

Commercialization of Fish and their Consumption Rate by the Population of Uvira, South Kivu, DR CONGO

Amisi Manala Christian¹, Mukabo Okito Gabriel², Kwibe Assani¹ and Lubunga Dunia Papy³

¹Department of Fisheries Socioeconomics, Uvira Hydrobiology Research Center, CRH-Uvira, BP-73Uvira, DR Congo

²Section Waters and Forests, Higher Institute of Agrovet and Conservation of Nature (ISAVC / Minembwe, DRC), BP 6295 Bujumbura, Burundi

³Department of Biology, Uvira Hydrobiology Research Center, CRH-Uvira, BP-73Uvira, DR Congo.

Abstract:- Commercialization of fish and their consumption rate by the population of Uvira, South Kivu, DR CONGO. This study was conducted in three major markets in the city of Uvira, South Kivu province of the Democratic Republic of Congo for 4 months, from the beginning of February until the end of May 2016. Its objective was to systematically inventory all species of fish sold according to their nature in the three major markets of Uvira by comparing their rate of consumption by the population with other sources of animal protein sources. The accelerated method of participatory research was used to gather information from the different target groups. A total of 20 vendors and 180 households were surveyed. The study found that the fish marketed in the different markets of the city of Uvira come from different origins: in addition to fresh fish from the different landing beaches of this environment, there are processed fish (smoked, salted and dried) imported from several other localities in the neighboring territory of Fizi. The most commercially marketed fish in the markets of Uvira are *Latesstappersii* (adult and juvenile), *Stolotrissatanganicae* (adult and juvenile) and *Limnothrissamiodon*. These fish with an average unit price of 500 Congolese francs are accessible on the stock exchange of the majority of households of which 85% use less than 1000 Congolese francs for the purchase of fish than meat.

Keywords:- Availability; Fish; Market; Consumption; Uvira-RDC.

I. INTRODUCTION

In the Democratic Republic of Congo and around the world, the consumption of fish and aquatic products is constantly increasing. Whether caught, reared or processed, the variety of these products meets the expectations of a growing number of consumers by the richness and diversity of their flavor throughout the year Micha J.C.,(2013)⁽¹⁾; Paul E.,(2008)⁽²⁾; . Fishermen but also fish farmers, employees of tide pools, wholesalers, processors, wholesalers, distributors and fishmongers develop in the fildes seasons all their know-how to offer consumers quality products that meet their expectations Okito et al, (2017)⁽³⁾.

Fish plays a very important socio-economic role. Its protein content is almost equivalent to that of other animal sources. Which ranks it among the high quality foods in providing animal protein easily accessible at a modest price compared to meat? Herve and Dominique, (2010)⁽⁴⁾; Van Pel,(1995)⁽⁵⁾; Tickner, (1975)⁽⁶⁾; . Available at all prices, the fish is accessible for all purses and remains very competitive, compared with the price of meat, for equivalent consumption opportunities (Synthesis France Agri-mer, 2012)⁽⁷⁾; .

It is estimated that 1% of the population lives from direct or indirect income from fishing; fish is a significant source of animal protein (34% of total animal protein intake) and the least expensive in the country Fon D.E., Nyebe I.M., Meutchaye F. and Jaza A.F.,(2015) ⁽⁸⁾; (FAO,1999)⁽⁹⁾. In developing countries fish is the main source of protein. and people depend on it for their livelihood PRODAP(2012)⁽¹⁰⁾; Dominique B., Olivier R., Bernardoni P., Bagal M. and all (2013) ⁽¹¹⁾; Maurice (2013)⁽¹²⁾; (FAO, 2008)⁽¹³⁾; (FAO,2010)⁽¹⁴⁾.

In such a context, the role of fish trade, which varies from country to country, is of great importance for many economies, especially in developing countries (PAM, 2014)⁽¹⁵⁾; (USAID,2010)⁽¹⁶⁾;(WFP,2008)⁽¹⁷⁾;. In the DRC, 73% of the population is in a situation of food insecurity linked to the inaccessibility of foodstuffs. The limited purchasing power of households does not give anyone access to food .Tshingombe, (2009) ⁽¹⁸⁾; KEES, L. and MAMBONA WB., (1992)⁽¹⁹⁾.

The city of Uvira, like the other cities of the province of South Kivu, in the Democratic Republic of Congo, is not immune to this alarming food crisis, in the sense that the food needs of households are not covered by the current local production, this situation is explained by the fact that population growth, which is of the order of 3.9%, is above the rate of growth in food production of around 2.5% and 2% for fishing and 1% for livestock (UNDP, 2013)⁽²⁰⁾.

However, despite a considerable increase in the number of fish sellers in Uvira, their consumption rate has not changed much and health indicators remain very worrying (PNNS, 2001)⁽²¹⁾. The current trend will not allow these sellers to achieve their goals and consumers to enrich themselves with animal protein (PAM, 2009) ⁽²²⁾. As long

as the population does not use more fish and livestock products, it is very likely that this trend will not change significantly Legall and Petit Gean ,(1975)⁽²³⁾; Bourret and LANDRIERE,(1980)⁽²⁴⁾. Attempting to get closer to the objectives requires measures to allow a positive evolution of the fish consumption rates for each household on the one hand and the regulation of fish prices in the different markets on the other hand.

This work is based on a survey of fish sellers and consumers to try to assess the availability of fish in the environment and the purchasing power of the population in order to understand the factors that could be acted upon to increase the consumption of fish on the one hand and ensure its always accessibility to the market in any kind. The distribution and the variation of the prices of the fish consumed with Uvira and marketed in these various markets, is not yet clearly explained, it is as well as we have invested in making it the subject of this study.

II. MATERIAL AND METHODS

➤ *Field of Study*

The present study was carried out in the Democratic Republic of the Congo, in the Province of South Kivu, city of Uvira situated between coordinates 3 ° 20 'and 4 ° 20' of South latitude, 29 ° and 29 ° 30 'of East longitude. It is bounded on the north by the Walungu Territory, on the West by the Mwenga Territory, on the South by the Fizi Territory and on the East by Lake Tanganyika and the Ruzizi River separating it from Burundi.

➤ *Sampling Sites and Data Collection Period*

We chose to sample in three markets in the city of Uvira namely the Maendeleo Market, Kalimabenge and Mulongwe. The choice of these sites is justified, on the one hand, by their location in relation to the landing sites of the fishermen and, on the other hand, by the fact that the largest quantity of fish consumed in Uvira comes from these markets.

The data collection was carried out during the period from the beginning of February to the end of May 2016, almost 4 months of investigation.

