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Assessment of body size and catch per unit effort of Nile perch (*Lates Niloticus*) caught using different fishing gears at Magu district in Lake Victoria, Tanzania

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Abstract

This study was conducted to assess body size distribution and Catch Per Unit Effort (CPUE) of Nile perch (*Lates cf. niloticus*) captured using three common fishing gears at Magu district in Tanzania. Three landing sites along Lake Victoria were selected for this assessment. Each site was visited twice per week for two months. At each site 10 boats were identified based on the gear used and randomly selected for fish count. Ten fish per boat were taken for weight and length measurements. The results show that the main fishing gears used to catch fish at all sites were gillnet (GN), long line (LL) and beach seine (BS). Mean length of captured fish recorded from each gear were 33.7, 41.5 and 43.8 for beach seine, gillnets and long lines respectively, which was below the minimal required length of 50 cm. Large proportion of small landed fish were observed in vessels fishing with beach seine, this was due to illegal nature of the beach seine, where by fishermen used small mesh sizes of 10 mm to 12 mm. However, beach seine had higher CPUE (kg/gear/day) (44.9) and gillnet had the lowest (22.6). This study revealed that the mean length from all sites were below the legal minimum size required by the Tanzanian government, suggesting that all beaches are involves in over exploration of fish.

Keywords: *Fishing gears, Catch Per Unit Effort (CPUE), Nile perch, Length*

1. Introduction

Nile perch and Nile tilapia were introduced in the Lake Victoria in the 1950s and 1960s with some controversial reasons of their introduction, though many articles describe the introduction as means of increasing fish productivity to improve domestics and region fish production, thus contribute to food security and employment (Pringle, 2005). The introduction led into enormous expansion of fisheries industries in the 1990s and the establishment of several fish processing plants whereby more than nine processing plants were constructed along the lake shore of Tanzania alone (LVFO, 2013; and Njiru *et al*., 2009). However, high decline in Nile perch has been reported recently, with several reasons associated with the decline. One of the reasons is that the

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fisheries resources in Tanzania are currently exploited using the open access principle, which means that participants are free to enter, and conduct fishing activities in any part of the area without permission. In addition, fishing seasons are not restricted, anyone can make or buy a vessel and start fishing (Ntiba *et al*., 2002). Between 2000 and 2014 the number of vessels in the inland fisheries almost doubled, from 25,014 to 49,627. The number of fishers also increased from 80,704 fishers to 147,479. Inland fisheries production increased from 271,000 tons to 320,566 tons in 2005 (Matsuishi *et al*., 2006).

Increase in human population along the lake basin (Balirwa, 1998) and the subsequent expansions of towns and cities bordering the lake has created huge demand for fisheries products (Abila, 2000; and Yongo *et al*., 2005). This has increased fishing pressure and where in most cases illegal fishing gears are used to maximize production (FAO, 2000; and LVFO, 2015). Uncontrolled harvest has been reported in many recent reports as the main source of decline in fish catch. The fishing pressure to meet demand for human consumption and fishmeal for livestock and poultry feeding has influenced fishermen to reduce mesh sizes of gillnets used. In addition, the increase in fishing pressure resulted in the modal length of Nile perch caught in the artisanal fishery in the Tanzanian part of the lake, to decrease from 60-80 cm in 1988 to 50-60 cm in 1992 and further down to 45-51 cm in 1994.

The artisanal fishermen in Lake Victoria use simple gears such as gillnets, cast nets traps and small hooks on longlines. Pressure is mainly placed on the Nile perch, where many of the fish caught are of a small size (Mkumbo and Marshall, 2015). Subsequent, the use of beach seine is the threats to juveniles and this could ultimately lead to the collapse of this lucrative fishery (Muhoozi, 2002; and Mkumbo and Marshall, 2015). Gillnets were used as far back as 1908 (Njiru *et al*., 2007). The legal mesh size for gillnets is six-inch for Nile perch between 50 and 85 cm total length. However, the currently fished cichlids (Witte *et al*., 2000) are not within the length range that the six-inch gillnets can catch, which has reduced the catching of these species. This has led to conflict between fisheries authorities and fishermen, especially when fishers resort to use small-size gillnets to catch cichlids.

In addition to high demand, the decrease in the quantity of catches (Mkumbo, 2000), has increased for a number of reasons, including market forces, poverty, falling incomes and corruption. The growing demand of the fish export markets encouraged local communities to adopt illegal gear and to catch juveniles had ready markets both amongst fish filleting factories and local communities. Therefore, the aim of this study was to assess the body size and Catch Per Unit Effort (CPUE) of Nile perch using different gear at three landing sites along Lake Victoria.

2. Materials and methods

2.1. Description of the study area

The study was conducted along Lake Victoria shoreline in Magu district, Tanzania which is among the seven districts in Mwanza region involved in fishery activities along Lake Victoria (DADPs, 2009/2010). Magu district lies within 2^{o} 10, and 2^{o} 50 latitudes (South of Equator) and 33^{o} and 34^{o} longitudes (East of Greenwich) (Ntiba *et al*., 2001), is not mentioned in the refernces list occupying an area of about 15,000 ha. The data for this study was collected from Ihale, Nyamikoma and Nyakaboja landing sites (Figure 1).

