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# Socio-economy and fishing biology in the north-western region of lake Tanganyika, Democratic Republic of the Congo

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**ABSTRACT:** This study aimed to identify fishermen and their fishing gears used, identify fished species and their maturity sizes. Data were collected in six sites of lake Tanganyika inclunding Kalundu, Mulongwe, Kilomoni, Makobola, Kirimba and Kasekezi. The sampling was conducted from April to June 2010. The fish samples were collected from commercial fishing.
1440 fishermen were recorded that 67% were married and more than 33% of fishermen are aged of 20 to 29 years. Fishermen use lift nets of 4 to 5 mm of mesh, gill nets of 8 mm of mesh, beach seine nets of 4 mm of mesh, mosquito nets of 1 mm of mesh and fishing lines of 100 m of length having 90 to 100 hooks. 167 lift nets, 97 gill nets, 44 beach seines, 184 fishing lines and 5 mosquito nets were recorded during the period of investigation. A total of 1208 specimens belonged to 3 commercial species were sexed and weighted. Their length was measured and their maturity size was determined. *Stolothrissa tanganicae* was highest abundant with 520 individuals followed by *Limnothrissa miodon* with 464 and *Lates stappersii* with 224. On 100% individuals caught of these three species; 42.09% were immature. The first maturity size of *S. tanganicae*, *L. miodon* and *L. stappersii* was respectively of 63.09 mm; 77.45mm and 247.92 mm of length.
The mean price of 1Kg for *L. stappersii* varied between 3.6 and 4 US$, while 1Kg for *S. tanganicae* and *L. miodon* cost 2.22 US$ and 1.66 US$ respectively.

**KEYWORDS:** Socio-economics, commercial fishing, *S. tanganicae*, *L. miodon*, *L. stappersii*, lake Tanganyika.

## 1 INTRODUCTION

Lake Tanganyika is the second largest of African lakes and a unique resource for its four littoral countries (Burundi, Democratic Republic of the Congo, United Republic of Tanzania, and Zambia). Lake Tanganyika, one of the world's oldest lakes, is renowned for its productive pelagic fishery and serves as an important source of protein for millions people in region [2], [8], [9].

Lake Tanganyika has a particularly rich and diverse fish fauna in the pelagic, benthic, and littoral biotopes. More than 350 species of Cichlid and non-Cichlid are present about 2/3 of which are endemic [21], [16], [20].

More than 90% of the catch in the northwestern region of lake Tanganyika are mainly two species of Clupeid (*Stolothrissa tanganicae* Regan, 1917 and *Limnothrissa miodon* Boulenger, 1906) and a Latid species, *Lates stappersii* Boulenger, 1914 [5], [3], [18], [11], [13].

Fishing is an important livelihood for communities living on the edge of the Lake. Most households living around the lake both depend on fishing and agricultural activities [21].

Illegal fishing is rampant on lake Tanganyika with clear effect on fish productivity. The fishermen of lake Tanganyika do not respect the normal techniques of fishing and of fisheries resources management because they catch fish of any size and overfishing without thinking to next generations. They capture young and littoral fish using mosquito nets and beach seines. Fishermen aim their subsistence and therefore use any kinds of fishing gear (even destructive gear) [21].

The state service responsible for issuing fishing licences does not play its role as it should because it is not equipped and has insufficient and poorly trained staff on aquatic resources for which it is responsible [15].

Poverty and overcrowding in some areas, combined with the lack of environmental education and regional insecurity are the ultimate causes of adverse behaviours against the environment by the destruction of habitats in the lake Tanganyika basin [21], [15].

This contribution has three objectives. First is to identify fished species of commercial importance in the north-western of lake Tanganyika. Second is to identify the fishermen and their fishing materials used. Third is to determine the maturity sizes of fished species.

## 2 Material And Methods

### 2.1 Study Area

The study was carried out in the north-western region of lake Tanganyika in Uvira territory (between 3°20’ and 4°20’S latitude, and between 29° and 29°30’E longitude) and at Fizi territory (between 3° 36’ and 18° 50’S latitude, and between 27° 54’ and 29° 5’E longitude).