➤ *The Accelerated Method of Participatory Research (MARP)*

The Accelerated Participatory Research Method (MARP) was used to collect informative data related to the marketing and consumption of fresh fish, both through participatory observation and semi-structured interviews by means of a questionnaire submitted to resource persons in the field.

The semi-structured interviews conducted with salesmen gathered in "focus group" made it possible to answer some questions for which it is not easy to obtain concise answers by questionnaire. These included the exploitation of the fishery, its management, fish conservation, social organization and the division of labor by gender.

➤ *Sample Size*

Since the study population has the same characteristics, we adopted the simple random sampling method where each member of a population has an equal chance of being included in the sample.

For this survey design based on a simple random sample, we were able to calculate the required sample size by applying the following formula.

Formula:

$$n = (t^2 \times p(1-p)) / m^2$$

With:

n = sample size required

t = 95% confidence level (typical value of 1.96)

p = estimated prevalence of households that consume fish

m = margin of error at 5% (standard value of 0.05)

Given the magnitude of the situation that affects almost all households in the city of Uvira in terms of the purchase and consumption of fish, estimates of the proportion p of the population and the margin of error m have allowed to have a total of 20 sellers per market and 180 households per neighborhood (due to 30 households per neighborhood) as the size of our sample.

➤ *Statistical Analyzes*

The summary tables of the data, the descriptive statistics (means, standard deviations, etc.) and the construction of the graphs were made using Microsoft Excel software (version 2011) and PAST under Microsoft Windows 7.

For statistical analysis, PAST software under Microsoft Windows 8 was used. ANOVA One-Way was used to compare the frequency of fish consumption compared to other protein source foods and the Student's T test to rank significant differences.

III. RESULTS

➤ *Sample Size*

This random stratified sampling was carried out in three markets (Maendeleo, Mulongwe and Kalimabenge) of the city of Uvira on the basis of a survey of the status of fish sold in the Maendeleo, Mulongwe and Kalimabenge markets. their rate of consumption by the population of the city of Uvira. All fish vendors who frequent these three markets were sampled.

The city of Uvira has 14 districts (Kalundu, Kabindula, Kakombe, Kavimvira, Kasenga, Kibondwe, Kilibula, Kimanga, Mulongwe, Nyamianda, Rombe 1, Rombe 2, Rugenge and Songo) with 352 avenues, 2201 cells and 200 430 inhabitants. The present study considered only 6 neighborhoods including Kabindula, Kimanga, Mulongwe, Nyamianda, Rombe I and Songo.

➤ *Fish Marketing Data*

Reading Figures 1, 2 and 3 show that the fish sellers of these three markets chosen are adults whose age varies between 23 and 52 years with a high representativeness of the age group between 23 and 32 years. In relation to their marital status, our results in all the sites show that more than 40% of the fish sellers are married, more than 30% are widowed against a minority who are still single.

The results given in Figure 4 show that out of 100% of salespeople surveyed, 60% had become traders without having completed high school, those who had obtained their state diplomas before starting business accounted for only 25% while those who did not finish primary school were less represented, 15% of the sample. This is justified by the fact that the trade is an activity which does not require to have a large diploma, it is enough only to be able to carry out certain arithmetical operations in order to be able to release the interest of the capital.

➤ *Synthetic data on the sales activity of fish*

The results relating to the sales activity of the fish (nature of the fish sold, their source of supply, the opinion of sellers on the management of the markets as well as those of the marketing of the fish are presented respectively by Figures 5, 6, 7, 8 and Tables 1, 2 and 3.

➤ *Nature of Fish Sold*

Figure 5 shows that in the three markets considered, the sellers of dried fish are represented in all markets with a representativity on the Maendeleo market (53.8%). The markets of Mulongwe and Kalimabenge have all types of fish sold in Uvira with a large number of sellers of fresh fish representing respectively 48.3% and 31%. Smoked and salted fish are sold in all Uvira markets.

➤ *Source of supply of processed fish*

Referring to Figures 6 and 7, it appears that the processed fish (*L. stappersii* and *Stolothrissatanganicae*) sold in different markets of Uvira come from 9 different sources according to the following order of attendance: Kabimba is frequented by 24.1% of sellers followed by Baraka (17.2%), Karamba (13.8%), Kazimia and Lusenda respectively with attendance of 10.3% of sellers. Other supply sites are less crowded.

Vendors' Opinions on Market Management (Maendeleo, Mulongwe and Kalimabenge)

From Figures 8, we note that the majority of vendors in Maendeleo and Mulongwe are satisfied with more than 50% of the way the market is managed. On the other hand, in Kalimabenge, the fish sellers share their opinions on this subject, 57.1% are against this management while only 42.9% who say they are satisfied with the way the market is managed.

➤ *Data on the marketing of processed *Stolothrissatanganicae* and *Latesstappersii**

Data on the commercialization of processed fish are presented in Tables 1, 2 and 3; they note that one kilogram of fresh adult *L. stappersii* is sold at the highest price (up to 3750 Fc per bunch). The selling price of a pile of *S. tanganicae* is higher compared to that of *L. miodon* and *L. stappersii* juvenile. In order of preference, therefore, we have in descending order among buyers: *Latesstappersii* adulte, *Stolothrissatanganicae* adulte, *Latesstappersii* (juvenile), *Stolothrissatanganicae* (juvenile), and finally *Limnothrissamiodon*

➤ *Data on fish consumption*

Reading Tables 4 and 5 reveals that about half of our respondents are between the ages of 20 and 39, ie 45.6% and 29.4% of the population at age between 40-69 years old. compared to 23.3% of those surveyed under the age of 20, while the over-70 age group, the oldest in our survey, represents only 1.7%.

According to the respondents, the fish are consumed much more during the fishing season in Lake Tanganyika. On the other hand, during the closed fishing period, fresh fish become scarce; this is how the consumption of processed fish and meat beat record to compensate for deficiency.

➤ *Level of education of the respondents*

Regarding the level of education of consumers, Figure 9 shows that 37.2% of our respondents had at least primary school, 32.2% arrived at secondary school and 18.7% of our survey respondents have not gone to school. On the other hand, only 11.9% of consumers have gone to university. The analysis in Figure 10 shows that the majority (64.6%) of our respondents know the importance of consuming fish.

Figure 11 shows that households with between 3 and 5 people are the most represented in all the sites with a peak in Mulongwe where 56.7% of households have this size. In general, we found that, for all 6 sites considered, the average household size is 4.71, with a standard deviation of 1,974, that is to say that each household has an average of $4.71 \pm 1,974$ people he has to feed.

➤ *Activities of the respondents*

Reading Figure 12 shows that 48.8% of consumers shop while 36.5% are employed somewhere. There are fewer teachers and humanitarians in this sample. The dominance of petty trading over other activities is justified by the fact that finding employment now is the chance of anyone, which is why many prefer to engage in this activity.

