4.2. Impacts of fishing gears, fishing methods and fishing effort in the fisheries of Lake Victoria and proposals for management

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Introduction

Lake Victoria is one of the African Great Lakes, which include lakes Tanganyika, Malawi, Turkana, Edward, Albert, Kyoga and Kivu. In the 20th century, these lakes experinced decline in fish stocks, fish species diversity, and deterioration of water quality. These changes resulted from human impacts on the ecosystem in general and over-exploitation of the fisheries in particular (Ogutu-Ohwayo *et al.*, 1997).

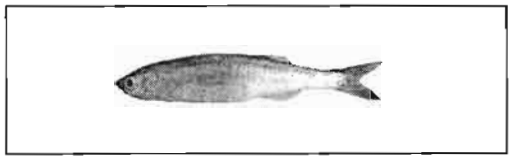
The Laurentian Great Lakes of North America went through similar changes and it cost billions of dollars to mitigate some of the problems whereas new problems caused by human activities continued to crop up (Hecky, 1993; Ogutu-Ohwayo *et al.*, 1997). Most African states, and the countries sharing Lake Victoria in particcular, lack such resources to solve major problems in these lakes. The conditions in Lake Victoria should therefore be prevented from deteriorating when there is still a chance to act.

The initial subsistence fisheries of Lake Victoria were dominated by two indigenous tilapiines, *Oreochromis esculentus* (Graham 1929) and *Oreochromis variabilis* Boulenger 1906, exploited with simple fishing crafts and gears that had little impact on the fish stocks (Jackson 1971). Commercial fisheries, targeting the tilapia fishery, started at the beginning of the 20th Century when cotton flax gillnets were first introduced in 1905 into the Nyanza Gulf in Kenya. Gillnets were quickly adopted around the whole lake and consequently, the native methods of fishing soon died out (Jackson 1971). Following the introduction of gillnets, fishing boats and their propulsion methods were also improved. These improvements in fishing capacity coincided with development of urban centres and increasing human population around the lake, which increased the demand for fishery products. To satisfy the increasing demand, fishing effort increased greatly during the 20th century, despite the decline of catch per unit of effort (CPUE) (Jackson 1971; Ogutu-Ohwayo 1990). The initial catch rates of 127mm (5 inch) mesh size gill nets in the tilapia-based fishery, in 1905, was in the range of

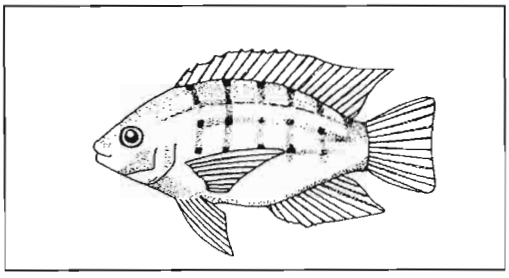
50 to 100 fish per gillnet of approximately 50 m in length. However, twenty years later, the catch rates of gillnets of the same mesh size had declined to about six fish per net and gillnets of smaller mesh sizes, which had better catch rates, had been introduced suggesting overfishing (Worthington and Worthington, 1933). The survey carried out in 1927-1928 (Graham 1929) confirmed overfishing of the tilapia stocks and recommended a minimum gillnet mesh size limit of 127 mm, which was imposed in 1931. Nevertheless, the entry of fishing boats into the fishery was not restricted and fishing effort continued to increase. Consequently, CPUE was falling and fishers ignored the 127 mm gillnet mesh size limit in preference for smaller illegal mesh sizes that gave better catches.

In 1952, synthetic fibre gillnets with higher fishing efficiency, compared with cotton flux gillnets were introduced followed by outboard engines in 1953, which improved transportation on the lake, (Jackson 1971; Ogutu-Ohwayo *et al.*, 1997; Lowe-McConnell 1997). With these developments, fishing effort increased tremendously and the CPUE fell to 0.35 tilapia per gillnet of 127 mm mesh size by 1968 (Jackson 1971). Eventually the fishery based on indigenous tilapiines collapsed mainly due to uncontrolled fishing effort and use of small gillnet mesh sizes (Jackson 1971; Fryer and Iles 1972). Similarly, *Labeo victorianus* which formed the most important fishery on the rivers within the Lake Victoria basin was destroyed due to intensive gill netting of gravid individuals on breeding migration (Cadwalladr 1969)

