

Demersal Fish Resources from Test Gill Netting in Lake Tanganyika, around Kigoma Town, Tanzania

Student: Anthony N. M. Kalangali (TAFIRI – Kigoma)

Mentors: Ismael A. Kimirei and Dr. Catherine O'Reilly

Introduction

Lake Tanganyika, the largest rift valley lake in Africa, has two main fishing zones, the demersal and pelagic. The pelagic water is mainly inhabited by three pelagic and endemic fish species. These are the two sardines (family Clupeidae)–*Stolothrissa tanganyicae* and *Limnothrissa miodon* and a centropomid–*Lates stappersii*. Other three centropomids–*Lates mariae*, *Lates microlepis* and *Lates angustifrons* are benthic but they come to the pelagic, mainly for feeding (Coulter *et al.*, (1991). Fishing techniques here are lift nets, hook and line and scoop nets. However, lift net is the main fishing technique used in the Tanzania sector of the lake. *Stolothrissa tanganyicae* and *Lates stappersii* are to-date, the major commercial fish species from the lake.

The demersal fishery extends from the shoreline down to the oxic-anoxic boundary. It includes the littoral, sublittoral, and benthic zones. There is higher fish diversity in this zone (Coulter. *et al.*, 1991). Cichlids alone contribute more than 200 species (Patterson. *et al* 1998, Michel, 2006).

Although the demersal fishery is a good source of revenue and high quality protein food to the societies around the lake, fisheries research and catch records in Kigoma area, have only concentrated on the pelagic fisheries. The demersal fish resources have only been under taxonomists (Bailey and Stewart, 1977) and few fish biology studies (Bayona, 1991 and Ndaro, 1992, 1997). Bayona (1991) and Ndaro (1992) used beach seine to study the biology of the emperor cichlid (*Boulengochromis microlepis* – “kuhe”) and species composition, distribution and abundance respectively.

This study set-out to investigate fish species composition, gill net selectivity and some aspects of the biology of *Limnotilapia dardennei* (‘Kungura’), a demersal fish species dominating the local beach markets in the study area and which fetches a good market price. The biometric study of *Limnotilapia dardennei* included body lengths, weights, sex ratio and gonad maturation.

Materials and Methods

The study to assess the demersal fish resources in the demersal waters around Kigoma town, Tanzania was conducted between 17 – 28th July, 2006. A test gill net unit made-up of six pieces of 100 metre long of mesh sizes 1”, 1.5”, 2”, 2.5”, 3” and 4” each was used. The six gill net pieces were joined together to make one net of 600 metres long and 2 metres wide. Using a plank canoe, the gill nets were set at the Kigoma harbour and Bangwe beach areas during the research period. A choice on these points was based on differences in substrates and level of gill-net fishermen using these areas – Kigoma harbour is muddy, has submerged macrophytes and there are relatively more fishermen activities in the area. On the other hand, Bangwe bay is sandy–muddy with few macrophytes and relatively few fishing activities. The level of disturbance in these two areas is different with the harbour being more disturbed than the Bangwe area. The nets were set in the afternoon and hauled the next morning. The landed catch was sorted according to mesh size and identified to species level, whenever possible, using Konings (1998) and Eccles (1992). The catch was then weighed to get total weight and species total weights using a top-end balance and the total number of individuals of the species was recorded. The average weight of fish by each mesh size of the test gill net was used as an index of gear selectivity.

Fish samples for biometric study of *Limnotilapia dardennei* were purchased from Katonga and Kibirizi landing beaches since the catch from the test gill nets had very few or sometimes no *L. dardennei* at all. In the laboratory, individual total length, weight, sex, gonad maturity stages and gonad weights were recorded. Gonad maturity staging was done according to Aro (1993). The length–weight relationship was calculated and length frequency distributions for daily samples were constructed. A model by Froese *et al.* (1999, FISHBASE 2004) was used to estimate the asymptotic length and size-at-first-maturity for *L. dardennei*.

Results

Catch composition

Fourteen (14) fish species under fourteen genera and eight families were caught and identified from the test gill netting. Out of the fourteen genera, seven (50%) were cichlids and were the most dominant by number (68%) (Fig.1). *Lates mariae*, the only centropomid recorded contributed about 16.1% with the majority of them coming from the Kigoma harbour. These were juveniles with total lengths ranging between 8.7 and 18.5cm.

Gear selectivity

Average weights determined separately for each mesh size of the test gill net gradually increased with increasing mesh size (Table1).

Some aspects of the biology of *Limnotilapia dardennei* ('Kungura')

A total of 304 individuals were bought from Katonga and Kibirizi and analysed for length-weight relationship, gonad maturation, sex ratio and size distribution. All the *L. dardennei* had a lot of fat in their bellies and a peculiar character of having only one male or female gonad. The sex ratio (male: female) was found to be 1:1. Length at infinity (L_{∞}) for this species was found to be 246.4 mm.