Figure 13 presents the results for the quantity of fish consumed per household in all the sites concerned. This figure shows that on average $8,97 \pm 4,701$ heaps of fish are consumed per household (with 1 heap = 0,5kg of fish).

Figure 14 shows that the larger the household size, the smaller the amount of fish to consume per household.

➤ *The frequency of fish compared to other foods*

The analysis in Table 6 shows that consumption of fresh and processed fish dominates in the weekly meal of the Uvira population in terms of animal protein supply with an average frequency of 5.56 ± 1.766 and 4.50 ± 1.976 followed by that of meat and milk with an average frequency of 2.16 ± 1.002 times per week and 1.36 ± 1.012 times per week per household. Egg consumption rarely appears in the weekly diet of the Uvira population.

Regarding the consumption of vegetable protein sources, our results reveal that beans are more consumed by the population of Uvira with an average score of 6.17 ± 1.108 times per week per household. These results reflect the reality taken from 180 households sampled in the city of Uvira.

The dominance of beans on other foods that are sources of vegetable protein is justified by the fact that with maize, it is the dominant crop in the villages underlying the city of Uvira.

➤ *Nature of Fish Eaten*

Analysis of the data presented in Figure 15 shows that fresh fish, general (Stolothrissatanganicaeet LatesStappersii) are more consumed in all the sites followed by dried fish (Ndakala: Stolothrissatanganica and Kabuchungu: Achenogranisoccidentalis, etc.) with a respective consumption rate of 43.8% and 24.8% while the fish smoked at the occurrence of Mukeke (Latesstappersii), salted (Makayabu: Orechromisniloticus) and others (tinned: sardine) are poorly consumed at a rate of 15, 7%; 13.4% and 2.4%.

IV. DISCUSSION

Most processed fish products are transported by road, in trucks, pick-up trucks, passenger vehicles, taxis and mopeds. The choice depends on the distance, the volume of loading, the costs and whether it is a rural or urban area. Lake transportation is very popular on Lake Tanganyika. The distribution of artisanal fishery products in the region is an important activity that includes several thousand traders, most of them women. While this activity serves social purposes such as providing food to the families of traders, its primary purpose is economic, namely, to generate income.

Compared with other foods, the consumption of fresh and processed fish dominates in the weekly meal of the population of Uvira in terms of animal protein supply with a respective average frequency of 5.56 ± 1.766 and 4.50 ± 1.976 followed by that of meat and milk with an average frequency of 2.16 ± 1.002 times per week and 1.36 ± 1.012 times per week per household. Egg consumption rarely appears in the weekly diet of the Uvira population. This is related to the dietary requirements of all Homo sapiens

evaluated according to WHO standards at 9,288 kJ and 60 g protein / d / individual Micha,(2013)⁽⁹⁾.

The inexistence of the sellers of fresh fish in the Maendeleo market is explained by the fact that this site is recognized for a landing place for processed fish coming from several sources. Thus, it is worth noting that most of the fresh fish sold in the various markets of Uvira come from the different beaches of Uvira while the majority of processed fish come from elsewhere, in Fizi generally. Examination of this table shows the survey took place in an age bracket of different generations. This explains the choice of the simple random probabilistic sampling method.

With regard to the data in Table 5, we note that the cover-up plus the parental household with a score of more than half of married respondents, followed by widowers, represent a significant category of population. fishmonger in Uvira and finally singles with a score of less than 20%. These values only show the representativeness of the target population and reflect the reality in terms of the proportions of the population. We would say that this is justified by the fact that the majority of our respondents were educated and are thus able to retain to understand the need for a diet in case they were given training and / or awareness sessions on this topic.

These average weekly fish consumption frequencies as revealed by our surveys do not deviate too much from the global standard of fish consumption as proposed by the Center for Research and Nutritional Information (CRIN / France) and supported by the FAO which adds that it is enough to eat fish twice a week, by alternating one of the richest omega 3 fatty fish and a lean fish. Or by choosing both moderately fat fish. If we eat fish once a week, we will choose a fatty fish, and if we want to eat more than twice a week, we must choose, in addition, the other fish. The dominance of fresh fish, dried, salted, smoked and those preserved in cans, in the food ration of the population of Uvira is justified by their high representation on the markets and accessible at all prices.

V. CONCLUSION

The study on the marketing of fish and their rate of consumption by the population of Uvira was conducted in the three major markets of the city of Uvira (Maendeleo, Mulongwe and Kalimabenge) between February to May 2016. With the accelerated method of the participatory research carried out on 20 sellers and 180 households as consumers, the results show that the fish sold in these markets are either fresh or processed under three different types: dried, smoked and salted and come from several localities in the territory of Fizi and from Uvira to the three markets of the city of Uvira. The prices of these fish vary according to the species and the nature of the fish concerned. The average household size is 4.71 persons per household and at least each household consumes an average of 8.97 heaps of fish twice a week.

➤ *Conflict of Interest*

The authors state that there is no conflict of interest.

➤ *Authors Contributions*

AMC and MOG intervened in all phases of the study. These are study design, data collection, tabulation, data processing and analysis, and writing of this manuscript; KA, LDP, SRR and NBN were involved in data collection, tabulation, processing and analysis.

➤ *Thanks*

Our thanks go to all those who, near or far, contributed to the realization of this study namely: the politico-administrative authorities of the city of Uvira. We also thank the authorities of the Hydrobiology Research Center of Uvira (CRH / Uvira) for welcoming us to their laboratory where all observations were made.

