Preliminary Results of the Frame Survey Conducted in the Ugandan Portion of Lake Albert

(29/01–26/02/1991)

by

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Edited by

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Abstract

A census of fish landing sites and active boat units was carried out in the Ugandan part of Lake Albert from 29/01–26/02/1991. This report gives an historical overview of earlier Frame Surveys (FS) and the objectives of the present one and describes the design of FS questionnaires, the planning and the subsequent implementation of the FS. Results of the census and the Catch Assessment Survey (CAS) design for Lake Albert based on the frame information are presented. Recommendations based on these preliminary results are made.

April, 1991

1. Introduction

Lake Albert is an international water body shared by two riparian states, Zaire and Uganda. The lake covers a total estimated surface area of 5,270 square kilometres with approximately 60% within Ugandan waters (Walker, 1972). Located in the western part of the great rift-valley at an altitude of 618 m, its mostly smooth shoreline is characterised by steep escarpments rising abruptly 2000 m above lake level. This is especially true for the middle reaches of the lake. The northern and southern parts of the lake lie in a plain of the rift valley. There, the plains are gently sloping and therefore swampy inshore waters are sometimes encountered. Major inflowing rivers are the Semliki and Kafu at the south. The Victoria Nile flows into the lake at the northern tip and flows out as the Albert Nile, imparting riverine influence in water chemistry and subsequently in the flora and fauna of that part of the lake.

The lake has a diverse and characteristic fish fauna and is therefore a multi-species fishery. Planning and management of this resource requires a reliable monitoring of trends in catches.

This is however impossible because past, available data about the fisheries of both riparian states were noted as inadequate, inconsistent and inaccurate. This grim assessment could only but strengthen the urgent need for a reliable frame of fishing factors on which a catch assessment sample design is based. Comparability of data between the two riparian states with respect to key fishery statistics and characteristics of importance need not be over-stressed. Essential in this respect is the harmonisation of data collection systems in terms of temporal sequence; methodology of conduct as well as closer collaboration between the states (IFIP, 1990).

To this direction, the FISHIN project (UGA/87/007) executed a Frame Survey for the Ugandan part of the lake from 29/1 to 26/2/91 with a view to generate the much needed sampling frame for its CAS design. This was done after an initial reconnaissance mission early January 1991 to better understand and appreciate the lake's operational area (Coenen, 1991).

2. Historical Overview

Several surveys have been conducted on lake Albert though most were multi-purpose and did not execute a census of fishing factors. The first was carried out in 1928 (Worthington, 1929) mainly describing the early fishery of the lake. The first actual estimate of the number of units operating on the lake was obtained with the start of licensing of canoes in 1950. This revealed the predominance of dug-out canoes. A survey conducted by a Belgian team from 1952–1954 to estimate the optimum annual production of fish for the lake and a subsequent follow-up of that survey from 1961 to 1962 by Holden, lacked information on fishing factors and distribution of landing places around the lake (Holden, 1963; Cadwalladr & Stoneman, 1966).

The results of aerial frame surveys of the lake and that of the Albert Nile conducted during 1960 and 1966 revealed 1,011 and 1,503 canoes respectively but gave no indication of number and distribution of landing places (Cadwalladr & Stoneman, 1966). Another aerial survey conducted by the Wildlife Services Ltd. in 1970 revealed 219 landings in Uganda waters with an estimated 826 canoes (Wildlife Services Ltd., 1970). Cadwalladr (1970) summarised the records available at the time as given in table 1.

The Uganda Fisheries Department conducted an aerial count of canoes on various water bodies in 1971 and recorded 985 canoes in L. Albert (Uganda), 23.8% of which were dug-outs (Walker, 1972).

A nation-wide fisheries survey conducted in 1988 by the Planning Unit in MAIF revealed 82 landing places on the lake with a total of 1,557 canoes (Planning Unit MAIF, 1989). It should be noted that due to the different methodologies used in these surveys, the basis for comparability is very much reduced. This could be due to differences in definitions of survey characteristics; approach to fish landings (land, water and aerial); questionnaire designs; etc.

3. Objectives of the Frame Survey 1991

As a result of the project revision based on the recommendations of the Project Evaluation Mission carried out in April/May 1990, the project (UGA/87/007) was extended/expanded to

include the Lake Albert region. The objectives of the project for that lake region are the same as for Lakes Victoria, George and Edward, the original regions covered by the project. The relevant immediate objective was:

- *Strengthening the capability of the Fisheries Department in information systems and fisheries statistics.. … through rehabilitation and improvement of a permanent fisheries monitoring system, especially with regard to the systematic collection, processing and analysis of fishing effort/catch….*

with some of the expected activities being :

- *Organise and conduct a census of all fishing and fish transport facilities operating on lakes Victoria, Edward and George (… later extended to Lake Albert)*.
- *Organise and conduct a census of all major ice plants, fish processing, storage and transport facilities operating on or from the shores of lakes Victoria, Edward and George (… later extended to Lake Albert)*.

The frame survey for L. Albert was implemented as part of these activities. Before the survey started, there existed only a sketchy list of fishing units, based mainly on reports from the field. This was insufficient to determine a sampling frame from which a catch assessment survey re-design could be derived.

4. Preparation of the FS Questionnaire

FS questionnaires were initially designed to collect data on Lakes Victoria, George and Edward. The first design was tried in 1989 on Lakes George and Edward (Nyeko, 1989), based on a modification of an original design by Bazigos (1974). It was later modified and put into its final format to meet specific demands of current data needs, inclusive of socio-economic variables (BIOSTAT UGA/87/007, 1991). Testing of this questionnaire was done through several pilot surveys around Entebbe, Kome and Lulamba Islands (Nyeko, 1990; Odongkara, 1990; Nyeko & Tumwebaze, 1990).

An additional form on individual boat particulars was later designed on the recommendation and in collaboration with Copolla, computer consultant from the Statistics Division, FIDI (Rome), to collect data for each fishing unit (BIOSTAT UGA/87/007, 1991). These standard forms were called FRAFORM.A1 and FRAFORM.A2 respectively, and were also used for the Lake Albert FS.

- FRAFORM.A1

  This questionnaire is composed of 13 questions with four skip patterns (qns. 3,5,6 & 10). The top of the form and qn. 1 are for the identification of the landing site. Qn. 2 consists of locational and status information of the fish landing. Qns. 3,4 & 5 gather information to enable detection of periodicities. Question 6 is for information on the flow of processed fish spatially. Question 7 is designed in a tabular format and collects information on fishing unit

characteristics of the landing. Question 8 asks the inventory of gear types in use. Question 9 asks the inventory of commercial fish species in the catches. Questions 10, 11, 12 and 13 are concerned with marketing and socio-economic characteristics.

• FRAFORM.A2

The boatcard is for individual boat particulars. The first five lines consist of identification information for the particular boat. Next two lines ask for ownership characteristics. The following 4 lines consist of socio-technical information on the particular boat unit. Remaining lines are on gear characteristics used by that boat.

5. Planning the Frame Survey

The Lake Albert survey area embraces the fisheries regions of Fort Portal in the south, Masindi in the middle and Panyimur in the north. For an efficient management of the survey, the survey area was assigned to one single project operational base, the Masindi regional fisheries office (Fig.1). It was decided that the survey would be co-ordinated by a biologist/statistician from the Fisheries Statistics and Information Systems Unit (FSISU), Entebbe, whose role would be the overall supervision of the FS exercise with assistance from the Regional Fisheries Officer, Masindi. The FS team was to be headed by the RFO, accompanied by two other fisheries staff. At the initial phase of the survey, the co-ordinator would accompany the team for one week to ensure that:

- The survey would be conducted in a manner consistent with survey schedule and methodology;
- Procedures would be followed and interview approach and conduct would be correct;
- Field staff would be routinely trained on-the-job to gain practical experience in completing correctly the boatcards;
- Advice would be given on record keeping of boat cards left behind to the local fisheries staff at landings and how best these could be recovered later.

Overall details of the implementation procedures were worked out drawing on experience from a similar, earlier survey conducted on lake Victoria (BIOSTAT UGA/87/007, 1991). Definitions of fishing factors were the same as for Lake Victoria (Nyeko, 1990). A schedule of activities was drawn up by early January 1991. Procurement of survey materials were effected simultaneously. A fibre glass survey boat was made available for the FS.

Survey maps of 1:50,000 covering the entire survey area were reproduced. A map codification system was worked out in order to ensure proper identification of fish landing distribution in space. Training for the survey team was already conducted together with those covering Lake Victoria in August 1990. Manuals prepared and distributed during that training exercise would be used as reference material while conducting the exercise (BIOSTAT UGA/87/007, 1991).

6. Implementation of the FS

6.1. Schedule Implementation

The schedule for the FS execution was discussed with both the Chief Technical Advisor (CTA) and the National Project Director (NPD) prior to the start of the implementation phase. It was agreed that the exercise would start from the northern part of the lake winding up in the southern tip bordering Zaire. The Masindi regional office was made the central point of co-ordination with respect to monitoring from Entebbe and boat card returns by staff from the field.

6.2. Conduct of the Frame Survey

The Entebbe survey co-ordinator arrived in Masindi on the 29th January, 1991 (see Itinerary in Annex I). Together with the survey team, consisting of 3 fisheries officers (see Annex II), detailed plans were discussed. The team was briefed on their roles in the exercise and the following important aspects were stressed :

- Orderly and systematic conduct of the FS as planned from start to end point;
- Daily starting and ending time of the FS to be 8.00 am. and 4.30 pm., respectively;
- Solution to possible problems during the FS to be sole responsibility of survey supervisor;
- Field data safeguard being combined responsibility of all participants.

One of the members already attended the refresher course organised for FS teams in July 1990 at FSISU, Entebbe. A separate briefing session was held for the other two on the start of the survey. The survey co-ordinator launched the FS and stayed on for one week participating jointly with the team to ensure satisfactory implementation. On-the-job training of resident staff in the completion of boat particulars were routinely done at landings. All boat particulars were completed by the survey team for those landings with difficult access for the field staff. The team was encouraged to utilise the Frame Survey Manual as reference material whenever problems were encountered.

The FS team used the 1:50,000 survey maps in order to complete the map codes for all the landings censused. Detection of possible landing places was simpler for more open shoreline in the middle stretches of the lake. For more swampy coastline to the north and south of the lake, special care was taken in order not to miss out on possible small hidden fish landing places. In such situations, binoculars were used to scan the shoreline. The interviewers were instructed to avoid aggregation of landings and to include all landings, whether seasonal or not. Boundary identification problems were not encountered since the international border with Zaire was the limit at the two extremes. The northernmost boundary was set along the confluence of the lake and river ecosystems.

After a week of working with the team, the co-ordinator left the team which was now fully trained to continue the FS on its own. The FS was completed on the 26th February 1991. The co-ordinator returned to Masindi for checking the quality of work done on the 29th February 1991. All questionnaires were screened to see if they were filled properly. The empty boatcards,

delivered and signed for by some field staff to complete the characteristics of those boats that were not covered by the survey team and later forwarded to the RFO, were verified for completeness using the form in Table 2.

6.3. Conduct of Interviews

For Fraform.A1, questions were asked by one team member to a responsible person from the landing visited. This person was usually an elected official of that landing (in the case of major fish landings) or a fisherman found at the landing for smaller landings with less organised community grouping. In most cases, especially in the former, the station masters (elected chief fishermen) had accurate or recent records of boat owners, their canoes and number of gears operated. The practice was to verify such records by quick counting of the boats by another member of the team as well as compare these notes with that of the local staff at the landing. The third member would in the meantime conduct on-the-job training for the local staff on how to complete the remaining boat cards (Fraform.A2). In smaller landings, with difficult access, all the forms were completed by the survey team before proceeding to the next landing. All the information on both FRAFORM.A1 and A2 were completely filled by the end of the survey. All questionnaires, together with all boat cards, were successfully returned to the RFO, Masindi. No major problems were encountered except in question 9 of FRAFORM.A1 where more species had to be registered than there was space available. This was solved by writing on blank spaces within that page.

Materials used for the interview procedure were:

- Topographic maps (1:50,000)
- One questionnaire (FRAFORM.A1) for each landing place
- One questionnaire (FRAFORM.A2) for each active boat

6.4. Observations during the FS

The following observations were made during the course of the survey:

- Some fishing boats are used more than once in a day by different fishermen using also different gears. This is true for cast netters and long liners who mainly borrow or hire boats from gill netters that have landed catch in the morning.
- Multi-gear fishery is in practice throughout the lake. These gears vary in relative importance towards contribution to catch. The predominant ones noted were gill nets, long lines, beach seines, cast nets and traps.
- Daily practice observed at various points along the lake was that landing time varied according to the gear used by a fishing unit. Generally, gill netters land early (6.30–7.30 am); long liners land catches later (8.00–9.00 am); beach seiners any time of day or night and cast netters throughout the day.
- Gill-nets of various sizes used on the lake varied in length, mounting and depth depending on the source (Zaire or Uganda). In very shallow waters, splitting of nets length-wise is common.

