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CATCH PER UNIT OF EFFORT (CPUE) STUDY FOR DIFFERENT AREAS AND FISHING GEARS OF LAKE TANGANYIKA

by

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PREFACE

The Research for the Management of the Fisheries on Lake Tanganyika project (LTR) 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 Program for the United Nations Development Organization (AGFUND).

LTR's objective is 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, Zaire and Zambia).

Particular attention is 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 the Governments concerned.

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1. Introduction

Basic landing statistics constitute one type of fishery-dependent information to evaluate the status of exploited fishery resources. Effort and catch data can be combined into indices of stock abundance, based on the Catch per Unit of Effort (CPUE). CPUE (or C/f), also called fishing success, is defined as "the catch of fish, in numbers or weight, taken by a defined unit of fishing effort". And the fishing effort is defined as "the total fishing gear in use for a specified period of time" (Ricker, 1975). Some authors also include the human effort (number of fishermen) into the total fishing effort.

When different kinds of fishing are conducted on the same stock, the effort and catch taken by each is tabulated separately. When one gear is predominant over the others in a fishery, the effort of all other gears may be scaled to terms of the dominant gear by dividing their gross catch by the catch/effort of the dominant gear. When a single homogeneous population is being fished, and when effort is proportional to the instantaneous rate of fishing mortality (F), it is well established that CPUE is proportional to the mean stock present during the time fishing takes place. However, for many kinds of fishing, the stock in different subareas is not homogeneous (not equally vulnerable to fishing) and will tend to vary approximately as stock density or fish present per unit area. An overall CPUE proportional to stock size can then be obtained by adding the CPUE values for individual subareas, weighting each as the size of its subarea (Ricker, 1975). Moreover, active gears and light attraction tend to concentrate (certain) fish to make them more vulnerable to be caught by the fishing gear in question. Comparison of CPUEs for different areas, even for an identical fishing gear, must therefore be handled with caution.

The CPUE of passive sampling gears (e.g. gill nets) should theoretically be directly proportional to the stock abundance, but many other variables also influence fishing efficiency (e.g. physical and chemical variables like season, water temperature, dissolved oxygen, turbidity, currents, habitat type, etc.). The most important ones are water T° and turbidity: generally, as water T° declines or turbidity increases, the CPUE declines. As fishing efficiency with passive gears is a function of fish movement, changes in fish behaviour result in a great degree of variability in CPUE among species and even among intra-species year classes (Hubert, 1983).

Absolute comparison of CPUEs for different areas might thus lead to wrong conclusions about relative stock abundance, as fish stocks for different areas are not homogenous. Moreover, in Lake Tanganyika, the two real pelagic fish species demonstrate migratory behaviour (schooling species) and live in an apparent prey-predator relationship. The clupeid fishery is also very dependent on the incoming age group (new recruits) each year, which are not yet caught with the pelagic gears in use. Relative abundance of the species in question is also variable and subject to quick changes.

Given the above limitations of CPUE analysis (fishery-dependent information), the need for fishery-independent information through vessel sampling programs is obvious. LTR is therefore executing absolute fish population estimates through direct stock assessment (instantaneous or snapshot picture of the stock compared to periodical averages in CPUE analysis) of the fish stocks of Lake Tanganyika. This is done through regular (during different seasons) hydroacoustic cruises with the R/V Tanganyika Explorer. The most recent one was executed in November 1997 and the last one is scheduled in February 1998. Hydroacoustics has a number of advantages over other assessment techniques, as well as several limitations (Thorne, 1983). Advantages include independence from fishery catch statistics (allows application to unexploited or poorly exploited stocks, no long lag times), favourable time scale (can be applied prior to harvest), relatively low operational costs, low variance and potential for absolute population estimation. Disadvantages include poor species discrimination, little or no sampling capability near bottom and surface, relatively high complexity, high initial investment, potential bias associated with target strength and calibration (use of a split beam sonar can solve this problem) and lack of biological samples (unless complementary sampling is done). During acoustic cruises with the R/V Tanganyika Explorer simultaneous biological sampling is indeed carried out. Different authors however recently suggested that trawl sampling may not accurately reflect the distribution and abundance of many species (Fox & Starr, 1996).

In the next chapters, the reports deals with:

- frame surveys (FS), especially the simultaneous lake-wide FS of 1995, mainly encompassing a determination of the fishing effort or the number, distribution and types of fishing vessels and fishing methods per (stratified) Lake area,
- catch assessment surveys (CAS) or estimates of catch per area and per time interval for the different types of fishing,
- catch per unit of effort (CPUE) analyses, based on calculations of the available effort and catch estimates (originating from FS, CAS and fish biology sampling) per fishing type, fishing area and time interval,
- an overview of world-wide behaviour patterns of clupeids and other factors (e.g. environmental conditions) influencing their distribution, recruitment, stock density, etc. and thus also CPUE,
- overall conclusions including a summary of FS, CAS and CPUE results, a call for caution when using CPUE as a measure of fish abundance and a section on the importance of environmental conditions on CPUE. Finally, some specific recommendations are made concerning future monitoring of catch/effort fishery statistics on Lake Tanganyika.

Fisheries statistical results that were already described in detail in earlier LTR reports are only mentioned where necessary. This report mainly deals with statistical data collected as from 1995.

2. Frame Surveys (FS)

2.1. Frame Survey history

In March 1995, the Fisheries Departments of the 4 riparian countries (Burundi, Tanzania, Zambia and Congo or ex-Zaïre) executed the first simultaneous frame survey (ground approach) of Lake Tanganyika, supported by the LTR Project. For details about this simultaneous picture of the fisheries frame (stratification; type and number of landing sites, vessels, etc.) in the 4 countries, we advise the reader to consult the following LTR reports: Coenen, 1995; Bambara, 1995; Mambona Wa Bazolana, 1996; Paffen *et al.*, 1996; Paffen & Lyimo, 1996; Paffen *et al.*, 1997.

Before the first ever simultaneous FS, these countries executed national frame surveys in an irregular way, depending on available national budgets and/or assisted by ongoing fisheries projects.

LTR executed also two lake wide aerial FS on Lake Tanganyika. The first FS occurred from 29.09-3.10.1992 and its results were described in Hanek *et al.*, 1993a & 1993b; Coenen *et al.*, 1993a & 1993b; Coenen, 1993. Compared to the 1995 FS, the aerial one in 1992 revealed a considerable lower number of boats and landing sites (most probably a number of smaller landing sites and a number of vessels, invisible from the air, were missed). For the reader's information, the 1992 aerial FS counted lake-wide 459 landing sites and a total of 13976 single vessels. The second one was executed on 19-21.05.1993 but due to the inferior quality of the video film no reliable boat counts were arrived at. LTR also assisted in several national FS.

2.2. Simultaneous FS (1995) results

2.2.1. Lake totals

Although there are big differences in the distribution and size of landing sites and in the type of vessels and gears used, it might be good for the reader to have an general idea of the density of the fishing activities along the 1828 km of shoreline of Lake Tanganyika. The March 1995 simultaneous FS results can be summarised as follows (Paffen *et al.*, 1997):

- ◊ a total of 786 landing sites or 1 fish landing site every 2.3 km,
- ◊ a total of 44957 active fishermen,
- ◊ a total of 19356 vessels of different types of which 18243 vessels were physically checked at the landing sites; the other 1113 were out on the Lake,
- ◊ 2263 vessels (11.7%) at the landing sites proved to be broken and were thus not active,
- ◊ the rest was composed of 15980 active fishing vessels (13192 active as fishing vessels, 2256 as lamp carrier/helper boats and 532 as transport boats),
- ◊ a total of 20379 fishing lamps and 1264 motorised vessels,
- ◊ the traditional fishery is the most common fishery, using mainly dugout canoes and wooden/planked boats (79%),

◊ traditional fishing gears: 20744 lines, 6300 gill net, 316 lusenga (scoop) nets, 13 traps and a number of mosquito nets, spears, poisoning methods, etc.,
◊ the artisanal[4] fishery, mainly using catamaran/trimaran units (19%) and some canoes/dugouts and auxiliary vessels, is using 2976 liftnets, 1143 (day) beach seines, 154 (night) kapenta beach seines, 128 apollo liftnets and 16 chiromila seines,
◊ the industrial fishery: out of 52 counted units (1 unit = 1 purse seiner and 4 auxiliary vessels including light boats), 28 units were still operational: 16 in Zambia (Mpulungu: 15; Isanga: 1), 6 in Zaïre (Baraka: 3; Kalemie: 3), 4 in Tanzania (Kigoma: 3; Kirando: 1) and 2 in Burundi (Rumonge: 1; Muguruka: 1).

2.2.2. Regional distribution of fishing effort per fishing type

The results of the 1995 simultaneous FS were used to estimate fishing effort per fishing type and per Lake area. The following 7 fishing types were discerned: industrial, catamaran (rarely trimaran) liftnet, apollo liftnet, kapenta seine, chiromila seine, beach seine and traditional fisheries (the latter including several types of traditional fishing gears, see above). The 13 different Lake fishing areas considered are (from north to south): Uvira (Zaïre); Bujumbura, Bururi and Makamba (Burundi); Fizi (Zaïre); Kigoma (Tanzania); Kalemie (Zaïre); Rukwa (Tanzania); Moba (Zaïre); Nsumbu, West Coast, East Coast and Mpulungu (Zambia).
Figure 1 shows the regional distribution - from the north down to the south end of the Lake - of fishing effort (expressed as number of fishing units) for each fishing type and for each of the 13 fishing areas mentioned above. The estimate of the number of traditional units per area was based on the number of dugout plus planked/wooden canoes per area and includes the counted active plus inactive canoes (the latter to compensate for the active ones out on the Lake for fishing and thus not counted). Negative bars represent areas on the west coast of the Lake while positive bars represent east coast areas of the Lake. It clearly shows that the traditional units make out the bulk of the active units on the Lake followed by catamaran liftnet and beach seine units.
In order to have an idea of "effort density" distribution, Figure 2 depicts the same distribution of effort per fishing type for each area but calculated per km of shoreline for each area. The Uvira area proves to be the area with the most dense number of fishing units (catamaran liftnets the most abundant, followed by traditional units). Next come the Moba, East Coast and Mpulungu areas, all with a majority of traditional units. The "less dense" areas include Makamba, Rukwa, Bururi and Nsumbu.

2.2.3. Attempt to visualise total regional fishing effort and catch

As already mentioned in the introduction, when one gear is predominant over the others in a fishery, the effort of all other

[4] Artisanal is a term that has commonly been applied to an improved fishing method of some sort, usually motor-powered, that catches more than traditional methods but costs more to purchase and operate (Coulter, 1991).

gears may be scaled to terms of the dominant gear. Therefore, we calculated the real fishing effort or fishing success per area and per km of shoreline expressed as the total number of "traditional effort units" (TEUs). This was done by using - for each area - a conversion factor based on the comparison of the (observed) average catch per unit (CPUE) for a traditional unit and the CPUE for each other fishing type. The conversion factors used are shown in Table 1. The result of this calculation is shown in Figure 3. It visualises the density of fishing effort/success for each area (expressed as TEUs/km). It shows clearly that the fish stocks at the north end (especially in the Uvira area), as well as at the south end of the Lake, undergo the heaviest fishing pressure per unit of fishing area. In the north it is mainly caused by the liftnet fishery while in the south it is mainly due to a combination of effort by the industrial (in the Mpulungu area) and the traditional fisheries. While in the Mpulungu area signs of overfishing by the industrial fishery are apparent, the north end of the Lake - if not overfished - is definitely subject to very heavy fishing pressure.

Using the same logic as for the calculations of Figure 3, it is an easy step to try to estimate and visualise the probable total catch per area (Figure 4). As an example, for all gears, an average number of 250 active fishing days/nights was assumed. The in this manner estimated total annual catch for the whole of the Lake amounts to 196570 tonnes/year with the following repartition for the riparian states:

- ◊ Burundi : 24946 tonnes,
- ◊ Tanzania: 60701 tonnes,
- ◊ Zambia : 16406 tonnes,
- ◊ Zaïre : 94517 tonnes.

The above estimates are within the order of magnitude of earlier country estimates and catch assessment results and confirm once again that the total catch for Zaïre and its contribution to the lake-wide total catch is probably much higher than always has been assumed.

The scenario presented above was only one out of the thousands of possible ones. To give only one example, when we vary the average number of fishing days per year used above (250) within a ±10% range (between 225 and 275) we find a total annual Lake catch estimate ranging between 176913 and 216227 tonnes with the corresponding country estimates varying with a ±10% proportion of the values above. But, for each individual area, a variety of different conversion factors can be used which each will give a different total estimate. We will therefore leave it up to the reader to try out his or her own scenarios.

Figure 5 visualises the effort (in TEUs) and - in a way - the corresponding catch per km for each area at the west and east coasts (each depicted with a length of 940 km) and for the total longitudinal north-south Lake profile. It demonstrates that the total effort and corresponding catch shows a decreasing gradient from north to south except for the south end (mainly due to heavy fishing in the Mpulungu and East Coast areas in Zambia). Also note the heavy fishing pressure in the north end of the Lake, mainly caused by the Uvira area (Congo).

3. Catch Assessment Surveys (CAS)

3.1. CAS in Burundi

3.1.1. CAS 1995

Despite the political and socio-economic problems in the country and the region, continuous CAS data collection at the landing sites went on without too many problems. The fishery in the Burundian part of Lake Tanganyika also managed to maintain the level of production of 1994 (for detailed 1994 Burundi CAS results, see Coenen, 1995). During the 12 operational lunar fishing campaigns in 1995 (only during the one in August-September the Lake was closed for security reasons), an estimated total of 21114 tonnes of fish was landed ashore by the fishermen (see Tables 2 to 5 for details). While the artisanal and traditional (subsistence) fisheries maintained their catch levels of 1994, a historical minimum was recorded for the industrial fishery, mainly due to a sharp decrease in the number of operational industrial units during recent years (13 in 1992; 12 in 1993; 9 in 1994; 4 in 1995):
- artisanal fishery: 20249 tonnes during 111822 fishing trips,
- traditional fishery: 833 tonnes during 52314 fishing trips,
- industrial fishery: 616 tonnes during 491 fishing trips.

The total value of the 1995 catch was estimated to amount to 2051.7 x 10^6 BIF (Burundian Francs) with an average landing price/kg of 97 BIF. Considering an average 1995 official exchange rate of 252 BIF for 1 US $, the total value of the catch at the landing sites and the average price/kg were respectively 8.1 x 10^6 US $ and 0.38 US $/kg. For comparison purposes, the values for the preceding years were the following (Coenen, 1995):
- 1994: 7.5 x 10^6 US $ and 0.34 US $/kg,
- 1993: 7.0 x 10^6 US $ and 0.45 US $/kg,
- 1992: 10.1 x 10^6 US $ and 0.41 US $/kg.

It has to be noted that the real values are about half the ones indicated above as the value of the BIF on the parallel market is about half (or less) the one on the official market. Breuil (1995) estimated that in 1991-92 the totality of the fisheries sector of Lake Tanganyika, including the post-harvest sector, contributed for about 1% to the GNP of the agricultural sector and for about 0.4% to the global GNP of the 4 riparian countries. For Burundi alone, the contributions to the Burundian agricultural and global GNPs were respectively 1% and 0.5%.

Figure 6 (A to D) shows the monthly evolution of effort (number of fishing trips), CPUE (kg/trip) and fish value at the landing site (BIF/kg) for the 4 major types of fishing. Noteworthy is the drastic reduction in industrial fishing effort (Fig. 6D), even within one year, and the increase in fish prices after a period of no fishing (scarcity of fish, see Fig. 6 A to C).

In 1995, the annual CPUEs for the different types of fishing were the following:
- industrial unit: **125.5 kg/night** or fishing trip,
- catamaran artisanal unit: **146.9 kg/night** or fishing trip,

◊ apollo artisanal unit: **373.8 kg/night** or fishing trip,
◊ traditional unit: **15.9 kg/night** or fishing trip.

Compared to the 1994 CPUEs (respectively 166, 144.7, 166 and 16 kg/trip), this means a further decrease for the industrial fishery, a further increase for the apollo units (which are gradually taking over the fishing 'niche' of the industrial units) and a status quo for the catamaran and traditional units.

Except for the catch of the traditional fishery, which is mainly composed of littoral species, the catch of the artisanal and industrial fisheries principally consists of 3 main fish species (2 clupeids, the pelagic *Stolothrissa tanganicae* and the more littoral *Limnothrissa miodon*, and the fast swimming centropomid pelagic predator *Lates stappersii*):
◊ industrial fishery: 46.2% clupeids, 49.3% *L. stappersii*,
◊ apollo fishery: 27.2% clupeids, 72.7% *L. stappersii*,
◊ catamaran fishery: 57.4% clupeids, 42.6% *L. stappersii*.

The monthly species fluctuations of the 3 types of pelagic fishery followed similar trends during 1995 (see Tables 3 to 5 and Figure 7). The more littoral fishing catamarans are catching more clupeids and less *L. stappersii* than the more pelagic fishing apollo and industrial units.
Since 1974 up to 1995, period for which artisanal catch data for Burundi are available, a general trend of gradually increasing yearly weight contributions of *L. stappersii* and of decreasing contributions of clupeids in the artisanal catch is obvious. In the mid-70's, artisanal catches were almost exclusively composed of clupeids while in 1995 the composition shows 48% clupeids and 52% *L. stappersii*. The possible main cause might be the observed increase in air temperature and reduction in wind speeds during the last 2-3 decades. As a result, thermal stratification increased and upwelling decreased. These phenomena would have favoured increased catches of *Lates stappersii* and reduced clupeid catches (Plisnier, 1997), especially in the south of the Lake.

3.1.2. CAS 1996

Due to the political turmoil in the country/region, CAS data for a few months only are available for 1996 (Lake closed for security reasons and/or no data collection possible).
During the 4 lunar fishing campaigns in 1996 (January-February, November (a few days) and December 1996), an estimated total of only 2994 tonnes of fish was landed ashore by the fishermen (see Tables 6 to 9 for details). This amounts to only 1/6 to 1/7 as compared to previous years. The traditional (subsistence) fishery maintained or even increased its level of importance, the artisanal fishery was less important and less efficient (lack of kerosene for the fishing lamps and/or other spares?) and the industrial fishery became almost non existent (only 1 unit remaining):
◊ artisanal fishery: 2702 tonnes during 23105 fishing trips,
◊ traditional fishery: 291 tonnes during 16847 fishing trips,
◊ industrial fishery: 1.1 tonnes during 10 fishing trips.

The total value of the 1996 catch was estimated to amount to 689.6 x 10^6 BIF (Burundian Francs) with - due to the scarcity of fish - an average landing price/kg of 230 BIF (more than doubled compared to 1995). Considering an average 1996 official exchange rate of 251 BIF for 1 US $, the total value of the catch at the landing sites and the average price/kg amounted respectively to 2.7 x 10^6 US $ and to a high of 0.92 US $/kg.

In 1996, the annual CPUEs for the different types of fishing were the following:
- ◊ industrial unit: **111.3 kg/night** or fishing trip,
- ◊ catamaran artisanal unit: **102.2 kg/night** or fishing trip,
- ◊ apollo artisanal unit: **184.9 kg/night** or fishing trip,
- ◊ traditional unit: **17.3 kg/night** or fishing trip.

Compared to the 1995 CPUEs, it means a slight decrease for the industrial and catamaran units, a sharp decrease (down to half the level of 1995) for the apollo units and a status quo/slight increase for the traditional units.

Due to insufficient data available, catch composition analysis was not performed.

3.2. CAS in Tanzania

At the last minute we fortunately obtained the so much needed standardised annual CAS data output (see Coenen, 1994b) for Tanzania covering the years 1993-1995. The computerisation of Tanzania's fisheries statistical system, at headquarters in Dar-es-Salaam as well as at regional level, encountered indeed several problems, causing considerable delays in data entry, analysis and reporting. The following table presents the summary of the recently received CAS data (in tonnes) for 1993-95 and - for comparison purposes - also shows the CAS data for the 3 previous years, 1990-1992.

YEAR	TC	CLUP	LST	LSSP	TILAPIA	OTH
1990	64 866	-	-	-	-	-
1991	63 503	36 518	11 958	2 463	-	-
1992	80 525	54 021	14 170	5 038	-	-
1993	71 730	39 963	30 962	643	415	2 747
1994	54 125	29 242	23 932	282	13	774
1995	54 652	40 764	11 546	435	203	1 704

TC = total catch; CLUP = clupeids; LST = *Lates stappersii*; LSSP = *Lates* spp.; TILAPIA = *Tilapia* spp.; OTH = other catch.

The above data are presented as they were received (no checks were performed). Surprising is the drop in the total catch estimate for 1994-1995 to a level of about 55000 tonnes although the simultaneous FS of 1995 showed that the effort (number of active vessels) was much higher (3405) as recorded 2 years earlier (2177). Also note the drop and corresponding increase of respectively the clupeids and *Lates stappersii* in 1993-1994.
The next table presents CPUEs (kg/night) for a number of fishing gears for the period 1993-95.

YEAR	LIFTNET	BEACH SEINE	GILL NETS
1993	104.0	50.4	35.0
1994	110.8	51.4	21.9
1995	50.2	47.9	17.8

For comparison, units monitored during LTR's SSP fish biology sampling (1993-96) revealed CPUEs amounting to:

128.8 kg/night for liftnets in Kigoma (see 4.1.4) and 80.5 kg/night for liftnets in Kipili (see 4.1.7),
and 50.4 kg/day for beach seines in Bujumbura (see 4.2.1).

3.3. CAS in Zambia

3.3.1. Artisanal/traditional fishing units

No continuous catch monitoring system of the commercial catch, landed by traditional/artisanal units[1] in the Zambian part of Lake Tanganyika is operational. Before 1993, the Department of Fisheries executed regular (3 to 4 times per year) one monthly FS/CAS surveys in the 4 strata. CAS estimates from these surveys were extrapolated for the year in question. Industrial units however, especially the ones in Mpulungu, were and are still monitored on a continuous basis.

No CAS data are available for the traditional/artisanal fishery in 1993. In 1994, LTR sponsored and executed a combined FS/CAS survey in June-July (Plisnier, 1995). The total extrapolated annual catch estimate for the traditional/artisanal fishery amounted to 9104 tonnes. During the same survey, CPUEs for different gears were estimated (caution: CPUEs based on very few observations):

◊ kapenta seine: 131 kg/haul with an estimated 1.7 hauls/night during an estimated 281 nights/year; depending on the stratum surveyed, the CPUE varied between 46 and 324 kg/haul,
◊ beach seine (without lights): 70 kg/haul with an estimated 1.9 hauls/night during an estimated 317 nights/year; depending on the stratum surveyed, the CPUE varied between 7 and 107 kg/haul,
◊ gill net: 4 kg/net of 90 m with an estimated average number of 3 nets/gill net unit or team during an estimated 317 nights/year; depending on the stratum surveyed, the CPUE varied between 3 and 10 kg/net of 90 m,
◊ handline (with on the average 14 hooks): 3 kg/(successful) pull; used throughout the year; depending on the stratum surveyed, the CPUE varied between 1 and 6 kg/pull,
◊ liftnet: 9 kg/haul with an estimated 4 hauls/night during an estimated 281 nights/year; only 8 units in one stratum were operational during the survey,
◊ chiromila seine: 57 kg/haul with an estimated average number of 4.3 hauls/night during an estimated 281 nights/year; only 8 units in one stratum were operational during the survey.

[1] In Zambia, traditional and artisanal units are both treated as "artisanal units".

3.3.2. Industrial units in Mpulungu and Nsumbu (Zambia)

3.3.2.1. Industrial units in Mpulungu

According to Plisnier (1995), the total industrial catch in 1994 for the industrial units based in Mpulungu was 3298 tonnes. The catch was mainly consisting of *L. stappersii* (96%), clupeids (2%, mainly *L. miodon*) and others (2%). The abundance of *S. tanganicae* in the industrial catches decreased in recent years. The industrial fishing effort however increased drastically since the early nineties.
Revised industrial data for 1994-1996 show a declining trend of the annual total catch figures for the industrial fishery in Mpulungu:

◊ 1994: 3452 tonnes with a CPUE of 877 kg/trip or 354 kg/haul,
◊ 1995: 2934 tonnes with a CPUE of 718 kg/trip or 273 kg/haul,
◊ 1996: 1869 tonnes with a CPUE of 535 kg/trip or 198 kg/haul.

Regarding fishing effort, on the average 14, 17 and 16 industrial units were operational each month in 1994, 95 and 96. Each year, a decreasing number of fishing trips was counted during the dry season months of June, July and August. However - during the other months - the fishing effort, expressed as number of fishing trips per month, remained almost constant throughout the years in question, fluctuating between 300 and 450 monthly fishing trips (see Table 10).
The fishing effort, which increased 2 to threefold since the early 90s, stabilised itself during 1994-96. The ever-decreasing CPUE however indicates that the industrial fishing effort is still too high and points to a possible overexploitation of the pelagic stocks in the fishing area near Mpulungu. The decrease of CPUEs might have been less drastic if the industrial fishermen of the Mpulungu area had not used more and more sophisticated equipment in recent years to obtain a higher catchability: use of echo sounder to track fish stocks, more performing fishing lamps, etc.
The catch composition almost remained constant. The industrial fishery of Mpulungu mainly targets *Lates stappersii* (95%), the dominant species since years. The average weight contribution of the clupeids to the total catch represents about 2-3% with some peak periods observed in each year: July-September 1994, November-December 1995 and August-September 1996 (Figure 8). The August-September periods correspond with upwelling/ phytoplankton induced peak periods as already observed for the monthly observations since 1967. The year 1995, with less strong south-eastern winds and weaker upwelling, showed a (delayed) clupeid peak in November-December only.

3.3.2.2. Industrial units in Nsumbu

Revised industrial data for 1994-1996 show the following annual catch figures for the industrial fishery in Nsumbu:

◊ 1994: 134 tonnes with a CPUE of 700 kg/trip or 241 kg/haul,
◊ 1995: 111 tonnes with a CPUE of 549 kg/trip or 235 kg/haul,
◊ 1996: 126 tonnes with a CPUE of 1390 kg/trip or 602 kg/haul.

The CPUEs for the Nsumbu area are just indicative due to the low and interrupted number of observations. Nevertheless, total

industrial fishing effort is far from its maximum sustainable level (as compared to the Mpulungu area) but good facilities and access roads are lacking to push ahead the expansion of this fishery in the Nsumbu area.
The catch composition almost remained constant during 1994-95 (see Table 11), for 1996 not enough data were available. As for Mpulungu, the industrial fishery in Nsumbu mainly targets *Lates stappersii* (95-99%). The average weight contribution of the clupeids to the total catch represents about 1% with one peak period each year identical to the ones observed in Mpulungu: July-September 1994 and November 1995 (Figure 9). Regular abundance minima of *L. stappersii* in the industrial catches of Mpulungu were already observed (Coenen, 1995) to occur annually in July-August since 1984 (before 1984 no detailed monthly records are available). This probably indicates massive movements of clupeids towards the south-end of the Lake (following upwelling phenomena in the south at the end of the dry and windy season?).
Regarding fishing effort, on the average 4, 2 and 2 industrial units were fishing during operational months in 1994, 95 and 96. Except for November 1994, each month some industrial units were active around Nsumbu in 1994-95. However, in 1996, only 3 months of industrial fishing activities were recorded: January and October-November. Catch records for the industrial unit 'Wicked Lady' of Isanga Bay were never received for the period October-December 1996.
The fishing effort, expressed as average number of fishing trips per month remained almost constant throughout the first 2 years (16 and 17 trips/month in 1994 and 1995 respectively) but decreased (due to several months of inactivity) in 1996 down to 6.
The total annual number of industrial fishing trips in Nsumbu (192, 202 and 91 for the 3 consecutive years) are to be neglected when compared to the heavy fishing pressure (twenty-fold or more) in the Mpulungu area (3937, 4090 and 3497 annual industrial fishing trips during the 3 consecutive years).

3.4. CAS in Congo

Congo (ex-Zaïre), never managed to put in place a continuous catch monitoring system of the catch landed in its part of Lake Tanganyika. Only irregular catch statistics were collected in and around some major towns (Uvira, Kalemie, Moba, etc.) along the Zairian shore of the Lake, as presented below.

3.4.1. Industrial units in Kalemie and Moba (Congo)

Coenen (1994a) discussed in detail the status of industrial fishing in Lake Tanganyika. The author also presented detailed fisheries statistics of the industrial fishery in Congo (Kalemie) for the period October 1992-November 1993. Coenen (1995) presented some additional statistics for Kalemie (till end of 1994) and also for Moba (only one unit active during 7-8/1994).
For the present report, additional statistics from Kalemie (up to May 1996) and for Moba (from October 1995 till April 1996) were available.

3.4.1.1 Industrial units in Kalemie

Data on industrial units in Kalemie for 41 months during the period October 1992-May 1996 (with the exception of April 1995 and January-February 1996 for which no data were available) were kindly provided by a Greek industrial fisherman operating there since many years (Table 12).

Due to the worsening socio-economic and political situation in the country, the number of operational industrial units in Kalemie decreased gradually (most of the units moved to Zambia) from 15 at the end of 1992 down to 2 units early 1995. Afterwards it increased again to about 6 units mid-1996. As a consequence, the fishing effort - expressed in number of fishing trips per month - followed the same general trend: from a high of 196 trips/month in November 1992 down to a low of about 14 trips/month in January 1995 with an increase up to about 75 around mid-1996. Apart from a few exceptions, between 15 and 20 days were fished on the average each month (Figure 10).

The CPUE, expressed as monthly average catch/unit/night, amounted to about 700 kg/unit/night for the whole period of observations. However, it fluctuated around 1000 kg/unit/night or trip from October 1992 till about July 1994 and then gradually decreased to a level of about 300 kg/unit/night in May 1995. Afterwards, this low level was maintained during the next year (with a slight increase up to about 400 kg/unit/night). On a yearly basis, the following annual CPUEs were estimated:

◊ 1992: 786 kg/fishing trip,
◊ 1993: 951 kg/fishing trip,
◊ 1994: 802 kg/fishing trip,
◊ 1995: 344 kg/fishing trip,
◊ 1996: 433 kg/fishing trip.

Assuming that the average fishing effort/efficiency per unit remained constant (same number of lights and hauls, same nets and fishing grounds, etc.), there has probably been a reduction of the size of the fishable fish stocks in recent years. This seems to be the case (see Fig. 10) for the *Lates stappersii* stock (decrease as from January 1995) as well as for the clupeid stocks (decrease already as from May 1994). The above assumption of constant fishing efficiency might not been true completely as one can suspect that the better equipped and performing units were the ones to leave Kalemie and move to Zambia.

Although the target species and the catch composition remained almost similar throughout the whole period (fluctuating around 94% *Lates stappersii* and about 6% clupeids), the main reason for the above mentioned probable stock size reduction might be the decreasing hydrodynamic phenomena. These are linked to lower dry season SE and local wind speeds, different heat budgets, etc. during recent years and resulted in less upwelling and mixing, lower amplitude internal waves, etc. The final result is a general, lower general productivity of the Lake, from nutrients through bacteria, phyto- and zooplankton up to the fish level (Plisnier, 1997; Plisnier & Coenen, in press).

3.4.1.2 Industrial units in Moba

Data for the industrial fishery in Moba were kindly provided by ECN (Office de l'Environnement et Conservation de la Nature). However, only data for 1 unit operating during 9 months (July-August 1994; October 1995-April 1996) are available (Table 13). The average CPUE during the period of observations was 802 kg/unit/night and the catch was exclusively composed of *Lates stappersii* (with no records of any clupeids!? Biased sampling!?).

3.4.2. Catamaran liftnets in Fizi District (Congo)

In order to be complete, it is interesting to mention the catch records of 4 catamaran units built and supported by Mzani ASBL, a non-governmental project. At the request of LTR, which also provided the catch registration forms, 4 fishing units operating in Baraka, Dine and Lusambo (situated in the Fizi District of the Sud-Kivu Province between 3° 30' and 5° 00' S) were monitored during the period December 1992-May 1993 (see Table 14 and Figure 11). During that period, a total of 448 night trips were registered with an average CPUE of 123.2 kg per fishing trip or fishing night. On a monthly basis, maximum CPUEs of 184.7 and 164.4 kg/catamaran/night were respectively observed in December 1992 and March 1993. On the other hand, minimum monthly CPUEs of 94.6 and 67.1 kg/catamaran/night occurred respectively in January and May 1993. Throughout the period monitored, the catch was mainly composed of clupeids (98%) and some *Lates stappersii* (2%).

4. Fisheries statistics recorded during fish biology sampling

4.1. Liftnets

A liftnet is an artisanal gear, operated at night using light attraction. It is the most common artisanal gear in Burundi, Tanzania and Congo for catching adult stages of *Stolothrissa tanganicae* and *Limnothrissa miodon* at large.

4.1.1. Bujumbura

An almost continuous data sampling series (32 months) for liftnets in Bujumbura was available for the 3 SSP years, except for August 1995 and from April 1996 on, when the Lake was closed for security reasons (Table 15).

Catches of 426 liftnet unit trips were monitored. A liftnet unit in Bujumbura made on the average **2.4 (2.3) hauls/night** using on the average **6.6 (6.6) fishing lamps/unit**. The average and the average between brackets represent respectively the mean of the 32 monthly means and the mean of the 426 individual unit observations. This will only be given as an example for Bujumbura liftnets. Hereafter, only the mean of monthly means will be presented. The total number of observations per month is indeed too variable (from a few to more than 20) to be used for the calculation of the mean of all the individual observations. A month with a high number of extreme individual values could then have too big an influence on the overall mean. Although the use of median CPUE has been reported to be a better indicator of changes in abundance than mean CPUE when using pooled data (Fox & Starr, 1996), we will mostly use the mean CPUE in this study. The major reasons for opting for mean CPUE instead of median CPUE are:

- the more widespread use of mean CPUE i.o. median CPUE,
- the possibility of making comparisons with previous studies, mainly using mean CPUE, and
- the fact that the data received were very often already pooled, making it impossible to (back)calculate the median CPUE.

The overall liftnet unit CPUE during the sampling period was **75.4 (71.6) kg/unit** (N=32 (426); SD=76.2 (114.4); 95Cl=27.5 (11.9); Med=55.4 (30)) and **29.9 (30.9) kg/haul**. By weight, the catch was on the average composed of 93 (97)% clupeids and 5 (3)% young (up to about 10 cm TL) specimens of *Lates stappersii*. The clupeid catch contribution, mainly consisting of immature specimens, was represented by 65 (76)% *Stolothrissa tanganicae* and 28 (21)% *Limnothrissa miodon* (Figure 12).

Correlation analysis (r values) between monthly unit CPUEs of different fishing zones (see Table 16) yielded significant linear correlations between overall catch rates of Bujumbura and Uvira (r=0.546, N=31, P<0.01) and of Bujumbura and Karonda (r=0.403, N=30, P<0.025). Monthly CPUEs used were transformed (ln(CPUE+1)) mean values, as described by Fox & Starr (1996).

However, at species level, only the catch rates of *Stolothrissa tanganicae* between Bujumbura and Uvira showed a significant correlation (r=0.515, N=31, P<0.01). The *Stolothrissa* liftnet catches in the northern end of the Lake (both Bujumbura and Uvira) contain indeed a large part of immature specimens as compared to the Karonda or Kigoma liftnet catches (Mannini *et al.*, 1996).

4.1.2. Uvira

As for Bujumbura, a continuous data sampling series (35 months) for liftnets in Uvira was available during the 3 SSP years, from August 1993 up to June 1996 (Table 17).
Catches of 413 liftnet unit trips were monitored during that period. A liftnet unit in Uvira made on the average **2.1 hauls/night** using on the average **6.8 fishing lamps/unit**.

The overall liftnet unit CPUE during the sampling period was **105.1 kg/unit** (n=35; SD=94.4; 95Cl=32.4; Med=64.7) and **48.6 kg/haul**. By weight, the catch was on the average composed of 77% clupeids and 23% young (up to about 10 cm TL) specimens of *Lates stappersii*. The clupeid catch contribution, mainly consisting of immature specimens was represented by 61% *Stolothrissa tanganicae* and 16% *Limnothrissa miodon* (Figure 13).

Correlation analysis (r values) between monthly unit CPUEs of different fishing zones (Table 16) yielded a significant correlation between overall catch rates of Uvira and Bujumbura (r=0.546, N=31,P<0.01). At species level, the catch rates of *Stolothrissa tanganicae* between Uvira and Bujumbura (r=0.515, N=31, P<0.01) as well as between Uvira and Karonda showed a significant correlation (r=0.476, N=31, P<0.01). A significant correlation between catch rates of *Lates stappersii* between Uvira and Kigoma (r=0.322, N=35, 0.025<P<0.05) was also observed.

4.1.3. Karonda

As for Bujumbura and Uvira, an almost continuous data sampling series (31 months) for liftnets in Karonda was available during the 3 SSP years, except for the first 2 months in 1993 and as from April 1996 as the Lake was closed for fishing (Table 18).

Catches of 286 liftnet unit trips were monitored during that period. A liftnet unit in Uvira made on the average **2.2 hauls/night** using on the average **8.0 fishing lamps/unit**.

The overall liftnet unit CPUE during the sampling period was **169.4 kg/unit** (N=31; SD=91.8; 95Cl=33.7; Med=160) and **76.8 kg/haul**. By weight, the catch was on the average composed of 80% clupeids and 19% *Lates stappersii* (young and adult specimens, bimodal catch composition). The clupeids can be divided in 73% *Stolothrissa tanganicae* and *7% Limnothrissa miodon* (Figure 14).

Correlation analysis (r values) between monthly unit CPUEs of different fishing zones (Table 16) yielded a significant correlation between overall catch rates of Karonda and Bujumbura (r=0.403, N=30,P<0.025). At species level, the catch rates of *Stolothrissa tanganicae* between Karonda and Uvira (r=0.476, N=31, P<0.01) showed a significant correlation.

4.1.4. Kigoma

Compared to the other 3 sampling stations above, Kigoma has a continuous data sampling series (36 months) for liftnets during the 3 SSP years (Table 19).

Catches of 378 liftnet unit trips were monitored during that period. A liftnet unit in Kigoma made on the average **2.7 hauls/night** using on the average **6.7 fishing lamps/unit**.

