

HANDLING FRESH FISH IN GHANA

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ABSTRACT

The paper examines handling methods at sea and ashore in relation to three levels of fishing in Ghana. Deterioration in fish quality is attributed to prolonged exposure of fresh fish to high ambient temperatures ($26^{\circ}\text{C} - 34^{\circ}\text{C}$) during handling at sea, sale ashore by bargain with a series of agents and during transportation to processing sites. It is suggested that proper use of ice at all stages of handling will preserve the initial quality of fish.

The need for research, inspection and quality control of fresh and frozen fish is expressed.

A. INTRODUCTION

With a population of about nine million and fish consumption in the region of 360,000 metric tons in 1972 (most recent data available, table I), Ghana is one of the developing countries with the greatest demand for fish. In 1972 the local fishing industry supplied about 78% of the demand while the remaining 22% was imported in the form of frozen fish and fish products.

In an effort to meet the demand for fish locally, the Ghana Government encouraged the expansion and development of the fishing industry with the result that emphasis shifted from rural marine fisheries in the 1950's to deep sea fisheries in the 1960's. This has created three levels of fishing with (a) Canoes (b) inshore motor vessels and (c) deep sea trawlers.

Fish handling operations on these fishing vessels and ashore have lagged behind the rate of expansion and development in the industry. Consequently, there is wastage of fish through spoilage. The purpose of this paper is to examine handling practices in relation to the three levels of fishing and to suggest improvements on existing practices to reduce fish spoilage. The scope of the paper is limited to marine fish.

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TABLE I

COMPOSITION OF FISH CONSUMPTION IN METRIC TONS FOR TEN YEARS

SOURCE OF FISH	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
Canoes	36,354	43,322	16,919	25,222	39,874	33,310	60,198	89,958	113,263	153,691
Inshore Motor - Vessels	2,493	29,975	49,740	49,345	24,568	12,458	19,330	20,192	19,051	30,081
Deep sea Trawlers	9,602	15,961	34,233	25,298	27,546	23,019	37,097	47,438	43,940	65,295
Inland Fishery	250	62	13,370	600	2,994	7,915	22,723	39,903	39,217	32,389
Total domestic production	48,699	66,923	114,262	100,465	94,982	76,702	139,348	197,491	215,471	281,456
Fish in transit sold locally	-	-	-	-	1,320	2,750	708	473	361	332
Total Imports	35,362	30,940	29,458	43,705	17,511	30,718	18,700	46,764	51,815	76,758
Total fish Consumption	84,061	67,863	143,720	144,170	113,813	110,170	158,756	244,728	267,647	358,516

Source: Fisheries Department, Ministry of Agriculture

HANDLING AT SEA

(1) On Canoes

The canoe is the traditional fishing craft in Ghana. It is less than 10m (30ft) in length and has no facility for carrying ice to sea. Most canoes are propelled by outboard motors but a few which operates close to the beach uses paddles.

The canoe fishermen go to sea at dawn or in the evening when temperatures are fairly low. On making a catch the fish are put into the bottom of the canoe and sorted roughly into species. Since there is no special compartment for the fish the crew walk on them causing crushing and bruising which facilitate the entry of bacteria. When the catch is heavy the guts of the lower fish, especially sardines, herrings and small macrerals, are squeezed out to infect the external surfaces.

The catch is usually landed in less than 6 hours after harvesting and apart from bruising and crushing, the quality of the fish is generally good.

(2) On Inshore Motor Vessels

Inshore motor vessels operating in Ghana have lengths in the range of 10m (30ft.) to 33m (100ft.). Vessels below 20m (60ft.) in length have no facilities for carrying ice to sea but the larger vessels have fish holds equipped with deck head cooling grids. Table 2 shows the distribution of these vessels between 1963 to 1972. It is evident that there are more vessels with no facilities for carrying ice on board and this trend has not changed over the years.

TABLE II

STATISTICS OF INSHORE MOTOR FISHING VESSELS OPERATING IN GHANA

(1963 - 1972)

LENGTH OF VESSEL		1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
Meters up to 10.6	Feet 32	183	129	182	223	228	154	145	201	200	168
11 - 20	33 - 60	50	44	66	92	107	111	128	131	119	95
20.3-33.3	61 - 100	18	19	40	39	39	21	29	28	27	21

Source: Ministry of Agriculture, Fisheries Department.