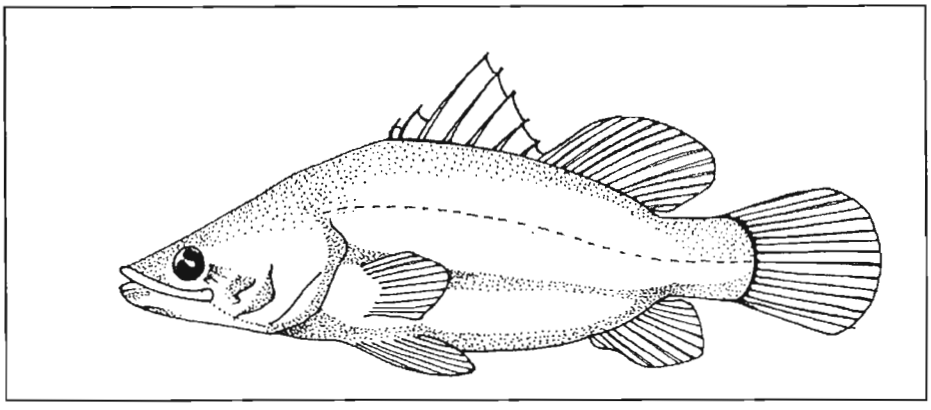
Following the depletion of the tilapiines, fishers shifted to exploit haplochromines using gillnet mesh sizes as small as 38 to 46 mm, and *Rastrineobola argentea* (mukene) using seine nets of 10 mm mesh size (Ogutu-Ohwayo *et al.,* 1997). In the mukene fishery, when the large fish were depleted, the fishers shifted to seine nets of 5 mm mesh size, which crop immature mukene. Further more, bottom trawling was initiated in Tanzanian part of the lake in the early 1970s to harvest haplochromines, which was followed by a drop in the catch rates and the size of the haplochromines harvested. Before trawling for haplochromines spread around the entire lake, populations of the predator *Lates niloticus* (Nile perch) introduced in the lake in the late 1950s and early 1960s had spread around the lake (Kudhongania and Cordone, 1974) and dominated the catches by the 1980s (Ogari, 1985). The tilapiines (*Oreochromis niloticus, Oreochromis leucostictus, Tilapia rendalli* and *Tilapia zillii*) introduced in mid 1950s and early 1960s to supplement the stocks of the native tilapiines that had collapsed also boosted the fishery (Gee 1964; Welcomme 1966; 1968; 1988). Since the 1980s, the fisheries of Lake Victoria have been dominated by *L. niloticus*, *O. niloticus* and the native mukene, all of which are heavily exploited. The introduction of exotic fish species, especially the Nile perch and Nile tilapia contributed to the increase in catches, but also contributed to the decline of the haplochromines and other native species through direct predation by the Nile perch and other biotic interactions(Ogutu-Ohwayo 1990).



Rastrineobola argentea (Mukene)



Oreochromis niloticus (Ngege)



Lates niloticus (Mputa)

The management regime of Lake Victoria has always been and is still characterized by open access policy to the fisheries. The expansion of the fishing industry has also been encouraged by increased Nile Perch export and the rapid population growth of the riparian human population among other factors. Over 30 million people depend on the lake which provides goods and services that support their livelihood. They are presently feeling the consequences of these changes. Protection of the aquatic assets and their sustainable exploitation offer the means by which humanity can hope to sustain his own well-being from what the system supplies. In Lake Victoria like in any other ecosystem, human welfare is also linked to concerns for species conservation and ecosystem integrity (Kaufman *et al.*, 1992). The Lake Victoria situation is characterized by a high loss of diversity and this has attracted substantial international attention. The purpose of this chapter, therefore, is to examine the effects of fishing gears and methods in use and increased fishing effort (boats and gears), on the fisheries of Lake Victoria, and recommend the strategies for increased and sustainable exploitation of the fishery resources.

Impact of different fishing gears and methods for exploitation of three major commercial fish species

Nile perch (Mputa)

Fishers targeting Nile perch use four major fishing gears/methods, i.e. beach seines, passive gill nets, drift gill nets and hooks on handlines and longlines, which select for different sizes of fish (Fig. 4.2.1).

Beach seines catch small Nile perch with the mode at 22 cm TL and hardly any fish

