and to CRH, Uvira based researcher, specialised in fisheries statistics.

3.3 Local staff training, etc.

Continuous in–service training (field operations; collection, checking, compiling, analyzing, reporting of fisheries statistical data) carried out by LTR staff during SSP field and office activities in the 3 main LTR stations (Bujumbura, Burundi; Kigoma, Tanzania; Mpulungu, Zambia) around Lake Tanganyika.

3.4 Gathering, checking, and compilation of past and present data concerning fisheries statistics in project data bank/documentation center

First compilation of past and present country fisheries statistical data was given in Coenen (1994b) with an update for Burundi in (Coenen & Nikomeze, 1994a,b); several other aspects of Lake Tanganyika fisheries statistics were reported in various Technical Documents and Travel Reports (TRAMs) (see 3.10 and 3.11). Numerous publications and data files on Lake Tanganyika fisheries statistics are already available in the Regional Documentation Center, Bujumbura and continue to be collected; lake wide and individual country data compilations also available as computer files. An updated summary on the present knowledge concerning Lake Tanganyika is given hereafter:

— Lake wide total catches for Lake Tanganyika, as well as for the 4 riparian countries, show an increasing trend since the early fifties and are estimated to attain levels of 130000 to 170000 tonnes during recent years (Fig. 1); historical annual catch/effort data, per country and per type of fishery, are presented in Tables 5-8;

— As a result, the overall average catch/ha/year increased from about 4 kg in 1953 up to 51 kg/ha/yr in 1992; for Burundi, showing some signs of local overfishing, this even amounts to 94.5 kg/ha/yr in 1992 and 83.9 kg/ha/yr in 1994 which is near the lower level of the estimated fish potential of the Lake (90—140 kg/ha/yr); the average catch/ha/yr for Zambia, Tanzania and Zaïre in 1992 amounts respectively to 69, 60 and 34 kg/ha/yr (Fig. 2);

- Lake wide total value of the catches landed in 1991 is estimated to amount to about 26 x 106 US $ or an average landing price per kg of fish of about 0.15 US $ (Burundi contributing the major part i.e. about 10 x 106 US $ and an average price per kg of 0.41 US $ kg); as a comparison, total annual values and average prices/kg for Burundi were respectively 10.1 x 106 US $ and 0.41 US $, 7 x 106 US $ and 0.45 US $, and 7.5 x 106 US $ and
0.34 US $ in 1992, 1993 and 1994:

- Total lake wide fishing effort, expressed as total number of all types of fishing units, hardly changed since the early seventies, varying between 10000 and 12000 fishing units (Fig.3). A considerable reduction in the total number of fishing units in Tanzania during the last decade (7700 down to 3200) was compensated for by an almost equivalent increase in Zaïre (4000 up to 7150); at present, it is estimated that there are about 7400 traditional units, 2000 artisanal liftnet units, 1000 scoopnet units (Tanzania), 200 kapenta seines (Zambia) and about 40 operational industrial units (20-25 in Mpulungu/Nsumbu, Zambia; 1 in Kigoma, Tanzania; 6-9 in Burundi; 7 and 1 in respectively Kalemie and Moba, Zaïre); the results of the lake wide simultaneous ground approach frame survey (February—March 1995) should give a more up to date picture of the overall distribution and types of fishing effort on Lake Tanganyika; fishing around the Lake is done by an estimated 40000 fishermen;

this means that probably several hundred thousand people are involved in fisheries related activities (fish processing, trade, transport, boat building, gear supply and repair, etc.);

– However, and very important, is the fact that the composition of the fishing fleet changed considerably since the early fifties: the not very productive traditional subsistence fishing diminished in favour of much more productive artisanal and industrial fishing units; as a result, and also due to the use of more efficient fishing gear, average annual catches per fishing unit of about 3 tonnes/yr/unit in the early fifties increased to an overall average of about 14 tonnes in 1992, with annual peak averages in Burundi and Zambia around 30 tonnes/yr/unit (Fig. 4);

- the unit of effort, defined as the fishing effort exercised by one fishing unit, its crew and gears, is completely different for different types of fishing units; the major types of units are:
traditional units, catamaran and Apollo liftnet units, 'kapenta' (clupeids) beach seine units (Zambia), and industrial units. therefore, the Catch per Unit of Effort (CPUEs) for these different units vary considerably in time and space, but, as a rule of thumb, the following average CPUE values can be used:

* industrial unit . 900 kg/night (170 for Burundi)
* catamaran liftnet unit: 130 kg/night
* Apollo liftnet unit : 300 kg/night (Burundi only)
* kapenta seine : 100 kg/night (Zambia)
* traditional unit : 25 kg/night

More detailed CPUE values, per type of fishing unit, and its variation in time and space, are given in 3.9 and in various publications and TDs.

- due to the continuous expansion of light fishing at night (artisanal liftnet units, kapenta seines, scoop nets, industrial) targeting especially the Clupeids *(Stolothrissa tanganicae, Limnothrissa miodon)* and *Lates stappersii,* overall catches are mainly composed of these 3 species. They show fluctuating abundances in space and time (daily, monthly, yearly, multi-annual cycles) and abundances for the 2 clupeid species and *L. stappersii* are negatively correlated. For the industrial fishing in Burundi, e.g., the Clupeids are in general more abundant while for the industrial fishing in Zambia, since 1986, adult *L. stappersii* became the most abundant (Figs. 5a and b; 6a and b). From figure 5a, it can be seen that *L. stappersii* shows regular minima in July-August in the industrial catches of the Mpulungu area in Zambia. In Burundi, these minima do not follow a regular pattern (Fig. 5b). The final results of the other subcomponents might allow in the future to make straight links between regular minima/maxima of *L. stappersii* and other pelagic species and certain limnological, meteorological or other phenomena. For example, *L. stappersii,* a known predator, might need a good visibility (thus high transparency or low turbidity of the water) to be able to detect and chase its prey, mainly clupeids (Plisnier, pers. comm.).

- also in Kalemie and Moba (Zaïre), the industrial catch in 1993-94 was mainly composed of *Lates stappersii* (see Table 5c); and also in Kigoma, Tanzania, the bulk of the industrial catch of the one remaining operational unit is mainly composed of *L. stappersii,* mainly adults (mean total length 26.4 cm) but also juveniles recruiting into the purse seine fishery at 8 cm of total length (Mannini, 1994). The north basin of the Lake, where mainly juvenile *L. stappersii* are fished, is thought to be a nursery area for this species.

– when comparing figures 6a and 6c, it is clear that the species composition of the industrial purse seine and the artisanal liftnet catches show the same pattern of fluctuations of *L. stappersii* and clupeids. It also shows that the industrial units, fishing in pelagic fishing grounds, catch more *L. stappersii* than the artisanal liftnet units which exploit more inshore fishing grounds. However, figure 6c also seems to indicate (gradual average increase of *L. stappersii* and corresponding decrease of clupeids throughout time) that the liftnet units are moving more and more to more pelagic fishing grounds.

3.5 Regular census (ground and aerial FS) on the numbers of fishermen, boats, etc. (nominal fishing effort), including a planned lake wide simultaneous FS in February-March 1995

– first lake wide aerial FS Lake Tanganyika, 29.09-03.10.92, its results being reported in Hanek *et al.* (1993a,b), Coenen *et al.* (1993a,b) and Coenen (1993c):

* total of 13976 single boat units of which 2464 units were composed as 1232 catamarans and 21 as 7 trimarans; Burundi: 1802, Tanzania: 3839, Zambia 76S and Zaïre 7S70 boat units; average number of boat units per km of shoreline: 8;
* total of 4S9 fish landing sites according to different size classes were recorded (B:34; T: 127; Zam: 41; Zai: 257); on the average 1 landing site per 4 km of shoreline;
* shoreline composed of rock (43 %), sand (31 %), rock/sand (21 %) and marshy zones around river estuaries (5 %).

- second lake wide aerial FS Lake Tanganyika, 19-21.05.93: due to the bad quality of the video film, reliable counts of boats could not be achieved.

- Zambia. FS/CAS 6.06-9.07.94: LTR/DOF Mpulungu execution (Mwape, 1994)

* total of 80 landing sites
* total of 55O artisanal fishing units (536 planked boats, 6 dugouts, 5 fiberglass boats, 3 catamarans), operated by 2273 fishermen and crew, and 19 transport boats; only 37 outboard engines (compared to 62 in 1992);
* main fishing gear is the kapenta seine (103 in number) with a CPUE of 104 kg/unit/night (mainly clupeids and particularly *Limnothrissa)* and using 850 fishing lamps; 1133 gill nets, 61 handlines, 12 longlines;

* 24 operational purse seiners (out of a total of 30; several of them moved in from Zaïre recently) with a CPUE of 877 kg/unit/trip and mainly catching *Lates stappersii* (96.6 %) and clupeids (2 %);

- first simultaneous (ground-approach) FS, February-March 1995: final meeting of the fisheries statistical coordinators of the 4 countries to finalise its preparations took place from 12-13.12.1994 in Bujumbura (Coenen, 1994d,e). The lake wide FS was financed by LTR (about 12.000 US $) and started end February - beginning of March 1995 in all four countries. The results will be analysed per country and a lake wide compilation of the results will be elaborated by LTR, Bujumbura. This SFS should give a more precise and detailed picture of the number, type and location of fishing effort on Lake Tanganyika than the one provided by the results of the earlier lake wide aerial FS. A preliminary analysis of the 95 Burundi SFS data reveals that there are 54 active fish landing sites of which 2 are temporary ones (Fig. 7). Out of a total of 1406 boat units, 1061 proved to be active units. The distribution of the different types of units enumerated, per stratum and per province, is given in Table 9. In all, a total of 438 catamaran and 101 Apollo liftnet units and 410 traditional active fishing canoes were identified (in 1992, respectively 604, 67 and 298 units were counted). Only 2 active industrial fishing units were enumerated, the other non operational units being moored in the harbour of Bujumbura. The fishing effort since 1992 has thus shifted towards less but more performing artisanal Apollo liftnet units, a revival of the traditional fishery and a continuous decrease of the industrial fishery. A total of 234 units (or about 22 %) are equipped with an outboard engine (ranging between 4 and 40 HP) and the level of motorisation of the catamaran and Apollo units is respectively 35 and 67 %.

3.6 Organisation of a Workshop on Fisheries Statistical Coordination and Standardization and of regular meetings of the fishery statistical coordinators of the 4 riparian countries

- Workshop on the Coordination and Standardization of Fisheries Statistics for Lake Tanganyika. Bujumbura 26-30.07.1993: major recommendations included the need for standardized annual national reporting of FS and CAS results (forms and definitions were adopted) because the possibility to try to adopt a uniform fisheries statistical data collection system was unanimously rejected; need for regular FS, including a simultaneous one in February 1995, and for regular meetings of the national fisheries statistical coordinators (Coenen 1993a,b).

- Annual meetings of the fishery statistical coordinators of the 4 riparian countries: the first one took place in Bujumbura, 12–13.12.1994, to prepare 02.95 simultaneous FS and to discuss annual and general fisheries statistics for Lake Tanganyika (Coenen, 1994d and 1995; see also 3.5).

3.7 Coordination of standardized reporting on annual FS and CAB results to enable the compilation of overall Lake Tanganyika fisheries statistics

- Following the recommendations of the Statistical Workshop in July 1993 (see 3.6), Burundi prepared its standardized fisheries statistical result outputs for 1993 (see also Coenen & Nikomeze, 1994a,b); they were sent to the Directors of Fishery and the fisheries statistical coordinators of the 3 other countries and to the CIFA Subcommittee for Lake Tanganyika, FAO, Rome; standardized result outputs for 1992 (not yet for 1993) from Tanzania and Zambia were submitted during the first fisheries statistics coordinators' meeting and were annexed in Coenen (1994, 1995)

- Pre-1993 overall Lake Tanganyika fisheries statistics compilations were prepared and reported in various TDs (see 3.10).

