**TOPIC: Comparative catchability characteristics of nylon monofilament and multifilament gillnets, case study at Kiyindi fishing ground, Buikwe district, Uganda.**

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**ABSTRACT**

*The study examined the comparative catchability characteristics of nylon monofilament and multifilament gillnets at Kiyindi fishing ground, Buikwe District, Uganda, with the view of furthering understanding of the use of these gears and recommend appropriate fisheries management measures on their usage. The study was guided by the examination of the design and construction of nylon monofilament and multifilament gillnets, experimental fishing to determine the catchability characteristics of nylon monofilament and multifilament gillnets, and assessing the efficiency and suitability of nylon monofilament and multifilament gillnets used at Kiyindi fishing ground, Uganda. The sample population of 67 was selected from a target population of 80 respondents. Findings from questionnares and interviews revealed that nylon monofilament gillnets caught fish of all types (species) and size indiscriminately while the multifilament gillnets, on the other hand, were more selective and caught specific fish sizes and fish types. Findings from experimental fishing revealed that monofilament nets caught more fish at a catch rate of 5.2 kg of fish per net because of its characteristics than multifilament gillnets which caught 2.3 kg of fish per net. The findings demonstrated that monofilament gillnets had higher catchability rate of 69% but were exploitative and indiscriminate compared to multifilament gillnet which was at the rate of 31% and were selective of the types and sizes of fish caught.*

***Key words: Comparative catchability characteristics, nylon monofilament and multifilament gillnets***

**Introduction**

Like any other country, the developments of fishing methods and gears in Uganda have evolved through centuries. Hand catching of fish in shallow waters of wetlands and lakes used to be quite pronounced. Fish poisoning with local herbs and other toxins used to be practiced practically in the many rivers in Uganda. Traditionally, spears, arrow, and traps of various designs were widespread up to the 20twentieth century. These fishing technologies were however rated very low, unproductive and generally inappropriate for exploitation of various fish species in the waters. The situation changed by the coming of foreign traders (Italians, British, Indians and Belgians) who introduced gillnets made of various fibres such as cotton, hemp and flax, (the mid-1950s) marking local gears with important introduction into the country of the said modern fishing gears. The Japanese gillnets were then used and they outmatched in their texture and quality. These nylon nets later became popular and proved to be more durable, adoptable and effective than any other artisanal gears. After the introduction of gillnets, other types of gears have found their way into waters such as cast net, and trawls of various designs (Simasiku, 2017).

World over, the fishing industry is passing through a critical situation, with new technologies bringing about drastic changes in the management of fisheries and hence enhanced access and significant expansion of effort and production (FAO, 2014). Today, the industry is twice as large as it is required, technological changes, such as the introduction of motorization and monofilament nets, have enabled fishermen to exploit near shore and offshore fisheries resources more intensively than was ever imagined a few decades ago. These technological advances have led to increased conflicts in overexploitation of some fisheries (Cabra, 2014) .The unrestrained development resulted in overexploitation consequently depleting certain fish species (Bjoringsoy, 2015) and disturbance in the natural ecosystem threatens biodiversity (Balik, 2008).

This study relates to the Yield Per Recruit (Y/R) model which is based on two basic assumptions: (1) independent of the combination of fishing mortality (*F*) and mesh size (if beyond size at maturity of fishing target), there will be sufficient recruits coming into the fishery every year and fishing is not expected to affect recruitment substantially; (2) gear selection follows a sigmoid selection curve, with all fish larger than the size at first capture (inflection point of the curve) being retained by the net. The model further states that gillnets with small mesh sizes are not necessarily destructive and may rather promote sustained production by allowing a higher proportion of the spawning biomass, (Nadiope, 2010).

In Uganda, the Frame surveys conducted from 2000 to 2006 recorded continuous increase of number of multifilament gillnets from 297,663 to 589,777, an overall increase of 81% (FAO, 2010). However, the following two surveys in 2008 and 2010 registered decreases to 404,006 and 327,098 gillnets respectively. The decrease was in both nets of legal mesh sizes (≥5 inch) and illegal ones (<5 inch). Nevertheless, the decrease of the illegal gillnets were in 3½ to 4½ inch mesh sizes while those of very smaller mesh sizes <2½ to 3½ inch mesh size increased by 94% from 2006 to 2010. Gillnets with very small mesh sizes are often used in shallow near shore waters to catch haplochromine bait for the long line Nile perch fishery. Thus, the increase observed may be related to the large long line fishery in the lake. In the process of catching haplochromine bait, the small mesh gillnets catch large quantities of juveniles of other untargeted fishes like Nile perch and tilapia (FAO, 2010).