REFERENCES

- [1]. Micha J.C., 2013: Fish Farming in the Congo Basin: Past, Present and Future. International Conference Nutrition and Food Production in the Congo Basin Royal Academy for Overseas Science Royal Academies for Science and the Arts of Belgium: National Committee for Biological Sciences Brussels, 30 September - 1 October, 2013 pp. 147-171.
- [2]. Paul E., 2008: Growth Strategies and Poverty Reduction Paper, Paul Media, 169pp
- [3]. Okito MG, Micha J.C., Habarugira J.B., Ntakimazi G., Nshombo M.V., Bizuru N.P and Muhirwa B.G. (2017): Socioeconomics of artisanal fisheries in Burundian waters of Lake Tanganyika in Mvugo and Muguruka. International Journal of Biological and Chemical Sciences 11 (1): 247-265, February 2017 (DOI: <http://dx.doi.org/10.4314/ijbcs.v11i1.20>) 2695-IJBCS
- [4]. HERVE J. and Dominique D. (2010): Fish and Fish Products, i stock, Surakit Harntonku, Drazen Vukelic, Alexander Podshivalovd
- [5]. Van Pel, 1995: A Simple Process for the Conservation of Fish, in Quarterly Bulletin, Vol. 5, No. 1, CPS.
- [6]. Tickner, V., 1975 Supply and distribution of food products in Lomé. Rome, FAO Communication Presented at the Seminar on Food Marketing in Major Urban Areas in Francophone Africa, Dakar, December 8-17, 1975, 15 pp.
- [7]. SYNTHESIS FRANCE AGRIMER 2012 .Fish or meat, is it only a question of price?, 50p
- [8]. Fon D.E., Nyebe I.M., Meutchaye F. and Jaza A.F., 2015: Cost Analysis of fish smoking in Cameroon. Journal of Animal Production Advances. 5 (11): 794-800. <http://dx.doi.org/10.5455/japa.20151111075937>
- [9]. FAO, (2009). General view of the national fisheries sector Democratic Republic of Congo. Fishing and aquaculture profiles by country. IDF / CP / DRC, FAO 2009, Rome, Italy, 70 p.
- [10]. PRODAP 2012. National Framework Survey Report 2011, Ministry of Agriculture and Livestock of Burundi. 83p
- [11]. Dominique B., Olivier R., Bernardoni P., Bagal M. and all 2013: Study of the Potential of Marketing ACP Agricultural Products (Africa, Caribbean, Pacific) using geographical indications and trademarks with origin (ACP-AGGI). IRAM, European Union, 153p.
- [12]. Maurice Consumption of Fish and Aquaculture Products - France Agri, 2013
- [13]. FAO, 2008. The cereal bill of poor countries flies away, governments try to limit the impact, Rome, FAO press, 55pp
- [14]. FAO, 2010
- [15]. PAM (2014) In-Depth Analysis of Food Security and Vulnerability (CFSVA). Democratic Republic of Congo, 121 p.
- [16]. USAID (2010). Diagnosis of commercial, legal and institutional reform in the agricultural sector of the Democratic Republic of Congo. AGCLR: Democratic Republic of Congo. October 2010, 174 p.
- [17]. WFP: impact of rising food prices (archive), 2008, 22p
- [18]. Tshingombe, M. 2009 Food Security in the DRC. Round Table 2009: Fighting poverty in the DRC. Bilanet perspective. Institute of Development Policy and Management (IOB). University of Antwerp.
- [19]. KEES, L. and MAMBONA, W. B. (1992) Socio-economic characteristics of Congolese fisheries in the northern part of Lake Tanganyika. UNDP / FAO Regional Project for Planning, Development and Management of Inland Fisheries in Eastern / Central / Southern Africa. RAF / 87/099-TD / 37/92. pp 1-56
- [20]. UNDP, 2013. Southern Exploration: Human Progress in a Diverse World. Human Development Report, UNDP, 228p.
- [21]. National Nutrition and Health Program (PNNS) (2001): Combating overweight and obesity, organisms, 68p
- [22]. PAM (2009): collection: Hunger and the role of markets, 215p
- [23]. Legall and Petit Gean, 1975: Economic study of sea fishing and fish marketing in the People's Republic of Congo. Pointe-Noire, O.R.S.T.O.M. Document 40, 55 pp.
- [24]. BOURRET and LANDRIER E, 1980: The marketing of agricultural products Conty, Ph., 1964. Fish trade in northern Cameroon. ORSTOM.

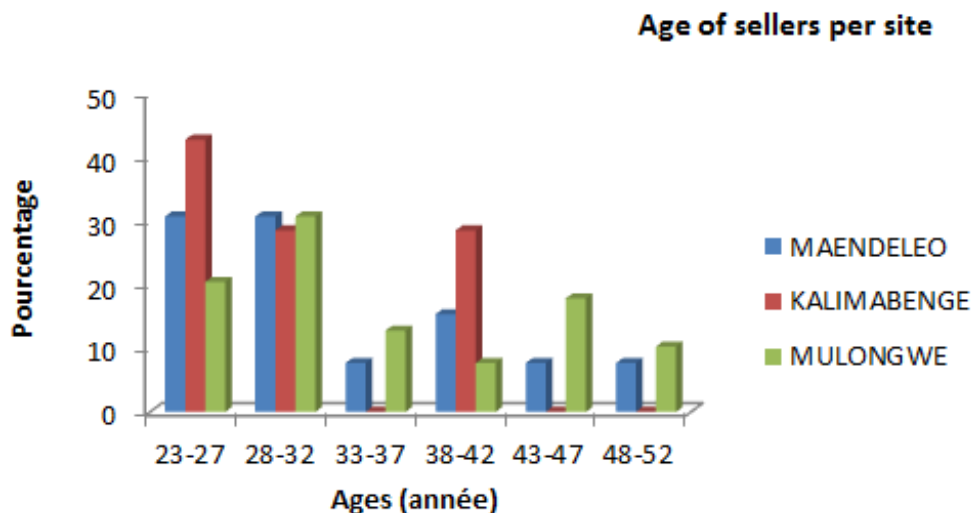


Fig 1:- Distribution of fish sellers by age.

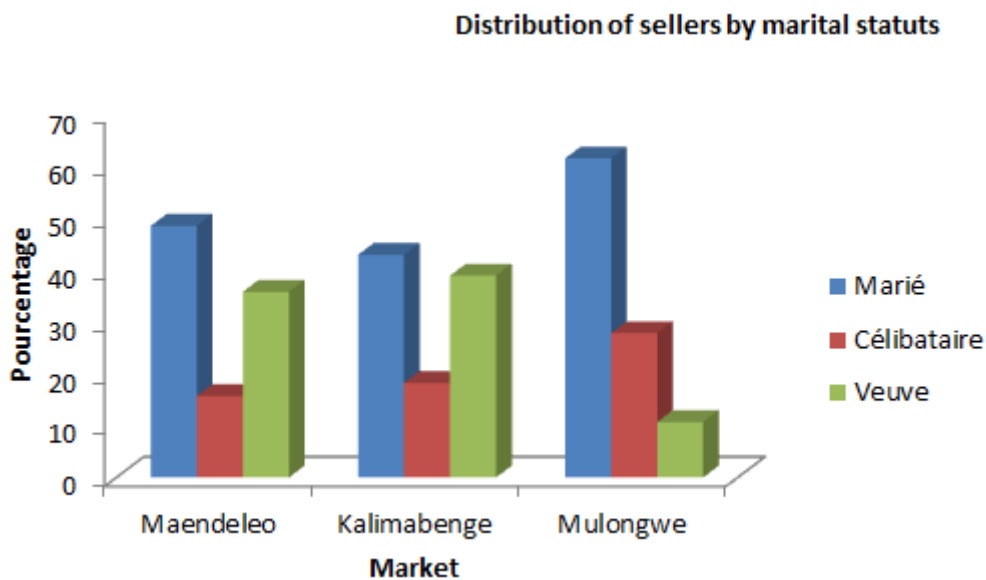


Fig 2:- Distribution of sellers by site according to their civil statut.