3.8 Collection and reporting on supplementary fishery statistics (e.g. industrial statistics in Kalemie and Moba, Zaïre; continuous monitoring of fish landing site(s) and daily kapenta (clupeid) splitting in Mpulungu, Zambia)

- Since October 1992, LTR is monitoring the collection of industrial fisheries statistical data from Kalemie, Zaïre with the help of a Kalemie based industrial fisherman (DD). Since July 1993, after strengthening the links with the ECN Subregional Coordinator of Kalemie, parallel ECN data on the industrial fishing were also received. A first compilation of data, up to 11.93, was published in Coenen (1994b). Total 1993 industrial catch (DD data) for Kalemie, with on the average 8.4 units fishing per monthly fishing cycle, amounted to 763 tonnes, with an average CPUE of 875 kg/night/unit (see Table 10). The bulk of the catch was mainly composed of *Lates stappersii* (94.0 %), Clupeids (5.1 %) and *Lates* spp. (0.9 %). Total 1994 industrial catch (DD data) for Kalemie, with on the average only 5.3 units fishing per monthly fishing cycle (6 units moved to Zambia while 2 units were turned into transport vessels), amounted to 402 tonnes, with an average CPUE of 830 kg/night/unit (Table 10). The bulk of the catch was again mainly composed of *Lates stappersii* (97.7 %), Clupeids (1.0 %) and *Lates spp.* (1.4 %). A comparison with ECN statistics for the periods 7.93 - 12.93 and 1-12.94 (see Table 11) revealed that, for reasons explained in Coenen (1994b), the latter only represent respectively 45 % and 53 % of the total catch and 49 % and 48 % of the average CPUE per fishing unit as recorded by DD. Out of the 14-17 units, of which on the average about 10 units were active in 1992, only 5-11 units were still operational in 1993 and even less in 1994, 4–7 units, due to the reasons mentioned above and due to lack of spare parts and diesel, the difficult political/economic situation of the country, etc..

- Since January 1994, LTR is also monitoring the collection of industrial fisheries statistical data from Moba, Zaïre thanks to the assistance of the ECN staff in Moba. The two remaining units, however, mainly due to the excessive prices of the (little) available diesel and to financial/management problems of the 2 fishing companies PEZATA and PROMOB, were not

operational during the whole of 1994, except for the unit UVIRA (PROMOB fishing company) which fished for 8 nights during 7-8.94 (see Table 12).

- Because of the fact that Zambia's fisheries statistical data collection system does not have a continuous monitoring of fish landing beaches but 3-4 one monthly CAS/FS rounds per year (which, due to unclear reasons, were not executed since 1993), LTR decided in September 1994 to start a continuous CAS monitoring of Katasa beach near Mpulungu and maybe later of another landing site in Nsumbu area (see also TRAM 53). A daily catch recording form was designed and total enumeration/sampling of fishing units started on 25.09.94, 3 times per week. As a result, monthly variations in catch, effort, CPUE, species composition, etc. can now be recorded and rough extrapolations made for all fish landings for Lake Tanganyika in Zambia.

- at the same time, LTR/Mpulungu started a daily kapenta (clupeids) splitting (determination of the composition *Limnothrissa* versus *Stolothrissa)* of a 1 kg sample of clupeids taken from one of the S industrial companies in Mpulungu.

3.9 Extraction of fishery statistical data from the fish biology subcomponent sampling

Since July 1993, weekly fish samples are taken from artisanal units, industrial units, beach seines, etc. at several LTR stations and substations around the Lake. Apart from data to be used for the fish biology subcomponent (length frequency, maturity, sex, etc.), also some fishery statistical data were extracted and compiled on a monthly basis for those stations and fishing units where enough samples were taken to obtain significant results regarding CPUE, species composition, etc. Table 13 gives the summary characteristics of the catamaran liftnet units sampled from 7.93 to 6.94 in the upper northern basin (Bujumbura–Uvira), in Karonda (70 km south of Bujumbura), in Kigoma (Tanzania) and in Mpulungu (Zambia). It shows that much less fish is caught by catamarans in the northern basin (due to local overfishing) than in the more southern fishing grounds. Figures 8 to 10 show the monthly variation in average catamaran catch per night and the 95 % confidence limits for the 3 areas sampled.

Table 14 presents some catch statistics for different gears (beach seines, catamaran liftnets (LN) and longlines (LL) used during catamaran fishing) and periods, taken from fish biology sampling data in different LTR stations.

The monthly species composition for the liftnet catches was arrived at by extrapolating the sample composition (Figs. 11 to 16)

- in Buja/Uvira, Clupeids show their minimum abundance during 10-11.93 and another minimum during 3.94; in general, *Stolothrissa tanganicae* (STA) is more abundant throughout the year except during 11-12.93 when *Limnothrissa miodon* (LMI) is the major species; similar abundances were observed for the Burundi CAS 93 (see TD/24);

– in Karonda, Clupeids show one important minimum abundance during 10.93; in general, Clupeids are principally composed of STA except during 9 and 11.93 (LMI);
- in Kigoma, Clupeids show their minimum abundance during 2-3.94 and another minimum during 10.93; here, Clupeids are almost exclusively composed of STA throughout the year.

As mentioned before, abundance peaks of Clupeids are negatively correlated with those of *Lates stappersii* (LST). In general, abundance trends look more or less similar for the above stations, although LMI is more abundant in the northern basin with a broad shallow sandy littoral belt than in Kigoma where the littoral belt is narrow and steep. The maximum abundance of LMI in the liftnet catches during 11.93 is most probably due to the observed (feeding) movements of LMI to the pelagic zone during October-November (Coulter, 1991) after a probable spawning in August-September (fish biology observation, 1993) in shallow waters. Thus, spawning behaviour might also play a role in movements of Clupeids from the littoral to the pelagic zone, or vice versa, and thus for their availability to be caught by liftnets. Unfortunately, species composition data for Mpulungu are not yet available, mainly because there were major problems in sampling unsorted catches.

3.10 Reporting, through Technical Documents, on national and lake wide aspects of Lake Tanganyika fisheries statistics

Since March 1993, even before the end of the preparatory phase of LTR, the reporting on Lake Tanganyika fisheries statistics started; the following TDs were prepared:

* TD 9 and 10: First aerial FS results;
* TD 11: Report on the First Workshop on the Coordination and Standardization of Fisheries Statistics for Lake Tanganyika;
* TD 15: Report on the historical data of the Fisheries, Fisheries Statistics, Fishing Gear and Water Quality of Lake Tanganyika, Tanzania;
* TD 16: Report on the (semi-) industrial fishing on Lake Tanganyika, with special emphasis on the industrial fishing in Kalemie, Zaïre and a compilation of lake wide fisheries statistical data;
* TD 17: Report on LTR's Second SSP Assessment Meeting;
* TD 18: Report on the October 1992 FS results on Lake Tanganyika in Burundi, with a comparison with past surveys;
* TD 24: Report on the 1992-93 CAS results for Lake Tanganyika, Burundi.
* TD 27: Report on LTR's Third Joint meeting, including a presentation on preliminary results in fisheries statistics.
* TD 28: Report on the First Fisheries Statistical Coordinators Meeting for Lake Tanganyika.
* TD 31: Report on the historical data on Fisheries Statistics, Limnology, Bromatology, Zooplankton, etc. of Lake Tanganyika, Zaïre.

3.11 Field missions to national and local fisheries statistical offices and field stations to discuss, organize, collect data, etc. regarding fisheries statistics activities mentioned above

Various national fisheries statistics headquarters and regional offices were visited for this purpose and these field missions were reported on in several reports (Hanek, 1992, 1993, 1994, 1995)

* TRAM 8 : Kigoma, historical data on fisheries statistics for Lake Tanganyika, Tanzania;
* TRAM 10: Chilanga and Mpulungu, historical data on fisheries statistics for Lake Tanganyika, Zambia;
* TRAM 12: Lake wide aerial FS travel report; Kigoma, historical data; Kalemie, collection of data on industrial fishing;
* TRAM 23: Assessment of fisheries statistical system in the Kigoma and Rukwa Regions/Districts, Tanzania;
* TRAM 29: Fisheries statistics identification mission Uvira, Kalemie, Moba, Bukavu, Zaïre;
* TRAM 31: First SSP subcomponents assessment meeting, Kigoma, Tanzania;
* TRAM 43: Check on the progress of decentralized TANFISH CAS data computer entry in Kigoma Region/District; second SSP subcomponents assessment meeting, Kigoma, Tanzania;
* TRAM 50: Discuss various aspects of data collection, compilation and reporting of CAS data from Lake Tanganyika, Tanzania; preliminary discussions on the preparation in Tanzania of the simultaneous FS in February 1995;
* TRAM 53: Check of progress of the fisheries statistics activities in Mpulungu station, Zambia.

4. CONCLUSIONS

The above outlined summary of results is still preliminary and only gives an update of LTR's activities and findings up to early 1995. Part of the data still have to be compiled and analyzed. More data are still needed in order to be able to link them with the results of other subcomponents and with fishery hydroacoustical data to be obtained during lake wide cruises with the R/V Tanganyika Explorer in 1995.

The major conclusion is probably the fact that lake wide catches are still increasing due to more and more efficient artisanal fishing units which exploit principally the 3 main pelagic species. Some parts of the Lake are already heavily exploited (the Burundi waters, Mpulungu area in Zambia) and the proper management of the fishing effort there seems urgent and indispensable. In Burundi, a natural shift of fishing effort towards the more southern fishing areas and a decline in the number of operational industrial fishing units has already been observed since several years. In Zambia, the solution would be to oblige part of the Mpulungu industrial (and maybe also artisanal) units to move to the Nsumbu area, but therefore better access roads, infrastructures *(e.g.* electricity supply), etc. should be developed for this area in order to allow fishing companies to establish themselves there (Pearce, 1992). The main part of the Lake however, in Tanzania and Zambia, and also Zaïre, is still underexploited and available for the (managed)

introduction of more fishing effort (artisanal units). Destructive gears, like beach seines and mosquito nets, and too small meshes should however be banned.

The follow-up of future trends in fish catches, CPUEs, etc. can only be monitored through the collection of reliable fisheries statistics. Unfortunately, up to this date, the importance of fisheries statistics and the resulting monitoring of a free animal protein resource (worth millions of dollars) is still undervalued (compared to the agricultural sector). Moreover, due to present severe budget constraints affecting all riparian countries, the collection of fisheries statistics is too often considered as the last priority when budgets have to be allocated.

Therefore, the existing fisheries statistical systems should be reinforced (rather than neglected) and more importance should be given to the establishment of recurrent annual budgets to run fisheries statistical field and headquarters operations, supervision of beach recorders, elaboration of standardized fisheries statistical result outputs and regular meetings of the fisheries statistics coordinators (as decided by the July 93 Statistical Workshop) to enable an adequate lake wide monitoring of the fisheries resources of Lake Tanganyika. Indeed, fisheries are usually anything but stable and characterized by fluctuations caused by environmental and only partially understood factors, in addition to man–induced changes (Hannesson, 1994). An inherent difficulty in fisheries management is the need to manage an unseen mobile resource, especially in the case of s shared lakes. As a result, fisheries managers are not able to manage fish stocks directly, but instead, they can only manage the effort that is applied to the stock(s). Also, since a number of alternative management strategies may achieve the same biological effect, there are obvious advantages in implementing the policy that will also provide the greatest benefits to all fishermen. In the absence of management, fishermen will attempt to remove as much of the stock as they can while it is there. Consequently, fisheries not subject to any management, risk both biological and economic overexploitation (Pascoe *et al.,* 1994).

5. RECOMMENDATIONS

In general, but dependent on the future of the project, the activities of LTR's fisheries statistics subcomponent should continue as long as the SSP continues, except for the aerial frame surveys which proved to be very time consuming to analyse and very dependent on the quality of the video film taken.

The remaining data, part of them still to be collected, have to be analysed and compiled. The preparation and distribution of standardized annual FS and CAS outputs, per country and for the whole lake, should continue, even after the project. Once again, it should be stressed that the national Fisheries Departments should try to secure annual recurrent budgets to carry out continuous CAS and regular FS (at least every 2 years) and to keep up their fisheries statistical units (maintenance of computers, printers and other hardware; budget

to buy stationary and computer supplies like disks, printer ribbons, printing paper, etc.). Indeed, without stable national inputs for the fisheries statistical units, no sustainability of the system nor any reliable continuity of data collected is possible.

Possible future technical assistance for the national fisheries statistical units should principally be directed to the strengthening of the headquarters and regional units (without changing too often the statistical systems put in place) and to the training and supervision of field staff (if the fisheries statistics collected at the landing sites are not correct, then any catch/effort estimate, calculated with whatever sophisticated computerized system, will not be reliable). The quality and precision of the results of any survey is dependent on the available budget. Therefore, when national governments, due to economical or other reasons, can not guarantee adequate budgets to keep up the system, it is better to simplify (make less costly) the surveys and thus accept the fact that it is better too be able to obtain less accurate estimates than unreliable or no estimates at all. For example, for Zaïre, some continuous, standardized CAS recordings could be initiated at some major centres/landing sites where MECNT staff is in place (e.g. Uvira, Kalemie, Moba) and the results extrapolated based on the results of the recent FS.

When considering all the money and effort, mostly invested through national project to assist Fisheries Departments in conceiving, developing and implementing computerized fisheries statistical FS and CAS systems, it is a pity to see that all these nicely implemented but always different computerized systems are blocking the way to ever reach a standardized system on a regional base as is the case for shared lakes like Tanganyika. Ideally, we should come to a simple, user friendly (with several options) but effective computerized fisheries statistical system (software package) that can cope with all kinds of river, lake and even marine fisheries and that can easily be implemented in any country, region and why not in all Africa. In this respect, a project profile proposal, to be funded as a TCP project or with other available funds, eventually with the case of Lake Tanganyika representing a well documented shared lake and forming the backbone for the development of such a software, is presented in Annex 1.