The overall liftnet unit CPUE during the sampling period was **128.8 kg/unit** (N=36; SD=81.2; 95Cl=27.5; Med=102.6) and **50.4 kg/haul**. By weight, the catch was on the average composed of 63% clupeids and 36% *Lates stappersii* (young and adult specimens, bimodal catch composition). The clupeids can be divided in 56% *Stolothrissa tanganicae* and 7% *Limnothrissa miodon* (Figure 15). As from 2/95 on, clupeids (especially *S. tanganicae*) became less important in the liftnet catches at the cost of *Lates stappersii*.

Correlation analysis (r values) between monthly unit CPUEs of different fishing zones (Table 16) yielded no significant correlation between overall catch rates of Kigoma and those of any of the other 3 sampling stations described. At species level, a surprising significant correlation was observed between the catch rates of *Lates stappersii* of Kigoma and Uvira (r=0.322, N=35,P<0.05). As in Uvira, *S. tanganicae* became less important at the expense of *L. stappersii* as from 2/95.

4.1.5. Kalemie

Due to logistical problems, Kalemie does not have a continuous sampling series for the 3 SSP years (Table 20). There are no data for July-December 1993, but an almost complete (except for March 1994) data series exists for the period January 1994-June 1996 (29 months).

Catches of 436 liftnet unit trips were monitored during that period. A liftnet unit in Kalemie made on the average **3.1 hauls/night** using on the average **4.0 fishing lamps/unit**.

The overall liftnet unit CPUE during the sampling period was **97.4 kg/unit** (N=29; SD=35.9; 95Cl=13.7; Med=90.0) and **31.3 kg/haul**. By weight, the catch was on the average composed of 100% clupeids and no *Lates stappersii* (sampling problem?, *L. stappersii* removed from catch before sampling?) were recorded. The clupeids were composed of 77% *Stolothrissa tanganicae* and 23% *Limnothrissa miodon* (Figure 16).

No correlation at all was found (Table 16) between Kalemie and Kigoma concerning monthly unit CPUEs neither for total catch nor for *Limnothrissa* and *Stolothrissa* catches (not applicable for *Lates stappersii,* as they were not recorded in Kalemie liftnet catches).

4.1.6. Moba

Due to logistical and other problems, only a limited and interrupted sampling series (18 months) is available for Moba. There are only data for 7 months between May and November 1994 and for 11 months from August 1995 up to June 1996 (Table 21).

Catches of 136 liftnet unit trips were monitored during that period. A liftnet unit in Moba made on the average **5.1 hauls/night** (increasing from 4-5 in 1994, up to 6+ in 1995 and decreasing again down to 3-5 in 1996) using on the average **3.2 fishing lamps/unit.**

The overall liftnet unit CPUE during the sampling period was **198.4 kg/unit** (N=18; SD=81.2; 95Cl=40.4; Med=209.2) and **40.0 kg/haul**. By weight, the catch was on the average composed of 73% clupeids and 27% *Lates stappersii*. The clupeid contribution contained 54% *Stolothrissa tanganicae* and 19% *Limnothrissa miodon* (Figure 17).

Due to insufficient data, no correlation analysis between Moba and other stations was done concerning monthly unit CPUEs.

4.1.7. Kipili

As for Moba, only a limited and interrupted sampling series (16 months) is available for Kipili, another small LTR station. There are only data for 6 months between November 1993 and April 1994, for 4 months between June and September 1994, for 5 months between December 1994 and April 1995 plus a single month in July 1995 (Table 22).

Catches of 304 liftnet unit trips were monitored during that period. A liftnet unit in Kipili made on the average **2.3 hauls/night** using on the average **2.4 fishing lamps/unit**.

The overall liftnet unit CPUE during the sampling period was **80.5 kg/unit** (N=16; SD=42.8; 95Cl=22.8; Med=82.7) and **45.1 kg/haul**. By weight, the catch was on the average composed of 24% clupeids and 76% *Lates stappersii*. The clupeid contribution contained 2% *Stolothrissa tanganicae* and 21% *Limnothrissa miodon*. Noteworthy is the quasi disappearance of *Stolothrissa tanganicae* in Kipili's liftnet catches, as compared to all other stations above (Figure 18).

Due to insufficient data, no correlation analysis between Kipili and other stations was done concerning monthly unit CPUEs.

4.1.8. Mpulungu

Due to sampling problems (random sampling was often impossible due to the fact that fishermen already divided their catch in species groups before landing), only a limited and interrupted sampling series (13 months) could be reconstituted for liftnet units which were sampled correctly in Mpulungu. There are only data for 4 months between September and December 1994, 1 month in March 1995, 3 months between July and September 1995, 4 months between December 1995 and March 1996 plus a single month in July 1996 (Table 23).

Catches of only 39 liftnet unit trips were sampled correctly during that period. A liftnet unit in Mpulungu made on the average **1.8 hauls/night** using on the average **3.3 fishing lamps/unit**.

The overall liftnet unit CPUE during the sampling period was **182.5 kg/unit** (N=13; SD=162.7; 95Cl=98.3; Med=109.4) and **102.1 kg/haul**. By weight, the catch was on the average composed of 55% clupeids and 45% *Lates stappersii*. The clupeid contribution contained 2% *Stolothrissa tanganicae* and 53% *Limnothrissa miodon*. As for Kipili, *Stolothrissa tanganicae* is quasi absent in Mpulungu's liftnet catches (Figure 19).

Due to insufficient data, no correlation analysis between Mpulungu and other stations was done concerning monthly unit CPUEs.

4.1.9. Liftnet CPUE correlations

Some significant correlations were found between LN transformed monthly total liftnet CPUE fluctuations of adjacent fishing areas during the 3 SSP years (Table 16). Their frequency distributions are depicted in Figure 20 showing almost normal histogram distributions. Skewed distributions would have indicated abnormally high or low (e.g. zero) catches observed. As might be expected, these correlations were found between total CPUEs of Bujumbura and Uvira and between Bujumbura and Karonda, but not between Uvira and Karonda nor between other adjacent fishing areas.
At species level, no correlation was found for *Limnothrissa miodon*, but for *Stolothrissa tanganicae* there were clear CPUE correlations between Bujumbura and Uvira and between Uvira and Karonda catches. For *Lates stappersii*, there was a surprising and significant CPUE correlation between Uvira and Kigoma.
Correlations at species level were found for fast migrating species which probably indicates within-the-month massive movements of shoaling *Stolothrissa* between Uvira and Bujumbura and between Uvira

and Karonda (but not between Bujumbura and Karonda) and for *L. stappersii* to and/or from Kigoma and Uvira (across the Lake).

4.1.10. Liftnet CPUE: species abundance and 'light adjustment' attempt

North of Kipili, *Stolothrissa tanganicae* is predominant in liftnet catches, while it is quasi absent south of Kipili where *Lates stappersii* is the predominant species. Sampling of already sorted catches probably caused the total absence of the latter species in the records of Kalemie liftnet catches (see above). For liftnet catches, comparison of CPUE results between areas can be misleading as liftnet units in different areas use different number of fishing lamps to attract fish: from 6.6 to 8.0 between Bujumbura and Kigoma compared to 2.4 to 4.O between Kalemie and Mpulungu. Therefore, the CPUE/haul was adjusted using tentatively the formula kg/haul*1/log(L), where L is the number of lights per fishing unit. The formula tries to reflect that adding fishing lamps to a fishing unit does not proportionally increase the number of fish attracted (phototaxis) nor the amount of fish caught.
For comparison purposes, monthly total catch CPUEs for each area, expressed as catch per haul, were corrected for the number of fishing lamps per fishing unit, and are presented in Figure 21 for the 3 years of sampling (top 8 graphs).
The bottom 2 graphs of Figure 21 show the increasing CPUE trend from north to south, especially visible for the light corrected CPUES (kg/haul, 3 yearly average for the period 7/93-6/96) south of Moba. The CPUEs per species (Fig. 21, bottom right graph) also demonstrate that this trend is mainly caused by *Lates stappersii* dominating the catches as from Kipili southwards and in Mpulungu even accentuated by considerable *Limnothrissa miodon* catches caught by the more littoral operated kapenta beach seines. There is an opposite clupeid-gradient for the pelagic *Stolothrissa tanganicae* (almost absent in the south, becoming more abundant towards the north of the Lake).

4.1.11. CPUEs per trimester (3 monthly term)

Figures 22 A and B show for each fishing area the liftnet CPUEs calculated for each trimester during the SSP sampling period 7/93-6/96 (graphs on the left) and the CPUEs per trimester averaged over the 3 sampling years (graphs on the right). Note the corresponding CPUE peaks in the north of the Lake (Bujumbura, Uvira, Karonda) during the October-December trimester (secondary upwelling, high clupeid abundance), followed by lows during the January-March trimester.

4.2. Beach seines (without lights)

This gear is also called 'the traditional beach seine'. It is operated during the day and is mainly used at the northern and middle shores of the Lake.

4.2.1 Bujumbura

A data sampling series of 25 months was available for Bujumbura: November 1993 till July 1995, September 1995, November-December 1995 and February 1996 (Table 24).

Catches of 65 beach seine units were monitored. A beach seine unit in Bujumbura made on the average **3.2 hauls/day**. The overall beach seine unit CPUE during the sampling period was **50.4 kg/unit** (n=25; SD=25.7; 95Cl=10.6; Med=43) and **20.1 kg/haul.** By weight, the catch was on the average composed of 94.7% miscellaneous littoral species (cichlids, etc.), 4.3% *Lates* spp. (*L. angustifrons, L. mariae* and *L. microlepis*), 1% clupeids (all mostly large sized *Limnothrissa miodon*) and no *Lates stappersii* (Figure 23). This species composition is totally different from the one for kapenta beach seines, using light attraction (see 4.3) to concentrate certain species(groups) like clupeids and *Lates stapperssi*.
For comparison purposes with the liftnet characteristics (see 4.1), Figure 23 also shows the LN(CPUE+1) frequency distribution of monthly CPUEs, CPUEs per trimester and 3 years trimester CPUE averages. Note the repeating highest beach seine CPUEs during trimester January-March and the repeating lowest CPUEs during trimester July-September. Due to the low number of monthly unit observations, these results should be handled with caution.

4.3. Beach seines (with lights)

This artisanal gear is also called 'kapenta seine'. It is operated during the night, using light attraction, and is only found in Zambia (southern shores of the Lake). It is said to be even more destructive than the traditional beach seine (destroying littoral bottom habitats and bottom nests of mainly cichlid species) as it mainly targets juvenile *L. miodon* living in the littoral zone using netting with a very small stretched mesh size (< 6 mm).

4.3.1. Mpulungu

An almost complete data sampling series of 35 months (except for January 1996) during the 3 SSP years was available for Mpulungu (Table 25).

Catches of 307 beach seine units were monitored. A beach seine unit in Mpulungu made on the average **1.3 hauls/night**. The overall beach seine unit CPUE during the sampling period was **54.2 kg/unit** (n=35; SD=47.3; 95Cl=16.2; Med=38.3) and **41.4 kg/haul.** By weight, the catch was on the average composed of 91.8% clupeids of which 85.4% (mainly juveniles; Paffen *et al.*, 1997) *L. miodon* and 8.3% *Stolothrissa tanganicae*, 1% *Lates stappersii* and 7.1% other species. Noteworthy is that in September 1995 a peak of 25% *Lates stappersii* occurred, followed by a 73.4% peak of *S. tanganicae* the following month (10/95), see Figure 24. Also note the repeating highest beach seine CPUEs during trimester July-September and the repeating lowest CPUEs during trimester January-March, probably linked to the presence of high or low numbers of juvenile *Limnothrissa miodon*.

4.4. Chiromila seines

Chiromila seines are artisanally operated gears, operated at night in the more pelagic waters and targeting (as does the liftnet fishery) the adult stages of both *S. tanganicae* and *L. miodon*. A total of 16 chiromila seines were identified in Zambia during the 1995 simultaneous frame survey on Lake Tanganyika (Paffen *et al*., 1997) and 13 during a 1993 FS in Tanzania.

4.4.1. Mpulungu

An interrupted data sampling series of 16 months during the 3 SSP years was available for Mpulungu (July-August 1994, October-November 1994, March-December 1995, February 1996 and June 1996), see Table 26.

Catches of 48 chiromila seine units were monitored. A chiromila unit in Mpulungu made on the average **1.9 hauls/night**. The overall chiromila unit CPUE during the sampling period was **248.5 kg/unit** (n=16; SD=318.4; 95Cl=169.6; Med=140) and **118.9 kg/haul.** By weight, the catch was on the average composed of 91.9% adult clupeids (Paffen *et al.*, 1997) of which 78.9% *L. miodon* and 16.4% *Stolothrissa tanganicae*, 6.9% *Lates stappersii* and 1.2% other species (Figure 25).
Generally, *L. miodon* was the most abundant species in the chiromila catches. But, as with the kapenta beach seine, a peak of 54.5% *Lates stappersii* was observed in September 1995 and another peak of 55.5% occurred in February 1996. However, during the dry and windy season (June to September), the transparency as well as the catchability of *L. stappersii*, probably a strong visual predator, decrease (Plisnier, 1997).
For *S. tanganicae*, peaks of 47.0, 95.0 and 60.3% were observed in August 1994, November 1995 and June 1996, respectively.
A considerable increase in unit CPUEs was observed during the last 3 trimesters of the SSP period, mainly to be attributed to an increase in the number of hauls per night (significant correlation, $P < 0.025$).
The characteristics of the chiromila units as described above are very similar to the ones observed for the kapenta beach seines (see 4.3). It raises the suspicion that the chiromila seine units monitored were probably operated very close to the shore (abundance of L. miodon) instead of in the pelagic area.

4.5. Purse seines

A purse seine unit is classified as belonging to the (semi-) industrial type of fishing. On the average, a purse seine unit consists of a steel purse seiner and 4 auxiliary vessels of which 3 are small light carrying boats. The total crew of one unit varies between 20 and 40 fishermen. The simultaneous frame survey of Lake Tanganyika in March 1995 counted 52 industrial units of which 28 were operational (16 in Zambia, 6 in Congo, 4 in Tanzania and 2 in Burundi). More than half of the operational industrial purse seiners (15) were based in Mpulungu (Zambia)(Paffen *et al.*, 1997).

4.5.1. Mpulungu

An almost complete data sampling series of 35 months (except for January 1996) during the 3 SSP years was available for Mpulungu (Table 27).

Catches of 257 purse seine unit trips were monitored. A purse seine unit in Mpulungu made on the average **2.0 hauls/night**. The overall purse seine unit CPUE during the sampling period was **701.0 kg/unit** (n=35; SD=612.1; 95Cl=210.2; Med=528) and **348.6 kg/haul.** Due to sampling problems (finding unsorted catch), an effective 'clupeid or kapenta splitting' sampling was only introduced as from September 1994. From that date on, the catch (by weight) was on the average composed of 93.8% *Lates stappersii,* 5.6% clupeids (2.4% *L. miodon* and 3.2% *Stolothrissa tanganicae)* and 0.6% other species (Figure 26).
L. stappersii was the predominant species throughout the sampling period except for a few months when the clupeids showed some small peaks: February-March 1995 (22-23%), October 1995 (40%) and March-April 1996 (10-11%). These periods of higher clupeid catches do not match completely the ones described in 3.3.2.1, probably due to a non-sufficient number of monthly observations.
During the 3 SSP years, the monthly purse seine CPUEs show a non-significant decrease. During the same period, the monthly average number of hauls and the average number of lights per industrial unit respectively show a non significant increase and significant ($P < 0.01$) increase through time. To avoid the influence of these correlations, the CPUEs were expressed as average catch/haul per unit and correction was made for the number of fishing lamps per unit (using catch/haul * 1/log(L) where L is the monthly average number of lights per unit). In this way, a significant ($P < 0.05$) CPUE decrease through time was found. As pointed out in 3.3.2, the industrial fishery in Mpulungu, with an almost constant level of effort (expressed as number of trips) during recent years, but with more and better performing fishing lamps and with an increasing number of hauls per fishing trip - is exercising an even heavier fishing pressure on the fish stocks. As a result, the fishing success (CPUEs) continues to decrease, indicating a local overexploitation of the *Lates stappersii* stock. Management measures to reduce (or disperse part of the effort to Nsumbu for example) the present effort are therefore urgent and should be taken into account in the planned management measures for the Lake.

4.5.2. Kigoma

An interrupted data sampling series of 28 months (September and November 1993, January-February 1994, April 1994 till July 1995, September 1995 till April 1996) during the 3 SSP years was available for Kigoma (Table 28).

Catches of only 66 purse seine unit trips were considered. More than 66 purse seine trips were monitored but did not have all the species groups specified in the catch records. A purse seine unit in Kigoma made on the average **1.1 hauls/night**. The overall beach seine unit CPUE during the sampling period was **238.7 kg/unit** (n=28; SD=320.0; 95Cl=124.1; Med=140.9) and **231.1 kg/haul.** The catch (by weight) was on the average composed of 86.4% juvenile and adult

Lates stappersii, 13.6% clupeids (7.9% *L. miodon* and 5.7% *Stolothrissa tanganicae)*, see Figure 27.
As in Mpulungu, *L. stappersii* was the predominant species in Kigoma throughout the sampling period except for a few months when the clupeids showed more or less important peaks: November 1993 (50%), February 1994 (65.3%), July 1994 (47.1%) and September 1995 (100%).
During the 3 SSP years, the monthly purse seine CPUEs, the monthly average number of hauls and the average number of lights per industrial unit each show a non-significant status quo through time. Similarly, the CPUEs, expressed as average catch/haul per unit and corrected for the number of fishing lamps per unit (using catch/haul * 1/log(L)), show a non-significant CPUE status quo through time.
Contrary to the liftnet units (operating within a 5 km radius around Kigoma), the purse seiners fish in more distant fishing grounds. This might explain the totally different catch characteristics between the Kigoma liftnet and purse seine units. The latter catch a majority of *L. stappersii* and some *S. tanganicae* containing more juveniles than in the liftnet *S. tanganicae* catches. It was suggested (Mannini *et al*., 1996) that the Kigoma purse seiners probably operate in offshore nursery areas. The latter were identified during lakewide trawling surveys with R/V Tanganyika Explorer.

5. Spawning, recruitment, relative abundance, environmental conditions, etc. in clupeids

Most of the findings below were observed for marine clupeids but are presented here as they might also apply to large freshwater lake systems inhabited by freshwater clupeids as is the case for Lake Tanganyika. It shows the considerable influence of the environment on the biology of clupeids.

5.1. Single and multiple spawning

In clupeids, a range of spawning behaviour between single spawning (e.g. herring) and intensive multiple spawning (anchovy, sprat) has been observed. Going from single to multiple spawning, an associated decrease in asymptotic fish mass ($W\infty$), an increase in the rate of growth towards this asymptote, a reduction in the age at maturity and a reduction in adult survival can also be noted (see next summary table).
In upwelling systems, with pulsed primary production, turbulent mixing and offshore Ekman transport, the multiple spawning behaviour of the dominant anchovies and sardines reduces the potentially wide fluctuations in reproductive success (Armstrong & Shelton, 1990). This probably also applies for the Lake Tanganyika sardines which are also multiple spawners (Mannini *et al.*, 1996).
Most clupeids are multiple spawners (iteroparous) which should be advantageous for short-lived species because it enables them to maintain relatively stable population sizes in unpredictable environments.

SINGLE SPAWNERS	MULTIPLE SPAWNERS
Greater W∞	Smaller W∞
Slower growth	Faster growth
Higher age at maturity	Lower age at maturity
Higher adult survival	Reduced adult survival
Higher fluctuations in reproductive success	Reduced fluctuations in reproductive success

5.2. Higher survival through larger number of smaller eggs/larvae

The superior evolutionary strategy is the investment in larger numbers of smaller eggs when resources are patchy on a relatively large spatial scale. In these conditions, a larger number of small larvae tends to yield more survivors then a small number of larger larvae (Winemiller & Rose, 1993).

5.3. Relation between food supply and level of spawning activity and fish fecundity

Spawning activity and fish fecundity of 3 short-lived clupeids (*Amblygaster sirm, Herklotsichthys quadrimaculatus* and *Spratelloides delicatulus*) in Kiribati (tropical central Pacific) were related to available energy reserves and, hence, food supply (Milton *et al.*, 1994).

5.4. Relation between level of recruitment and post-hatching survival and egg production

During the same study, the level of recruitment was observed to be more dependent on post-hatching survival rates than on egg production (Milton *et al.*, 1994).

5.5. Relation between temperature and spawning success

For the pacific herring (*Clupea harengus pallasi*), modelling work suggested a significant dome-shaped relationship between temperature and spawning success, with an optimal temperature during larval stages resulting in maximum production of recruits (Stocker *et al.*, 1985).
At first sight, the observed effects of El Niño on the gonadal index *of Porichthys notatus* seem to indicate a case of non-optimal temperatures. In 1984 (within a strong El Niño period lasting from fall 1982 till spring 1985), the lowest gonadal index for *Porichthys notatus* was observed off the coast of southern California. During this El Niño event (with high air temperatures and low wind speeds), anomalously warm, nutrient-poor water, coupled with reduced planktonic productivity, persisted in the California Current. However, the reduced gonadal allocation of female *P. notatus* at this time may have reflected lower food intake (DeMartini, 1990).

5.6. Other factors influencing recruitment success

The link between recruitment and abundance/survival during pre-juvenile life stages of clupeids and other marine fishes is sufficiently well documented. However, processes operating during the post-larval stages can significantly moderate, and even regulate, recruitment in some fishes (Legget & Deblois, 1994). Strong recruitment in several marine fish populations has also been attributed to temporal pulses of planktonic production, and correlations have been found between larval fish condition or abundance of several marine fish populations and the spatial distribution and density of zooplankton (Winemiller & Rose, 1993). It has also been suggested that mortality in pelagic eggs might be more important when the anoxic hypolimnion is nearer to the surface during periods of reduced upwelling, increased stratification, etc. (Plisnier, 1997).

5.7. Influence of wind and upwelling on the spawning success

A study on the northern anchovy (*Engraulis mordax*) off the coast of southern California revealed that spawning seasons with many high wind speed events (dissipating concentrated patches of food vital to survival of larval fish) were associated with a high mortality rate amongst young larvae of the anchovy (Peterman & Bradford, 1987). The upper mixed layer of the ocean must be in a stable (non-turbulent) state for survival of enough larval anchovy to insure the production of a good year-class. Turbulent conditions destroy food aggregations and dilute potential food organisms to below feeding threshold concentrations of first-feeding larval anchovies (Lasker, 1981).
While wind-driven upwelling of nutrient-rich water could lead to the opposite effect by increasing productivity of larval food, the study showed that this process did not offset the detrimental effect of winds. The adult anchovy biomass and offshore transport contributed little to interannual variation in larval mortality rate compared with wind speed (Peterman & Bradford, 1987).
Timing of onset and the duration of upwelling are crucial determinants for survival of larvae and the resultant year classes of the northern anchovy (Lasker, 1978).

In any case, upwelling- and wind-generated turbulence may, in fact, be major regulators of the true availability of food to larval marine fishes, and of their growth, survival and recruitment. Starvation and predation in the egg and larval stages might regulate recruitment in marine fishes. The major influence of food may be indirect and may operate principally through its regulation of the timing and intensity of mortality due to predation (Legget & Deblois, 1994).

In general, spawning clupeids seem to avoid upwelling centres and to produce a massive number of eggs over a long spawning period during times and in places where the eggs and larvae are at least risk (Lasker, 1985).

5.8. Spatial distribution of clupeids

The spatial distribution range of clupeids tends to decrease towards the more favourable habitats as the biomass of the population declines (MacCall, 1990).
During periods of increasing abundance, sardines often expand their spawning areas upstream, thereby facilitating the advection of larvae to productive areas. As well as expanding their

spawning range, sardines also extend their feeding range towards areas of high food productivity, whether upstream or downstream. On the contrary, when their abundance is low, sardines contract into a few relatively fixed locations, and migratory behaviour is greatly reduced.

5.9. Migrations

Fluctuations in the relative abundance of clupeids might be related to migrations (Milton *et al.*, 1994). In Lake Tanganyika, movement of fish into and out of fished areas is likely to take place. A great flux to and from fished areas is likely in *Lates stappersii* and *L. microlepis*. *Stolothrissa* and *Limnothrissa* have a more limited mobility. Large seasonal and long-term stock fluctuations occur, especially in *Stolothrissa* (its biomass appears to vary at least threefold within a year). And the uneven and patchy longitudinal distribution of biomass renders CPUE calculations per unit area very difficult (Coulter, 1991).

5.10. Environmental fluctuations

Short-term variability of sardine and anchovy populations, on time-scales of a few years, is undoubtedly influenced by environmental fluctuations and such variability tends to be amplified by exploitation.

At time-scales of several decades, fluctuations in catches of sardines and anchovies are seemingly dominated by long-term environmental variations which cause large and prolonged changes in abundance and give rise to 'regimes' of sardine or anchovy (Lluch-Belda *et al.*, 1989).

5.11. Factors affecting fishing operations targeted at clupeids

Fishing for clupeids is hampered by several factors (Coulter, 1991):

- each month (about 5 days around full moon), fishing operations cease because the moonlight diminishes light attraction to the fishing lamps,
- during windy periods, causing the water surface to be ruffled, clupeid schools - although abundant - tend to move deeper away from the lamps,
- fishing operations are often interrupted by periods (lasting a few days) of very strong winds,
- dense phytoplankton seems to exercise an exclusion effect on clupeids; the presence of medusas (*Limnocnida tanganicae*) also seems inimical to clupeids, etc.

6. Summary and conclusions

6.1. FS, CAS and CPUE results

The 1995 simultaneous FS revealed the presence of about 17000 vessels active in fishing and operating from about 800 landing sites. Traditional units are the dominant fishing type followed by liftnets and beach seines. Uvira (north-west coast, Zaïre) is the area where the most dense fishing effort (principally

liftnets and traditional units) is present when expressed as number of fishing units per km of shoreline. Next come Moba (south-west coast, Zaïre) and East Coast and Mpulungu (Zambia) with a majority of traditional units. Least dense effort areas include Bururi and Makamba (Burundi), Rukwa (Tanzania) and Nsumbu (Zambia).
Converted in "traditional effort units" (TEUs), results show that especially the north and south ends of the Lake are subject to the heaviest fishing pressure, respectively by liftnets and by industrial/traditional units. In between the heavily exploited north and south ends there is a decreasing effort gradient from north to south.
Previous total annual catch estimates for the Lake have most probably underestimated the contribution of Zaïre (estimated at about 90000 tonnes) to the total annual Lake catch which in recent years might have approached 200000 tonnes. Moreover, it is believed that the present period is one of reduced annual fish yields due to changed environmental conditions (cause: increased air temperature → reduced wind speeds → reduction of upwellings and other hydrodynamic phenomena → reduced primary production → lower fish yields).

Recent CAS estimates per country indicate that:

Burundi maintained its fish yield level of about 21000 tonnes in 1995. However, in 1996 - due to numerous closures of the Lake because of security reasons - the annual fish catch estimate dropped to about 3000 tonnes (1/7 of previous years) resulting in a more than doubling of the price of fish and in an increased importance of the traditional subsistence fishery.

Tanzania recorded lower annual fish yields in 1994-95 of about 55000 tonnes compared to 72000 and 80500 tonnes in 1992 and 1993, respectively.

Zambia estimated in 1994 a total annual fish yield of about 127OO tonnes (9100 traditional/artisanal and 3600 industrial). Because a continuous catch monitoring system is not in place, except for the industrial fishery in Mpulungu, no annual total catch estimates were available for 1993 and 1995-1996. Although the Mpulungu industrial effort in 1994-1996 remained almost constant, the industrial CPUE showed a declining trend, form 877 kg/fishing trip in 1994 down to 535 kg/trip in 1996. This is an indication of local overfishing by the industrial units in the pelagic fishing grounds around Mpulungu, especially of the *Lates stappersii* stock, the dominant species in the catches.

Zaïre has no CAS monitoring system in place for its part of Lake Tanganyika. Based on extrapolated fishing effort counts (1995 FS), a possible annual fish yield of 90000 has been estimated. Some local CAS estimates for the industrial fisheries in Kalemie and Moba are presented.

More detailed CPUE estimates, especially as to the clupeid species composition, were obtained during the fish biology sampling programme (SSP, 7/93-6/96) for different fishing gears and fishing areas.

Liftnet catches show an increasing CPUE trend from north to south, mainly caused by *L. stappersii* dominating the catches as from Kipili southwards at the cost of *Stolothrissa tanganicae*. Strange enough, the use of liftnets in the extreme south in not

very popular because these units are apparently not very safe during rough weather and windy conditions. Some liftnet CPUE correlations were found between monthly total and/or species CPUEs of adjacent fishing areas in the north (Bujumbura, Uvira, Karonda, Kigoma). An attempt was made to correct liftnet CPUEs for different numbers of fishing lamps used per liftnet unit in different areas around the Lake.
Detailed CPUE characteristics are also presented for beach, kapenta, chiromila and purse seines (see also Table 29).

6.2. CPUE: a measure of abundance?

Starting from catch and effort estimates (originating from CAS, FS and fish biology sampling data), CPUEs for different fishing gears, used in different fishing areas of Lake Tanganyika and measured over different time spans (month, trimester, year, 3 years SSP period) were presented. Emphasis was put on new data from LTR's SSP period (7/93-6/96) which were not yet analysed and presented in earlier Technical Documents. The latter period is the most important one because an important number of data were collected in different disciplines during this period. The acoustic surveys with R/V Tanganyika Explorer were also started during this period.
CPUE results might prove to be a tool for comparison with the magnitude and characteristics of the spatial and temporal biomass estimates obtained during the acoustic cruises. CPUEs do indeed reflect - in certain cases - the magnitude of abundance of fish stocks. However, as mentioned before, in the case of Lake Tanganyika, the CPUE results are not *de facto* a measure of fish abundance and should therefore be handled with extreme caution. And this because of several reasons: the species in question are mostly fast swimming, shoaling and migratory species and in - the case of *S. tanganicae* - with a very short longevity and thus a fast turnover of the stocks. On top of that, they have a patchy distribution and the CPUE estimates originate from fishing units using light attraction that concentrates the fish towards the fishing gear used. CPUE estimates might thus not reflect the real natural abundance of the species considered.
CPUEs have another disadvantage: they are averages of catch observed over a certain time span and in a specific geographical area and have therefore levelled out certain variations which might have occurred during the time span in question. For example, it has been observed that - for the same fishing type and in the same fishing area - daily unit catches change e.g. from a few kilograms today to nearly one tonne the day after.

6.3. The influence of environmental conditions on CPUE

Apart from the effects of the fisheries and the prey-predator relationship (the latter which previously was thought to have a dominant effect on prey and predator abundance) on fish stock abundance, we have seen in chapter 5 that a number of other factors are very important in the regulation of species abundance, especially for the clupeids. They include intrinsic biological factors but also a number of environmental factors which are probably as important if not more important in regulating species abundance and distribution in the short and long term.

Environmental factors include temperature, wind speed, upwelling, turbidity, hydrodynamic phenomena, etc. and are all interrelated. Some effects of these factors on clupeid spawning success, larval survival, recruitment, etc. were already presented in chapter 5. An example is the situation in recent years for Lake Tanganyika: higher air temperatures (possibly influenced by El Niño events (ENSO) in the Pacific Ocean), lower wind speeds (especially the dry season south-east winds), less tilting of the Lake volume, reduced hydrodynamic phenomena (oscillation amplitude, internal waves, upwelling, etc.), lower turbidity when less upwelling, lower primary production through lower nutrient availability, lower food availability and recruitment (less and smaller eggs, reduced survival of larvae, etc.), reduced fish population size and catches, etc. Although the environmental interrelationships might have been presented a bit simplified in previous example, it does reflect the tremendous effect of environmental conditions on the fish habitat and thus on the CPUEs of the exploited fish stocks.
Related to the above, and also influencing fish stock abundance and CPUE estimates, it was also observed that:

- small *Lates stappersii* (up to 10 cm) are found together (as observed in Bujumbura fish biology samples) with shoaling clupeids displaying a similar non-predator behaviour,
- adult *Lates stappersii*, a high visual predator, favour areas without windy conditions, when turbidity is low and visibility high,
- clupeids favour areas with windy conditions, with high turbidity and thus low visibility (disadvantage for its predator *L. stappersii*), often coinciding with higher nutrient availability and primary production.

6.4. Future monitoring of catch/effort fishery statistics

The LTR project, in collaboration with the 4 riparian countries, is now preparing a Fisheries Management Plan for the fisheries on Lake Tanganyika. The proposal will be based on the results of the multidisciplinary research activities executed during recent years on Lake Tanganyika.
Apart from specific measures (e.g. standardisation, limiting or banning of certain practices, promotion of other practices or activities, etc.), LTR will also propose and support the execution of a continuing Monitoring Programme. In this way, the necessary data to follow up the evolution of the Lake characteristics, including catch/effort and other fishery statistical parameters can be obtained. This will not only measure the impact of the implemented management measures but will also allow to adjust (cancel, introduce other measures, etc.) the management measures already in place. The Lake, its environment and fish stocks are indeed subject to very rapid changes which demands a continuous monitoring and assessment of implications of the measures in place.
Part of the Monitoring Programme will consist of the follow up of the catch and effort evolution in different areas of the Lake. It is therefore recommended that:

- the riparian countries, in collaboration with LTR or any other project coming into effect to implement the management/monitoring programme, should reinstate, sustain and even reinforce their efforts to execute adequate and continuous catch/effort surveys (continuous CAS, FS minimum every 2-3 years),

these countries continue their efforts to adopt similar and standardised methods for collecting catch/effort statistics and at least produce compatible reporting outputs of their annual fisheries statistics (according to the adopted recommendations of the Fisheries Statistical Co-ordinators Meeting, see Coenen 1994b). The increased computerisation and use of standardised fisheries statistical software packages can only support this not avoidable trend,

these countries increase their efforts to create (in case they do not yet exist) or reinforce existing fisheries statistical units, not only competent in the planning and follow up of the execution of FS, CAS and other surveys but also in data analysis and presentation of the results obtained,

these countries give their full support to the Management Plan and Monitoring Programme to be implemented, especially in the field of fisheries statistics,

the planned Monitoring Programme, especially the fisheries statistics component, and within the limits of the available budget to maintain the programme, would consider:

- ❖ to give its full support to the riparian countries in the execution of their CAS and FS surveys,
- ❖ give assistance in the training and development of their respective fisheries statistical units,
- ❖ support efforts for standardisation of fisheries statistical strategies/methods/outputs and for regular meetings between the fisheries statistical co-ordinators of the respective countries,
- ❖ support the execution of complementary continuous CAS surveys as was done in the case of the industrial fisheries in Kalemie and Moba (Zaïre),
- ❖ maintain the collection of additional catch/effort (CPUE) statistics for specific gears as was done in combination with the fish biology sampling during the 1993-96 SSP period. The intensity and frequency will of course depend on the planned fish biology monitoring sampling programme but should preferably maintain - for each type of fishing gear to be monitored - a **frequency of sampling 4 units every week (minimum 4 units every 2 weeks)**. As during the SSP, for each unit sampled, place and time, unit characteristics (type, number of lamps, hauls), total catch and catch per species estimates (using catch subsamples) are to be determined.
- ❖ types of fishing units sampled should not only include liftnets, industrial units, kapenta seines, beach seines but should also **include traditional fishing units** as they constitute the dominant type of fishing on the Lake (see chapter 2), followed by liftnets and beach seines.

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1993 tiny offspring? **Am.Nat., Vol. 142: 585-603.**

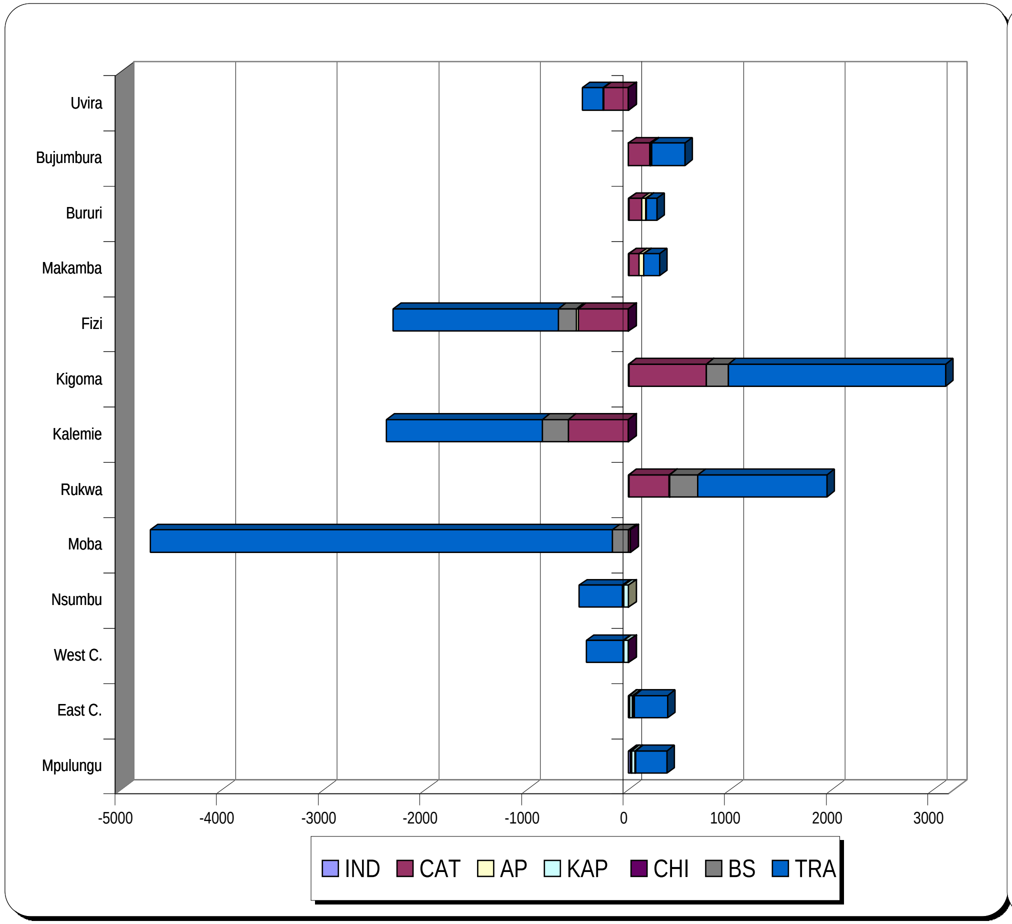

Figure 1: Lake Tanganyika (FS 1995), fishing effort (number of units), per type of fishing, from northend down to southend.
East coast: + values; west coast: - values.

