

S U R V E Y

O F

TRADITIONAL POST-HARVEST FISH PROCESSING
TECHNOLOGY IN TANZANIA & MALAWI

1. Fish Landings and Processing

by

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BACKGROUND

1. A study tour was undertaken in September/October 1978 as a result of an FAO/CECAF/FRI contract to study the traditional post-harvest fish processing technology in Tanzania, Malawi and Nigeria.
2. The objectives of the tour was to hold discussions with fisheries personnel and to study and obtain, by means of visits and questionnaires, information on:
 - i. types of fish available and used for processing;
 - ii. pre-processing and post-processing treatments employed;
 - iii. types of traditional processing methods used.
3. The immediate objective of the contract project was to evaluate and introduce improved kilns for traditional processing of fish.
4. The contract project stipulates that since the traditional processing kilns in most African countries have a lot of defects such as
 - i. lack of temperature control
 - ii. lack of smoke control
 - iii. high wastage of fuel
 - iv. limited amount of fish processed at a time; they are inefficient.

The result of the tour was therefore to assist in obtaining data for the designing and construction of simple, inexpensive kilns which could be utilized for traditional processing of fish without loss of characteristics acceptable by the average consumer.

TANZANIA

Fish Landings

5. Banda Beach:- There are specific beaches along the Tanzanian sea coast where marine fish is landed. In Dar-es-salaam the main landing site is the Banda beach. In fact, it is required by law that fish be landed at specific places for statistical data to be collected on the landings. At Banda beach therefore the following data is collected by fisheries personnel 12 hours a day to cover all landings:

- i. type of boat and registration number;
- ii. gear size and number of gear;
- iii. species of fish; iv. weight of fish in kilograms;
- v. value of fish in shillings.

At the time of visit to Banda beach data on the following species were being compiled:

- i. Lethrimus - Chango (Swahili)
- ii. Carangoides - Kolekole (Swahili)
- iii. Rastreliger - Vibua (Swahili)
- iv. Sigarus - Fasi (Swahili)
- v. Scomberomorus - Nguru (Swahili)
- vi. Sharks (general) - Papa (Swahili)
- vii. Thunnus - Jodasi (Swahili)

These species of fish are said to be normally obtained throughout the year during full moons.

6. Statistics collected at Banda beach forms very small part of the Landings at the coast.

There is a high demand for the fresh fish landed and therefore practically none is left to be processed.

7. Kunduchi Beach

This beach which is about 24 kilometres from Dar-es-salaam has a Fisheries Research Institute in its immediate vicinity.

Very small fish landings take place at this beach. The demand for the fresh fish is great. Small quantities are however, channelled into frying at a nearby village called Mtogaati.

All fish landings are auctioned at the various sites.

Fish Processing Areas

8. The demand for fresh marine fish is great hence very little is left from the landings for processing. Some processing is however, undertaken in and around coastal towns like Kilwa, Masoko, Mtwara as well as on the Island of Pemba and Zanzibar.

More processing was attempted in other areas but was not sustained.

9. Freshwater fish processing is however on a large-scale and is done in the hinterland. The most notable of these areas in Kigoma region and town which is on Lake Tanganyika and along small villages such as Karama and Kipili. Other areas where freshwater fish processing is undertaken in Mwanza region on Lake Victoria; Mwanza town in Mara region around Lake Victoria; Bukoba town, West Lake region, Lake Kukwa, region and town, Mtwara region, Lake Nyasa.

Processing is also done along small villages and towns along river tributaries.

10. Small-scale processing of fish from aquaculture is practised. Aquaculture was introduced into Tanzania about 20 years ago and is spread all over the country except along the coastal areas.
11. Appendix 1 shows the list of common fish species obtainable at various landing areas.

Processing Methods

12. There are four main methods used in the processing/preservation of fish in Tanzania, namely 1. Drying ie. drying without salting; 2. Salting and drying; 3. Smoking 4. Frying.

Of the four methods the most important ones are drying and smoking. Processing activities are concentrated along the various lakes with the highest concentration along lakes Tanganyika, Nyasa and Victoria.

