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LAKE TURKANA STATION
FRESH WATER SYSTEMS**



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**A factsheet on the assessing the selectivity of gill nets on fish catches
in Lake Turkana to inform fisheries management.**

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EXECUTIVE SUMMARY

- The population sizes of key commercial fish species were estimated using the catch curves and gear selectivity data obtained from experimental fishing by monofilament and multifilament gill nets.

- The objective of the study was to assess the selectivity of gill nets on fish catches in Lake Turkana to inform fisheries management, and share findings with stakeholders.
- Fish samples were collected using both monofilament and multifilament gill nets, and comparisons made with the fishers catches using similar multifilament gill nets.
- The gill nets were set at Kerio River and Turkwel River Mouths Delta, Napasinyang River Mouth and Omo River Mouth Delta on different dates from September 2019 to December 2019 in Lake Turkana.
- The gill nets were set from a fibre glass boat measuring 30 m long mounted with a 75 HP outboard engine.
- A set of monofilament and multifilament gill nets consisted of ten different meshes with geometric increment in their mesh sizes (25, 38, ..., 203 mm). In this study gillnet used ranged from mesh sizes of 25 mm (1 inch), 38 mm (1.5 inches), 51 mm (2 inches), 63 mm (2.5 inches), 76 mm (3 inches), 88 mm (3.5 inches), 102 mm (4 inches), 114 mm (4.5 inches), 127 mm (5 inches), 140 mm (5.5 inches), 152 mm (6 inches), 178 mm (7 inches) to 203 mm (8 inches).
- Gillnet selectivity index influences the population structure of the key commercial species including *Alestes baremose*, *Bagrus bayad*, *Bagrus docmak*, *Barbus bynii*, *Citharinus citharus*, *Clarias gariepinus*, *Distichodus niloticus*, *Hydrocinus forskalii*, *Labeo horie*, *Lates niloticus*, *Oreochromis niloticus*, *Schilbe uranoscopus*, *Gymnarchus niloticus* and *Synodontis schall* in Lake Turkana, Kenya.
- The mean size of fish for each mesh size were 22 cm TL in the 25 mm mesh, 25 cm TL in the 38 mm mesh, 31 cm TL in the 51 mm, 38 cm TL in 63 mm mesh, and 42 cm TL in the 76 mm mesh, and 200 cm in 203 mm mesh sizes.
- The mean length for *Lates niloticus* caught in 88 mm mesh, 101 mm mesh, 114 mm mesh, 127 mm mesh and 203 mesh size were 29, 30, 32 and 33 cm and 200 cm TL respectively.
- The higher catches of fish noted in 38 mm for *Alestes baremose* might be related to the selective properties of gill nets giving the resulting catches in 25 mm lower than the higher meshes.
- This study recommends the optimal mesh sizes of more than 127 mm for both *Oreochromis niloticus* and *Labeo horie*.
- Thus, for *Lates niloticus* sustainability and fish stocks replenishment, there is need for a minimum of 127 mm mesh size, targeting exploitation of older mature fish.
- The significance and use of gillnet selectivity knowledge of the selectivity of any gear, especially gillnets, and allows better management of a commercial fish stock through the choice of mesh size to suit the available population of fish.

- Gillnet selectivity also allows an independent estimate of the population structure of fish from the commercial catch data, something not feasible with uncorrected gillnet catch data.

Key words: Catch curves, Gillnet selectivity percentage - Fish population structure – Key commercial fish species – Monofilament - Multifilament - Lake Turkana

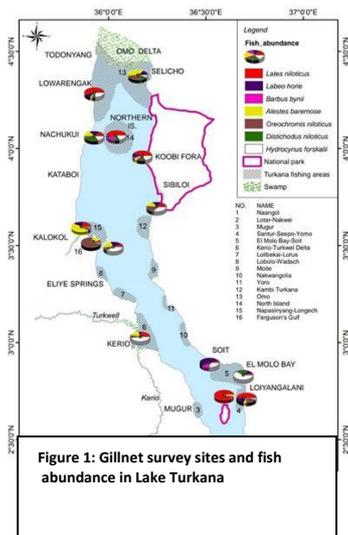


Figure 1: Gillnet survey sites and fish abundance in Lake Turkana

INTRODUCTION

- Gillnet is one of the oldest types of fishing gear and is widely used to harvest diverse lake species.
- Gillnets are classified as a passive gear, consisting of a large wall of netting which can be set at or below the surface on the lake bed, or any depth in between.
- Its construction can be single, double or triple.
- Depending on the operation, gillnet can be drifting, fixed or encircling.
- Fish caught in gillnets are usually gilled, but can be wedged, snagged or entangled.
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The modern nets are made of synthetic fibres such as polyamide and can be monofilament or multifilament or a combination of both in the case of more than one panel.