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Fig. 1: Historical reconstruction of total catch, per country, for Lake Tanganyika

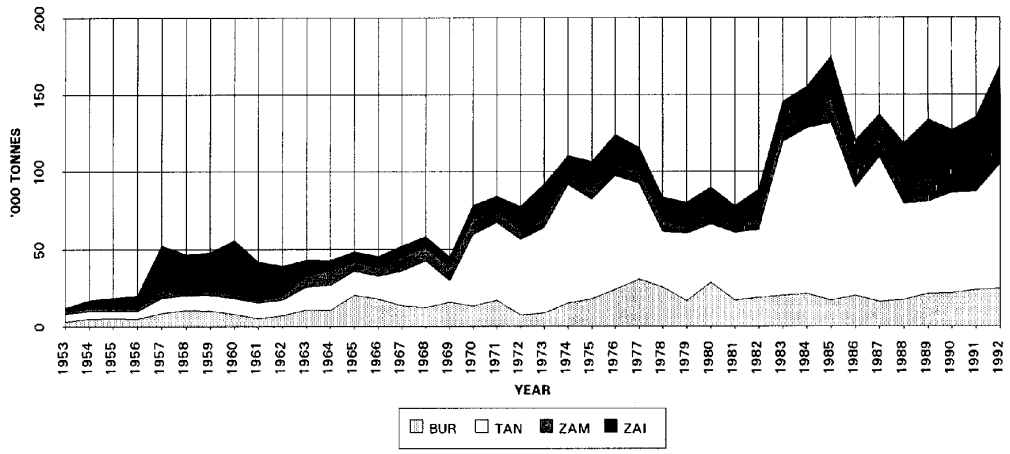

Fig. 2: Historical evolution of annual CPUEs, per country, for Lake Tanganyika

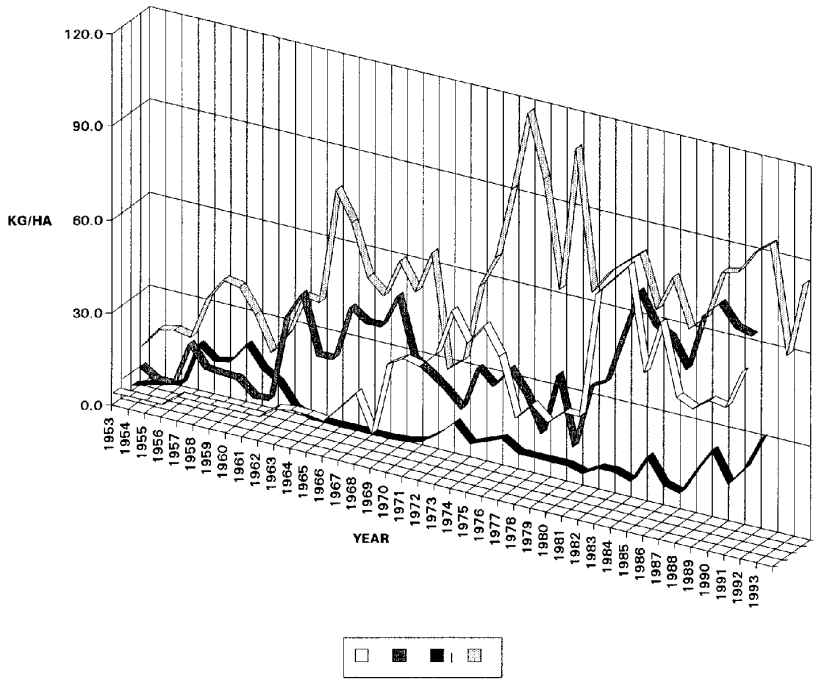

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Fig. 3: Reconstruction of the evolution of fishing effort, per country, Lake Tanganyika

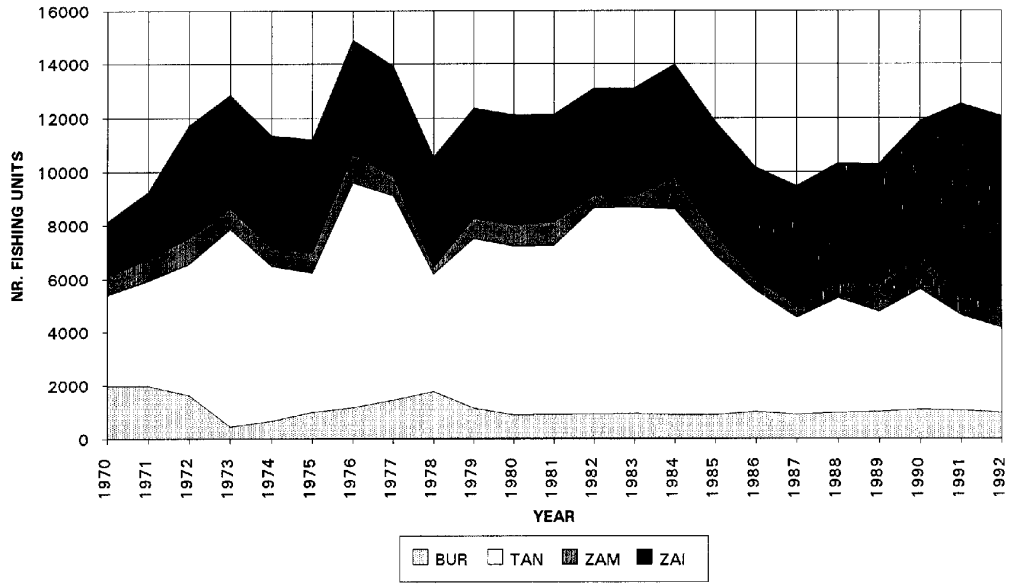

Fig. 4: Reconstruction of the evolution of annual fishing unit CPUE, per country, Lake Tanganyika

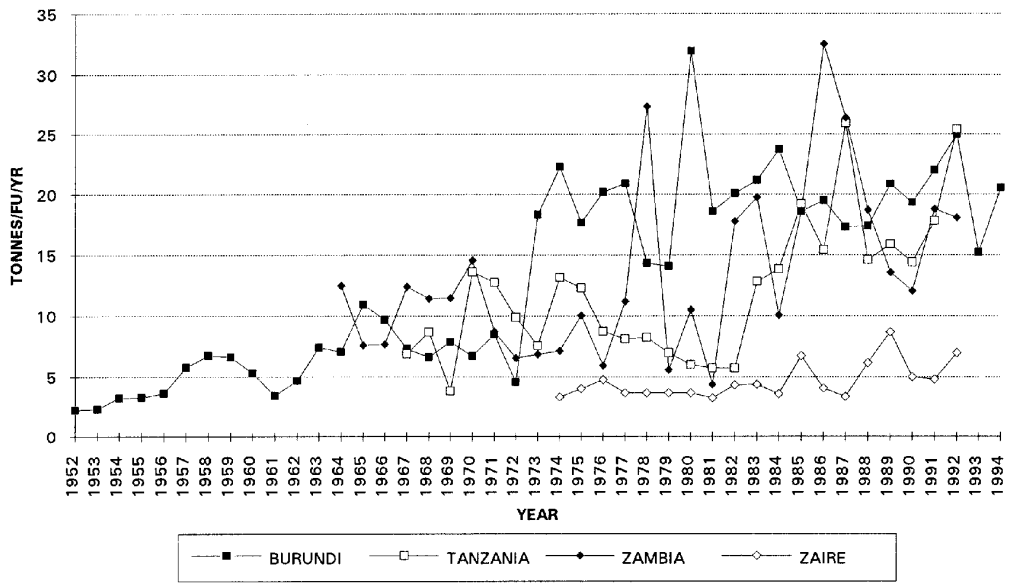

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Fig. 5a: Monthly variations in industrial catch composition, Mpulungu, Zambia (1984-94)

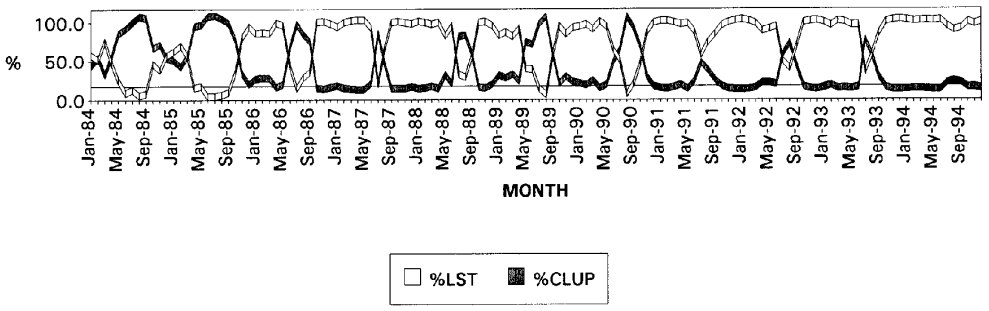


Fig. 5b: Monthly variations in industrial catch composition, Burundi (1984-94)

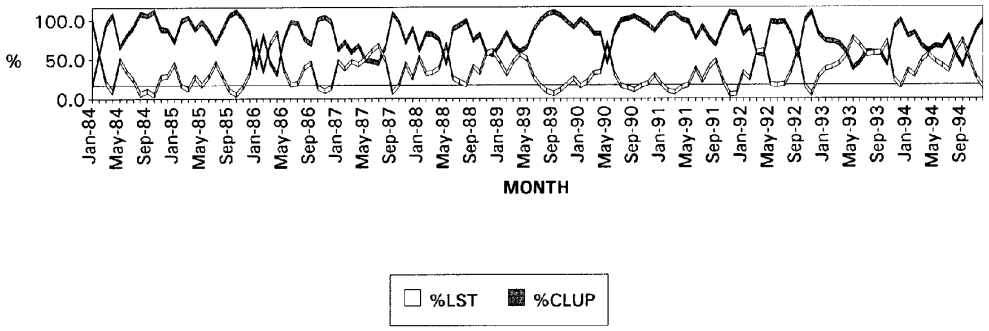


Fig. 5c: Monthly variations in industrial catch composition, Kalemie, Zaire (1993-94)

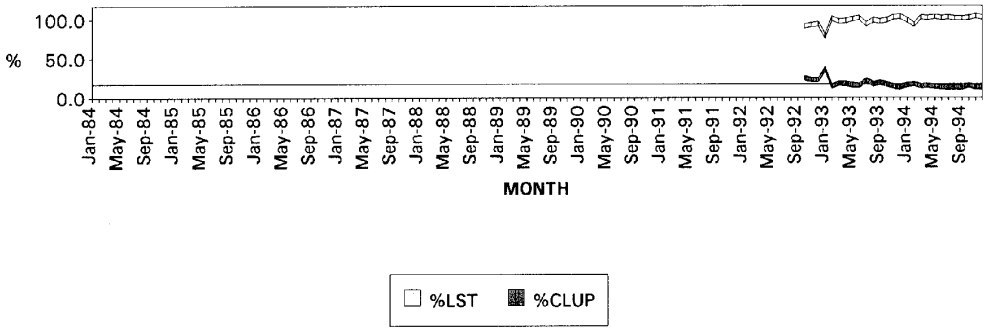


Fig. 6a: Yearly variation in industrial catch composition, Burundi (1956-1994)

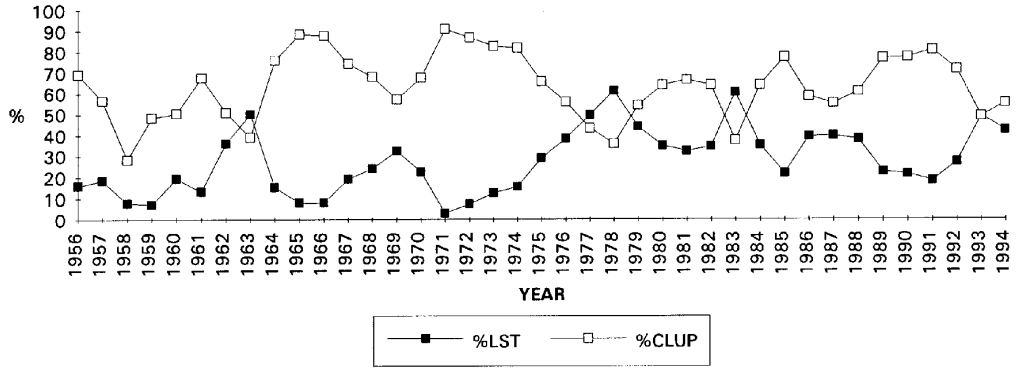


Fig. 6b: Yearly variation in industrial catch composition, Mpulungu, Zambia (1963-94)