**METHODS & MATERIALS**

This study used a case study research design using a descriptive and analytical method. The study used both quantitative and qualitative approach. Kiyindi fishing ground in particular has an estimated population of over 25,000 people and a target population of 80 people was considered. The target sample size of 67 out of the 80 (target population) was determined by a Yamane’s (2002) Formula. The researcher used both purposive and simple random sampling techniques. Visits were made to specific libraries at Nkumba University, Fisheries Training Institution, Directorate of Fisheries Resources, to collect necessary information and data for the project.

Questionnaires were administered to fishermen (05), fisheries officers and (15) fishermen because they were able to read and write and were also the target respondents.The Oral interviews were also conducted to specific target respondents that qualitative and quantitative data for the project was recorded. Interviews were held with 5 fishermen, 10 market vendors and 7 members of the local community hence their responses were recorded and analysed respectively. Observations were made on the spot on physical technical characteristics of the gear (e.g. gear design, and their constructional materials, color of the gears) and operation of the gears at the fishing ground.

Fishing was carried out using nylon monofilament and multifilament gillnets following the technological processes discussed above. The catches that land by monofilament and multifilament gillnets were sampled and sorted out according to species and the data was collected and recorded on the data forms. Mesh – sizes and other gear parameters were determined by direct measurement using a ruler or tape measure. Quantitative data from the questionnaires was analyzed with the use of descriptive statistics such as percentages and frequencies. Qualitative data was analyzed using content analysis where the researcher tried and build some categorization into the data collection with the intention of collecting patterns related to the themes of the study, it involved gathering data and analyzing data based on content related objectives.

**RESULTS & DISCUSSIONS OF FINDINGS**

**Fish Catch Data of the Research Project**

The researcher first analysed the fish catch data at Kiyindi fishing site and the results obtained are presented in Table 1.

**Table 1: Fish catch data of the Nylon Monofilament and multifilament gillnets at Kiyindi fishing ground**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sampling date September 2020 | Canoe No. | Gear specification | Qty/No. of gillnets | **Fish species** | | | | | | | | | | **%equi-**  **valent** | **Degree equivalent** |
| ***Lates nilotics mputa*** | | | **Oreochromis Nilotics** | | | **By-catches** | | **Total Fish** | |  |  |
| 1st -2nd | 1 | Monofi210d/0.6 mmx6” |  | No. | Wt(kg) | Length | No. | Wt(kg) | Length | No. | Wt(kg) | No. | Wt(kg) |  |  |
| 3 | 1 | 2 | 11” | 56 | 40.4 | 4” | 3 | 2.9 | 60 | 45.3 |  |  |
| Multifi210d/6” | 3 | 0 | 0 | 0 | 28 | 21.2 | 5” | 0 | 0 | 28 | 21.2 |  |  |
| 5th – 6th | 2 | Monofi210d/0.6 mmx6” | 3 | 1 | 1.2 | 9” | 43 | 32.4 | 6” | 1 | 0.9 | 45 | 34.5 |  |  |
| Multifi210d/6” | 3 | 2 | 2 | 15” | 21 | 17 | 9” | 0 | 0 | 23 | 19 |  |  |
| 7th – 9th | 3 | Monofi210d/0.6 mmx6” | 3 | 4 | 8.7 | 8” | 28 | 11.6 | 2” | 2 | 17 | 34 | 37.3 |  |  |
| Multifi210d/6” | 3 | 1 | 1 | 20” | 7 | 3 | 10” | 1 | 0.6 | 13 | 4.6 |  |  |
| 14th – 15th | 4 | Monofi210d/0.6 mmx6” | 3 | 2 | 1.6 | 13” | 34 | 25.7 | 7” | 1 | 1.3 | 37 | 28.6 |  |  |
| Multifi210d/6” | 3 | 3 | 4.4 | 28” | 19 | 7.9 | 6” | 0 | 0 | 22 | 12.3 |  |  |
| 17th – 18th | 5 | Monofi210d/0.6 mmx6” | 3 | 0 | 0 | 0 | 26 | 18.3 | 9” | 0 | 0 | 26 | 18.3 |  |  |
| Multifi210d/6” | 3 | 0 | 0 | 0 | 21 | 11.5 | 11” | 3 | 4.2 | 21 | 11.5 |  |  |
| 25th – 26th | 6 | Monofi210d/0.6 mmx6” | 3 | 0 | 0 | 0 | 39 | 30 | 4” | 3 | 4.2 | 42 | 35 |  |  |
| Multifi210d/6” | 3 | 1 | 1.5 | 6” | 20 | 23.4 | 12” | 1 | 2.5 | 22 | 15 |  |  |
| 29th – 30th | 7 | Monofi210d/0.6 mmx6” | 3 | 2 | 4 | 19” | 28 | 14.5 | 11” | 4 | 5 | 34 | 23.5 |  |  |
| Multifi210d/6” | 3 | 2 | 1.1 | 4” | 13 | 4.8 | 7” | 0 | 0 | 15 | 5.9 |  |  |
| **TOTAL** |  | **Monofilament (monof/gn)** | 21 | 10.5 | 17 | **60”** | 254 | 172.9 | **43”** | 14 | 31.3 | 278 | 221.7 | 69% |  |
|  | **Multifilament(multif/gn)** | 21 | 8 | 10 | **73”** | 129 | 88.4 | **69”** | 2 | 3.1 | 144 | 101.9 | 31% |  |
| **GRAND TOTAL** |  |  | 42 | 18 | 27.5 | **133”** | 383 | 261.3 | **112”** | 16 | 34.4 | 422 | 323.6 | 100% |  |
|  |  | **% composition** |  | **8%** | | | **81%** | | | **11%** | |  |  |  |  |