### 2.2 Data Collection

Sampling was collected in six sites in the north-western part of lake Tanganyika that three in Uvira territory included Kalundu, Mulongwe and Kilomoni and three others in Fizi territory included Makobola, Kirimba and Kasekezi from April to June 2010.

A survey was submitted to fishermen to record fisheries data in each site, such as fishing gears used, number of gears, length of net (metre), number of fishermen by fishing unit, capture effort (kg) and price per kg (US$) of fishing products. The mesh size of each net used has also been measured.

Fish were collected from commercial catch samples. Fish collected were preserved in 70% ethanol and then transported to Biology laboratory of Hydrobiological Research Centre (CRH) in Uvira for further processing.

### 2.3 Measurements And Observations Conducted In The Laboratory

At total of 1208 specimens belonging to 3 commercial species included *S. tanganicae*, *L. miodon* and *L. stappersii* were sexed and weighted as well as their lengths were measured and maturity stages were determined according to the length-maturity keys proposed by [17], [4].

### 2.4 Data Analysis

Statistical analyses were performed using ANOVA in R software (version 3.1.2) to compare variables, as well as correlation coefficients between weight of the body (g) and length (mm) were calculated.

## 3 Results

### 3.1 Socio-Professional Distribution Of Fishermen

1440 fishermen have been recorded that 67% were married, 47.5% have reached primary school. Besides fishing activities, 54% are also farmers. 84% of fishermen answered that the best period for fishing occurs between the moths of June and December. The fishermen reported that low catch is a major problem at the lake Tanganyika. As showed in the Figure (1), more than 33% of fishermen are aged of 20 to 29 years.

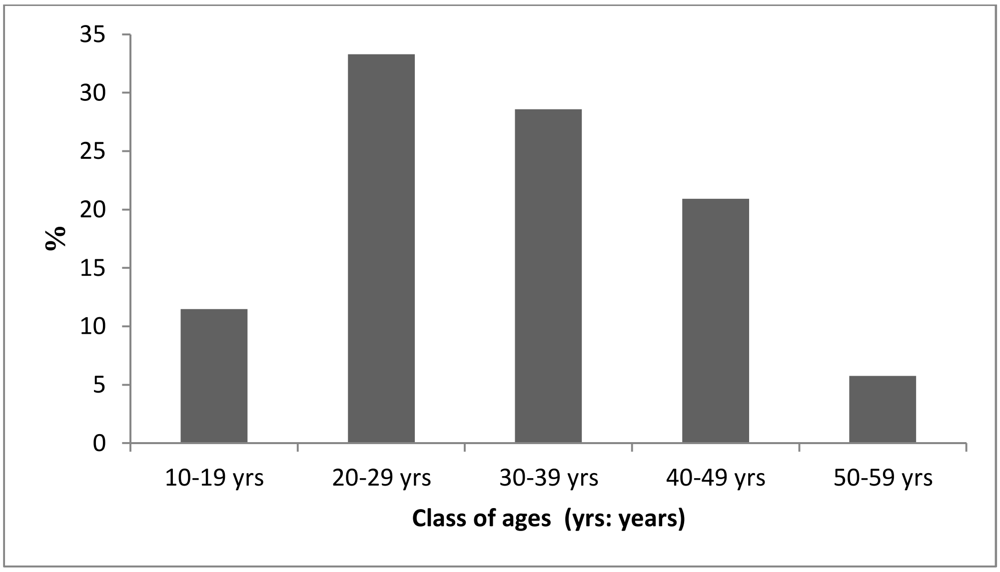


***Fig. 1. Class of ages of fishermen***

### 3.2 FISHING GEARS USED REPORTED IN ALL SITES

Fishermen of lake Tanganyika use lift nets of 4 to 5 mm of mesh, gill nets of 8 mm of mesh, beach seines of 4 mm of mesh, mosquito nets of 1 mm of mesh and fishing lines of 100 m of length having 90 to 100 hooks. As showed in the figures (2, 3, 4, 5 & 6), 497 fishing gears were recorded included 167 lift nets, 97 gill nets, 44 beach seine nets, 184 fishing lines and 5 mosquito nets.

