Fish Quality Assurance at Landing Beaches and During Transportation to Fish Processing Plants

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Abstract

Fish contamination, fish spoilage and post harvest losses were identified as major problems affecting fish trade in Lake Victoria. This paper summarizes efforts which have been made to improve fish quality before reaching fish processing plants i.e. during fishing, landing and transportation. Fish landing systems have been improved to include in water fish transfer, beach landing racks and floating barge. These measures have almost eliminated fish contamination during landing. The design and usage of these methods are elaborated. The paper identifies current fish transportation deficiencies and advises on appropriate measures to improve performance, setting of technical standards and areas for technology transfers.

Key words: Fish Landing, Floating Barge, Fish Racks, Collection Boats, Insulated Containers.

Introduction

The majority of fishing vessels in Lake Victoria are planked non-motorized canoes, typically 5-9 meter length. Fishing is a night operation and most of the fishermen use gillnets or long lines. Fishing gears are set in the evenings and hauled in the early mornings. The 10-12 hrs interval between setting and hauling the gear results in spoilage of some fish. Almost all catches on board the fishing vessels for all seasons contain some spoiled fish, irrespective of season. Nanyaro and Makene, (1998), tentatively estimated net spoiled Nile perch to be over 18% during the hot season. They also identified the fish landing environment to be the major source of fish quality problems. Water quality at fishing villages and camps is poor and the beaches are crowded with small, poorly constructed mud and grass thatched huts, contributing to an unhygienic environment.

Efforts to improve Lake Victoria Nile perch handling before it reaches the fish processing plants were started in the early 1990`s. FAO, under the cooperative adaptive Research Programme (1993), contracted the Kenya Marine and Freshwater Research Institute, Kisumu Laboratory KMFRI), Kenya (; Nyegezi Freshwater Fisheries Institute (NFFI), Mwanza, Tanzania, Entebbe Fisheries Institute (EFI), Entebbe, Uganda,; Mbegani Fisheries Development Centre (MFDC), Bagamoyo Tanzania, and the Institut de Technologie Almentaire (ITA), Dakar Senegal to develop appropriate insulated containers for Nile perch collection boats (Makene, 1996). The project gave birth to the now popularly known "kontena," an insulated "v" shaped tailor made container, a design adopted from Senegal`s "Ice pirogues"

Performance of these containers was studied by the Lake Victoria Environment Management Project (LVEMP).

In addition to Nile perch, the paper reports on the development work done on Dagaa. Dagaa is not yet processed in factories but this bound to happen in the future. Markets for well-

processed Dagaa products are expanding, a number of investors are investigating the industry and the fishery has a commercial potential.

Material and methods

Multi-Hauling Fishing

Under the LVEMP, multi-hauling practice was recommended, to reduce fish spoilage during fishing. Experiments were performed over nine days, using three sets of gill nets. During fishing, all sets of nets were set in the evenings, at the same fishing ground and hauled at different times. One group of nets was hauled every four hours, while the other nets were hauled twice, at midnight and morning. The last set was hauled only once, in the morning. Catch from the fishing was assessed organolepticaly (Table 1)

Table 1: Nile Perch Quality Assessment Scheme

Grade	OUTER APPEARANCE					
	Skin	Gill colour	Gill odour	Eyes	Texture	Score
Grade A	Natural brilliance silver	Red, No slime	Fresh, water weeds neutral	Transparent, Convex	Firm elastic	9 8
Grade B	Grayish Loss of metallic shine	Bleached Have slime	Slight off Odours	Red Slightly milky flat	Soft	7 6 5 4
Grade C	Yellow Slime	Green	Strong off odour	Sunken	Soft sloppy	3 2 1

Fish Landings

To improve fish quality during fish landing, the LVEMP – Fisheries management component introduced three methods of fish landing;

- Transfer of fish from fishing boat to fish collection boat in offshore or inshore waters.
- Use of wooden constructed beach fish landing racks
- Use of a floating barge as a fish landing facility.

These measures ware introduced to eliminate dipping of clean fish in contaminated inshore waters. The traditional practice involved dragging fish through the beach shallow water and finally throwing it on the sand. The practice contaminates fish with bacteria, including pathogens.

Fish landing on fish collection boats

To facilitate the transfer of fish from fishing boats to fish collection boats, all fish collection boats were advised to construct a Biped or Tripod stand on their boat for hanging weighing scales (Fig. 1) for weighing fish during sales. On arrival at the fishing villages/camps, fish collectors ware advised to anchor their boats at a distance (5-10 meters) from the beach, away from the contaminated beach water. Fishing boats were advised to go along side the fish collection boats. A reserved area for fishermen to directly transfer good quality Nile perch into the fish collection boats was established.