2.2. Ihale landing site

Ihale beach which is a large landing sites was selected as a potential candidates because there is a huge processing plant at the beach; hence, most fishermen landed on this site and conducted their fish length and weight measurements at the beach. The beach had an accessible road throughout the year. In addition, it was easier to get other information because a social-economic study has been carried out at Ihale beach (LVEMP, 2000; and Wog, 2000).

2.3. Nyamikoma and Nyakaboja landing sites

These were also large landing sites situated 4 km apart from Ihale. The beaches were selected because they are highly populated with well-constructed design and good management activities. The area also possessed building plants for fisheries activities but small in size compared to the one found at Ihale. At these sites, a lot of women are engaged in fish processing, and sell processed fish to different people (DADPs, 2009/2010; and Wog, 2000).

2.4. Data collection/sampling procedure

A total of 230 boats were randomly selected for data collection. At each landing site 10 boats were randomly selected and from each boat 10 fish were randomly selected for body weight and length measurements. Total length was measured by using measuring board or ruler to the nearest 0.01cm and weight was measure using weighing balance to the nearest 0.01g. Types of the gear, time spent fishing, total numbers of fishermen operating in each boat were also recorded. Sampling was done in the day time between 7.30 am and 6.30 pm for two months. The daily total catches of individual boats, size of the gear, number of gears per vessels and number of fishers per Vessels were recorded. The weight-length relationship of Nile perch was established using the following equation: $W = aL^b$ (Le Cren, 1951).

2.5. Catch Per Unit Effort (CPUE)

CPUE for several gears were calculated based on the weight of fish that were caught during a fishing day per gear (kg / day / fishing gear) using the following formulae:

$$CPUE = \frac{Total\ \ weight\ \ of\ \ fish\,in\ \ all\ \ landing\ \ sites\,(kg)}{Total\,number\,of\ \ fishing\,effort\ \left(\dfrac{gear}{day}\right)}$$

3. Data Analysis

Data were analyzed using R Studio software version 3.5.0 (2018) (Kleinman and Horton, 2014). Before the analysis, data were checked for normality and fish weight and length were log transformed to reduce skewedness. Then data were subjected to one way Analysis of Variance (ANOVA) to test whether there were significant differences in body size and CPUE based on gears used to catch Nile perch at 5% level of significance. Subsequently, Turkey test was used for post hoc analysis to separate the means where significant difference existed. The relationships between fish weight and effort were determined by using Pearson correlation.

4. Results

The study revealed variation in the number of boats and fishermen between the three landing sites whereby 127 and 257 for Nyamikoma, 50 and 141 for Nyakaboja and 53 and 138 for Ihale were observed. The study also revealed that three main gears were used for this study (gillnet (GN), long line (LL) and beach seine (BS)) to catch fish at Nyamikoma, Nyakaboja and Ihale beaches. The proportional of catches landed by each gear are calculated and presented in percentages (Figure 1).

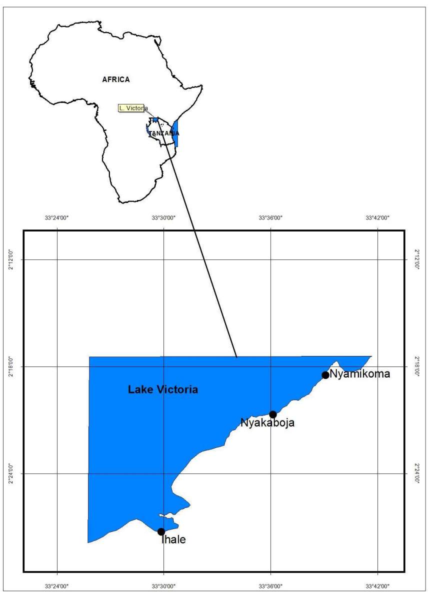

Figure 1: A Map showing the three landing sites (Nyamikoma, Nyakaboja and Ihale) at Magu- Tanzania

4.1. Length frequency distributed

The length distribution of Nile perch caught using different gear types was slightly different among the sites and indicated that more than 70% of all Nile perch catch were below 50 cm TL (Figure 3). These catches were collected using three types of gears which were LL, GN and BS. Most fishes between 40 to 60 cm were caught using GN and LL. BS caught mostly small fish < 50 cm (Figure 4A and 4B). Analysis of catch size distribution showed that there was a relationship between the size of Nile perch caught and the distribution of the gear types being used in the current Nile perch fishery (Table 1). Fish length differed significantly among sites ($F_{2,4149}$ = 120.7, $p < 0.05$) and between gears ($F_{2,4149}$ = 33.8, $p < 0.05$).