13. There appears to be no fish fermentation activities in Tanzania. Evidence of this is shown by the absence of such processed fish in the newly-opened market Kariakoo, in Dar-es-salaam, where most of the processed freshwater fish from the various lakes in the hinterland and some of the processed marine fish are sold.

14. Again, salt curing of fish and salting and drying activities appear to be just beginning as depicted by the very limited quantity at the Kariakoo market.

15. Appendices 2,3 and 4 show the regions, towns and types of fish used for drying, salting and drying, smoking and frying respectively.

16. In Kigoma, which is the main fishing centre on the Tanzanian shore of the Lake Tanganyika, freshwater fish is the only type of fish dried, whilst marine fish is the only type dried, salted and dried smoked and fried in Kunduchi, which is a sea coastal town. In Mwanza both freshwater and marine fish are either dried, or salted and dried. The fish is obtained either fresh or iced from local fishermen and from commercial boats. In Kunduchi, some of the fish is obtained from boats belonging to the Fisheries Training Institute there. The fish is conveyed to the nearby processing sites in baskets made of bamboo and palm leaves. These baskets are able to hold about 30-40 kilograms of fish. A basket has a stick passing through it and the free ends hung over the shoulders of two men. At times the fish is conveyed by trucks, bicycles or

trolleys when the catch is big and the processing site is a little farther away from the landing site. One such sites is Namiasi.

Fish from the landing sites normally reaches the processing site in less than one hour. In any case no fish gets to the processing ~~is~~ more than two hours.

At the processing site the fish is either processed straight-away or when iced it is processed not later than 3-4 hours after landing.

Fish to be processed is washed mostly with fresh water but at times seawater or pipe-borne water is used. The fish is then scaled and gutted. With small fish no scaling is done. Most of the fish have their gills removed and the large ones are cut up into pieces. In some cases the head of the fish is removed. Sometimes, especially in Kunduchi Fisheries Training Institute, the fish is filleted and quickly frozen. The waste products of the fish including entrails are either thrown away or dried for meal or turned into fish oil. At times the waste fish products are buried in the ground.

17. Drying

In Mwanza both marine and freshwater fish are dried. Among the types of fish dried, sardinella and protopterus species predominate. The quantities dried vary tremendously and are dependent on the catch. The fish is normally dried at the processing site on pebbles, mats, rocks, roof tops and on elevated platform, such as bamboo rack or wire mesh, which is about 1 metre high. Depending upon the weather conditions, the fish is left for 2-3 days to dry. During that period, the fish is turned at least three times and is covered or removed when it rains.

The dried fish, which is ascertained by feeling, breaking and tasting, is either sold right away or packed in baskets, wooden

boxes, or dry grass containers and sold within a day or two or within a week. Depending upon available buyers, the fish may be stored for over 12 days. In any event no dried fish is stored for more than one month before being marketed in the locality or in other parts of the country. If this is not done the fish becomes highly infested with moulds, insects or maggots. Depending upon the type and the degree of infestation, the fish is channelled to be used as animal feed resulting in wasted effort and loss of revenue.

In Kunduchi, fish drying on wire-mesh racks, 1 metre high, is done at the Fisheries Training Institute. At times, fish is dried in a specially - constructed hot air drying kiln made of galvanised sheeting. The fish normally dried is mixed and of marine origin. During the fish season, about 220kg are dried in a day and about 7000kg, a week. On the average, about 15000kg of fish is dried during the fish season.

~~The fish being sundried on the fish racks is left for about 2-3 days. In the drying kiln the fish is left for 6-12 hours.~~ During the drying period the fish is turned about three times. In a rainy weather the fish on the drying rack is removed while the one in the drying kiln is left since it is in an enclosed chamber which is under a shed.

The dried fish, which is ascertained by the feel of the hand, is sold right away or is pack for sale within 1-2 days or at most between 3-4 days. Some of the fish is packaged for laboratory analysis. All packaging is done in polythene bags. In order to determine the storage life or shelf-life, the fish is stored for about 1-2 months or for 5-6 months. Sometimes it is stored to enable the determination of their marketing potential.