- Characteristic observed predominance of certain particular species along the lake in clustered area "zones". This predominance is probably highly correlated to water depth and nature of the fishing grounds. *Alestes spp.* fisheries is predominant around Wanseko and Panyimur where the Nile joins and leaves the lake. Tilapiine fishery predominates around Kabolwa and Bugoigo where there is a shallow and swampy shoreline, with lagoons and bays. The same is true of southern landings from Songa Kiyanja to Rukwanzi where the waters are surrounded by papyrus swamps. The waters are shallow and muddy, hence catch is predominated by *Protopterus spp.*, *Clarias spp.*, *Polypterus spp.* and Tilapias. Pelagic *Hydrocynus spp.* and *Lates* fisheries predominate for the rest of the lake (Kibiro to Nkondo) where the lake is very deep right from the steep escarpment (Owori-Wadunde, 1991).

6.5. Survey Expenditures

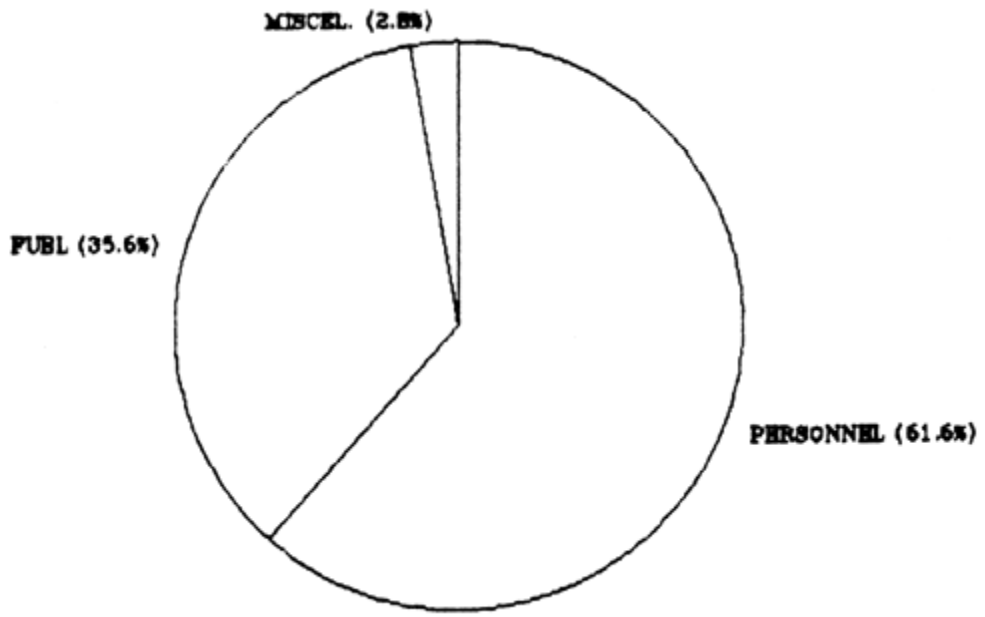
The following project survey equipment was available from the earlier L. Victoria survey:

- Out-board engine (14 Hp)
- Fibre glass boat (9m)
- Camping equipment (2 units)
- 4 WD Vehicle (1)
- Stationary & Miscellaneous Equipment

Therefore, the actual survey expenditures were reduced to:

- Personnel costs (during the survey conduct)
    - Greatly reduced since all other resident staff at the fish landings who assisted in the survey were considered carrying out routine assignment.
    - Survey personnel were paid night allowance (per diem) and accounted for a big fraction of the total cost of the survey budget as shown below.
- Fuel costs
    - on-water approach meant appreciable expenses in terms of fuel costs. The use of a 14 Hp engine however meant greater economy in fuel consumed. A greater Hp would probably have made travel costs prohibitive.

The percentage contribution of personnel and fuel costs to the overall costs of the survey is summarised in table 4 and depicted overleaf. This demonstrates that with the availability of inputs, expenses on personnel and fuel (transport) becomes a major factor to consider in survey planning.



7. Frame Survey Results

7.1. Office Editing of Raw Data

Data from the field were clerically edited at the FSISU in Entebbe. This was done to check whether the questionnaires were complete in numbers or not and if they did contain possible erroneous entries or not. This was also to counter check that the number of active boats entered on FRAFORM.A1 was equal to the one of the boatcards for any single landing place. For this purpose, a boatcard return verification form was used (Table 3).

7.2. Data Entry & Processing

The UGASTAT part for FS was not yet operational. Therefore, as for Lake Victoria, those FS data needed for CAS design were processed with Lotus 1–2–3.

7.3. Results

Preliminary FS analysis results are presented as figures/tables (Annex III) and maps (Annex IV).

In order to get a clear picture of the distribution of the landings for the Ugandan part of the lake, landings surveyed were re-plotted on maps of scale 1:500,000 (Figs. 2, 3, 4 and 5). Fisheries staff disposition and number are also indicated (Fig. 10).

Results of the preliminary analysis are presented by district in Annex III. Tables 5 to 8 show, per district, a listing of all landings surveyed together with their location, boat particulars and calculated percentages.

The FS identified a total of 140 landings distributed along the Ugandan shores of the lake (Fig 2, 3, 4 and 5).

The total number of active boats observed were 2091 of which 1971 were fishing and 120 for transport. A total of 1913 planked fishing canoes and 58 dug-out canoes were censused. Of the planked canoes, 163 were powered. A summary of the distribution of active canoes by type per district is given in table 9.

It was found that 96.9% of the active canoes are planked; 2.9% dug-out and 6.9% powered. The number of active fishing canoes as a percent of total number of active canoes is 94.7%.

There is a noticeable variation in the distribution of fishing canoe types by district. A comparison between percentages of some FS characteristics in the surveyed districts reveals that:

- Bundibugyo district has the highest percentage of dug-out canoes (11.8%). This is probably because of the predominance of shallow and swampy sheltered inshore waters in that district.
- Hoima district has the lowest percentage (0%) of dug-out canoes. The total absence of dug-out canoes in Hoima district is probably linked to hostile lake conditions in this deep water pelagic fishery which makes it difficult for small and unsafe boats (with less gears) to operate
- Hoima district also has the highest percentage of powered canoes (12%) because the lake conditions (strong waves) necessitate the use of powered canoes for fishing in deep waters and for easier means of transportation of fish, people and other goods to markets across the lake.

These observations are summarised in table 10 as percentage distribution of active canoes around Lake Albert, per type and by district. Wide variations in lake and fishing conditions by district are thus observed. The ratio of powered canoes to active canoes is probably a good indication of such variation. The lowest percentage of motorisation is encountered in Nebbi district (2.4%) followed by Bundibugyo (2.6%). Higher percentages of motorisation are observed in Masindi (9.3%) and Hoima (12%) districts. The first two districts have more sheltered shore lines and consequently fishing/transport is possible without much serious need for motorisation. The last two districts have beaches with more exposed shorelines and a predominantly pelagic deep water fishery. Here, motorisation becomes an important factor in the production and transportation of fish.

The size distribution for all the landings surveyed in terms of their number of active canoes, is presented in Figure 6. More than half of the landings (56%) possess 1 to 10 active canoes; 25% have 11 to 20 canoes; 9% have 21 to 30 canoes; 6% have 31 to 80 canoes and 4% have 81 to 110 canoes.

Figure 4 depicts the spatial size distribution of landings by district. There are noticeable variations in frequencies. Almost all the landings in Hoima district (70.4%) are with less than 11 canoes; followed by Masindi (44.8%), Bundibugyo (38.5%) and Nebbi (23.5%). The predominance of these tiny small landings in Hoima is probably due to steep escarpments rising

directly from the lake. Contact with settlements on the hinterland is therefore difficult and space for any big landing site establishment is limited.

The largest concentration of major landings with more than 90 active canoes is found in Masindi district where 4 of the landings (14.3%) have that attribute. Apart from these, only Ntoroko in Bundibugyo has this phenomenal large landing site establishment. These settlements are found to be located where there is relative ease of contact (access roads) with population centres on the hinterland for disposal of the catches.

Major landings on the Ugandan side of the lake, with 30 or more active canoes for Nebbi, Masindi and Bundibugyo districts and 20 or more for Hoima district are summarised in table 11.

When characteristics of these major landings with respect to types of canoes, motorisation and number of transport boats are analysed, it is found that:

- Wanseko in Masindi district, has the highest number of active canoes (108); transport canoes (16) and canoes with outboard engine (16). However, Ntoroko (C) in Bundibugyo district has the highest number of fishing canoes (98).
- Kamuga landing in Bundibugyo district has the highest number of dug-out canoes (12);
- Wanseko, Kabolwa, Bugoigo, Kiina and Ntoroko; all large landings with more than 90 canoes are characteristically served with reliable road transport. This probably stimulated their growth since ready market for catches and secondary activities related to the fishery are well established.
- The major landings above are served by water transport and account for 30.7% of the total number of powered canoes on the Ugandan side of the lake.

8. CAS design for Lake Albert

Information generated from the FS was further restructured for use in the design of a new CAS for the lake.

8.1. Stratification

Lake Albert is heterogeneous in terms of species composition, ecology, limnochemistry, bathymetry, administration and lake and fishing conditions. The conduct of the frame survey provided a reliable frame for meaningful stratification of the lake in time and space for the planned CAS design.

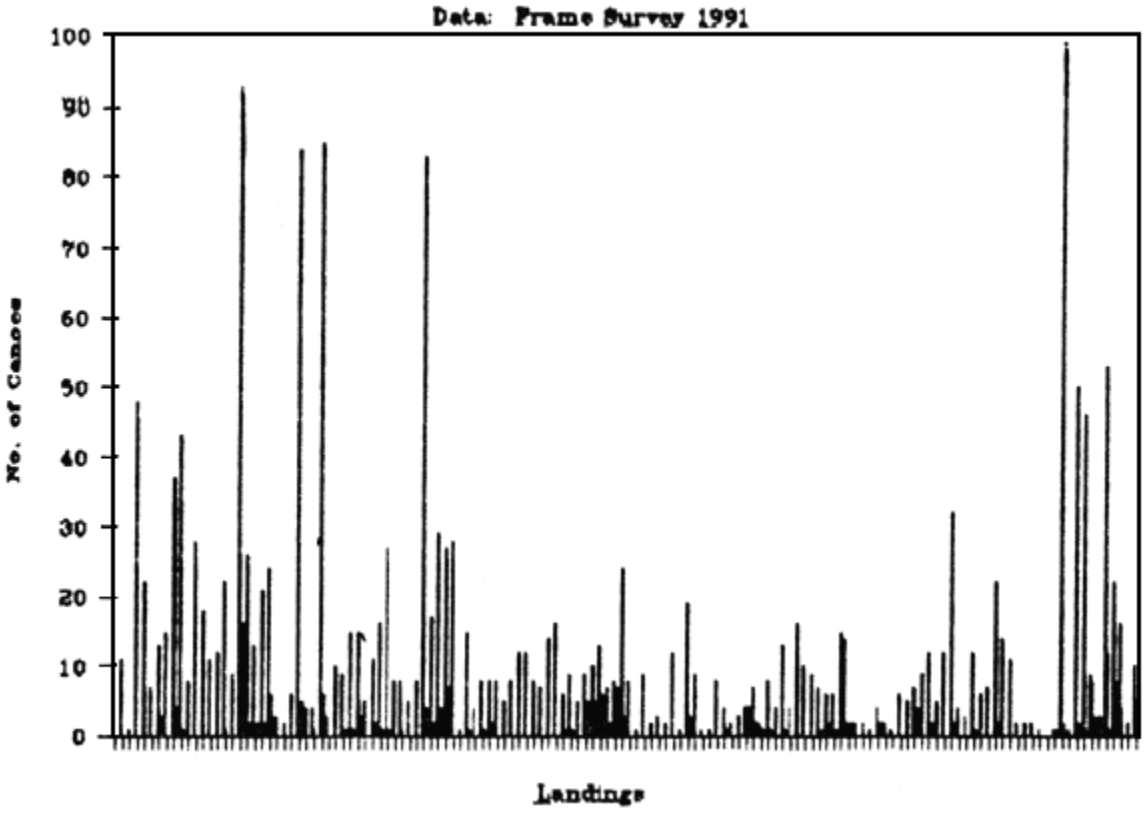
Earlier attempts for spatial stratification of the lake were done by Holden (1963) and walker (1972) as given in Figs. 8 & 9. These were mainly strata delineated following observations of ecological and physical characteristics of the lake portions.

8.1.1. Spatial Stratification

8.1.1.1. First and Second Stage Stratification

The lake was divided into 2 first stage strata: Uganda and Zaire. The Ugandan part of Lake Albert formed the subject for further stratification. In order to control the variability of estimates of catch, the area was stratified based on the recent frame data. Fishing effort, defined as the number of fishing canoes per fish landing site, was used as the major criterion in a second stage stratification. The spatial distribution of effort along the Ugandan part of the lake is shown next page.