Table 1: Mean length, weight, condition factor and CPUE of Nile perch for each fishing gear at Ihale, Nyakaboja and Nyamikoma landing sites at Magu district

Parameter	Gears	Beaches		
		Ihale	Nyakaboja	Nyamikoma
Length (cm)	BS	32.92 ± 0.9[b]	42.01 ± 1.7[a]	26.31 ± 0.7[c]
Length (cm)	GN	39.17 ± 0.6[b]	40.32 ± 0.7[b]	45.10 ± 0.5[a]
Length (cm)	LL	47.2 ± 0.9[a]	42.8 ± 0.4[b]	41.4 ± 0.6[b]
Weight (g)	BS	1135.18 ± 88	1411.46 ± 130	825.06 ± 96
Weight (g)	GN	1453.62 ± 112	1068.25 ± 44	1331.63 ± 63
Weight (g)	LL	2329.26 ± 160	1276.18 ± 41	1743.43 ± 125
CPUE (kg/gear/day	BS	44.76b ± 2.4	34.93c ± 1.2	55.28a ± 3.8
CPUE (kg/gear/day	GN	28.15a ± 3.9	25.24b ± 1.2	14.63c ± 2.5
CPUE (kg/gear/day	LL	30.69ab ± 4.6	24.05b ± 6.3	38.91a ± 9.8

Note: *[abc] The same superscript letter in the column per each item indicates there is no significant different ($p > 0.05$) among treatments.

Fish specimens ranged from an average size of 10 cm to over 100 cm TL; the most common size of fish, i.e., the modal size fell between 30 and 60 cm TL; and the average total length was highest when LL was used 47.2 ± 0.9) and smallest when BS was used (26.3 ± 0.7cm) (Table 1). All the length frequency distributions of catches from each gear type and for the whole sample tended to have normal distribution except for BS in all sites. The numerical values of the distribution characteristics of Nile perch from the different gear types generally became smaller and smaller when moving from LL (42 cm) to GN (38 cm) to BS (35 cm).

4.2. Length – weight relationship and condition factor

Our result indicated that Nile perch catch below 50 cm TL were observed at all sites and a few brooders (>85 cm TL) were also caught at each beach (Figure 4). The ANOVA shows that there were significant different in mean weight ($F_{(2,4151)}$ = 12; $p < 0.05$), length $F_{(2,4151)}$ = 8.9; $p < 0.05$) and condition factors between sites ($F_{(2,4151)}$ = 45; $p < 0.05$). In general, Ihale had the highest mean weight (1700.31 ± 70 kg) and Nyakaboja the lowest (1200 ± 50 kg). The highest weight was obtained by using LL and lowest when BS were used (Table 1).

4.3. The Catch Per Unit Efforts (CPUE)

The average CPUE values ranged between 30 and 102 kg/gear/day for BS, 8 and 36 for GN and 3 and 10 for LL fishing gears. BS had significantly ($p < 0.05$) the highest CPUE at Nyamikoma than LL and GN (Figure 5). The lowest CPUE (14.63) was observed at Nyamikoma when gillnets were used. In general, BS had the highest mean CPUE at each fishing site and gillnets showed the lowest values (Figure 5, Table 1).

5. Discussion

Fishing gears are defined as tools used to capture aquatic resources. The fishing methods and gear you choose to employ can make a huge difference to the quantity and quality of the fish you catch (Prado, 1991). Artisanal fishes at Magu district used canoes propelled either manually (paddle) about 10% or by engines (90%). This study, shows that the size of fish catch varied among sites depending on fishing gear used. LL had the highest proportional catch (43%) than GN and BS. A possible cause for high catch may be due to the setting of the gear. Longline fishing is a commercial fishing technique set and operated in deep offshore water (where big fish are found) and they use a small number of baited hooks with big holes approximately with spinner hook sizes (5, 6, 7) which allow large fishes to be caught (URT, 2003).

Gillnets are set and operated in deep offshore water with mesh size of >6 inch's which is allowed by the Tanzania Fisheries Regulation (URT, 2009), however, some of the fishing activities were conducted on shore using gillnets as a result small fish were collected under GN gear. BS had the lowest total catch of fishes 26% (Figure 2) possibly because a beach seine is a fishing net hauled from the shore. This gear is not allowed by the government (FAO, 2001-2020; and URT, 2009) because it is operated on shoreline using bottom trawl which destruct fishing grounds. The beach seine fishing activities always trail across the lakebed, it scours the latter, scooping up pretty much everything in its path. Beach seines do not provide fish with a 'sporting chance' at freedom, and the gear is widely detested amongst those who practice fisheries conservation. It is little surprise that the gear was still being used. Comparing the different fishing gears, commercial fishers' uses pelagic set GN and LL which tend to harvest larger fishes compared to the bottom trawl which uses BS and this is normally operated by small fisheries who do not have large capital.