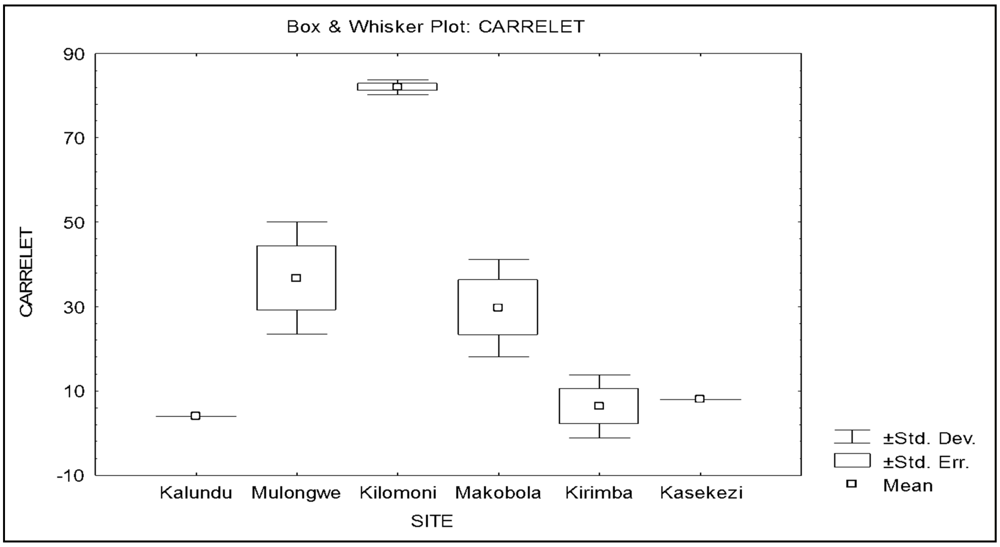


***Fig. 2. Variation of average number of lift nets by site***

Fig. 2 showed the number of lift nets was highest at Kilomoni (with 82) followed by Mulongwe (with 37).

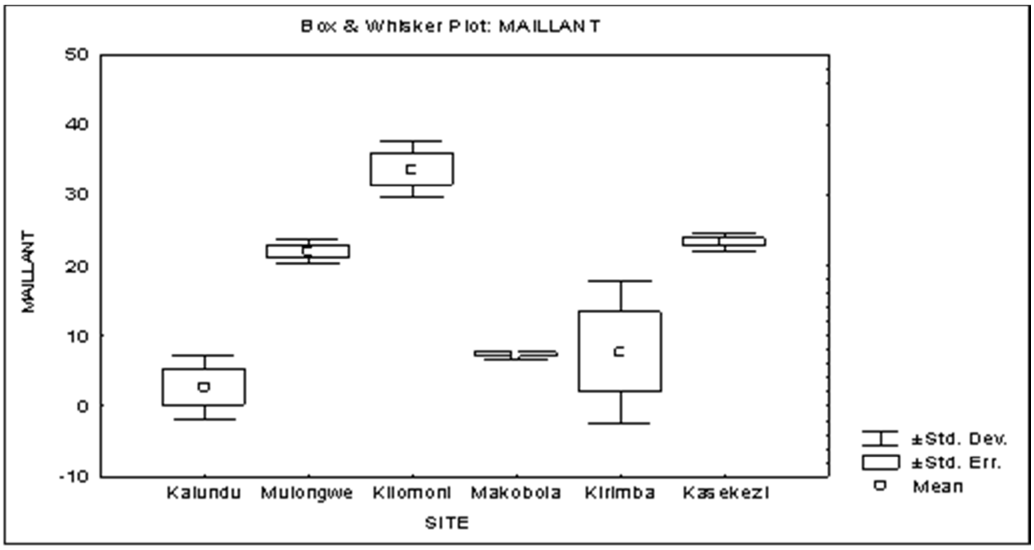


*Fig. 3. Variation of average number of gill nets by site*

Fig. 3 showed the gill nets were most recorded at Kilomoni (with 34) followed by Kasekezi and Mulongwe (with respectively 23 and 22).