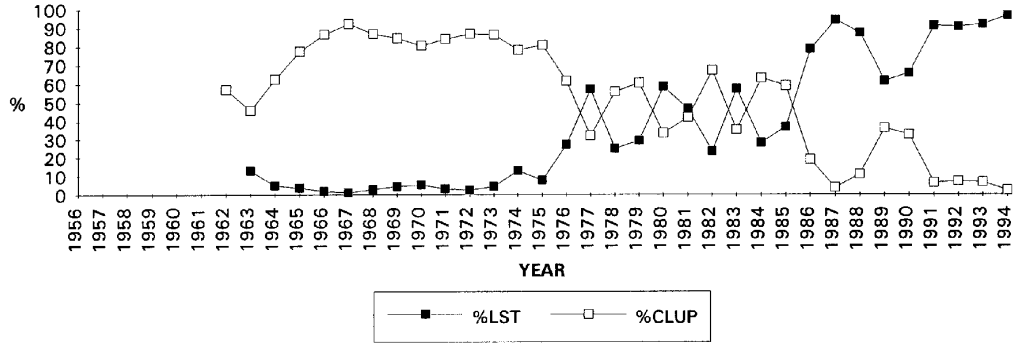
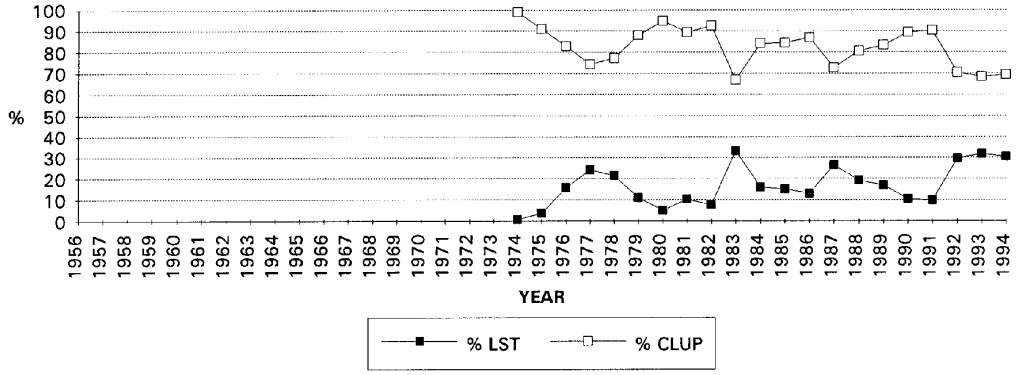


Fig. 6c: Yearly variation in artisanal liftnet catch composition, Burundi (1974-1994)



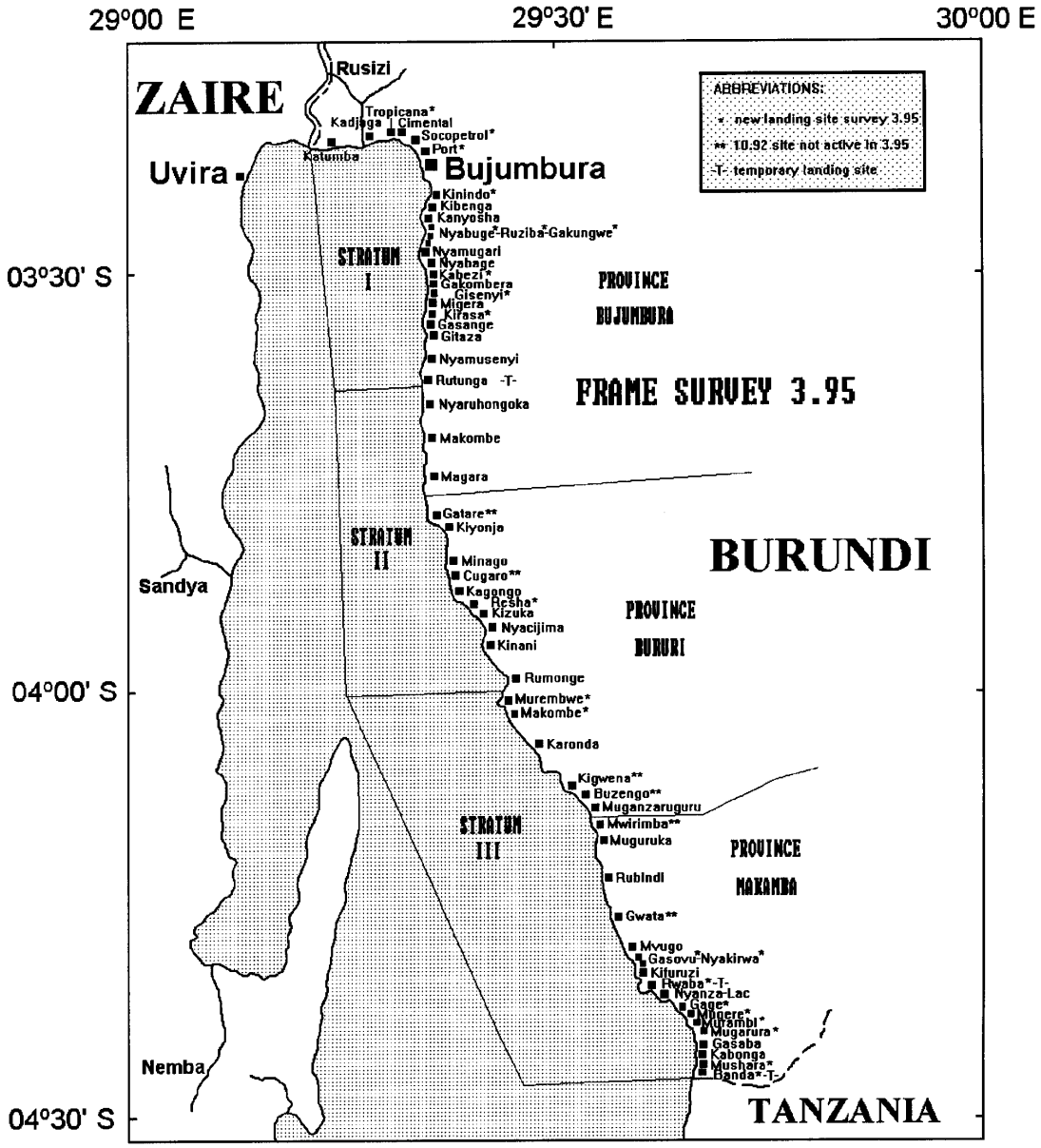


Fig. 7: Fish landing sites surveyed during the first simultaneous frame survey, Burundi (2-3.95)

Fig. 8: Monthly variation in average catamaran catch/night and 95 % confidence limits, Bujumbura-Uvira

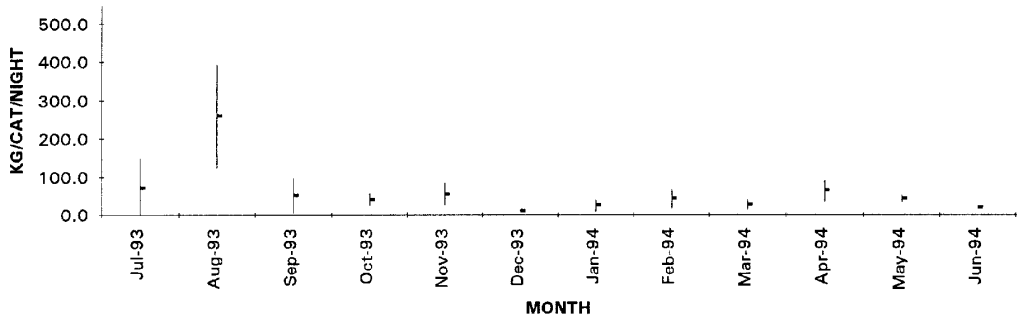


Fig. 9: Monthly variation in average catamaran catch/night and 95 % confidence limits, Karonda

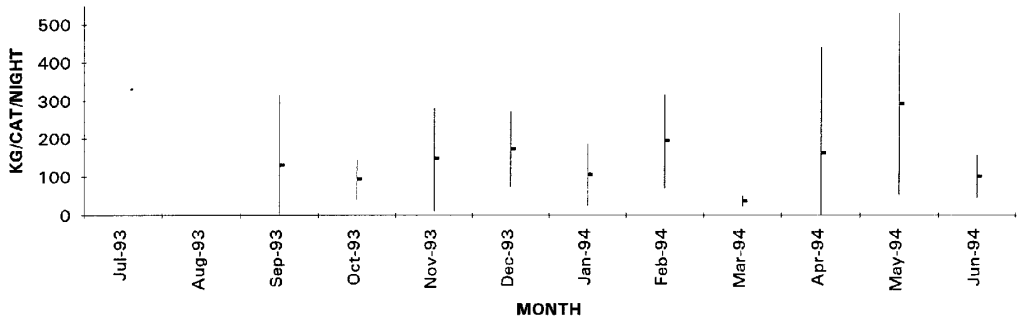


Fig. 10: Monthly variation in average catamaran catch/night and 95 % confidence limits, Kigoma

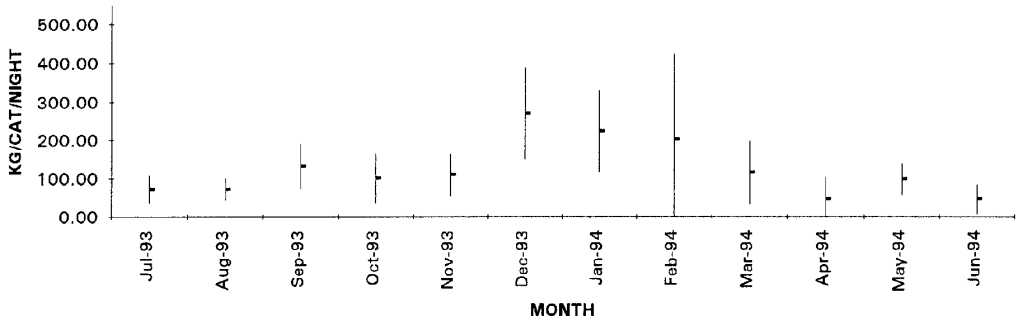


Fig. 11: Monthly species composition, Buja-Uvira

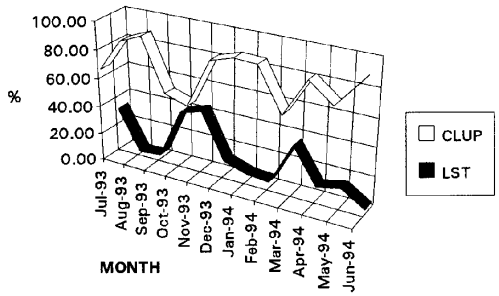


Fig. 12: Monthly species composition, Buja-Uvira

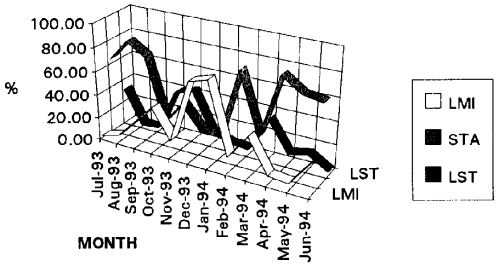


Fig. 13: Monthly species composition, Karonda

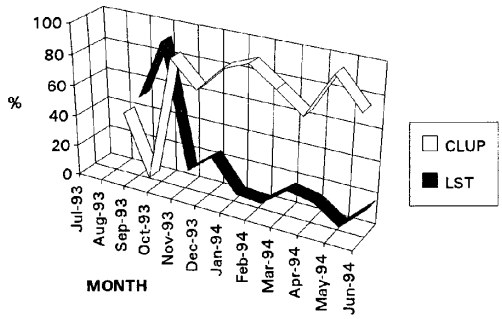


Fig. 14: Monthly species composition, Karonda

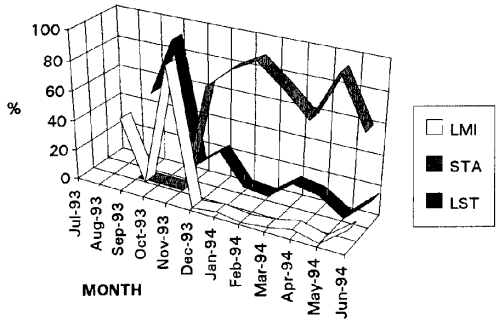


Fig. 15: Monthly species composition, Kigoma

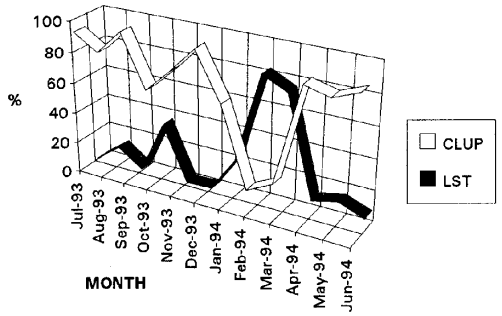
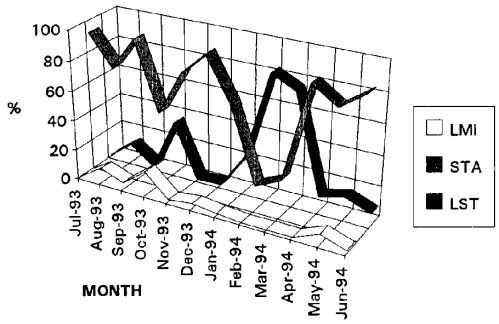