Inshore motor vessels stay at sea for one to five days depending on the size of the vessel. When a catch is made it is hauled onto the deck, sorted roughly into species and then shovelled into the fish holds where it is stored in bulk with or without ice depending on the facilities on the vessel. The bulk storage causes bruising and crushing of the lower fish and where the fish are un-iced the centre of the pile heats up causing spoilage. Even where icing facilities exist on board the catch may be of poor quality because ice has not been taken to sea or insufficient ice has been put on the fish.

Three factors have contributed to the inadequate use of ice on inshore vessels. These factors are (a) inadequate supply (b) high prices of ice (c) poor quality of ice.

(a) Inadequate supply

Almost all the ice producing companies are situated at the main fishing harbour at Tema where 75% of the vessels berth. Thus 25% of the vessels have no access to ice. Even at Tema, the biggest company producing ice for inshore vessels has only two plants with capacities of 44 tonnes flake ice and 40 tonnes crushed ice respectively per day. With constant breakdowns of machines and lack of spare parts to maintain them, the company is unable to operate at full capacity and therefore gets nowhere near satisfying the demand.

(b) High Prices of Ice

The selling price of a tonne of flake ice is twelve cedis (C12.00) which is roughly six pounds (£6.00) and that of block ice is eighty pesewas (80p) or forty pence (40p) per block. Assuming 2kg. of flake ice is used to ice 1kg of fish, it will cost twenty four cedis (C24.00) to ice a tonne of fish and this is an appreciable cost on production. Since the demand for fish is high and the selling price does not depend on the quality, owners of inshore vessels do not usually see the justification for adding the extra cost of ice to production costs.

(c) Poor Quality of Ice

The quality of block ice is poor. The block is usually opaque and has numerous air gaps. There have been occasions when block ice produced by private company had holes through the centre of the blocks. Investigations showed that the freezing process was slow with the result that the centre of the block was not frozen. Crushed ice from such a block melts quickly and does not last through the fishing trip.

Flake ice produced by a state owned company is of good quality but the ice is transported to the vessels in open wooden trucks - with no protection from the sun. This exposure accelerates melting and wastage of ice before it is put to use.

3. Handling on Deep Sea Trawlers

All the deepsea trawlers operating in Ghana have facilities for freezing and cold storage of fish. The catch is sorted into species with no regard to size and then arranged in metal trays with average capacity of 20kg. (44lb) or 30kg (66lb) of fish. The trays are then conveyed on a trolley into a blast freezer where the fish are frozen for about 6 hours. While this operation is going on the remaining fish are exposed and the quality deteriorates. Such fish are not discarded but frozen and mixed with good quality fish.

After the freezing process the fish are packed into paper cartons and conveyed to fish holds at minus 20°C. During storage in the holds the fish dehydrate and lose weight because the cartons used in packaging is not a good moisture barrier.

In the early 1960's attempts were made to overcome the problem of dehydration by lining the carton with a plastic film. This precaution has been stopped due to unavailability of the film on the local market.

(4) HANDLING ASHORE

1. Canoe Fish

(i) Discharging

Canoe fish is discharged with the aid of a medium sized plastic bucket into basins which are regarded as the unit measure

in the sale of fish. About three bucketfulls of fish make a basin which may contain from 100 to 500 fish depending on the size of the fish.

(ii) Sale of Fish

After the discharging operation, the leader of the crew bargains the price of each basinful of fish with an agent who usually is the wife or a relation of the owner of the canoe or a shareholder in the business. Subsequent transfers are by a similar bargain before the fish eventually get to the processor. This method of selling fish may take about three or more hours during which the fish are exposed to the sun and the wind. Because the fish are not iced quality deterioration occurs before the end of the sales.

2. Fish from inshore vessels

(i) Discharging

The fish are unloaded from the holds by shovelling into plastic buckets. The bucketfulls of fish are then passed along a line of the crew to the quayside where the contents are poured into a wooden fish box with capacity of about 30kg. Each member of the crew takes one or two fish from the bucket as payment for the service being rendered.

After unloading all the holds, the boxes are arranged in piles of five in the sun for purposes of counting. This method of unloading the catch by hand takes up to 4 hours during which the

fish warm up considerably. Table 3 shows landing temperatures of 100 boxes of iced fish.