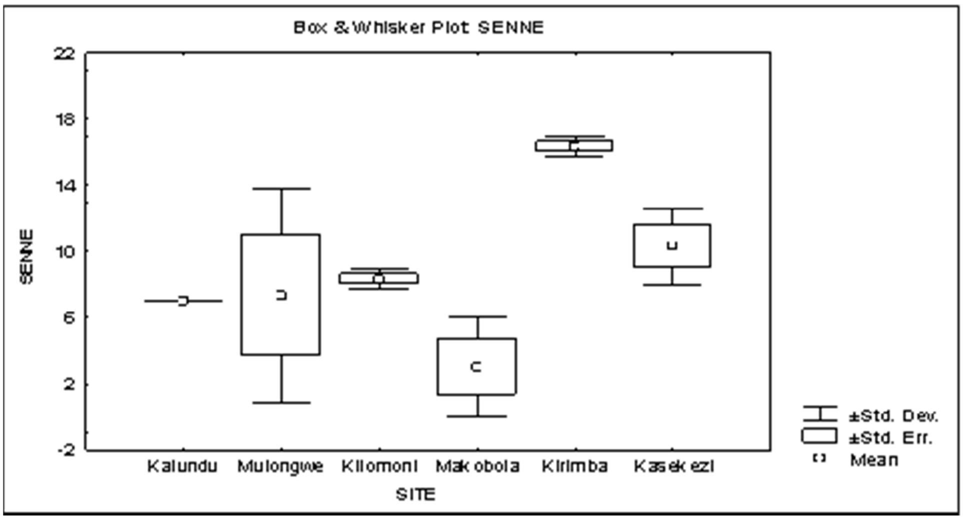


*Fig. 4. Variation of average number of beach seines by site*

Fig. 4 showed the highest number of beach seine nets was registered at Kirimba (with 16) followed by Kasekezi (with 10).

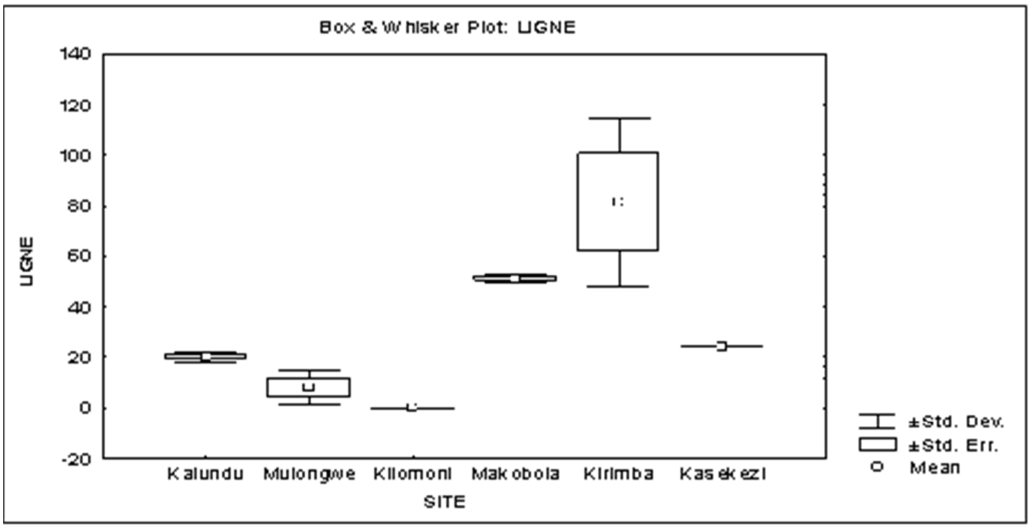


***Fig. 5. Variation of average number of fishing lines by site***

Fig. 5 showed the fishing lines were highest reported at Kirimba (with 81) followed by Makobola (with 51).