FIG. 1: Fish Collection Boat

FIG. 2: Floating Barge

Use of beach fish receiving racks

Beach Management Units (BMU), groups nominated by villages to manage beach activities were advised to construct fish landing racks made from available materials, which can easily be cleaned. Rack size depended on amount of fish landed.

Floating barge

To eliminate beach contamination during fish landing, LVEMP introduced floating barges to be used as landing jetties. In designing the barges, the following parameters were taken into consideration: -

- Capacity for Nile perch landing/beach/time
- Number of fish collectors at a point/time
- Fish collection boats – sizes and design
- Fishing boats – sizes and design
- Topography of the landing beaches
- Weather and wind effects
- Approved stability
- Acceptable rolling and pitching
- Self propelling with outboard engine or towed

- Available local material
- Reasonable cost
- Easy maintenance

Fish Collection Boats
A field study was conducted to study the performance of the prefabricated, tailor-made insulated containers. Informal interviews were conducted with fishermen, fish collectors and boat owners.

Dagaa Processing
Work to improve hygienic practices concentrated on improving Dagaa processingtechniques. Appropriate kilns and drying racks were constructed (Fig. 3) and drying techniques demonstrated.

Results and discussions

Multi-hauling

TABLE 2: Single and multi hauled catches quality assessment

	Hauled in the morning	Hauled Midnight and morning	Hauled after every 4 hrs.
Total No. of fish	638	587	518
Total weight	1638	1564	1270
Weight accepted	1545	982	1271
% of rejects	5.7	7.1	7.2

Results of the multi-hauling experiments are summarized in Table 2. Fish hauled during the night had a lower score than those hauled in the morning. This was the opposite of what was expected. The fishermen did not use ice, and fish caught in the night were left at at ambient temperature and subsequently deteriorated. Total catch was affected by the multi-hauling practice, the greater the number of hauls, the smaller the catch. Fish LandingTransfer of fish in water
In areas sheltered from waves and wind, the transfer of fish from fishing boat to fish collector's boat was easy and acceptable. Many Fish collectors preferred the system, as it simplified fish handling work. They easily assessed the quality, weighed and iced the fish in the insulated container on board. Fishermen then continued to the beach to sell the rejected fish.

Fish receiving racks
Most villages constructed wooden or reed racks of one metre height, one and half metre width, and two to four metres length . In most villages, when a fishing boat arrives at the beach, fish carriers – popularly known as health officers, carry fish from the boat to the landing racks. These health officers are responsible for beach cleanliness and fish landing. The carriers use special baskets or wheelbarrows.

Sales are by auction or price negotiation. After the sales, the health officer clean the racks using water from off shores.

Floating barges

In designing the floating barge it was found that 12m x 5m x 1.2m was a suitable barge size, able to accommodate four fish collection boats ata time. Barges were constructed by Mwanza Boatyard and put in use as fish transfer platforms.

Fishing boats returning from fishing, go along one side of the barge, while fish collection boats operate on the other side. Four barges were made for Mihama, Ito, Nansio and Kayenze.

The barges were placed under the responsibility of Beach Management Units (BMU) of the area. The BMU had quality control and safety assurance guidelines from the competent authority of the Lake Zone Office.

The use of the floating barge became a breakthrough in fish handling because clean fish, caught in clean deep waters, remained clean all the way to the fish processing plants.

The use of the barges however, had some shortcomings namely;

- Number of fish porters on the barge per fish trader were high, resulting in over crowding.
- A few fishermen had a tendency to remain on the barge after sales, increasing over crowding.
- Some fish traders/agents kept several insulated containers on the barge further reducing the available space.
- It was difficulty to use the barge during strong winds.
- There was no provision of a portable water system for washing the barge and the fish handling facilities after use.