Distribution of Effort Across L. Albert



Fishing effort is known to be correlated to catch, hence suitable as a criterion for stratification. This, together with administrative boundary considerations; ecological and known biological characteristics, were used to delimit the lake district into 4 major strata whose boundaries are defined below:

Stratum	Fisheries Administrative Region	Boundary Description
I	Albert Nile	Zaire border from Dei to confluence of Naloi stream at approx. 31°20' E and 2°17' N; then S-East to southern

		most point north of the Victoria Nile delta near Wanseko.
II	Masindi	Wanseko, southwards up to Waki river south of Butiaba pier at approx. 31° 18' E and 1° 46' N.
III	Masindi (Hoima Dist.)	Waki river, southwards to Baker's view approximately 30°44' E and 1° 15' N at Kiakapere.
IV	Masindi/Fort-Portal	Baker's view to Zaire border.

Ecological differences exist between the 4 strata, e.g. stratum I is distinct in terms of ecology as a result of its riverine influence when compared to other strata. The northern delineation of this stratum was based on a known historical fisheries boundary for earlier collection of catch and effort statistics (see Holden, 1963). Stratum III with a predominantly pelagic fishery is similarly ecologically distinct from both II & IV due to the absence of a shallow water inshore fishery. It is expected that catch characteristics by species are more alike within strata than between strata. Table 12 summarises the present distribution of canoes per stratum for Lake Albert.

8.1.1.2. Third Stage Stratification

The four major strata were further divided into manageable workload size chunks (minor strata) that the field staff are able to handle. Factors considered were: the size of the landings in terms of numbers of active fishing boats; total effort per stratum; landing densities (number of landings per stretch of shoreline); staff disposition vs. length of shoreline to be covered and administrative district boundaries. A total of 21 minor strata were delineated and labelled alphabetically within any one second stage (major) stratum. Figure 10 summarises the stratification as proposed above for the lake.

The above minor stratum stratification is presented in 4 major stratum maps (see Figs. 2, 3, 4 and 5) indicating clear boundary delineations for the minor strata to avoid overlap by field personnel during CAS. In future, the distribution of frame information on a minor stratum basis to the field personnel assigned to it will improve their capability to update information over time. Where new landings and/or boats will be observed or existing ones become obsolete, frame information can be updated. This is important for the CAS estimation procedure and the subsequent reliability of the estimates in such a dynamic artisanal fishery.

8.1.2. Temporal Stratification

A year is divided into 12 periods corresponding to calendar months. Days of the month (calendar dates) for which sampling is conducted is predetermined for each minor stratum: total number of days sampled within any minor stratum depends on the sampling intensity allocated to that minor stratum. The minor strata II-A, II-D and IV-A, where respectively the major landings of Wanseko, Bugoigo and Ntoroko more or less constitute a minor stratum, were allocated greater intensity of sampling (every second day). The selected landings of the 18 other minor strata are to be sampled every third day. The landings to be sampled, in a given minor stratum for each month, is chosen by Probability Proportionate to Size (PPS) of landings. The bigger the landing

in terms of number of active fishing boats, the higher the probability of being selected for sampling. Percentage contributions of each landing to the total number of fishing boats in a minor stratum was derived from the FS results (see tables 5, 6, 7 and 8).

8.1.3. Raising Factors for CAS Estimation

CAS estimation procedures by minor strata as proposed by Malvestuto (1990) means availability of reliable frame information per minor stratum and a number of raising factors.

The total number of fishing boats in a minor stratum divided by the number of surveyed boats for a given landing sampled gives the area raising factor. The information on total number of fishing boats is extracted from the frame data hence the importance of an accurate frame.

The total number of fishing boats landing their catch to the sampled landing on the sampled date divided by the total number of sampled boats gives the landing raising factor.

The total number of days in the calendar month for which catch estimate is required divided by the number of days in which sampling was carried out gives the time raising factor.

9. Conclusions & Recommendations

Interesting developments have taken place as can be seen from comparisons between results of earlier Frame Surveys and the present one for the Ugandan part of Lake Albert (Table 13).

The number of fishing boats have progressively increased over the years in terms of quality and quantity. A substantial decline in the number of dug-out canoes (89%) with a concordant increase in the number of planked canoes (87%) was observed during the past 21 years. For the same period, the total number of fishing canoes censused almost doubled (Table 13).

Up to 1957 (see Table 1), dug-out canoes (700 in number) accounted for 100% of registered boats on the Ugandan part of the lake (Cadwalladr, 1970). The introduction of Kabalega planked canoe in 1958 and a type of planked canoes from Zaire (Barque) displaced the traditional dug-out canoes. The number of dug-out canoes censused in 1991 is only 58 and contributes only to 2.9 % of the total number of active boats.

Though Cadwalladr & Stoneman (1966) mentioned that the construction of dug-outs around the Ugandan part of the lake had ceased by 1962, the current figure of 58 points to the fact that it may be otherwise. A fishing unit using a dug-out canoe can only economically survive where catchability is high, as e.g. in shallow and sheltered, swampy lagoons and bays. Their manoeuvrability in such habitat compared to conventional planked canoes suggests that dug-out production may not cease altogether.

However, the assumption by Okaronon & Kamanyi (1989) that two dug-out canoes fishing unit (FU) catches can be equated to that of one planked canoe FU in the CAS estimation could be questioned. Catchability depends also on other factors than the type of boat or the number of gears used, namely: the abundance and distribution of the target fish species; the level of

exploitation; the nature of the fishing grounds; the personal skill of the fisherman; etc. Therefore, there is need for a detailed case study on the difference between mean catch rates of two such units. At present, CAS estimates are based on catch/boat/day whether the fishing unit is a planked canoe or a dug-out. Anyway, the system of random sampling of fishing boats to be surveyed already caters for possible differences in catch rates between these two boats.

When results of the 1970 aerial survey (Wild Life Services Ltd., 1970), the 1988 on-land survey (Planning Unit MAIF, 1989) and the 1991 on-water are compared, the following can be discerned (see table 13):

- If the Wild Life Services Ltd. (1970) figures are to be relied upon, the decline in the number of landings over the last 21 years from 219 in 1970 to 140 in 1991, were mainly in Masindi district; from 87 landings in 1970 to 29 (in Buliisa county) in 1991 as shown in Table 14.
- It is however possible and probable that the aerial survey conducted in 1970 could have counted "resting sites for canoes[1]" mistakenly for fish landings. This quite is possible in the absence of an on-land coverage check survey (CCS) that should have been used to adjust for erroneous inclusions.

In conclusion, the FS provided a reliable frame for the catch assessment sample survey design. Using the results of the FS, a multistage stratified sampling plan based on 3 stages of stratification was described. Altogether, two recognisable frames were presented: a list of all landing places and one for all boats at those landings. Regular updates of these frames based on information from field staff is recommended. This will enable the reduction of errors in future catch estimates for the established minor and major strata. The Fisheries Department should utilise the initial frame and continue to improve on it periodically with a goal of obtaining a updated, reliable sample frame at minimal cost. When more funds should be available in future, the sample design could be more refined and detailed for obtaining more reliable and precise CAS estimates.

The observed practices of landing catch more than once a day using the same fishing boat, but different gear types, bias the present catch estimation procedures based on catch/boat/day catch assessment. A similar phenomenon applies for beach seiners who land their catches at any place and any time of night or day. The first problem could be solved if the surveyor monitors and records catch of the sampled boat for the whole day even if that boat goes out several times. There is, therefore, urgent need to strengthen existing administrative laws on time and place of operation of beach seines for Lake Albert and the following is recommended:

- A total ban on beach seines could be reinforced;
- An independent and fully empowered Fishery Law Enforcement Unit (FLEU) should be created to reinforce all fisheries regulations.

The practice of splitting gill-nets lengthwise; the differences in the lengths of pieces of nets sold (according to the manufacturer); the state or condition of any fishing gear; etc. probably render any catch estimation procedure based on catch/gear/day unreliable in artisanal fisheries.

1. *a resting site is a place where the fisherman after landing his catch at the fish landing, takes his canoe for keeping e.g. gear preparation, before he goes out again to fish.*

The observed predominance of certain particular species in the catches due to habitat differences is useful in the CAS design as one of the stratification criteria. This obviously helps to improve the reliability of the estimates by ensuring less variability within strata.

Fish landings on the Ugandan part of lake Albert need to be assisted by improvement of roads and communication facilities. Parallel to this, some of the landings should be declared illegal by legislation. Limits could be set to minimal number of canoes that should operate at a fish landing. This would help in solving the problem of numerous scattered and/or satellite landings and in improving the infrastructure development at landings, in general, and also the collection of statistics.

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Preliminary Results of the Frame Survey Conducted in the Ugandan Portion of Lake Albert (Cont.)

Annex I

ITINERARY OF THE FRAME SURVEY

Date	*Activity*
29th January	Survey Inputs Delivered to Masindi Regional Office (Boat, Engine, Fuel, Forms etc.)
30th January	Survey Team (ST) launches the new boat at Butiaba for Panyimur to start the Frame Survey exercise accompanied by a staff member of the FSISU, Entebbe.
31st January	Frame Survey starts from Dei, the southern most landing of Panyimur (close to Zaire boarder)
3rd February	Enumeration completed in Panyimur and ST crosses to Wanseko
4th February	Exercise starts from Wanseko southerly to Bugoigo
5th February	FSISU staff member leaves the ST. ST continues the FS south, up to Ntoroko (Bundibugyo District)
21st February	FS finalised at last fish landing site (Rukwanzi) near Uganda-Zaire border
22–23rd February	FS execution in Ndaiga area which had been skipped earlier

Annex II

Frame Survey Team Participants

Name	*Title/Location*	*Activity*
1. D. Nyeko	*FO, FSISU*	*Survey Co-ordinator*
2. A. Owori-Wadunde	*RFO, Masindi*	*Survey Supervisor*
3. E. Bazaire	*FDO, Hoima*	*Survey Team Member*
4. E. Mbaziira	*AFDO, Masindi*	*-do-*

ANNEX III

Table 1: Past Frame Survey Results for Lake Albert and Albert Nile (*After: Cadwalladr, 1970.*)

Year	Lake Albert		Albert & Alb. Nile		Survey Methods
	Dug-out	Planked	Dug-out	Planked	
1951	497	-	-	-	Licensing Records
1952	546	-	-	-	-do-
1953	568	-	-	-	-do-
1954	600	-	-	-	-do-
1955	659	-	-	-	-do-
1956	700	-	-	-	-do-
1957	-	-	-	-	-
1958		30	-	-	Prod. figs. Bt. Buil.
1960		-	930	183	Aerial survey
1962		-	460	126	Aerial survey
1963		-	-	-	
1965	520	244	818	244	Aerial survey
1966	878	262	1,235	268	
1970	327	499	-	-	Aerial survey by professional firm

Table 2: Form used for Field Transmittal of Boatcards

REGIONAL OFFICE BOATCARD RETURN VERIFICATION FORM

Date	Landing	Map Code	# BCards Complete	# BCards Not Com.	Name staff	Signature

Table 3: Form used for Verification of Boatcard returns

FSISU OFFICE PROCESSING BOATCARD RETURN VERIFICATION FORM

Landing	Map Code	# Act. Boats Fraform.A1	# Act. Boatcards Receieved	Difference (+/-)

Table 4: Overall estimate of expenditures for the Frame Survey conducted on Lake Albert

Running Cost (Uganda Shillings) - Frame Survey Lake Albert			
Components	DAILY AMT	D	TOTAL AMT
PERSONNEL:			
01 DSA			
1 RFO	12,000.00	21	252,000.00
1 FDO	12,000.00	21	252,000.00
1 FA	5,000.00	21	105,000.00
1 FO	24,000.00	10	240,000.00
02 Training			
1 FA	30,000.00	1	30,000.00
TRAVEL COSTS:			
01 Fuel (On-Water)	15,238.00	21	320,000.00
02 Fuel (On-Land)	48,750.00	4	195,000.00
MISCELLANEOUS:			
01 Reporting Costs			35,000.00
02 Sundry			5,200.00
COSTS TOTAL			1,434,200.00