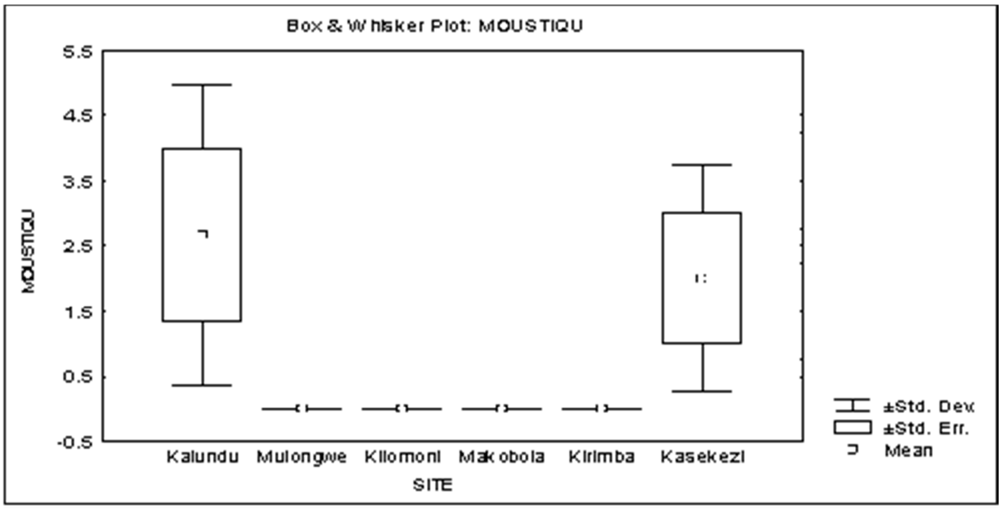


***Fig. 6. Variation of average number of mosquito nets by site***

Fig. 6 showed that the mosquito nets were only recorded at Kalundu and Kasekezi.

### 3.3 CATCH EFFORT RECORDED IN ALL SITES DURING THE PERIOD OF INVESTIGATION

Fig. (7, 8 & 9) summarised the capture effort (kg) of *S. tanganicae*, *L. miodon* and *L. stappersii* recorded from the studied sites, as well as the table (1) showed the average price (US$) per Kg of fishery products.

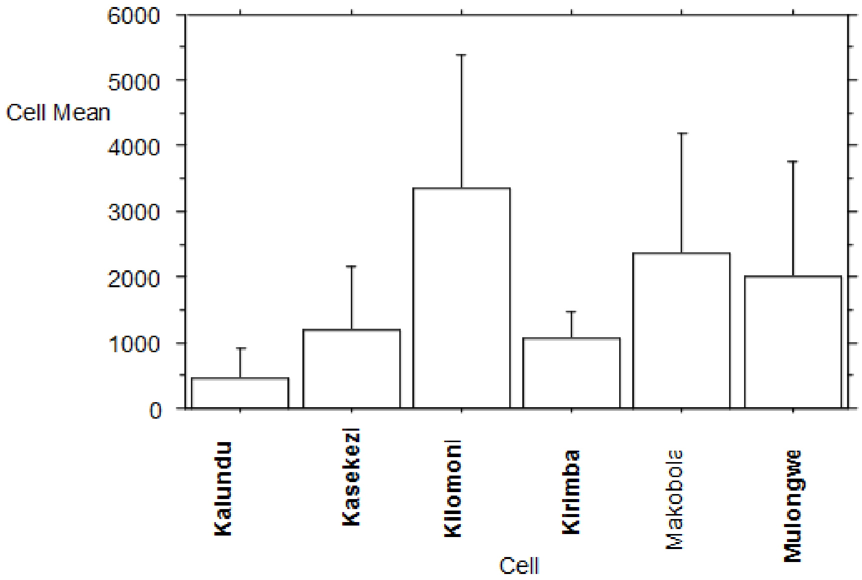


*Fig. 7. Mean catch (Kg) of S. tanganicae by site*

Fig. 7 showed the catch effort was highest at Kilomoni (with 3350 Kg) followed by Makobola (with 2367 Kg).