**Source: Field Data, 2020**

Table 2 above indicates that monofilament catches were much of fish with less length (43 inches) while multifilament catches had less fish of high length (69 inches). Monofilament catches had more weights (221.7 Kgs) whereas multifilament catches had less fish weight (101.9 Kgs). Monofilament nets caught more fish (278) compared to multifilament nets (114). Monofilament catches mainly had fish species of small size (77 inches) whereas multifilament catches fish were composed of big size (84 inches).

**Relative abundance of Fish Catches by Monofilament and Multifilament Gillnets (RA)**

Formula/ method

RA = Total fish catch wt (kg) by a particular gear x 100%   
 Grand total fish catch wt(kg) of all gears

OR Total fish catches wt (kg) by a particular gear x 3600   
 Grand total fish catch wt. (kg) of all gears

**Figure 3: Relative abundance of fish catches by monofilament and multi filament gillnet**

Results from Figure 3 shows that there are more monofilament gillnets (69%) and less multifilament gillnets (31%) used at Kiyindi fishing ground. This is an implication that there are more monofilament gillnets (illegal) compared to multifilament gillnets.

**Table 2: Findings on the Design and Construction of Nylon Monofilament Compared to Multifilament Gillnets**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Responses** | **SA** | **A** | **NS** | **D** | **SD** |
| Designs of the Nylon Monofilament are Efficient and Effective Compared to Multifilament Gillnets  Construction of Nylon Monofilament helps the Fishing Practices Compared to Multifilament  Operations Carried out using Nylon Monofilament have Enabled Fishermen to Improve their Fishing Practices Compared to Multifilament | 25.4%  37.3%  29.9% | 41.8%  31.3%  43.3% | -  -  - | 17.9%  19.5%  17.8% | 14.9%  11.9%  9.0% |

Table 2 shows that generally (41.7%) agreed, none was not sure and (17.9%) disagreed, while (14.9%) strongly disagreed. Majority of the respondents (68.6%) generally agreed that Construction of nylon monofilament helped the fishing practices at Kiyindi Fishing Grounds compared to multifilament. Generally (43.3%) agreed, that the operations carried out along Kiyindi Fishing grounds using nylon monofilament have enabled fishermen to improve their fishing practices compared to multifilament gillnets.

**Table 3: Determination of the Catchability Characteristics of Nylon Monofilament Compared to Multifilament**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Responses** | **SA** | **A** | **NS** | **D** | **SD** |
| Nylon Monofilament have Increased the Rate of Fish Caught at Kiyindi Fishing Grounds Compared to Multifilament  Nylon monofilament work best when fishing compared to multifilament  Nylon monofilament gillnets have more catchability characteristics than the nylon multifilament gillnets | 26.9%  14.9%  14.9% | 32.8%  31.3%  11.9% | 6.0%  -  10.4% | 20.9%  34.3%  34.3% | 13.4%  19.5%  28.5% |

Table 3 indicates that most of the respondents believed that nylon monofilament gillnets have increased the rate of fish caught at Kiyindi fishing ground compared to multifilament gillnets to which the majority, (59.7%). The table also shows that the nylon multifilament works better when fishing at the fishing ground compared to monofilament. Some of the respondents believed that nylon monofilament gillnets have more catchability characteristics for example designs, efficiency and catchability rate than the nylon multifilament gillnets used at Kiyindi Fishing ground in that (14.9%) of the respondents strongly agreed, (11.9%) agreed, (34.3%) disagreed, (28.5%) strongly disagreed while (10.4%) were not sure. This therefore implied that nylon monofilament gillnets do not have more catchability characteristics than the nylon multifilament gillnets used at Kiyindi Fishing ground.