- The importance of gillnets in the modern fishing industry is relevantly modest in terms of catch compared with towed gears such as trawls and seines.
- But the gillnets, at least those with a single netting, are, in general, considered as having a high degree of selectivity, in terms of fish species, as well as the size of the fish, which directly depends on the size of the mesh.
- However incidental catch of a number of endangered species in certain areas is a matter of growing concern.
- The objective of this study was to establish gillnet selectivity and its effect on population structure for key commercial species (Nile tilapia, Nile perch, Labeo and Alestes) in Lake Turkana, Kenya
- This research was also carried out with aim to reduce the risk of incidental catch of a number of fish in endangered fish habitats and in fish breeding areas of Lake Turkana.
- This study was based on gillnet records which were collected from five different areas in Northern and southern part of Lake Turkana waters in November 2019
- The comparison of selectivity was done on the different twines of net and mesh size in five areas, the other gear parameters, such as vertical slack, flotation and weights are equal in construction.



Figure 2. Procedures during annual gillnet survey in Lake Turkana in 2019 and 2020.

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KEY FINDINGS



eters during the annual
ke Turkana in June 2019

- In all the five areas sampled, this study reveals that, catch reduces in multifilament as the mesh size increases. This study found that monofilament gillnets catch better than multifilament.
- The mean lengths of Nile perch, Nile Tilapia, labeo and Alestes increased with mesh size of gillnet but the difference of netting material did not affect selection range.

- However the selection was affected by size distribution and abundance of Nile perch, Nile Tilapia, Labeo and Alestes. This approach emphasises that the process of catch such as wedging, snagging, and entangling should be considered in gillnet selectivity studies because it has been demonstrated that small mesh size of gillnet can catch large fish and large mesh size can catch small fish.
- For the above-mentioned reasons, this study encourages the use of passive gears such as gillnets and hooks in small scale fisheries.
- This research focuses on the effect of two types of twine (monofilament and multifilament) in the selectivity of Nile perch conducted in five different areas at Lwarengak, Nariokotome, Kaito, Napasinyang and Eliye-Springs in Lake Turkana waters.

CONCLUSIONS

- The species are exploited using gillnets and baited long lines.
- However, the use of beach seine is slowly gaining prominence in the fishery, particularly among fishers targeting tilapiines in shallow sandy areas.

RECOMMENDATIONS

This study recommends that:

- The current regulation recommends the minimum gill nets mesh size for fishing in the lake at 5 inches, however, fishers are using smaller mesh sizes to the tune of 2.0 inches, thus the

stakeholders including The State Department of Fisheries, Kenya Fisheries Services, County Fisheries Department, KMFRI and BMUs need to enforce this regulation for sustainable conservation and management of the lakes fishery, otherwise the co-management institutions should realistically agree to revise the gillnet mesh size to a minimum of 3.5 inches.

- Our gill net selectivity estimation needs more data for more than 80% of the lake to provide insight into the use of gillnets by fishers; thus future research surveys might provide the optimal minimum mesh sizes for the fishery as recommended in above.
- Long line, to target the offshore species, is recommended as the most viable means for exploiting *L. niloticus* as this method mostly catches older mature fish, thus allowing replenishment of the stocks and future research might consider defining the right hook sizes.
- Nonetheless, for sustainability of the fishery, use of beach seine is discouraged, although it is a fishery that is practised by the BMUs at Impresa Beach, Kalokol and BMUs at Namukuse Beaches at Ferguson's Gulf.
- In future, surveys could cover the Omo River course/Lake Turkana interface using appropriate sampling gear preferably electro fisher to obtain definite representative abundance of fish population, gillnet effects and diversity in the lake.
- Donors assisting the fisherfolk with gillnets should base their gillnets donations on optimal mesh sizes of at least five inches.

For sustainable exploitation of Lake Turkana fisheries there is need to consider the following issues:

- Improving communication and road infrastructure would solve the problems of transportation, so that large sized fish landed using gillnets of 127 mm reach market in time before spoilage.
- Impressive biomass densities were observed in the deeper parts of the lake using gillnets of mesh sizes above 127 mm. Appropriate fishing incentives to be provided to the fishers to exploit offshore rich fishing grounds with gillnets of mesh sizes above 127 mm.
- A major observation at the fishing sites is the rate of repeated use of one site without any moratorium of the fishery resulting in overexploitation of fishery with gill nets of mesh sizes above 127 mm.
- Offshore fishery requires large sized gillnets of over 127 mm.
- Long line, to target the offshore species, is recommended as the most viable means for exploiting *Lates niloticus* and the two *Bagrus* species as this method mostly catches older mature fish thus allowing replenishment of the stocks.

Nonetheless, for sustainability of the fishery, use of beach seine is discouraged and future research will consider defining the right hook sizes.

- The ability of *Oreochromis niloticus* to use naturally available food sources could be harnessed in shallow depressions close to the margin of the lake to culture Tilapia. Rainstorms arising from the inconsistent rains could be managed to boost fish production under artificial conditions. On the other hand, cage culture in well-flushed sheltered areas can easily be adopted in the Lake Turkana to boost food security in the region.
- Since gillnets are highly selective gear, the small fishes below 18 cm were hardly represented.
- Though no data was collected on the impact of the ongoing beach seine operation by fishers, the low catch rates of market size fishes especially of tilapiines in shallow sandy areas cannot be ignored.
- Observed catch composition mostly of immature fish by fishers from beach seining does not augur well for the sustainability of the lakes fishery