Fig. 16: Monthly species composition, Kigoma



Tab. 1: Fishing effort, total catch and catch by species(group), CPUE and average price per kg by species(group) for the catamaran liftnet fishery, Lake Tanganyika (CAS 1994)

PERIOD	TRIPS	CLUPjuv. CATCH	CLUPjuv. VAL.	CLUP CATCH	CLUP VAL.	L.ST.juv. CATCH	L.ST.juv. VAL.	L.ST. CATCH	L.ST. VAL.	L.SPP. CATCH	L.SPP. VAL.	OTH. CATCH	OTH. VAL.	TOTAL CATCH	TOTAL VAL.
29/12/93-27/01	7533	195592	11025995	382230	36216103	18759	1740747	461191	65053267	40	7977	0	0	1057812	114044089
28/01-26/02	8672	58711	8783885	649882	55822770	32497	3258737	24009	5271072	376	65076	0	0	765475	73201540
27/02-27/03	7276	112589	8190540	263716	25438742	56578	4581679	199325	22608442	35	7734	0	0	632243	60827137
28/03-25/04	11777	350971	41718806	275519	27995030	358807	20675523	517586	54676029	0	0	0	0	1502883	145065388
26/04-25/05	12608	634173	44883756	1055466	54181742	219993	14264728	207320	26209567	396	220816	0	0	2117348	139560609
26/05-23/06	10396	48291	8207883	945564	83262328	37843	6712638	81947	13541836	2654	1206892	1756	263422	1118055	113194999
24/06-22/07	8688	264881	24344275	269367	34382267	309500	15021273	47126	8644458	226	193370	998	180062	892098	82765705
23/07-21/08	8621	1251505	50458564	291233	30288094	197499	13995823	731824	67900024	109	50211	0	0	2472170	162692716
22/08-19/09	10170	241435	18659235	1215702	72849691	149994	7285776	337724	39639325	2128	693239	479	156776	1947462	139284042
20/09-19/10	6298	80518	8483995	360116	38752435	133045	10945469	155992	20200276	1481	703186	59	21827	731211	79107188
20/10-18/11	9878	427952	38379896	632138	76632273	42768	5797568	36593	7606622	578	147124	5529	782794	1145558	129346277
19/11-18/12	9629	224716	18247821	1511218	82693422	12333	1391642	5795	1425604	390	93723	93	17885	1754545	103870097
TOTAL 94	**111546**	**3891334**	**281184651**	**7852151**	**618514897**	**1569616**	**105671603**	**2806432**	**332776522**	**8413**	**3389348**	**8914**	**1422766**	**16136860**	**1342959787**

PERIOD	TOTAL F/KG	CLUPjuv. F/KG	CLUP F/KG	L.ST.juv. F/KG	L.ST. F/KG	L.SSP. F/KG	OTH. F/KG	TOTAL KG/TR.	CLUPjuv. KG/TR.	CLUP KG/TR.	L.ST.juv. KG/TR.	L.ST. KG/TR.	L.SSP. KG/TR.	OTH. KG/TR.
29/12/93-27/01	108	56	95	93	141	199		140.4	26.0	50.7	2.5	61.2	0.0	0.0
28/01-26/02	96	150	86	100	220	173		88.3	6.8	74.9	3.7	2.8	0.0	0.0
27/02-27/03	96	73	96	81	113	221		86.9	15.5	36.2	7.8	27.4	0.0	0.0
28/03-25/04	97	119	102	58	106			127.6	29.8	23.4	30.5	43.9	0.0	0.0
26/04-25/05	66	70	51	65	126	558		167.9	50.3	83.7	17.4	16.4	0.0	0.0
26/05-23/06	101	170	88	177	165	455	150	107.5	4.6	91.0	3.6	7.9	0.3	0.2
24/06-22/07	93	92	128	49	183	856	180	102.7	30.5	31.0	35.6	5.4	0.0	0.1
23/07-21/08	66	40	104	71	93	461		286.8	145.2	33.8	22.9	84.9	0.0	0.0
22/08-19/09	72	77	60	49	117	326	327	191.5	23.7	119.5	14.7	33.2	0.2	0.0
20/09-19/10	108	105	108	82	129	475	370	116.1	12.8	57.2	21.1	24.8	0.2	0.0
20/10-18/11	113	90	121	136	208	255	142	116.0	43.3	64.0	4.3	3.7	0.1	0.6
19/11-18/12	59	81	55	113	246	240	192	182.2	23.3	156.9	1.3	0.6	0.0	0.0
TOTAL 94	**83**	**72**	**79**	**67**	**119**	**403**	**160**	**144.7**	**34.9**	**70.4**	**14.1**	**25.2**	**0.1**	**0.1**

Abbrev: - CATCH and value (VAL.) expressed in kg and burundi francs (F), respectively
- CLUPjuv., CLUP, L.ST.juv., L.ST., L.SPP., OTH. = respectively juveniles and adults of Clupeids and Lates stappersii; Lates spp. and Other species
- TR. = fishing trip (CPUE = average catch per fishing trip)

Tab. 2: Fishing effort, total catch and catch by species(group), CPUE and average price per kg by species(group) for the apollo liftnet fishery, Lake Tanganyika (CAS 1994)

PERIOD	TRIPS	CLUPjuv. CATCH	CLUPjuv. VAL.	CLUP CATCH	CLUP VAL.	L.ST.juv. CATCH	L.ST.juv. VAL.	L.ST. CATCH	L.ST. VAL.	L.SPP. CATCH	L.SPP. VAL.	OTH. CATCH	OTH. VAL.	TOTAL CATCH	TOTAL VAL.
29/12/93-27/01	441	24823	1115347	59743	4504703	14062	1869316	85397	11069912	73	20816	0	0	184098	18580094
28/01-26/02	966	0	0	120837	9792898	23420	2207601	12154	2246044	87	16848	0	0	156498	14263391
27/02-27/03	435	38195	2491379	28384	2596731	5859	592439	42829	5601866	0	0	0	0	115267	11282415
28/03-25/04	2766	273622	16234492	67288	4298968	184667	13030633	369972	50123145	0	0	0	0	895549	83687238
26/04-25/05	1046	26855	970328	163274	12089548	19326	1695457	75668	11163566	2674	342152	19	3017	287816	26264068
26/05-23/06	1185	1971	226665	254581	25883611	35004	4197640	54695	11830559	938	565003	938	130044	348127	42833522
24/06-22/07	1371	168530	12208867	68283	10261454	48157	4106746	39945	7161564	157	59234	754	92743	325826	33890608
23/07-21/08	1459	68233	3115233	49555	3750943	63596	4929229	474884	43040228	16	8481	0	0	656284	54844114
22/08-19/09	1101	17365	725085	285896	16585253	24697	2085441	153114	17735737	355	143782	0	0	481427	37275298
20/09-19/10	1218	45942	4135313	171835	15707544	37119	4065040	88815	10569176	194	59379	0	0	343905	34536452
20/10-18/11	1146	111803	7498202	99451	12605965	20177	2043173	28127	5658524	665	263150	8578	737503	268801	28806517
19/11-18/12	1288	11540	754176	462665	20832390	15841	1609547	14156	3030100	329	134639	55	8800	504586	26369652
TOTAL 94	14422	788879	49475087	1831792	138910008	491925	42432262	1439756	179230421	5488	1613484	10344	972107	4568184	412633369

PERIOD	TOTAL F/KG	CLUPjuv. F/KG	CLUP F/KG	L.ST.juv. F/KG	L.ST. F/KG	L.SSP. F/KG	OTH. F/KG	TOTAL KG/TR.	CLUPjuv. KG/TR.	CLUP KG/TR.	L.ST.juv. KG/TR.	L.ST. KG/TR.	L.SSP. KG/TR.	OTH. KG/TR.
29/12/93-27/01	101	45	75	133	130	285		417.5	56.3	135.5	31.9	193.6	0.2	0.0
28/01-26/02	91		81	94	185	194		162.0	0.0	125.1	24.2	12.6	0.1	0.0
27/02-27/03	98	65	91	101	131			265.0	87.8	65.3	13.5	98.5	0.0	0.0
28/03-25/04	93	59	64	71	135			323.8	98.9	24.3	66.8	133.8	0.0	0.0
26/04-25/05	91	36	74	88	148	128	159	275.2	25.7	156.1	18.5	72.3	2.6	0.0
26/05-23/06	123	115	102	120	216	602	139	293.8	1.7	214.8	29.5	46.2	0.8	0.8
24/06-22/07	104	72	150	85	179	377	123	237.7	122.9	49.8	35.1	29.1	0.1	0.5
23/07-21/08	84	46	76	78	91	530		449.8	46.8	34.0	43.6	325.5	0.0	0.0
22/08-19/09	77	42	58	84	116	405		437.3	15.8	259.7	22.4	139.1	0.3	0.0
20/09-19/10	100	90	91	110	119	306		282.4	37.7	141.1	30.5	72.9	0.2	0.0
20/10-18/11	107	67	127	101	201	396	86	234.6	97.6	86.8	17.6	24.5	0.6	7.5
19/11-18/12	52	65	45	102	214	409	160	391.8	9.0	359.2	12.3	11.0	0.3	0.0
TOTAL 94	90	63	76	86	124	294	94	316.8	54.7	127.0	34.1	99.8	0.4	0.7

Abbrev: - CATCH and value (VAL.) expressed in kg and burundi francs (F), respectively
- CLUPjuv., CLUP, L.ST.juv., L.ST., L.SPP., OTH. = respectively juveniles and adults of Clupeids and Lates stappersii; Lates spp. and Other species
- TR. = fishing trip (CPUE = average catch per fishing trip)

Tab. 3: Fishing effort, total catch and catch by species(group), CPUE and average price per kg by species(group) for the industrial fishery, Lake Tanganyika (CAS 1994)

PERIOD	UNITS	TRIPS	CLUPjuv. CATCH	CLUPjuv. VAL.	CLUP CATCH	CLUP VAL.	L.ST.juv CATCH	L.ST.juv. VAL.	L.ST. CATCH	L.ST. VAL.	L.SPP. CATCH	L.SPP. VAL.	OTH. CATCH	OTH. VAL.	TOTAL CATCH	TOTAL VAL.
29/12/93-27/01	9	163	1577	61342	10161	601572	249	29473	5313	1105779	317	130698	0	0	17617	1928864
28/01-26/02	9	130	200	20000	7950	828200	1764	204800	1100	255300	524	187500	0	0	11538	1495800
27/02-27/03	9	183	12427	619000	9762	832500	2575	382900	15199	3379100	550	197300	0	0	40513	5410800
28/03-25/04	9	219	3289	212800	17338	1356200	4300	524700	18049	5125300	162	64000	0	0	43138	7283000
26/04-25/05	9	170	1126	36100	14624	1282600	4012	473900	8525	1704200	713	256000	0	0	29000	3752800
26/05-23/06	7	165	200	16000	12350	1191800	4288	622700	4662	1067000	2225	854000	0	0	23725	3751500
24/06-22/07	7	160	8125	696400	8076	798700	2412	274000	5165	1258600	513	194000	0	0	24291	3221700
23/07-21/08	8	128	4012	262094	7620	629856	1805	197222	12733	2300500	166	55778	0	0	26336	3445450
22/08-19/09	7	159	104	10435	7256	653748	4947	463640	13040	2387165	143	53909	158	32612	25648	3601509
20/09-19/10	8	205	14451	962900	9313	880900	13200	1470900	7744	1678200	238	75000	0	0	44946	5067900
20/10-18/11	8	164	1363	97000	17476	1679900	2275	304600	3576	846000	750	291000	0	0	25440	3218500
19/11-18/12	6	118	338	27000	11187	968300	875	97500	525	136000	486	209500	0	0	13411	1438300
TOTAL 94	96	1964	47212	3021071	133113	11704276	42702	5046335	95631	21243144	6787	2568685	158	32612	325603	43616123