Fish Collection Boats

The study on fish collection boat revealed the following problems:

- There was rampant use of wrong size containers,
- Inappropriate insulation materials were used,
- In some cases very thin insulation materials were used,
- In some other cases there was absence of insulation materials
- Some containers had connected inner and outer lining made of galvanized iron sheets, thus conducting heat from outside to the inside of the containers,
- Unsuitable inner lining materials were used
- There were no drainage holes at the bottom
- Wrong door size was used
- Unsealed inner lining surfaces
- Unprotected outer surfaces
- There was no front – rear elevation thus retaining splashed water

Table 3: Comparison of 10 Fish Collection Boats Landings (1998)

No:	Boat size (meter)	Container capacity (tons)	Period month	No. of landing	Total wt. kg	Wt. rejected kg	% of reject
1.	13.4	11	Feb-Dec	36	250474	12558	5.0
2.	14.0	11	Feb-Dec	27	201674	12793	6.3
3.	14.0	8	Feb-Dec	29	133036	8851	6.7
4	11.0	8	March-Dec	27	149855	10615	7.1
5	11.0	7	Feb-Dec	30	131643	10646	8.1
6.	12.5	6	Feb-Dec	27	127895	9931	7.8
7.	10.7	5	Feb-Dec	3	143053	5434	3.8
8	10.2	5	Feb-Dec	41	131284	6269	4.8
9.	10.0	4	March-Dec	23	44083	1565	3.6
10.	9.3	2	May-Dec	27	41743	1374	3.3

The effects of using a big container and less ice are shown in Table 3. This data originates from 10 fish collection boats, selected randomly among 25 boats of similar size, supplying fish to one Mwanza fish processing plant. As can be seen from the table the bigger size containers (capacity > 5 tons) had a bigger chance of landing higher percentages of fish rejects (>5.0%). There was though no direct correlation between the actual size and rejects indicating that other factors might be playing a role too. The role of container size may be due to frequency of opening of the container which increases the rate of melting of ice, longer collection days surpassing shelf life period, and fish at he bottom of the container being squashed by overlying fish. Boat No. 6 had the highest reject value. The boat is a good example of the effect of using less ice. The average weight of fish carried per trip was 4737 kg. The container capacity was 6,000kg. That means only 1363 kg space capacity was left for ice or an icing ratio of 0.29:1. The best icing ratio is 1:1 (ice: fish**).**

Apart from these technical faults, it was found that delay in icing was one of the factors contributing to high rejection rates.

The rectification of these technical faults, were included in the one-day technical workshop for carpenters engaged in container construction, boat builders and fish traders funded by LVEMP (August 1999). On a separate initiative, NFFI conducted short courses to fish traders, fishermen, youths and women. These efforts have had a significant impact on improving the quality of Nile perch.

Dagaa products

Products from the racks (Fig. 3) proved to be of high quality, very clean, without sand and with shining colour. Most of the processed Dagaa remained round an attractive shape.

Figure 3: Drying Dagaa at Ntama Beach, Sengerema District

Conclusions and reccommendations

- Fishermen contribute significantly to the National Economy. Like any other income generating groups they need to be given an opportunity to improve their social welfare. Fishermen's earnings are much higher compared to farmers. Given appropriate opportunities they will improve their present hygienic standards. This would improve hygienic environment were fish are landed.

- Experiments on multi-hauling practices and procedures were not followed up. More work should be done in this area to establish appropriate hauling time during warm and cool seasons and optimum time for leaving the nets in the water.

- By using ice onboard fishermen will improve the quality of fish. Fishermen should be encouraged to use ice in the ratio of 1:1 (1 kg of ice: I kg of fish) and small insulated containers of one ton capacity to minimize fish contamination and deterioration while on board a fishing vessels.

- The use of floating barges for fish landing was demonstrated to be a solution of poor fish handling during fish landing. More barges should be constructed at least 5 barges per District. The barges should be installed with a reliable supply of portable water. This will improve further the hygienic standards.

- Fisheries Division should introduce standards for fish collection boats and fish insulated containers, in terms of size, design and materials. Long narrow boats of 6-8 tons capacity, with a short draft, where fish can be iced while standing on

bottom planks are ideal. Fish containers of 2-3 tons capacity, made of easy cleaned, non-corrosive materials, with appropriate insulation materials of not less then 5 cm are recommended.

- Fisheries Division should prepare a training program, train and distribute training materials for fish handling, processing, fish quality control, safety assurance, appropriate design for fish collection boats, insulated containers, fish preservation by using ice, etc. The training materials can be in form of manuals, pamphlets, and brochure in Kiswahili for fishermen, fish processors, and boat builders and fish traders.

- Demand for of ice for fish icing is far beyond the present urban supplies. Ice availability needs to be increased in fishing areas. Efforts to use solar power and wind power to produce ice should be encouraged. Fisheries Division should promote investments in ice production plants.

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