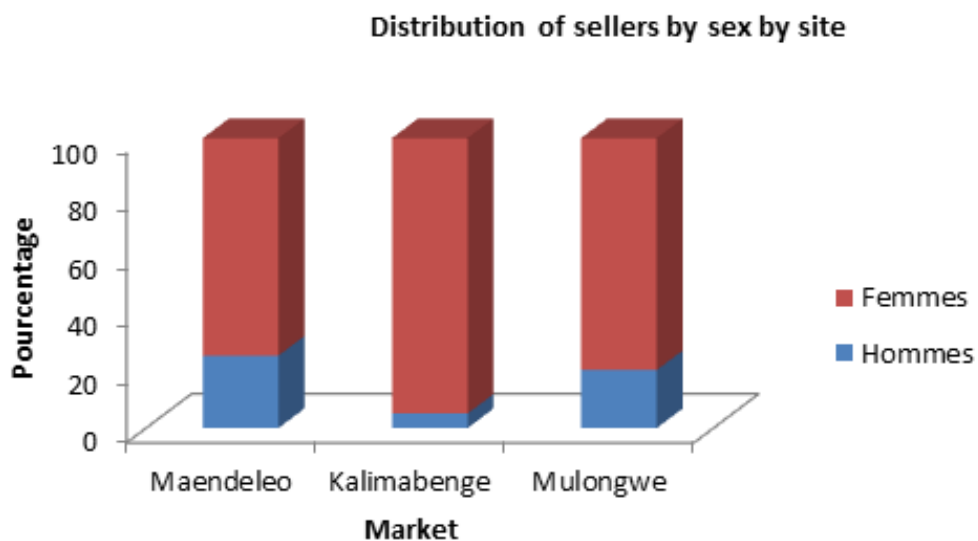


Fig 3:- Distribution of respondents by site according to their gender.

Distribution of sellers according to their level of education

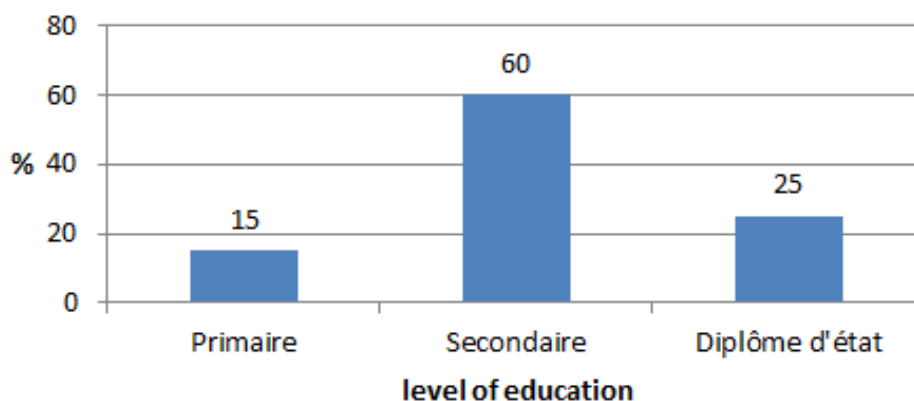


Fig 4:- Level of education of fish sellers.

Nature of fish sold in the markets

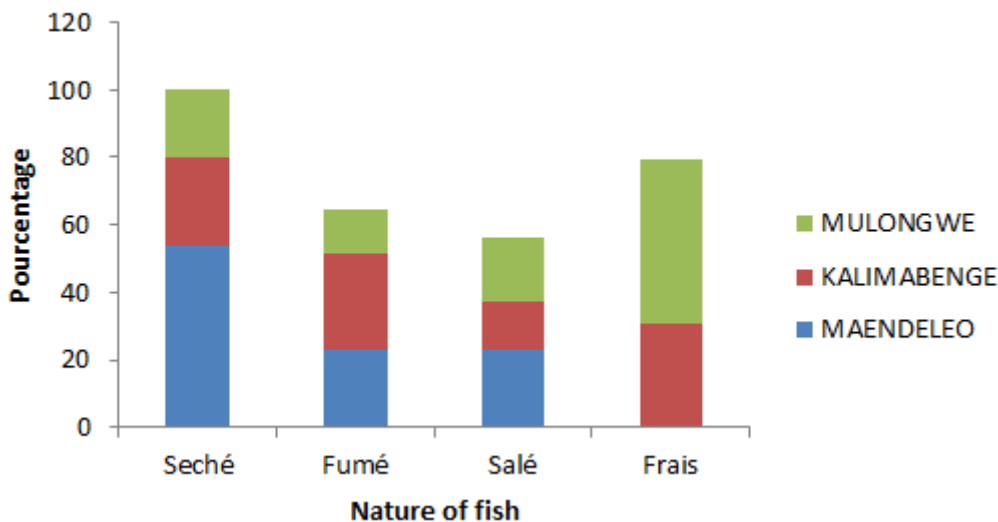


Fig 5:- Nature of the fish sold in the 3 selected markets in Uvira.

Source of fresh fish planting sold in Uvira

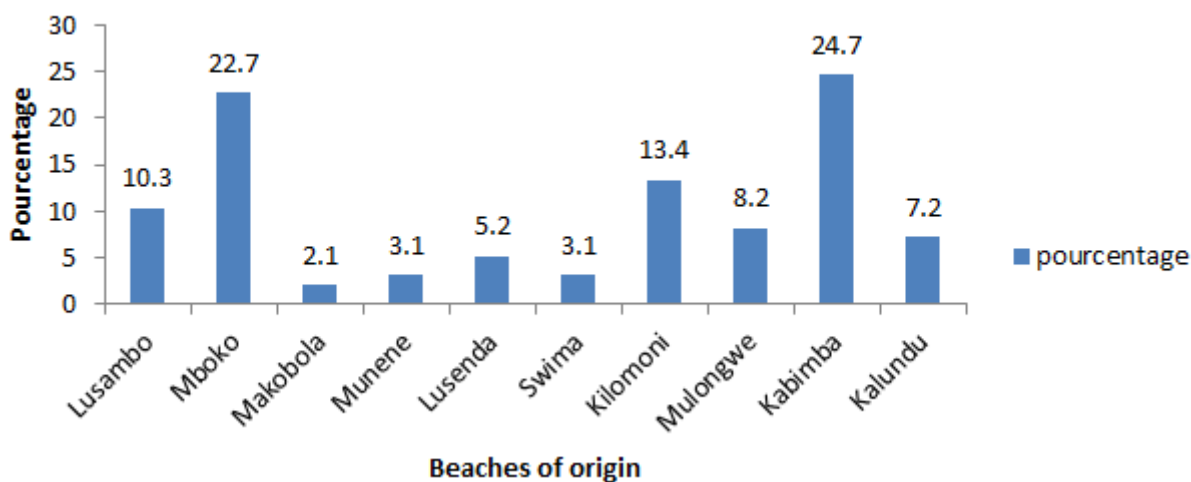


Fig 6:- Sites of provenances of fresh fish sold in Uvira.