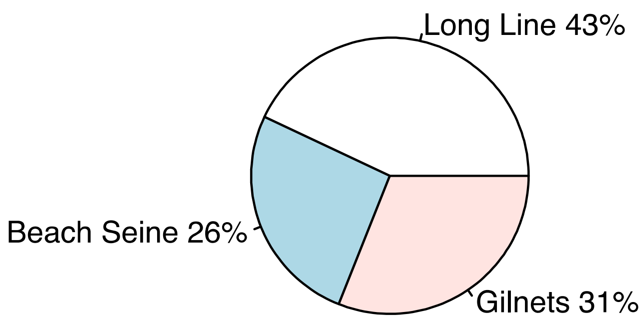

Figure 2: Contribution to total landings of each gear used in the Nile perch fishery at three landing sites in Magu district, Lake Victoria

A striking difference between the three sites (beaches) in fish range was observed in terms of weight and length size structure of fish harvested during this study. Length frequency distribution of the fish from this study indicates that more than 70% of all catch were below 50 cm (TL) which suggests that a large number of the fish harvested in the three beaches were small and under size (Figures 2 and 3). Based on the Tanzania

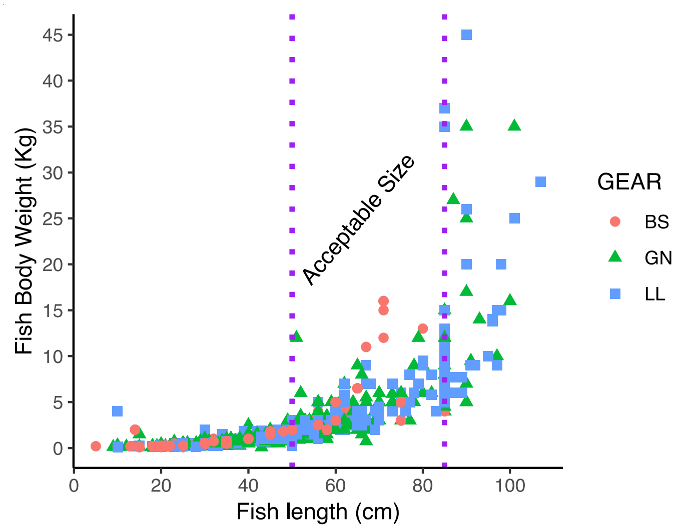

Figure 3: Weight - Length relationship of Nile perch for each fishing gear at Magu district

government regulations, fishermen are not supposed to harvest small fish. The required size slot for length is about 50-85 cm, (URT, 2009; and 2003). The availability of small fish in terms of total length (TL) was due to the fact that most fishermen used illegal fishing gears like the use of long line (LL) which has spinner hook sizes number (10, 11, and 12) which are smaller than 5, 6, and 7 allowed by Tanzanian government. Some fisherman used single gillnet (GN) with small mesh size < 5 inches. The results in the present study are consistence with that reported by Marshall and Mkumbo (2011) which indicated a reduction in the proportion of fish < 50 cm in the catch from 65% in the period 1980s to 17% by the mid 2000s. Nile perch below 50 cm TL was also reported to make up to 40% of the total landings recorded in the catch assessment surveys (LVFO, 2014).

Fishing regulations in Lake Victoria are for the most part focused on the Nile perch and Tilapia. Gillnets were used as far back as 1908 (Njiru *et al.*, 2006). The legal mesh size for this gear was recently increased from five to six inches. The legal six-inch mesh size gillnets target Nile perch fish of between 50 and 85 cm in total length. However, the currently resurging cichlids (Witte *et al*., 2000) are not within the length range that the six-inch gillnets can catch, which has limited the catching of these species and subsequently, the freedom to fish for all the available resources in the lake. This has led to conflict with fisheries authorities, especially when fishers resort to use small-size gillnets to catch cichlids.

Gillnetters sometimes are used in fishing technology whereby the nets are set and allowed to drift in the lake to collect anything in their path. This result in collection of small fish < 50 cm, destruction of the breading ground and loss of other gears. Although, the legal mesh size is six, a study done by Mpomwenda (2018), revealed that when paddled gillnet with mesh sizes less than 8 inches were used Nile perch captured were below the minimum size slot of 50 cm TL, only mesh size > 8 was able to capture fish above 50 cm TL. Another study by Msuku *et al.* (2011) on effectiveness of the gillnet regulation done in Tanzania recommended the use of size 7-inch mesh compared to the 5-inch mesh which was earlier considered by (Ogutu-Ohwayo *et al.*, 1998), because with 6-inch still small fish were caught. For this study, most of the GN were operated onshore areas (shallow water) where most of the small fish were found. Likewise, BS had the largest number of under size fish caught (Figure 4). A possible reason for this could be unavailability of the large fish in these shallow areas where bottom trawl was conducted (Balirwa, 1998; and Wilson *et al*., 1999).