Length-weight relationship:

Limnotilapia dardennei was found to grow isometrically with every increase in length resulting in increase in weight. Its growth therefore followed the equation:

$Wt (g) = 3E^{-5}TL (mm)^{2.8067}$ ($r^2 = 0.8785$) where Wt is weight in grams, TL is total length in millimetre (Fig. 2).

Maturity stages:

Almost all *Limnotilapia dardennei* sampled were mature in stage 3 and 4 of maturity. The size at first maturity was found to be 107 mm and 111.2 mm for males and females, respectively. There were 6 spent females.

Length frequency distribution

The length frequency distributions were constructed and presented in Figure 3. The average total length of all individuals was found to be 173.71 mm.

Discussion - Conclusion & Recommendations

Almost all individuals caught by the test gill net were small fishes. These were caught by the 1", 1.5", 2" and 2.5" mesh sizes. Among these, juveniles of *Lates mariae* were abundant in the first fishing day which was done at the harbour. These had total lengths ranging from 8.7cm to 18.5cm. Mature *Lates mariae* reach up to 200cm (Eccles, 1992). It is important also to note that all these *L. mariae* were caught by a net of 1" mesh size, indicating that Kigoma bay could be one of the important nursery sites. This is important because if the fishermen are using nets with fine meshes, they will be fishing them in large numbers which has a detrimental effect on *L. mariae* stock since the shallow areas are their breeding and nursery grounds. Such areas like Kigoma harbour should be isolated and kept as conservation areas to raise the *L. mariae* stocks in the lake. Another observation that was made is that, among the smaller individuals recorded were *Synodontis* spp. These were smaller than juvenile *L. mariae* caught but they were all mature in stage 4 of maturity. Therefore, if the fishery was targeting this species alone, then the gill net with mesh size in this range would be acceptable but since this is a multispecies fishery, then a net that will select larger individuals is suggested.

The smallest average weights of fish caught by smallest mesh sizes of test gill netting and vice-versa for the biggest mesh sizes, indicates the high selectivity of gill nets. The gill net mesh size which is suitable for Lake Tanganyika is, therefore, hereby recommended to be 3". This size also is the one recommended by the Fisheries Division (Fisheries Act, 2003; Fisheries Regulation, 2005). This type will select the bigger fishes and allow juveniles to grow and perpetuate the resources. This is also in agreement with results on *Limnotilapia dardennei* caught by the fishermen. From the survey, Lowe (2006) observed that mesh sizes used were ranging from 1 to 4 inches with an average around 2".

All *L. dardennei* caught were mature. Males and females were in maturity stages 3 and 4. This is an indication that, probably, June/July is their breeding period/season. All *L. dardennei* had a lot of fat in their bellies. This indicates the presence of enough food in the demersal zone during the period. The harvesting of mature individuals in stage 4 of maturity in large numbers is not so desired however since their removal might mean less individuals are allowed to reproduce. This in a long run will have adverse impacts on the stock. So this study is suggesting a closure system so that during the breeding period less or no fishing should be done in the shallow littoral areas.

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Figure 1: Family composition from test gill netting