Transformed fish supply source sold to Uvira

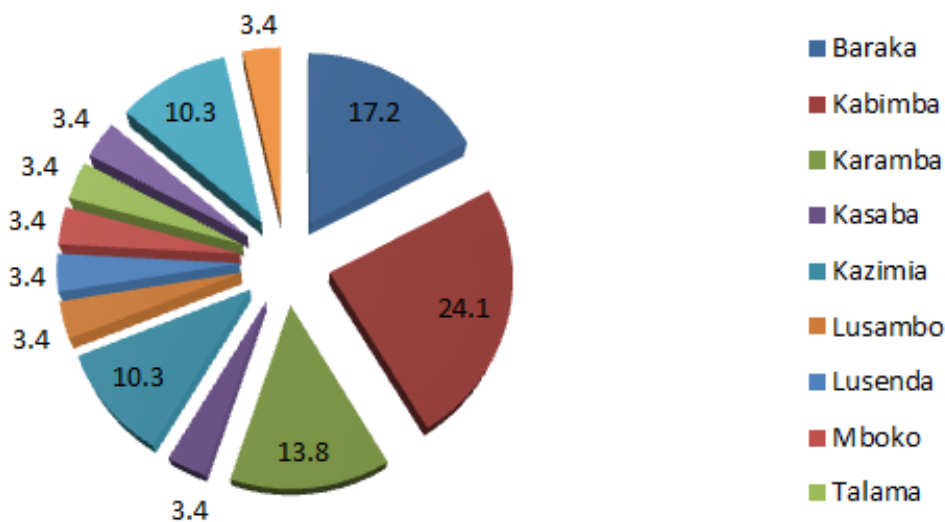


Fig 7:- Sites of provenances of processed fish sold in Uvira.

Seller's opinion on the management of the market

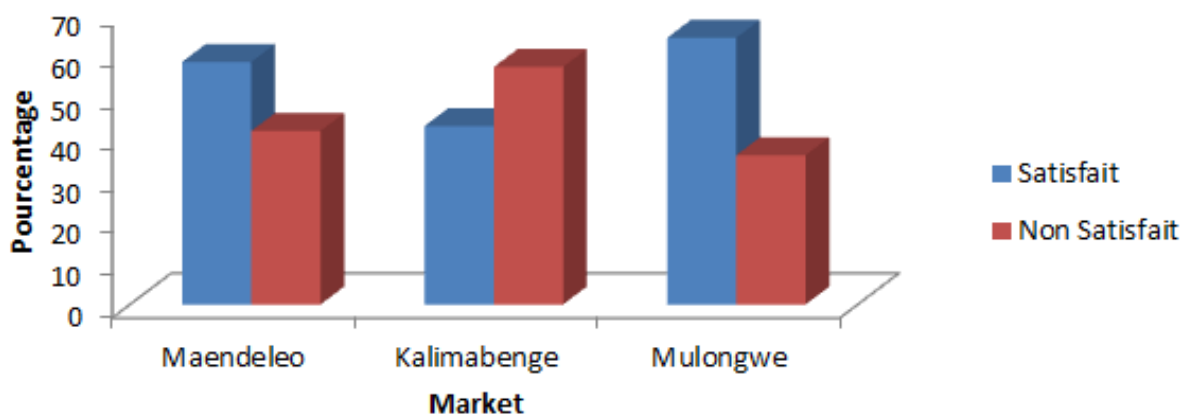


Fig 8:- Vendors' opinions regarding contract management.

| Origin | Type of package | Weight in kg | P.A.M (\$) | F.T (\$) | F.D. (\$) | F.S. (\$) | Taxes en \$ |
|---------|-----------------|--------------|------------|----------|-----------|-----------|-------------|
| Baraka | Regular bag | 42 ± 8,0 | 240 ± 40 | 7 ± 2 | 1 ± 0,1 | 1 ± 0,5 | 1 ± 0,4 |
| Kabimba | Regular bag | 35 ± 5,0 | 145 ± 25 | 5 ± 0,7 | 1 ± 0,3 | 1 ± 0,5 | 1 ± 0,2 |
| Karamba | Regular bag | 47 ± 2,5 | 265 ± 25 | 13 ± 0,5 | 1 ± 0,2 | 1 ± 0,4 | 1 ± 0,2 |
| Kazimia | Regular bag | 43 ± 1,3 | 280 ± 36 | 15 ± 2,5 | 1 ± 0,2 | 1 ± 0,6 | 1 ± 0,4 |
| Lusambo | Regular bag | 40 ± 1,0 | 185 ± 10 | 15 ± 4 | 1 ± 0,1 | 1 ± 0,3 | 1 ± 0,2 |
| Ubwari | Regular bag | 40 ± 5,0 | 140 ± 20 | 13 ± 3 | 1 ± 0,3 | 1 ± 0,2 | 1 ± 0,1 |
| Wimbi | Regular bag | 35 ± 6 | 160 ± 24 | 20 ± 5 | 1 ± 0,5 | 1 ± 0,4 | 1 ± 0,2 |

Mean values ± Standard deviation.

P.A.M. = Average purchase price; P.V.M. = Average selling price; F.T. = Shipping costs; F.D. = Landing fees; F.S. = Storage costs (deposit);

Table 1:- Synthetic data of the sales activity of Stolothrissatanganicaeau market Maendeleo

| Origin | Type of package | Weight in kg | P.A.M (\$) | F.T (\$) | F.D. (\$) | F.S. (\$) | Taxes in \$ |
|---------|-----------------|--------------|------------|----------|-----------|-----------|-------------|
| Baraka | Basket | 120 ± 15 | 350 ± 45 | 13 ± 4 | 6,3 ± 0,4 | 1 ± 0,4 | 2 ± 0,7 |
| Kasaba | Ghent cardboard | 80 ± 20 | 300 ± 25 | 10 ± 2 | 5 ± 0,5 | 1 ± 0,2 | 2 ± 0,5 |
| Lusenda | Small cardboard | 36 ± 4 | 160 ± 38 | 16 ± 3 | 3,1 ± 0,2 | 1 ± 0,1 | 2 ± 0,2 |
| Mboko | Small cardboard | 36 ± 4 | 150 ± 20 | 13 ± 2 | 3 ± 0,4 | 1 ± 0,3 | 2 ± 0,3 |
| Talama | Small cardboard | 40 ± 10 | 200 ± 40 | 24 ± 3 | 5 ± 0,2 | 1 ± 0,5 | 2 ± 0,2 |
| Wimbi | Small cardboard | 38 ± 12 | 275 ± 33 | 20 ± 5 | 4 ± 0,7 | 1 ± 0,3 | 2 ± 0,5 |
| Yungu | Small cardboard | 50 ± 8 | 350 ± 40 | 42 ± 15 | 7 ± 1 | 1 ± 0,4 | 2 ± 0,2 |

(Valeurs moyennes ± Ecart-type).