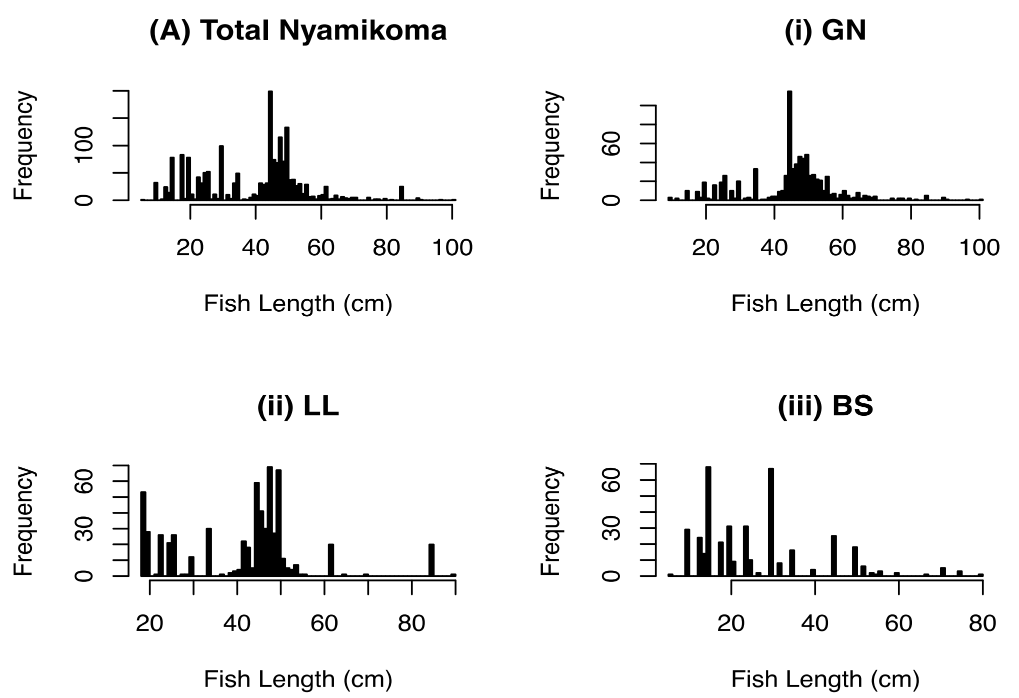

Figure 4: Length frequency of Nile perch for each fishing gear at three different landing sites (A) Nyamikoma, (B) Ihale (C) Nyakaboja, (D) data collected for two months at Magu district in Lake Victoria

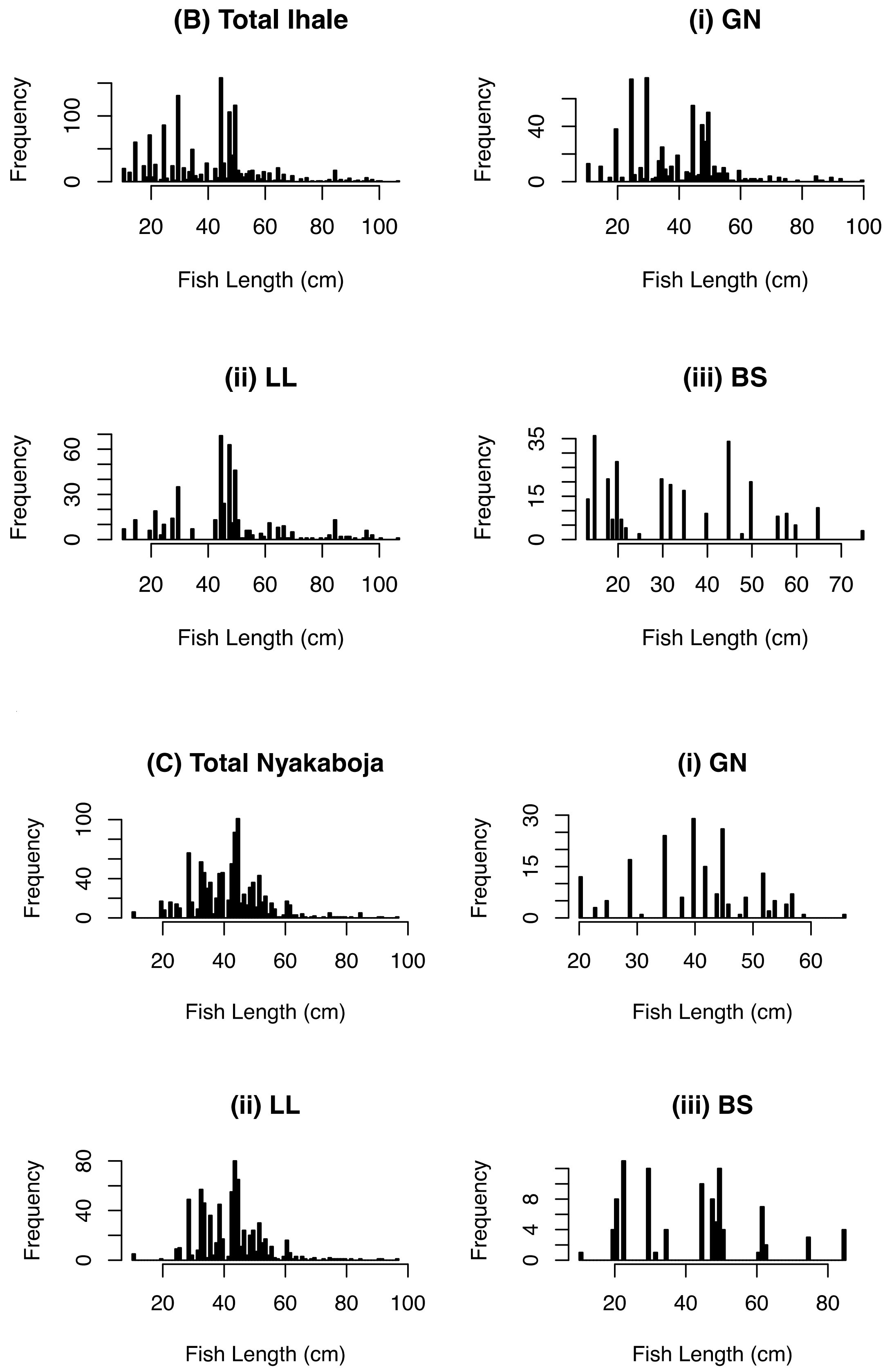

Figure 4 (Cont.)