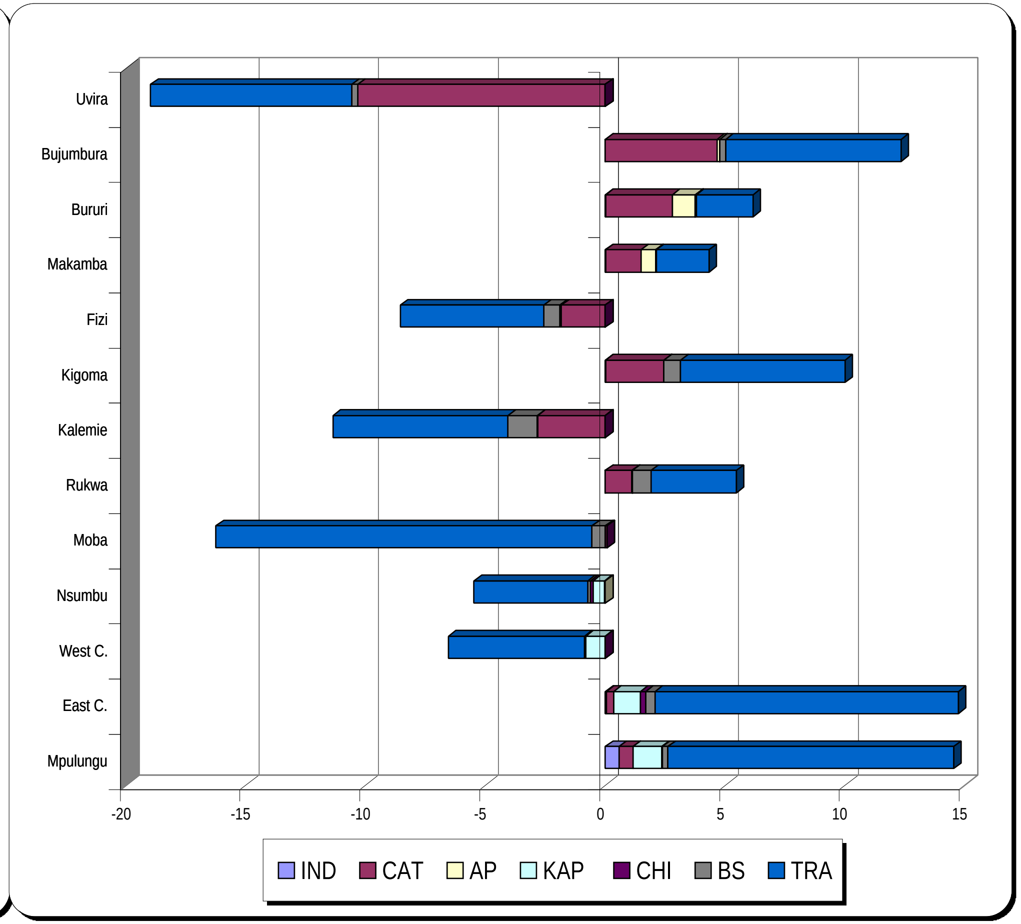

Figure 2: Idem as Fig. 1, but fishing effort per area expressed per km of shoreline.

IND = industrial unit; CAT = catamaran liftnet; AP = apollo liftnet unit; KAP = kapenta seine unit; CHI = chiromila seine unit; BS = beach seine unit; TRA = traditional unit.

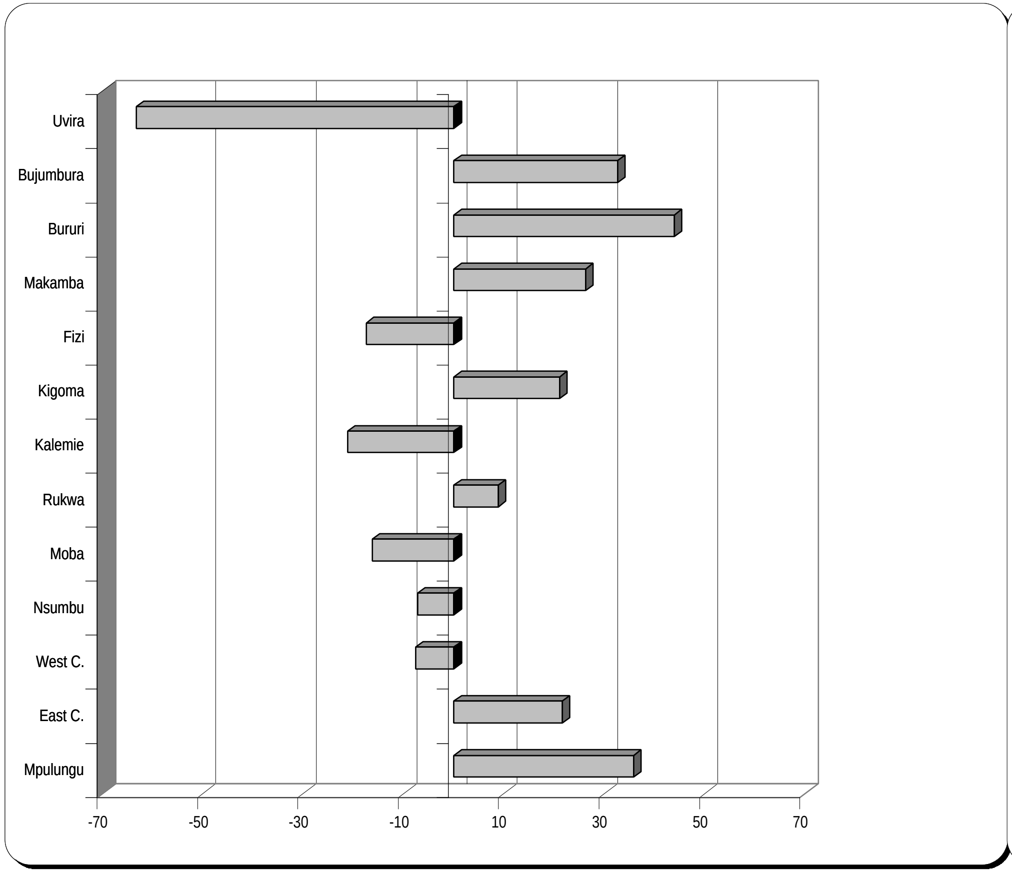

Figure 3: Idem as Fig. 2, but fishing effort per area and per km of shoreline converted into number of traditional effort units (TEUs)/km.

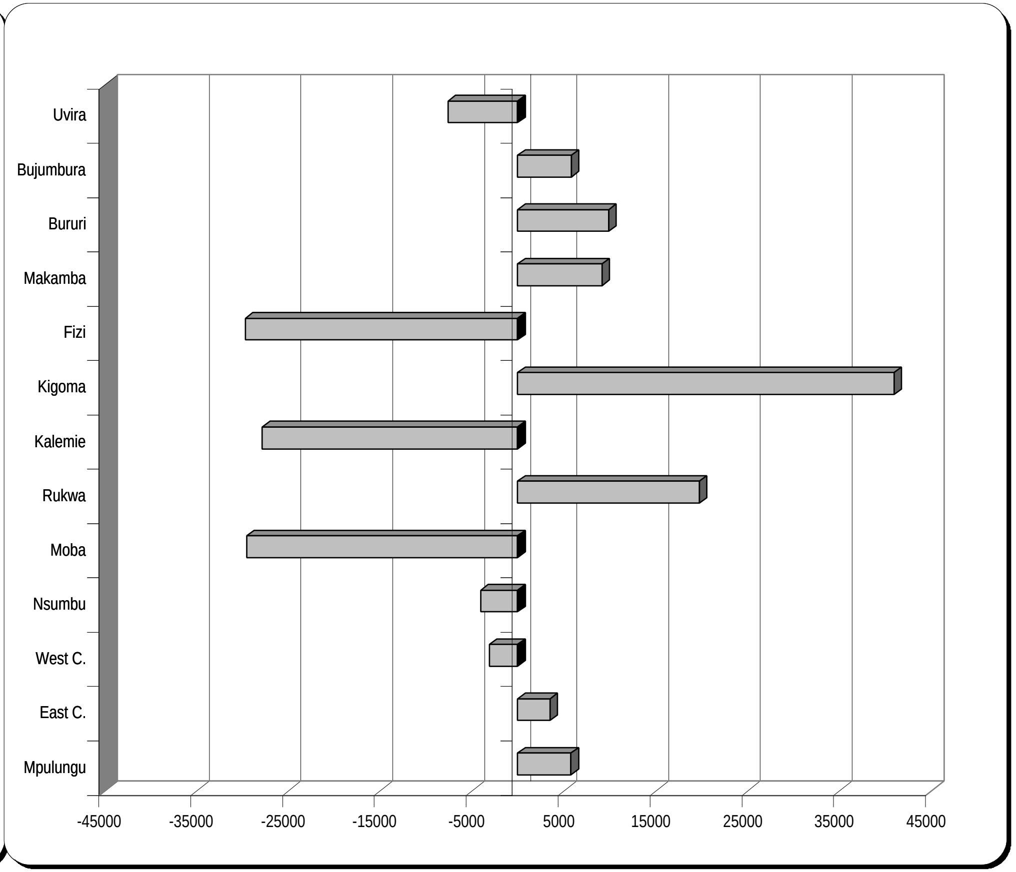

Figure 4: Estimated total annual catch per area (tonnes) using the effort values of Fig. 3. Assumption: average number of fishing days/year = 250.

Area	Ind.	Cat./trim.	Apol.	Kap.	Chir.	BS	Trad.
Uvira		5.3				2.5	1
Bujumbura		4.7	23.4			3.1	1
Bururi	6.3	8.5	18.7			2.5	1
Makamba	6.3	8.5	18.7			2.5	1
Fizi	8.0	4.9	15.0			2.0	1
Kigoma	9.6	5.2	15.0			2.0	1
Kalemie	28.0	3.9	15.0			2.0	1
Rukwa	9.6	3.2	15.0			2.0	1
Moba		7.9				2.0	1
Nsumbu		7.3		2.2	10.0	2.0	1
West C.		7.3		2.2		2.0	1
East C.	30.7	7.3		2.2	10.0	2.0	1
Mpulungu	28.0	7.3		2.2	10.0	2.0	1

Table 1: Conversion factors per type of fishing, per area, for transformation into traditional effort units (TEUs).

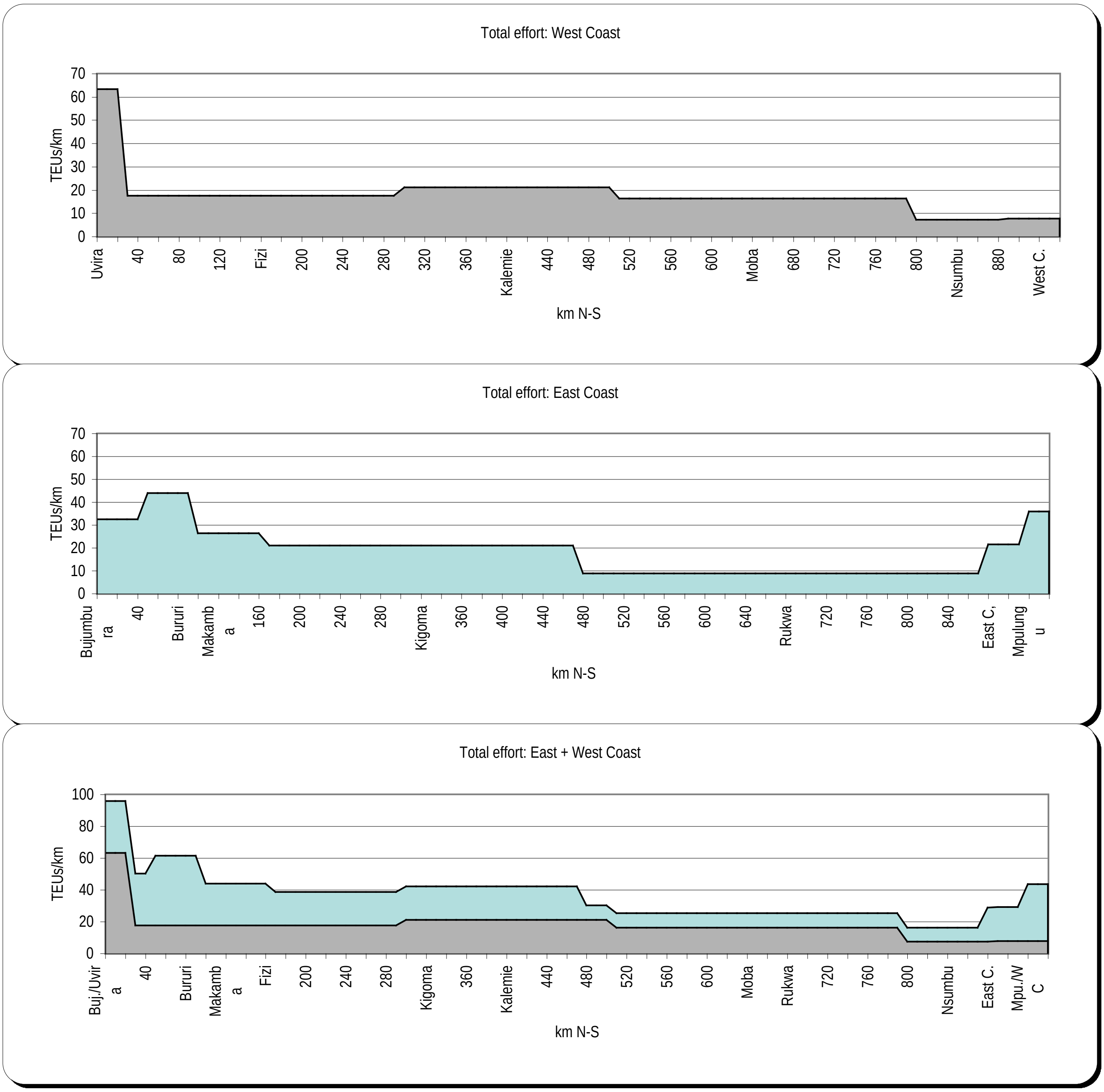

Figure 5: TEUs/km for east, west and combined east-west coasts in a north-south Lake profile.

		CATCH	CATCH	CATCH	CATCH	CATCH	CATCH	CATCH	VALUE
PERIOD	**TRIPS**	**CATF**	**CICHL**	**CLUP**	**L.ANG.**	**L.M/M**	**OTH.**	**TOTAL**	**TOTAL**
19/12/94-16/01/95	2,458	8.7	7.7	8.2	0.1	0.7	11.6	36.9	5,929.3
17/01-15/02/95	3,332	28.7	5.3	9.5	0.3	0.7	23.7	68.2	10,969.9
16/02-17/03/95	5,466	22.3	8.3	17.5	0.5	0.2	35.6	84.4	13,929.3
18/03-15/04/95	6,473	6.9	22.9	4.6	1.6	2.1	83.3	121.3	15,971.0
16/04-14/05/95	3,611	3.8	5.6	0.5	0.5	0.6	36.9	47.9	7,296.7
15/05-13/06/95	4,684	4.1	6.3	0.0	0.5	0.2	56.6	67.7	9,363.4
14/06-12/07/95	305	0.4	0.8	0.0	0.3	0.4	3.3	5.2	650.9
13/07-10/08/95	6,968	7.5	23.1	10.7	0.2	0.2	92.4	133.9	20,955.9
11/08-09/09/95			**LAKE CLOSED FOR SECURITY REASONS**						
10/09-08/10/95	4,017	0.0	16.6	0.0	0.0	3.7	25.5	45.8	9,557.4
09/10-07/11/95	4,281	8.4	8.0	0.0	0.7	0.1	46.3	63.6	12,206.0
08/11-07/12/95	4,875	5.6	22.6	4.7	1.0	1.5	34.6	70.1	12,655.1
08/12-05/01/96	5,844	5.5	31.6	0.0	1.9	6.4	42.7	88.0	12,869.3
TOTAL 95	**52,314**	**102.0**	**158.7**	**55.7**	**7.5**	**16.7**	**492.5**	**833.1**	**132,354.2**

	KG/TR.	KG/TR.	KG/TR.	KG/TR.	KG/TR.	KG/TR.	KG/TR.	BIF/KG
PERIOD	**CATF**	**CICHL**	**CLUP**	**L.ANG.**	**L.M/M**	**OTH.**	**TOTAL**	**TOTAL**
19/12/94-16/01/95	3.5	3.1	3.3	0.0	0.3	4.7	15.0	160.6
17/01-15/02/95	8.6	1.6	2.8	0.1	0.2	7.1	20.5	161.0
16/02-17/03/95	4.1	1.5	3.2	0.1	0.0	6.5	15.4	165.0
18/03-15/04/95	1.1	3.5	0.7	0.2	0.3	12.9	18.7	131.6
16/04-14/05/95	1.1	1.6	0.1	0.1	0.2	10.2	13.3	152.4
15/05-13/06/95	1.4	2.5	0.0	1.0	1.2	10.9	17.0	125.7
14/06-12/07/95	1.1	3.3	1.5	0.0	0.0	13.3	19.2	156.5
13/07-10/08/95	1.1	3.3	1.5	0.0	0.0	13.3	19.2	156.5
11/08-09/09/95			**LAKE CLOSED FOR SECURITY REASONS**					
10/09-08/10/95	0.0	4.1	0.0	0.0	0.9	6.3	11.4	208.6
09/10-07/11/95	2.0	1.9	0.0	0.2	0.0	10.8	14.9	191.9
08/11-07/12/95	1.2	4.6	1.0	0.2	0.3	7.1	14.4	180.6
08/12-05/01/96	0.9	5.4	0.0	0.3	1.1	7.3	15.1	146.2
TOTAL 95	**1.9**	**3.0**	**1.1**	**0.1**	**0.3**	**9.4**	**15.9**	**158.9**

Table 2: Fishing effort, total catch and catch by species(group), CPUE and average price per kg by species(group) for the traditional fishery, Burundi, Lake Tanganyika (CAS 1995).

- CATCH and value (VAL.) expressed in tonnes and '000 Burundi Francs (BIF), respectively (upper table only).
- CATF, CICHL, CLUP, L.ANG., L.M/M, OTH. = Catfish, Cichlids, Clupeids, Lates angustifrons, Lates mariae & L. microlepis and Other species.
- TR. = fishing trip (CPUE = KG/TR. = average (monthly) catch per fishing trip)
- BIF/KG = average (monthly) landing value in Burundi Francs per kg.

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.
19/12/94-16/01/95	6,067	6,741	762,940	962,143	63,372,581	11,440	1,229,605	84,608	16,359,933	340	95,225	0	0	1,065,272	81,820,284
17/01-15/02/95	8,107	56,346	6,703,340	456,100	46,487,176	283,109	17,077,988	227,750	28,481,725	126	31,676	24	12,061	1,023,455	98,793,966
16/02-17/03/95	8,977	173,418	18,284,181	171,387	26,465,192	252,297	25,594,957	346,904	50,725,799	16	4,806	0	0	944,022	121,074,935
18/03-15/04/95	9,776	270,757	40,379,829	203,886	22,408,518	165,849	16,272,247	209,996	30,038,562	106	25,801	223	30,115	850,817	109,155,072
16/04-14/05/95	10,447	124,068	15,960,536	428,518	52,873,713	88,448	9,354,737	221,452	31,860,419	514	131,969	1,694	271,020	864,694	110,452,394
15/05-13/06/95	9,099	4,400	56,568	591,575	73,235,726	83,142	7,043,551	258,813	35,825,634	222	61,977	0	0	938,152	116,223,456
14/06-12/07/95	8,867	73,855	6,341,359	393,999	60,825,237	77,332	6,757,725	142,022	18,375,980	152	37,002	0	0	687,360	92,337,303
13/07-10/08/95	9,893	1,567,606	78,875,727	613,723	44,009,812	20,971	1,877,548	476,533	36,918,818	0	0	0	0	2,678,833	161,681,905
11/08-09/09/95							**LAKE CLOSED FOR SECURITY REASONS**								
10/09-08/10/95	2,229	0	0	98,938	23,582,400	3,891	718,636	1,473	327,699	14	5,334	0	0	104,316	24,634,069
09/10-07/11/95	4,192	341,940	10,244,277	270,290	26,863,588	31,144	2,616,627	643,167	55,351,368	140	47,070	3,356	448,669	1,290,037	95,571,599
08/11-07/12/95	8,991	54,345	5,437,169	920,592	77,978,875	311,100	18,831,468	832,232	74,097,930	230	53,687	23	4,715	2,118,522	176,403,844
08/12-05/01/96	8,314	0	0	218,734	38,068,067	330,390	27,940,323	831,624	79,485,875	45	18,885	0	0	1,380,793	145,513,150
TOTAL 95	**94,959**	**2,673,476**	**183,045,926**	**5,329,885**	**556,170,885**	**1,659,113**	**135,315,412**	**4,276,574**	**457,849,742**	**1,905**	**513,432**	**5,320**	**766,580**	**13,946,273**	**1,333,661,977**

PERIOD	TOTAL BIF/KG	CLUPjuv. BIF/KG	CLUP BIF/KG	L.ST.juv. BIF/KG	L.ST. BIF/KG	L.SSP. BIF/KG	OTH. BIF/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.
19/12/94-16/01/95	77	113	66	107	193	280		175.6	1.1	158.6	1.9	13.9	0.1	0.0
17/01-15/02/95	97	119	102	60	125	251	503	126.2	7.0	56.3	34.9	28.1	0.0	0.0
16/02-17/03/95	128	105	154	101	146	300		105.2	19.3	19.1	28.1	38.6	0.0	0.0
18/03-15/04/95	128	149	110	98	143		135	87.0	27.7	20.9	17.0	21.5	0.0	0.0
16/04-14/05/95	128	129	123	106	144	257	160	82.8	11.9	41.0	8.5	21.2	0.0	0.2
15/05-13/06/95	124	13	124	85	138	279		103.1	0.5	65.0	9.1	28.4	0.0	0.0
14/06-12/07/95	134	86	154	87	129	243		77.5	8.3	44.4	8.7	16.0	0.0	0.0
13/07-10/08/95	60	50	72	90	77			270.8	158.5	62.0	2.1	48.2	0.0	0.0
11/08-09/09/95						**LAKE CLOSED FOR SECURITY REASONS**								
10/09-08/10/95	236		238	185	222	381		46.8	0.0	44.4	1.7	0.7	0.0	0.0
09/10-07/11/95	74	30	99	84	86	336	134	307.7	81.6	64.5	7.4	153.4	0.0	0.8
08/11-07/12/95	83	100	85	61	89	233	205	235.6	6.0	102.4	34.6	92.6	0.0	0.0
08/12-05/01/96	105		174	85	96	420		166.1	0.0	26.3	39.7	100.0	0.0	0.0
TOTAL 95	**96**	**68**	**104**	**82**	**107**	**270**	**144**	**146.9**	**28.2**	**56.1**	**17.5**	**45.0**	**0.0**	**0.1**

Table 3: Fishing effort, total catch and catch by species(group), CPUE and average price per kg by species(group) for the catamaran fishery, Burundi, Lake Tanganyika (CAS 1995).

- 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 = KG/TR. = average (monthly) catch per fishing trip).
- BIF/KG = average (monthly) landing value in Burundi Francs per kg.

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.
19/12/94-16/01/95	1,379	6,833	384,343	411,252	22,320,987	4,568	542,819	42,812	8,062,668	112	39,333	0	0	465,577	31,350,150
17/01-15/02/95	1,575	213	22,187	74,941	6,843,921	131,893	10,802,623	329,795	37,003,782	522	179,320	0	0	537,364	54,851,833
16/02-17/03/95	1,246	39,186	2,810,560	16,225	2,546,463	86,998	7,744,253	140,735	18,433,043	24	5,544	9	1,800	283,177	31,541,663
18/03-15/04/95	1,413	12,412	1,118,261	18,902	2,974,235	119,334	11,254,073	200,485	23,327,329	97	23,963	36	4,384	351,266	38,702,245
16/04-14/05/95	1,483	299	26,091	95,143	9,249,295	58,811	5,916,693	198,540	26,983,824	563	628,590	0	0	353,356	42,804,493
15/05-13/06/95	1,640	0	0	83,869	10,702,704	86,944	8,760,435	114,907	13,518,460	134	28,593	0	0	285,854	33,010,192
14/06-12/07/95	1,019	108,481	6,533,372	46,789	5,161,779	64,465	3,766,454	73,157	8,011,044	338	99,920	214	16,061	293,444	23,588,630
13/07-10/08/95	1,531	246,684	10,220,132	23,762	2,034,383	25,730	2,076,380	885,820	52,792,707	78	18,296	0	0	1,182,074	67,141,898
11/08-09/09/95						**LAKE CLOSED FOR SECURITY REASONS**									
10/09-08/10/95	244	2,570	263,823	6,705	1,547,473	536	69,825	21,640	1,949,603	0	0	0	0	31,451	3,830,724
09/10-07/11/95	1,773	110,726	4,396,558	135,381	14,802,157	14,818	1,375,640	323,040	28,528,898	131	13,341	1,166	182,272	585,262	49,298,866
08/11-07/12/95	1,776	7,585	331,100	227,702	18,920,459	144,880	7,129,343	515,205	47,308,109	50	14,649	188	37,446	895,610	73,741,106
08/12-05/01/96	1,784	0	0	41,650	11,506,143	162,690	11,001,352	832,284	103,749,320	84	35,564	2,088	497,196	1,038,796	126,789,575
TOTAL 95	**16,863**	**534,989**	**26,106,427**	**1,182,321**	**108,609,999**	**901,667**	**70,439,890**	**3,678,420**	**369,668,787**	**2,133**	**1,087,113**	**3,701**	**739,159**	**6,303,231**	**576,651,375**

PERIOD	TOTAL BIF/KG	CLUPjuv. BIF/KG	CLUP BIF/KG	L.ST.juv. BIF/KG	L.ST. BIF/KG	L.SSP. BIF/KG	OTH. BIF/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.
19/12/94-16/01/95	67	56	54	119	188	351		337.6	5.0	298.2	3.3	31.0	0.1	0.0
17/01-15/02/95	102	104	91	82	112	344		341.2	0.1	47.6	83.7	209.4	0.3	0.0
16/02-17/03/95	111	72	157	89	131	231	200	227.3	31.4	13.0	69.8	112.9	0.0	0.0
18/03-15/04/95	110	90	157	94	116	247	122	248.6	8.8	13.4	84.5	141.9	0.1	0.0
16/04-14/05/95	121	87	97	101	136	1117		238.3	0.2	64.2	39.7	133.9	0.4	0.0
15/05-13/06/95	115		128	101	118	213		174.3	0.0	51.1	53.0	70.1	0.1	0.0
14/06-12/07/95	80	60	110	58	110	296	75	288.0	106.5	45.9	63.3	71.8	0.3	0.2
13/07-10/08/95	57	41	86	81	60	235		772.1	161.1	15.5	16.8	578.6	0.1	0.0
11/08-09/09/95						**LAKE CLOSED FOR SECURITY REASONS**								
10/09-08/10/95	122	103	231	130	90			128.9	10.5	27.5	2.2	88.7		
09/10-07/11/95	84	40	109	93	88	102	156	330.1	62.5	76.4	8.4	182.2	0.1	0.7
08/11-07/12/95	82	44	83	49	92	293	199	504.3	4.3	128.2	81.6	290.1	0.0	0.1
08/12-05/01/96	122		276	68	125	423	238	582.3	0.0	23.3	91.2	466.5	0.0	1.2
TOTAL 95	**91**	**49**	**92**	**78**	**100**	**510**	**200**	**373.8**	**31.7**	**70.1**	**53.5**	**218.1**	**0.13**	**0.22**

Table 4: Fishing effort, total catch and catch by species(group), CPUE and average price per kg by species(group) for the apollo fishery, Burundi, Lake Tanganyika (CAS 1995).

- 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 = KG/TR. = average (monthly) catch per fishing trip).
- BIF/KG = average (monthly) landing value in Burundi Francs per kg.

			CLUPjuv.	CLUPjuv.	CLUP	CLUP	L.ST.juv.	L.ST.juv.	L.ST.	L.ST.	L.SPP.	L.SPP.	OTH.	OTH.	TOTAL	TOTAL
PERIOD	**UNITS**	**TRIPS**	**CATCH**	**VAL.**	**CATCH**	**VAL.**	**CATCH**	**VAL.**	**CATCH**	**VAL.**	**CATCH**	**VAL.**	**CATCH**	**VAL.**	**CATCH**	**VAL.**
19/12/94-16/01/95	4	62	25	3,000	2,237	256,000	400	45,500	1,062	288,000	1,388	646,000	60	3,000	5,172	1,241,500
17/01-15/02/95	4	91	0	0	2,776	302,600	2,825	322,200	2,989	699,300	912	353,000	0	0	9,502	1,677,100
16/02-17/03/95	2	36	250	22,500	1,237	170,600	1,474	175,900	2,150	550,000	412	164,000	0	0	5,523	1,083,000
18/03-15/04/95							**NO FISHING ALLOWED**									
16/04-14/05/95	3	53	0	0	3,237	323,600	2,000	192,500	550	118,000	0	0	0	0	5,787	634,100
15/05-13/06/95	3	59	0	0	975	125,000	1,588	212,500	675	167,000	0	0	0	0	3,238	504,500
14/06-12/07/95	3	73	871	63,859	1,791	184,078	3,006	403,185	1,624	415,986	0	0	0	0	7,292	1,067,108
13/07-10/08/95	3	52	894	39,762	8,183	795,040	146	14,615	1,606	274,660	0	0	0	0	10,829	1,124,077
11/08-09/09/95	1	1	0	0	0	0	0	0	38	5,000	0	0	0	0	38	5,000
10/09-08/10/95	1	17	0	0	0	0	0	0	2,843	329,833	0	0	0	0	2,843	329,833
09/10-07/11/95	2	32	0	0	4,017	395,192	25	2,000	54	10,385	0	0	0	0	4,096	407,577
08/11-07/12/95	1	7	0	0	1,983	116,083	175	9,800	350	33,250	0	0	0	0	2,508	159,133
08/12-05/01/96	1	8	0	0	0	0	4,800	768,000	0	0	0	0	0	0	4,800	768,000
TOTAL 95	**28**	**491**	**2,040**	**129,121**	**26,436**	**2,668,193**	**16,439**	**2,146,200**	**13,941**	**2,891,414**	**2,712**	**1,163,000**	**60**	**3,000**	**61,628**	**9,000,928**

	TOTAL	CLUPjuv.	CLUP	L.ST.juv.	L.ST.	L.SSP.	OTH.	TOTAL	CLUPjuv.	CLUP	L.ST.juv.	L.ST.	L.SSP.	OTH.
PERIOD	**BIF/KG**	**BIF/KG**	**BIF/KG**	**BIF/KG**	**BIF/KG**	**BIF/KG**	**BIF/KG**	**KG/TR.**	**KG/TR.**	**KG/TR.**	**KG/TR.**	**KG/TR.**	**KG/TR.**	**KG/TR.**
19/12/94-16/01/95	240	120	114	114	271	465	50	83.4	0.4	36.1	6.5	17.1	22.4	1.0
17/01-15/02/95	176		109	114	234	387		104.4	0.0	30.5	31.0	32.8	10.0	0.0
16/02-17/03/95	196	90	138	119	256	398		153.4	6.9	34.4	40.9	59.7	11.4	0.0
18/03-15/04/95							**NO FISHING ALLOWED**							
16/04-14/05/95	110		100	96	215			109.2	0.0	61.1	37.7	10.4	0.0	0.0
15/05-13/06/95	156		128	134	247			54.9	0.0	16.5	26.9	11.4	0.0	0.0
14/06-12/07/95	146	73	103	134	256			99.9	11.9	24.5	41.2	22.2	0.0	0.0
13/07-10/08/95	104	44	97	100	171			208.3	17.2	157.4	2.8	30.9	0.0	0.0
11/08-09/09/95	132				132			38.0	0.0	0.0	0.0	38.0	0.0	0.0
10/09-08/10/95	116				116			167.2	0.0	0.0	0.0	167.2	0.0	0.0
09/10-07/11/95	100		98	80	192			128.0	0.0	125.5	0.8	1.7	0.0	0.0
08/11-07/12/95	63		59	56	95			358.3	0.0	283.3	25.0	50.0	0.0	0.0
08/12-05/01/96	160			160				600.0	0.0	0.0	600.0	0.0	0.0	0.0
TOTAL 95	**146**	**63**	**101**	**131**	**207**	**429**	**50**	**125.5**	**4.2**	**53.8**	**33.5**	**28.4**	**5.5**	**0.1**

Table 5: Fishing effort, total catch and catch by species(group), CPUE and average price per kg by species(group) for the industrial fishery, Burundi, Lake Tanganyika (CAS 1995).

- 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 = KG/TR. = average (monthly) catch per fishing trip).
- BIF/KG = average (monthly) landing value in Burundi Francs per kg.

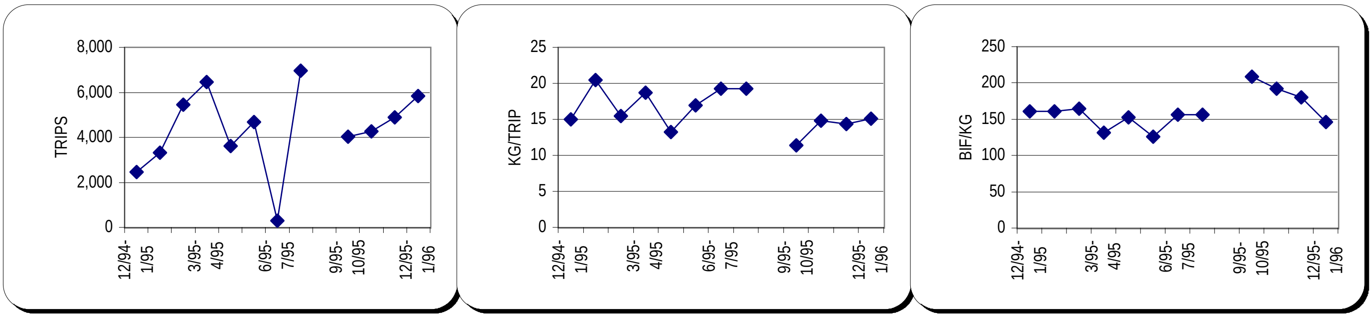

Figure 6A: Monthly number of trips, CPUE and landing value for the traditional fishery, Burundi (CAS, 1995).

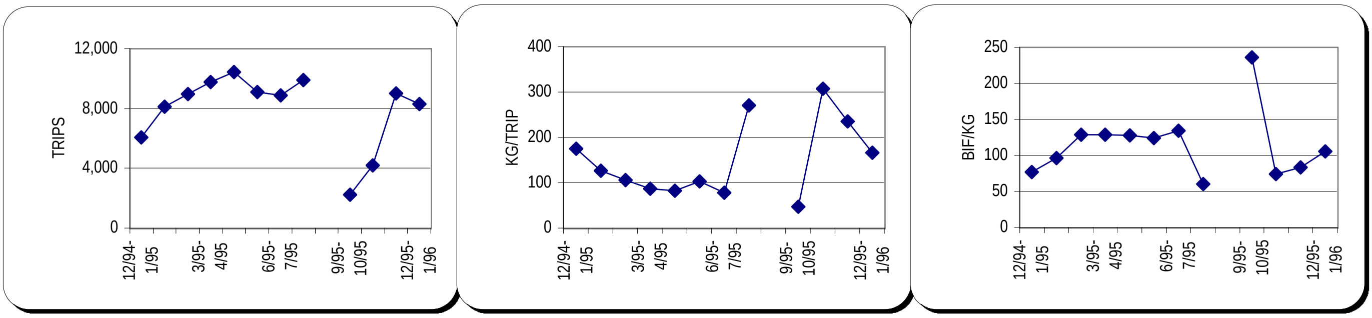

Figure 6B: Monthly number of trips, CPUE and landing value for the catamaran liftnet fishery, Burundi (CAS, 1995).

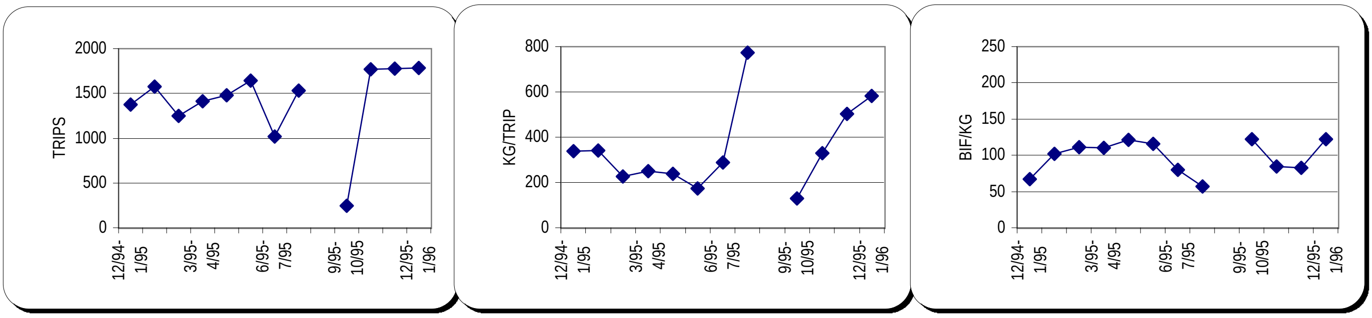

Figure 6C: Monthly number of trips, CPUE and landing value for the apollo liftnet fishery, Burundi (CAS, 1995).

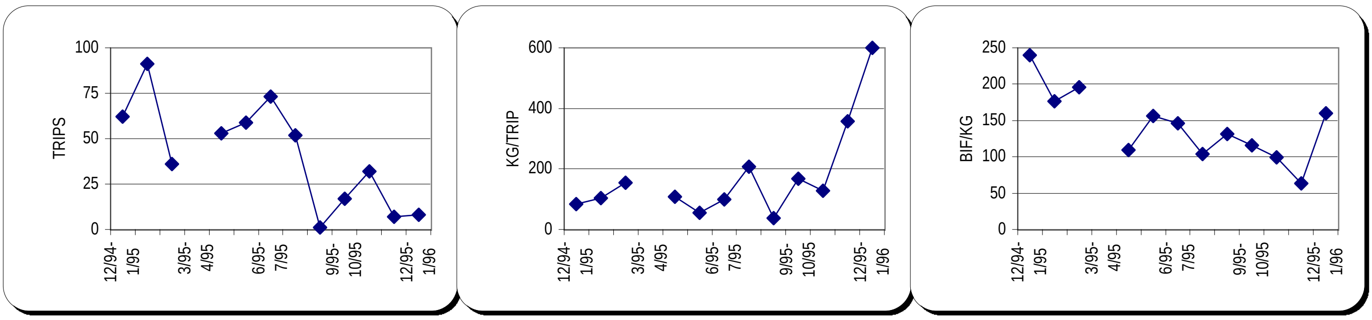

Figure 6D: Monthly number of trips, CPUE and landing value for the industrial fishery, Burundi (CAS, 1995).