P.A.M. = Average purchase price; P.V.M. = Average selling price; F.T. = Shipping costs; F.D. = Landing fees; F.S. = Storage costs (deposit);

Table 2:- Synthetic data of the sales activity of Latesstappersii au Maendeleo market.

| Species | Period of study | | | | |
|---------------------------------|-----------------|------|-------|------|-------------|
| | Février | Mars | Avril | Mai | Moyenne |
| <i>L. miodon</i> | 1200 | 1500 | 1600 | 1600 | 1475 |
| <i>L. stappersii</i> (juvénile) | 1750 | 2000 | 2500 | 2500 | 2190 |
| <i>S. tanganicae</i> (Juvénile) | 1200 | 1500 | 1500 | 1500 | 1425 |
| <i>Stolothrissatanganicae</i> | 1750 | 2100 | 2500 | 2750 | 2275 |
| <i>Latesstappersii</i> | 3000 | 2750 | 3500 | 3750 | 3250 |

Table 3:- Average price in FC per kg per species of fresh fish during the sampling period.

| Age range (years) | Frequency | Percentage (%) |
|-------------------|------------|----------------|
| Moins de 20 ans | 42 | 23,3 |
| De 20 à 39 ans | 82 | 45,6 |
| de 40 à 69 | 53 | 29,4 |
| plus de 70 | 3 | 1,7 |
| Total | 180 | 100 |

Table 4:- Age of the respondents.

| Civil status | Kabindula | | Kimanga | | Mulongwe | | Nyamianda | | Rombe I | | Songo | |
|--------------|-----------|------|---------|------|----------|------|-----------|------|---------|------|-------|------|
| | F | % | F | % | F | % | F | % | F | % | F | % |
| Married | 18 | 60 | 20 | 66,7 | 15 | 50 | 17 | 56,7 | 24 | 80 | 10 | 33,3 |
| Single | 5 | 16,7 | 4 | 13,3 | 4 | 13,3 | 3 | 10 | 1 | 3,3 | 5 | 16,7 |
| Widowed | 7 | 23,3 | 6 | 20 | 11 | 36,7 | 10 | 33,3 | 5 | 16,7 | 15 | 50 |
| Total | 30 | 100 | 30 | 100 | 30 | 100 | 30 | 100 | 30 | 100 | 30 | 100 |

Table 5:- Distribution of consumers according to their civil status by site.

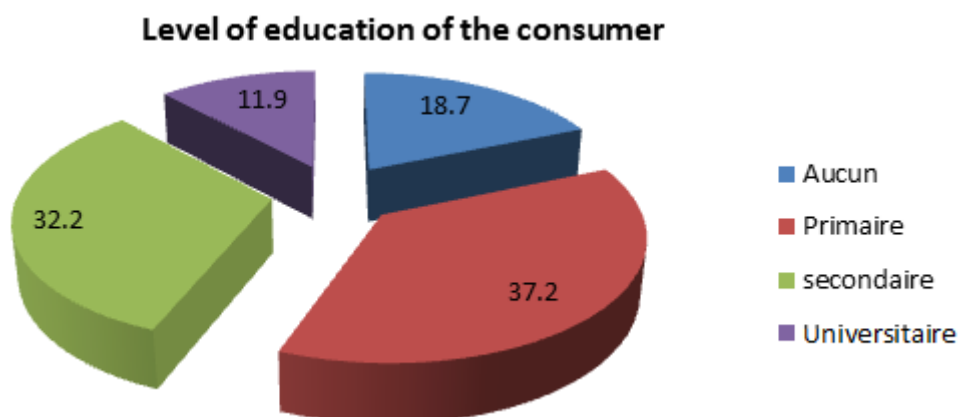


Fig 9:- Level of education of the consumers surveyed.

Knowledge of the population on the nitrite value of fish

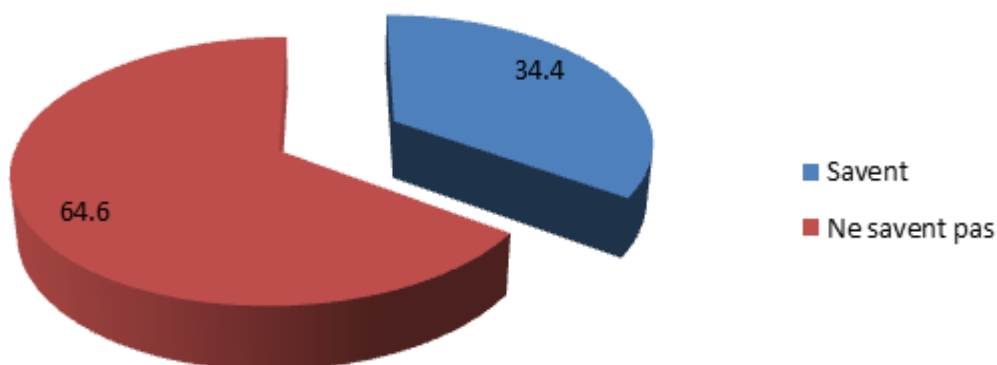


Fig 10:- Knowledge about the nutritional value of fish.