The weight-length relationship revealed that the lowest size was less that 18 cm, based on the assessment done by Mpomwenda (2018), fish at this weight may be caught using mesh sizes less that 2.5 inches. Compared to deep water operated gears which are double gillnets and long lines (LL), which tends to harvest relatively large fish between 40 and 60 cm (total length). However, this study shows also that a few fishermen harvested bigger fishes greater than 85 cm total length when LL and GN were used but not for BS gear (Figure 4). According to Njiru *et al*. (2014) and Msuku *et al*. (2011), bigger fish > 85 cm are not allowed to be fished out because these are the brood stocks. Brooders should be left in the lake to produce more fingerlings for feature generation.

The condition factor of Nile perch can be affected by age, sex, food availability and fishing gears used in the lake. When condition factor is greater it indicates suitable site. The condition factor was measured from length-weight relationship data of the fish. Lower condition factor at Nyakaboja was due to lower weight and length at the same beach. Generally, the lower the fish weigh or length relationship the lower the condition factor. This tendency of difference in condition factor based on fishing gear was also observed in the Lake Victoria (Uganda) on the same species in 2004-2005 (Namisi, 2005). From this study fish condition factor was relatively good in all sites because it was > 1. Although some of the fish were small (< 40 cm) still they had good well-being.

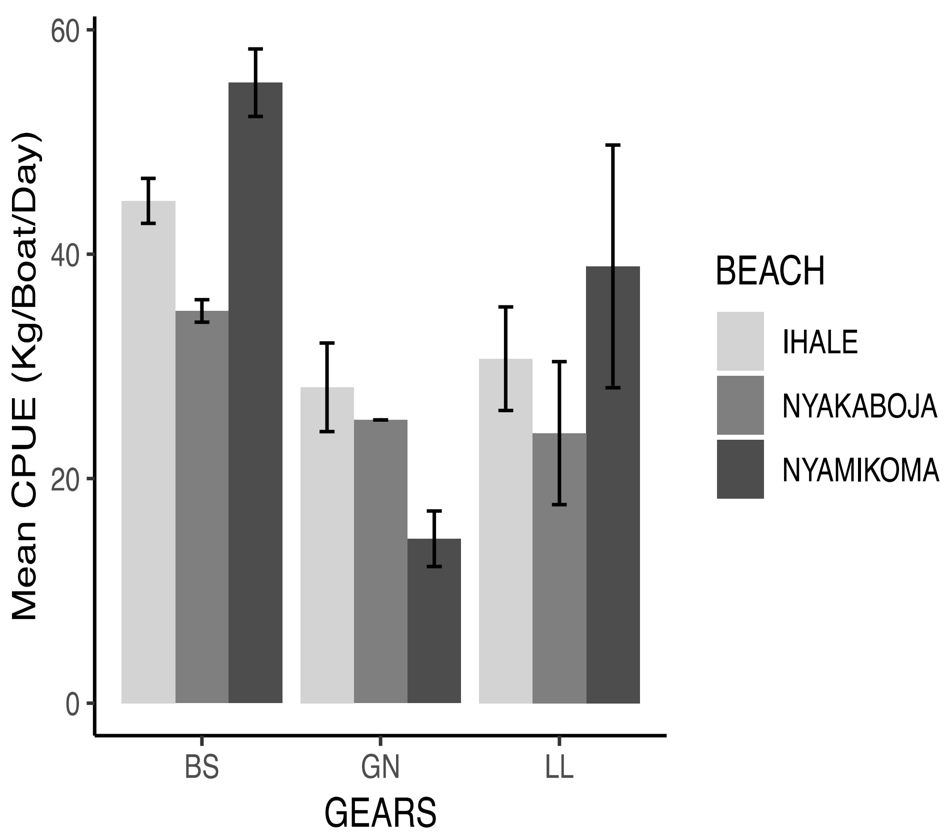

Figure 5: Catch Per Unit Effort (Mean ± sem) of Nile perch caught using beach seine, gillnets and long line fishing gears at Ihale, Nyakaboja and Nyamikoma landing sites at Magu district