Fish stored in the Fisheries Training Institute, Kunduchi, have been found at times to be infested with moulds, insects, or maggots. Depending upon their infested state the fish is either

dried for later consumption or sold at the prevailing price. Highly infested fish is however used as animal feed.

19. In Kigoma, freshwater fish is dried on rocks, elevated chicken wire and bamboo rocks, 1 metre high. Of the species of fish dried, the Sardinella, Lethrinops and Hapochromis species predominate. The quantities of fish dried vary but the average 540kg a day to 1000kg a week and 3500kg a month respectively.

The fish is normally dried at a site about 100 metres from the landing site. The fish is dried for 2-3 days during which period it is turned once.

The dried fish, which is ascertained by the feel of the hand, is either sold immediately when the market demand is good. Otherwise it is packed in baskets, or jute bags for sale within a day or two. At times the fish is stored for about one month either because of rains or to await a good market in order parts of the country.

In storage the fish is usually infested with insects. The infested fish is at times consumed after further drying. In some cases they are sold at reduced prices.

Smoking

20. Fish is also smoked at the Fisheries Training Institute in Kunduchi. Using Altona-type of oven, hot smoked fish is produced from the types of fish listed in Appendix 4. About 90kg, 300kg and 720kg are hot smoked in a day, a week or a month at the Institute. Fish to be smoked is washed, scaled, brined, at times gutted, split or knobbed, before pre-drying in the sun for 1-2 hours. After pre-drying the fish is hung on tenters and smoked for 8 hours in the oven. The oven is usually preheated for about 15 minutes. 15kg of charcoal and 4kg of sawdust are usually used for the smoking process. Properly hot smoked fish is determined by the colour of by feeling with the hands or by testing.

The hot smoked fish is either sold after 6 hours or packed in plastic bags for sale or storage. Depending upon what the fish is to be used for the smoked fish is stored for some months. At times part of the stored fish is used for analysis.

Fish stored at the Institute has been found to be infested with either moulds, insects or maggots. Such infested fish is either resmoked for consumption or for sale at a lower price.

Salting and Drying

21. In the town and region of Mwanza marine fish is at times salted and sun-dried. The types of fish usually used for such purpose include sardines, mackerel, barracuda, tuna, kingfish, and sharks. The quantities salted and dried in a day, a week or a month is dependent upon the catch. Solar or rock salt is the salt normally used for salting the fish. Approximately 15 per cent of the weight of fish to be salted is the amount of salt used in the salting process. The salt and fish are arranged in alternate layers in wooden barrels, basins, or concrete tubs. At times the salt is made into brine and the fish is put into it. Normally the fish is kept in the salt or brine for less than one hour. At times salting of the fish continues for over 6 days.

After removing the fish from the salt/brine the excess salt is removed or the brine is drain off. The excess salt/brine is either thrown away when it is too dirty or when not needed. However, when there is a lot of fish to be salted/brined additional salt is added and the reinforced salt/brine is used once or two times more before it is thrown away. At times the salt/brine is used for more than three times depending upon its state of concentration.

In Mwanza, the drying of salted fish is done in the same way and manner as in the drying of unsalted fish. The methods used in attesting the dryness state, packing for sale or storage or marketing of unsalted fish apply equally well with salted dried fish. In the packing of salted dried fish for storage, at times, special contain-

ers called "tenga" are used. Salted dried fish is stored for less than one month or at most between 1-2 months to wait transportation to other parts of the country or for a good market. Fish which becomes infested with mould during storage is sold at a lower price or used for animal feed. In both cases the eventual disposal method is dependent on the degree and type of infestation.