AMT = Amount (Ug Shs)
DSA = Daily Subsistence Allowance
D = Number of Days

Table 5: LAKE ALBERT (UGANDA)
FRAME SURVEY DATA SUMMARY - NEBBI DISTRICT

Landing	Parish	Sub County	County	District	Map Code	Seasonal Use	Active Canoes	Transp. Canoes	Fishing Canoes	Dugout Canoes	Plank Canoes	Powered Canoes	%D-Out Canoes	% Plank Canoes	% Powered Canoes	% Fish Canoes/ Total Fish Can.
Dei	Nyakagei	Panyimur	Jonam	Nebbi	1	All	67	1	66	0	66	1	0.0	98.5	1.5	17.5
Nyamutagana	Nyakagei	Panyimur	Jonam	Nebbi	2	All	11	0	11	0	11	0	0.0	100.0	0.0	2.9
Songa Ger	Nyakagei	Panyimur	Jonam	Nebbi	3	All	1	0	1	0	1	0	0.0	100.0	0.0	0.3
Kayonga	Nyakagei	Panyimur	Jonam	Nebbi	4	All	48	0	48	0	48	0	0.0	100.0	0.0	12.7
Angumu	Nyakagei	Panyimur	Jonam	Nebbi	5	All	22	0	22	0	22	0	0.0	100.0	0.0	5.8
Rwanga	Nyakagei	Panyimur	Jonam	Nebbi	6	All	7	0	7	0	7	0	0.0	100.0	0.0	1.9
Singla (A)	Nyakagei	Panyimur	Jonam	Nebbi	7	All	13	0	13	0	13	3	0.0	100.0	23.1	3.4
Singla (B)	Ganda	Panyimur	Jonam	Nebbi	8	All	16	1	15	0	16	0	0.0	100.0	0.0	4.0
Abok	Ganda	Panyimur	Jonam	Nebbi	9	All	37	0	37	0	37	4	0.0	100.0	10.8	9.8
Munywa	Ganda	Panyimur	Jonam	Nebbi	10	All	45	2	43	0	45	1	0.0	100.0	2.2	11.4

Ogal	Ganda	Panyimur	Jonam	Nebbi	11	All	9	1	8	0	9	0	0.0	100.0	0.0	2.1
Wangkado	Boro	Panyimur	Jonam	Nebbi	12	All	29	1	28	0	29	0	0.0	100.0	0.0	7.4
Kivuje	Boro	Panyimur	Jonam	Nebbi	13	All	18	0	18	0	18	0	0.0	100.0	0.0	4.8
Kaligonzi	Boro	Panyimur	Jonam	Nebbi	14	All	11	0	11	0	11	0	0.0	100.0	0.0	2.9
Jakok	Boro	Panyimur	Jonam	Nebbi	15	All	12	0	12	0	12	0	0.0	100.0	0.0	3.2
Mututu	Boro	Panyimur	Jonam	Nebbi	16	All	22	0	22	1	21	0	4.5	95.5	0.0	5.8
Mbagru	Boro	Panyimur	Jonam	Nebbi	17	All	9	0	9	0	9	0	0.0	100.0	0.0	2.4
TOTAL NO. OF LANDINGS = 17							377	6	371	1	375	9	0.3	99.5	2.4	98.4

Table 6: LAKE ALBERT (UGANDA)
FRAME SURVEY DATA SUMMARY - MASINDI DISTRICT

Landing	Parish	Sub County	County	District	Map Code	Seas't y All/Part	Active Canoes	Transp. Canoes	Fishing Canoes	Dugout Canoes	Plank Canoes	Powered Canoes	% D-out Canoes	% Plank Canoes	% Powered Canoes	% Fish Canoes/ Total Fish Can.
Wanseko	Kigwera	Buliisa	Buliisa	Masindi	18	All	108	16	92	7	101	16	6.5	93.5	14.8	13.2
Wankende	Kigwer	Buliis	Buliis	Masin	19	All	28	2	26	2	24	2	7.1	85.7	7.1	3.7

	a	a	a	di												
Kalolo	Kigwer a	Buliis a	Buliis a	Masin di	20	All	13	0	13	1	12	2	7.7	92.3	15.4	1.9
Katala	Kisiabi	Buliis a	Buliis a	Masin di	21	All	21	0	21	1	20	2	4.8	95.2	9.5	3.0
Karakaba	Kisiabi	Buliis a	Buliis a	Masin di	22	All	25	1	24	0	25	6	0.0	100.0	24.0	3.4
Chogo Liech (A)	Kisiabi	Buliis a	Buliis a	Masin di	23	All	3	0	3	0	3	0	0.0	100.0	0.0	0.4
Chogo Liech (B)	Kisiabi	Buliis a	Buliis a	Masin di	24	Part	2	0	2	0	2	0	0.0	100.0	0.0	0.3
Chogo Liech (C)	Kisiabi	Buliis a	Buliis a	Masin di	25	All	6	0	6	0	6	0	0.0	100.0	0.0	0.9
Kabolwa	Kisiabi	Buliis a	Buliis a	Masin di	26	All	89	5	84	1	88	5	1.1	98.9	5.6	12.0
Mulango Mbili	Kisiabi	Buliis a	Buliis a	Masin di	27	All	4	0	4	0	4	0	0.0	100.0	0.0	0.6
Waisoke	Kisiabi	Buliis a	Buliis a	Masin di	28	Part	4	0	4	1	3	0	25.0	75.0	0.0	0.6
Bugoigo	Butiab a	Biiso	Buliis a	Masin di	29	All	87	2	85	1	86	6	1.1	98.9	6.9	12.2
Songa	Butiab a	Biiso	Buliis a	Masin di	30	All	3	0	3	0	3	0	0.0	100.0	0.0	0.4
Sonsio (A)	Butiab a	Biiso	Buliis a	Masin di	31	All	10	0	10	0	10	0	0.0	100.0	0.0	1.4
Sonsio (B)	Butiab a	Biiso	Buliis a	Masin di	32	All	9	0	9	0	9	1	0.0	100.0	11.1	1.3
Nyamukuta	Butiab a	Biiso	Buliis a	Masin di	33	All	15	0	15	0	15	1	0.0	100.0	6.7	2.1

Kamagongoro	Butiaba	Biiso	Buliisa	Masindi	34	All	15	0	15	0	15	3	0.0	100.0	20.0	2.1
Bube	Butiaba	Biiso	Buliisa	Masindi	35	All	5	0	5	0	5	0	0.0	100.0	0.0	0.7
Walukuba	Butiaba	Biiso	Buliisa	Masindi	36	All	13	2	11	0	13	2	0.0	100.0	15.4	1.6
Tugo Mbili	Butiaba	Biiso	Buliisa	Masindi	37	All	17	1	16	0	17	1	0.0	100.0	5.9	2.3
Kampala (B)	Butiaba	Biiso	Buliisa	Masindi	38	All	28	1	27	1	26	1	3.6	92.9	3.6	3.9
Kampala (A)	Butiaba	Biiso	Buliisa	Masindi	39	Part	8	0	8	0	8	0	0.0	100.0	0.0	1.1
Fisheries Camp	Butiaba	Biiso	Buliisa	Masindi	40	All	8	0	8	1	7	0	12.5	87.5	0.0	1.1
Pida	Butiaba	Biiso	Buliisa	Masindi	41	All	5	0	5	0	5	0	0.0	100.0	0.0	0.7
Seseko	Butiaba	Biiso	Buliisa	Masindi	42	All	8	0	8	0	8	0	0.0	100.0	0.0	1.1
Kiina	Butiaba	Biiso	Buliisa	Masindi	43	All	87	4	83	0	87	4	0.0	100.0	4.6	11.9
Severino's Camp	Butiaba	Biiso	Buliisa	Masindi	44	All	18	1	17	0	18	2	0.0	100.0	11.1	2.4
Songa	Butiaba	Biiso	Buliisa	Masindi	45	All	30	1	29	0	30	4	0.0	100.0	13.3	4.2
Kawaibanda	Butiaba	Biiso	Buliisa	Masindi	46	All	29	2	27	0	29	7	0.0	100.0	24.1	3.9
TOTAL NO. OF LANDINGS = 29							698	38	660	16	679	65	2.3	97.3	9.3	94.6

Table 7: LAKE ALBERT (UGANDA)
FRAME SURVEY DATA SUMMARY - HOIMA DISTRICT

Landing	Parish	Sub County	County	District	Map Code	Seas'ty All/ Part	Active Canoes	Transp. Canoes	Fishing Canoes	Dugout Canoes	Plank Canoes	Powered Canoes	% D-Out Canoes	% Plank Canoes	% Powered Canoes	% Fish Canoes/ Total Fish Can.
Waki	Kapapi	Kigoroba	Bugaya	Hoima	47	All	28	0	28	0	28	0	0.0	100.0	0.0	4.2
Katongi	Kapapi	Kigoroba	Bugaya	Hoima	48	All	1	0	1	0	1	0	0.0	100.0	0.0	0.1
Runga	Kapapi	Kigoroba	Bugaya	Hoima	49	All	15	0	15	0	15	1	0.0	100.0	6.7	2.2
Bikunyu	Bikunyu	Kigoroba	Bugaya	Hoima	50	All	4	0	4	0	4	0	0.0	100.0	0.0	0.6
Kababwa	Kiganja	Kigoroba	Bugaya	Hoima	51	All	8	0	8	0	8	1	0.0	100.0	12.5	1.2
Kibiro	Kiganja	Kigoroba	Bugaya	Hoima	52	All	8	0	8	0	8	2	0.0	100.0	25.0	1.2
Kachuru	Kiganja	Kigoroba	Bugaya	Hoima	53	All	8	0	8	0	8	0	0.0	100.0	0.0	1.2
Kyabarangwa	Kiganja	Kigoroba	Bugaya	Hoima	54	All	5	0	5	0	5	0	0.0	100.0	0.0	0.7
Petie	Kiganja	Kigoroba	Bugaya	Hoima	55	All	8	0	8	0	8	0	0.0	100.0	0.0	1.2
Songa Gagi	Kiganja	Kigoroba	Bugaya	Hoima	56	All	12	0	12	0	12	0	0.0	100.0	0.0	1.8

Hoimo (A)	Kiganja	Kigoroby a	Bugaya	Hoima	57	All	12	0	12	0	12	0	0.0	100.0	0.0	1.8
Hoimo (B)	Toonya	Buseruka	Bugaya	Hoima	58	All	8	0	8	0	8	0	0.0	100.0	0.0	1.2
Hoimo (C)	Toonya	Buseruka	Bugaya	Hoima	59	All	7	0	7	0	7	0	0.0	100.0	0.0	1.0
Buhuma	Toonya	Buseruka	Bugaya	Hoima	60	All	14	0	14	0	14	0	0.0	100.0	0.0	2.1
Fofo	Toonya	Buseruka	Bugaya	Hoima	61	All	16	0	16	0	16	0	0.0	100.0	0.0	2.4
Rwentale	Toonya	Buseruka	Bugaya	Hoima	62	All	7	1	6	0	7	1	0.0	100.0	14.3	0.9
Nana (A)	Toonya	Buseruka	Bugahya	Hoima	63	All	10	1	9	0	10	1	0.0	100.0	10.0	1.3
Nana (B)	Toonya	Buseruka	Bugahya	Hoima	64	All	5	0	5	0	5	0	0.0	100.0	0.0	0.7
Kiryambo ga	Toonya	Buseruka	Bugahya	Hoima	65	All	13	4	9	0	13	5	0.0	100.0	38.5	1.3
Toonya	Toonya	Buseruka	Bugahya	Hoima	66	All	12	2	10	0	12	5	0.0	100.0	41.7	1.5
Kisaigi	Toonya	Buseruka	Bugahya	Hoima	67	All	16	3	13	0	16	6	0.0	100.0	37.5	1.9
Songamar i (A)	Toonya	Buseruka	Bugahya	Hoima	68	All	7	0	7	0	7	2	0.0	100.0	28.6	1.0
Songamar i (B)	Toonya	Buseruka	Bugahya	Hoima	69	All	13	5	8	0	13	7	0.0	100.0	53.8	1.2
Kijangi	Toonya	Buseruka	Bugahya	Hoima	70	All	25	1	24	0	25	3	0.0	100.0	12.0	3.6
Kabanda	Toonya	Buseruka	Bugahya	Hoima	71	All	8	0	8	0	8	0	0.0	100.0	0.0	1.2
Mbegu (A)	Toonya	Buseruka	Bugahya	Hoima	72	All	1	0	1	0	1	0	0.0	100.0	0.0	0.1
Mbegu (B)	Toonya	Buseruka	Bugahya	Hoima	73	All	9	0	9	0	9	0	0.0	100.0	0.0	1.3
Ruhanga Rwengabi	Toonya	Buseruka	Bugahya	Hoima	74	All	2	0	2	0	2	0	0.0	100.0	0.0	0.3