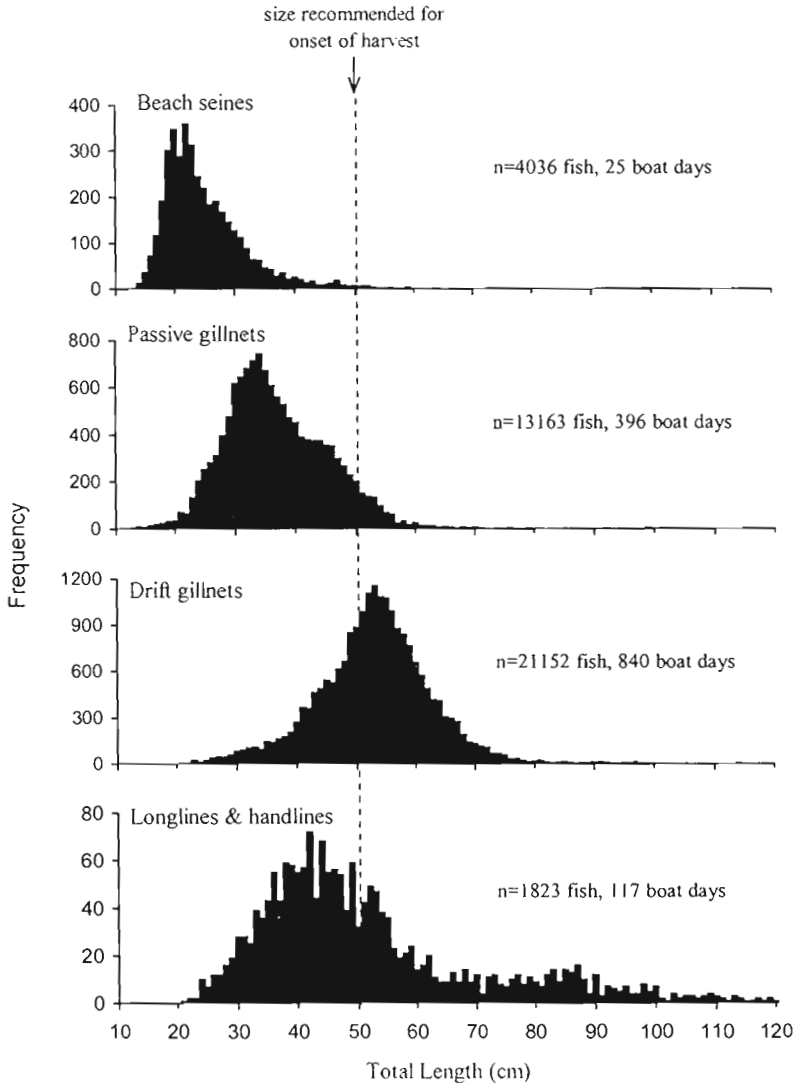


Fig. 4.2.1. Size distribution of Nile perch caught in the four major fishing gears/methods that target Nile perch in the Ugandan part of Lake Victoria (source: Muhoozi, 2000)

above the minimum size (50 cm TL) recommended for harvest. The Nile perch from gillnets operated passively have the mode at 34 cm TL, with over 90% of the catch smaller than 50 cm TL. The mode of Nile perch catches of gillnets operated as drift nets is at 53 cm TL, whereby only 31% of the fish are smaller than 50 cm TL. Hooks on long lines or hand lines are comparatively unselective as they catch a wide range of Nile perch sizes between 20 and 120 cm TL, with the mode at 42 cm TL.

Nile tilapia (Ngege)

Fishers targeting Nile tilapia use four major gears/methods, i.e. basket traps, active gill nets, passive gillnets and cast nets, which also selected for different sizes of fish (Fig. 4.2.2).

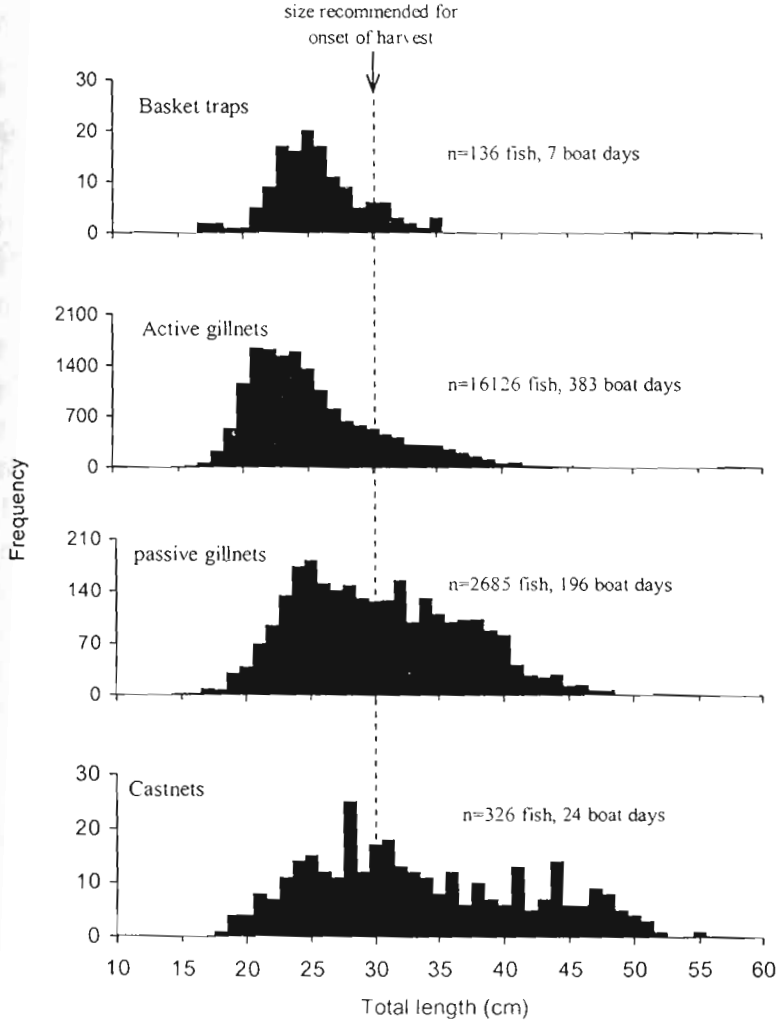


Fig. 4.2.2. Size distribution of Nile tilapia caught in the four major fishing gears/methods that target Nile tilapia in the Ugandan part of Lake Victoria(source: Muhoozi, 2002).