Frying

22. In the village of Mtongani in the town of Kunduchi, fish-mongers who are men, fry small quantities of their catch in very shallow iron pans, 45cm - 53cm inside diameter, 3.8cm - 6.3 cm deep on three-cornered stone stoves using firewood obtainable from nearby woods. The same types of marine fish dried are also fried in coconut oil or cotton seed oil, which is preheated for about 10 minutes. About 15kg, 100kg or 350kg of fish is fried in a day, a week or a month in this village. At times fish to be fried is sprayed with salt. Depending upon the size of fish, frying may last for less than 10 minutes to about 30 minutes. During frying the fish is turned four times. When it is ascertained through the colour or tasting or stick piercing, the fish is put on the side of the pan to drain for 10 minutes and then transferred onto a newspaper.

All of the fried fish, except a small amount for the use of the fishmonger, is sold on the spot for cash.

MALAWI

Fishing Landings and Processing

23. Namiasi:- There are a number of fish landing sites along the shores of Lake Malawi which is the Malawian portion of Lake Nyasa. One of the most important of these sites is Namiasi village, in the district of Mangochi, which has a Tanzanian counterpart town also called Namiasi.

Namiasi has a jetty where fishing boats anchor to land their catch fish landed are weighed in wooden crates to ascertain the total catch for each boat. The only statistical data collected

is the quantity of fish landed by each boat on a particular day. Data on species of fish is not controlled prices by a marketing personnel.

There is a fish processing and analysis laboratory at Namiasi. This facility is part of the Department of Fisheries in the Ministry of Agriculture. The laboratory undertakes fish drying and smoking experiments and the formulation of animal feed using fish as one of the main ingredients.

24. Mpwepwe: There is a Fisheries Training Centre which is situated at Mpwepwe, a few kilometres from Namiasi. Included in the training programme of this centre are fish drying and processing experiments. For these experiments, elevated drying racks and modified Altona - type smoking ovens have been constructed.

25. Maldeco Fisheries Ltd:- In a nearby village, along the coast of Lake Malawi, is a commercial enterprise called Maldeco Fisheries Ltd. which undertakes large-scale sun-drying of fish. For this Maldeco has constructed, over a wide area, suitable elevated drying racks, with stands made up of burnt solid bricks, of height 76cm and drying surface area of 8 sq. metres. Fish mostly dried is Tilapia and is exported to neighbouring countries.

Maldeco has a jetty where fish is landed. There is also a large cold store where fish is stored before being processed.

Processing Method

26. Drying:- A lot of fish is dried in Namiasi and its environs, in Mpwepwe Fish Training Centre and at Maldeco Fisheries Ltd. Appendix 5 gives the details of some of the species of fish dried in Namiasi. A large quantity of tilapia is also dried at Maldeco.

The fish is landed fresh by commercial boats and are conveyed mostly in trolleys and in some cases especially in the Namiasi area, in trucks, to the processing area within one to two hours. Fish landed in the evening is allowed to stay overnight before being handled. Fish to be dried is washed with fresh water before being dried.

On the average about 1,800kg, 40,800kg and 32,400kg of fish are dried on elevated racks 1-2 metres high, in a day, a week and a month respectively at the processing sites.

At the Fisheries Centre in Namiasi the fish is dried in various drying structures which include the elevated racks solar drying box and solar tent.*

Quantities of fish dried at Maldeco Fisheries are about ten times the amounts dried in Namiasi and its environs. The drying process takes about 3-6 days. During the drying the fish is turned once a day. On rainy days the fish is covered with polythene sheets. The dryness state of the fish is attested by feeling and is then collected into hessian sacks for sale. Depending upon the market demand, the fish may be stored for a week or two or longer during which period the sacks are heaped around a dwelling hours or in a commercial warehouse. At Maldeco Fisheries, the dried fish is kept in heaps in especially - constructed warehouses to await shipment. Transport difficulties in some cases make the fish to be kept longer than necessary.

While in long storage, the dried fish is at times infested with beetles, rodents maggots and sometimes moulds. Depending upon the state of infestation, the fish is either used for animal feed or is further dried before being sold at a lower price.

27. Smoking:- Fish to be smoked is also obtained a few hours after landing. If the fish is landed in the evening it is smoked the following morning.

*For details refer to Report on Smoking Ovens & Dryers.