Ruhanga Rwengabi	Toonya	Buseruka	Bugahya	Hoima	75	All	3	0	3	0	3	0	0.0	100.0	0.0	0.4
Nyabyasa	Toonya	Buseruka	Bugahya	Hoima	76	All	2	0	2	0	2	0	0.0	100.0	0.0	0.3
Kaiso	Toonya	Buseruka	Bugahya	Hoima	77	All	12	0	12	0	12	0	0.0	100.0	0.0	1.8
Misege	Kaseeta	Kabooya	Buhaguzi	Hoima	78	Part	1	0	1	0	1	0	0.0	100.0	0.0	0.1
Kyehoro	Kaseeta	Kabooya	Buhaguzi	Hoima	79	All	20	1	19	0	20	3	0.0	100.0	15.0	2.8
Kyevunda	Kaseeta	Kabooya	Buhaguzi	Hoima	80	All	9	0	9	0	9	0	0.0	100.0	0.0	1.3
Sebagaro (A)	Kaseeta	Kabooya	Buhaguzi	Hoima	81	All	1	0	1	0	1	0	0.0	100.0	0.0	0.1
Sebagaro (B)	Kaseeta	Kabooya	Buhaguzi	Hoima	82	Part	1	0	1	0	1	0	0.0	100.0	0.0	0.1
Sebagaro (C)	Kaseeta	Kabooya	Buhaguzi	Hoima	83	All	8	0	8	0	8	0	0.0	100.0	0.0	1.2
Nyawaiga (A)	Kaseeta	Kabooya	Buhaguzi	Hoima	84	All	5	1	4	0	5	1	0.0	100.0	20.0	0.6
Nyawaiga (B)	Kaseeta	Kabooya	Buhaguzi	Hoima	85	All	2	0	2	0	2	0	0.0	100.0	0.0	0.3
Sabasaba	Kaseeta	Kabooya	Buhaguzi	Hoima	86	All	3	0	3	0	3	0	0.0	100.0	0.0	0.4
Nkondo (A)	Kaseeta	Kabooya	Buhaguzi	Hoima	87	All	6	2	4	0	6	4	0.0	100.0	66.7	0.6
Nkondo (B)	Kaseeta	Kabooya	Buhaguzi	Hoima	88	All	7	0	7	0	7	2	0.0	100.0	28.6	1.0
Nkondo (C)	Kaseeta	Kabooya	Buhaguzi	Hoima	89	All	2	0	2	0	2	1	0.0	100.0	50.0	0.3
Nkondo (D)	Kaseeta	Kabooya	Buhaguzi	Hoima	90	All	9	1	8	0	9	1	0.0	100.0	11.1	1.2
Nkondo (E)	Kaseeta	Kabooya	Buhaguzi	Hoima	91	All	4	0	4	0	4	0	0.0	100.0	0.0	0.6

Songa	Kaseeta	Kabooya	Buhaguzi	Hoima	92	All	14	1	13	0	14	1	0.0	100.0	7.1	1.9
Bulinga	Kaseeta	Kabooya	Buhaguzi	Hoima	93	All	4	0	4	0	4	0	0.0	100.0	0.0	0.6
Susa	Bugoma	Kyangwali	Kikuube	Hoima	94	All	16	0	16	0	16	0	0.0	100.0	0.0	2.4
Kyenyanja	Bugoma	Kyangwali	Buhaguzi	Hoima	95	All	10	0	10	0	10	0	0.0	100.0	0.0	1.5
Busige	Bugoma	Kyangwali	Buhaguzi	Hoima	96	All	11	2	9	0	11	0	0.0	100.0	0.0	1.3
Kyakapere .A.	Bugoma	Kyangwali	Buhaguzi	Hoima	97	All	8	1	7	0	8	1	0.0	100.0	12.5	1.0
Kyakapere (B)	Bugoma	Kyangwali	Buhaguzi	Hoima	98	All	7	1	6	0	7	2	0.0	100.0	28.6	0.9
Kyabasambu	Bugoma	Kyangwali	Buhaguzi	Hoima	99	All	6	0	6	0	6	1	0.0	100.0	16.7	0.9
Nsonga (A)	Bugoma	Kyangwali	Buhaguzi	Hoima	100	All	19	4	15	0	19	14	0.0	100.0	73.7	2.2
Nsonga (B)	Bugoma	Kyangwali	Buhaguzi	Hoima	101	All	3	1	2	0	3	2	0.0	100.0	66.7	0.3
Nsonga (C)	Bugoma	Kyangwali	Buhaguzi	Hoima	102	All	2	0	2	0	2	0	0.0	100.0	0.0	0.3
Nsonga (D)	Bugoma	Kyangwali	Buhaguzi	Hoima	103	All	2	0	2	0	2	0	0.0	100.0	0.0	0.3
Nsonga (E)	Bugoma	Kyangwali	Buhaguzi	Hoima	104	All	1	0	1	0	1	0	0.0	100.0	0.0	0.1
Nsonga (F)	Bugoma	Kyangwali	Buhaguzi	Hoima	105	All	4	0	4	0	4	2	0.0	100.0	50.0	0.6
Kiina (A)	Bugoma	Kyangwali	Buhaguzi	Hoima	106	All	2	0	2	0	2	0	0.0	100.0	0.0	0.3

Kiina (B)	Bugoma	Kyangwali	Buhaguzi	Hoima	107	All	1	0	1	0	1	0	0.0	100.0	0.0	0.1
Kiina (C)	Bugoma	Kyangwali	Buhaguzi	Hoima	108	All	6	0	6	0	6	0	0.0	100.0	0.0	0.9
Kiina (D)	Bugoma	Kyangwali	Buhaguzi	Hoima	109	All	5	0	5	0	5	0	0.0	100.0	0.0	0.7
Kiina (E)	Bugoma	Kyangwali	Buhaguzi	Hoima	110	All	8	1	7	0	8	4	0.0	100.0	50.0	1.0
Kacunde	Bugoma	Kyangwali	Buhaguzi	Hoima	111	All	9	0	9	0	9	0	0.0	100.0	0.0	1.3
Senjojo	Bugoma	Kyangwali	Buhaguzi	Hoima	112	All	13	1	12	0	13	2	0.0	100.0	15.4	1.8
Songarau	Bugoma	Kyangwali	Buhaguzi	Hoima	113	All	6	1	5	0	6	0	0.0	100.0	0.0	0.7
Nguse	Nyakarongo	Bwikara	Buyaga	Hoima	114	All	12	0	12	0	12	0	0.0	100.0	0.0	1.8
Kitebere	Nyakarongo	Bwikara	Buyaga	Hoima	115	All	34	2	32	0	34	2	0.0	100.0	5.9	4.8
Songarau	Nyakarongo	Bwikara	Buyaga	Hoima	116	All	4	0	4	0	4	0	0.0	100.0	0.0	0.6
Nyamasoga (A)	Nyakarongo	Bwikara	Buyaga	Hoima	117	All	3	0	3	0	3	0	0.0	100.0	0.0	0.4
Nyamasoga (B)	Kitebere	Bwikira	Buyaga	Hoima	118	All	12	0	12	0	12	1	0.0	100.0	8.3	1.8
Nyamasoga (C)	Kitebere	Bwikira	Buyaga	Hoima	119	All	6	0	6	0	6	0	0.0	100.0	0.0	0.9
Kamina	Ndaiga	Bwikira	Buyaga	Hoima	120	All	7	0	7	0	7	0	0.0	100.0	0.0	1.0
Rwabigongoro	Ndaiga	Bwikira	Buyaga	Hoima	121	All	23	1	22	0	23	2	0.0	100.0	8.7	3.3

Ndaiga	Ndaiga	Bwikira	Buyaga	Hoima	122	All	15	1	14	0	15	0	0.0	100.0	0.0	2.1
Kabukanga	Ndaiga	Bwikira	Buyaga	Hoima	123	All	11	0	11	0	11	0	0.0	100.0	0.0	1.6
Muzizi (A)	Ndaiga	Bwikira	Buyaga	Hoima	124	All	2	0	2	0	2	0	0.0	100.0	0.0	0.3
Muzizi (B)	Ndaiga	Bwikira	Buyaga	Hoima	125	All	2	0	2	0	2	0	0.0	100.0	0.0	0.3
Muzizi (C)	Ndaiga	Bwikira	Buyaga	Hoima	126	All	2	0	2	0	2	0	0.0	100.0	0.0	0.3
Muzizi (D)	Ndaiga	Bwikira	Buyaga	Hoima	127	All	1	0	1	0	1	0	0.0	100.0	0.0	0.1
TOTAL NO. OF LANDINGS = 81							668	39	629	0	668	80	0.0	100.0	12.0	94.2

Table 8: LAKE ALBERT (UGANDA)
FRAME SURVEY DATA SUMMARY - BUNDIBUGYO DISTRICT

Landing	Parish	Sub County	County	District	Map Code	Seas'ty All/Part	Active Canoes	Transp. Canoes	Fishing Canoes	Dugout Canoes	Plank Canoes	Powered Canoes	% D-Out Canoes	% Plank Canoes	% Powered Canoes	% Fish Canoes/ Total Fish Can.
Ntoroko (A)	Ntoroko	Karugutu	Ntoroko	Bundibugyo	128	All	6	6	0	0	6	0	0.0	100.0	0.0	0.0
Ntoroko (B)	Ntoroko	Karugutu	Ntoroko	Bundibugyo	129	All	2	1	1	0	2	1	0.0	100.0	50.0	0.3
Ntoroko	Ntoroko	Karugutu	Ntoro	Bundibug	130	All	104	6	98	0	104	2	0.0	100.0	1.9	28.2

(C)			ko	yo												
Kanara (A)	Ntoroko	Ntoroko	Ntoroko	Bundibugyo	131	All	1	0	1	0	1	0	0.0	100.0	0.0	0.3
Kanara (B)	Ntoroko	Karugutu	Ntoroko	Bundibugyo	132	All	52	2	50	0	52	2	0.0	100.0	3.8	14.4
Songa Kiyanja	Ntoroko	Karugutu	Ntoroko	Bundibugyo	133	All	46	0	46	1	45	0	2.2	97.8	0.0	13.2
Rwangara	Rwangara	Rwebisengo	Ntoroko	Bundibugyo	134	All	17	8	9	8	9	3	47.1	52.9	17.6	2.6
Katanga	Rwangara	Rwebisengo	Ntoroko	Bundibugyo	135	All	3	0	3	3	0	0	100.0	0.0	0.0	0.9
Kamuga	Rwangara	Rwebisengo	Ntoroko	Bundibugyo	136	All	60	7	53	12	48	1	20.0	80.0	1.7	15.2
Katolingo	Rwangara	Rwebisengo	Ntoroko	Bundibugyo	137	All	24	2	22	8	16	0	33.3	66.7	0.0	6.3
Mulango	Rwangara	Rwebisengo	Ntoroko	Bundibugyo	138	All	19	3	16	4	15	0	21.1	78.9	0.0	4.6
Rukwanzi (A)	Rwangara	Rwebisengo	Ntoroko	Bundibugyo	139	All	2	0	2	0	2	0	0.0	100.0	0.0	0.6
Rukwanzi (B)	Rwangara	Rwebisengo	Ntoroko	Bundibugyo	140	All	12	2	10	5	7	0	41.7	58.3	0.0	2.9
TOTAL NO. OF LANDINGS = 13							348	37	311	41	307	9	11.3	88.2	2.6	89.4

Table 9: Distribution of active canoes around Lake Albert, per type and by district.

DISTRICT	Active Canoes	Transp. Canoes	Fishing Canoes	Dugout Canoes	Plank Canoes	Powered Canoes
NEBBI	377	6	371	1	375	9
MASINDI	698	38	660	16	679	65
HOIMA	668	39	629	0	668	80
BUNDIBUGYO	348	37	311	41	307	9
TOTAL	2091	120	1971	58	2029	163

Table 10: Percentage distribution of active canoes around Lake Albert, per type and by District.

DISTRICT	% D-Out Canoes	% Plank Canoes	% Powd. Canoes	Fish-Can % Total
NEBBI	0.3	99.5	2.4	98.4
MASINDI	2.3	97.3	9.3	94.6
HOIMA	0.0	100.0	12.0	94.2
BUNDIBUGYO	11.8	88.2	2.6	89.4

Table 11: Some characteristics of selected major landings around Lake Albert by District.

District	Landings		# Act. Can.	# Fish. Can.	PWD.
Nebbi	Dei	(+30)	67 (1T)	66	1
	Kayonga	"	48	48	
	Abok	"	37	37	4
	Munywa	"	45 (2T)	45	1
Masindi	Wanseko	(+30)	108 (16T)	92 (2D)	16
	Kabolwa	"	89 (5T)	84 (1D)	5
	Bugoigo	"	87 (2T)	85 (1D)	6
	Kiina	"	87 (4T)	83	4
	Songa	"	30	29	
Hoima	Kijangi	(+20)	25 (1T)	24	3
	Kitebere	"	34 (2T)	32	2
	Rwabigongoro	"	23 (1T)	22	2
	Kyehoro	(=20)	20 (1T)	19	3

	Ntoroko (C)	(+30)	104	(6T)	98		2
Bundibugyo	Kanara (B)	"	52	(2T)	50		2
	Songa Kiyanja	"	46		46	(1D)	
	Kamuga	"	60	(7T)	53	(12D)	1

T : Transport Boat
D : Dug-out
PWD : Powered Boats,

Table 12: Distribution of active canoes around Lake Albert, per type and by stratum.

Stratum--> Canoes	ST1	ST2	ST3	ST4
Active	377	698	395	621
Transp.	6	38	23	53
Fishing	371	660	372	568
Dugout	1	16	0	41
Plank	375	679	395	580
Powered	9	65	47	42

Table 13: Results of various surveys conducted on Lake Albert from 1965 to 1991.