Nile tilapia catches of basket traps and active gillnets are dominated by small fish, compared with passive gillnets and cast nets. Cast nets are basically non-selective, catching all sizes in the areas over which they are cast. Over 80% of the Nile tilapia catches from basket traps and actively operated gillnets are smaller than 30 cm TL, the size recommended for the onset of harvest of the species. In contrast, less than 50% of Nile tilapia catches of passively set gillnets and cast nets, i.e. 48.6% and 38.0% respectively, are <30 cm TL.

The *Rastrineobola argentea* (Mukene)

Unlike the large fishes of Lake Victoria, i.e. Nile perch, Nile tilapia and other species, which are harvested by the fishing gears and methods considered above, the fishery of *R. argentea*, a small pelagic cyprinid, is unique in that it is based on the attraction of the fish by an artificial light source (kerosene pressure lamps) in Lake Victoria.

Nets of small meshes (mosquito nets), which can be operated as beach seines, boat seines, lift nets or scoop nets are used in this fishery. Where the *R. argentea* is caught using mosquito seine nets of 5 mm mesh size, operated as boat seines, pooled length frequencies of *R. argentea* from commercial catches have the mode at 41 mm SL that corresponds with the size at first maturity of females, the minimum size recommended for harvest (Fig. 4.2.3).



Fig. 4.2.3. Size distribution of *Rastrineobola argentea* from commercial catches in the Ugandan part of Lake Victoria (Source: Muhoozi, 2002)

The commercial catches thus contain a large proportion of immature fish, contributing over 50% of the total catch in numbers.

Concerns on the destructive fishing gears and methods

The various fishing gears used in Lake Victoria have a variety of negative impacts on the fisheries of the lake. However, there are major concerns of the effects of fishing gears that take large quantities of juvenile Nile perch and Nile tilapia, prominent of which are the dragged gears, i.e. trawls with cod ends less than 127 mm mesh size and beach seines operated in shallow waters (Kamanyi, 1996; Ogutu-Ohwayo *et al.*, 1998). In addition to catching juveniles, these gears disrupt courtship of fish in breeding grounds; destroy benthic organisms and habitats, which in turn affect productivity of important foods of fish. Commercial trawling and beach/boat seining are banned on Lake Victoria but whereas the ban on trawling is now effective, seining activity is still prevalent around the lake.

In the gillnet fishery, the recommended minimum mesh size of 127 mm is appropriate for Nile tilapia but harvests large numbers of Nile perch below the minimum recommended size of 50 cm TL (Kamanyi, 1996a; Ogutu-Ohwayo *et al.*, 1998). Nile tilapia in Lake Victoria has low fecundity of 2000 to 4000 eggs (Balirwa, 1998), thus requiring protection of spawners. Conversely, fecundity may not be a limiting factor for Nile perch because a female produces millions of eggs at each breeding (Ogutu-Ohwayo, 1988). However, female Nile perch mature at very large sizes, i.e. the size at first maturity is around 75 cm TL (Muhoozi, 2002), which is too large to be realistically recommended as the size of first capture. This is because large Nile perch above 50 cm TL feed predominantly on other commercially important fish species such as Nile tilapia, mukene and its own young (Ogutu-Ohwayo, 1985), thus fishing out the predatory sizes is beneficial to the prey. In contrast Nile perch below 50 cm TL feed predominantly on invertebrates, which are converted into a consumable commodity fish. Therefore harvesting Nile perch using the minimum gillnet mesh size of 152 mm would reduce predation pressure on other important fish species. To protect the female Nile perch spawners, a slot size of 50-85 cm TL corresponding to catches of the gillnet mesh size range 152 to 229 mm, was recommended by the Lake Victoria Fisheries Research Project (UNECIA, 2002).



Plate 4.2.1. Small craft (Paracute) invariably target immature fish

Active operation of gillnets by beating of water to drive fish into stationary gillnets; cast netting and basket traps are operated mainly from small parachute/dugout boats in shallow waters, which are breeding and/or nursery grounds of most fish especially during courtship. They catch breeding individuals and force mouth brooding fish to spit the young thus reducing recruitment. These fishing gears/methods also take large tolls of juvenile Nile tilapia. In experimental cast nets of 127mm mesh size over 75% of Nile tilapia caught were above the minimum recommended size of 30 cm TL (Kamanyi, 1996a). However, these cast nets are fished several times on each fishing trip thus increasing the fishing effort in addition to disrupting breeding activity in the littoral areas where they are often operated.

Drift gillnetting, a recent innovation of operating gillnets in mid-waters of deep open areas of the lake targeting large Nile perch has become a popular fishing method providing fresh fish to the industrial fish processors. This fishing method needs further investigations especially regarding conflicts with fishers' set nets being carried away by the drifting net (Muhoozi, 2002). The factors contributing to selectivity of hooks in the Nile perch fishery of Lake Victoria also need to be put into perspective. It is likely the nature, type and size of bait, or fishing grounds affect the size of fish caught.