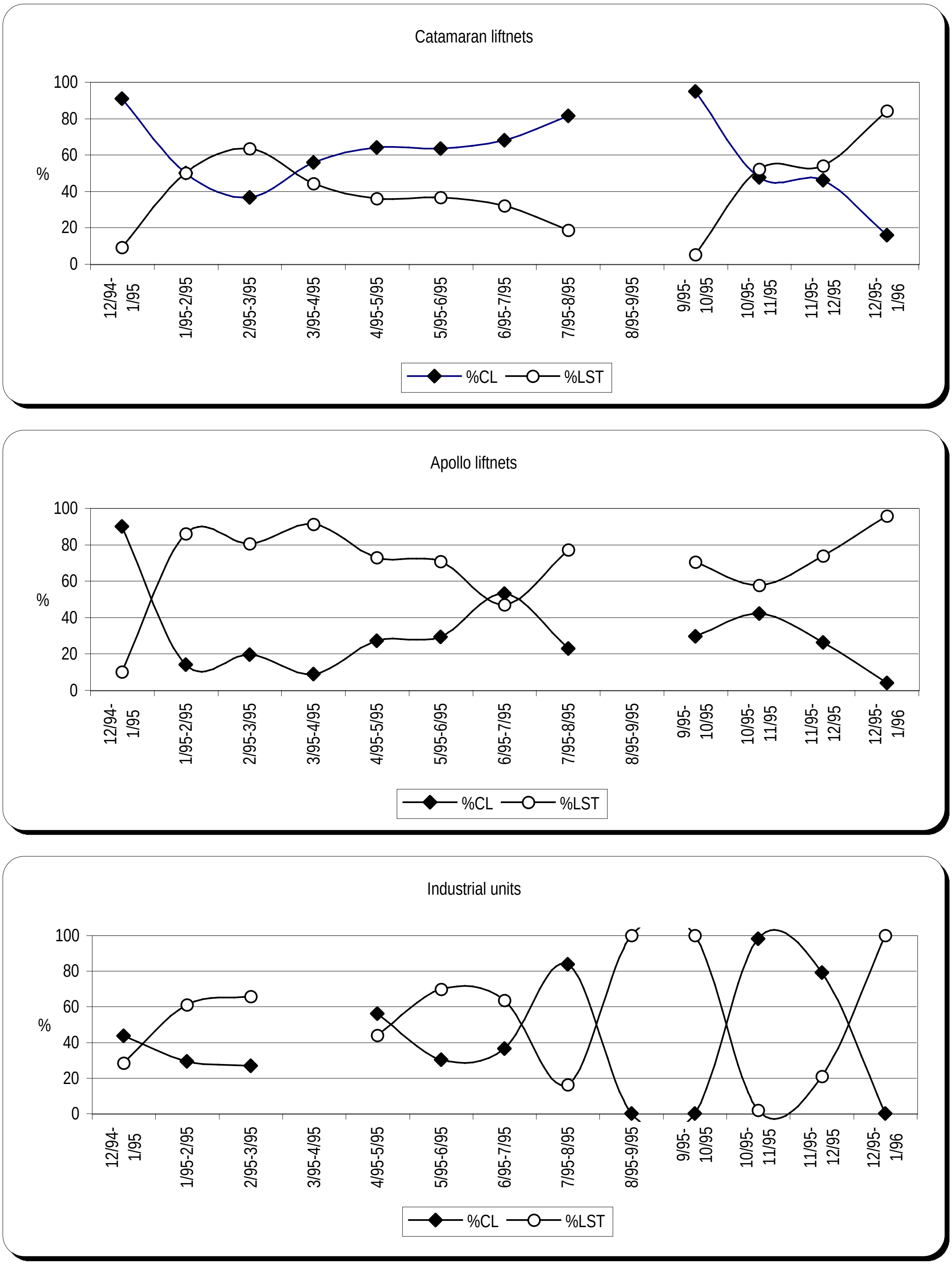

Figure 7: Monthly catch composition (%) for different types of fishing, Burundi (CAS, 1995).

PERIOD	TRIPS	CATCH CATF	CATCH CICHL	CATCH CLUP	CATCH L.ANG.	CATCH L.M/M	CATCH OTH.	CATCH TOTAL	VALUE TOTAL
06/01-04/02/96	3,963	3.6	8.1	8.4	0.7	0.9	25.6	47.3	10,976
05/02-05/03/96	2,649	3.9	7.6	0.7	0.6	0.7	33.3	46.8	9,508
06/03-04/04/96									
05/04-03/05/96				LAKE CLOSED FOR FISHING					
04/05-01/06/96									
02/06-01/07/96				AND/OR					
02/07-30/07/96									
31/07-28/08/96				NO DATA COLLECTION POSSIBLE					
29/08-27/09/96									
28/09-26/10/96									
27/10-25/11/96	155	0.4	0.5	0.0	0.0	0.1	1.7	2.7	415
26/11-24/12/96	10,080	2.5	16.8	0.3	0.1	0.5	174.1	194.3	72,850
TOTAL 96	**16,847**	**10.4**	**32.9**	**9.5**	**1.4**	**2.2**	**234.8**	**291.1**	**93,748**

PERIOD	KG/TR. CATF	KG/TR. CICHL	KG/TR. CLUP	KG/TR. L.ANG.	KG/TR. L.M/M	KG/TR. OTH.	KG/TR. TOTAL	BIF/KG TOTAL
06/01-04/02/96	0.9	2.0	2.1	0.2	0.2	6.5	11.9	232
05/02-05/03/96	1.5	2.9	0.3	0.2	0.3	12.6	17.7	203
06/03-04/04/96								
05/04-03/05/96				LAKE CLOSED FOR FISHING				
04/05-01/06/96								
02/06-01/07/96				AND/OR				
02/07-30/07/96								
31/07-28/08/96				NO DATA COLLECTION POSSIBLE				
29/08-27/09/96								
28/09-26/10/96								
27/10-25/11/96	2.8	2.9	0.0	0.0	0.4	11.1	17.2	156
26/11-24/12/96	0.2	1.7	0.0	0.0	0.1	17.3	19.3	375
TOTAL 96	**0.6**	**2.0**	**0.6**	**0.1**	**0.1**	**13.9**	**17.3**	**322**

Table 6: Fishing effort, total catch and catch by species(group), CPUE and average price per kg by species(group) for the traditional fishery, Burundi, Lake Tanganyika (CAS 1996).

- CATCH and value (VAL.) expressed in tonnes and '000 Burundi Francs (BIF), respectively (upper table only).
- CATF, CICHL, CLUP, L.ANG., L.M/M, OTH. = Catfish, Cichlids, Clupeids, Lates angustifrons, Lates mariae & L. microlepis and Other species.
- TR. = fishing trip (CPUE = KG/TR. = average (monthly) catch per fishing trip)
- BIF/KG = average (monthly) landing value in Burundi Francs per kg.

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.
06/01-04/02/96	6,452	115,539	16,816,163	67,876	15,684,935	212,558	29,446,770	278,939	45,826,814	61	32,828	91	35,330	675,064	107,842,840
05/02-05/03/96	4,572	51,893	11,528,247	62,414	14,532,497	95,588	17,150,847	139,494	30,556,013	28	11,388	3,114	688,585	352,531	74,467,577
06/03-04/04/96															
05/04-03/05/96						**LAKE CLOSED FOR FISHING**									
04/05-01/06/96															
02/06-01/07/96						**AND/OR**									
02/07-30/07/96															
31/07-28/08/96						**NO DATA COLLECTION POSSIBLE**									
29/08-27/09/96															
28/09-26/10/96															
27/10-25/11/96	112	55,906	10,407,443	0	0	0	0	0	0	0	0	0	0	55,906	10,407,443
26/11-24/12/96	7,859	47,896	17,514,835	770,727	216,978,811	38,319	17,473,351	1,315	880,606	11	7,043	0	0	858,268	252,854,646
TOTAL 96	**18,995**	**271,234**	**56,266,688**	**901,017**	**247,196,243**	**346,465**	**64,070,968**	**419,748**	**77,263,433**	**100**	**51,259**	**3,205**	**723,915**	**1,941,769**	**445,572,506**

PERIOD	TOTAL BIF/KG	CLUPjuv. BIF/KG	CLUP BIF/KG	L.ST.juv. BIF/KG	L.ST. BIF/KG	L.SSP. BIF/KG	OTH. BIF/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.
06/01-04/02/96	160	146	231	139	164	538	388	104.6	17.9	10.5	32.9	43.2	0.0	0.0
05/02-05/03/96	211	222	233	179	219	407	221	77.1	11.4	13.7	20.9	30.5	0.0	0.7
06/03-04/04/96														
05/04-03/05/96						**LAKE CLOSED FOR FISHING**								
04/05-01/06/96														
02/06-01/07/96						**AND/OR**								
02/07-30/07/96														
31/07-28/08/96						**NO DATA COLLECTION POSSIBLE**								
29/08-27/09/96														
28/09-26/10/96														
27/10-25/11/96	186	186						499.2	499.2	0.0	0.0	0.0	0.0	0.0
26/11-24/12/96	295	366	282	456	670	640		109.2	6.1	98.1	4.9	0.2	0.0	0.0
TOTAL 96	**229**	**207**	**274**	**185**	**184**	**513**	**226**	**102.2**	**14.3**	**47.4**	**18.2**	**22.1**	**0.0**	**0.2**

Table 7: Fishing effort, total catch and catch by species(group), CPUE and average price per kg by species(group) for the catamaran fishery, Burundi, Lake Tanganyika (CAS 1996).

- 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 = KG/TR. = average (monthly) catch per fishing trip).
- BIF/KG = average (monthly) landing value in Burundi Francs per kg.

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.
06/01-04/02/96	1,391	19,085	2,439,822	16,283	3,833,185	89,095	12,590,079	205,715	33,351,133	133	40,000	489	117,115	330,800	52,371,334
05/02-05/03/96	1,950	1,950	353,682	29,580	6,997,679	53,609	11,521,466	83,772	16,547,064	0	0	606	149,554	169,517	35,569,445
06/03-04/04/96															
05/04-03/05/96						LAKE CLOSED FOR FISHING									
04/05-01/06/96															
02/06-01/07/96						AND/OR									
02/07-30/07/96															
31/07-28/08/96						NO DATA COLLECTION POSSIBLE									
29/08-27/09/96															
28/09-26/10/96															
27/10-25/11/96	28	0	0	31,651	5,670,088	0	0	0	0	0	0	0	0	31,651	5,670,088
26/11-24/12/96	741	0	0	226,452	55,419,519	411	142,205	1,022	797,172	0	0	0	0	227,885	56,358,896
TOTAL 96	**4,110**	**21,035**	**2,793,504**	**303,966**	**71,920,471**	**143,115**	**24,253,750**	**290,509**	**50,695,369**	**133**	**40,000**	**1,095**	**266,669**	**759,853**	**149,969,763**

PERIOD	TOTAL BIF/KG	CLUPjuv. BIF/KG	CLUP BIF/KG	L.ST.juv. BIF/KG	L.ST. BIF/KG	L.SSP. BIF/KG	OTH. BIF/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.
06/01-04/02/96	158	128	235	141	162	301	239	237.8	13.7	11.7	64.1	147.9	0.1	0.4
05/02-05/03/96	210	181	237	215	198		247	86.9	1.0	15.2	27.5	43.0	0.0	0.3
06/03-04/04/96														
05/04-03/05/96						LAKE CLOSED FOR FISHING								
04/05-01/06/96														
02/06-01/07/96						AND/OR								
02/07-30/07/96														
31/07-28/08/96						NO DATA COLLECTION POSSIBLE								
29/08-27/09/96														
28/09-26/10/96														
27/10-25/11/96	179		179					1130.4	0.0	1130.4	0.0	0.0	0.0	0.0
26/11-24/12/96	247		245	346	780			307.5	0.0	305.6	0.6	1.4	0.0	0.0
TOTAL 96	**197**	**133**	**237**	**169**	**175**	**301**	**244**	**184.9**	**5.1**	**74.0**	**34.8**	**70.7**	**0.03**	**0.3**

Table 8: Fishing effort, total catch and catch by species(group), CPUE and average price per kg by species(group) for the apollo fishery, Burundi, Lake Tanganyika (CAS 1996).

- 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 = KG/TR. = average (monthly) catch per fishing trip).
- BIF/KG = average (monthly) landing value in Burundi Francs per kg.

			CLUPjuv.	CLUPjuv.	CLUP	CLUP	L.ST.juv.	L.ST.juv.	L.ST.	L.ST.	L.SPP.	L.SPP.	OTH.	OTH.	TOTAL	TOTAL
PERIOD	UNITS	TRIPS	CATCH	VAL.	CATCH	VAL.	CATCH	VAL.	CATCH	VAL.	CATCH	VAL.	CATCH	VAL.	CATCH	VAL.
06/01-04/02/96	1	10	0	0	350	76,500	225	56,500	88	45,500	450	144,000	0	0	1,113	322,500
05/02-05/03/96																
06/03-04/04/96																
05/04-03/05/96																
04/05-01/06/96						LAKE CLOSED FOR FISHING										
02/06-01/07/96																
02/07-30/07/96						AND/OR										
31/07-28/08/96																
29/08-27/09/96						NO DATA COLLECTION POSSIBLE										
28/09-26/10/96																
27/10-25/11/96																
26/11-24/12/96																
TOTAL 96	1	10	0	0	350	76,500	225	56,500	88	45,500	450	144,000	0	0	1,113	322,500

	TOTAL	CLUPjuv.	CLUP	L.ST.juv.	L.ST.	L.SSP.	OTH.	TOTAL	CLUPjuv.	CLUP	L.ST.juv.	L.ST.	L.SSP.	OTH.
PERIOD	BIF/KG	BIF/KG	BIF/KG	BIF/KG	BIF/KG	BIF/KG	BIF/KG	KG/TR.	KG/TR.	KG/TR.	KG/TR.	KG/TR.	KG/TR.	KG/TR.
06/01-04/02/96	290		219	251	517	320		111.3	0.0	35.0	22.5	8.8	45.0	0.0
05/02-05/03/96														
06/03-04/04/96														
05/04-03/05/96														
04/05-01/06/96						LAKE CLOSED FOR FISHING								
02/06-01/07/96														
02/07-30/07/96						AND/OR								
31/07-28/08/96														
29/08-27/09/96						NO DATA COLLECTION POSSIBLE								
28/09-26/10/96														
27/10-25/11/96														
26/11-24/12/96														
TOTAL 96	290		219	251	517	320		111.3	0.0	35.0	22.5	8.8	45.0	0.0

Table 9: Fishing effort, total catch and catch by species(group), CPUE and average price per kg by species(group) for the industrial fishery, Burundi, Lake Tanganyika (CAS 1996).

- 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 = KG/TR. = average (monthly) catch per fishing trip).
- BIF/KG = average (monthly) landing value in Burundi Francs per kg.

MONTH	CLUP	LA+M	LST	LMIC	OTH	TC	HAULS	LB	UNITS	COMP	TRIPS	KG/TRIP	KG/HAUL	%CLUP	%LST	%LSSP	%OTH
January-94	2.452	1.143	439.770	0.242	0.372	443.979	833	1,084	13	8	287	1,547.0	533.0	0.6	99.1	0.3	0.1
##########	4.449	7.649	267.927	0.585	0.157	280.767	1,004	1,118	14	9	378	742.8	279.6	1.6	95.4	2.9	0.1
March-94	3.524	1.672	290.147	0.293	0.259	295.895	1,023	1,246	13	7	413	716.5	289.2	1.2	98.1	0.7	0.1
April-94	2.884	3.473	385.595	0.272	0.046	392.270	899	1,150	14	8	362	1,083.6	436.3	0.7	98.3	1.0	0.0
May-94	3.207	6.821	456.845	0.382	1.483	468.738	933	1,127	14	8	386	1,214.3	502.4	0.7	97.5	1.5	0.3
June-94	1.220	0.346	223.540	0.014	1.304	226.424	563	769	12	7	242	935.6	402.2	0.5	98.7	0.2	0.6
July-94	10.543	0.944	111.900	0.151	0.340	123.878	377	592	11	5	170	728.7	328.6	8.5	90.3	0.9	0.3
August-94	11.332	1.885	100.180	0.214	0.907	114.518	720	919	13	7	293	390.8	159.1	9.9	87.5	1.8	0.8
##########	12.775	3.390	148.947	0.241	0.577	165.930	833	998	14	7	332	499.8	199.2	7.7	89.8	2.2	0.3
October-94	5.860	1.306	218.498	0.172	0.011	225.847	867	1,043	13	6	356	634.4	260.5	2.6	96.7	0.7	0.0
##########	9.675	2.329	307.861	0.217	2.435	322.517	975	1,174	19	8	412	782.8	330.8	3.0	95.5	0.8	0.8
##########	5.523	2.757	379.221	0.264	3.673	391.438	715	898	12	2	306	1,279.2	547.5	1.4	96.9	0.8	0.9
January-95	1.597	1.138	531.316	0.434	0.159	534.644	971	1134	18	8	377	1418.2	550.6	0.3	99.4	0.3	0.0
##########	6.455	1.613	308.565	0.601	0.027	317.261	889	1004	16	7	333	952.7	356.9	2.0	97.3	0.7	0.0
March-95	6.401	11.5915	278.623	2.421	1.574	300.6105	982	1208	18	8	405	742.2	306.1	2.1	92.7	4.7	0.5
April-95	2.619	51.159	212.584	1.659	2.264	270.285	1101	1237	18	8	420	643.5	245.5	1.0	78.7	19.5	0.8
May-95	6.673	1.876	355.206	0.103	3.341	367.199	1064	1278	20	10	407	902.2	345.1	1.8	96.7	0.5	0.9
June-95	1.843	0.883	88.564	0.01	1.401	92.701	577	718	17	8	200	463.5	160.7	2.0	95.5	1.0	1.5
July-95	0.069	0.037	55.22	0	0	55.326	362	422	9	5	143	386.9	152.8	0.1	99.8	0.1	0.0
August-95	0.633	0.742	117.059	0.013	0	118.447	508	634	13	7	204	580.6	233.2	0.5	98.8	0.6	0.0
##########	1.742	1.023	258.439	13.911	0.263	275.378	925	1102	17	9	365	754.5	297.7	0.6	93.8	5.4	0.1
October-95	4.824	2.764	153.515	0.05	0.144	161.297	1100	1241	19	10	416	387.7	146.6	3.0	95.2	1.7	0.1
##########	39.225	13.324	154.61	0.462	0.304	207.925	1090	1222	19	10	398	522.4	190.8	18.9	74.4	6.6	0.1
##########	33.603	4.035	195.85	0.326	0.096	233.910	1190	1308	19	9	422	554.3	196.6	14.4	83.7	1.9	0.0
January-96	0.868	0.954	299.205	0.307	0.264	301.598	999	1188	17	9	390	773.3	301.9	0.3	99.2	0.4	0.1
##########	0.961	0.658	168.248	0.243	2.597	172.707	817	1065	17	9	342	505.0	211.4	0.6	97.4	0.5	1.5
March-96	0.491	0.899	132.423	0.037	1.082	134.932	896	1039	17	8	333	405.2	150.6	0.4	98.1	0.7	0.8
April-96	0.452	0.322	128.364	0.037	1.106	130.281	864	986	17	9	320	407.1	150.8	0.3	98.5	0.3	0.8
May-96	0.536	0.874	351.906	0.038	6.373	359.727	1225	1264	19	8	443	812.0	293.7	0.1	97.8	0.3	1.8
June-96	0.2395	1.007	21.829	0.003	0.652	23.7305	290	371	12	4	128	185.4	81.8	1.0	92.0	4.3	2.7
July-96	0	0.889	0.006	0	0.252	1.147	31	34	1	1	17	67.5	37.0	0.0	0.5	77.5	22.0
August-96	5.566	0.224	2.101	0.021	0	7.912	272	328	7	3	76	104.1	29.1	70.3	26.6	3.1	0.0
##########	46.689	0.378	33.076	0.118	0.322	80.583	708	917	18	7	239	337.2	113.8	57.9	41.0	0.6	0.4
October-96	2.139	0.311	237.042	0.056	0	239.548	1205	1392	21	8	409	585.7	198.8	0.9	99.0	0.2	0.0
##########	4.999	1.221	166.198	0.019	0.289	172.726	1032	1286	21	8	383	451.0	167.4	2.9	96.2	0.7	0.2
##########	1.43	2.267	239.808	0.308	0.398	244.211	1097	1378	19	8	417	585.6	222.6	0.6	98.2	1.1	0.2
January-97	0.683	0.349	319.672	0.329	2.275	323.308	996	1166	18	8	366	883.4	324.6	0.2	98.9	0.2	0.7

Table 10: Summary of the industrial fishery characteristics in Mpulungu (Zambia) for the period 1/94-1/97.

- catches in tonnes (unless otherwise indicated); TC: total catch; number of LB (light boats), COMP (fishing companies)..
- CLUP: clupeids; LST: Lates stappersii; LMIC: Lates microlepis; OTH: other species.
- LA+M: Lates angustifrons + L. mariae; LSSP: all Lates species combined except for L. stappersii..

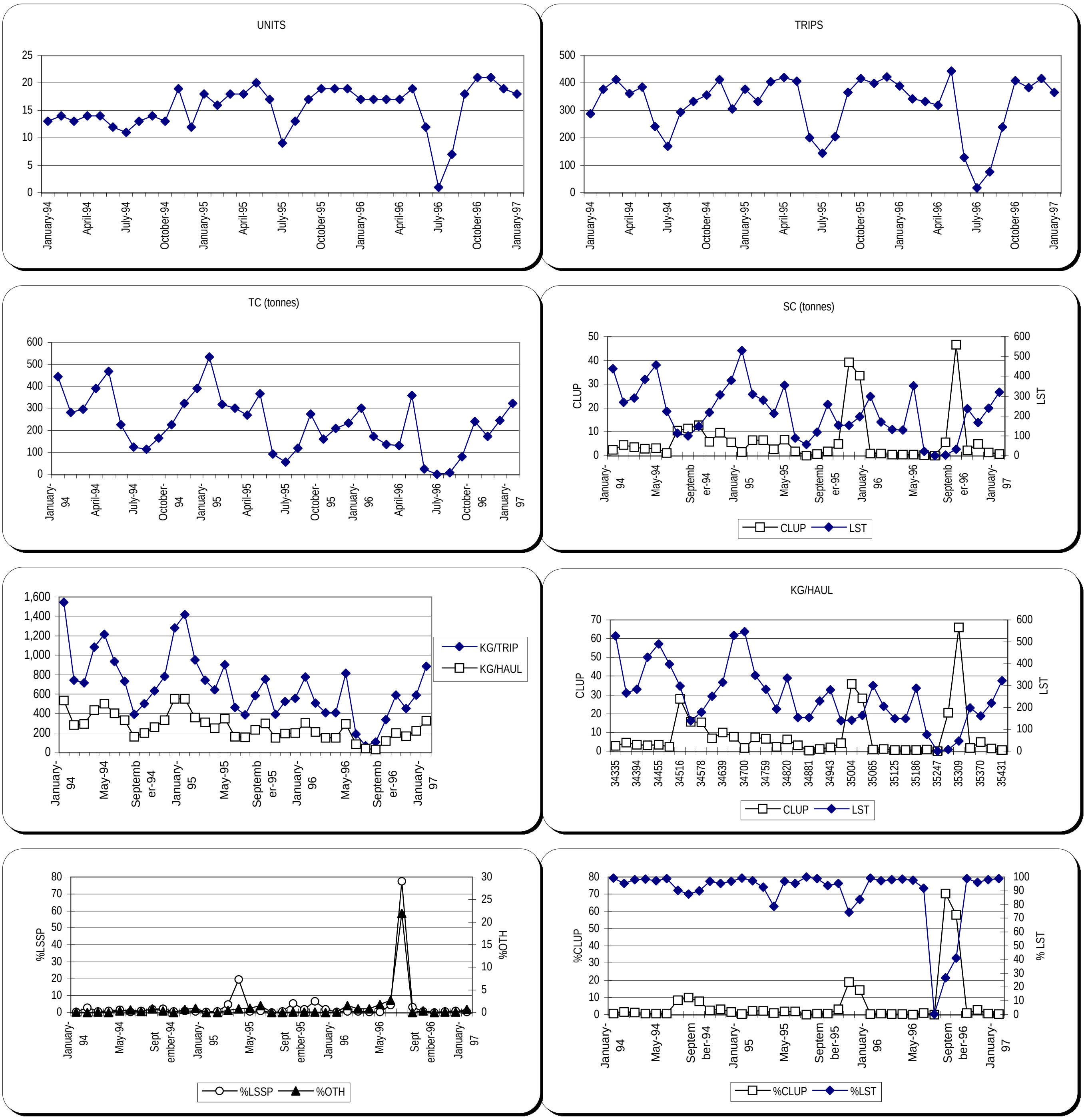

Figure 8: Visualisation of different characteristics of the industrial fishery in Mpulungu, Zambia (1/94-1/97).
TC = Total catch; SC = Catch per species(group).

MONTH	CLUP	LA+M	LST	LMIC	OTH	TC	HAULS	LB	UNITS	COMP	TRIPS	KG/TRIP	KG/HAUL	%CLUP	%LST	%LSSP	%OTH
########	0	0	8.211	0.007	0	8.218	14	15	3	1	5	1,643.6	587.0	0	99.9	0.1	0
########	0	0.009	8.579	0.024	0	8.612	32	31	5	2	11	782.9	269.1	0	99.6	0.4	0
March-94	0	0.063	11.005	0.014	0	11.172	42	48	5	2	16	698.3	266.0	1	98.5	0.7	0
April-94	0	0.025	10.470	0.004	0	10.499	34	41	4	1	12	874.9	308.8	0	99.7	0.3	0
May-94	0	0.000	2.708	0	0	2.708	23	23	4	1	8	338.5	117.7	0	100.0	0.0	0
June-94	0	0.016	4.729	0	0	4.745	23	29	4	1	9	527.2	206.3	0	99.7	0.3	0
July-94	1.174	0.013	6.364	0	0	7.551	79	36	4	2	20	377.6	95.6	15.5	84.3	0.2	0
########	0.182	0.140	2.989	0	0.011	3.322	35	42	4	1	13	255.5	94.9	5.5	90.0	4.2	0.3
########	0.165	0.107	2.528	0.013	0	2.813	33	33	3	1	11	255.7	85.2	5.9	89.9	4.3	0
########	0.143	0.093	14.974	0.010	0	15.220	39	51	4	2	14	1,087.1	390.3	0.9	98.4	0.7	0
########									**NO DATA RECEIVED**								
########	0.028	0.141	55.163	0.056	4.208	59.596	205	218	8	4	73	816.4	290.7	0	92.6	0.3	7.1
########	0.205	0.078	10.602	0	0	10.885	66	66	1	1	22	494.8	164.9	1.9	97.4	0.7	0
########	0.2	0	14.542	0	0	14.742	60	60	1	1	20	737.1	245.7	1.4	98.6	0	0
March-95	0	0	37.847	0	0	37.847	121	123	2	1	41	923.1	312.8	0	100.0	0	0
April-95	0	0	4.583	0	0	4.583	32	33	2	1	11	416.6	143.2	0	100.0	0	0
May-95	0	0	24.683	0	0	24.683	63	66	2	1	22	1122.0	391.8	0	100.0	0	0
June-95	0	0	1.064	0	0	1.064	11	12	2	1	44	24.2	96.7	0	100.0	0	0
July-95	0.011	0	1.248	0	0	1.259	11	12	2	1	4	314.8	114.5	0.9	99.1	0	0
########	0	0	1.114	0	0	1.114	12	12	2	1	4	278.5	92.8	0	100.0	0	0
########	0	0	6.337	0	0	6.337	23	24	3	1	10	633.7	275.5	0	100.0	0	0
########	0	0	1.383	0	0	1.383	24	24	2	1	8	172.9	57.6	0	100.0	0	0
########	0.709	0.013	2.873	0.019	0	3.614	24	24	1	1	8	451.8	150.6	19.6	79.5	0.9	0
########	0.054	0	3.239	0.004	0	3.297	24	24	2	1	8	412.1	137.4	1.6	98.2	0.1	0
########	0	0	5.167	0	0	5.167	15	15	1	1	5	1033.4	344.5	0	100.0	0	0
########																	
March-96																	
April-96																	
May-96									**NO DATA RECEIVED**								
June-96																	
July-96																	
########																	
########																	
########	43.606	12.811	7.079	1.015	0.716	65.227	85	144	2	1	45	1449.5	767.4	66.9	10.9	21.2	1.1
########	21.94	9.579	23.591	0.385	0.578	56.073	110	128	2	1	41	1367.6	509.8	39.1	42.1	17.8	1.0
########																	
########									**NO DATA RECEIVED**								

Table 11: Summary of the industrial fishery characteristics in Nsumbu (Zambia) for the period 1/94-1/97.

- catches in tonnes (unless otherwise indicated); TC: total catch; number of LB (light boats), COMP (fishing companies)..
- CLUP: clupeids; LST: Lates stappersii; LMIC: Lates microlepis; OTH: other species.
- LA+M: Lates angustifrons + L. mariae; LSSP: all Lates species combined except for L. stappersii..
- October-December 1996: no data received for industrial unit "Wicked Lady" of Isanga Bay.

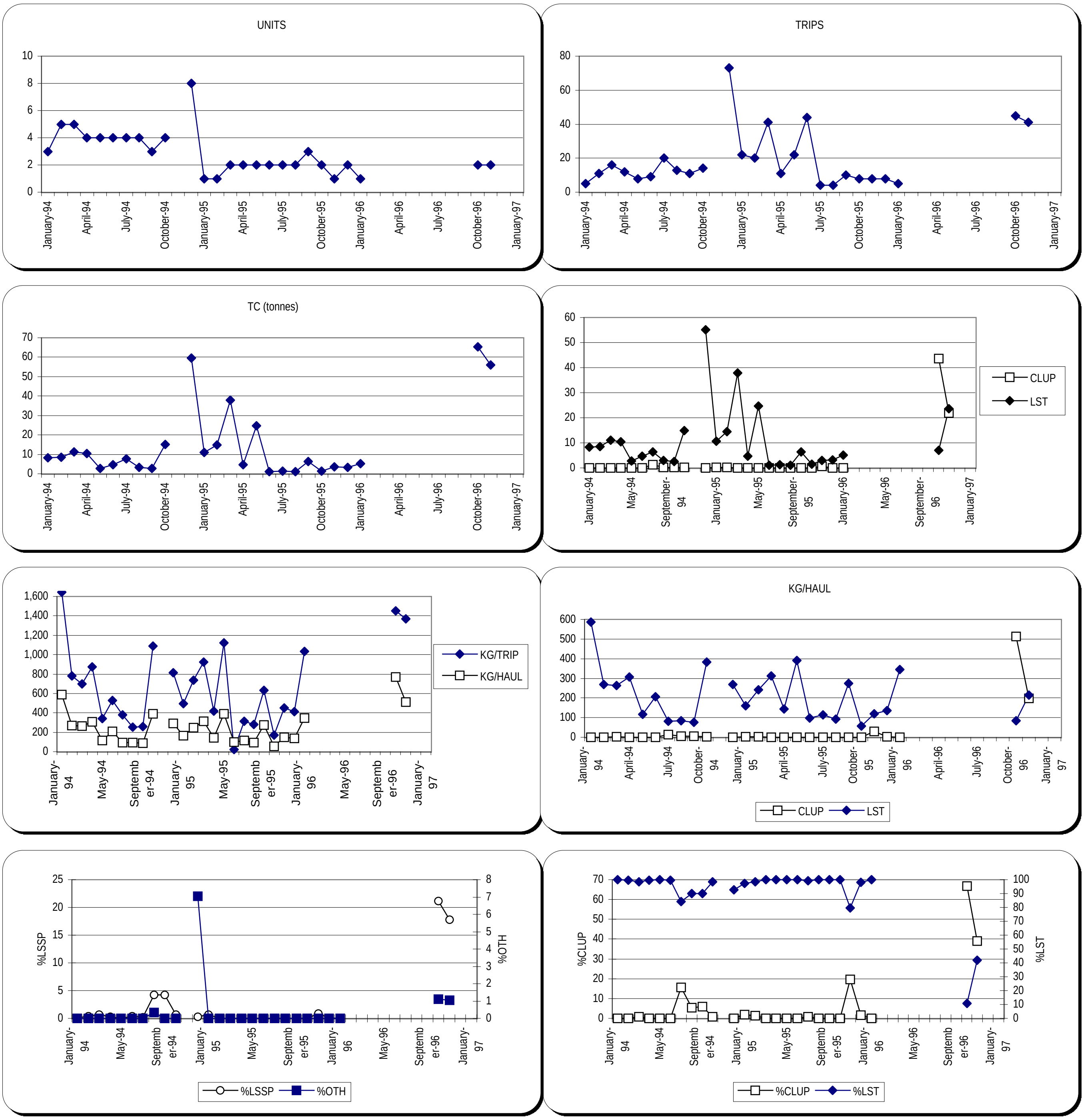

Figure 9: Visualisation of different characteristics of the industrial fishery in Nsumbu, Zambia (1/94-1/97).
TC = Total catch; SC = Catch per species(group).

MONTH	NIGHTS	TRIPS	UNITS	UNITS	UNITS	CLUP	LMI	STA	LST	OTH	TOTAL	M.A.	D.AV.	D.MED.	D.AV.	CLUP	LMI	STA	LST	OTH
	NR	NR	MaxM	MaxD	D.AV.	KG	KG	KG	KG	KG	KG	KG/TRIP	KG/TRIP	KG/TRIP	CL95	%	%	%	%	%
October-92	17	129	13	10	7.6	6,798	528	6,270	49,093	315	56,206	436	457	374	131	12.1	0.9	11.2	87.3	0.6
##########	19	196	15	13	10.3	22,902	2,068	20,834	216,348	3,171	242,421	1,237	1,258	1,093	282	9.4	0.9	8.6	89.2	1.3
##########	16	128	14	11	8.0	8,160	0	8,160	79,040	552	87,752	686	645	515	232	9.3	0.0	9.3	90.1	0.6
January-93	22	71	9	6	3.2	11,396	220	11,176	36,300	828	48,524	683	690	574	197	23.5	0.5	23.0	74.8	1.7
February-93	21	142	10	9	6.8	924	0	924	115,082	2,448	118,454	834	865	577	299	0.8	0.0	0.8	97.2	2.1
March-93	14	114	11	10	8.1	5,280	4,884	396	91,718	921	97,919	859	819	601	321	5.4	5.0	0.4	93.7	0.9
April-93	15	48	8	6	3.2	1,848	594	1,254	34,980	366	37,194	775	1,240	660	1,236	5.0	1.6	3.4	94.0	1.0
May-93	15	58	9	8	3.9	1,958	0	1,958	64,570	291	66,819	1,152	1,036	682	567	2.9	0.0	2.9	96.6	0.4
June-93	8	23	5	4	2.9	396	396	0	18,810	0	19,206	835	798	341	1,132	2.1	2.1	0.0	97.9	0.0
July-93	15	76	9	7	5.1	5,500	1,496	4,004	53,097	603	59,200	779	823	772	430	9.3	2.5	6.8	89.7	1.0
August-93	17	120	10	10	7.1	5,346	594	4,752	115,082	537	120,965	1,008	963	947	297	4.4	0.5	3.9	95.1	0.4
##########	14	103	11	10	7.4	3,300	1,188	2,112	50,864	237	54,401	528	522	394	202	6.1	2.2	3.9	93.5	0.4
October-93	15	66	8	6	4.4	2,486	550	1,936	53,108	339	55,933	847	910	655	556	4.4	1.0	3.5	94.9	0.6
##########	11	30	6	4	2.7	704	374	330	63,954	135	64,793	2,160	1,895	880	1,648	1.1	0.6	0.5	98.7	0.2
##########	11	21	5	4	1.9	0	0	0	19,756	120	19,876	946	1,090	880	495	0.0	0.0	0.0	99.4	0.6
January-94	14	35	5	5	2.5	858	88	770	24,068	390	25,316	723	705	572	250	3.4	0.3	3.0	95.1	1.5
February-94	18	35	5	3	1.9	660	484	176	12,408	857	13,925	398	386	277	152	4.7	3.5	1.3	89.1	6.2
March-94	17	62	7	5	3.6	968	924	44	65,934	57	66,959	1,080	1,129	880	503	1.4	1.4	0.1	98.5	0.1
April-94	16	34	7	6	2.1	726	0	726	31,350	0	32,076	943	1,289	754	1,330	2.3	0.0	2.3	97.7	0.0
May-94	13	32	5	5	2.5	308	308	0	28,136	0	28,444	889	978	858	425	1.1	1.1	0.0	98.9	0.0
June-94	13	41	6	5	3.2	88	88	0	47,234	984	48,306	1,178	1,109	693	602	0.2	0.2	0.0	97.8	2.0
July-94	13	35	6	5	2.7	0	0	0	31,812	456	32,268	922	957	616	680	0.0	0.0	0.0	98.6	1.4
August-94	16	42	4	4	2.6	0	0	0	31,614	954	32,568	775	764	567	376	0.0	0.0	0.0	97.1	2.9
##########	16	52	5	4	3.3	0	0	0	41,492	1,158	42,650	820	804	661	289	0.0	0.0	0.0	97.3	2.7
October-94	8	24	5	5	3.0	198	0	198	8,426	0	8,624	359	388	314	199	2.3	0.0	2.3	97.7	0.0
##########	17	46	4	4	2.7	0	0	0	29,832	0	29,832	649	644	600	173	0.0	0.0	0.0	100.0	0.0
##########	17	46	4	4	2.7	0	0	0	40,216	618	40,834	888	875	645	302	0.0	0.0	0.0	98.5	1.5
January-95	12	14		2	1.2	100	60	40	2,320	1,070	3,490	249	240	220	77	2.9	1.7	1.1	66.5	30.7
February-95	17	21		2	1.2	240	240	0	5,200	2,710	8,150	388	429	300	188	2.9	2.9	0.0	63.8	33.3
March-95	18	35		3	1.9	0	0	0	8,920	479	9,399	269	272	195	92	0.0	0.0	0.0	94.9	5.1
April-95										NO DATA AVAILABLE										
May-95	11	39		5	3.5	360	360	0	9,600	560	10,520	270	256	213	86	3.4	3.4	0.0	91.3	5.3
June-95	18	57		5	3.2	140	140	0	24,690	945	25,775	452	556	453	286	0.5	0.5	0.0	95.8	3.7
July-95	18	58		5	3.2	0	0	0	22,360	570	22,930	395	374	310	140	0.0	0.0	0.0	97.5	2.5
August-95	19	49		5	2.6	640	640	0	13,920	555	15,115	308	277	183	113	4.2	4.2	0.0	92.1	3.7
##########	21	63		5	3.0	1,620	440	1,180	20,060	840	22,520	357	374	340	115	7.2	2.0	5.2	89.1	3.7
October-95	17	49		5	2.9	0	0	0	13,510	345	13,855	283	278	210	127	0.0	0.0	0.0	97.5	2.5
##########	17	35		3	2.1	140	140	0	13,040	130	13,310	380	385	345	152	1.1	1.1	0.0	98.0	1.0
##########	20	87		7	4.4	760	760	0	36,280	845	37,885	435	383	339	97	2.0	2.0	0.0	95.8	2.2
January-96										NO DATA AVAILABLE										
February-96																				
March-96	18	72		6	4.0	220	220	0	29,360	315	29,895	415	377	340	159	0.7	0.7	0.0	98.2	1.1
April-96	18	81		6	4.5	0	0	0	32,780	1,350	34,130	421	427	374	111	0.0	0.0	0.0	96.0	4.0
May-96	16	55		6	3.4	0	0	0	25,100	385	25,485	463	552	324	262	0.0	0.0	0.0	98.5	1.5

Table 12: CAS data for the industrial fishery in Kalemie (Congo) for the period 10/92-5/96 (Data collected by D. Detsimas and ECN).