TABLE III

Temperatures of 100 boxes of iced fish immediately after unloading the holds of an inshore vessel at Tema Fishing Harbour

Temperature range °C	% of boxes at temperature	
	Top of box	Middle of box
0 - 5	14	20
6 - 15	69	63
16 - 27	17	17

Source: Food Research Institute report on Tema Fishing Harbour.

Seventeen percent of the boxes, with temperatures above 15°C, were among the first to be loaded with fish. Iced fish in these boxes had warmed up to almost ambient temperature by the end of the discharging operation, but boxes which were among the last to be loaded with fish had temperatures between 0°C to 5°C. These observations show that the manual unloading process and exposure cause a rise in the initial temperature of the iced fish. Since the spoilage rate of fresh fish doubles for every six degrees rise in temperature, the fish which were

first unloaded from the holds, would spoil very quickly and the efforts made in keeping the fish cool at sea wasted by the slow unloading process.

(ii) Sale of fish

The sale of fish from inshore vessels is very similar to that of canoe fish. The exceptions are that the vessel owner conducts the sale and the agents are not usually related to the vessel owner.

Fish from deep sea trawlers

The cartons of fish are discharged mechanically by cranes into wooden trucks and transported to cold rooms at minus 10°C. During the discharging operation the frozen fish warm up and the cartons become wet with drippings from the fish. Tables 4a and b show the temperatures of frozen fish at the time of unloading the holds of two trawlers. The fish were supposed to be at minus 20°C but because of the high ambient temperature at the time of unloading, none of the fish was at this temperature. The average temperatures of fish from vessel A were a few degrees above minus 10°C which was the temperature of the cold room where the fish would be stored on land. In April 1971 the vessel B unloaded fish which had temperatures below minus 10°C on two occasions. Such fish when stored in the cold room would freeze slowly to equilibrate the cold room temperature and textural deterioration is likely to occur.

Table 4a

Temperatures of frozen fish during discharge from Vessel A

Date of unloading	Temperature (Minus °C)		No of fish examined
	Average	Range	
29th Nov. 1971	15	14 - 15	10
30th Nov. 1971	17	15 - 18	30
1st Dec. 1971	16	14 - 18	20
2nd Dec. 1971	16	14 - 18	30
3rd Dec. 1971	15	14 - 17	30
10th March 1972	13	10 - 15	30
30th March 1972	13	12 - 15	20
24th April 1972	14	12 - 15	10
21st June 1972	15	13 - 17	30
17th Nov. 1972	14	12 - 16	20
18th Nov. 1972	15	14 - 17	30

Source: Fisheries Department, Tema (Ministry of Agriculture)

TABLE 4b

TEMPERATURES OF FROZEN FISH DURING DISCHARGE FROM VESSEL B

Date of unloading	Temperature (minus °C)		No of fish examined
	Average	Range	
8th April, 1971	13	10 - 16	30
13th April 1971	8	5 - 10	30
27th April 1971	4	2 - 8	24
30th July 1971	13	12 - 14	20
2nd August 1971	13	12 - 14	10
3rd August 1971	13	12 - 15	20
4th August 1971	13	13 - 14	10
5th August 1971	15	14 - 15	10
6th August 1971	14	12 - 15	30
5th Jan. 1972	13	10 - 15	30
7th Jan. 1972	14	13 - 17	30
20th March 1972	13	10 - 16	30
21st March 1972	13	10 - 16	30
22nd March 1972	13	12 - 15	20

Source: Fisheries Department Tema (Ministry of Agriculture)

Sale of Frozen Fish:

Frozen fish used to be sold through a pass book system until quite recently. The fish were allocated to the passbook holder at fixed prices and she usually sold her fish to the processor or retailer.

Recently the government banned the passbook system and frozen fish is now sold direct to the processor and retailer.

D. PROCESSING AND DISTRIBUTION

The majority of fresh fish purchased from canoes and inshore vessels are processed at the coast before distribution inland. Most of the processing sites are close to the landing sites, but during the lean fishing season the processors travel distances of about 32km (20mils) to purchase fresh fish. They depend on public means of transportation which is unreliable. Processors in the same locality may hire a lorry to convey the fish but when this fails they stand by the road side for hours in an attempt to get a lorry. Since deterioration started during sale further exposure of the fish in this way accelerates spoilage.