In the Ugandan waters of Lake Victoria, the mukene fishery is mainly concentrated in inshore waters. Initially, mukene was exploited using 10 mm mesh size seine net but as the large fish got depleted fishers shifted to a smaller mesh sizes of 5 mm that crop a large proportion of immature fish. Studies carried out in Pilkington Bay of Lake Victoria in 1970 and 1990 (Ogutu-Ohwayo *et al.*, 1997) indicated that the size of mukene landed had tremendously decreased apparently due to high fishing pressure and a shift to smaller mesh size of seine nets. The size of mukene in commercial catches using 5 mm mesh seine (Muhoozi, 2002) increased from inshore waters (near mainland) to offshore (islands) suggesting high abundance of young fish inshore.

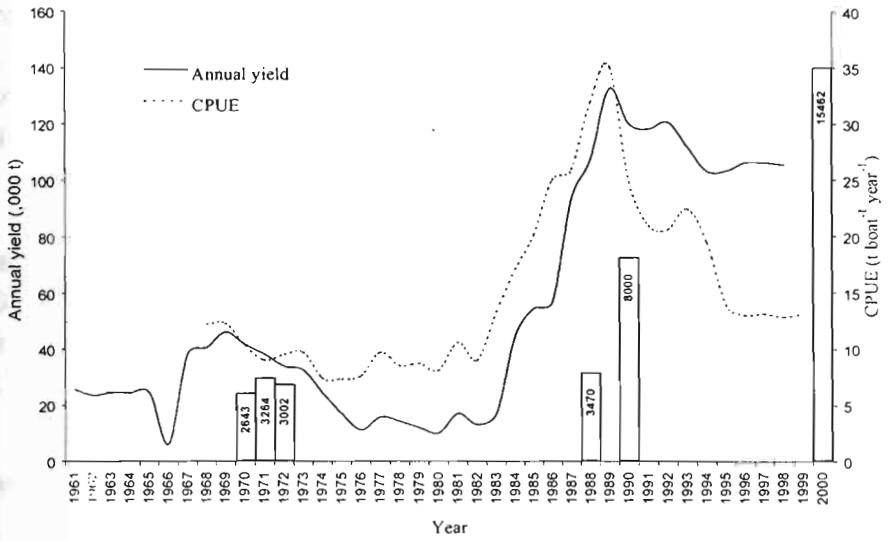


Fig. 4.2.4. The estimated number of fishing boats (bars, number of boats inside thebars)and estimated annual fish catches in the Ugandan part of Lake Victoria (ssource: Department of Fisheries Resources records); estimated catch per unit of effort (CPUE) for the whole lake, 1961 to 2000 (source: Asila, 2001).

Impact of changes in fishing effort on annual fish catches

Historical trends in fishing effort and annual fish catches in the Ugandan part of Lake Victoria indicate the numbers of fishing boats, despite the discontinuous information, remained relatively low and stable around 3000 boats from 1970 to 1988 (Fig.4.2.4). However, the number increased tremendously to 8000 boats in 1990 and over 15 000 boats in 2000 (Tumwebaze and Coenen, 1991; Muhoozi, 2002).

The total annual fish catches were low between 1973 and 1982, but rose from about 17,000 to 132,400 t from 1983 to 1989 respectively, and started declining thereafter. The catch per unit of effort (CPUE) followed a similar trend, i.e. stable between 1968 and 1983, rising to a peak in 1989 and later falling steadily.

The above changes were along with some qualitative changes in fishing effort, which have implications on the fish catch composition.

Table 4.2.1. Change in the numbers and the percentage increase of the three major categories of fishing boats in the Ugandan part of Lake Victoria from 1990 to 2000 frame survey.

Boat category	1990	2000	Percentage increase
Dugout/Parachute	2030	5611	176
Sesse paddled	5122	7132	39
Sesse motorized	849	1999	136

The increase of numbers of fishing boats was biased to the small parachute/dugout boats, which are specialised in the inshore tilapia fishery, and the large motorized Sesse boats, which are specialised in the offshore Nile perch fishery (Table 4.2.1). This suggested greater fishing pressure targeted to the two fish species, the Nile perch and Nile tilapia. The paddled Sesse boats that are unspecialised show the least increase.

Despite the increase in the total number of boats using every fishing gear between 1990 and 2000, the proportion of boats using gillnets decreased by about 20% while that of boats using hook and line, traps, cast nets and mosquito seines increased, which is suggestive of diversification of fishing strategies (Table 4.2.2).

Table 4.2.2. Change in numbers and overall percentages of boats using each of the main fishing gears in the Ugandan part of Lake Victoria from 1990 to 2000 frame survey.

Gear type	Number of boats in 1990	Number of boats in 2000	Percentage of boats in 1990	Percentage of boats in 2000
Gillnets	5921	9800	84.1	61.9
Beach seines	348	730	4.9	4.6
Longlines	329	793	4.6	5.0
Hook and line	39	799	0.6	5.0
Mosquito seines	269	2130	3.8	13.5
Traps	83	547	1.2	3.5
Cast nets	51	1026	0.7	6.5

Gillnets continue to be the most prominent fishing gear in the Ugandan part of Lake Victoria. Therefore any changes in their composition have serious consequences in the fishery. A shift from use of large gillnet mesh sizes in 1990 to utilisation of smaller mesh sizes in 2000 is evident in all the three main categories of boats in addition to increase of the number of gillnets by about 3.5 times, from 75 364 nets in 1990 to 294 529 nets in 2000 (Fig. 4.2.5).