- NR = number; MaxM = maximum monthly number; MaxD = maximum daily number; D.AV. = daily average number.
- CLUP = clupeids; LMI = Limnothrissa miodon; STA = Stolothrissa tanganicae; LST = Lates stappersii; OTH = other species.
- M.A. = monthly average; D.A. = daily average; D.MED. = daily median; CL95 = 95% confidence limits.
- 2/94: no D. Detsimas data available, replaced by ECN data corrected for different average fish box and Lates spp. weights.

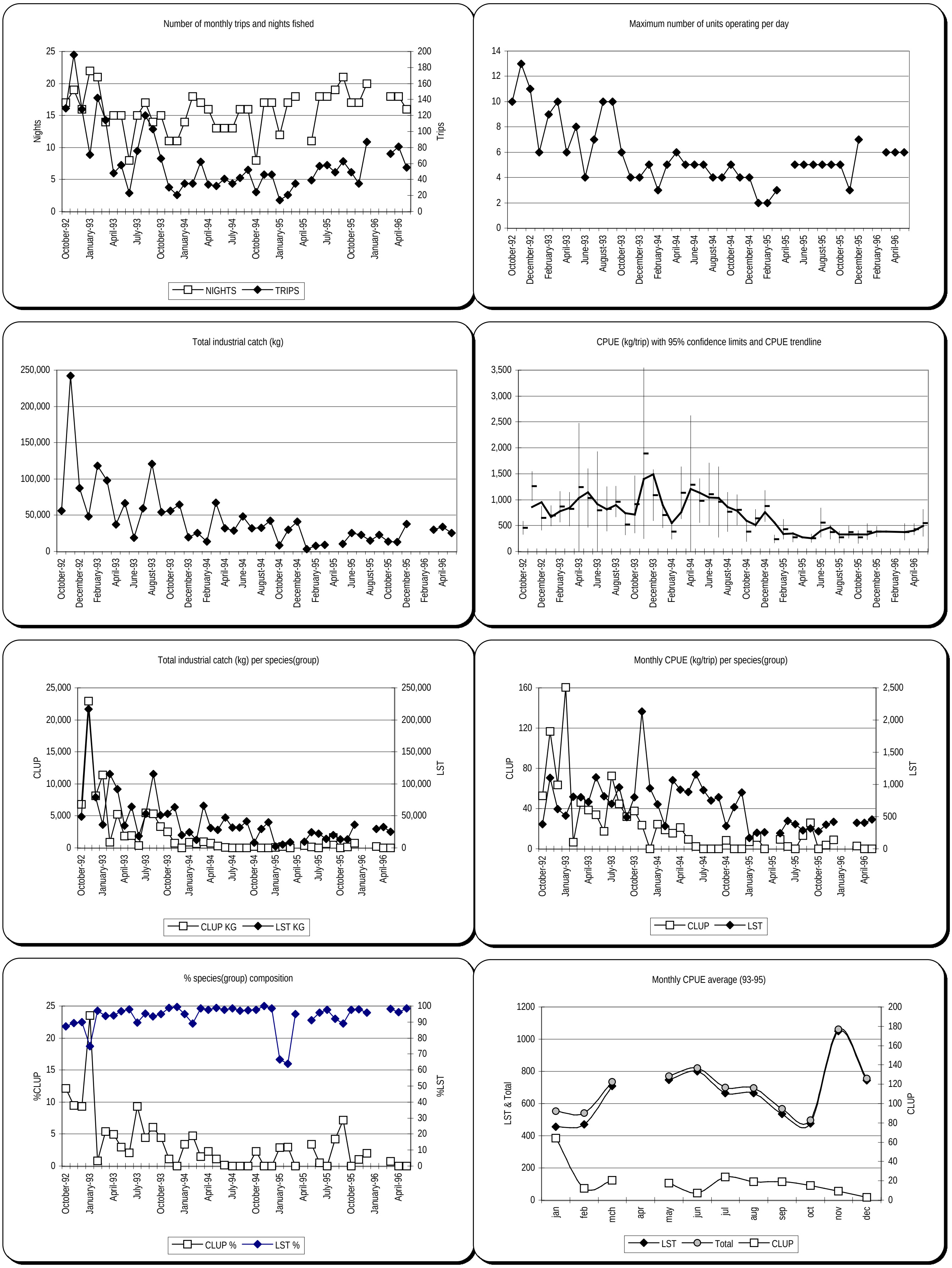

Figure 10: Visualisation of different characteristics for the industrial fishery in Kalemie, Congo (10/92-5/96).

Fishing cycles	Fishing nights	Active units	Fishing trips	*Luciol. stappers.*	*Stolot. tangan.*	*Lates spp.*	*Limnot. miodon*	TOTAL CATCH	CPUE kg/trip
Jul-94	3	1	3	1780	0	0	0	1780	593.3
Aug-94	5	1	5	1760	0	0	0	1760	352.0
9/94-9/95		NO DATA AVAILABLE AND/OR NO UNITS OPERATIONAL							
oct/95	10	1	10	10620	0	0	0	10620	1062.0
Nov-95	13	1	13	6820	0	0	0	6820	524.6
Dec-95	13	1	13	9540	0	0	0	9540	733.8
Jan-96	18	1	18	18220	0	0	0	18220	1012.2
Feb-96	16	1	16	20860	0	0	0	20860	1303.8
Mar-96	16	1	16	6620	0	0	0	6620	413.8
Apr-96	15	1	15	11240	0	0	0	11240	749.3
9 cycles	**109**	**9**	**109**	**87460**	**0**	**0**	**0**	**87460**	**kg**
Average number of industrial fishing trips per cycle:								12.1	trips
Average catch per industrial fishing unit per night (CPUE):								802.4	kg
Average total catch per cycle:								9717.8	kg
Average number of active units per cycle:								1.0	units
Average number of active fishing nights per cycle:								12.1	nights

Table 13: CAS data for the industrial fishery in Moba, Congo (source: ECN).

MONTH	AREA	TRIPS	CLUP	LST	TOTAL	KG/TRIP	%CLUP	%LST
###########	Lusambo	87	16067	0	16067	184.7	100.0	0.0
January-93	Lusambo	89	8273	143	8416	94.6	98.3	1.7
February-93	Lusambo	68	6923	338	7261	106.8	95.3	4.7
March-93	Lusambo	54	8933	0	8933	165.4	100.0	0.0
April-93	Dine	83	9398	608	10006	120.6	93.9	6.1
May-93	Dine/Baraka	67	4496	0	4496	67.1	100.0	0.0
TOTAL		**448**	**54090**	**1089**	**55179**	**123.2**	**98.0**	**2.0**

Table 14: CAS data for 4 catamaran units in Fizi District, Congo (source: Mzani).

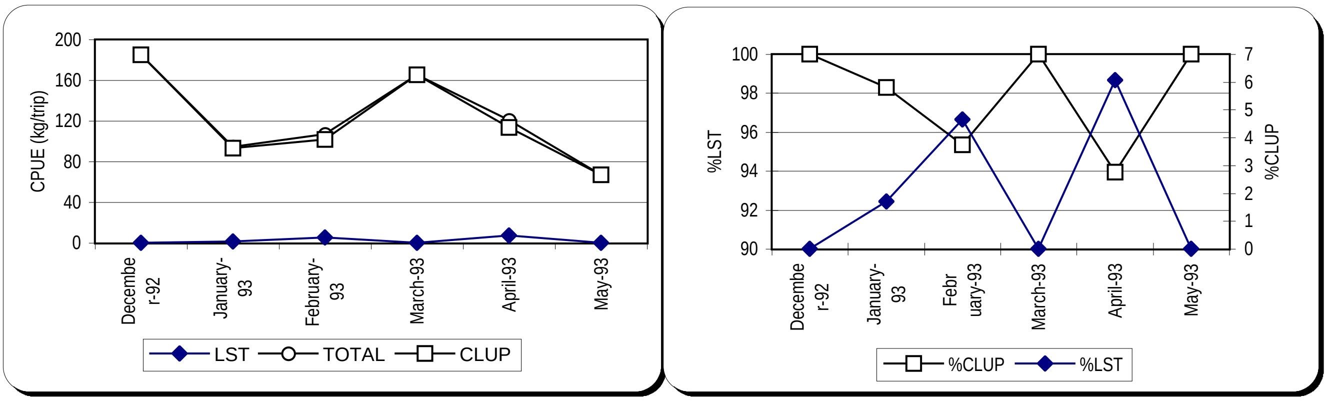

Figure 11: CPUE and species composition, catamaran units Fizi, Congo (source: Mzani).

Month	N	meanC	95cl	meanH	medC	meanC/H	meanL	mLMI	mSTA	mCLUP	mLST	%LMI	%STA	%CLUP	%LST
July-93	7	71.4	79.9	2.0	50.0	35.7	7.9	1.3	45.7	47.0	21.8	1.8	66.5	68.4	31.6
August-93	5	385.0	130.7	3.6	350.0	106.9	5.8	13.8	322.4	336.2	1.9	4.1	95.4	99.4	0.6
September-93	6	75.0	94.3	4.3	27.5	17.3	6.5	6.9	67.3	74.2	0.0	9.3	90.7	100.0	0.0
October-93	6	40.8	22.6	3.2	40.0	12.9	7.5	4.9	8.8	13.7	26.1	12.3	22.2	34.5	65.5
November-93	14	23.6	12.8	2.4	15.0	10.0	5.9	5.9	6.4	12.3	10.7	25.6	27.7	53.3	46.7
December-93	15	8.0	2.9	2.5	5.0	3.2	5.3	7.7	0.1	7.9	0.0	98.2	1.8	100.0	0.0
January-94	12	24.9	21.3	2.1	8.5	12.0	5.4	20.2	4.6	24.8	0.0	81.4	18.6	100.0	0.0
February-94	16	17.6	8.0	2.0	10.0	8.8	5.4	3.7	13.2	16.9	13.2	12.4	43.8	56.2	43.8
March-94	14	14.3	8.5	1.6	7.0	9.0	5.5	8.6	5.0	13.6	0.6	60.3	35.2	95.5	4.5
April-94	11	43.2	25.9	3.0	40.0	14.4	4.8	2.3	47.2	49.5	0.0	4.7	95.3	100.0	0.0
May-94	15	37.9	14.6	2.1	40.0	17.8	5.3	4.6	25.9	30.5	0.3	14.9	84.1	99.0	1.0
June-94	17	14.2	6.9	2.1	10.0	6.9	5.4	6.3	7.5	13.8	0.0	45.9	54.0	99.9	0.1
July-94	16	19.3	11.8	1.9	10.0	10.3	6.3	12.8	6.0	18.8	0.0	68.2	31.8	100.0	0.0
August-94	16	148.9	121.3	2.7	50.0	55.4	6.8	11.4	126.3	137.6	5.0	8.0	88.5	96.5	3.5
September-94	20	54.9	34.3	2.9	25.0	19.2	5.4	4.1	47.5	51.6	2.9	7.6	87.1	94.8	5.2
October-94	13	105.8	85.6	2.3	30.0	45.8	7.2	42.2	60.5	102.7	0.2	41.1	58.8	99.9	0.1
November-94	14	86.6	35.8	2.7	85.0	31.9	6.9	18.7	67.9	86.6	0.0	21.6	78.4	100.0	0.0
December-94	17	121.0	44.7	2.7	100.0	44.7	7.3	2.7	110.7	113.4	6.5	2.3	92.3	94.5	5.5
January-95	14	83.7	35.3	2.0	61.0	41.9	6.3	8.5	72.8	81.3	2.4	10.1	87.0	97.1	2.9
February-95	10	56.0	26.5	2.3	40.0	24.3	7.5	20.2	35.8	56.0	0.0	36.1	63.9	100.0	0.0
March-95	11	43.9	46.2	2.6	18.0	16.7	7.5	13.5	30.2	43.7	0.2	30.7	68.8	99.5	0.5
April-95	14	58.5	31.5	2.0	31.5	29.2	7.4	6.2	49.1	55.3	2.6	10.8	84.7	95.5	4.5
May-95	14	71.1	56.4	1.9	35.0	38.3	7.3	9.6	61.5	71.1	0.0	13.6	86.4	100.0	0.0
June-95	20	74.3	26.5	2.0	60.0	38.1	7.2	20.2	54.7	74.9	0.0	26.9	73.1	100.0	0.0
July-95	15	161.3	114.9	2.9	60.0	56.3	7.1	14.4	147.1	161.4	0.0	8.9	91.1	100.0	0.0
August-95							NO DATA AVAILABLE								
September-95	4	32.5	20.8	2.5	27.5	13.0	6.5	8.1	24.4	32.5	0.0	25.0	75.0	100.0	0.0
October-95	20	169.9	97.2	2.2	90.0	79.0	7.9	92.8	69.1	161.9	6.9	55.0	40.9	95.9	4.1
November-95	16	201.4	110.3	2.6	130.2	78.6	8.1	9.8	188.6	198.4	0.6	4.9	94.8	99.7	0.3
December-95	20	29.3	14.4	1.5	20.0	19.5	8.7	11.8	17.1	29.0	0.0	40.8	59.2	100.0	0.0
January-96	16	16.2	8.7	1.9	13.5	8.6	5.8	10.3	5.9	16.2	0.0	63.5	36.5	100.0	0.0
February-96	15	116.1	99.3	2.5	40.0	45.8	6.3	23.9	91.9	115.8	0.0	20.6	79.4	100.0	0.0
March-96	6	7.2	6.1	1.3	4.0	5.4	6.0	2.6	4.6	7.1	0.0	35.9	64.1	100.0	0.0
April-96															
May-96							NO DATA AVAILABLE								
June-96															
MonthAv	**32**	**75.4**	**27.5**	**2.4**	**55.4**	**29.9**	**6.6**	**13.4**	**57.0**	**70.5**	**3.2**	**28.2**	**64.9**	**93.1**	**6.9**
UnitAv	**426**	**71.6**	**11.9**	**2.3**	**30.0**	**30.9**	**6.6**	**15.2**	**54.4**	**69.7**	**1.9**	**21.0**	**76.0**	**97.0**	**3.0**

Table 15: Fish biology sampling, liftnets, Bujumbura, monthly characteristics of units sampled.

N = number of units sampled; meanC = mean monthly catch (kg); 95cl = 95 % confidence limits of meanC; medC = median monthly catch (kg).
meanC/H = mean monthly catch/haul (kg); meanL = mean monthly number of fishing lights.
mLMI, mSTA, mCLUP, mLST = mean monthly catch per unit (kg) for L. miodon, S. tanganicae, clupeids and L. stappersii.
%SPECIES ABBR. = percentage contribution of the species in question to the total monthly meanC.

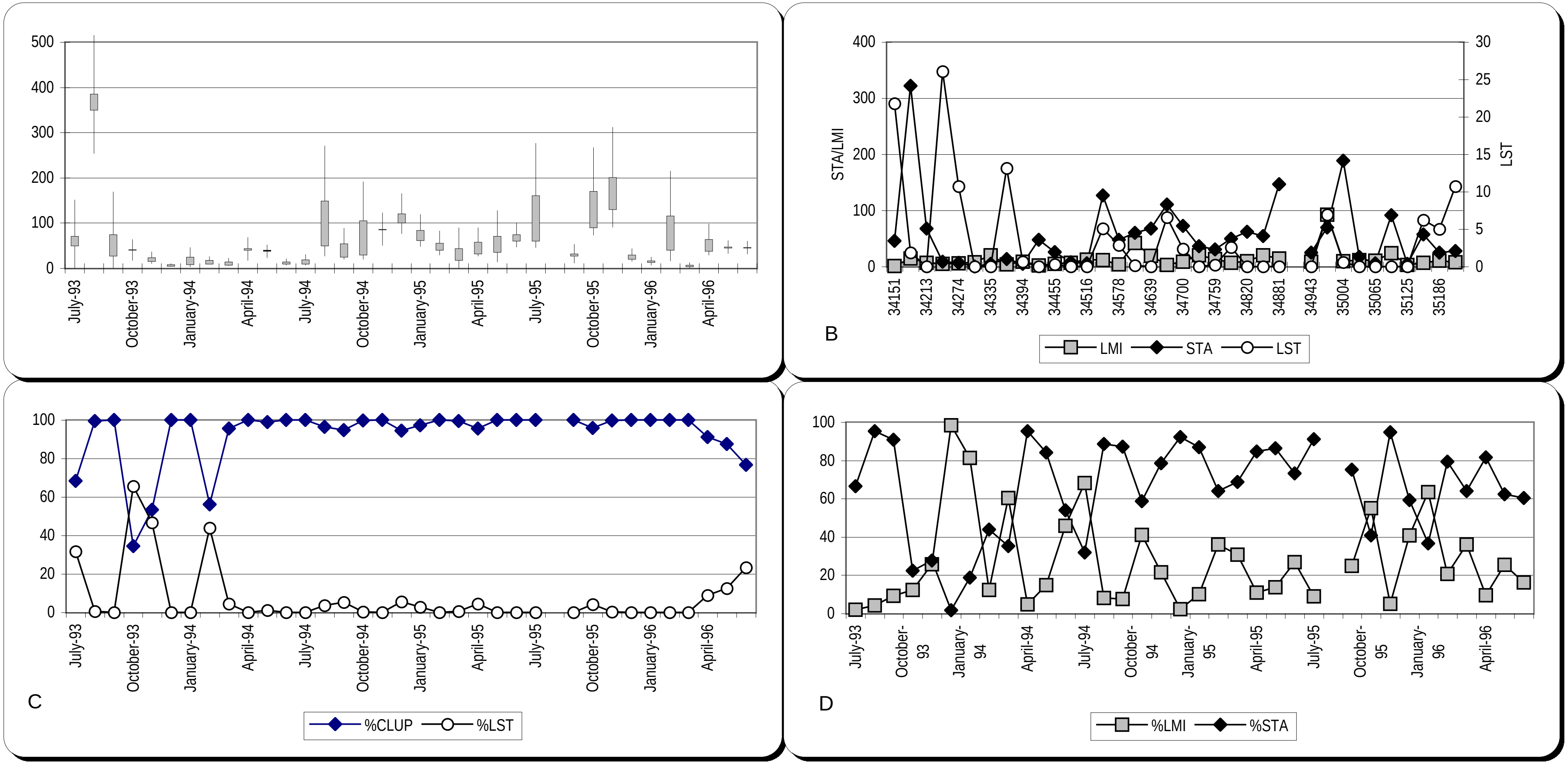

Figure 12: Fish biology sampling, liftnets, Bujumbura, monthly characteristics of units sampled.
A = monthly CPUE as median and mean with 95% confidence limits.
B = monthly mean CPUEs per species.
C = monthly % species composition, clupeids and Lates stappersii.
D = monthly % species composition, Stolothrissa tanganicae and Limnothrissa miodon.

Areas compared	CPUEtotal	CPUElmi	CPUEsta	CPUElst
BUJ-UV	**0,546*** n=31	-0.073 n=31	**0,515*** n=31	-0.134 n=31
BUJ-KAR	**0,403**** n=30	-0.007 n=30	0.269 n=30	-0.047 n=30
BUJ-KIG	-0.027 n=32	0.215 n=32	0.128 n=32	-0.123 n=32
UV-KAR	0.177 n=31	0.013 n=31	**0,476*** n=31	-0.128 n=31
UV-KIG	-0.181 n=35	0.217 n=35	-0.041 n=35	**0,322***** n=35
KAR-KIG	0.26 n=31	0.061 n=31	0.034 n=31	-0.179 n=31
KIG-KAL	0.118 n=29	0.053 n=29	-0.29 n=29	- -

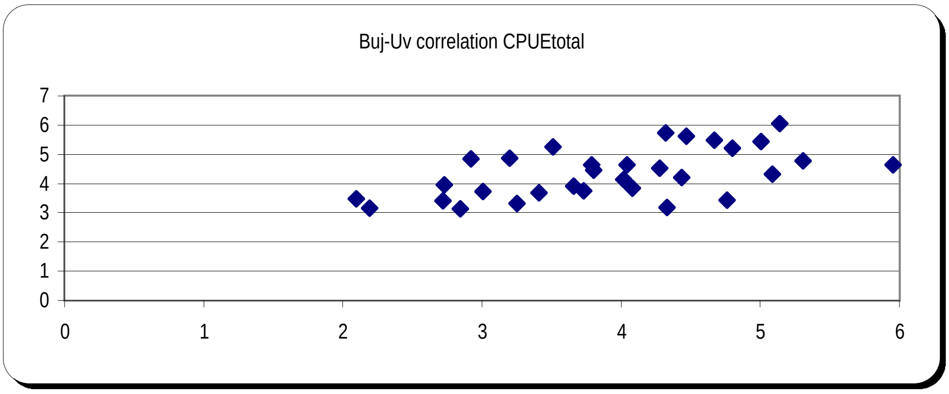

Table 16: Results of correlation analysis (r values) between LN transformed CPUEs (total and species) from adjacent fishing areas and example figure for the CPUEtotal between Bujumbura and Uvira.

* P<0,01
** P<0,025
*** P<0,05

BU = Bujumbura
UV = Uvira
KAR = Karonda
KIG = Kigoma
KAL = Kalemie

lmi = L. miodon
sta = S. tanganicae
lst = L. stappersii

Month	N	meanC	95cl	meanH	medC	meanC/H	meanL	mLMI	mSTA	mCLUP	mLST	%LMI	%STA	%CLUP	%LST
July-93							NO DATA AVAILABLE								
August-93	4	101.3	132.3	3.0	67.5	33.8	5.3	19.5	74.6	94.1	3.6	20.0	76.4	96.3	3.7
September-93	5	22.7	9.2	2.8	22.5	8.1	5.3	17.5	0.3	17.8	3.2	83.2	1.5	84.8	15.2
October-93	4	41.4	46.7	1.8	39.4	23.7	5.5	33.4	6.7	40.1	0.9	81.4	16.4	97.8	2.2
November-93	6	128.3	77.2	2.7	137.5	48.1	5.3	12.8	57.3	70.0	54.8	10.2	45.9	56.1	43.9
December-93	4	22.2	18.3	1.8	22.5	12.7	5.0	7.0	9.5	16.5	5.7	31.4	42.9	74.3	25.7
January-94	4	26.1	24.0	1.3	22.5	20.9	5.3	13.8	5.8	19.6	5.6	54.8	23.0	77.8	22.2
February-94	5	123.8	77.9	2.2	135.0	56.3	5.8	13.1	99.2	112.3	7.4	10.9	82.8	93.8	6.2
March-94	7	51.1	40.2	1.9	45.0	27.5	6.3	11.8	12.1	23.9	27.0	23.2	23.7	47.0	53.0
April-94	9	100.3	72.6	2.1	60.0	47.5	6.8	10.0	74.2	84.2	16.1	10.0	74.0	84.0	16.0
May-94	16	48.7	20.2	2.3	39.4	21.7	6.6	0.8	35.1	35.9	11.0	1.7	74.8	76.5	23.5
June-94	10	28.8	7.7	2.1	33.8	13.7	5.9	4.0	23.1	27.1	1.6	13.8	80.5	94.3	5.7
July-94	16	40.5	23.2	2.1	26.3	19.1	6.9	0.8	35.2	35.9	2.9	2.0	90.4	92.4	7.6
August-94	13	227.0	126.0	2.1	135.0	109.3	6.2	1.8	221.3	223.1	0.4	0.8	99.0	99.8	0.2
September-94	18	60.5	27.0	2.1	45.0	29.4	6.7	2.5	36.1	38.6	21.8	4.2	59.7	63.9	36.1
October-94	14	237.0	129.4	1.9	167.5	122.9	6.5	2.1	225.0	227.1	9.8	0.9	95.0	95.9	4.1
November-94	12	274.4	144.8	2.3	250.0	121.9	7.6	6.2	268.3	274.5	0.1	2.3	97.7	100.0	0.0
December-94	16	178.6	100.5	2.1	100.0	86.6	8.7	2.0	179.9	181.9	2.3	1.1	97.6	98.7	1.3
January-95	15	64.7	23.7	2.2	50.0	29.4	8.5	3.9	60.2	64.1	0.2	6.1	93.6	99.6	0.4
February-95	10	101.3	55.4	1.9	50.0	53.3	7.3	5.1	10.3	15.3	88.1	4.9	9.9	14.8	85.2
March-95	17	84.9	90.8	2.1	45.0	40.1	7.5	7.6	58.7	66.4	18.6	9.0	69.1	78.1	21.9
April-95	9	44.9	16.5	2.1	37.5	21.3	8.1	4.2	19.2	23.4	21.5	9.4	42.7	52.1	47.9
May-95	16	89.7	30.4	1.9	85.0	47.8	8.8	0.0	62.7	62.7	27.0	0.0	69.9	69.9	30.1
June-95	17	302.1	374.2	2.1	75.0	142.7	8.0	52.3	61.1	113.4	188.7	17.3	20.2	37.5	62.5
July-95	14	73.9	54.9	1.9	31.3	38.3	6.7	7.1	62.3	69.3	4.3	9.6	84.6	94.2	5.8
August-95	16	199.9	74.8	2.3	195.5	86.4	7.9	0.0	176.5	176.5	23.3	0.0	88.3	88.3	11.7
September-95	11	187.5	71.9	1.9	200.0	98.2	8.4	4.7	6.3	11.1	163.7	2.7	3.6	6.3	93.7
October-95	20	423.0	177.1	3.1	375.0	138.7	7.2	2.4	393.2	395.5	29.3	0.6	92.5	93.1	6.9
November-95	19	115.7	54.8	1.9	75.0	59.4	7.3	1.1	95.0	96.0	19.7	0.9	82.1	83.0	17.0
December-95	13	38.1	13.7	2.1	37.5	18.3	6.6	6.3	13.4	19.7	18.4	16.5	35.2	51.6	48.4
January-96	6	21.5	16.0	1.7	22.5	12.9	6.5	7.9	13.6	21.5	0.0	36.8	63.2	100.0	0.0
February-96	11	29.7	6.9	2.0	25.0	14.9	6.8	6.2	21.0	27.2	2.9	20.6	69.8	90.4	9.6
March-96	15	31.0	14.2	2.4	25.0	12.9	6.7	9.4	4.5	13.9	19.8	27.9	13.4	41.2	58.8
April-96	14	63.9	34.1	1.8	37.5	35.5	5.7	6.7	57.3	64.0	6.2	9.5	81.6	91.2	8.8
May-96	13	47.5	14.0	1.8	45.0	26.4	7.2	10.2	25.1	35.3	5.0	25.3	62.3	87.6	12.4
June-96	14	46.2	14.4	2.0	45.0	23.1	7.6	7.5	27.7	35.2	10.7	16.3	60.3	76.7	23.3
MonthAv	**35**	**105.1**	**32.4**	**2.1**	**64.7**	**48.6**	**6.8**	**8.6**	**72.3**	**81.0**	**23.5**	**16.2**	**60.7**	**76.8**	**23.2**

Table 17: Fish biology sampling, liftnets, Uvira, monthly characteristics of units sampled.

N = number of units sampled; meanC = mean monthly catch (kg); 95cl = 95 % confidence limits of meanC; medC = median monthly catch (kg).

meanC/H = mean monthly catch/haul (kg); meanL = mean monthly number of fishing lights.

mLMI, mSTA, mCLUP, mLST = mean monthly catch per unit (kg) for L. miodon, S. tanganicae, clupeids and L. stappersii.

%SPECIES ABBR. = percentage contribution of the species in question to the total monthly meanC.

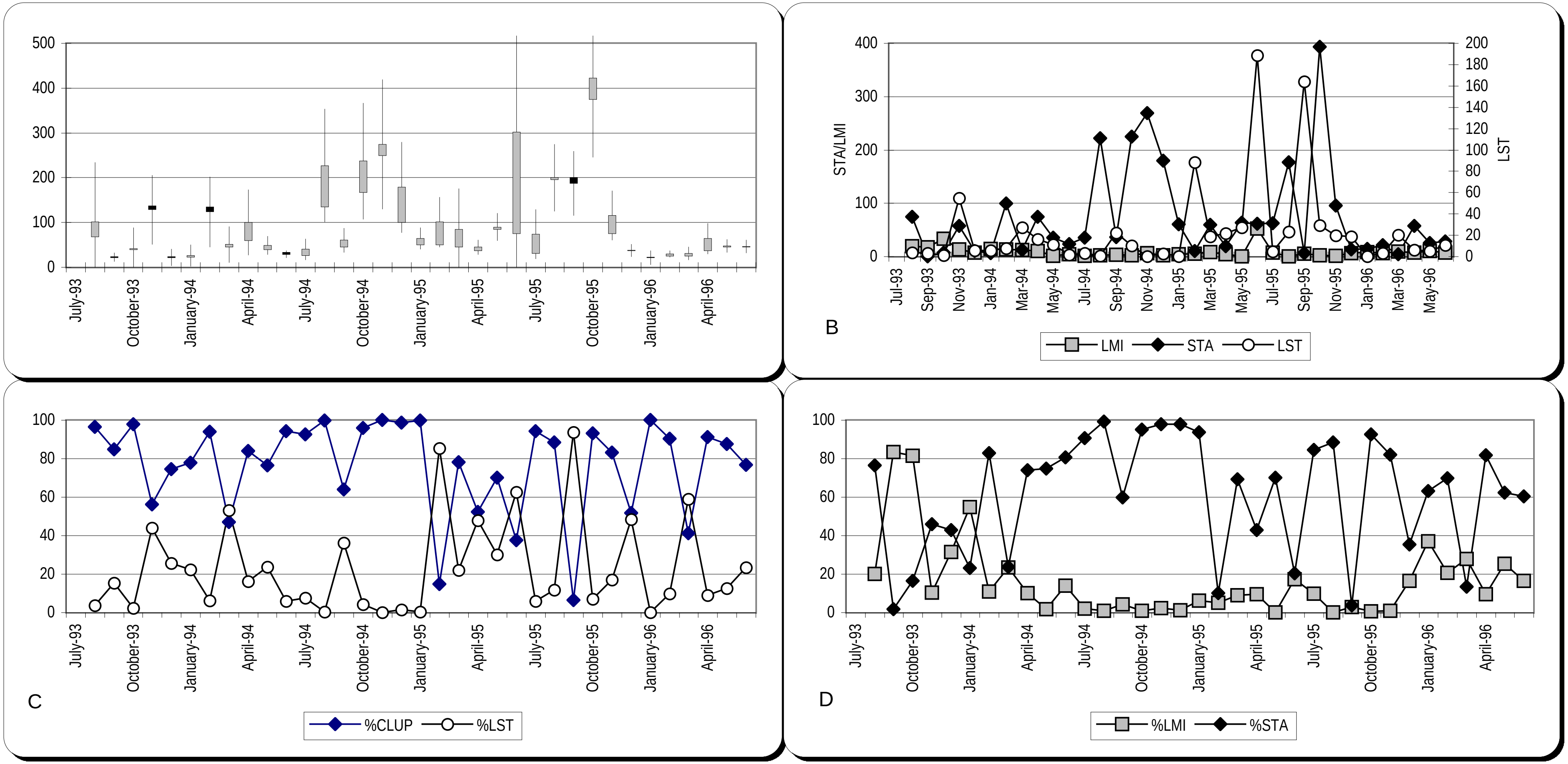

Figure 13: Fish biology sampling, liftnets, Uvira, monthly characteristics of units sampled.
A = monthly CPUE as median and mean with 95% confidence limits.
B = monthly mean CPUEs per species.
C = monthly % species composition, clupeids and Lates stappersii.
D = monthly % species composition, Stolothrissa tanganicae and Limnothrissa miodon.

Month	N	meanC	95cl	meanH	medC	meanC/H	meanL	mLMI	mSTA	mCLUP	mLST	%LMI	%STA	%CLUP	%LST
July-93							NO DATA AVAILABLE								
August-93															
September-93	3	160.0	225.6	3.0	210.0	53.3	8.0	76.7	0.0	76.7	83.3	47.9	0.0	47.9	52.1
October-93	5	90.0	84.0	2.6	60.0	34.6	7.8	8.2	0.0	8.2	81.8	9.1	0.0	9.1	90.9
November-93	6	160.0	156.0	2.7	100.0	59.3	7.5	143.3	0.0	143.3	16.7	89.6	0.0	89.6	10.4
December-93	8	173.1	100.1	2.0	140.0	86.6	8.6	0.1	126.6	126.7	40.9	0.0	75.5	75.6	24.4
January-94	6	105.0	82.5	2.0	70.0	52.5	7.3	2.3	91.7	94.0	3.2	2.4	94.3	96.7	3.3
February-94	5	194.0	124.5	2.2	250.0	88.2	7.8	0.2	186.1	186.3	2.9	0.1	98.4	98.5	1.5
March-94	9	36.7	13.7	2.0	40.0	18.4	7.8	0.6	30.3	30.9	5.3	1.7	83.7	85.4	14.6
April-94	6	160.8	280.0	2.3	50.0	68.9	7.2	8.4	107.6	116.0	18.2	6.2	80.2	86.4	13.6
May-94	11	290.8	238.7	2.3	148.0	128.0	8.1	2.2	288.6	290.8	0.0	0.8	99.2	100.0	0.0
June-94	13	105.4	59.1	2.3	50.0	46.1	7.8	15.5	72.6	88.1	17.5	14.7	68.7	83.4	16.6
July-94	12	186.7	110.6	2.3	145.0	81.2	8.3	2.8	107.2	110.0	76.6	1.5	57.4	58.9	41.1
August-94	18	374.2	85.1	2.4	350.0	155.9	7.3	3.0	267.7	270.7	76.5	0.9	77.1	78.0	22.0
September-94	12	279.2	141.4	2.2	210.0	126.9	8.1	0.0	277.5	277.5	2.8	0.0	99.0	99.0	1.0
October-94	10	181.1	132.8	2.1	105.0	86.2	7.5	5.8	150.8	156.6	24.5	3.2	83.3	86.5	13.5
November-94	11	100.9	101.7	1.8	40.0	56.1	7.2	0.0	97.0	97.0	3.9	0.0	96.1	96.1	3.9
December-94	12	250.8	170.3	1.8	135.0	139.3	7.2	0.7	250.1	250.8	0.0	0.3	99.7	100.0	0.0
January-95	13	168.2	89.7	2.1	180.0	80.1	8.2	0.8	163.0	163.8	4.3	0.5	97.0	97.4	2.6
February-95	10	139.0	67.6	2.0	150.0	69.5	8.6	0.8	74.3	75.1	64.0	0.6	53.4	54.0	46.0
March-95	12	165.8	73.0	2.1	145.0	79.6	9.1	8.7	104.8	113.5	52.5	5.2	63.1	68.4	31.6
April-95	7	137.1	147.7	2.3	60.0	59.6	7.9	0.8	114.9	115.7	21.4	0.6	83.8	84.4	15.6
May-95	13	170.8	81.0	2.2	140.0	77.6	8.2	16.5	154.3	170.8	0.0	9.7	90.3	100.0	0.0
June-95	13	95.4	30.1	2.0	100.0	47.7	7.5	0.0	52.3	52.3	43.1	0.0	54.8	54.8	45.2
July-95	9	84.4	54.9	1.9	50.0	44.4	8.0	0.0	45.6	45.6	38.9	0.0	54.0	54.0	46.0
August-95	4	53.8	34.9	2.0	45.0	26.9	8.8	7.8	46.0	53.8	0.0	14.5	85.5	100.0	0.0
September-95	4	117.5	75.7	1.8	110.0	65.3	9.5	0.4	117.1	117.5	0.0	0.3	99.7	100.0	0.0
October-95	13	311.5	98.9	2.4	270.0	129.8	7.4	7.1	304.3	311.4	0.1	2.3	97.7	100.0	0.0
November-95	13	245.4	82.8	2.8	210.0	87.6	7.2	0.0	245.4	245.4	0.0	0.0	100.0	100.0	0.0
December-95	7	421.4	274.4	2.0	300.0	210.7	7.3	27.3	64.3	91.6	329.9	6.5	15.3	21.7	78.3
January-96	13	88.5	59.7	2.5	70.0	35.4	8.0	4.9	74.2	79.1	8.8	5.6	84.4	90.0	10.0
February-96	16	142.8	57.2	2.3	140.0	62.1	9.2	0.0	142.7	142.7	0.0	0.0	100.0	100.0	0.0
March-96	4	60.0	15.2	2.3	65.0	26.1	9.5	0.0	60.0	60.0	0.0	0.0	100.0	100.0	0.0
April-96															
May-96							NO DATA AVAILABLE								
June-96															
MonthAv	**31**	**169.4**	**33.7**	**2.2**	**160.0**	**76.8**	**8.0**	**11.1**	**123.1**	**134.2**	**32.8**	**7.2**	**73.0**	**80.2**	**18.7**

Table 18: Fish biology sampling, liftnets,Karonda, monthly characteristics of units sampled.