**Table 4**: **Findings on Efficiency and Suitability of Nylon Monofilament**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Responses** | **SA** | **A** | **NS** | **D** | **SD** |
| Nylon monofilament and multifilament gillnet fibres  The Nylon monofilament and multifilament gillnet fibres are excellent when it comes to tensile strength  Efficiency and Suitability of the nylon monofilament and multifilament fibres | 17.9%  34.3%  38.8% | 16.4%  40.3%  44.8% | -  7.5%  10.4% | 29.9%  10.4%  6.0% | 35.8%  7.5%  - |

The information provided in the Table 4 above indicates that (17.9%) of the respondents strongly agreed that nylon monofilament and multifilament gillnet fibres were not efficient in fishing at Kiyindi Fishing grounds and (16.4%) agreed, (29.9%) disagreed, (35.8%) strongly disagreed, and none were not sure. This implies that nylon monofilament and multifilament gillnet fibres were not efficient in fishing at Kiyindi fishing grounds as the majority (35.8%) strongly disagreed with the statement. From the Table 4, it is clear that (34.3%) of the respondents strongly agreed that nylon monofilament and multifilament gillnet fibres were excellent when it comes to tensile strength, (40.3%) agreed, (10.4%) disagreed, (7.5%) strongly disagreed, and (7.5%) were not sure.

This implies that the nylon monofilament fibres are excellent when it comes to tensile strength compared to multifilament as the majority 50 (74.6%) of the respondents generally agreed to the statement. The Table 4 shows that (38.8%) of the respondents strongly agreed that the efficiency and effectiveness of the nylon monofilament and multifilament gillnet fibres are generally based on resistance to wrinkles and sunlight, (44.8%) agreed, (6%) disagreed, none strongly disagreed, while (10.4%) were not sure. This implied that efficiency and effectiveness of the nylon monofilament fibres are generally based on resistance to wrinkles and sunlight compared to multifilament as majority of the respondents 56 (83.6%) generally agreed.

**Table 5. Assessment of the Impacts of Nylon Gillnets on the Fish Stocks**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Responses** | **SA** | **A** | **NS** | **D** | **SD** |
| Impact of nylon monofilament are productive compared to multifilament  Fish is heavily exploited when fishermen use the nylon monofilament compared to multifilament  The nylon monofilament is more dangerous as compared to multifilament | 16.4%  26.9%  23.9% | 22.4%  25.4%  29.9% | 7.5%  10.4%  - | 29.9%  22.4%  25.3% | 23.9%  14.9%  14.9% |

Findings in Table 5 indicate that (16.4%) of the respondents strongly agreed that the impacts of nylon monofilament were not productive compared to multifilament, (22.4%) agreed, (29.9%) disagreed, (23.9%) strongly disagreed, and (7.5%) were not sure. This means that the impacts of nylon monofilament are productive compared to multifilament. Table 5 indicates that (26.9%) of the respondents strongly agreed that their fish is heavily exploited when fishermen use the nylon monofilament and multifilament gillnets, (25.4%) agreed, (22.4%) disagreed, (14.9%) strongly disagreed and (10.4%) were not sure. This implied that fish is heavily exploited when fishermen use the nylon monofilament rather than multifilament gillnets. Table 5 indicates that (23.9%) of the respondents strongly agreed that the nylon monofilament gillnets were more dangerous compared to multifilament and (29.9%) agreed, (25.3%) disagreed, (14.9%) strongly disagreed and none was not sure. This implied that the Nylon monofilament is more dangerous as they tend to get lost in water during fishing activities at the fishing ground.

**DISCUSSION OF FINDINGS**

**Design and Construction of Nylon Monofilament and Multifilament Gillnets**

Findings revealed that monofilamanent gillnets were constructed using single monofilament yawn, to make a curtain like piece while multifilament use double yawn of any colour either in terms of cast net fashion to make the gear. Also, a single yawn of monofilament is designed in square structure until a curtain like is formed and on top there is a thicker line and bottom there is a thinner line. The yawn of a monofilament is bigger than that of a multifilament, and when designing one should make sure those plastic yawns are stronger (thicker). The findings agree with Nadiope (2010) who designed a paired experiment using five monofilament and five multifilament nets with stretched mesh sizes of 76 mm, 89, 102, 114, and 127, a depth of 76 meshes and a hanging ratio of 0.5. The nets were set on 45 nights during monthly surveys between March 2020 and Oct 2020. Gillnets were set in three zones (A- C) at approximately 17: 00h and retrieved at 06: 00h. To minimize the soak time difference, nets were hauled in the order in which they were set. The location of the nets was changed each night to minimize depletion effects. The findings from this experiment indicated that fish caught in each net were identified to species level and measured to the nearest mm total length and weighed to the nearest gram.