The overall use of illegal gillnets <127 mm mesh size increased from 3.7% in 1990 to 18.4 % in 2000. Most of the illegal gillnets in 2000 were used by parachute/dugout boats and paddled Sesse boats in which they constituted 53.3 and 22.5% of the gillnet fleets, respectively. They contributed only 3.7% of gillnets used by motorised boats. The mean number of gillnets per boat as a measure of the amount of effort by each fishing unit also increased between 1990 and 2000 indicating more increase of fishing pressure than is implied by the number of boats per se (Fig. 4.2.6).

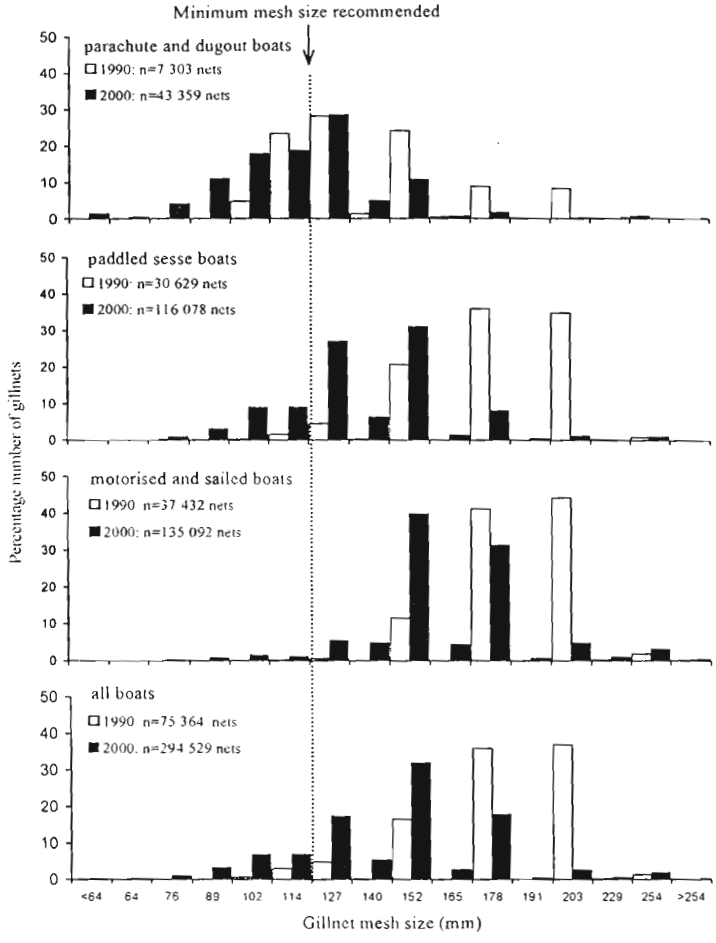


Fig. 4.2.5. Mesh size composition of gill nets used by different categories of boats in the Ugandan part of Lake Victoria in 1990 and 2000 (Source: Muhoozi, 2002)

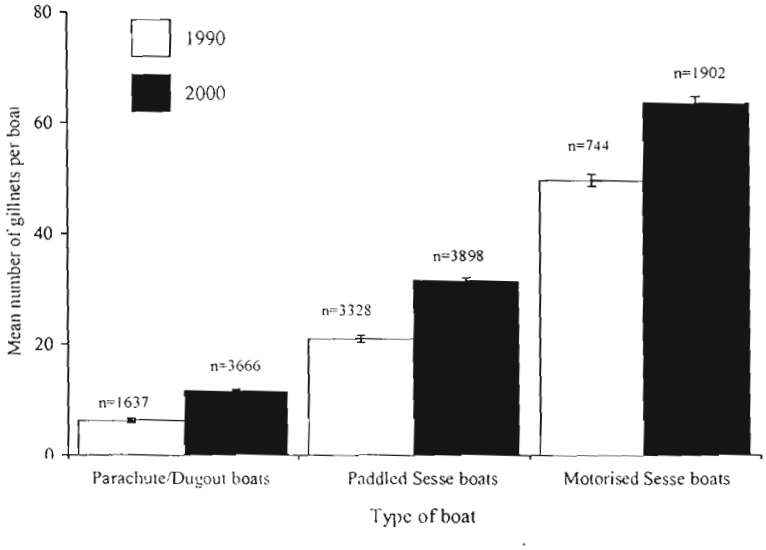


Fig. 4.2.6. Mean number of gill nets per boat for the three main categories of fishing boats in the Ugandan part of Lake Victoria in 1990 and 2000 (n=number of boats and error bars = 95% CL) (source: Muhoozi, 2002)

Relationships between fishing effort patterns, fish catch rates and target species

Amongst boats using gillnets, the mode of operation of gillnets, the gillnet mesh size composition, fish catch rates and target species are unique in each of the three major categories of boats (Fig. 4.2.7). In about 85% of parachute boats, gillnets are operated actively, i.e. by pounding/beating water and/or other methods of herding fish into the set nets. Conversely, in the majority of paddled Sesse boats (74%), gillnets are operated passively, whereas most boats with sails or motor (94%) operated gillnets as driftnets. Despite the similarities in the mesh size composition of gillnets used by parachute and paddled Sesse boats, the former target Nile tilapia while the latter target Nile perch, and the boats with sails or motor, which use gillnets with the largest mesh sizes catch almost exclusively Nile perch. The mean fish catch rates (all fish species) are lowest in parachute boats (approximately 21 kg boat^{-1} day^{-1}), followed by about 23 and 56 kg boat^{-1} day^{-1} in paddled and motorised/sailed Sesse boats, respectively.