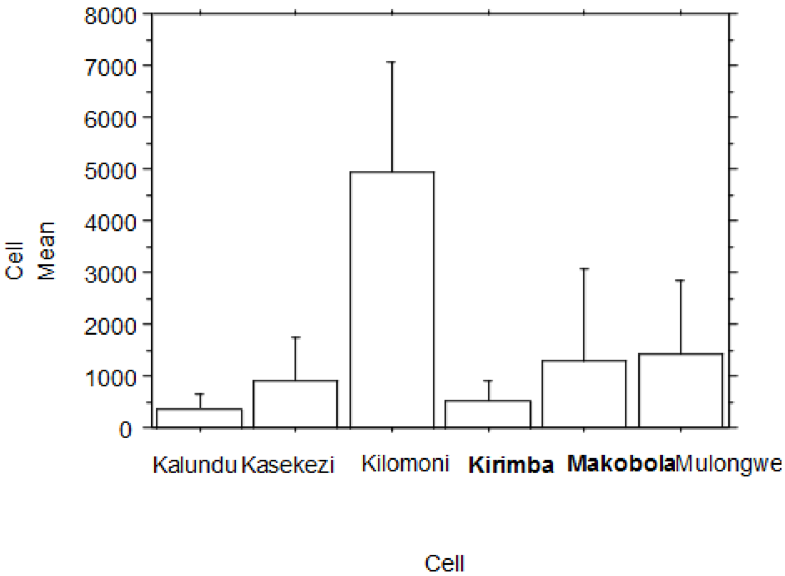


*Fig. 8. Mean capture (Kg) of L. miodon by site*

Fig. 8 showed *L. miodon* was highest caught at Kilomoni (with 4963 Kg) followed by Mulongwe and Makobola (with 1402 Kg and 1292 Kg respectively).

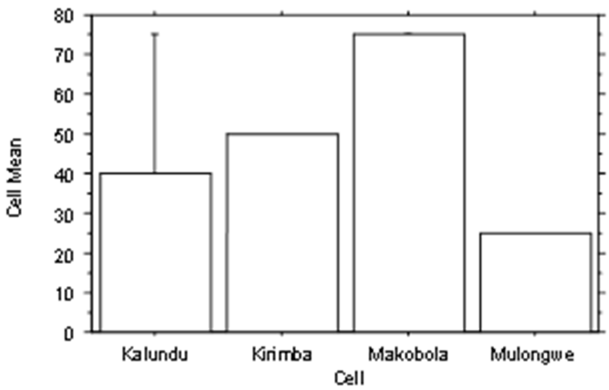


***Fig. 9. Mean total capture (Kg) of L. stappersii by site***

Fig. 9 showed the *L. stappersii* was most captured at Makobola (with 75 Kg). During the sampling period, the populations of *L. stappersii* were not caught at Kilomoni and Kasekezi.

***Table 1. Mean price per Kg (US$) of fishery products***

| Fishery products | Price per Kg |
|---|---|
| *Stolothrissa tanganicae* | 2.22 US$ |
| *Limnothrissa miodon* | 1.66 US$ |
| *Lates stappersii* | 3.6 to 4 US$ |

Table 1 showed that 1Kg of *L. stappersii* cost higher than 1 Kg of *S. tanganicae* and *L. miodon*.

### 3.4 Biological Data Of Fished Species Of Commercial Importance

A total of 1208 specimens belonged to 3 commercial species were collected. *S. tanganicae* was highest abundant (with 520) individuals followed by *L. miodon* (with 464) and *L. stappersii* (with 224). As for *S. tanganicae*, 40.49% were females with 63.91 mm, 22.05% of males with 65.68 mm and 37.45% with 37.34 mm of length were found immature. However, *L. miodon*, 26.39% were females with 77.39 mm, 43.35% of males with 78.52mm and 30.26% were immature with 40.32 mm of length, while *L. stappersii*, 12.5% were found female with 264.64 mm, 10.27% of males with 191.43 mm and 77.23% were immature with 57.64 mm of length.

On 100% of specimens caught of these three species; 42.09% were immature. The first maturity size of *S. tanganicae*, of *L. miodon* and *L. stappersii* was respectively of 63.09 mm; 77.45mm and 247.92 mm of length.

Fig. (10, 11 & 12) showed a positive significant correlation between weight of the body and length of these three species. The weight of the body is the most influenced by the length.