N = number of units sampled; meanC = mean monthly catch (kg); 95cl = 95 % confidence limits of meanC; medC = median monthly catch (kg).

meanC/H = mean monthly catch/haul (kg); meanL = mean monthly number of fishing lights.

mLMI, mSTA, mCLUP, mLST = mean monthly catch per unit (kg) for L. miodon, S. tanganicae, clupeids and L. stappersii.

%SPECIES ABBR. = percentage contribution of the species in question to the total monthly meanC.

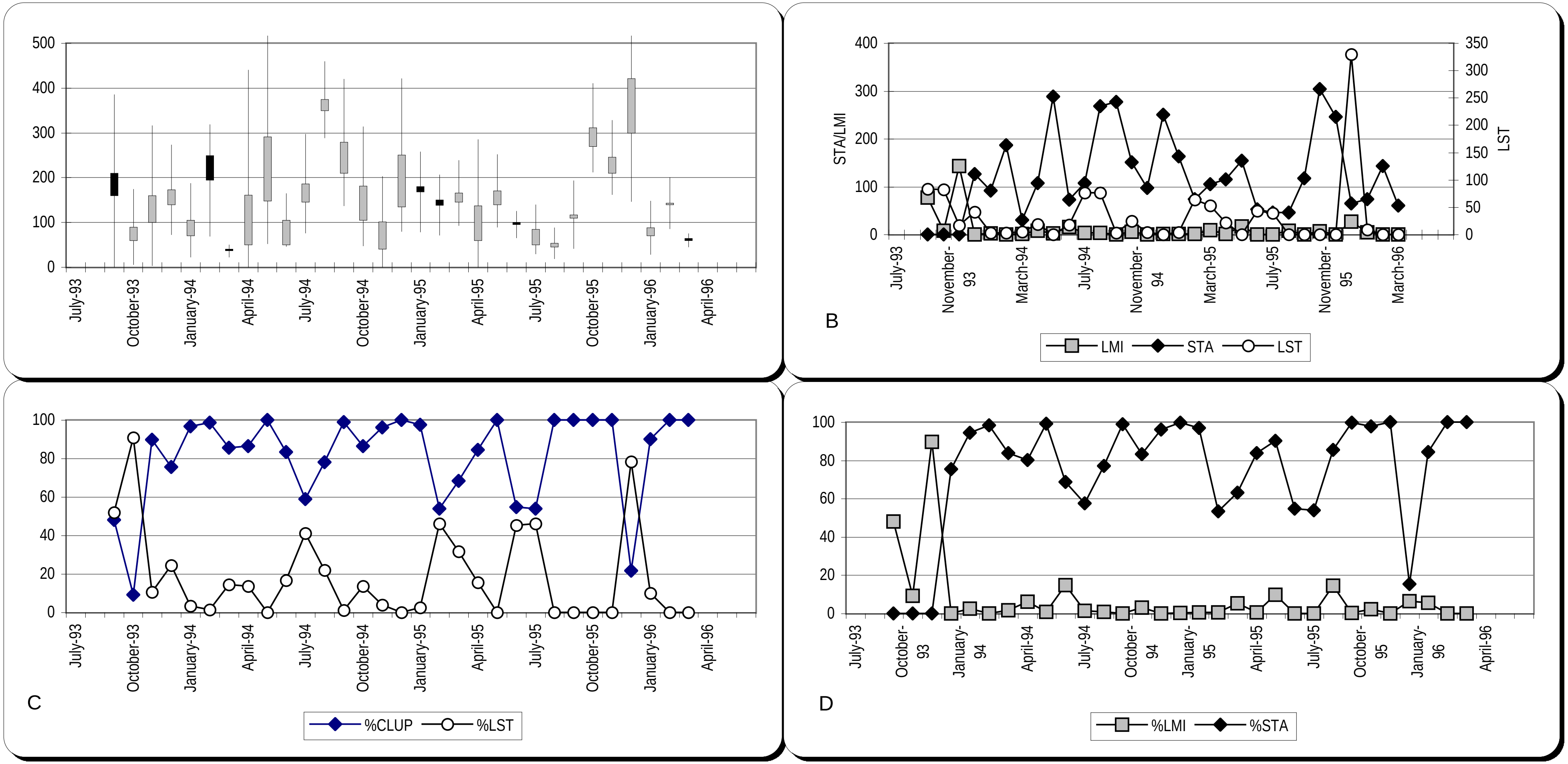

Figure 14: Fish biology sampling, liftnets, Karonda, monthly characteristics of units sampled.
A = monthly CPUE as median and mean with 95% confidence limits.
B = monthly mean CPUEs per species.
C = monthly % species composition, clupeids and Lates stappersii.
D = monthly % species composition, Stolothrissa tanganicae and Limnothrissa miodon.

Month	N	meanC	95cl	meanH	medC	meanC/H	meanL	mLMI	mSTA	mCLUP	mLST	%LMI	%STA	%CLUP	%LST
July-93	12	72.3	35.8	**1.8**	60.0	41.3	7.0	0.2	66.4	66.6	0.5	0.2	99.0	99.3	0.7
August-93	19	71.8	28.6	1.7	60.0	42.3	6.8	7.3	51.7	59.0	8.8	10.8	76.3	87.0	13.0
September-93	15	132.0	59.1	2.8	90.0	47.1	6.1	5.9	123.7	129.6	1.3	4.5	94.5	99.0	1.0
October-93	9	101.1	66.0	2.3	80.0	44.0	7.1	16.4	49.2	65.6	35.6	16.2	48.6	64.8	35.2
November-93	9	129.1	73.9	2.2	80.0	58.7	7.0	2.4	124.8	127.2	0.6	1.9	97.6	99.5	0.5
December-93	12	270.0	120.6	2.3	240.0	117.4	7.1	9.4	253.1	262.5	2.3	3.6	95.6	99.1	0.9
January-94	13	225.4	116.4	2.6	200.0	86.7	6.5	3.2	157.6	160.8	57.8	1.4	72.1	73.5	26.5
February-94	12	202.1	223.9	1.9	65.0	106.4	6.1	0.0	33.4	33.4	167.3	0.0	16.6	16.6	83.4
March-94	8	115.6	83.3	2.3	75.0	50.3	7.3	0.0	28.5	28.5	86.7	0.0	24.7	24.7	75.3
April-94	5	47.0	56.9	1.8	35.0	26.1	5.8	0.0	42.1	42.1	4.9	0.1	89.5	89.6	10.4
May-94	13	98.5	41.6	3.1	70.0	31.8	6.3	7.0	77.2	84.2	14.3	7.1	78.4	85.5	14.5
June-94	7	46.0	37.4	2.1	30.0	21.9	5.8	0.7	41.5	42.2	3.7	1.6	90.3	91.9	8.1
July-94	9	104.0	71.9	2.4	60.0	43.3	5.6	3.3	63.0	66.3	37.8	3.2	60.6	63.7	36.3
August-94	14	161.4	128.1	2.6	105.0	62.1	7.1	3.3	111.4	114.7	47.9	2.0	68.5	70.6	29.4
September-94	9	393.3	323.2	2.3	340.0	171.0	6.8	4.3	335.5	339.8	53.8	1.1	85.2	86.3	13.7
October-94	11	100.5	30.9	2.7	120.0	37.2	5.8	40.2	24.4	64.6	35.7	40.1	24.3	64.4	35.6
November-94	2	15.0	63.5	3.0	15.0	5.0	6.5	1.1	13.9	15.0	0.0	7.3	92.7	100.0	0.0
December-94	15	141.3	84.5	2.3	120.0	61.4	6.6	0.9	126.2	127.1	14.3	0.6	89.3	89.9	10.1
January-95	21	201.9	94.5	2.9	120.0	69.6	5.9	1.5	194.7	196.2	5.7	0.7	96.4	97.2	2.8
February-95	12	93.8	53.1	3.2	75.0	29.3	6.6	8.0	27.8	35.8	57.8	8.6	29.7	38.3	61.7
March-95	9	121.3	112.9	3.3	80.0	36.8	6.8	5.3	75.0	80.3	41.0	4.4	61.8	66.2	33.8
April-95	8	83.8	30.4	3.0	80.0	27.9	5.5	0.9	46.1	47.0	36.8	1.1	55.0	56.1	43.9
May-95	12	57.9	17.1	2.8	60.0	20.7	7.5	5.1	19.9	25.0	32.8	8.8	34.4	43.3	56.7
June-95	16	116.9	120.9	3.4	55.0	34.4	6.4	11.5	21.4	32.9	84.0	9.8	18.3	28.1	71.9
July-95	14	88.2	42.6	3.6	60.0	24.7	6.4	0.0	58.6	58.6	29.6	0.0	66.4	66.4	33.6
August-95	9	125.0	83.6	2.9	80.0	43.3	5.8	0.0	25.5	25.5	99.3	0.0	20.5	20.5	79.5
September-95	10	98.5	52.5	2.7	77.5	36.5	6.5	9.2	38.2	47.4	51.1	9.3	38.8	48.1	51.9
October-95	7	72.1	40.4	2.9	70.0	25.3	7.4	0.0	43.8	43.8	28.3	0.0	60.8	60.8	39.2
November-95	4	330.0	281.1	2.3	350.0	146.7	5.5	0.0	187.5	187.5	142.5	0.0	56.8	56.8	43.2
December-95	10	86.5	26.7	3.2	85.0	27.0	7.0	7.0	23.5	30.5	56.0	8.1	27.1	35.2	64.8
January-96	7	92.1	56.7	3.4	70.0	26.9	7.4	39.6	16.1	55.7	36.4	43.0	17.5	60.5	39.5
February-96	8	243.8	214.3	3.3	175.0	75.0	6.6	19.2	147.6	166.7	77.0	7.9	60.5	68.4	31.6
March-96	13	63.2	18.1	3.2	60.0	20.0	7.4	13.4	4.0	17.3	45.8	21.2	6.3	27.4	72.6
April-96	5	148.3	173.0	2.8	60.0	53.0	9.8	0.2	0.0	0.2	148.1	0.1	0.0	0.1	99.9
May-96	10	144.5	116.2	2.7	57.5	53.5	8.8	3.2	99.5	102.7	41.8	2.2	68.9	71.0	29.0
June-96	9	43.3	31.5	2.4	30.0	17.7	7.9	10.3	9.6	19.9	23.4	23.9	22.1	45.9	54.1
MonthAv	**36**	**128.8**	**27.5**	**2.7**	**102.6**	**50.4**	**6.7**	**6.7**	**76.7**	**83.4**	**44.7**	**7.0**	**56.8**	**63.8**	**36.2**

Table 19: Fish biology sampling, liftnets,Kigoma, monthly characteristics of units sampled.

N = number of units sampled; meanC = mean monthly catch (kg); 95cl = 95 % confidence limits of meanC; medC = median monthly catch (kg).

meanC/H = mean monthly catch/haul (kg); meanL = mean monthly number of fishing lights.

mLMI, mSTA, mCLUP, mLST = mean monthly catch per unit (kg) for L. miodon, S. tanganicae, clupeids and L. stappersii.

%SPECIES ABBR. = percentage contribution of the species in question to the total monthly meanC.

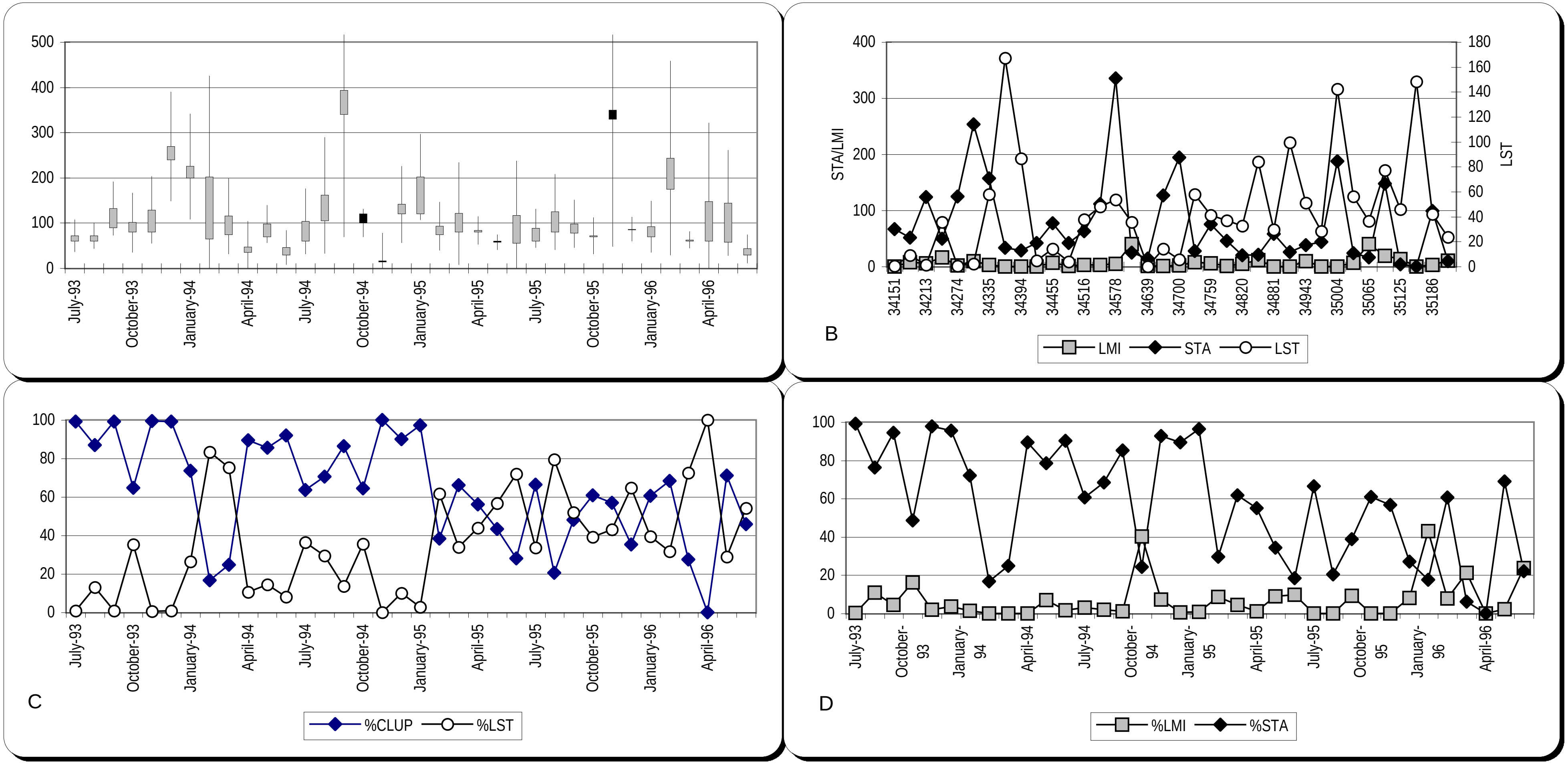

Figure 15: Fish biology sampling, liftnets, Kigoma, monthly characteristics of units sampled.

A = monthly CPUE as median and mean with 95% confidence limits.

B = monthly mean CPUEs per species.

C = monthly % species composition, clupeids and Lates stappersii.

D = monthly % species composition, Stolothrissa tanganicae and Limnothrissa miodon.

Month	N	meanC	95cl	meanH	medC	meanC/H	meanL	mLMI	mSTA	mCLUP	mLST	%LMI	%STA	%CLUP	%LST
July-93															
August-93															
September-93							NO DATA AVAILABLE								
October-93															
November-93															
December-93															
January-94	3	56.7	7.2	2.3	60.0	24.6	4.0	0.0	54.0	54.0	0	0.0	100.0	100	0
February-94	4	68.8	16.6	2.5	65.0	27.5	4.0	0.0	68.8	68.8	0	0.0	100.0	100	0
March-94							NO DATA AVAILABLE								
April-94	4	85.0	20.4	2.5	21.9	34.0	4.0	0.0	79.6	79.6	0	0.0	100.0	100	0
May-94	12	92.1	13.2	2.3	91.0	40.0	4.0	2.8	85.3	88.1	0	3.1	96.9	100	0
June-94	16	87.5	19.1	2.6	80.0	33.7	4.0	32.5	55.0	87.5	0	37.1	62.9	100	0
July-94	14	60.4	4.3	2.4	60.0	25.1	4.0	11.1	49.2	60.4	0	18.4	81.6	100	0
August-94	24	156.0	32.2	3.6	127.5	43.3	4.0	91.5	64.4	155.9	0	58.7	41.3	100	0
September-94	14	85.0	27.7	3.1	67.5	27.4	4.0	49.4	35.6	85.0	0	58.1	41.9	100	0
October-94	12	74.2	14.2	3.2	67.5	23.2	4.0	36.9	37.2	74.2	0	49.8	50.2	100	0
November-94	19	50.8	6.4	2.8	50.0	18.1	4.0	7.1	43.7	50.8	0	13.9	86.1	100	0
December-94	15	62.3	14.0	3.1	60.0	20.1	4.0	30.9	42.8	73.7	0	41.9	58.1	100	0
January-95	14	84.3	14.0	3.6	87.5	23.4	4.0	31.7	52.6	84.3	0	37.6	62.4	100	0
February-95	14	96.4	12.2	3.9	95.0	24.7	4.0	59.8	36.6	96.4	0	62.0	38.0	100	0
March-95	20	90.0	16.7	3.1	82.5	29.0	4.0	28.7	61.3	90.0	0	31.9	68.1	100	0
April-95	16	105.6	11.3	3.0	105.0	35.2	4.0	45.9	59.8	105.6	0	43.4	56.6	100	0
May-95	14	93.6	9.5	3.2	92.5	29.2	4.0	33.5	60.0	93.6	0	35.8	64.2	100	0
June-95	22	92.0	15.9	3.0	87.5	30.7	4.0	28.4	63.7	92.0	0	30.8	69.2	100	0
July-95	12	81.8	21.9	3.3	75.0	24.8	4.0	22.9	58.9	81.8	0	28.0	72.0	100	0
August-95	11	76.4	18.5	2.8	80.0	27.3	4.0	17.7	57.7	75.5	0	23.5	76.5	100	0
September-95	11	95.5	21.6	3.5	105.0	27.3	4.0	34.5	61.0	95.5	0	36.1	63.9	100	0
October-95	15	107.3	17.1	3.3	110.0	32.5	4.0	30.4	76.9	107.3	0	28.3	71.7	100	0
November-95	13	75.0	12.0	3.0	70.0	25.0	4.0	4.4	70.6	75.0	0	5.9	94.1	100	0
December-95	15	78.7	9.8	3.1	75.0	25.4	4.0	14.9	63.8	78.7	0	18.9	81.1	100	0
January-96	13	96.9	12.2	3.7	95.0	26.2	4.0	13.5	83.5	96.9	0	13.9	86.1	100	0
February-96	13	223.8	69.4	3.4	280.0	65.8	4.0	0.0	223.8	223.8	0	0.0	100.0	100	0
March-96	16	134.1	35.7	3.6	117.5	37.3	4.0	0.0	134.1	134.1	0	0.0	100.0	100	0
April-96	24	128.2	42.9	3.5	100.0	36.6	4.0	0.0	128.2	128.2	0	0.0	100.0	100	0
May-96	32	142.0	34.9	3.3	112.5	43.0	4.0	0.0	142.0	142.0	0	0.0	100.0	100	0
June-96	24	144.6	22.0	3.0	142.5	48.2	4.0	0.0	144.6	144.6	0	0.0	100.0	100	0
MonthAv	**29**	**97.4**	**13.7**	**3.1**	**90.0**	**31.3**	**4.0**	**21.7**	**75.7**	**97.4**	**0**	**23.4**	**76.6**	**100**	**0**

Table 20: Fish biology sampling, liftnets, Kalemie, monthly characteristics of units sampled.

N = number of units sampled; meanC = mean monthly catch (kg); 95cl = 95 % confidence limits of meanC; medC = median monthly catch (kg).

meanC/H = mean monthly catch/haul (kg); meanL = mean monthly number of fishing lights.

mLMI, mSTA, mCLUP, mLST = mean monthly catch per unit (kg) for L. miodon, S. tanganicae, clupeids and L. stappersii.

%SPECIES ABBR. = percentage contribution of the species in question to the total monthly meanC.

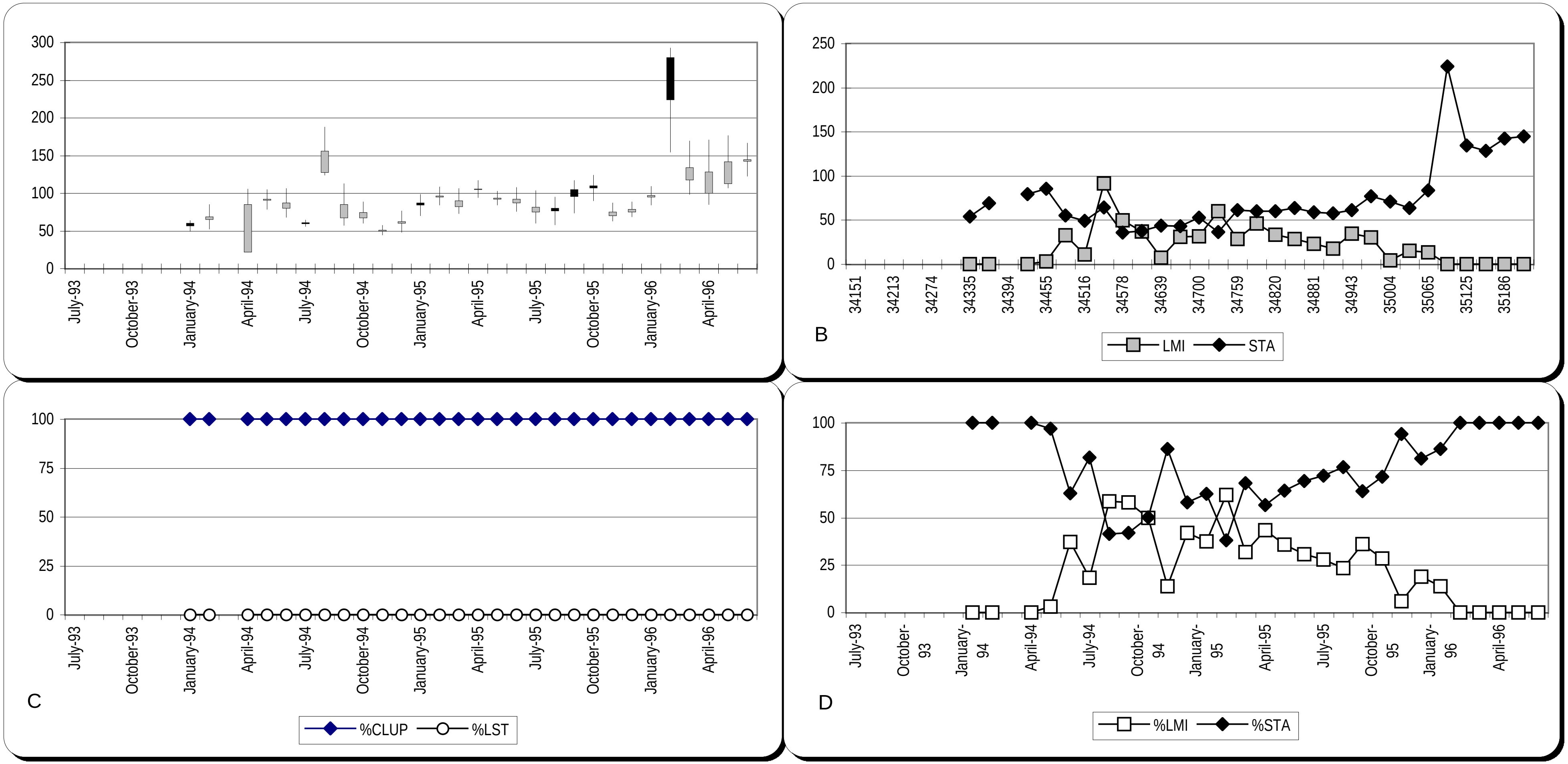

Figure 16: Fish biology sampling, liftnets, Kalemie, monthly characteristics of units sampled.
A = monthly CPUE as median and mean with 95% confidence limits.
B = monthly mean CPUEs per species.
C = monthly % species composition, clupeids and Lates stappersii.
D = monthly % species composition, Stolothrissa tanganicae and Limnothrissa miodon.

Month	N	meanC	95cl	meanH	medC	meanC/H	meanL	mLMI	mSTA	mCLUP	mLST	%LMI	%STA	%CLUP	%LST
July-93															
August-93															
September-93															
October-93															
November-93							NO DATA AVAILABLE								
December-93															
January-94															
February-94															
March-94															
April-94															
May-94	4	152.5	55.1	4.8	150.0	31.8	2.8	0.0	75.0	75.0	77.5	0.0	49.2	49.2	50.8
June-94	7	100.7	38.5	5.4	90.0	18.7	3.0	22.5	22.3	44.8	55.8	22.4	22.2	44.5	55.5
July-94	6	200.0	88.1	4.2	210.0	47.6	3.0	44.9	60.1	105.0	95.0	22.4	30.1	52.5	47.5
August-94	3	78.3	31.2	4.0	75.0	19.6	3.0	39.8	38.6	78.4	0.0	50.8	49.2	100.0	0.0
September-94	6	110.7	27.0	4.0	104.5	27.7	3.0	18.5	92.1	110.6	0.0	16.8	83.2	100.0	0.0
October-94	14	133.6	19.7	5.2	122.5	25.7	3.0	61.1	72.5	133.6	0.0	45.7	54.3	100.0	0.0
November-94	8	49.4	12.3	4.3	50.0	11.5	4.0	25.4	24.0	49.4	0.0	51.4	48.6	100.0	0.0
December-94															
January-95															
February-95															
March-95							NO DATA AVAILABLE								
April-95															
May-95															
June-95															
July-95															
August-95	8	331.9	135.0	6.0	315.0	55.3	3.8	0.3	91.0	91.3	240.6	0.1	27.4	27.5	72.5
September-95	5	307.0	116.3	6.6	297.0	46.5	3.0	14.1	196.2	210.3	96.6	4.6	63.9	68.5	31.5
October-95	3	313.3	222.5	8.0	220.0	39.2	3.0	0.0	173.3	173.3	140.0	0.0	55.3	55.3	44.7
November-95	7	216.4	60.2	6.1	205.0	35.5	3.0	66.1	63.2	129.3	87.1	30.5	29.2	59.7	40.3
December-95	5	186.0	57.1	6.2	170.0	30.0	3.0	75.2	80.8	156.0	30.0	40.4	43.5	83.9	16.1
January-96	7	241.4	87.2	5.9	175.0	40.9	3.0	50.3	67.2	117.5	123.8	20.8	27.8	48.7	51.3
February-96	6	234.2	31.9	4.5	227.5	52.0	2.8	0.0	234.2	234.2	0.0	0.0	100.0	100.0	0.0
March-96	6	203.3	37.9	4.5	205.0	45.2	2.7	0.0	203.3	203.3	0.0	0.0	100.0	100.0	0.0
April-96	9	252.2	144.3	5.3	150.0	47.6	2.9	0.0	60.0	60.0	176.7	0.0	25.3	25.3	74.7
May-96	16	215.0	80.7	3.1	155.0	69.4	4.0	45.0	170.0	215.0	0.0	20.9	79.1	100.0	0.0
June-96	16	245.0	74.9	3.2	225.0	76.6	4.0	46.7	194.7	241.4	0.0	19.3	80.7	100.0	0.0
MonthAv	**18**	**198.4**	**40.4**	**5.1**	**209.2**	**40.0**	**3.2**	**28.3**	**106.6**	**134.9**	**62.4**	**19.2**	**53.8**	**73.1**	**26.9**

Table 21: Fish biology sampling, liftnets, Moba, monthly characteristics of units sampled.
N = number of units sampled; meanC = mean monthly catch (kg); 95cl = 95 % confidence limits of meanC; medC = median monthly catch (kg).
meanC/H = mean monthly catch/haul (kg); meanL = mean monthly number of fishing lights.
mLMI, mSTA, mCLUP, mLST = mean monthly catch per unit (kg) for L. miodon, S. tanganicae, clupeids and L. stappersii.
%SPECIES ABBR. = percentage contribution of the species in question to the total monthly meanC.

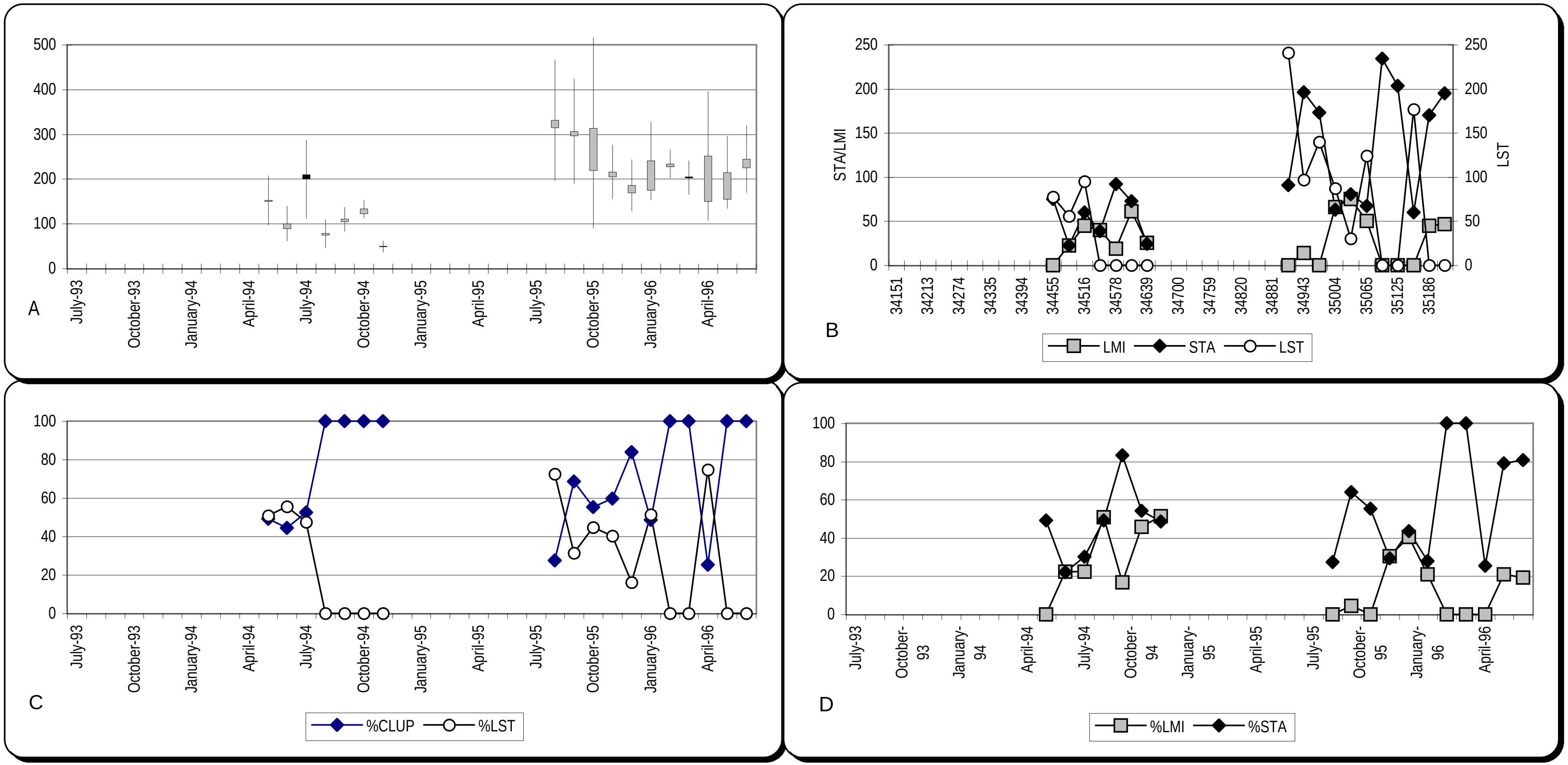

Figure 17: Fish biology sampling, liftnets, Moba, monthly characteristics of units sampled.
A = monthly CPUE as median and mean with 95% confidence limits.
B = monthly mean CPUEs per species.
C = monthly % species composition, clupeids and Lates stappersii.
D = monthly % species composition, Stolothrissa tanganicae and Limnothrissa miodon.

Month	N	meanC	95cl	meanH	medC	meanC/H	meanL	mLMI	mSTA	mCLUP	mLST	%LMI	%STA	%CLUP	%LST
July-93															
August-93							NO DATA AVAILABLE								
September-93															
October-93															
November-93	15	120.0	23.3	2.0	120.0	60.0	1.9	0.0	0.0	0.0	120.0	0.0	0.0	0.0	100.0
December-93	20	123.5	21.0	1.7	120.0	72.6	1.4	0.9	0.0	0.9	122.6	0.7	0.0	0.7	99.3
January-94	22	93.0	27.2	2.0	77.5	46.5	2.2	1.0	0.0	1.0	92.0	1.1	0.0	1.1	98.9
February-94	31	123.1	13.7	2.4	120.0	51.3	2.5	0.0	0.0	0.0	123.1	0.0	0.0	0.0	100.0
March-94	32	61.9	6.4	1.9	60.0	32.6	2.6	19.7	0.0	19.7	42.2	31.8	0.0	31.8	68.2
April-94	24	33.2	3.5	2.1	33.5	15.8	2.3	33.2	0.0	33.2	0.0	100.0	0.0	100.0	0.0
May-94							NO DATA AVAILABLE								
June-94	14	85.4	21.7	1.1	82.5	77.6	1.9	2.1	0.0	2.1	83.2	2.5	0.0	2.5	97.5
July-94	10	32.0	7.0	1.3	30.0	24.6	2.0	32.0	0.0	32.0	0.0	100.0	0.0	100.0	0.0
August-94	23	158.1	45.0	1.1	190.0	143.7	2.0	7.2	0.0	7.2	150.9	4.6	0.0	4.6	95.4
September-94	24	134.8	18.2	1.3	120.0	103.7	2.2	0.0	0.0	0.0	134.8	0.0	0.0	0.0	100.0
October-94							NO DATA AVAILABLE								
November-94															
December-94	24	37.5	5.4	2.6	40.0	14.4	2.3	3.2	0.6	3.8	33.7	8.5	1.6	10.1	89.9
January-95	23	55.0	15.4	3.7	50.0	14.9	2.3	0.1	0.0	0.1	54.9	0.2	0.0	0.2	99.8
February-95	24	87.5	22.0	4.5	70.0	19.4	3.1	0.0	0.0	0.0	87.5	0.0	0.0	0.0	100.0
March-95	15	51.3	10.5	4.3	60.0	11.9	2.6	10.7	2.7	13.4	38.0	20.8	5.3	26.1	73.9
April-95	1	80.0		3.0	80.0	26.7	2.0	0.0	0.0	0.0	80.0	0.0	0.0	0.0	100.0
May-95							NO DATA AVAILABLE								
June-95															
July-95	2	11.0	8.6	2.0	11.0	5.5	4.5	7.5	3.5	11.0	0.0	68.2	31.8	100.0	0.0
August-95															
September-95															
October-95															
November-95															
December-95															
January-96							NO DATA AVAILABLE								
February-96															
March-96															
April-96															
May-96															
June-96															
MonthAv	**16**	**80.5**	**22.8**	**2.3**	**82.7**	**45.1**	**2.4**	**7.4**	**0.4**	**7.8**	**72.7**	**21.1**	**2.4**	**23.6**	**76.4**

Table 22: Fish biology sampling, liftnets, Kipili, monthly characteristics of units sampled.

N = number of units sampled; meanC = mean monthly catch (kg); 95cl = 95 % confidence limits of meanC; medC = median monthly catch (kg).
meanC/H = mean monthly catch/haul (kg); meanL = mean monthly number of fishing lights.
mLMI, mSTA, mCLUP, mLST = mean monthly catch per unit (kg) for L. miodon, S. tanganicae, clupeids and L. stappersii.
%SPECIES ABBR. = percentage contribution of the species in question to the total monthly meanC.

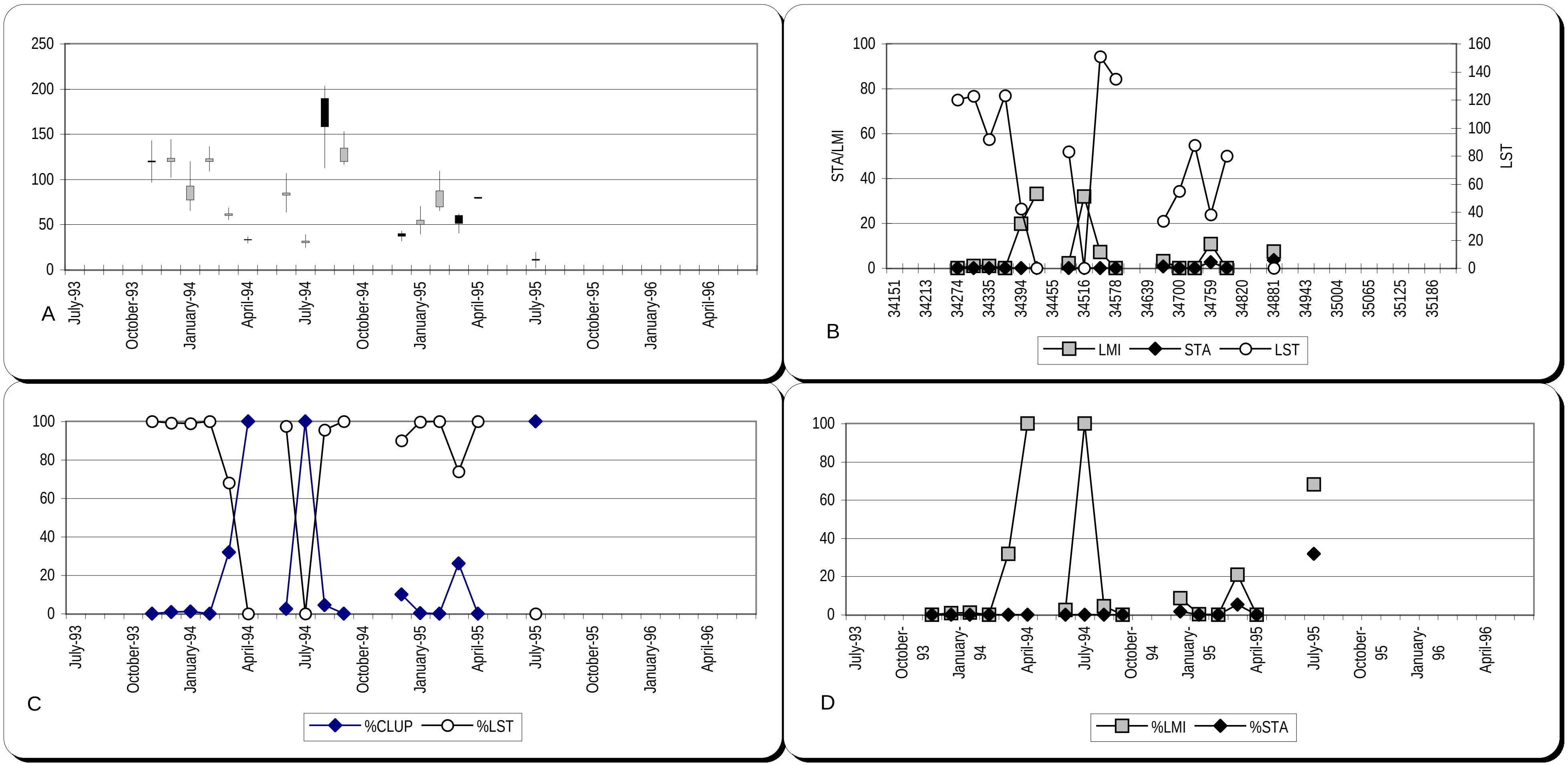

Figure 18: Fish biology sampling, liftnets, Kipili, monthly characteristics of units sampled.
A = monthly CPUE as median and mean with 95% confidence limits.
B = monthly mean CPUEs per species.
C = monthly % species composition, clupeids and Lates stappersii.
D = monthly % species composition, Stolothrissa tanganicae and Limnothrissa miodon.