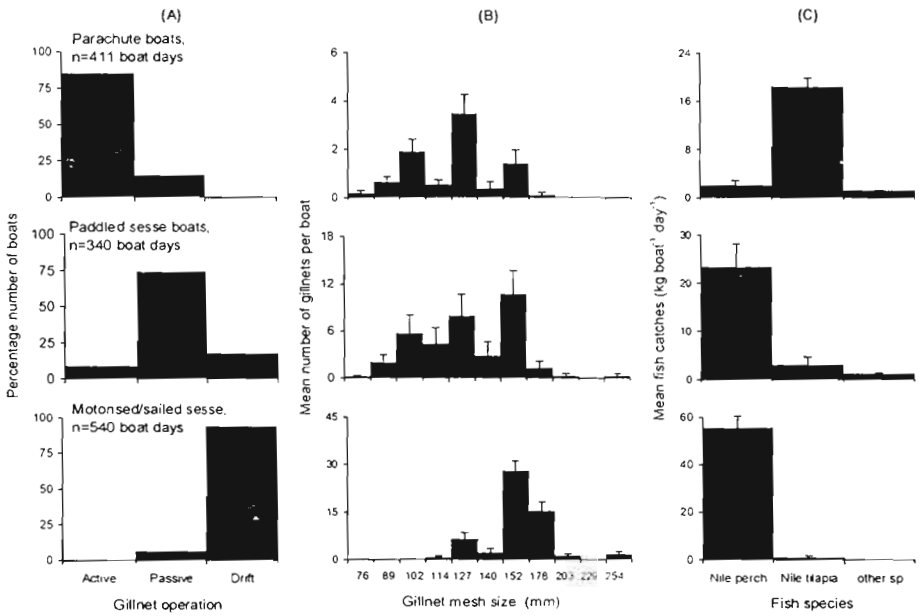


Fig. 4.2.7. A - Percentage number of boats in which gill nets are operated actively, passively or as drift nets, B - Mean number of gill nets per boat and C - fish catch rates in parachutes (flat bottom boats), paddled Sesse boats in the Uganda Part of Lake victoria (Error bars =95%) (Source: Muhoozi, 2002).

Other innovations to adjust fishing effort

The magnitude of fishing effort in the Ugandan part of Lake Victoria is represented by several inter-related elements. The numbers of fishing boats and gears directly relate to the magnitude of fishing effort. However, there are other indirect elements of fishing effort that manifest in the form of innovations of fishing strategies to increase the chances of catching fish. Such innovations include: shifting between fishing gears, changes in gear characteristics like gillnet mesh sizes and their mode of operation, changes in quantities of gear units used per boat, shifting to use of particular type of boats e.g. motorisation to gain access to offshore waters. Between 1990 and 2000 all these elements changed in a manner indicative of tremendous increase of fishing effort in the Ugandan part of Lake Victoria.

The total number of fishing boats increased from 3002 in 1972 to 8000 in 1990 (Tumwebaze and Coenen 1991), in a period of 28 years. By contrast, the rate of increase in fishing boats from 8000 in 1990 to 15,462 in 2000, a period of 10 years was substantially greater. Besides fishing boats, the number of fishing gears per boat is one of the primary factors that determine the amount of fishing effort imparted by the boat. Therefore, the increase in number of gear units per boat, especially the number of gillnets, the major fishing gear on the lake, also points to more fishing effort than is implied by the increase in numbers of boats between 1990 and 2000. Further to increase in number of gillnets per boat, marked declines in gillnet mesh sizes occurred, thus shifting fishing effort to fish of smaller size resulting into recruitment over-fishing.

The initial incentive to increase fishing effort from 3,470 boats in 1988 to 8,000 in 1990 was probably a response to increased catches of the introduced Nile perch and Nile tilapia but subsequently the effort continued to rise against the declining CPUE. The rapid increase in fishing effort in the 1990s also reflects the huge changes that occurred in the fishery associated with Nile perch population explosion but the apparent stabilisation of catches from around 1995 could be arising from increase in the alternative fisheries when the Nile perch and Nile tilapia catches started to decline. This is displayed by the decline in the proportion of boats using gillnets by 20% between 1990 and 2000. This was mainly due to expansion of the mukene fishery with mosquito seines and also increase of boats using cast nets, long lines, hand lines and traps. These fishing gears are relatively inexpensive (Kamanyi 1996b) compared with gillnets, thus a small catch would remain profitable as fish stocks decline. This could be linked to the open access nature of fishery where new entrants, especially the poor can start fishing with minimum investment. Further more, set gillnets left behind overnight are more prone to theft than other fishing gears (Kamanyi 1996b), which could be contributing to proportional reduction in their use. Perhaps the diversification of fishing gears to those that provide greater fishing efficiency is also a mechanism of maintaining catch rates with increasing fishing pressure.