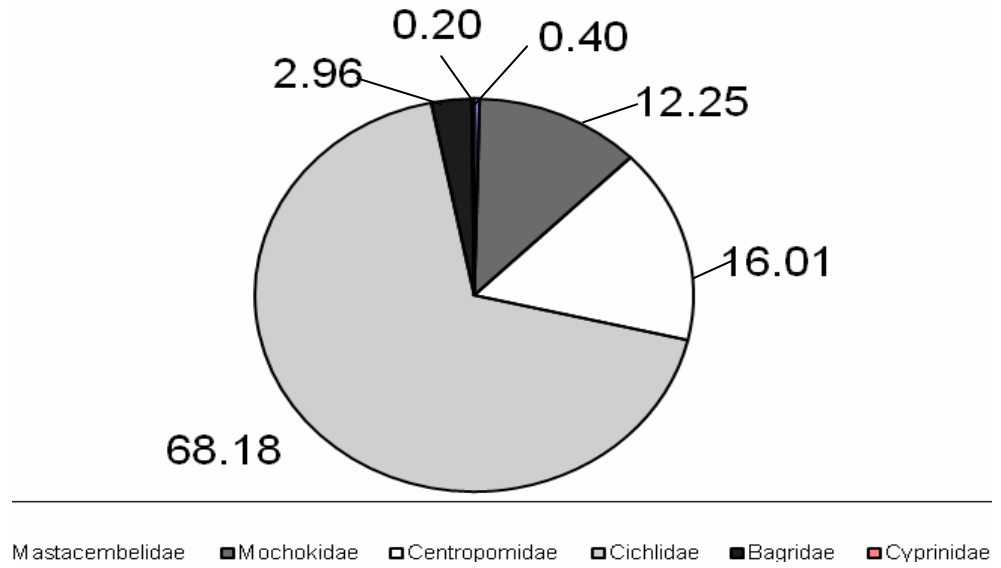


Figure 1

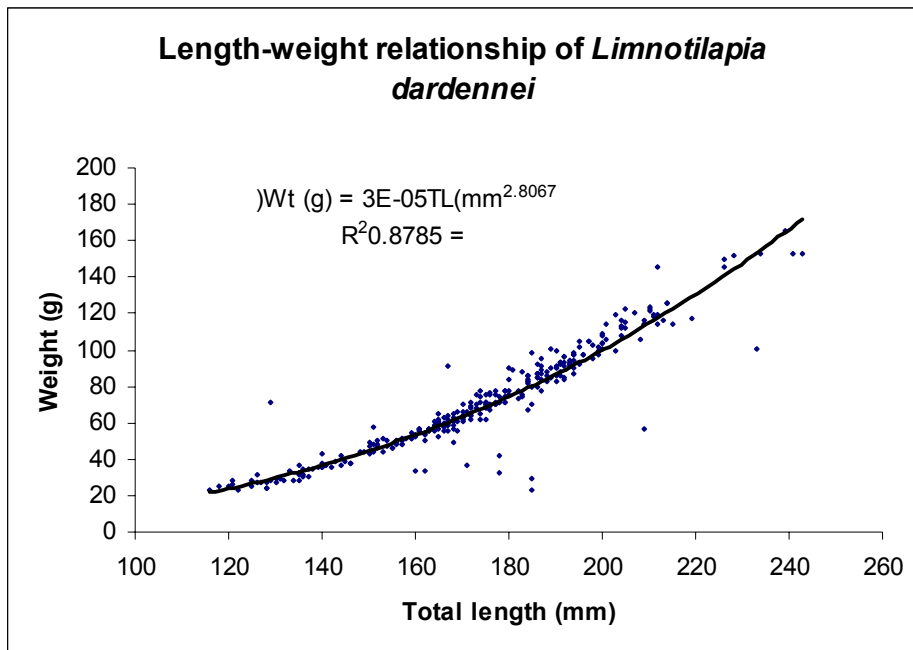


Figure 2

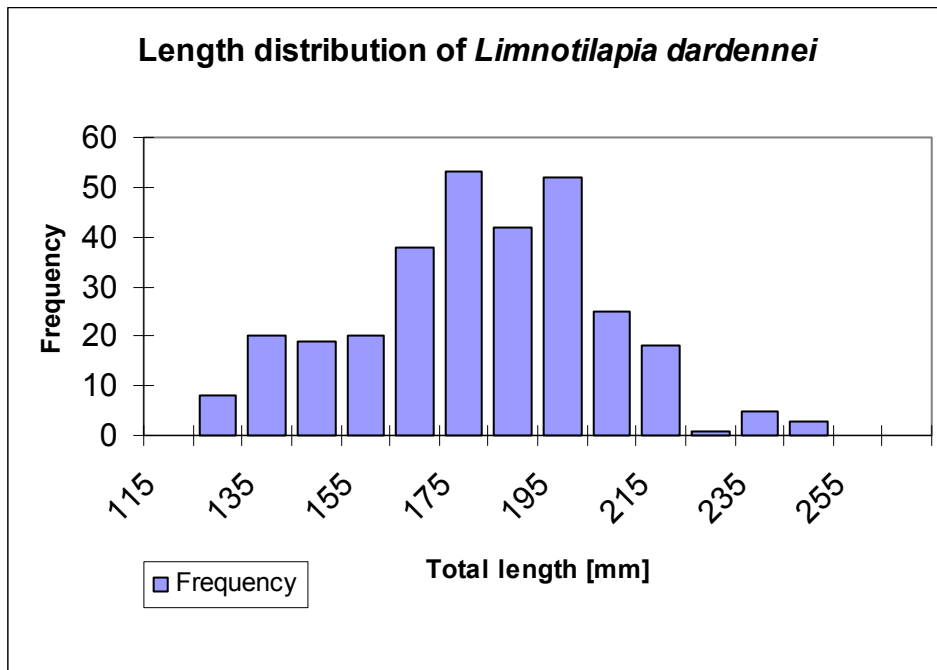


Figure 3

Mesh size (inches)	Total number	Total weight (gm)	Average weight (gm)
1	354	3816.74	10.78
1.5	103	2263.16	21.97
2	28	1559.59	55.70
2.5	20	2013.72	100.69
3	4	650	162.50
4	0	0	0

Table 1 : Gill net gear selectivity.