Year	FS Executor	Number Landings	Number Fishing Canoes	Number Planked Canoes	Number Dugout
1965	UFD	-	764	244	520
1966	UFD	-	1,140	262	878
1970	Wild. Serv. Ltd.	219	826	327	499
1988	MAIF	82	1,479	1,401	78
1991	UFD/FAO	140	1,971	1,809	58

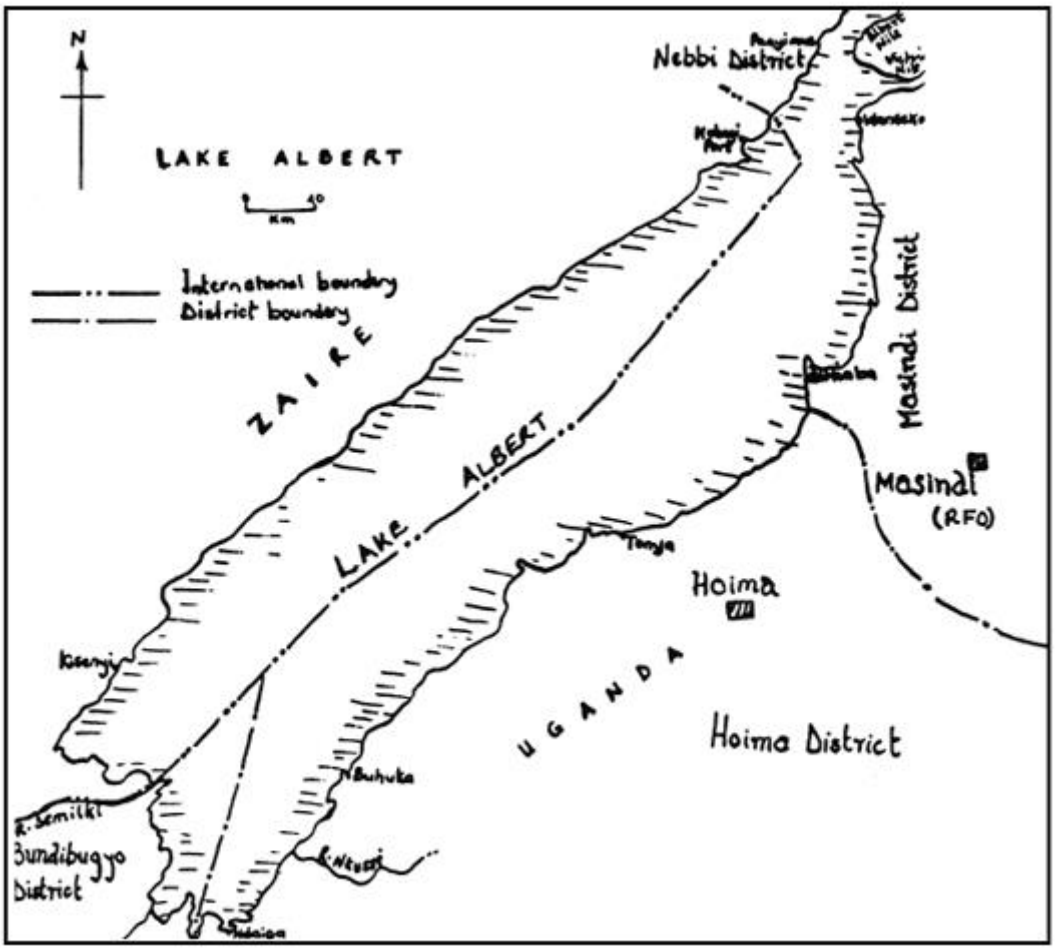
Table 14: Comparison of findings of the 1970 aerial survey and the 1991 frame survey on Lake Albert by county.

County	# Landings		Remarks
	WS Ltd. 1970	FAO 1991	

Jonam	25	17	Noticeable Decline
Buliisa	87	29	Drastic Decline. Numerous bays & lagoons + swamps
Bugahya & Buhaguzi	67	68	Stable situation. Distinct rocky stretch of shoreline
Buyaga	19	14	Noticeable Decline.
Ntoroko	21	13	Noticeable Decline. Numerous bays & lagoons + swamps

ANNEX IV

FIG. 1



* Masindi Fisheries Region covers Hoima + Masindi districts

FIG. 2

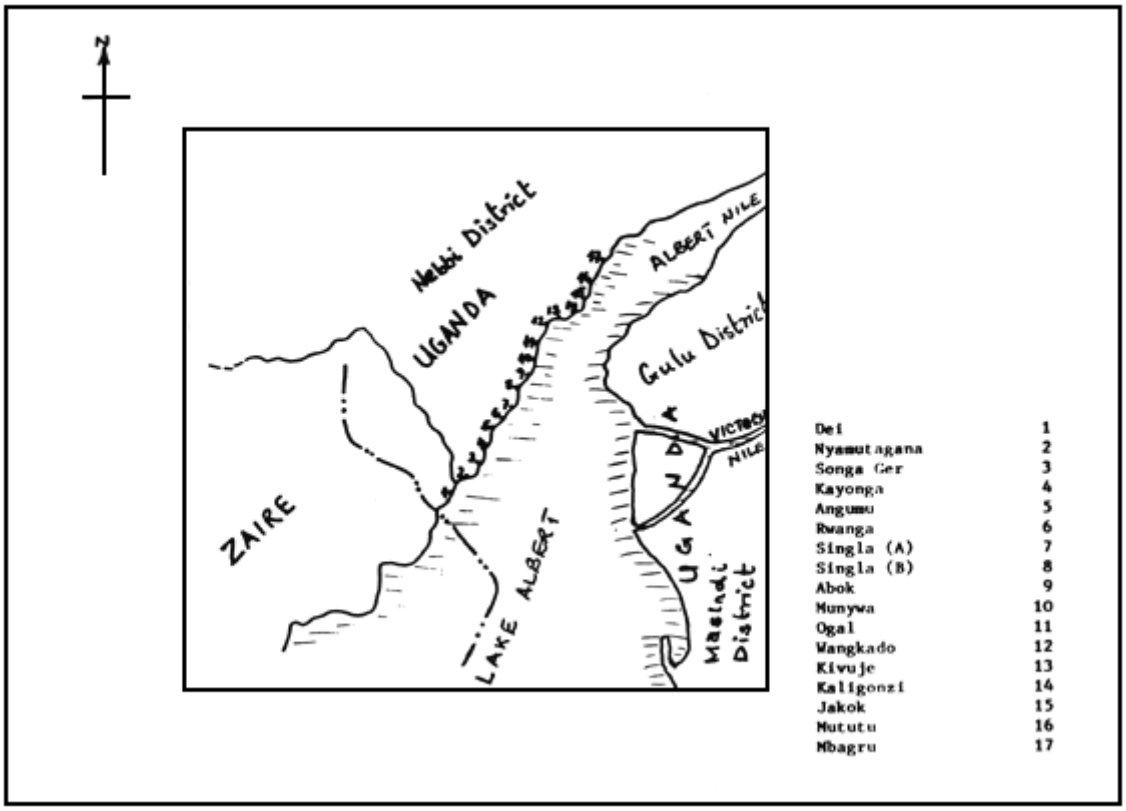

N
Nebbi District
UGANDA
ALBERT NILE
Gulu District
ZAIRE
LAKE ALBERT
UGANDA
Masindi District
Dei 1
Nyamutagana 2
Songa Ger 3
Kayonga 4
Angumu 5
Rwanga 6
Singla (A) 7
Singla (B) 8
Abok 9
Munywa 10
Ogal 11
Wangkado 12
Kivuje 13
Kaligonzi 14
Jakok 15
Mututu 16
Mbagru 17

FIG. 3

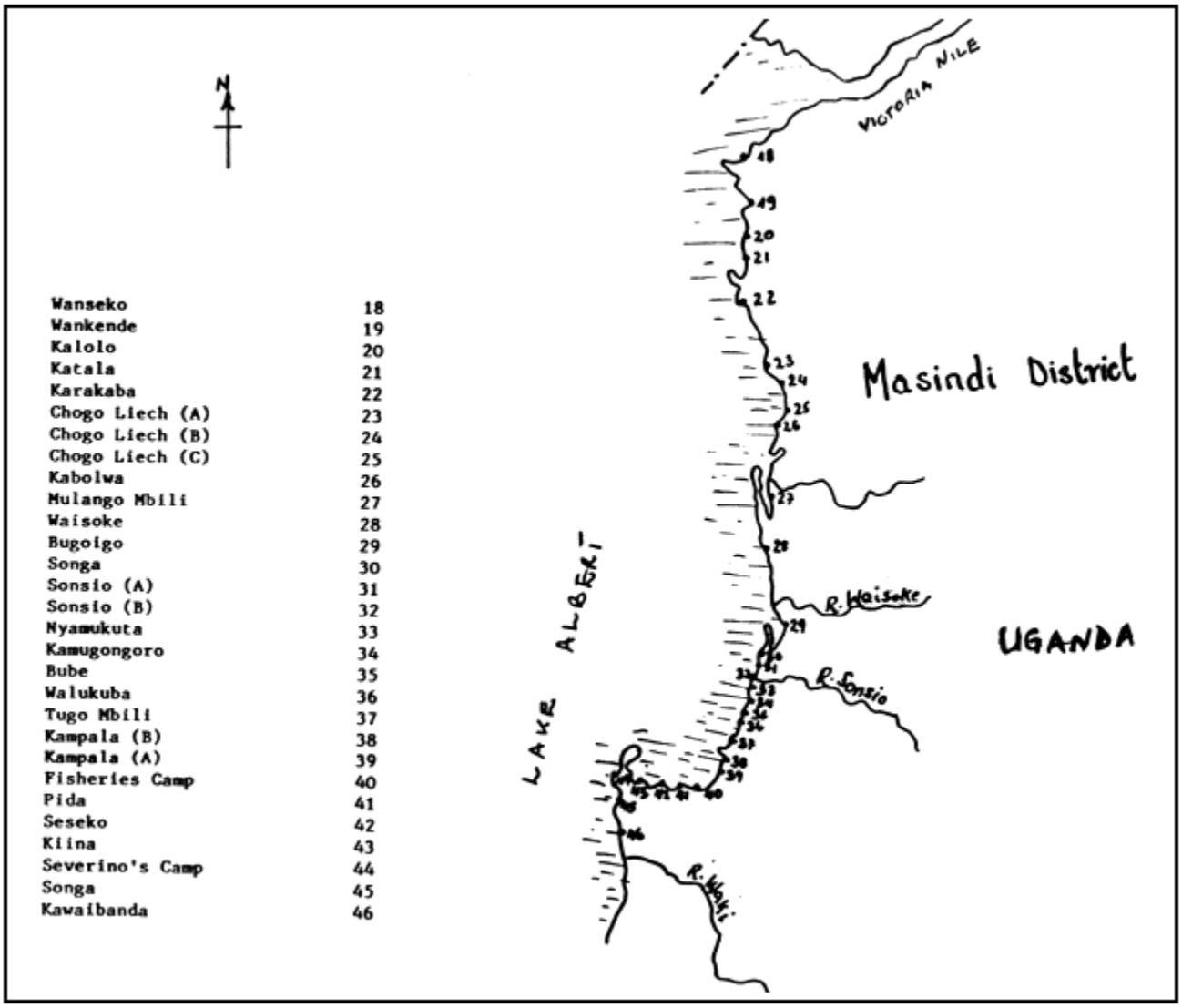

N
Wanseko 18
Wankende 19
Kalolo 20
Katala 21
Karakaba 22
Chogo Liech (A) 23
Chogo Liech (B) 24
Chogo Liech (C) 25
Kabolwa 26
Mulango Mbili 27
Waisoke 28
Bugoigo 29
Songa 30
Sonsio (A) 31
Sonsio (B) 32
Nyamukuta 33
Kamugongoro 34
Bube 35
Walukuba 36
Tugo Mbili 37
Kampala (B) 38
Kampala (A) 39
Fisheries Camp 40
Pida 41
Seseko 42
Kiina 43
Severino's Camp 44
Songa 45
Kawaibanda 46
VICTORIA NILE
LAKE ALBERT
Masindi District
UGANDA
R. Waisoke
R. Sonsio
R. Waki