PERIOD	TOTAL F/KG	CLUPjuv. F/KG	CLUP F/KG	L.ST.juv. F/KG	L.ST. F/KG	L.SSP. F/KG	OTH. F/KG	TOTAL KG/TR.	CLUPjuv. KG/TR.	CLUP KG/TR.	L.ST.juv. KG/TR.	L.ST. KG/TR.	L.SSP. KG/TR.	OTH. KG/TR.
29/12/93-27/01	109	39	59	118	208	412		108	9.7	62.3	1.5	32.6	1.9	0.0
28/01-26/02	130	100	104	116	232	358		89	1.5	61.2	13.6	8.5	4.0	0.0
27/02-27/03	134	50	85	149	222	359		221	67.9	53.3	14.1	83.1	3.0	0.0
28/03-25/04	169	65	78	122	284	395		197	15.0	79.2	19.6	82.4	0.7	0.0
26/04-25/05	129	32	88	118	200	359		171	6.6	86.0	23.6	50.1	4.2	0.0
26/05-23/06	158	80	97	145	229	384		144	1.2	74.8	26.0	28.3	13.5	0.0
24/06-22/07	133	86	99	114	244	378		152	50.8	50.5	15.1	32.3	3.2	0.0
23/07-21/08	131	65	83	109	181	336		206	31.3	59.5	14.1	99.5	1.3	0.0
22/08-19/09	140	100	90	94	183	377	206	161	0.7	45.6	31.1	82.0	0.9	1.0
20/09-19/10	113	67	95	111	217	315		219	70.5	45.4	64.4	37.8	1.2	0.0
20/10-18/11	127	71	96	134	237	388		155	8.3	106.6	13.9	21.8	4.6	0.0
19/11-18/12	107	80	87	111	259	431		114	2.9	94.8	7.4	4.4	4.1	0.0
TOTAL 94	134	64	88	118	222	378	206	166	24.0	67.8	21.7	48.7	3.5	0.1

Abbrev: - CATCH and value (VAL.) expressed in kg and burundi francs (F), respectively
- CLUPjuv., CLUP, L.ST.juv., L.ST., L.SPP., OTH. = respectively juveniles and adults of Clupeids and Lates stappersii; Lates spp. and Other species
- TR. = fishing trip (CPUE = average catch per fishing trip)

Tab. 4: Fishing effort, total catch and catch by species(group), CPUE and average price per kg by species(group) for the traditional fishery, Lake Tanganyika (CAS 1994)

PERIOD	TRIPS	CATCH CATF	CATCH CICHL	CATCH CLUP	CATCH L.MAR.	CATCH L.ANG.	CATCH OTH.	CATCH TOTAL	VALUE TOTAL
29/12/93-27/01	4002	4.71	2.89	2.21	0.83	0.73	67.81	79.18	4575.0
28/01-26/02	2231	3.18	0.81	0.10	0.68	0.43	11.75	16.95	2553.1
27/02-27/03	3211	1.32	8.17	6.48	0.19	0.28	24.92	41.36	5162.0
28/03-25/04	4481	6.00	2.28	14.61	0.45	0.26	20.64	44.24	4752.3
26/04-25/05	5732	16.50	7.92	25.20	1.22	3.13	33.66	87.63	9760.7
26/05-23/06	5121	4.74	10.40	19.84	2.67	5.53	40.44	83.62	11272.9
24/06-22/07	4614	1.17	3.39	30.54	0.17	0.56	25.26	61.09	6317.8
23/07-21/08	5771	1.52	3.70	55.01	0.55	1.22	29.38	91.38	10074.5
22/08-19/09	3988	0.95	4.47	15.51	0.37	0.44	25.17	46.91	5397.5
20/09-19/10	2760	4.39	4.74	3.93	0.94	0.70	18.89	33.59	4726.3
20/10-18/11	5835	29.97	9.35	63.26	0.98	1.26	53.61	158.43	16978.3
19/11-18/12	2031	13.37	2.23	7.71	12.35	0.56	14.23	50.45	6217.3
TOTAL 94	**49777**	**87.82**	**60.35**	**244.40**	**21.40**	**15.10**	**365.76**	**794.83**	**87787.7**

PERIOD	KG/TR. CATF	KG/TR. CICHL	KG/TR. CLUP	KG/TR. L.MAR.	KG/TR. L.ANG.	KG/TR. OTH.	KG/TR. TOTAL	F/KG TOTAL
29/12/93-27/01	1.2	0.7	0.6	0.2	0.2	16.9	19.8	58
28/01-26/02	1.4	0.4	0.0	0.3	0.2	5.3	7.6	151
27/02-27/03	0.4	2.5	2.0	0.1	0.1	7.8	12.9	125
28/03-25/04	1.3	0.5	3.3	0.1	0.1	4.6	9.9	107
26/04-25/05	2.9	1.4	4.4	0.2	0.5	5.9	15.3	111
26/05-23/06	0.9	2.0	3.9	0.5	1.1	7.9	16.3	135
24/06-22/07	0.3	0.7	6.6	0.0	0.1	5.5	13.2	103
23/07-21/08	0.3	0.6	9.5	0.1	0.2	5.1	15.8	110
22/08-19/09	0.2	1.1	3.9	0.1	0.1	6.3	11.8	115
20/09-19/10	1.6	1.7	1.4	0.3	0.3	6.8	12.2	141
20/10-18/11	5.1	1.6	10.8	0.2	0.2	9.2	27.2	107
19/11-18/12	6.6	1.1	3.8	6.1	0.3	7.0	24.8	123
TOTAL 94	**1.8**	**1.2**	**4.9**	**0.4**	**0.3**	**7.3**	**16.0**	**110**

Abbrev:
- CATCH and value (VAL.) expressed in tonnes and '000 burundi francs (F), respectively (upper table only)
- CATF, CICHL, CLUP, L.MAR., L.ANG., OTH. = Catfish, Cichlids, Clupeids, Lates mariae, Lates angustifrons and Other species
- TR. = fishing trip (CPUE = average catch per fishing trip)

Table 5: Historical annual catch/effort data, per type of fishery, Lake Tanganyika, Burundi (1950-1994)

	TOTAL	INDUSTRIAL FISHERY								ARTISANAL FISHERY								TRADITIONAL FISHERY					
YEAR	TC	TIC	TRIPS	UNITS	L. ST.	CLUP.	LAT. SP.	OTHERS	%ICTC	ARTC	TRIPS	UNITS	L. ST.	CLUP.	LAT. SP.	OTHERS	%ARTC	TRC	TRIPS	UNITS	CLUP.	OTHERS	%TRTC
1950	1010																	1010			1010		100.0
1951	1500																	1500			1500		100.0
1952	3000																	3000		1360	2500	500	100.0
1953	3220																	3220			3000	220	100.0
1954	4917	317		2			317	0	6.4									4600		1512	4000	600	93.6
1955	5182	482		2			482	0	9.3									4700		1678	4200	500	90.7
1956	4892	1817		4	288	1267	272	0	37.1									3075		1360	2675	400	62.9
1957	8477	2912		8	635	1648	729	0	34.4			12						5565		1462	5065	500	65.6
1958	10333	3657		12	287	1038	2332	0	35.4			22						6676		1500	6167	500	64.6
1959	10083	3346		12	240	1617	1489	0	33.2	620		32		600		20	6.1	6117		1475	5617	500	60.7
1960	8120	2881		12	559	1464	868	0	35.5	327		32		304		23	4.0	4912		1488	4412	500	60.5
1961	5240	1963		8	259	1326	378	0	37.5	410		59		397		13	7.8	2867		1458	2617	250	54.7
1962	7151	2195		8	794	1114	287	0	30.7	1021		56		939		82	14.3	3935		1458	3636	300	55.0
1963	10624	2396		9	1201	936	259	0	22.6	896		82		821		75	8.4	7332		1343	7082	250	69.0
1964	10433	2598		8	394	1974	230	0	24.9	1479		127		1415		64	14.2	6356		1343	6310	46	60.9
1965	20207	2686		8	215	2376	95	0	13.3	2134		180		2041		93	10.6	15387		1660	15387	0	76.1
1966	17803	5045		9	409	4426	210	0	28.3	2657		198		2549		108	14.9	10101		1624	9983	118	56.7
1967	13521	4941		8	945	3677	319	0	36.5	1947		221		1907		40	14.4	6633		1624	6578	55	49.1
1968	12288	5046		10	1213	3437	396	0	41.1	1493		221		1422		71	12.2	5749		1624	5556	193	46.8
1969	15558	4138		11	1340	2367	431	0	26.6	5123		506		4889		234	32.9	6297		1459	6230	67	40.5
1970	13291	5467		13	1227	3686	544	0	41.1	3760		516		3473		287	28.3	4074		1459	4064	10	30.7
1971	16896	6054		15	180	5511	363	0	35.8	4876		516		4693		183	28.9	5966		1459	5963	3	35.3
1972	7443	4327		13	316	3763	248	0	58.1	1270		418		1238		32	17.1	1846		1200	1258	588	24.8
1973	8525	5621		14	707	4655	259	0	65.9	1336		65		1312		24	15.7	1568		386	1145	423	18.4
1974	15062	6211		15	967	5087	157	0	41.2	6776		134	45	6716	12	3	45.0	2075		527	1917	158	13.8
1975	17806	6144		18	1788	4037	319	0	34.5	7834		259	287	7123	22	402	44.0	3828		729	3567	261	21.5
1976	23871	8715	6628	22	3364	4877	472	12	36.5	11462		451	1812	9496	126	28	48.0	3694		707	2617	1077	15.5
1977	30530	6646	6044	19	3307	2886	431	22	21.8	18312		674	4399	13572	164	177	60.0	6572		866	5466	116	18.3
1978	25353	4042	4408	17	2480	1447	91	24	15.9	14607		751	3135	11276	42	154	57.6	6704		1000	6525	179	26.4
1979	16468	4670	5400	20	2054	2534	79	3	28.4	9434		442	1040	8302	20	72	57.3	2364		706	2037	327	14.4
1980	28531	6409	6060	22	2243	4101	64	1	22.5	21025		500	1061	19950	7	7	73.7	1097		372	822	275	3.8
1981	16895	5796	6515	22	1883	3862	58	3	34.3	10099		600	1060	9038	6	5	59.8	*1000*		*286*	*387*	*613*	*5.9*
1982	18799	5894	5313	21	2038	3773	78	5	31.4	11905		656	896	11008	1	0	63.3	*1000*		*268*	*360*	*640*	*5.3*
1983	19986	5946	5071	19	3597	2222	119	8	29.8	13040		670	4313	8717	10	0	65.2	*1000*		*266*	*360*	*660*	*5.0*
1984	21119	6625	5638	20	2295	4173	53	4	30.9	13594		602	2157	11431	6	0	64.4	*1000*		*269*	*340*	*660*	*4.7*
1985	16753	4629	4566	17	1018	3581	30	2	27.6	11124		613	1686	9392	29	18	66.4	*1000*		*269*	*320*	*680*	*6.0*
1986	19776	4248	5025	17	1670	2492	80	6	21.5	14528		660	1875	12632	16	5	73.5	*1000*		*337*	*310*	*690*	*5.1*
1987	15829	3440	4037	16	1369	1900	168	3	21.7	11389		556	2993	8268	16	111	72.0	*1000*		*341*	*300*	*700*	*6.3*
1988	17017	3016	3939	16	1146	1831	32	7	17.7	13001		582	2494	10484	23	0	76.4	*1000*		*380*	*290*	*710*	*5.9*
1989	21190	3332	4602	18	752	2560	19	1	15.7	16858		623	2827	14030	1	0	79.6	*1000*		*376*	*280*	*720*	*4.7*
1990	21529	2748	4365	18	587	2127	33	1	12.8	18114		671	1920	16179	8	7	84.1	667		425	116	551	3.1
1991	23498	2548	4265	15	464	2057	25	2	10.8	19882		645	1935	17935	11	1	84.6	1068		408	302	788	4.5
1992	24560	1090	3677	13	298	780	13	0.3	4.4	22808	149183	871	6756	16043	9.2	0.4	92.9	682	40683	298	139	523	2.7
1993	15585	462	3088	12	227	226	8	0.6	3.0	14808	107223	*605*	4693	10114	1.1	0.2	95.1	295	20209	*364*	86	209	1.9
1994	21825	326	1964	9	138	180	68	0.2	1.5	20705	125968	539	6308	14364	13.9	19.2	94.9	795	49777	410	244	551	3.6

Abbreviations:
- **TC, TIC, ARTC, TRC**: respectively total catch, total industrial catch, total artisanal catch and total traditional catch (tonnes)
- **L.ST., CLUP., LAT.SP, OTHER**: respectively Lates stappersii, Clupeids, 3 other Lates spp., all other species
- **%**: percentage catch contribution of one type of fishery towards total catch
- ***numbers in italics: rough estimates or uncertain values***

Table 6: Historical annual catch/effort data, per area and type of fishery, Lake Tanganyika, Zaire (1950-1994)