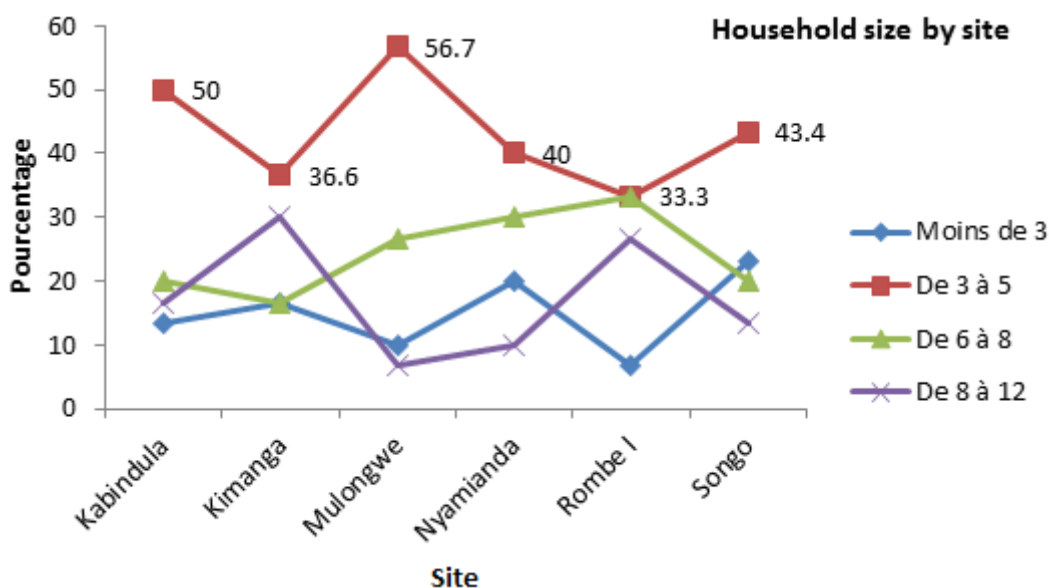


Fig 11:- Size of households by site.

Activity of the investigated

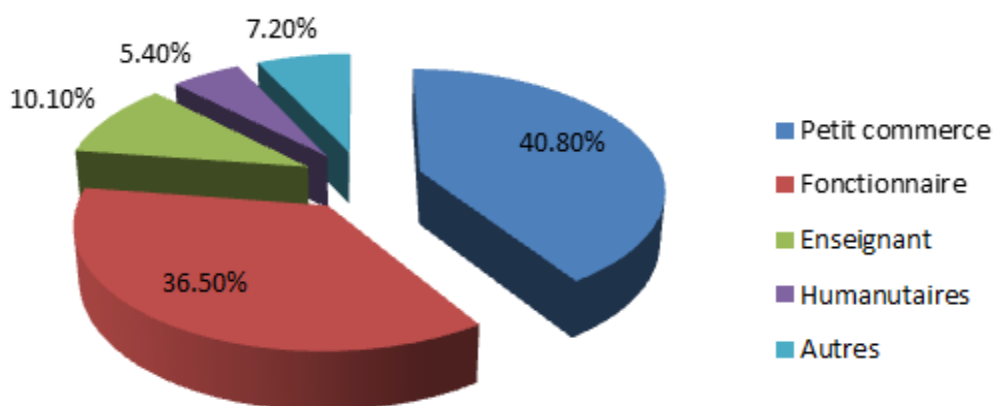


Fig 12:- Distribution of consumers according to their activities.

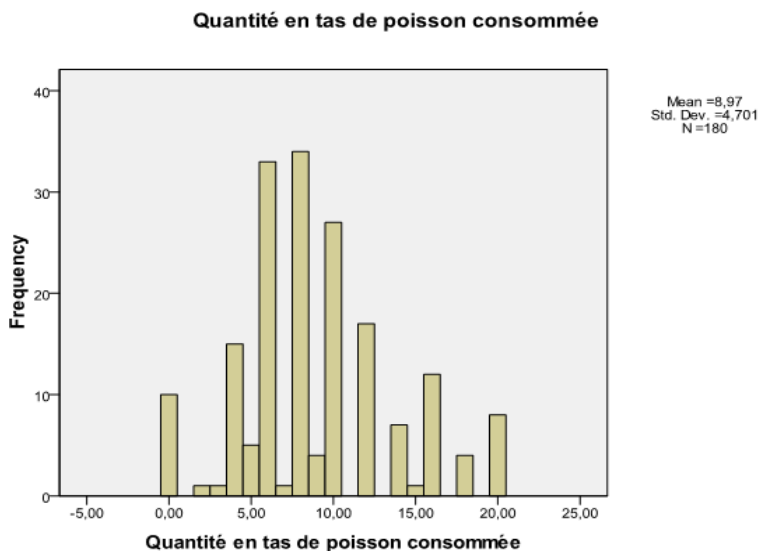


Fig 13:- Quantity (in heaps) of fish consumed per household.

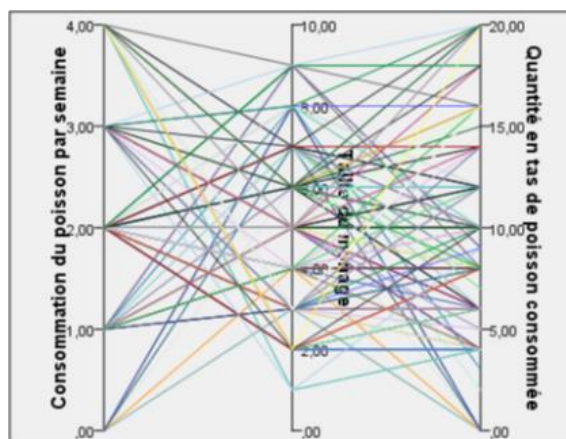


Fig 14:- Variation in fish consumption in quantity by household size.

| | P.F | P.T. | Meat | egg | Milk | Vegetable | Bean |
|---|-------|-------|-------|-------|-------|-----------|-------|
| Average | 5,56 | 4,50 | 2,16 | 0,85 | 1,36 | 4,49 | 6,17 |
| Standard deviation | 1,766 | 1,976 | 1,002 | 1,184 | 1,012 | 1,416 | 1,108 |
| F | 1,235 | 2,484 | 2,71 | 3,02 | 2,325 | 0,454 | 0,281 |
| Confidence level (α) | 0,05 | 0,05 | 0,05 | 0,05 | 0,05 | 0,05 | 0,05 |

P.F. = Fresh Fish et P.T. = Processed fish

Table 6:- The results of ANOVA on the frequency of fish consumption compared with other protein sources.

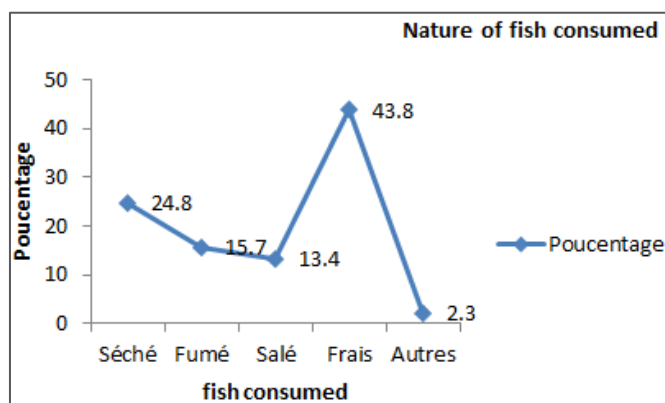


Fig 15:- Nature of fish consumed by the population of Uvira.