The average CPUE for all fishing gears in the three sites varied widely (Figure 5) because the CPUE was not only affected also by environmental factors such as water level, wind action, water quality, productivity, turbidity, (Zhou *et al*., 2004) but also by fishing gears, fishing pressure and the fishers' preferences. CPUE for several gears were calculated based on the weight of fish that were caught during a fishing day per gear (kg / day / fishing gear). This indicates the amount of fish caught in all landing sites with corresponding number of fishing gear. The reasons for the significant high CPUE for BS were the size of the nets used (<5 inch) the total number of hooks used, the fish bait and the experience of the fishers. Another reason for the difference in the fish catches was that BS are operated in beaches where a lot of small fish were caught. In Tanzania trawling, beach seines and small gillnets of less than five inches (127 mm) were banned long time ago (Medard, 1998; and Wilson *et al*., 1999), but due to high demand for fish fishermen are still using it. Although the CPUE was high for BS most of the fish caught were small fingerling and juvenile which tends to accumulate near the shore area, because most of these areas are the breeding and nursery ground. BS is operated on the beach areas where the number of small fishes are highest (Ahmed, 2008). Another reason for lower CPUE may be because there is no effective control of the size or number of fishing gear used. Ineffective enforcement of legislation and inadequate coordination among agencies, and lack of effective monitoring and communication systems, allows a large amount of fisherman to engage in fishing activities.

6. Conclusion and Recommendations

This study found that the fishing gears used at Magu district in Lake Victoria, has profound effect on the resultant catch of the Nile perch. Gears with low mesh size captured small fingerling and juvenile fish before reaching the optimum harvest size and hence this may result to a lower maximum yield. This agrees with the observation that high exploitation of fish below 60 cm in Lake Victoria by gill nets, long line, and beach seines leaves little opportunity for fish to escape and grow to maturity. Mean length from all sites are below 50 cm which is the minimal size requirement of fish to be caught this imply that all beaches are involves in over exploration with illegal fish. Therefore, efforts should be undertaken to make sure that illegal fishing, uncontrolled fishing method and use of poor gears are prohibited in order to develop sustainable fisheries activities.

Finally, education should be provided to resource managers, policy makers, government and non-government organizations and other stakeholders, with the objectives of enhancing aquaculture development in the country. This could reduce fishing pressure of Nile perch because farmers will get fish from other means of farming system rather than depending on fish caught from the lake.

References

Abila, R. O. (2000). The development of the lakes Victoria fishery, A bloom or bane for food security? LUCN Report No. 8, Nairob, Kenya.

Ahmed, M. S. (2008). Assessment of fishing practices on the exploitation of the titas floodplain in Brahmanbaria, Bangladesh. *Turkish Journal of Fisheries and Aquatic Sciences*, 8, 329-334.

Balirwa, J. S. (1998). Lake Victoria wetlands and the ecology of the Nile tilapia, Oreochromis niloticus Linne (Doctoral dissertation). Wageningen Agricultural University, Wageningen, Netherlands. Retrieved from https://library.wur.nl/WebQuery/wurpubs/42895.

Bwathonde, P. (1998). The states of fishing industry in Tanzania with particular references to inland. Mwanza. Tanzania. 5-11.

District Agriculture Development Plans. (DADPs). (2009-2010). Magu District Council Plan.

FAO, (2000). The State of World Fisheries and Aquaculture, Vol. 3.

Food and Agriculture Organization, FAO, (2006). FAO, (2001-2020). Fishing Gear Types. Beach seines. Technology Fact Sheets. In: FAO Fisheries and Aquaculture Department [online]. Rome. http://www.fao.org/fishery/

Kleinman, K. and Horton, N. J. (2014). SAS and R: Data Management, Statistical Analysis, and Graphics. 2nd edition. CRC Press, Boca Raton.

Le Cren E. D. (1951). The length weight relationship and season cycle in gonad weight and condition in Perch (Percafluviatilis). *J. Anim. Ecol.*, 20, 179-219. London. 225 p.

LVEMP-Lake Victoria Environmental Management Project (2000). A Report on Co-Management, Fish Landing Sites and Closed Fishing Areas, in Mara Region by Kilosa, E.S and Janet J Uronu.

LVFO-Lake Victoria Fisheries Organization (2013). Regional status report on Lake Victoria biennial frame surveys between 2000 and 2012.

LVFO (2014). Regional Catch Assessment Survey Synthesis Report June 2005 to April 2014. Jinja: Lake Victoria Fisheries Organisation.

Medard, M. (1998). The development and prospects of experimental and commercial Trawling in Lake Victoria. Trawling in Lake Victoria. Its History, Status and Effects. In IUCN Eastern Africa Programme. Socio-

Economics of the Lake Victoria Fisheries, ed. Mbuga James Siwo, A. Gitabu, Asila Andrew, Medard Modesta, and Abila Richard, 17–21. Nairobi: The World Conservation Union.

Marshall, B. and Mkumbo, O. (2011). The fisheries of Lake Victoria: Past, present and future. *Nature et Faune,* 26, 8-13.

Medard, M. (1998). The development and prospects of experimental and commercial Trawling in Lake Victoria. Trawling in Lake Victoria. Its History, Status and Effects. In *IUCN Eastern Africa Programme. Socio-Economics of the Lake Victoria Fisheries*, ed. Mbuga James Siwo, A. Gitabu, Asila Andrew, Medard Modesta, and Abila Richard, 17–21. Nairobi: The World Conservation Union.