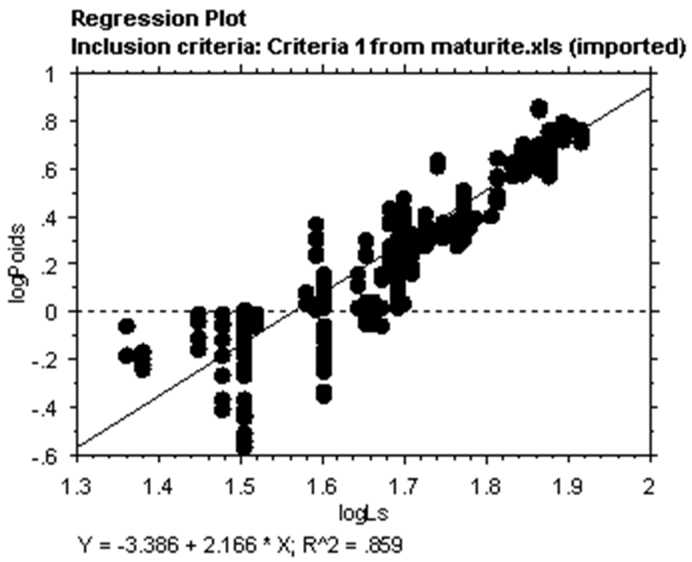


*Fig. 10. Weight of S. tanganicae is highly influenced by length*

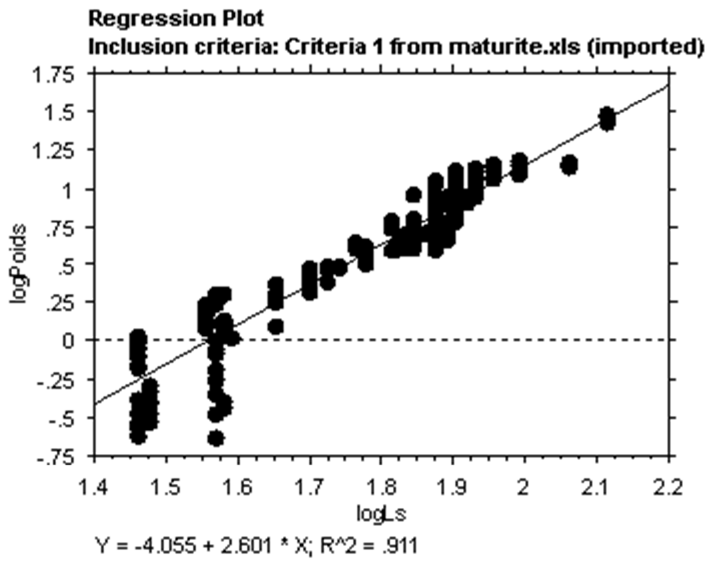


*Fig. 11. Weight of L. miodon is much affected by length*

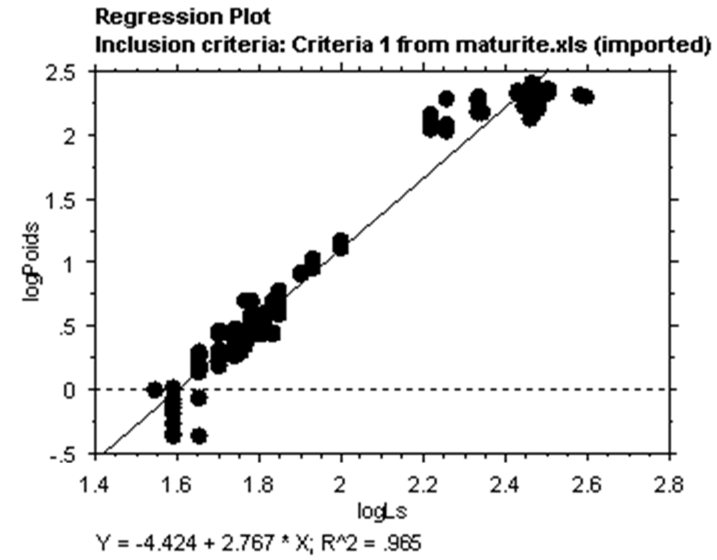


*Fig. 12. Weight of L. stappersii is highly influenced by length*

## 4 DISCUSSION

Apart from results obtained from surveys carried out on the fishing activities in the north-west basin of lake Tanganyika, there is intensity of fishermen reached a maximum in the age-group from 20 to 29 years old. This class of ages is more characterized by young people. Note that fishing activities require a hard work. The number of married fishermen who are head of households was more than unmarried. The fishermen have also some related occupations such as agriculture and livestock farming. They report the low capture is a major problem. This would explain the use of prohibited fishing gears that increase pressure on immature fish. The results found by [7] showed the lack of adequate fishing gears was the most important problem. Our findings are near to these recorded by [14], [19].