The increase in numbers of boats between 1990 and 2000 was also biased to parachute boats, which operate exclusively in inshore areas targeting tilapia and motorized boats that operate in deep offshore waters targeting Nile perch other than paddled Sesse boats, which are less specialised. This implies greater fishing effort targeting Nile tilapia and Nile perch. The inshore areas of Lake Victoria in particular, have been described as the typical habitat of tilapiines (Graham 1929; Lowe-McConnell 1958; Welcomme 1966) and presently, Nile tilapia is the main commercial fish species caught there (Balirwa 1995; 1998). Therefore, any measures of managing the Nile tilapia fishery should target the operations of parachute boats.

Conclusion

In the Ugandan part of Lake Victoria, comparison of 1990 and 2000 Frame Survey results revealed tremendous increase in all aspects of fishing effort and demonstrated a general decline of gillnet mesh sizes and increased use of illegal gillnets below the recommended minimum mesh size of 127mm. The increase in number of fishing boats was biased to parachute and motorized Sesse boats, which are specialized in Nile tilapia and Nile perch fisheries respectively suggesting intensification of fishing pressure in both shallow inshore waters for Nile tilapia and deep offshore waters for Nile perch.

Beach seines are the most destructive fishing gear to the Nile perch stocks because immature fish smaller than the recommended size at first capture of 50 cm TL constituted over 99% of the catch. Passively set gillnets operated by paddled Sesse boats also have similar undesirable catches. In drift nets operated predominantly by motorised boats, 68% of the Nile perch are larger than the minimum recommended size at first capture and would probably land better catches if gillnets less than 152 mm mesh size would be eliminated from the fleets. The Nile perch catches from hooks spread over a wide range of sizes with 58% below 50cm TL and 14% larger than 75cm TL (size at first maturity for female Nile perch), thus among the fishing gears and methods used to target Nile perch, it is in the fishery with hooks that catches considerable quantities of breeding females. The Mukene commercial catches in the Ugandan waters of Lake Victoria with 5 mm mesh size seine nets are generally dominated by fish below the recommended size of first capture especially in inshore waters.

Management of fishery resources and their biodiversity

Several instruments should be put in place to assist in promoting sustainable exploitation, management and conservation of Lake Victoria fishery resources.

These include:
Establishment of an effective system of availing accurate, up-to-date information for management and conservation of the resource. Scientific inventory, research and monitoring, which play a vital role in gathering the necessary information on which decision-makers and the publics depend. Public awareness, whereby well informed citizens get involved actively in resource management and exerting pressure on governments to take appropriate decisions in favour of managing the resources. The effectiveness of regulations which are used by both central and local governments depends on either public awareness, control and/or enforcement.

The following are recommended for management of the fisheries resources and biodiversity of Lake Victoria:

1. The minimum gillnet mesh size regulation of 127 mm should be enforced for paddled boats operating in near shore waters especially in the Nile tilapia fisheries. The large motorised or sailed boats, which operate in deep offshore waters targeting Nile perch should have the minimum gillnet mesh size set at 152 mm. This is to catch Nile perch in the slot size range of 50-85 cm TL, which are selected by gillnets in the 152-229 mm mesh size range.

2. Active operation of gillnets (e.g. tycoon), use of traps, beach seines and cast nets should be abolished.

3. The operation of gillnets as driftnets though active in nature is the main method of fishing for Nile perch in deep waters. The impacts of this fishing method should be investigated further, but in the meantime it should be allowed.

4. There is need to investigate the Nile perch selectivity of hooks in relation to the nature, type, size and mortality rate of hook bait and to encourage fish farmers to produce bait like *Clarias* to reduce pressure on juvenile tilapias, haplochromines, and other species obtained from the lake to be used as live bait.

5. In the Mukene fishery, the mesh size of small seines in use should not be allowed to drop below 5 mm pending further investigations. Fishing should be discouraged in shallow inshore areas and bays but encouraged in offshore areas beyond 1.5 km from the shoreline.

6. The numbers of fishing gear units carried by fishing boats should be urgently studied with the view of limiting the maximum number of gear units that should be carried by each fishing boat.

7. The numbers of parachute/dugout and paddled Sesse fishing boats, which operate exclusively in the heavily fished near shore areas should be restricted.

8. Open access to the fishery for both fishing crafts and gears should be reviewed to limit entry.

9. Breeding and nursery grounds of fish should be properly identified and mapped to protect breeding and enhance recruitment and biodiversity conservation.

10. Degraded ecosystems and depleted fish populations can be restored. For example, restoration of populations, which have been depleted or have declined, in Lake Victoria may be manipulated and or enhanced with methods such as introduction and stocking. However, all methods of recovering populations require a good knowledge on the species and the lake ecosystem. But these activities should be seen as a last resort. Priority should be placed on maintaining existing ecosystems and populations by removing the problems.