FIG. 4

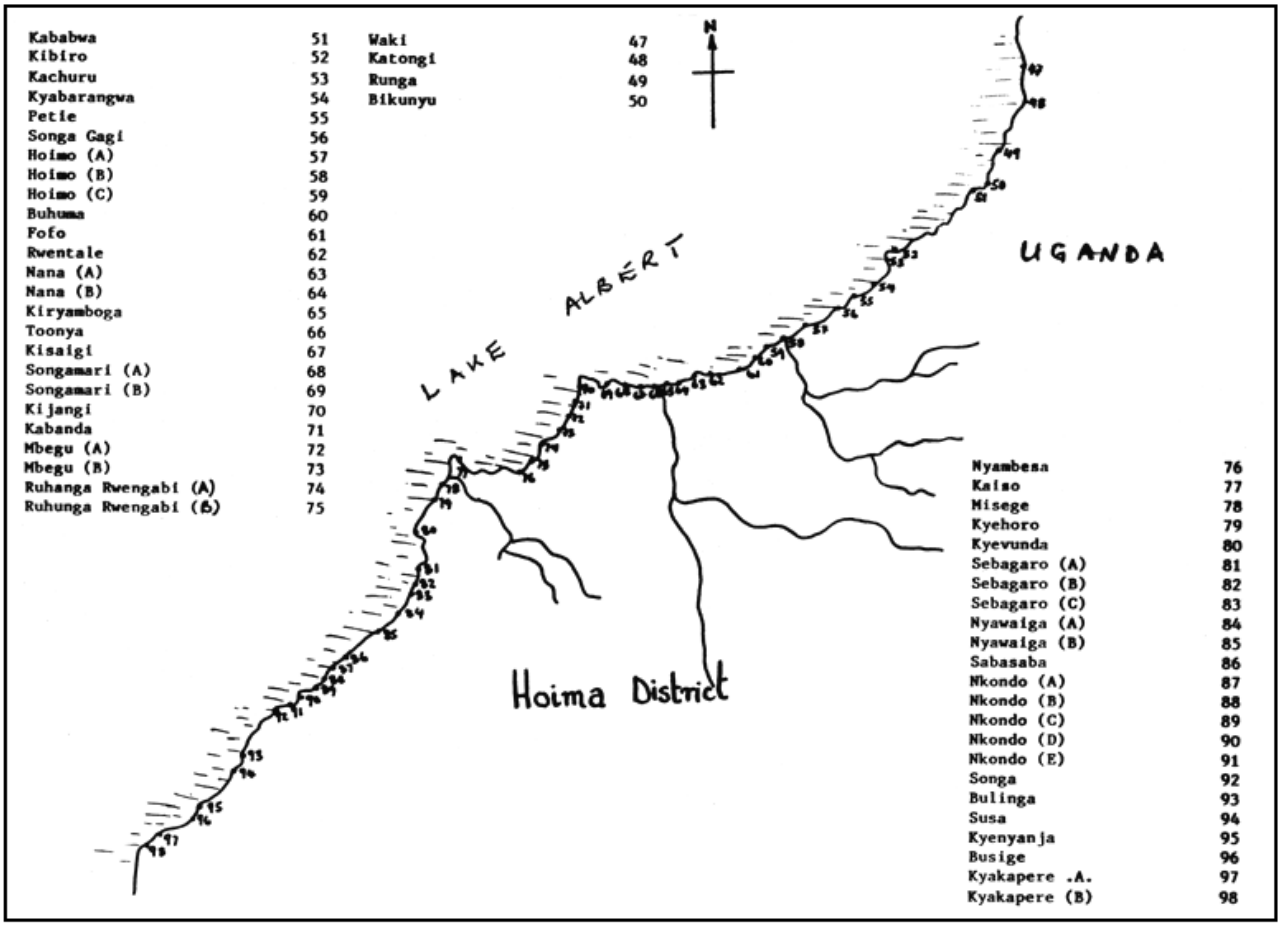

Kababwa 51
Kibiro 52
Kachuru 53
Kyabarangwa 54
Petie 55
Songa Gagi 56
Hoimo (A) 57
Hoimo (B) 58
Hoimo (C) 59
Buhuma 60
Fofo 61
Rwentale 62
Nana (A) 63
Nana (B) 64
Kiryamboga 65
Toonya 66
Kisaigi 67
Songamari (A) 68
Songamari (B) 69
Kijangi 70
Kabanda 71
Mbegu (A) 72
Mbegu (B) 73
Ruhanga Rwengabi (A) 74
Ruhunga Rwengabi (B) 75
Waki 47
Katongi 48
Runga 49
Bikunyu 50
N
LAKE ALBERT
UGANDA
Hoima District
Nyambesa 76
Kaiso 77
Misege 78
Kyehoro 79
Kyevunda 80
Sebagaro (A) 81
Sebagaro (B) 82
Sebagaro (C) 83
Nyawaiga (A) 84
Nyawaiga (B) 85
Sabasaba 86
Nkondo (A) 87
Nkondo (B) 88
Nkondo (C) 89
Nkondo (D) 90
Nkondo (E) 91
Songa 92
Bulinga 93
Susa 94
Kyenyanja 95
Busige 96
Kyakapere .A. 97
Kyakapere (B) 98