	ZAIRE	KAL	KALEMIE INDUSTRIAL					KALEMIE	UVIRA	UVIRA INDUSTRIAL					UVIRA	UVIRA	MOBA	MOBA INDUSTRIAL					MOBA	FIZI	FIZI	FIZI
YEAR	TC	TC	TIC	UN	LST	CLUP	LAT	ART/TR	TC	TIC	UN	LST	CLUP	LAT	ART	TR	TC	TIC	UN	LST	CLUP	LAT	ART/TR	TC	ART	TR
1950	2090																									
1951	2174																									
1952	*2246*																									
1953	2439																									
1954	4614																									
1955	6570										2															
1956	8469			1							6															
1957	*29500*		300	1							10															
1958	*23400*										12															
1959																										
1960	*35000*																									
1961																										
1962																										
1963																										
1964																										
1965																										
1966																										
1967																										
1968																										
1969																										
1970	7727								946															565		
1971	9406								1084															1679		
1972	14758								1477	639														741		
1973	*22000*								6700	2437														632		
1974	*14000*		750	6					3092	1409	8													1222		
1975	*17000*			8																						
1976	*20000*																									
1977																										
1978								2092	4235	1962	9				1280	989								1390	1099	291
1979								2292	2962	1328					1386	249								4529		
1980	*15000*							3219	4783	2592					2144	77								5831		
1981	*13000*							6519	4197	1849	8				2094	209								3722		
1982	*17300*		1517	16	1131	386		7550	2269	1208	8				914	147								7858		
1983	*17500*							8899	1817	930	8				728	159								3451		
1984	*15000*	5538	2319	14	851	1468		14989	1920	1024	6	244	780		809	87		98						2161		
1985	*16000*	8091	1573	16	944	586	42	*23048*	1655	496	4				1087	72	3201	40	2				3161	*15326*	3766	11560
1986	17120	9378	1828		1205	562	60	13549	1846	155	2				1633	58	3810	158	2	153	1.7	3.2	3652	2086		
1987	14978	10042	1143		669	445	28	26565	481						400	81	3395	*44*	2	41	*0.2*	3.2	3348	1060		
1988	27550	16563	1574		1111	412	51	42043	950						810	140	7960	*109*	2	108		0.1	7801	*2077*		
1989	38798	30873	7825	15				23048	1543						1301	242	3831	49	2	49			3795	*2551*		
1990	18695	14002	1453		670	702	81	13549	1048	56	1				854	138	1683	87	2	86	*0.2*	0.5	1596	1962	1417	545
1991	33105	26565	1067		481	577	10		1076		1				1076		3069	124	1	124	*0.1*		1571	*2395*		
1992	*50000*	3812	829	17	503	666	2		805						805		1698	103	1	22						
1993			763	16	717	39	7			0	0	0	0	0					5							
1994			402	7	393	4	5			0	0	0	0	0				4	1	4	0	0				

Abbreviations:
- **TC, TIC, ART, TR:** respectively total catch, total industrial catch, total artisanal catch and total traditional catch (tonnes)
- **UN:** number of units
- **LST, CLUP, LAT:** respectively Lates stappersii, Clupeids and the 3 other Lates spp.
- ***numbers in italics: rough estimates or uncertain values***

Table 7: Annual catch/effort data, per area and per type of fishery, Lake Tanganyika, Zambia (1953-1994)

YEAR	ZAMBIA TOTAL			INDUSTRIAL FISHERY NSUMBU														
	TC	TIC	ART/TR	TRIPS	HAULS	LIGHTS	C/TRIP	LST	STA	LMI	CLUP	LMIC	LM/A	LAT	IC	%LST	%CLUP	%LAT
1953	1200		1200															
1954	2200		2200															
1955	1560		1560															
1956	1592		1592															
1957	4446		4446															
1958	3077		3077															
1959	2971		2971															
1960	2943		2943															
1961	2000		2000															
1962	2093	677	1416															
1963	7678	778	6900															
1964	9439	1207	8232															
1965	5690	1483	4207															
1966	5772	1319	4453															
1967	9317	1497	7820															
1968	8598	1622	6976															
1969	8621	1242	7379															
1970	10835	1047	9788															
1971	6988	1472	5516															
1972	6281	2391	3890															
1973	5532	1993	3539															
1974	4522	2071	2451															
1975	7585	2406	5179															
1976	6558	1714	4844															
1977	7895	1688	6207															
1978	6449	1071	5378															
1979	4221	1102	3119															
1980	8255	1508	6747															
1981	3875	1892	1983															
1982	8009	2289	5720															
1983	9144	3642	5502	446	1085	1821	1.392	6			545	38	32	70	621	1	88	11
1984	13871	6559	7312	1194	1870	3431	1.751	48	1632	303	1935	46	62	108	2091	2	93	5
1985	16693	7764	8929	1181	3338	4382	1.520	*10*			1688	47	50	97	1795	1	94	5
1986	14024	6530	7494	1191	4221	4842	0.877	28	445	518	963	30	24	54	1045	3	92	5
1987	13138	5097	8041	1116	3018	3985	0.703	103	133	519	652	19	11	30	785	13	83	4
1988	12055	6461	5594	805	2249	2279	1.771	50	647	705	1352	15	9	24	1426	4	95	2
1989	14816	5293	9523	210	402	438	2.043	*0*	*215*	*212*	*427*	*1*	*1*	*2*	*429*	*0*	*100*	*0*
1990	15419	5449	9970	83	108	111	2.361	*0*			*196*	*0*	*0*	*0*	*196*	*0*	*100*	*0*
1991	14113	6041	8072	242	596	763	0.740	*0*			*176*	*1*	*2*	*3*	*179*	*0*	*98*	*2*
1992	13829	5253	8576					722			40	6	6	12	770	94	5	2
1993																		
1994																		

Abbreviations:

- **TC, TIC, ART, TR:** respectively total catch, total industrial catch, total artisanal catch and total traditional catch (tonnes)
- **C/TRIP:** average catch (tonnes) per fishing trip
- **LST, CLUP, LAT, OTH:** respectively Lates stappersii, Clupeids, the 3 other Lates spp. and all other species
- **STA, LMI, LMIC, LM/A:** respectively Stolothrissa tanganicae, Limnothrissa miodon, Lates microlepis and Lates mariae/angustifrons
- ***numbers in italics: rough estimates or uncertain values***

Table 7 (cont.)

YEAR	INDUSTRIAL FISHERY MPULUNGU																		
	UNITS	TRIPS	HAULS	LIGHTS	C/TRIP	LST	STA	LMI	CLUP	LMIC	LM/A	LAT	OTH	IC	%ICTC	%LST	%CLUP	%LAT	%OTH
1953																			
1954																			
1955																			
1956																			
1957																			
1958																			
1959																			
1960																			
1961																			
1962	1	257							387			290		677	32		57	43	
1963	1	220	599		3536	101	236	120	356	192	129	321		778	10	13	46	41	
1964	1	414			2915	60			753	187	207	394		1207	13	5	62	33	
1965	2	571			2597	56	528	621	1149	129	150	278		1483	26	4	77	19	
1966	2	557			2368	26	482	659	1141	93	59	152		1319	23	2	87	12	
1967	2	538			2783	17	903	478	1381	69	30	99		1497	16	1	92	7	
1968	2	575			2821	46			1409	103	65	167		1622	19	3	87	10	
1969	6	668	2169		1859	56	591	459	1050	87	49	136		1242	14	5	85	11	0
1970	5	669	1632		1565	56	549	293	842	97	52	149		1047	10	5	80	14	0
1971	4	518	1446		2842	45	892	345	1237	114	76	190		1472	21	3	84	13	0
1972	4	868	2316		2755	55	1641	433	2074	165	97	262		2391	38	2	87	11	0
1973	4	961	2797	4400	2074	91			1723	139	40	179		1993	36	5	86	9	0
1974	5	974			2126	271			1616	109	75	184		2071	46	13	78	9	0
1975	5	976			2465	188			1945	206	67	273		2406	32	8	81	11	0
1976	4	705	*2018*		2431	463			1055	146	50	196		1714	26	27	62	11	0
1977	3	662	1571	*2517*	2550	964			538	99	57	156	30	1688	21	57	32	9	2
1978	2	353	840	1913	3034	268			597	*56*	49		206	*1071*	17	25	56		19
1979	2	453	1258	2354	2433	*323*			667	*36*	47		112	*1102*	26	29	61		10
1980	2	581	1472	2858	2596	879			504	58	53	111	14	1508	18	58	33	7	1
1981	3	878	2508	4895	2155	880	317	475	792	55	86	141	79	1892	49	47	42	7	4
1982	3	971	2342	5178	2357	535	980	558	1538	70	68	138	78	2289	29	23	67	6	3
1983	5	1257	3116	6120	2403	1736	441	623	1064	88	98	186	35	3021	33	57	35	6	1
1984	9	1836	4457	8283	2434	1257	2001	818	2819	82	189	272	120	4468	32	28	63	6	3
1985	12	2495	5413	12436	2392	2202	2222	1287	3509	137	73	210	48	5969	36	37	59	4	1
1986	15	3021	7441	14547	1816	4297	486	551	1037	60	61	121	30	5485	39	78	19	2	1
1987	16	3182	8236	15766	1355	4053	13	150	163	38	45	83	13	4312	33	94	4	2	0
1988	18	3525	9054	17625	1428	4390	268	286	554	23	38	61	30	5035	42	87	11	1	1
1989	19	3366	7848	15457	1573	3260	1308	602	1910	29	66	95	29	5294	36	62	36	2	1
1990	16	3650	9028	18084	1398	3346	1147	506	1653	31	51	82	21	5102	33	66	32	2	0
1991	16	3360	8341	14533	1359	4151	78	205	283	14	57	71	60	4565	32	91	6	2	1
1992	20	3969	10318	14740	1130	4059	*	*	318	28	44	72	34	4483	32	91	7	2	1
1993	19	3997	10803	14660	983	3609	*	*	253	10	21	31	36	3929		92	6	1	1
1994	20	3747	8993	11446	880	3176	*	*	67	8	29	37	17	3297		96	2	1	1

Abbreviations:

- TC, TIC, ART, TR: respectively total catch, total industrial catch, total artisanal catch and total traditional catch (tonnes)
- C/TRIP: average catch (tonnes) per fishing trip
- LST, CLUP, LAT, OTH: respectively Lates stappersii, Clupeids, the 3 other Lates spp. and all other species
- STA, LMI, LMIC, LM/A: respectively Stolothrissa tanganicae, Limnothrissa miodon, Lates microlepis and Lates mariae/angustifrons
- *numbers in italics: rough estimates or uncertain values*

Table 8: Historical annual catch/effort data, per type of fishery, Lake Tanganyika, Tanzania (1964-1994)

YEAR	IUN	IC	ART/TR	TC	%ICTC	LST	CLUP	LAT	LAT+LST	OTH
1964				16200						
1965				15700						
1966				15000						
1967				22497		15	17163	2798		2521
1968				30387		247	15272	7659		7209
1969				14184						
1970				46452						
1971				50568			45289		1935	3344
1972	2			49017			38006		3414	7597
1973	3	589	55333	55922	1.1		23106		9438	23378
1974	5	3131	73488	76619	4.1		51536		9209	15874
1975	3	530	63815	64345	0.8					
1976	3	220	73336	73556	0.3					
1977	5	550	61338	61888	0.9		50136		3815	7937
1978	4	635	35821	36456	1.7		30593		2007	3856
1979	4	460	43714	44174	1.0	12.5	22590	7922.6		13648.9
1980	4	470	37576	38046	1.2					
1981	4	240	43976	44216	0.5					
1982	3	220	43980	44200	0.5					
1983	4	195	99160	99355	0.2					
1984	3	117	106995	107112	0.1	8456	72299	5188		21169
1985	6	243	114720	114963	0.2	16861	82522	5772		9808
1986	7	320	69707	70027	0.5	15694	45126	1768		7439
1987	6	183	93728	93911	0.2	22517	61735	2146		7513
1988	6	74	62736	62810	0.1					
1989		20	59474	59494	0.0					
1990	1			64866						
1991	3			63503		11958	36518	2463		12564
1992	1			80525		14170	54021	5632		6702
1993										
1994										

Abbreviations:

- IUN: number of industrial units
- IC, ART/TR, TC: respectively industrial, artisanal plus traditional, and overall total catch (tonnes)
- %ICTC percentage catch contribution of industrial fishery towards total catch
- LST, CLUP, LAT, OTH: respectively Lates stapperssii, Clupeids, the 3 other Lates species and all other species

Table 9: Summary results of frame survey L. Tanganyika, Burundi (2-3.95)

Stratum/Province/Total	STR. I	STR. II	STR. III	BUJUMBURA	BURURI	MAKAMBA	TOTAL
Total active & broken units	562	401	443	705	327	374	1406
Total active units	399	338	324	524	270	267	1061
Total broken units	163	63	119	181	57	107	345
Total active catamarans	120	199	119	210	125	103	438
Total active apollos	2	43	56	5	43	53	101
Total active pirogues	198	66	91	223	63	69	355
Total active dugouts	2	12	20	4	17	13	34
Total act. transport boats	6	7	8	8	5	8	21