Month	N	meanC	95cl	meanH	medC	meanC/H	meanL	mLMI	mSTA	mCLUP	mLST	%LMI	%STA	%CLUP	%LST
July-93															
August-93															
September-93															
October-93															
November-93															
December-93															
January-94							NO DATA AVAILABLE								
February-94															
March-94															
April-94															
May-94															
June-94															
July-94															
August-94															
September-94	8	10.4	5.2	1.0	7.0	10.4	2.4	9.4	0.0	9.4	1.0	90.4	0.0	90.4	9.6
October-94	2	87.0	83.9	1.0	87.0	87.0	4.0	87.0	0.0	87.0	0.0	100.0	0.0	100.0	0.0
November-94	1	100.0		1.0	100.0	100.0	4.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0
December-94	2	410.0	86.0	2.0	410.0	205.0	5.0	0.0	0.0	0.0	410.0	0.0	0.0	0.0	100.0
January-95							NO DATA AVAILABLE								
February-95															
March-95	1	8.0		1.0	8.0	8.0	2.0	8.0	0.0	8.0	0.0	100.0	0.0	100.0	0.0
April-95															
May-95							NO DATA AVAILABLE								
June-95															
July-95	1	380.0		2.0	380.0	190.0	2.0	380.0	0.0	380.0	0.0	100.0	0.0	100.0	0.0
August-95	2	222.0	425.7	2.5	222.0	88.8	3.0				210.0	2.5	2.5	5.0	100.0
September-95	2	192.0	309.6	3.5	192.0	54.9	3.5	24.0	0.0	24.0	168.0	12.5	0.0	12.5	87.5
October-95							NO DATA AVAILABLE								
November-95															
December-95	5	532.2	645.1	2.0	96.0	266.1	4.2				500.0	2.0	2.0	4.0	100.0
January-96	4	161.3	40.3	1.0	162.5	161.3	4.5	0.0	0.0	0.0	161.3	0.0	0.0	0.0	100.0
February-96	5	109.4	138.2	2.4	48.0	45.6	4.0	0.0	0.0	0.0	89.8	0.0	0.0	0.0	100.0
March-96	2	81.5	18.3	1.0	81.5	81.5	1.5	76.0	0.0	76.0	0.0	100.0	0.0	100.0	0.0
April-96							NO DATA AVAILABLE								
May-96															
June-96	10	78.4	55.3	2.7	54.0	29.0	2.4	60.2	18.2	78.4	0.0	76.8	23.2	100.0	0.0
MonthAv	**13**	**182.5**	**98.3**	**1.8**	**109.4**	**102.1**	**3.3**	**57.3**	**1.4**	**58.7**	**118.5**	**52.6**	**2.1**	**54.8**	**45.9**

Table 23: Fish biology sampling, liftnets, Mpulungu, monthly characteristics of units sampled.
N = number of units sampled; meanC = mean monthly catch (kg); 95cl = 95 % confidence limits of meanC; medC = median monthly catch (kg).
meanC/H = mean monthly catch/haul (kg); meanL = mean monthly number of fishing lights.
mLMI, mSTA, mCLUP, mLST = mean monthly catch per unit (kg) for L. miodon, S. tanganicae, clupeids and L. stappersii.
%SPECIES ABBR. = percentage contribution of the species in question to the total monthly meanC.

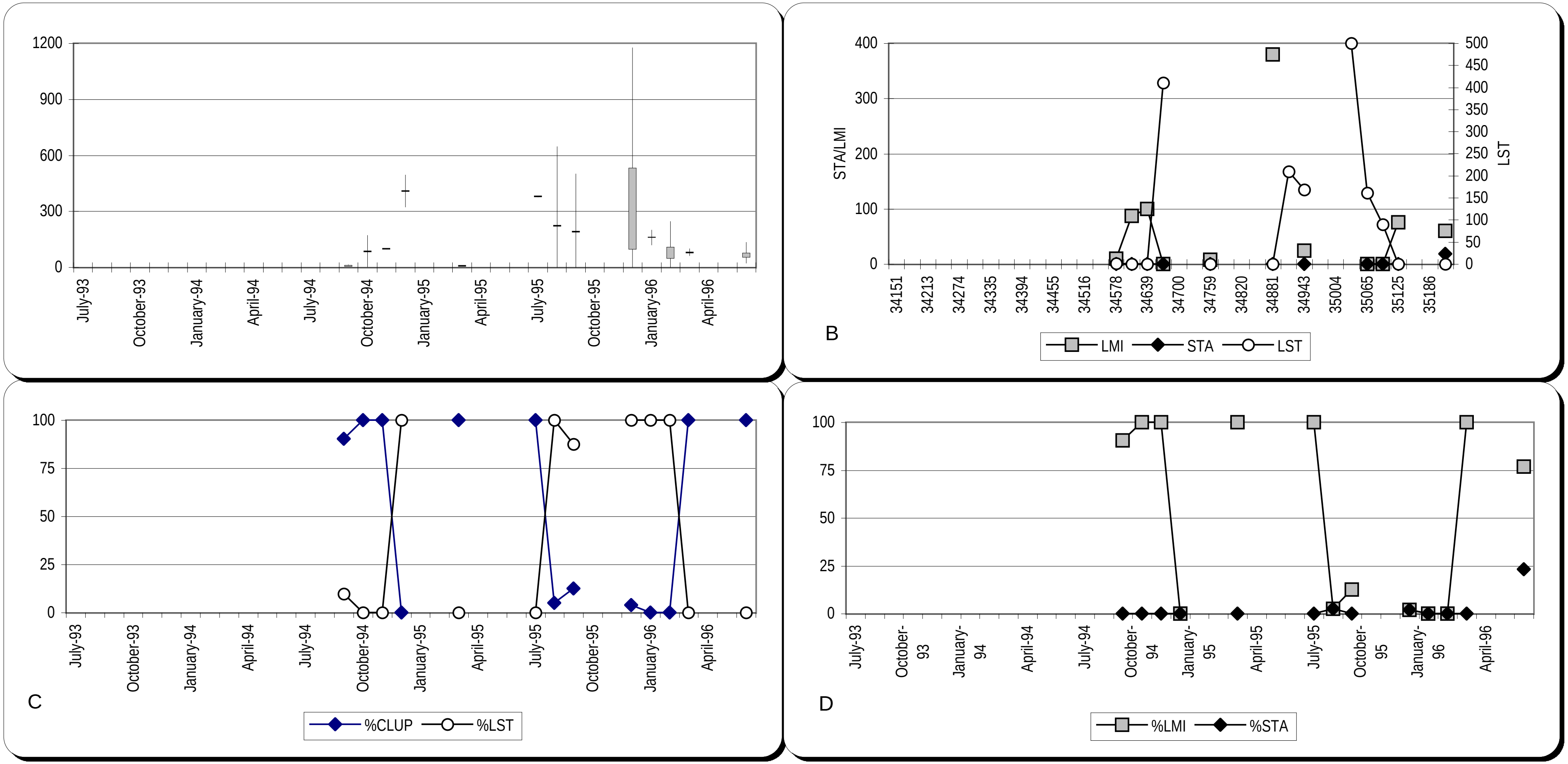

Figure 19: Fish biology sampling, liftnets, Mpulungu, monthly characteristics of units sampled.
A = monthly CPUE as median and mean with 95% confidence limits.
B = monthly mean CPUEs per species.
C = monthly % species composition, clupeids and Lates stappersii.
D = monthly % species composition, Stolothrissa tanganicae and Limnothrissa miodon.

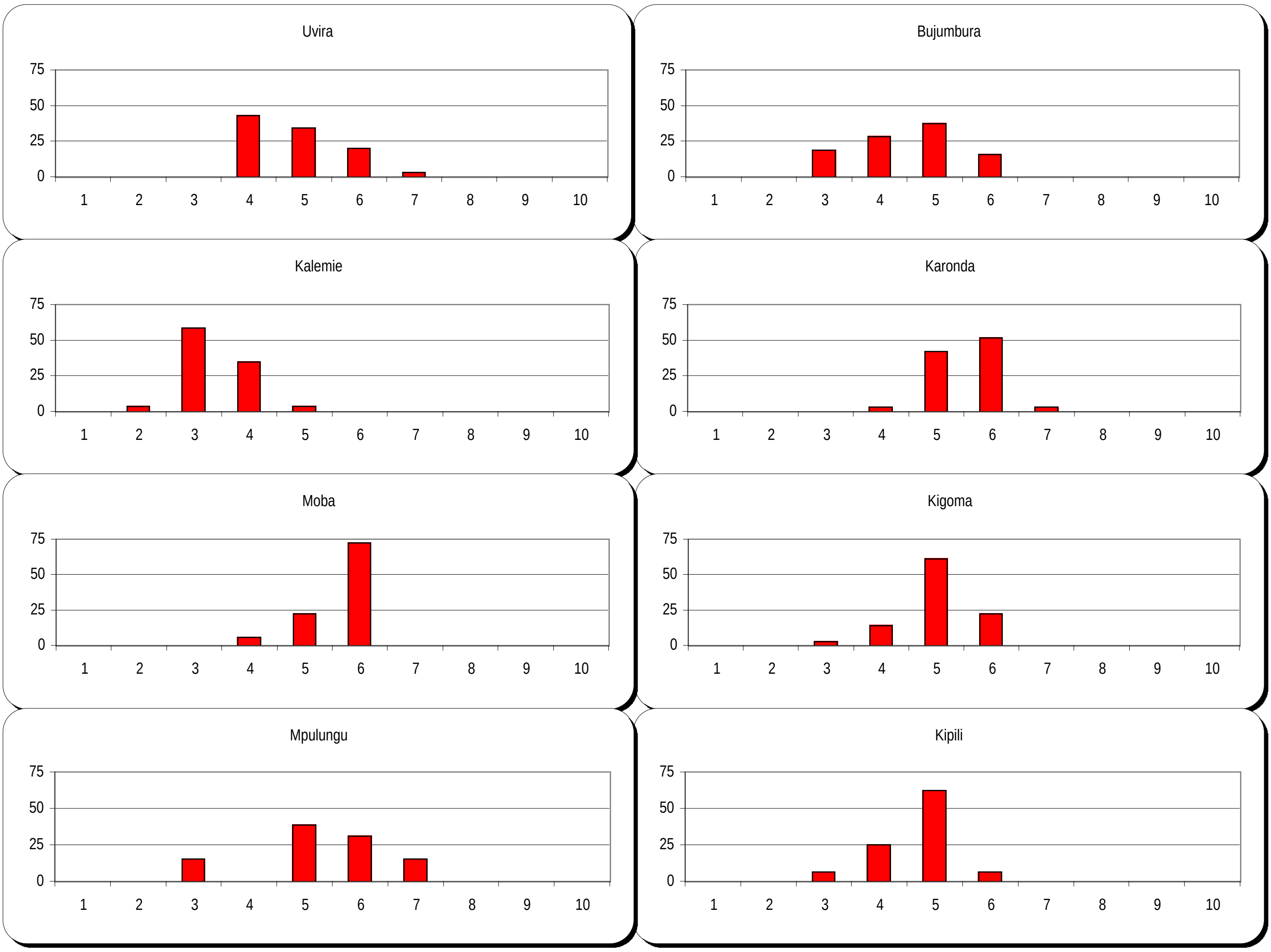

Figure 20: Fish biology sampling, liftnets, frequency distribution of monthly LN(CPUE + 1) per area.

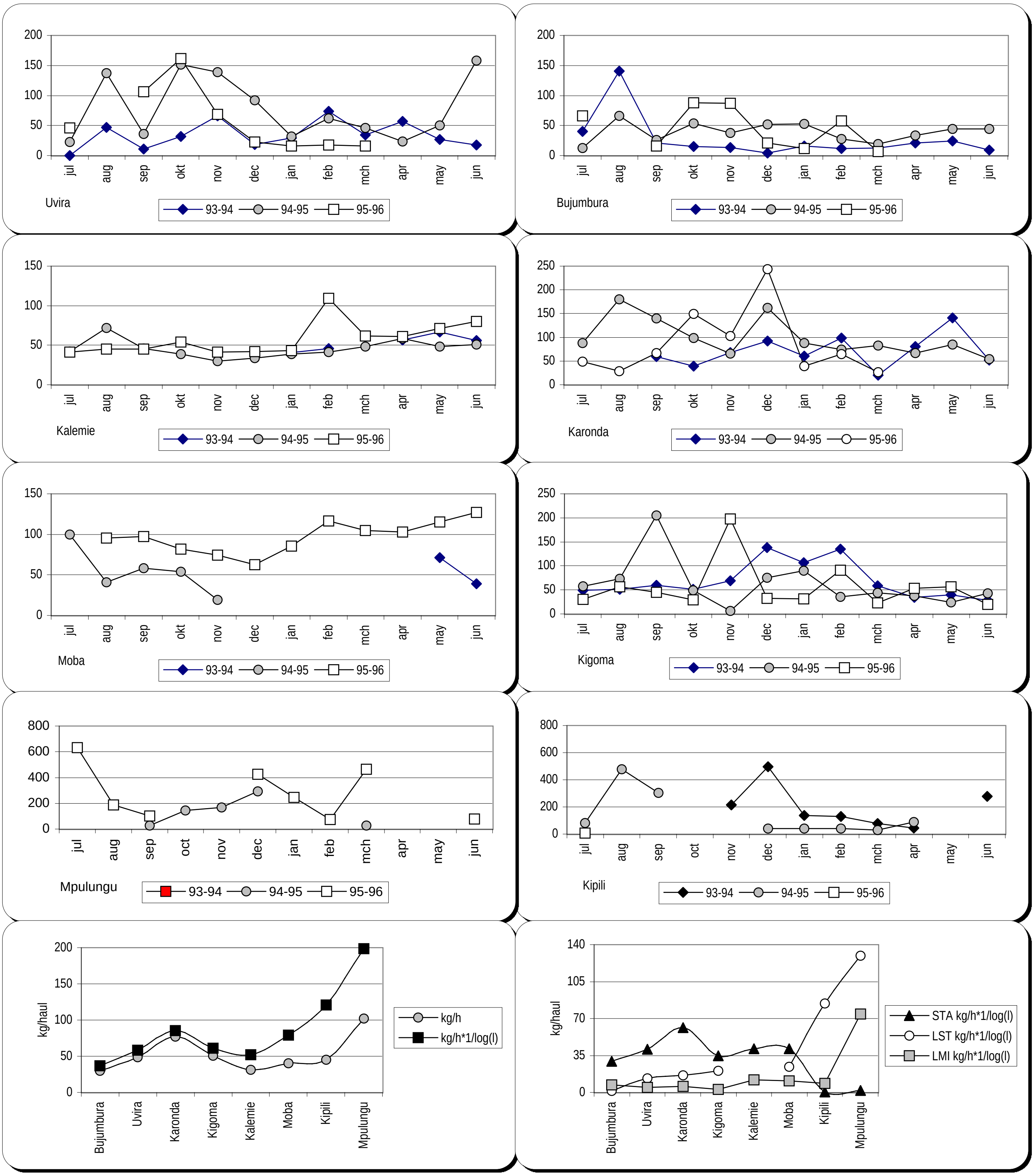

Figure 21: Fish biology sampling, liftnets, CPUEs (kg/haul) after application of light correction factor, per area.
- top 8 graphs: monthly CPUEs (kg/haul) per fishing area, after application of correction factor for number of fishing lamps, period 7/93-6/96.
- bottom 2 graphs: 3 yearly average (7/93-6/96) CPUEs (kg/haul), for total catch and catch per species (S. tanganicae = STA, L. miodon = LMI and L. stappersii = LST), without and with light correction.

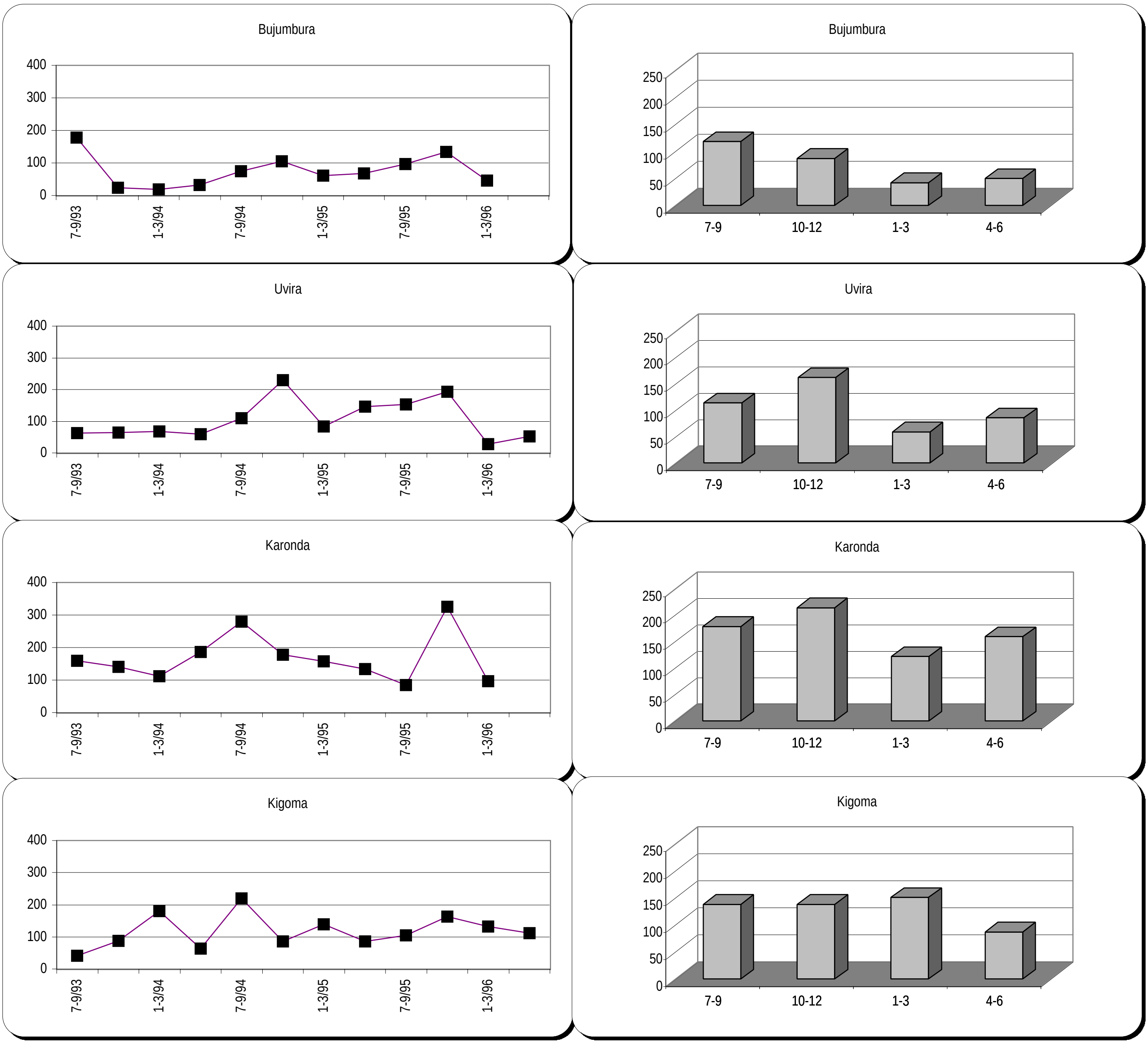

Figure 22A: Fish biology sampling, liftnets, CPUE per trimester and average trimester CPUE for period 7/93-6/96.

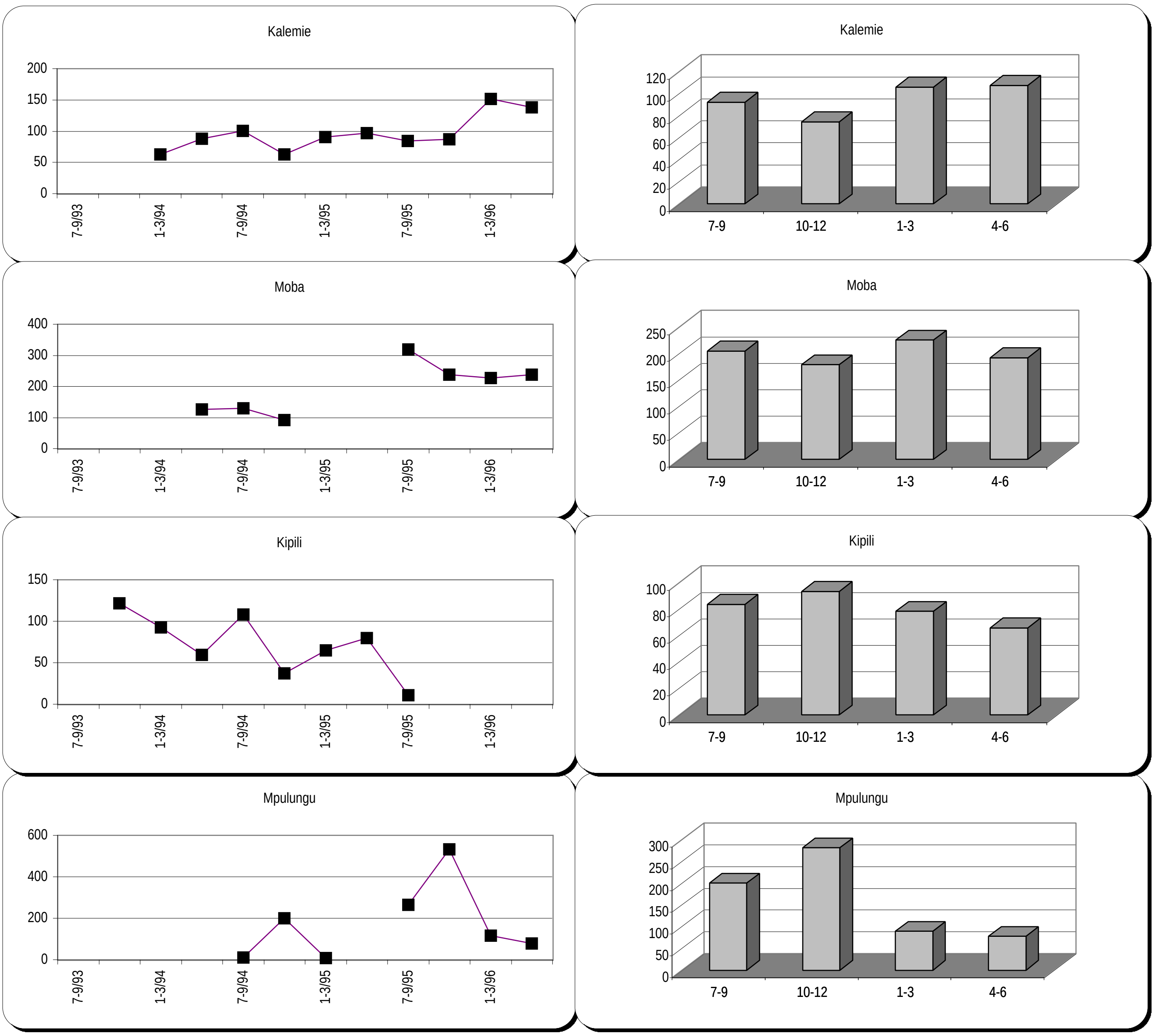

Figure 22B: Fish biology sampling, liftnets, CPUE per trimester and average trimester CPUE for period 7/93-6/96.

Month	N	meanC	95cl	meanH	meanC/H	mLMI	mSTA	mCLUP	mLST	mLssp	mOTH	%LMI	%STA	%CLUP	%LST	%Lssp	%OTH
July-93																	
August-93								NO DATA AVAILABLE									
########																	
########																	
########	2	32.8	348.1	1.0	32.8	0.1	0.0	0.1	0.0	2.0	30.7	0.3	0.0	0.3	0.0	6.1	93.6
########	2	18.8	73.1	1.0	18.8	0.1	0.0	0.1	0.0	0.7	18.0	0.5	0.0	0.5	0.0	3.7	95.7
########	2	87.5	813.2	1.0	87.5	0.3	0.0	0.3	0.0	1.0	86.2	0.3	0.0	0.3	0.0	1.1	98.5
########	3	101.4	263.1	2.0	50.7	0.3	0.0	0.3	0.0	1.2	99.9	0.3	0.0	0.3	0.0	1.2	98.5
March-94	2	22.5	31.8	3.0	7.5	0.2	0.0	0.2	0.0	0.7	21.6	0.9	0.0	0.9	0.0	3.1	96.0
April-94	1	40.0		3.0	13.3	0.1	0.0	0.1	0.0	3.1	37.7	0.2	0.0	0.2	0.0	7.6	92.2
May-94	3	30.0	43.0	3.3	9.1	0.7	0.0	0.7	0.0	3.2	26.1	2.3	0.0	2.3	0.0	10.7	87.0
June-94	4	57.3	42.1	3.0	19.1	0.6	0.0	0.6	0.0	2.7	54.0	1.0	0.0	1.0	0.0	4.7	94.2
July-94	3	19.0	28.6	2.0	9.5	1.3	0.0	1.3	0.0	1.1	16.6	6.8	0.0	6.8	0.0	5.8	87.4
August-94	3	43.0	53.1	1.7	25.3	0.2	0.0	0.2	0.0	2.9	39.9	0.5	0.0	0.5	0.0	6.7	92.8
########	1	30.0		1.0	30.0	0.1	0.0	0.1	0.0	0.4	29.5	0.3	0.0	0.3	0.0	1.3	98.3
########	2	60.0	127.1	5.5	10.9	0.0	0.0	0.0	0.2	0.3	59.5	0.0	0.0	0.0	0.3	0.5	99.2
########	4	67.5	95.8	3.5	19.3	0.2	0.0	0.2	0.0	1.9	65.4	0.3	0.0	0.3	0.0	2.8	96.9
########	7	37.1	16.6	3.6	10.3	0.5	0.0	0.5	0.0	1.0	35.6	1.3	0.0	1.3	0.0	2.7	96.0
########	3	22.0	81.8	2.0	11.0	0.4	0.0	0.4	0.0	0.4	21.2	1.8	0.0	1.8	0.0	1.8	96.4
########	3	50.0	24.8	5.0	10.0	0.7	0.0	0.7	0.0	1.3	48.0	1.4	0.0	1.4	0.0	2.6	96.0
March-95	3	116.7	71.7	4.0	29.2	0.0	0.0	0.0	0.0	2.9	113.7	0.0	0.0	0.0	0.0	2.5	97.5
April-95	3	38.3	91.6	5.0	7.7	0.2	0.0	0.2	0.0	2.7	35.4	0.5	0.0	0.5	0.0	7.0	92.4
May-95	2	55.0	317.7	2.0	27.5	0.2	0.0	0.2	0.0	3.5	51.3	0.4	0.0	0.4	0.0	6.4	93.3
June-95	2	70.0	381.2	5.0	14.0	0.0	0.0	0.0	0.0	3.9	66.1	0.0	0.0	0.0	0.0	5.6	94.4
July-95	3	43.3	57.4	3.7	11.7	1.0	0.0	1.0	0.0	6.1	36.2	2.3	0.0	2.3	0.0	14.1	83.6
August-95								NO DATA AVAILABLE									
########	1	40.0		5.0	8.0	0.1	0.0	0.1	0.0	0.7	39.1	0.3	0.0	0.3	0.0	1.8	98.0
########								NO DATA AVAILABLE									
########	2	75.0	317.7	5.0	15.0	0.3	0.0	0.3	0.0	1.4	73.3	0.4	0.0	0.4	0.0	1.9	97.7
########	3	31.7	25.9	4.3	7.4	0.8	0.0	0.8	0.0	1.5	29.3	2.5	0.0	2.5	0.0	4.7	92.7
########								NO DATA AVAILABLE									
########	1	70.0		4.0	17.5	0.7	0.0	0.7	0.0	0.2	69.0	1.0	0.0	1.0	0.0	0.3	98.7
March-96																	
April-96								NO DATA AVAILABLE									
May-96																	
June-96																	
MonthAv	**25**	**50.4**	**10.6**	**3.2**	**20.1**	**0.4**	**0.0**	**0.4**	**0.0**	**1.9**	**48.1**	**1.0**	**0.0**	**1.0**	**0.0**	**4.3**	**94.7**

Table 24: Fish biology sampling, beach seine, Bujumbura, monthly characteristics of units sampled.
N = number of units sampled; meanC = mean monthly catch (kg); 95cl = 95 % confidence limits of meanC.
meanC/H = mean monthly catch/haul (kg); mLssp, mOTH = mean monthly catch per unit (kg) for Lates spp. and Other species.
mLMI, mSTA, mCLUP, mLST = mean monthly catch per unit (kg) for L. miodon, S. tanganicae, clupeids and L. stappersii.
%SPECIES ABBR. = percentage contribution of the species in question to the total monthly meanC.

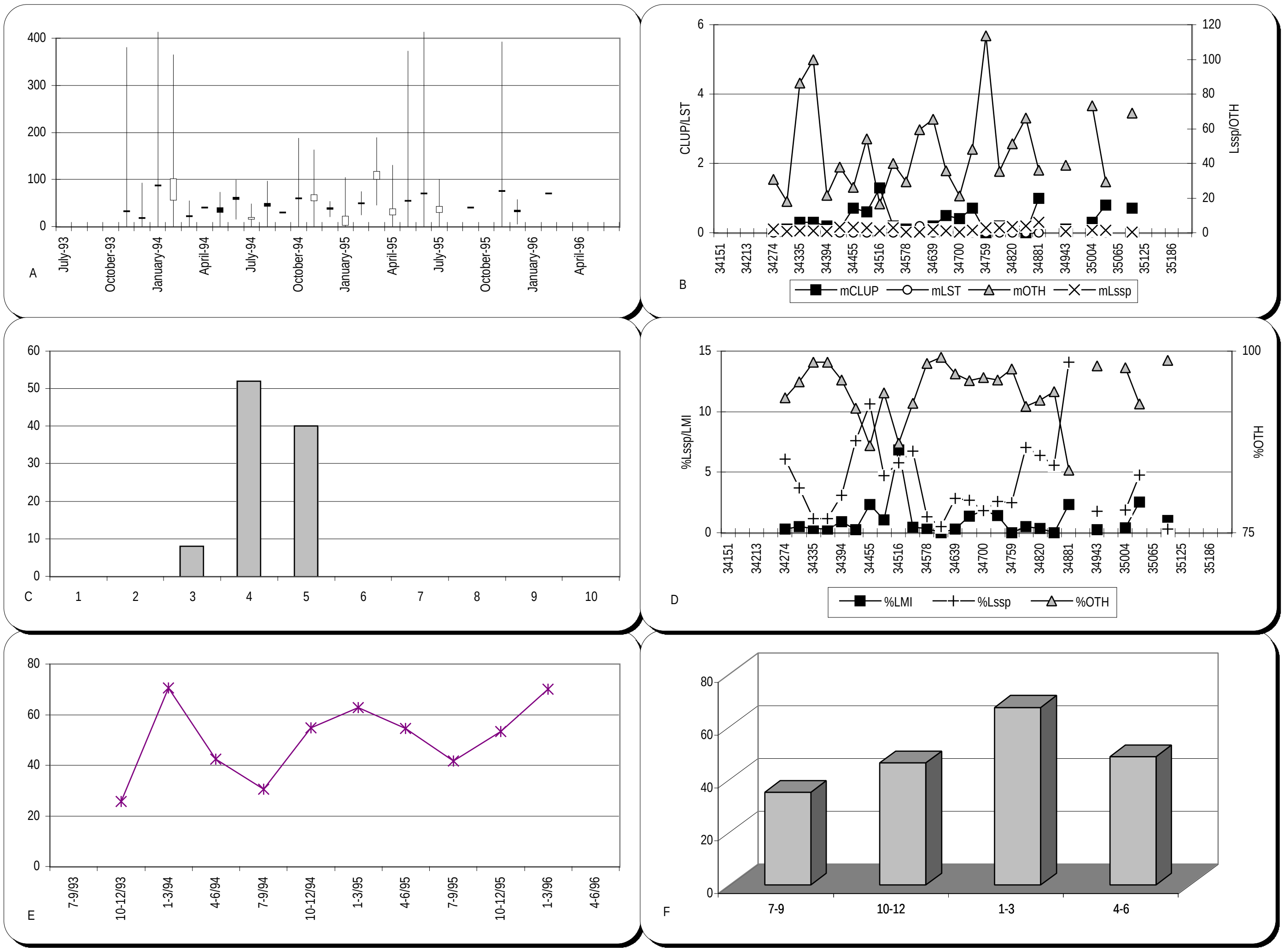

Figure 23: Fish biology sampling, beach seine, Bujumbura, characteristics of units sampled.

A = monthly CPUEs (kg/trip) as mean and median catch with 95% confidence limits.
B = monthly CPUEs (kg/trip) per species(group), CLUP =clupeids, LST = Lates stappersii, Lssp = Lates ssp., OTH = other species.
C = frequency distribution of monthly LN(CPUE+1).
D = monthly % species(group) composition, LMI = Limnothrissa miodon.
E = trimester CPUEs (kg/trip) for the period sampled.
F = trimester CPUEs (kg/trip) averaged over the 3 sampling years.

Month	N	meanC	95cl	meanH	medC	meanC/H	meanL	mLMI	mSTA	mCLUP	mLST	mOTH	%LMI	%STA	%CLUP	%LST	%OTH
July-93	2	23.0	2.2	1.0	23.0	23.0	2.0										
#########	2	94.0	176.3	1.5	94.0	62.7	2.5										
#########	9	67.8	40.2	1.2	50.0	55.5	3.2										
#########	3	65.0	76.3	1.7	40.0	39.0	2.7										
#########	2	27.0	6.5	1.5	27.0	18.0	4.5					**NO DATA AVAILABLE**					
#########	12	23.5	16.6	1.5	14.5	15.7	3.4										
#########	3	18.0	9.0	1.7	16.0	10.8	2.7										
#########	5	18.7	9.9	1.6	22.0	11.7	2.8										
March-94	6	6.9	3.7	1.0	7.0	6.9	2.7										
April-94	6	17.6	10.7	1.3	15.0	13.2	2.8	15.6	0.0	15.6	0.0	2.1	88.1	0.0	88.1	0.0	11.9
May-94	8	213.8	166.5	1.4	128.0	155.5	2.4	213.4	0.0	213.4	0.0	0.3	99.9	0.0	99.9	0.0	0.1
June-94	8	23.7	13.2	1.3	24.7	19.0	2.9	13.5	0.0	13.5	0.0	10.3	56.6	0.0	56.6	0.0	43.4
July-94	7	151.6	81.8	1.6	108.0	96.5	3.3	151.6	0.0	151.6	0.0	0.0	100.0	0.0	100.0	0.0	0.0
#########	14	52.3	26.1	1.0	48.0	52.3	2.3	45.6	5.7	51.4	0.0	0.9	87.3	11.0	98.3	0.0	1.7
#########	7	70.7	63.5	1.0	42.0	70.7	2.7	70.7	0.0	70.7	0.0	0.4	99.4	0.0	99.4	0.0	0.6
#########	9	28.4	11.7	1.0	24.0	28.4	2.0	28.1	0.0	28.1	0.0	0.3	98.9	0.0	98.9	0.0	1.1
#########	14	38.3	15.5	1.0	27.0	38.3	3.0	31.2	7.0	38.3	0.0	0.1	81.4	18.3	99.7	0.0	0.3
#########	8	56.9	79.5	1.0	7.5	56.9	2.3	54.9	1.9	56.9	0.0	0.0	96.5	3.4	100.0	0.0	0.0
#########	9	25.3	14.6	1.1	23.0	23.0	2.4	25.2	0.0	25.2	0.0	0.0	99.8	0.2	100.0	0.0	0.0
#########	7	58.0	3.8	1.1	8.0	52.7	2.1	7.6	0.0	7.6	0.0	0.3	96.2	0.0	96.2	0.0	3.8
March-95	9	17.3	11.0	1.4	9.0	11.9	1.8	16.2	1.0	17.2	0.0	0.1	93.9	5.9	99.7	0.0	0.3
April-95	8	59.2	72.7	1.3	21.0	47.4	2.5	47.0	12.1	59.2	0.0	0.0	79.5	20.5	100.0	0.0	0.0
May-95	7	36.1	30.5	1.3	20.0	28.1	2.4	36.1	0.0	36.1	0.0	0.0	100.0	0.0	100.0	0.0	0.0
June-95	11	40.2	16.8	1.2	40.0	34.0	2.7	35.3	0.0	35.3	0.0	4.9	87.8	0.0	87.8	0.0	12.2
July-95	5	156.8	74.7	1.0	180.0	156.8	2.2	156.8	0.0	156.8	0.0	0.0	100.0	0.0	100.0	0.0	0.0
#########	23	21.2	10.3	1.9	12.0	11.1	2.5			16.1	0.0	5.0			76.3	0.0	23.7
#########	6	19.7	14.4	1.7	18.0	11.8	2.0			12.2	5.0	2.5			61.9	25.4	12.7
#########	14	102.2	158.5	1.4	6.5	71.6	2.1	27.1	75.0	102.1	0.0	0.1	26.5	73.4	99.9	0.0	0.1
#########	12	139.8	173.5	1.8	48.0	76.3	2.8			136.0	0.0	3.6			97.4	0.0	2.6
#########	3	51.7	60.3	1.7	48.0	30.4	2.3			45.0	0.0	6.7			87.0	0.0	13.0
#########								**NO DATA AVAILABLE**									
#########	8	43.0	22.1	1.9	38.0	22.9	2.6			42.5	0.1	0.5			98.6	0.2	1.2
March-96	8	32.7	28.0	1.3	19.5	26.2	2.3	17.6	7.6	25.2	0.0	6.5	55.5	24.0	79.5	0.0	20.5
April-96	16	18.0	8.6	1.1	11.4	16.0	2.0	14.7	0.0	14.7	0.1	3.1	82.0	0.0	82.0	0.7	17.3
May-96	16	20.5	9.6	1.3	12.0	15.6	2.3	16.7	0.4	17.1	0.0	3.4	81.5	1.9	83.4	0.0	16.6
June-96	20	59.4	23.6	1.5	48.0	41.0	2.1	48.5	9.1	57.6	0.1	1.7	81.7	15.3	97.0	0.1	2.9
MonthAv	**35**	**54.2**	**16.2**	**1.3**	**38.3**	**41.4**	**2.5**	**51.1**	**5.7**	**55.6**	**0.2**	**2.0**	**85.4**	**8.3**	**91.8**	**1.0**	**7.1**

Table 25: Fish biology sampling, kapenta beach seine, Mpulungu, monthly characteristics of units sampled.
N = number of units sampled; meanC = mean monthly catch (kg); medC = median monthly catch (kg); 95cl = 95 % confidence limits of meanC.
meanC/H = mean monthly catch/haul (kg); meanL = mean number of lights per unit; mOTH = mean monthly catch per unit (kg) for Other species.
mLMI, mSTA, mCLUP, mLST = mean monthly catch per unit (kg) for L. miodon, S. tanganicae, clupeids and L. stappersii.
%SPECIES ABBR. = percentage contribution of the species in question to the total monthly meanC.