According to fishing materials, 497 gears were recorded included 167 lift nets, 97 gill nets, 44 beach seine nets, 184 fishing lines and 5 mosquito nets. Lift nets of 4 to 5 mm of mesh, gill nets of 8 mm of mesh, beach seines of 4 mm of mesh, mosquito nets of 1 mm of mesh and fishing lines of 100 m of length having 90 to 100 hooks are the most used.

The highest catch effort of *L. miodon* (with 4963Kg) and *S. tanganicae* (with 3350 Kg) was recorded in Kilomoni, a site where lift nets and gill nets are the most used. But *L. stappersii* (with 75 Kg) was the most captured at Makobola. During the period of investigation, the populations of *L. stappersii* were not caught at Kilomoni and Kasekezi. These three species are derived from catch to light [1].

The mean price of 1Kg for *L. stappersii* varied between 3.6 and 4 US$, while 1Kg for *S. tanganicae* and *L. miodon* cost 2.22 US$ and 1.66 US$ respectively.

Fishing statistics for clupeids and latids from Congolese side of lake Tanganyika recorded in 1988 was in the order of 30.000 tonnes [7].

The potential capture of Congolese fisheries was estimated between 135.000 and 210.000 tonnes per year [7].

Our findings showed that on 100% of specimens caught of these three species; 42.09% were immature. The first maturity size of *S. tanganicae*, of *L. miodon* and *L. stappersii* was respectively of 63.09 mm; 77.45 mm and 247.92 mm of length.

The results of [2] indicated that *S. tanganicae* reached the first maturity at 70 mm; individuals of less than 70 mm were immature. The first maturity size for males and females of *S. tanganicae* was 64 mm and 68 mm respectively [11]. *L. miodon* reached sexual maturity between 70 and 80 mm and at this size it reached about 6 months old [10]. The first maturity size for females and males of *L. miodon* was 64 mm and 75 mm respectively [5]. The first maturity for males and females of *L. miodon* was 58 and 68 mm respectively [11]. The size at the maturity of *L. stappersii* was between 180 and 220 mm [3]. But it was between 130 and 250 mm, when *L. stappersii* reached 2 years old [3].

In the northern region of lake Kivu, the young of *L. miodon* become sexually mature at 50 mm, but this is only 75 mm that 100% of the population is mature [6].

The findings of [12] showed that clupeids are small-sized (L∞ 90-110 mm for *S. tanganicae*, 155-170 mm for *L. miodon*) and short-lived (average life expectancy, 1 year for *S. tanganicae*, 2 years for *L. miodon*), species characterised by their high growth and natural mortality rates. *L. stappersii* is mid-sized (L∞ 470-520 mm) and is of an “average” life expectancy (6-10 years).

## 5 CONCLUSION

This study provides information about the fishermen and their fishing gears used, fished species and their maturity sizes in the north-western region of lake Tanganyika. The fishermen aim mainly sardines of Clupeidae (*S. tanganicae* and *L. miodon*) and Latidae species especially *Lates stappersii*, although in their catch efforts, they catch other species. Beach seines and mosquito nets are particularly destructive gears for fish stock because they capture immature fish as well as operate near the coast in the small canoes. Mesh sizes could not be less than the maturity size of the fish to the catch. The meshes used are not compatible with the specimen caught. The fishermen have difficulties to accept that is the crucial cause of low capture.

The basic rules of conservation of fisheries resources such as fishing methods, fishing period, and fishing areas are not met, however overfishing with destructive methods has a negative impact on the economy and social of the fishermen.

The authorities and state service responsible for fishing activities are inoperative, in difficulty to implement these important rules for sustainable management of fisheries resources.

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