**Determination of the catchability characteristics**

Findings further revealed that; nylon monofliamanet gillnets catch fish types of all sizes, and fish with less weight (Table 9) multifilament hence its ineffeciency and unsuitable fishing gear. On the other hand a mutifilament gillnet catch fish of specific types, sizes with more weight hence its effeciency and suitability. It was revealed that gillnets bearing less than 5(127mm) mesh size catch immature nile perch and tilapia species and others such as *Clarias, Synodontis, Protopterus aethiopicus* and *Bagrus.* Further the above findings concur with (McClanahan, 2000) who reported that as catches decline, the gear that extracts the smallest size and most diverse fish resources may be the ‘better competitor’ and will reduce the catch of other gear types that select larger and more species-specific targets. McClanahan further suggested that the slightly different twine diameter and mesh size combination has no effect of catches of different gillnet types**.**

**Assessment of the efficiency and suitability of nylon gillnets**

Findings showed that the efficiency of nylon monofilament and multifilament gillnets (Table 12) basing on the nylon fibre properties was not very important as the fibre helps improve the strength and versatility of the gillnets in so many ways than one as observed in the findings above. It was found out that the effeciiency of the monofilamant gillnet was not good and not suitable because it was more destructive compared to multifilamant gillnet. The above findings agree with Stewart (2009) who compared the nets used in the United Kingdom for cod and found that multifilament nets captured better than monofilament.

**Determination and Assessment of the Impact of Nylon** **Gillnet**

Findings showed that the impact of nylon monofilament gillnets on the fish stocks is exploitative (Table 15) because the gillnets have destructive fish catchability characteristics compared to multifilament gillnets which are less destructive and in turn they are both good for business and to the fishermen at the fishing ground. In reference to (Sathiadhas *et al*., 2006), the findings relate to the economic efficiency of the multifilament gillnet in a fishery who stated that multi-species and multi-fleet fisheries are generally open-access with low operating costs, which make fish resources more susceptible to overfishing. In this setting, one critical point to improve management requires considerable technical changes to the gear to increase its selectivity.

**CONCLUSION & RECOMMENDATIONS**

The study concludes that the characteristics of nylon monofilament gillnets in terms of size, width and length makes them exploitative as they catch immature and very young fish compared to multifilament gillnets that enable high fishing loads at Kiyindi fishing grounds since it catches mature fish of big sizes. In turn this helps the fishermen to earn a better living. The nylon fibre properties such as withstanding sunlight and harsh weather have made these fishermen to handle their fishing activities in and around the fishing grounds.

Findings concluded that nylon monofliamanet catches fish types of all sizes, with less weight hence making it an ineffecient and unsuitable fishing gear. On the other hand a mutifilament gillnet catches fish of specific types, sizes with heavier weight hence its effeciency and suitability. Findings showed that the impact of nylon monofilament gillnets on the fish stocks is exploitative because the gillnets have destructive fish catchability characteristics compared to multifilament gillnets which are less destructive and in turn they are both good for business and to the fishermen at the fishing ground. The impact of the gillnets especially monofilament gilInets has also been exploitative to the fish stocks in the waters around the fishing grounds and this has led to decrease or reduction low in volumes of some of the fish species in the Lake Victoria, compared to multifilament that is less exploitative and less destructive in nature.

**Recommendations**

The catchability charcteristics of the fishing gears should be thoroughly checked by professionals in fisheries in the line ministries deparment and other stakeholders responsible before they are authorized to catch fish in the fishing grounds.

The design and construction of nylon gillnet should be put into consideration aim of ensuring that the gears do not affect the fish stock sustainability.

Appropriate time of catch data should be always collected kept and analysed to ensure that the fishing gears are catching the right size, types of fish as recommedned by Fish Act Cap 197 and existing statutory instruments.

The combined effort should be put together by the government and stakeholders to ban the use of monofilament gillnets through the use of government policies, laws and strategies in order to ensure no use of such destructive gears.

There should be extensive training of all fishermen on the dangers of monofilamant gillents since it is highly destructive and reduces the biomas of fish stocks. This should involve continous senstitization of fishermen about the dangers of nylon monofilament.

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