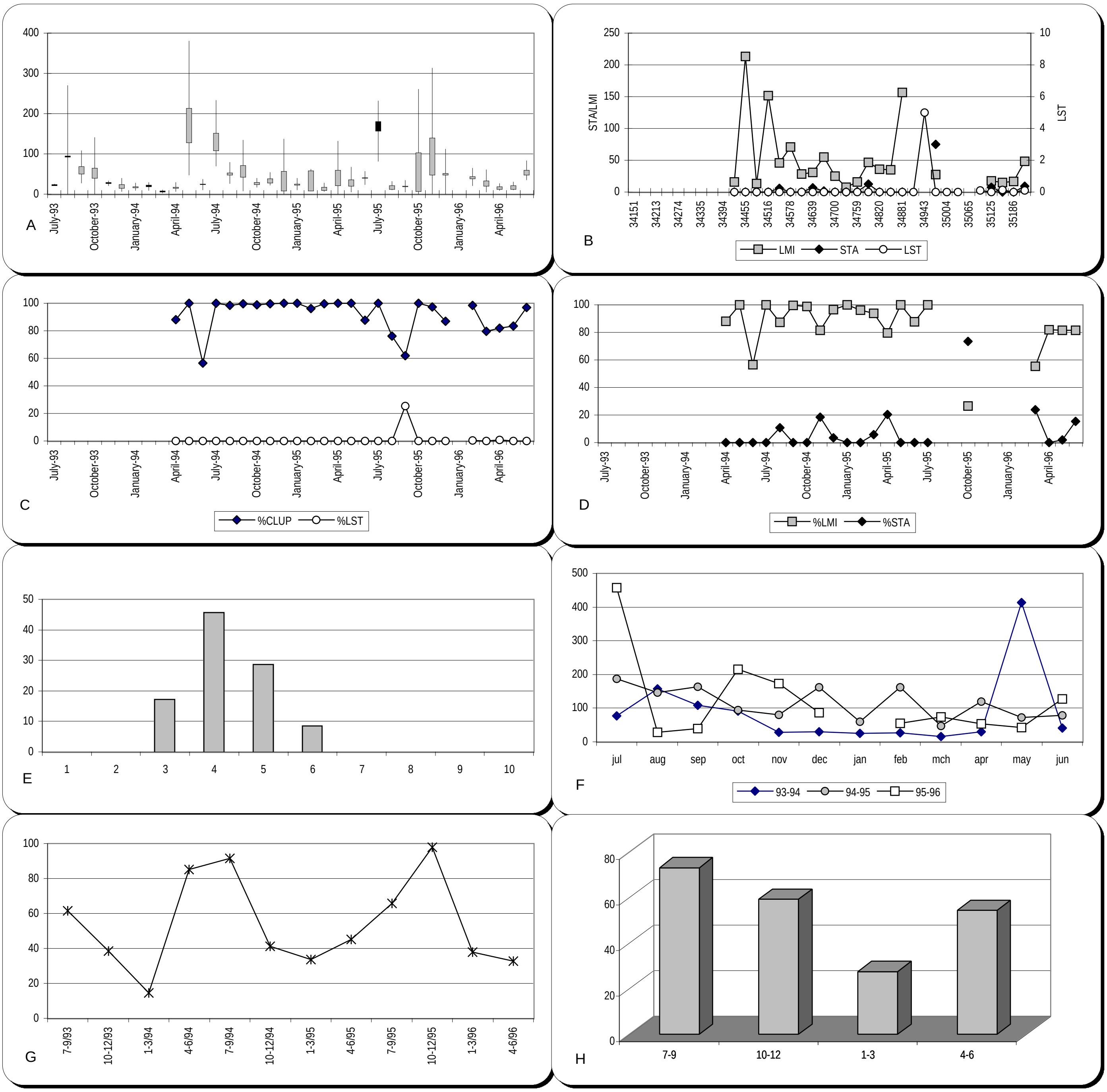

Figure 24: Fish biology sampling, kapenta beach seine, Mpulungu, characteristics of units sampled.

A = monthly CPUEs (kg/trip) as mean and median catch with 95% confidence limits.
B = monthly CPUEs (kg/trip) per species(group), STA = S. tanganicae, LIM = L. miodon, LST = Lates stappersii.
C = monthly % species(group) composition, CLUP = clupeids.
D = monthly % species composition of the clupeids.
E = frequency distribution of monthly LN(CPUE+1).
F = monthly CPUES, after light correction.
G = trimester CPUEs (kg/trip) for the period sampled.
H = trimester CPUEs (kg/trip) averaged over the 3 sampling years.

Month	N	meanC	95cl	meanH	medC	meanC/H	meanL	mLMI	mSTA	mCLUP	mLST	mOTH	%LMI	%STA	%CLUP	%LST	%OTH
July-93																	
#########																	
#########																	
#########																	
#########																	
#########																	
#########								NO DATA AVAILABLE									
#########																	
March-94																	
April-94																	
May-94																	
June-94																	
July-94	2	230.0	127.1	2.0	230.0	115.0	2.0	230.0	0.0	230.0	0.0	0.0	100.0	0.0	100.0	0.0	0.0
#########	1	60.0		1.0	60.0	60.0	4.0	31.8	28.2	60.0	0.0	0.0	53.0	47.0	100.0	0.0	0.0
#########								NO DATA AVAILABLE									
#########	1	250.0		1.0	250.0	250.0	3.0	250.0	0.0	250.0	0.0	0.0	100.0	0.0	100.0	0.0	0.0
#########	1	140.0		1.0	140.0	140.0	6.0	140.0	0.0	140.0	0.0	0.0	100.0	0.0	100.0	0.0	0.0
#########																	
#########								NO DATA AVAILABLE									
#########																	
March-95	3	41.7	89.0	1.0	36.0	41.7	3.3	41.2	0.0	41.2	0.0	0.5	98.8	0.0	98.8	0.0	1.2
April-95	2	84.0	457.7	1.5	84.0	56.0	2.0	84.0	0.0	84.0	0.0	0.0	100.0	0.0	100.0	0.0	0.0
May-95	3	47.3	111.1	1.0	38.0	47.3	2.7	47.3	0.0	47.3	0.0	0.0	100.0	0.0	100.0	0.0	0.0
June-95	2	126.0	686.3	1.5	126.0	84.0	2.0	121.0	0.0	121.0	0.0	5.0	96.0	0.0	96.0	0.0	4.0
July-95	5	170.8	139.5	1.2	178.0	142.3	4.6	170.8	0.0	170.8	0.0	0.0	100.0	0.0	100.0	0.0	0.0
#########	1	174.4		3.0	174.4	58.1	3.0			174.0	0.4	0.0			99.8	0.2	0.0
#########	5	39.6	10.7	2.8	40.0	14.1	2.0			18.0	21.6	0.0			45.5	54.5	0.0
#########	1	140.0		2.0	140.0	70.0	2.0			120.0	0.0	20.0			85.7	0.0	14.3
#########	4	1029.0	2335.2	2.5	900.0	411.6	4.5	51.5	977.6	1029.0	0.0	0.0	5.0	95.0	100.0	0.0	0.0
#########	4	65.5	104.8	3.0	54.0	21.8	6.7	58.3	7.2	65.5	0.0	0.0	89.0	11.0	100.0	0.0	0.0
#########								NO DATA AVAILABLE									
#########	6	335.2	334.5	2.8	171.5	119.7	4.5	149.0	0.0	149.0	186.0	0.2	44.5	0.0	44.5	55.5	0.1
March-96																	
April-96								NO DATA AVAILABLE									
May-96																	
June-96	7	1042.3	1596.8	3.9	696.0	270.0	5.7	410.2	628.6	1038.9	3.4	0.0	39.4	60.3	99.7	0.3	0.0
MonthAv	**16**	**248.5**	**169.6**	**1.9**	**140.0**	**118.9**	**3.6**	**137.3**	**126.3**	**233.7**	**13.2**	**1.6**	**78.9**	**16.4**	**91.9**	**6.9**	**1.2**

Table 26: Fish biology sampling, chiromila seine, Mpulungu, monthly characteristics of units sampled.
N = number of units sampled; meanC = mean monthly catch (kg); medC = median monthly catch (kg); 95cl = 95 % confidence limits of meanC.
meanC/H = mean monthly catch/haul (kg); meanL = mean number of lights per unit; mOTH = mean monthly catch per unit (kg) for Other species.
mLMI, mSTA, mCLUP, mLST = mean monthly catch per unit (kg) for L. miodon, S. tanganicae, clupeids and L. stappersii.
%SPECIES ABBR. = percentage contribution of the species in question to the total monthly meanC.

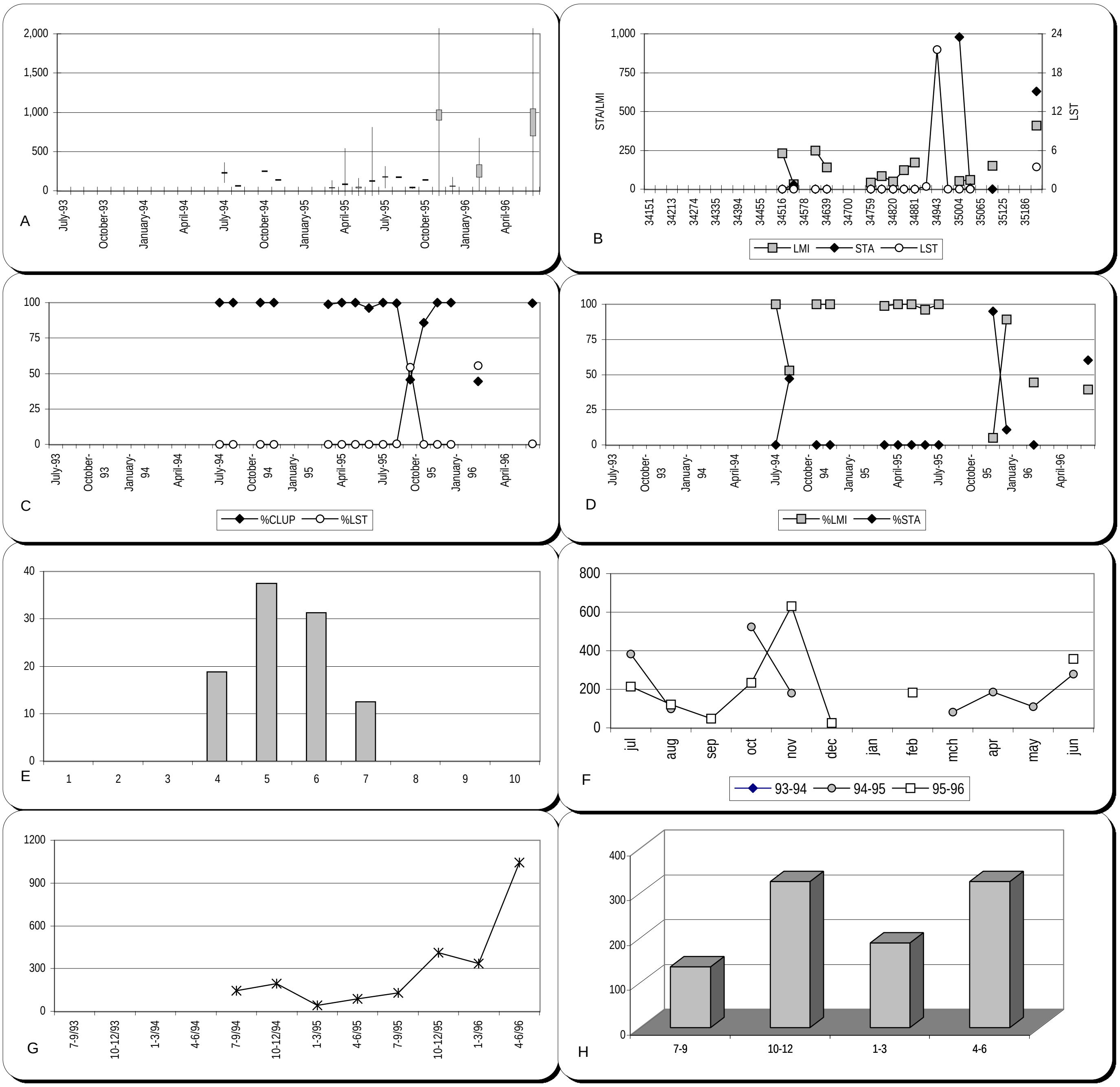

Figure 25: Fish biology sampling, chiromila seine, Mpulungu, characteristics of units sampled.
A = monthly CPUEs (kg/trip) as mean and median catch with 95% confidence limits.
B = monthly CPUEs (kg/trip) per species(group), STA = S. tanganicae, LIM = L. miodon, LST = Lates stappersii.
C = monthly % species(group) composition, CLUP = clupeids.
D = monthly % species composition of the clupeids.
E = frequency distribution of monthly LN(CPUE+1).
F = monthly CPUES, after light correction.
G = trimester CPUEs (kg/trip) for the period sampled.
H = trimester CPUEs (kg/trip) averaged over the 3 sampling years.

Month	N	meanC	95cl	meanH	medC	meanC/H	meanL	mLMI	mSTA	mCLUP	mLST	mOTH	%LMI	%STA	%CLUP	%LST	%OTH
July-93	10	114.0	55.8	2.4	111.0	47.5	7.5										
August-93	6	460.0	262.2	2.0	393.0	230.0	10.2										
########	4	45.6	3.7	1.8	45.8	25.3	3.5										
########	9	1530.0	1230.5	2.2	911.0	695.5	10.0										
########	10	2916.0	1384.3	2.3	3359.0	1267.8	8.9										
########	9	1500.0	1189.8	2.0	1170.0	750.0	9.6										
########	16	1080.0	773.2	2.3	492.5	469.6	10.1										
########	11	646.0	263.0	2.0	600.0	323.0	8.7										
March-94	14	815.0	317.2	2.3	669.0	354.3	8.6										
April-94	6	461.0	366.6	2.0	420.5	230.5	8.3										
May-94	6	1609.0	1872.1	1.7	671.0	946.5	8.7										
June-94	6	1271.0	1698.6	2.0	49.0	635.5	10.0										
July-94	3	72.0	25.8	1.3	84.0	55.4	11.3										
August-94	5	821.0	616.5	2.0	716.0	410.5	7.8										
########	1	220.0		1.0	220.0	220.0	6.0	0.0	0.0	0.0	216.0	4.0	0.0	0.0	0.0	98.2	1.8
########	3	143.0	140.5	2.0	174.0	71.5	8.7	6.0	0.0	6.0	137.3	0.0	4.2	0.0	4.2	95.8	0.0
########	4	276.0	161.3	1.5	251.0	184.0	7.0	0.0	0.0	0.0	275.5	0.0	0.0	0.0	0.0	100.0	0.0
########	6	1106.0	749.1	2.0	1090.0	553.0	13.0	0.0	0.0	0.0	1084.2	7.8	0.0	0.0	0.0	99.3	0.7
########	6	453.0	256.5	1.5	400.0	302.0	6.5	0.0	0.0	0.0	453.3	0.0	0.0	0.0	0.0	100.0	0.0
########	7	116.0	87.5	1.3	100.0	89.2	6.3	0.0	27.0	27.0	89.4	0.0	0.0	23.2	23.2	76.8	0.0
March-95	7	141.0	144.2	1.3	100.0	108.5	6.9	31.4	0.0	31.4	109.3	0.0	22.3	0.0	22.3	77.7	0.0
April-95	6	699.0	442.6	2.0	864.0	349.5	10.3	3.8	0.0	3.8	695.0	0.0	0.5	0.0	0.5	99.5	0.0
May-95	6	1856.0	2413.9	2.0	832.0	928.0	9.0	0.0	0.0	0.0	1856.0	0.0	0.0	0.0	0.0	100.0	0.0
June-95	7	256.0	298.5	2.1	100.0	121.9	10.6	0.3	1.1	1.4	254.7	0.0	0.1	0.4	0.5	99.5	0.0
July-95	5	643.0	722.6	1.4	192.0	459.3	11.2	0.0	0.0	0.0	643.0	0.0	0.0	0.0	0.0	100.0	0.0
August-95	7	193.0	132.5	1.7	200.0	113.5	10.0			0.0	192.0	0.0	0.0	0.0	0.0	100.0	0.0
########	11	955.0	827.3	2.0	372.0	477.5	9.0			0.0	945.1	0.0	0.0	0.0	0.0	100.0	0.0
########	3	257.0	277.4	2.7	260.0	95.2	10.0	16.7	86.7	103.4	153.7	0.0	6.5	33.7	40.2	59.8	0.0
########	2	634.0	570.8	2.0	633.5	317.0	8.0			0.0	445.5	30.0	0.0	0.0	0.0	93.7	6.3
########	4	775.0	705.1	2.0	780.5	387.5	11.5			0.0	720.5	0.0	0.0	0.0	0.0	100.0	0.0
########					**NO DATA AVAILABLE**												
########	4	567.0	416.2	3.0	455.0	189.0	10.5	0.0	0.0	0.0	566.5	0.0	0.0	0.0	0.0	100.0	0.0
March-96	21	422.0	201.1	2.5	300.0	168.8	11.2	30.9	15.0	45.9	373.0	0.4	7.4	3.6	10.9	89.0	0.1
April-96	16	502.0	178.7	2.1	410.0	239.0	12.0	27.2	22.9	50.1	445.7	0.0	5.5	4.6	10.1	89.9	0.0
May-96	10	454.0	229.1	2.4	350.0	189.2	10.9	10.9	6.1	17.0	413.7	1.7	2.5	1.4	3.9	95.7	0.4
June-96	6	528.0	530.0	2.7	277.5	195.6	10.7	7.1	1.1	8.2	500.8	19.3	1.3	0.2	1.6	94.8	3.7
MonthAv	**35**	**701.0**	**210.2**	**2.0**	**528.0**	**348.6**	**9.2**	**7.9**	**9.4**	**14.0**	**503.3**	**3.0**	**2.4**	**3.2**	**5.6**	**93.8**	**0.6**

Table 27: Fish biology sampling, purse seine, Mpulungu, monthly characteristics of units sampled.
N = number of units sampled; meanC = mean monthly catch (kg); medC = median monthly catch (kg); 95cl = 95 % confidence limits of meanC.
meanC/H = mean monthly catch/haul (kg); meanL = mean number of lights per unit; mOTH = mean monthly catch per unit (kg) for Other species.
mLMI, mSTA, mCLUP, mLST = mean monthly catch per unit (kg) for L. miodon, S. tanganicae, clupeids and L. stappersii.
%SPECIES ABBR. = percentage contribution of the species in question to the total monthly meanC.

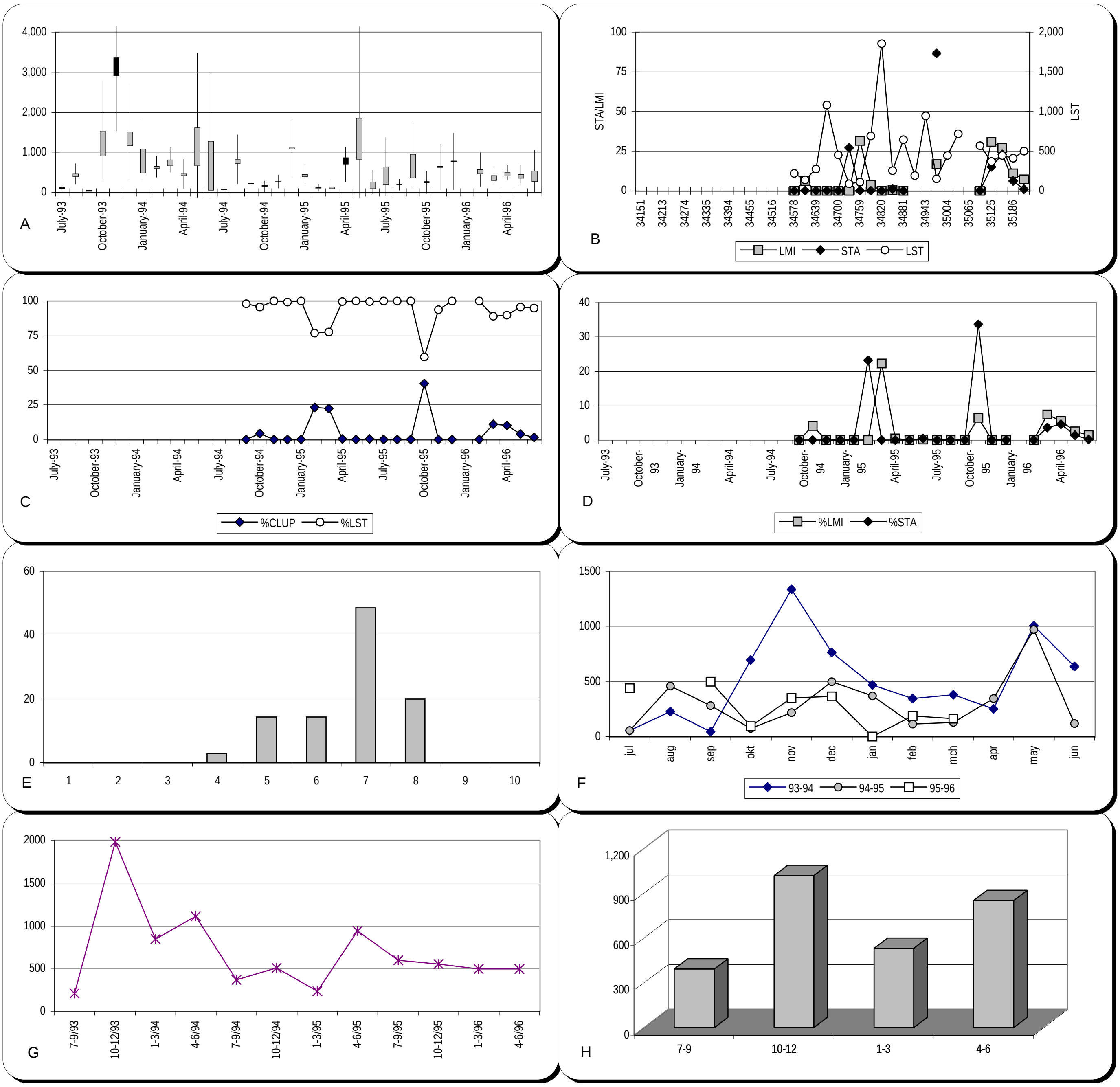

Figure 26: Fish biology sampling, purse seine, Mpulungu, characteristics of units sampled.
A = monthly CPUEs (kg/trip) as mean and median catch with 95% confidence limits.
B = monthly CPUEs (kg/trip) per species(group), STA = S. tanganicae, LIM = L. miodon, LST = Lates stappersii.
C = monthly % species(group) composition, CLUP = clupeids.
D = monthly % species composition of the clupeids.
E = frequency distribution of monthly LN(CPUE+1).
F = monthly CPUES, after light correction.
G = trimester CPUEs (kg/trip) for the period sampled.
H = trimester CPUEs (kg/trip) averaged over the 3 sampling years.

Month	N	meanC	95cl	meanH	medC	meanC/H	meanL	mLMI	mSTA	mCLUP	mLST	mOTH	%LMI	%STA	%CLUP	%LST	%OTH
July-93								NO DATA AVAILABLE									
August-93																	
########	1	300.0		1.0	300.0	300.0	9.0	52.0	22.0	74.0	226.0	0.0	17.3	7.3	24.7	75.3	0.0
########								NO DATA AVAILABLE									
########	2	135.0	190.6	1.0	135.0	135.0	2.0	7.5	60.0	67.5	67.5	0.0	5.6	44.4	50.0	50.0	0.0
########								NO DATA AVAILABLE									
########	3	460.0	741.9	1.0	340.0	460.0	2.0	0.0	0.0	0.0	460.0	0.0	0.0	0.0	0.0	100.0	0.0
########	1	90.0		1.0	90.0	90.0	8.0	52.3	6.5	58.8	31.2	0.0	58.1	7.2	65.3	34.7	0.0
March-94								NO DATA AVAILABLE									
April-94	2	55.0	63.5	1.0	55.0	55.0	2.0	0.0	0.0	0.0	55.0	0.0	0.0	0.0	0.0	100.0	0.0
May-94	3	211.7	142.9	1.0	210.0	211.7	2.0	0.0	0.0	0.0	211.7	0.0	0.0	0.0	0.0	100.0	0.0
June-94	6	146.7	160.8	2.0	65.0	73.4	4.2	0.3	7.8	8.1	138.6	0.0	0.2	5.3	5.5	94.5	0.0
July-94	3	115.0	237.9	1.0	160.0	115.0	2.0	0.4	53.7	54.1	60.8	0.0	0.3	46.7	47.1	52.9	0.0
August-94	2	75.0	190.6	1.0	75.0	75.0	1.5	11.5	6.0	17.5	57.4	0.0	15.4	8.0	23.4	76.6	0.0
########	3	160.0	151.1	1.0	130.0	160.0	2.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	0.0	100.0	0.0
########	3	883.3	847.6	1.0	850.0	883.3	2.3	5.7	0.0	5.7	877.7	0.0	0.6	0.0	0.6	99.4	0.0
########	2	125.0	190.6	1.0	125.0	125.0	2.5	13.5	0.0	13.5	111.5	0.0	10.8	0.0	10.8	89.2	0.0
########	3	71.7	63.7	1.0	65.0	71.7	4.7	11.8	0.0	11.8	59.9	0.0	16.5	0.0	16.5	83.5	0.0
########	2	30.0	127.1	1.0	30.0	30.0	1.5	1.7	0.0	1.7	28.3	0.0	5.7	0.0	5.7	94.3	0.0
########	3	200.0	430.3	1.0	100.0	200.0	3.0	18.6	0.0	18.6	181.4	0.0	9.3	0.0	9.3	90.7	0.0
March-95	2	300.0	0.0	1.0	300.0	300.0	2.0	0.0	0.0	0.0	300.0	0.0	0.0	0.0	0.0	100.0	0.0
April-95	2	80.0	127.1	1.0	80.0	80.0	2.0	0.0	0.0	0.0	80.0	0.0	0.0	0.0	0.0	100.0	0.0
May-95	3	88.3	47.0	1.0	80.0	88.3	4.0	5.2	0.0	5.2	83.2	0.0	5.9	0.0	5.9	94.1	0.0
June-95	2	50.0	127.1	1.0	50.0	50.0	2.5	0.0	0.0	0.0	50.0	0.0	0.0	0.0	0.0	100.0	0.0
July-95	3	246.7	631.1	2.3	100.0	107.3	2.0	2.1	0.0	2.1	244.6	0.0	0.9	0.0	0.9	99.1	0.0
August-95								NO DATA AVAILABLE									
########	1	30.0		1.0	30.0	30.0	2.0	19.8	10.2	30.0	0.0	0.0	66.0	34.0	100.0	0.0	0.0
########	1	1600.0		1.0	1600.0	1600.0	8.0	0.0	0.0	0.0	1600.0	0.0	0.0	0.0	0.0	100.0	0.0
########	2	470.0	381.2	1.0	470.0	470.0	5.5	0.0	0.0	0.0	470.0	0.0	0.0	0.0	0.0	100.0	0.0
########	2	217.5	1429.4	1.0	217.5	217.5	5.0	0.0	0.0	0.0	217.5	0.0	0.0	0.0	0.0	100.0	0.0
########	3	183.3	122.5	1.0	160.0	183.3	1.7	0.0	0.0	0.0	183.3	0.0					
########	2	87.5	158.8	1.0	87.5	87.5	3.0	0.0	0.0	0.0	87.5	0.0	0.0	0.0	0.0	100.0	0.0
March-96	2	167.5	95.3	1.0	167.5	167.5	3.0	0.0	0.0	0.0	167.5	0.0	0.0	0.0	0.0	100.0	0.0
April-96	2	105.0	571.8	1.0	105.0	105.0	4.0	0.8	0.0	0.8	104.3	0.0	0.8	0.0	0.8	99.2	0.0
May-96								NO DATA AVAILABLE									
June-96																	
MonthAv	**28**	**238.7**	**124.1**	**1.1**	**140.9**	**231.1**	**3.3**	**7.3**	**5.9**	**13.2**	**225.5**	**0.0**	**7.9**	**5.7**	**13.6**	**86.4**	**0.0**

Table 28: Fish biology sampling, purse seine, Kigoma, monthly characteristics of units sampled.

N = number of units sampled; meanC = mean monthly catch (kg); medC = median monthly catch (kg); 95cl = 95 % confidence limits of meanC.
meanC/H = mean monthly catch/haul (kg); meanL = mean number of lights per unit; mOTH = mean monthly catch per unit (kg) for Other species.
mLMI, mSTA, mCLUP, mLST = mean monthly catch per unit (kg) for L. miodon, S. tanganicae, clupeids and L. stappersii.
%SPECIES ABBR. = percentage contribution of the species in question to the total monthly meanC.

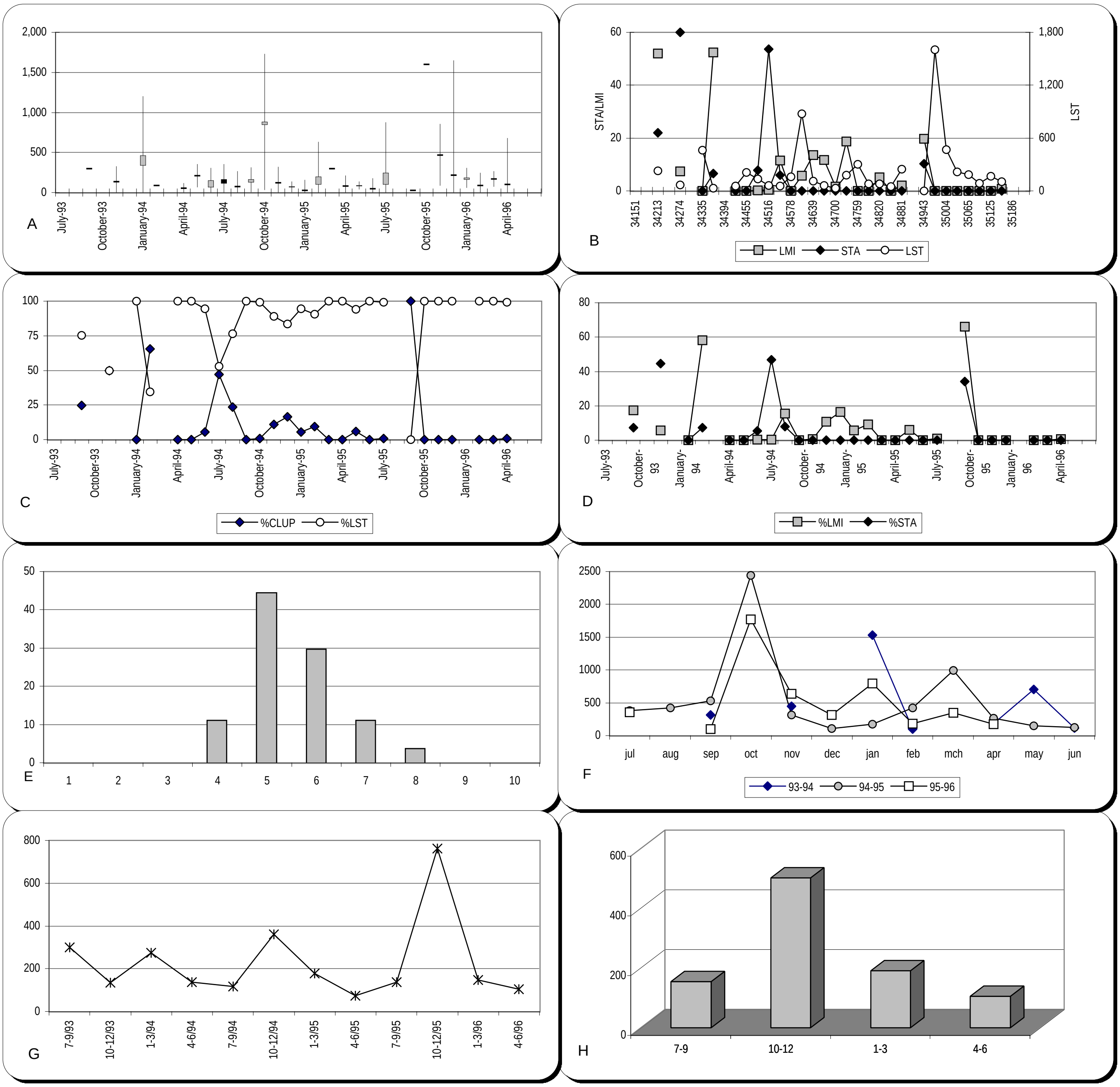

Figure 27: Fish biology sampling, purse seine, Kigoma, characteristics of units sampled.
A = monthly CPUEs (kg/trip) as mean and median catch with 95% confidence limits.
B = monthly CPUEs (kg/trip) per species(group), STA = S. tanganicae, LIM = L. miodon, LST = Lates stappersii.
C = monthly % species(group) composition, CLUP = clupeids.
D = monthly % species composition of the clupeids.
E = frequency distribution of monthly LN(CPUE+1).
F = monthly CPUES, after light correction.
G = trimester CPUEs (kg/trip) for the period sampled.
H = trimester CPUEs (kg/trip) averaged over the 3 sampling years.

LOCATION	PERIOD	IND	CAT	APOL	BS	KS	CHIR	TRAD	GILL
BURUNDI	1994	166.0	144.7	166.0				16.0	
BURUNDI	1995	125.5	146.9	373.8				15.9	
BURUNDI	1996	111.3	102.2	184.9				17.3	
Bujumbura	*1993-96*		*75.4*		*50.4*				
Bujumbura	*1993*		*100.6*						
Bujumbura	*1994*		*57.4*		*49.6*				
Bujumbura	*1995*		*89.3*		*54.2*				
Karonda	*1993-96*		*169.4*						
Karonda	*1994*		*188.8*						
Karonda	*1995*		*175.9*						
TANZANIA	1993		104.0		50.4				35.0
TANZANIA	1994		110.8		51.4				21.9
TANZANIA	1995		50.2		47.9				17.8
Kigoma	*1993-96*	*238.7*	*128.8*						
Kigoma	*1993*		*129.4*						
Kigoma	*1994*	*217.6*	*137.5*						
Kigoma	*1995*	*301.1*	*123.0*						
Kigoma	*1996*	*(135,8)*	*122.5*						
Kipili	*1993-96*		*80.5*						
Kipili	*1994*		*84.3*						
Kipili	*1995*		*(57,0)*						
ZAMBIA	1994		(36)		(133)	(223)	(245)		(9-30)
Mpulungu	*1993-96*	*701.0*	*182.5*			*54.2*	*248.5*		
Mpulungu	1993	983.0							
Mpulungu	*1993*	*1,094.3*				*50.0*			
Mpulungu	1994	877.0							
Mpulungu	*1994*	*710.0*	*(151,9)*			*58.1*	*(170,0)*		
Mpulungu	1995	718.0							
Mpulungu	*1995*	*581.5*	*(266,8)*			*60.6*	*191.8*		
Mpulungu	1996	535.0							
Mpulungu	*1996*	*(494,6)*	*(107,7)*			*(34,7)*			
Nsumbu	1994	700.0							
Nsumbu	1995	549.0							
Nsumbu	1996	1,390.0							
CONGO									
Uvira	*1993-96*		*105.1*						
Uvira	*1993*		*(63,2)*						
Uvira	*1994*		*116.4*						
Uvira	*1995*		*143.8*						
Fizi	1993		123.2						
Kalemie	*1993-96*		*97.4*						
Kalemie	1993	951.0							
Kalemie	1994	802.0	*79.9*						
Kalemie	1995	344.0	*89.7*						
Kalemie	1996	433.0	*144.9*						
Moba	1994-96	802.0							
Moba	*1993-96*		*198.4*						
Moba	*1994*		*117.9*						
Moba	*1995*		*(270,9)*						
Moba	*1996*		*231.9*						

Table 29: Summary of observed CPUEs (kg/trip) for different gears, time spans and locations on Lake Tanganyika.
IND = industrial unit; CAT = catamaran liftnet; APOL = apollo liftnet; BS = beach seine; KS = kapenta beach seine.
CHIR = chiromila seine; TRAD = average traditional unit; GILL = gill net traditional unit.

* trip = one night or day of fishing.

**** data in italics = data originating from SSP fish biology sampling.***

* data not in italics = data originating from CAS.

* (data between brackets) =(CPUEs based on very few observations).