At the processing sites the fish are washed and scaled. They may be gutted as well if they are intended for salting and sun drying. Fish intended for smoking are not gutted.

A small proportion of fresh fish from inshore vessels may be frozen and cold stored especially during the season of glut.

Fish is also sold in the fresh state without ice. Such fish spoils quickly because of exposure at high ambient temperatures.

E. RECOMMENDATIONS

Attempts are being made on governmental level to improve and develop fishing techniques, but very little is being done to improve handling practices even on sophisticated fishing crafts like deep sea trawlers. Possible ways of improving handling practices on each of the fishing craft are indicated below.

1. Handling at sea

(i) Canoes and small inshore vessels below 20m (60ft) in length

These crafts have no facilities for carrying ice but they can use insulated boxes to carry ice to sea. The fish can be packed into these boxes and top iced. Boxing the catch will prevent crushing and bruising which occurs with the present bulk storage.

(ii) Large inshore vessels above 20m (60ft) in length

The vessels have to make full use of their facilities for carrying ice to sea. The fish can be boxed and top iced as indicated under (ii) and the vessel owners should be encouraged to take sufficient ice to sea.

(iii) Deep sea trawlers

Fish caught by the deep sea trawlers are frozen and stored for about six months. Therefore Special care in handling is necessary to ensure that the initial quality before freezing is good.

To maintain the initial quality during handling, the fish must be chilled and protected from the sun. Chilling can be done by submerging the fish in refrigerated potable sea water. As an alternative a small flake ice machine can be carried on the trawler and ice can be made from potable sea water.

Fish which spoil before freezing should be sorted out and frozen separately. Such fish can be used for fish meal.

The Paper carton used for packaging frozen fish is unsuitable since it permits dehydration and has poor water repellent properties. A more suitable material is waxed carton but in the absence of this material, the cartons used presently can be lined with a suitable film such as cellophane.

2. Handling Ashore

(i) Canoes and inshore vessels

The discharging operations on inshore vessels have to be mechanised to speed up the operation, since the present manual method contributes greatly to the spoilage of fish at the quayside.

The sale of fish by bargain should be discouraged and sale by contract introduced. Contract sale has the advantage of not being time consuming, therefore the fish are not exposed to the sun for long periods. In 1972, when there was a bumper catch of fish, the Government experimented contract sale with 45 inshore vessels at

Tema. The Government was to supply ice at a reduced price to the vessels from which fish would be purchased at fixed prices according to the species. The experiment was unsuccessful because the Government could not meet the demand for ice and most of the fish landed was of poor quality. Also the vessel owners were not prepared to accept prices other than the guaranteed price although the fish were of very poor quality (Amu, 1973).

Having learnt from the 1972 experience the experiment can be repeated with good results.

(ii) Deep sea trawler

Insulated vans should be used to convey frozen fish from the vessels to the cold room. This will check temperature rise in the product.

3. Processing and distribution

The application of ice to the fish before processing and during distribution should be encouraged in order to reduce spoilage.

To overcome transportation difficulties, the fish processors should be encouraged to purchase lorries through their co-operative associations. This will go a long way to reduce spoilage of fish.

4. Ice making Facilities

Before the use of ice in the fishing industry is encouraged there must be a reliable supply of ice. The largest company supplying ice to the fishing industry cannot meet the demand for ice because of constant break down of machines. Since the breakdown is due to the old age of the machines and lack of spare parts to maintain them, new machines should be installed and spare parts should be made available for regular maintenance. Also the number of commercial ice plants should ^{be} increased so that all the fishing ^A harbours and landing sites get access to ice. This will help reduce the price of ice. The quality of ice, especially block ice, can be improved by quick freezing with a refrigerant at very low temperature. Also flake ice should be transported in insulated vans to the fishing vessels in order to prevent melting.

5. Fish inspection and quality control

There is no fish inspection and quality control at the quayside therefore fish of any quality are sold to the processor who has to find some use for them. A system of fish inspection and quality control should be introduced to ensure that fish unfit for human consumption are discarded, or used for fish meal.

6. Research

There is room for research into handling with a view to improving the practice. Though ice is being used in the fishing industry the benefits derived from this method of preservation have not been studied in great detail for Ghanaian fish and tropical fish in general. Research in this respect is therefore essential. The Food Research Institute embarked upon research into handling methods, but since its fish preservation section is limited in personnel, work has not progressed as expected.

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