Table 10: Summary of catch statistics industrial units, Kalemie, Zaire (10.92-12.94)

Fishing cycles	Fishing nights	Active units	Fishing trips	*Luciol. stappers.*	*Stolot. tangan.*	*Lates spp.*	*Limnot. miodon*	TOTAL CATCH	CPUE
10-11.92	17	13	129	49093	6270	315	528	**56206**	435.7
11-12.92	19	15	196	216348	20834	3171	2068	**242421**	1236.8
12.92	16	14	128	79040	8160	552	0	**87752**	685.6
01-02.93	22	9	71	36300	11176	828	220	**48524**	683.4
02-03.93	21	10	142	115082	924	2448	0	**118454**	834.2
03.93	14	11	114	91718	396	921	4884	**97919**	858.9
04-05.93	15	8	48	34980	1254	366	594	**37194**	774.9
05.93	15	9	58	64570	1958	291	0	**66819**	1152.1
06.93	8	5	23	18810	0	0	396	**19206**	835.0
07.93	15	9	76	53097	4004	603	1496	**59200**	778.9
08.93	17	10	120	115082	4752	537	594	**120965**	1008.0
09.93	14	11	103	50864	2112	237	1188	**54401**	528.2
10.93	15	8	66	53108	1936	339	550	**55933**	847.5
11.93	11	6	30	63954	330	135	374	**64793**	2159.8
12.93	11	5	21	19756	0	120	0	**19876**	946.5
01.94	14	5	35	24068	770	390	88	**25316**	723.3
02.94 (*)	17	5	35	12408	176	857	484	**13924.67**	397.8
03.94	17	7	62	65934	44	57	924	**66959**	1080.0
04.94	16	7	34	31350	726	0	0	**32076**	943.4
05.94	15	5	32	28136	0	0	308	**28444**	888.9
05-06.94	13	6	41	47234	0	984	88	**48306**	1178.2
06-07.94	13	6	35	31812	0	456	0	**32268**	921.9
07-08.94	16	4	42	31614	0	954	0	**32568**	775.4
08-09.94	16	5	52	41492	0	1158	0	**42650**	820.2
09-10.94	8	5	24	8426	198	0	0	**8624**	359.3
10-11.94	17	4	46	29832	0	0	0	**29832**	648.5
11-12.94	18	4	46	40216	0	618	0	**40834**	887.7
27 Cycles	**410**	**206**	**1809**	**1464324**	**66020**	**16336.67**	**14784**	**1551465**	**kg**
				93.7	**4.3**	**1.1**	**1.0**	**100.0**	**%**
Average number of industrial fishing trips per cycle:								**67.0**	trips
Average catch per industrial fishing unit per night (CPUE):								**857.6**	kg
Average total catch per cycle:								**57461.7**	kg
Average number of active units per cycle:								**7.6**	units
Average number of active fishing nights per cycle:								**15.2**	nights
1993 12 Cycl.	**178**	**101**	**872**	**717321**	**28842**	**6825**	**10296**	**763284**	**kg**
				94.0	**3.8**	**0.9**	**1.3**	**100.0**	**%**
Average number of industrial fishing trips per cycle:								**72.7**	trips
Average catch per industrial fishing unit per night (CPUE):								**875.3**	kg
Average total catch per cycle:								**63607.0**	kg
Average number of active units per cycle:								**8.4**	units
Average number of active fishing nights per cycle:								**14.8**	nights
1994 12 Cycl.	**180**	**63**	**484**	**392522**	**1914**	**5473.667**	**1892**	**401801.7**	**kg**
				97.7	**0.5**	**1.4**	**0.5**	**100.0**	**%**
Average number of industrial fishing trips per cycle:								**40.3**	trips
Average catch per industrial fishing unit per night (CPUE):								**830.2**	kg
Average total catch per cycle:								**33483.5**	kg
Average number of active units per cycle:								**5.3**	units
Average number of active fishing nights per cycle:								**15.0**	nights

(Source: DD, Kalemie, Zaire)

(*) DD data for 2.94 not being available, ECN data, corrected for different average fish box and Lates spp. weights, are presented.

Table 11: Summary of catch statistics industrial units, Kalemie, Zaire (7.93-1.95)

Fishing cycles	Fishing nights	Active units	Fishing trips	*Luciol. stappers.*	*Stolot. tangan.*	*Lates spp.*	*Limnot. miodon*	TOTAL CATCH	CPUE
07.93	16	9	63	24880	2060	3745	1680	32365	513.7
08.93	19	11	131	54940	0	670	1400	57010	435.2
09.93	6	10	82	20280	0	560	380	21220	258.8
10.93	17	9	63	18940	100	610	400	20050	318.3
11.93	13	3	24	16900	0	630	180	17710	737.9
12.93	16	3	23	20540	0	295	0	20835	905.9
01.94	16	4	33	11920	45	550	180	12695	384.7
02.94	17	5	35	11280	160	1285	440	13165	376.1
03.94	18	7	58	29200	1200	1375	0	31775	547.8
04.94	15	7	41	15140	260	2695	660	18755	457.4
05.94	16	7	40	18620	300	1770	540	21230	530.8
06.94	14	5	46	19180	20	2640	540	22380	486.5
06-07.94	17	5	49	16000	0	670	20	16690	340.6
07-08.94	16	4	40	12040	120	1030	220	13410	335.3
08-09.94	18	5	54	19540	0	1200	60	20800	385.2
09-10.94	12	5	25	4860	80	120	0	5060	202.4
10-11.94	21	4	53	13900	240	700	20	14860	280.4
11-12.94	21	4	58	21580	0	980	60	22620	390.0
12-01.95	12	3	22	5740	40	1317	60	7157	325.3
19 Cycles	**300**	**110**	**940**	**355480**	**4625**	**22842**	**6840**	**389787**	**kg**
				91.2	**1.2**	**5.9**	**1.8**	**100**	**%**
Average number of industrial fishing trips per cycle:								**49.5**	trips
Average catch per industrial fishing unit per night (CPUE):								**414.7**	kg
Average total catch per cycle:								**20515.1**	kg
Average number of active units per cycle:								**5.8**	units
Average number of active fishing nights per cycle:								**15.8**	nights
1993	**87**	**45**	**386**	**156480**	**2160**	**6510**	**4040**	**169190**	**kg**
6 Cycl.				**92.5**	**1.3**	**3.8**	**2.4**	**100**	**%**
Average number of industrial fishing trips per cycle:								**64.3**	trips
Average catch per industrial fishing unit per night (CPUE):								**438.3**	kg
Average total catch per cycle:								**28198.3**	kg
Average number of active units per cycle:								**7.5**	units
Average number of active fishing nights per cycle:								**14.5**	nights
1994	**201**	**62**	**532**	**193260**	**2425**	**15015**	**2740**	**213440**	**kg**
12 Cycl.				**90.5**	**1.1**	**7.0**	**1.3**	**100**	**%**
Average number of industrial fishing trips per cycle:								**44.3**	trips
Average catch per industrial fishing unit per night (CPUE):								**401.2**	kg
Average total catch per cycle:								**17786.7**	kg
Average number of active units per cycle:								**5.2**	units
Average number of active fishing nights per cycle:								**16.8**	nights

(Source: ECN, Kalemie, Zaire)

Table 12: Summary of catch statistics industrial units, Moba, Zaire (1994)

Fishing cycles	Fishing nights	Active units	Fishing trips	*Luciol. stappers.*	*Stolot. tangan.*	*Lates spp.*	*Limnot. miodon*	TOTAL CATCH	CPUE
7.94	3	1	3	1780	0	0	0	1780	593.3
8.94	5	1	5	1760	0	0	0	1760	352.0
2 Cycles	**8**	**2**	**8**	**3540**	**0**	**0**	**0**	**3540**	**kg**
				100.0	**0.0**	**0.0**	**0.0**	**100**	**%**
Average number of industrial fishing trips per cycle:								**4.0**	trips
Average catch per industrial fishing unit per night (CPUE):								**442.5**	kg
Average total catch per cycle:								**1770.0**	kg
Average number of active units per cycle:								**1.0**	units
Average number of active fishing nights per cycle:								**4.0**	nights

(Source: ECN, Kalemie, Zaire)

TAB11TDF.XLS

Table 13: Summary fisheries statistical characteristics of sampled catamaran liftnet units (7.93-6.94)

PARAMETER - LIFTNET UNIT	BUJA-UVIRA	KARONDA	KIGOMA	MPULUNGU (*)
N	218	80	139	2
KG/Fish.Unit	48	142	128	(127.5)
KG/Haul	19.5	63.0	54.7	(127.5)
KG/Light	9.3	18.9	18.7	(63.8)
Hauls/Fish.U.	2.3	2.3	2.2	(1.0)
Lights/F.U.	5.8	7.8	6.6	(2.0)

(*) Only 2 liftnet units were sampled during the whole period, in May 1994; therefore the averages are not significant and are given between brackets.

Table 14: Summary fisheries statistical characteristics for different gears (beach seines, catamaran liftnets (LN) and longlines (LL) used during catamaran fishing) and periods, taken from fish biology sampling data in different LTR stations.

PARAME-TER	BUJUMBURA BEACH S.	MPULUNGU BEACH S.	UVIRA CAT.LN.	KALEMIE CAT.LN.	KARONDA CAT.LL.
PERIOD	7.93-5.94	7.93-6.94	8.93-5.94	9.93-5.94	9.93-5.94
N	16	72	63	28	19
KG/F.U.	57.3	43.3	65.7	78.6	4.9
ST.DEV.	63.3	75.6	62.7	22.0	3.0
MINIM.	5.4	2.1	7.5	50	1.2
MAX.	222.4	500	270	123	13
HAULS	1 to 5	1 to 2	1 to 5	2 to 3	-

Annex 1: Project profile

Project: DEVELOPMENT OF AN OVERALL COMPATIBLE FISHERIES STATISTICAL SOFTWARE PACKAGE FOR THE ENTRY, ANALYSIS AND PRODUCTION OF STANDARDIZED RESULT OUTPUTS OF FRAME AND CATCH ASSESSMENT DATA

Sector: (INLAND) FISHERIES

Executing Agency: FAO

Project location: FAO, Rome

Proposed starting date: as soon as possible

Proposed duration: 4 months

Estimated donor contribution: 40,000 US $ (TCP or other funding)

1. BACKGROUND AND JUSTIFICATION

In recent years, fisheries statistical data entry and analysis systems for Frame and Catch Assessment Surveys in Africa become more and more computerized. Through national projects, individual national fisheries statistical systems were revised and adapted for the development of a national computerized software package, most often through FAO executed projects (e.g. UGASTAT (Uganda), TANFISH (Tanzania), dBaseIII programmed software (Burundi), etc.).

However, all these packages are different, based on different fisheries statistical systems, using very often different definitions for describing fisheries statistical parameters, and producing non compatible result outputs.

The non compatibility of these systems is hampering a lot the efforts of standardizing or harmonizing statistical systems and result outputs at regional level, especially when dealing with shared waterbodies (lakes, rivers) *e.g.* Lake Tanganyika shared by 4 countries with different fisheries statistical systems. Moreover, a lot of effort and money has been spent to develop all these different softwares. With only a fraction of this effort and money, an overall, multi–functional, standardized software could have been elaborated.

It is therefore urgent and indispensable that one user friendly, easy, versatile (with several options to adapt to different national fisheries statistical systems) and compatible software package be developed to enable entry, data analysis and production of standardized results outputs for Frame and Catch Assessment Surveys of various fisheries (traditional, artisanal, industrial) in Africa. The well documented case of Lake Tanganyika (cf. LTR project), shared by four countries, could be used as the backbone for the development of such a software package.

2. OBJECTIVE

The objective of this short-term project would be to avail to different countries a user friendly, easy, versatile and compatible software package to enable entry, data analysis and production of standardized results outputs for Frame and Catch Assessment Surveys of their national fisheries. The implementation and accompanying local staff training for such a package in the different countries can be done through national fisheries development projects.

3. WORKPLAN

A. Preparatory phase (1 month)

Comparison of different fisheries statistical systems and software packages in use and elaboration of the basic needs (data entry, analysis, standardized result outputs) for the development of a universal package that can be used for any fisheries statistical system in use.

B. Development of fisheries statistical software package (3 months)

B.1. Determine best database software and programming language for the development of such a package.

B.2. Develop the package based on the conclusions of A.

B.3. Test the package using real data.

4. REQUIRED BUDGET

	Est. Costs (US $)
- Consultant (fisheries statistician) with ample experience with fisheries statistical systems in Africa (1 month)	10,000
— Consultant (computer programmer) with ample experience in developing fisheries statistical software (3 months)	30,000
TOTAL:	**40,000**