FIG. 5

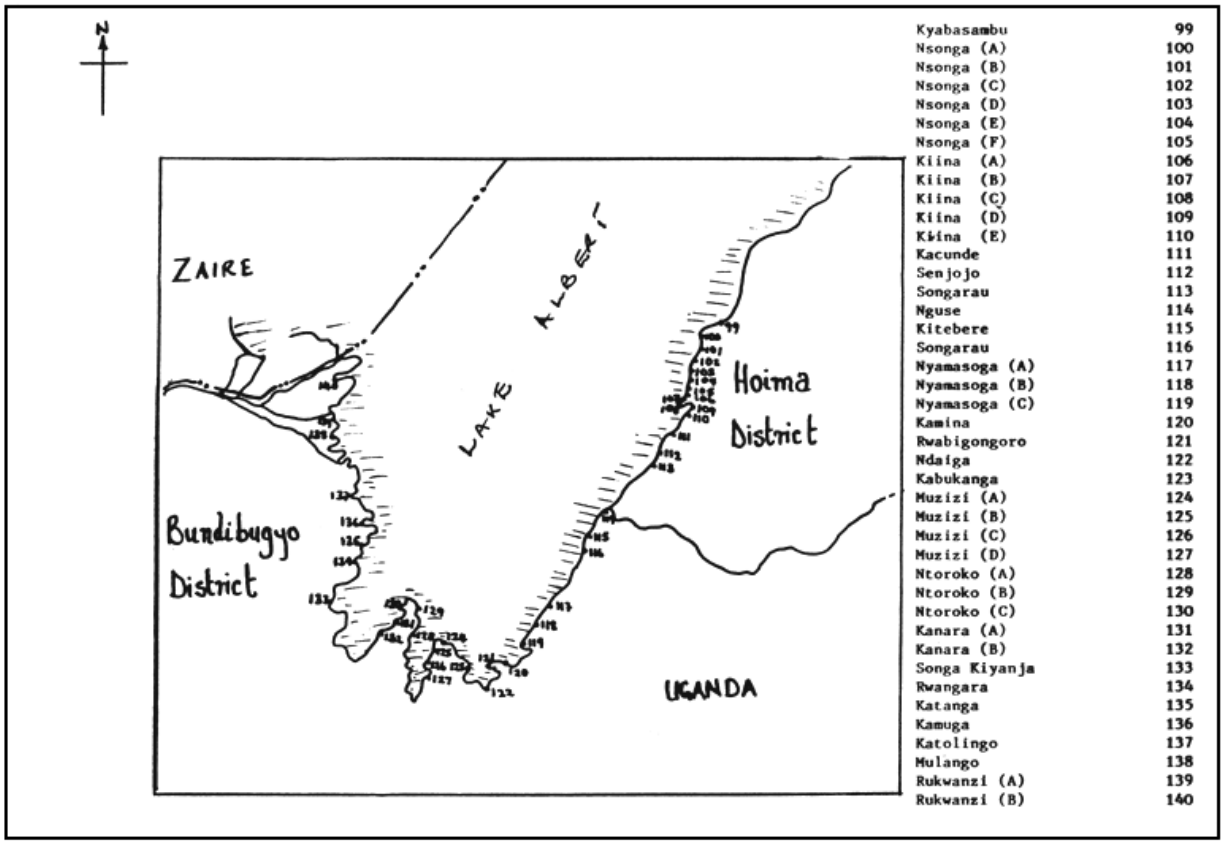


FIG. 6

Size Distribution of Fish Landings

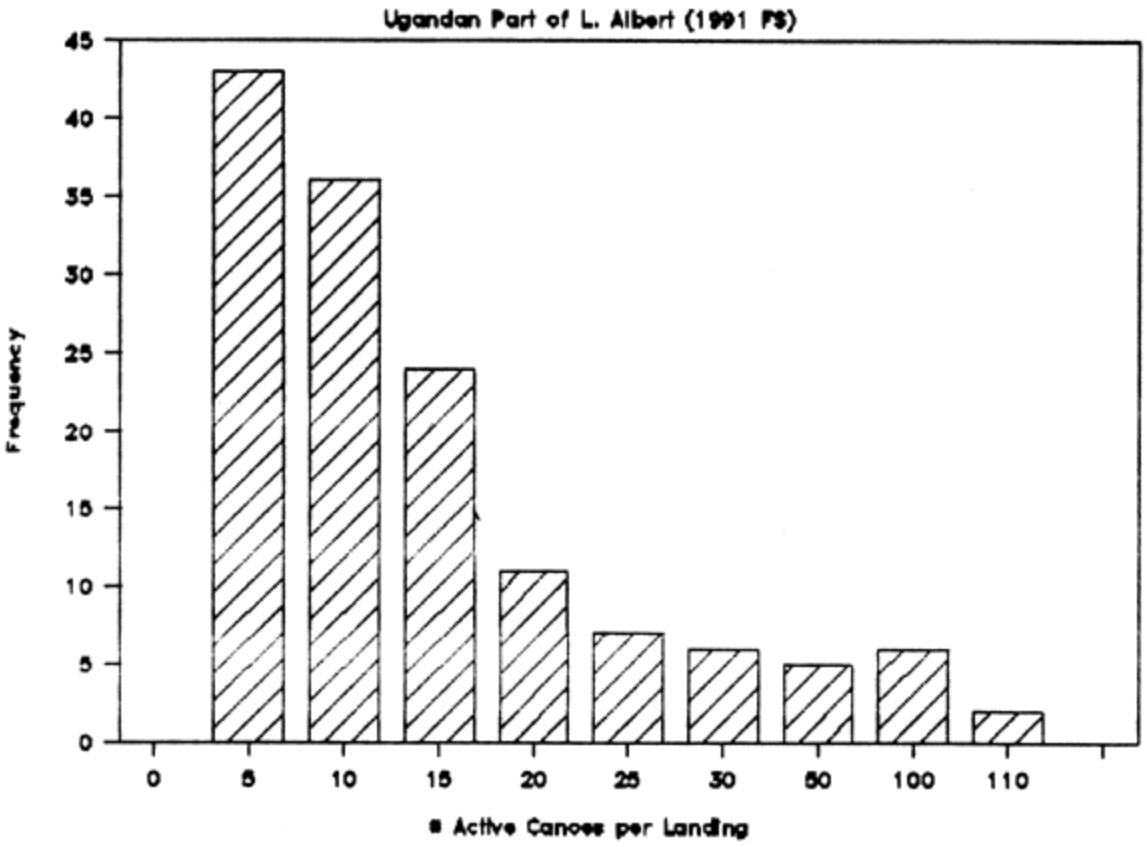


FIG. 7

Spatial Size Distribution of Fishing Effort per landing

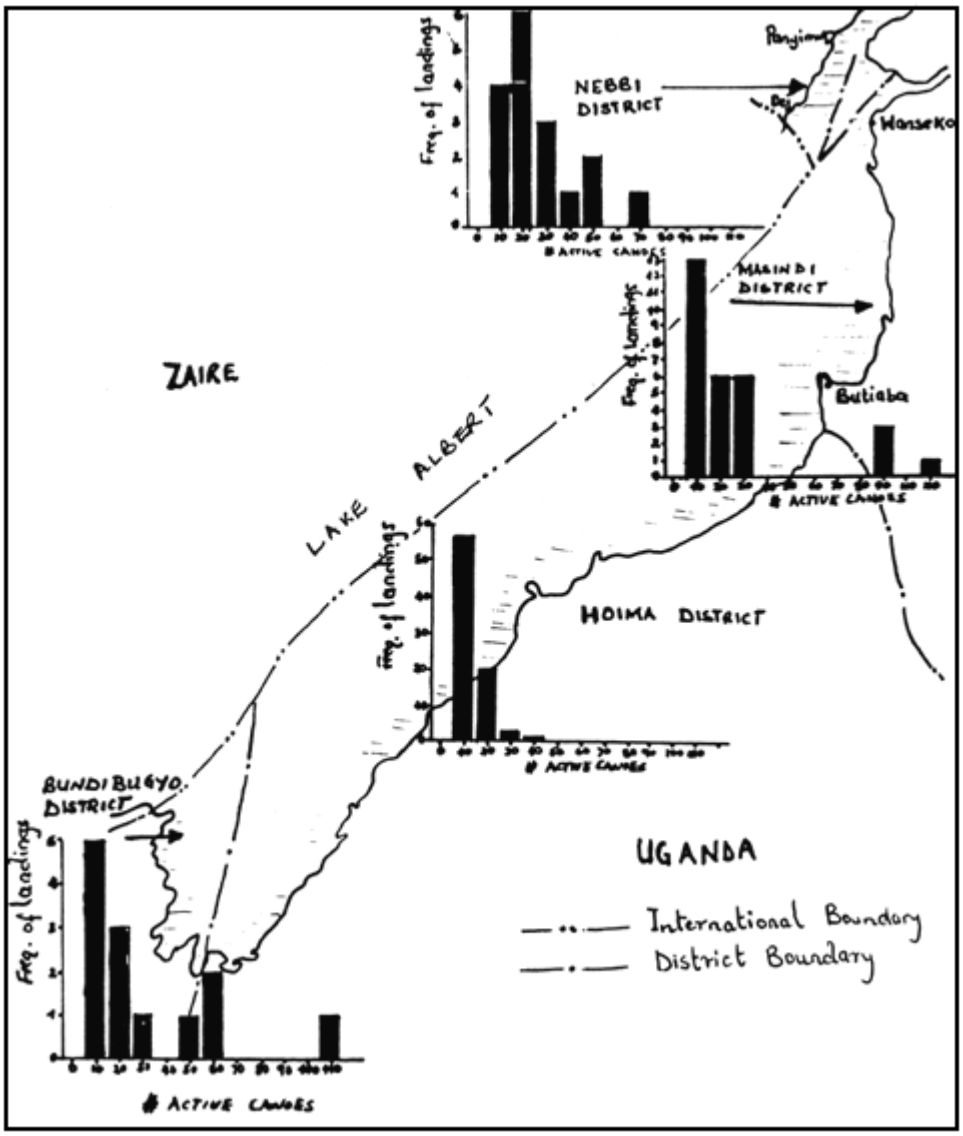
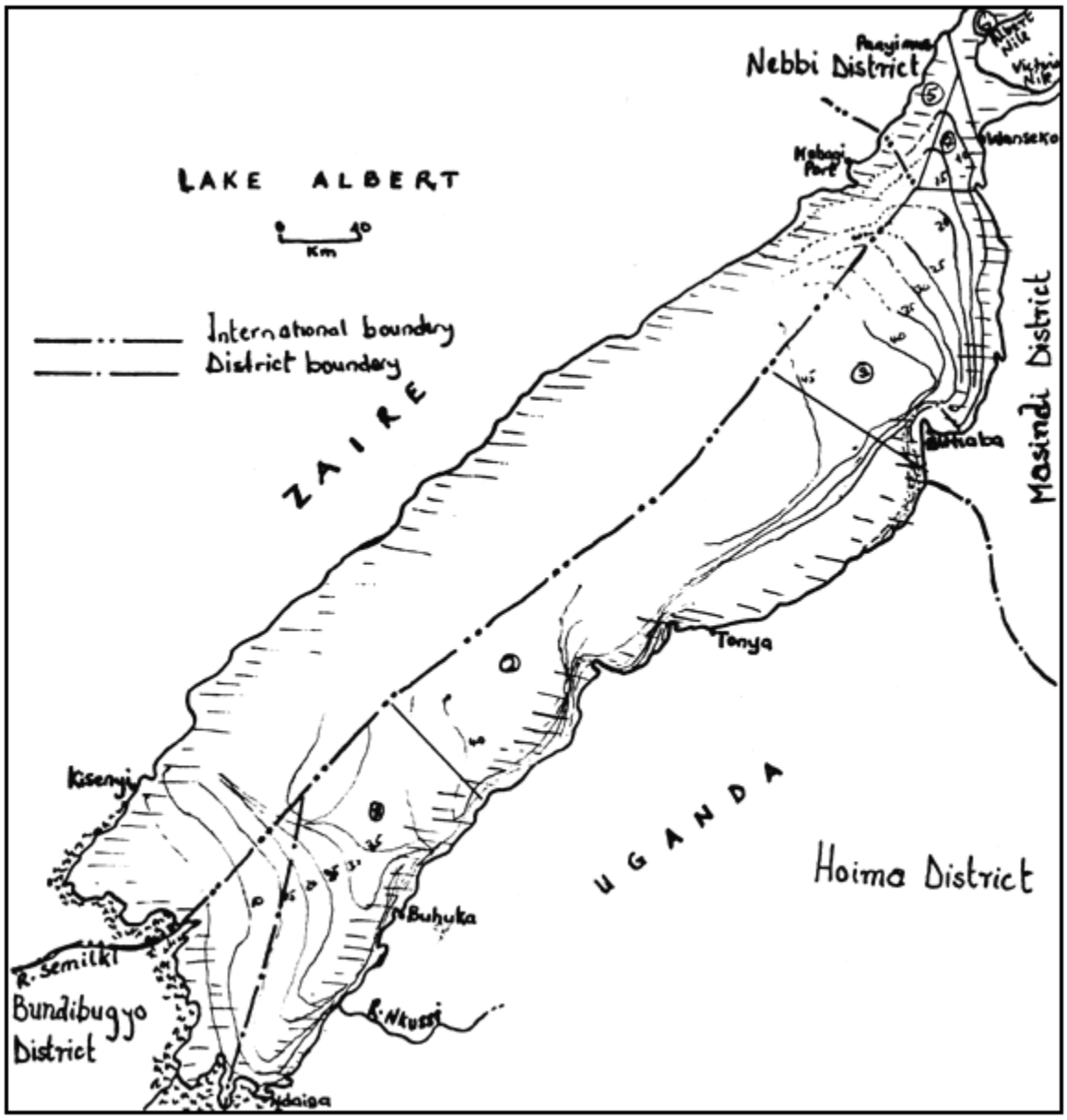


FIG. 8

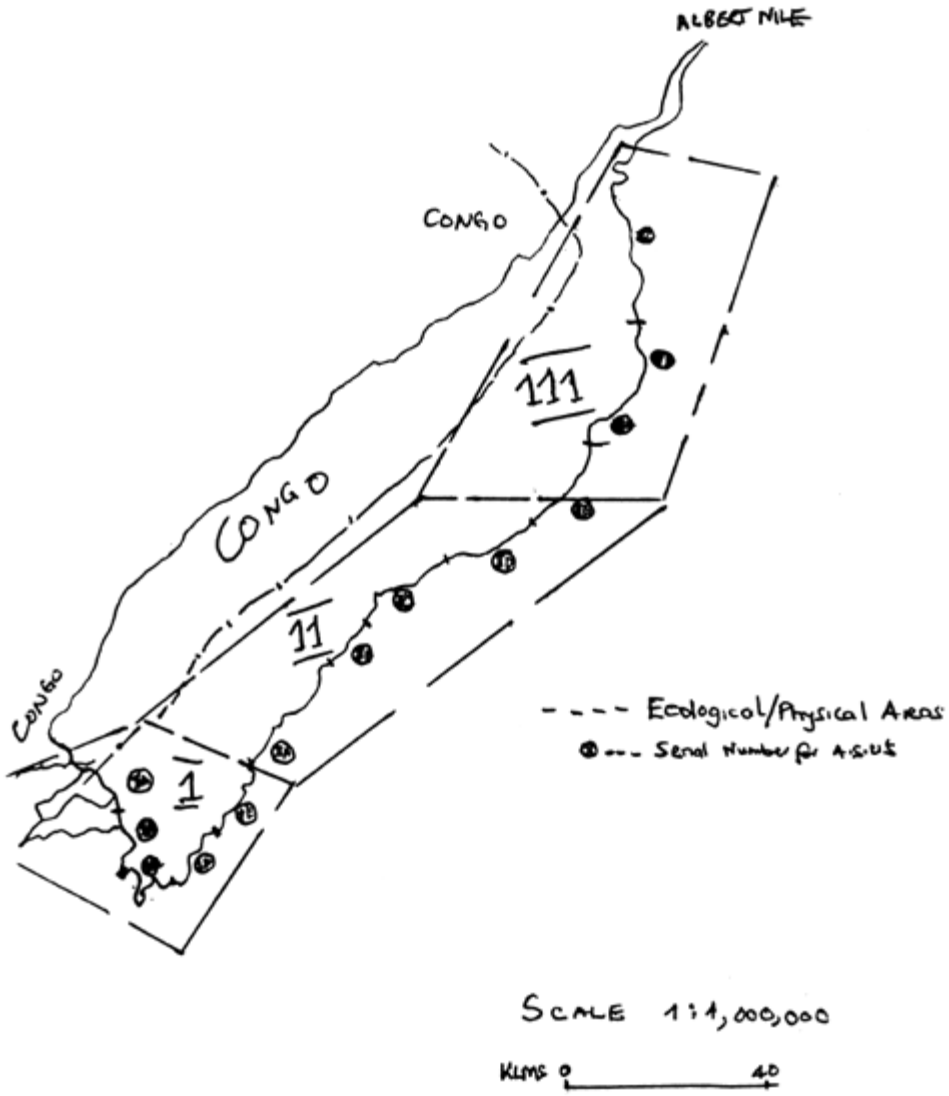
Map of Lake Albert and Albert Nile, showing limits of arrears used for analysis of Catch and Effort Statistics.



Source: Holden, 1963

FIG. 9

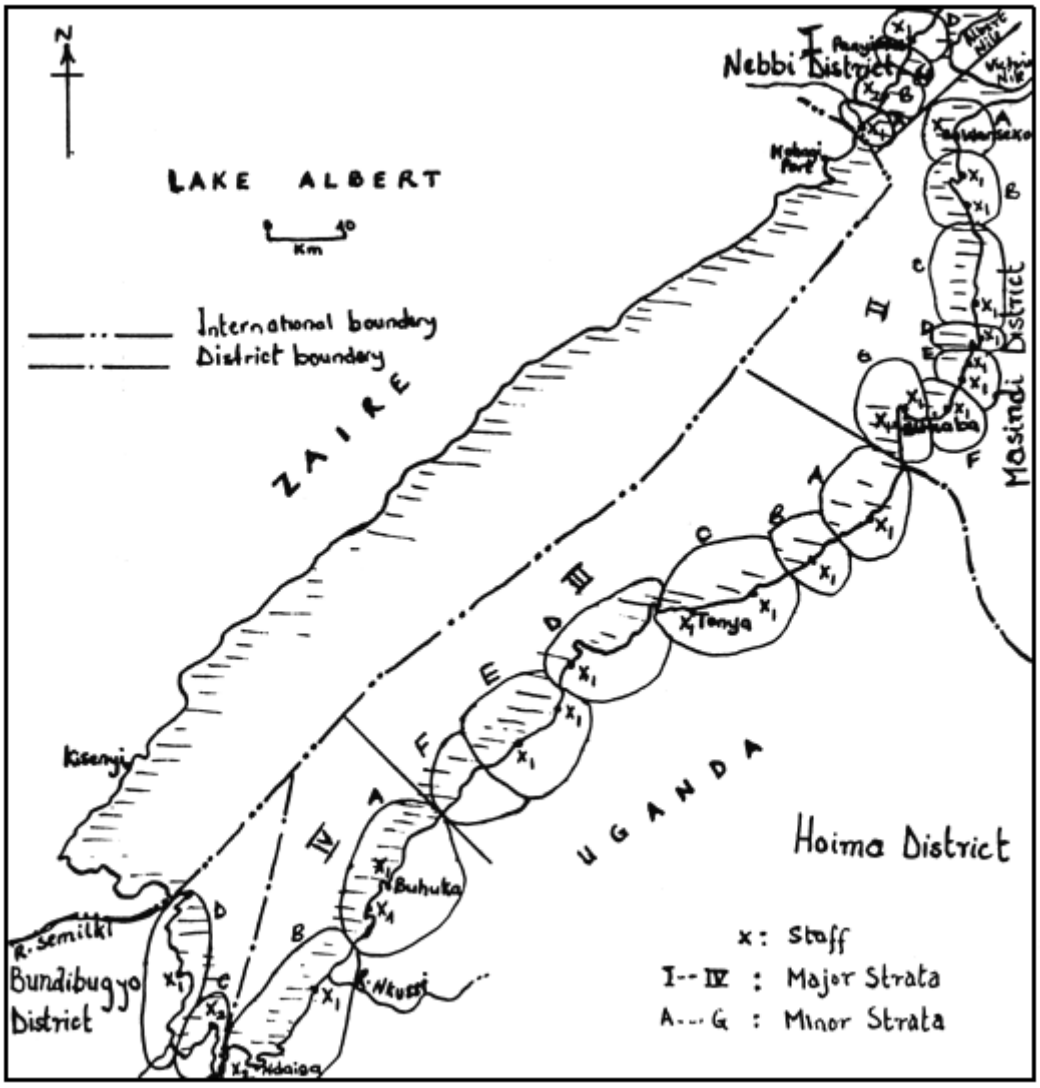
LAKE ALBERT - AREA STRATIFICATION AND ASH'S (INITIAL)



Source: Walker, 1972

FIG. 10

CAS Stratification for L. Albert


N
LAKE ALBERT
40
Km
International boundary
District boundary
ZAIRE
UGANDA
Nebbi District
Masindi District
Hoima District
Bundibugyo District
Kisenyi
R. Semliki
Buhuka
Tonya
x : Staff
I -- IV : Major Strata
A --- G : Minor Strata