Mkumbo, O. C. (2000). Recent trends in the distribution patterns and catch rates from trawl surveys in Lake Victoria, Tanzania. In Tweddle, D. and Cowx, I. G. (Eds). Report on the Third FIDAWOG workshop held at the Triangle Hotel, Jinja, 29 March to 1 April, 1999. *LVFRP Technical Document* No. 6. LVFRP/TECH/99/05. Fisheries Data Working Group of the Lake Victoria Fisheries Research Project, Jinja: 18-29.

Mpomwenda, V. (2018). The development and effects of the gillnet mesh size regulation on Lake Victoria, Uganda. Case of the Nile perch fishery. United Nations University Fisheries Training Programme, Iceland [final project]. http://www.unuftp.is/static/fellows/document/veronica15prf.pdf

Msuku, B., Mrosso, H. and Nsinda, P. (2011). Acritical look at the current gillnet regulations meant to protect the Nile perch stocks in Lake Victoria. *Aquatic Ecosystem Health and management,* 14(3), 252-259.

Muhoozi, I. L (2002). Exploitation and management of the artisanal fisheries in the Ugandan water of Lake Victoria. PhD Theses submitted for the Degree of Doctor of Philosophy in the University of Hull. 260pp.

Namisi, P. (2005). Social and economic implications of fishery distribution patterns on Lake Victoria, Uganda. LVEMP Socio-economic Research Report 3. NARO-FIRRI, Jinja

Njiru, M., Nzungu, P., Getabu, A., Wakwabi, E., Othina, A., Jembe, T. and Wekesa, S. (2006). Are fisheries management measures in Lake Victoria successful? the case of Nile perch and Nile tilapia fishery. *African Journal of Ecology,* 45, 315-323.

Njiru, M., Getabu, A.,Taabu, A. M., Mlaponi, E., Muhoozi, L. and Mkumbo, O.C.(2009). Managing Nile perch using slot size: is it possible? African Journal of Tropical Hydrobiology and Fisheries, 12, pp. 9-14.

Njiru, M., Van der Knaap, M., Taabu-Munyaho, A., Nyamweya, C. S., Kayanda, R. J. and Marshall, B. E. (2014). Management of Lake Victoria fishery: Are we looking for easy solutions?.Aquatic Ecosystem Health & Management, 17(1), 70-79.

Ntiba, M.J., Kudoja, W.M. and Mukasa C.T. (2001). Management Issues in Lake Victoria watershed. In: Lakes & Reservoirs: Research Management, 6: 211-216.

Ogutu-Obwayo, R., Wandera, S. B. and Kamanyi, J. R. (1998). Fishing gear selectivity for Lates niloticus L., Oreochromis niloticus L. and Rastrineobola argentea P. in Lakes Victoria, Kyoga and Nabugabo. Uganda Journal of Agricultural Sciences, 3(1), 33-38.

Prado, J., Beare, R. J., Siwo Mbuga J. and Oluka, L. E. (1991). A catalogue of fishing methods and gear used in Lake Victoria. UNDP/FAO Regional Project for Inland Fisheries Development (IFIP), FAO RAF/87/099-TD/ 19/91 (En). Rome, Food and Agricultural Organization.

Pringle, R. M. (2005a). The origins of the Nile perch in Lake Victoria, *BioScience*, 55(9), 780–787. September 2005. https://doi.org/10.1641/0006-3568(2005)055[0780:TOOTNP]2.0.CO;2

Pringle, R. M. (2005b). The Nile perch in Lake Victoria: local responses and adaptations. *Africa: Journal of the International African Institute*, 75(4), 510-538. doi:10.3366/afr.2005.75.4.510

URT. (2003). The Fisheries Act No. 22 of 2003. The United Republic of Tanzania (URT). Fisheries Division, Ministry of Natural Resources and Tourisms (MNRT), 42. Dar Es Salaam, Tanzania: Re-prints of 2007.

URT. (2009). The Fisheries Regulations (G.N No. 308 of 28/8/2009). Government Printer. United Republic of Tanzania (URT). Dar Es Salaam, Tanzania. 246 p.

Wilson, D. C., Medard, M., Harris, C. K. and Wiley, D. S. (1999). The implications for participatory fisheries management of intensified commercializationon Lake Victoria. *Rural Sociology,* 64(4), 554-572.

Witte, B. S. F., Msuku, J. H., Wanink, O., Seehausen, E. F., Katunzi, B., Goudswaard, P. C. and Goldschmidt, T. (2000). Recovery of cichlid species in Lake Victoria: An examination of factors leading to differential extinction. *Reviews in Fish Biology and Fisheries,* 10, 233-241.

Wog, S. (2000). Report of the PRA carried out at Ihale Beach, Tanzania.

Yongo, E., Keizire B. and Mbilinyi, G. (2005). Social economic impacts of trade in state of fisheries resources of Lake Victoria and their management. Proceeding of the Regional Stakeholder, s conference, pp. 124-31. Lake Victoria Fisheries Organization Secretariat, jinja, Uganda.

Zhou, S., Fan, W., Cui, X. and Cheng, Y. (2004). Effects of environmental factors on catch variation of main species of stow net fisheries in East China sea. Ying yong sheng tai xue bao=. The Journal of Applied Ecology, 15(9), 1637-1640.

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