The fish is washed, scaled, gutted and at times split, before being smoked. Filleting of small quantities of fish is also undertaken at Baldeco Fisheries. At times the heads are removed. At the Namiasi Laboratory, the heads together with the guts and entrails are used in the formulation of fish hydrolysate.

Traditionally, the fish is pre-dried in the sun for about 1 hour before being hot smoked on dug-out pits. The quantity smoked averages 30kg a day, 125kg a week and 400kg a month. The fish is normally arranged on wire netting above the dug-out pit. The size of the wire netting is dependent on the size of the pit and the fish is arranged in a mixture of head to head and head to tail. Palm nuts (different from the Ghanaian palm nuts) are normally used as firewood. Where there are no palm nuts any hardwood is used.

Semicommercially, rectangular brick oven or Ivory Coast type oven is used for smoking. Altona-type of oven is also used. The ovens used are not preheated.

Commercially, fish to be smoked is rinsed in water and is smoked in Torry Kilns. Fillets are normally put on wire trays before smoking. About 40kg., 400kg. and 1200kg of fillets are smoked commercially in a day, a week and in a month respectively. The fish is usually arranged head to tail on the trays. Sawdust from hardwood or wood shavings are used for the smoking process. 34.5kg of sawdust is usually able to smoke 29.4kg of fillets a day. The wood sawdust and savings are cheap and give good flavour.

Fish is normally hot-smoked for between 1 to 6 hours. During the process the fish is turned in singles, twice after every 3 hours. Hot-smoked fish is determined by either the colour or by the feel.

Smoked fish is packed for sale in baskets within 4 days. Commercially the smoked fish is frozen to accumulate for transport. It is usually stored for not more than 1 month before it is sold. When not so treated and especially when the fish is undersmoked, the smoked fish is infested with moulds, maggots or beetles when in storage. Depending upon the degree of infestation, the fish is either thrown away or sold at a lower price.

APPENDIX 1

Type of fish Landed at Beaches
Tanzania

Scientific/English Name	Swahili Name
Lethrinops	Chisawasawa
Sharks (General)	Papa
Scomberomorus/Kingfish	Nguru
Thunnus	Jodasi
Carangoides	Kolekole
Xiphias gladius	Samsuri
Cephalophalos	Chewa
Rock cods	"
Siganus/Parrot Fish	Tasi Pono
Nemipterus	Kaona
Tachysurus	Hongwe
Sphyraena	Mzia
Chirocentrus	Mkongge
Rast religer	Vibua
Pseltoodes/Bothus	Gayogayo/Wayo
Lobster)	
Prawn)	Kamba
)	
Sardinella	Dagaa

APPENDIX 2FISH USED FOR DRYING

COUNTRY	REGION	TOWN	TYPE OF FISH	
			Marine	Freshwater
Tanzania	Kigoma	Kigoma		Tilapia, Nile perch Perch, Catfish, Snout Fish, Pipe fish, Hapochromis spp.
	Nwanza	Nwanza	Sardines, Red Snapper, Mackerel, Barracuda, Tuna, Half beak, Mulletts, Kingfish	
		Kunduchi Village	Sardines, Red Snapper, Mackerel Sole, Thread fin, Barrachda, Tuna, Half beak, Mulletts Eels, Tachyrus spp.	

APPENDIX 3

FISH USED FOR SALTING & DRYING

COUNTRY	REGION	TOWN	TYPE OF FISH	
			Marine	Freshwater
Tanzania	Mwanza	Mwanza	Sardine, Red snapper Mackerel, Barracuda, Tuna, Half, beak, Mulletts, Kingfish, Sharks	Tilapia, Nile Perch Catfish, Sardine (Dagaa)

APPENDIX 4

FISH USED FOR SMOKING & FRYING

COUNTRY	REGION	TOWN	TYPE OF FISH	
			Marine	Freshwater
Tanzania		Kunduchi	<u>For Smoking</u> Sardines, Red snapper, Mackerel, Thread fin, Sole, Barracuda, Tuna Half beak, Mulletts, Eels, Tachysurus spp.	
		Kunduchi	<u>For Frying</u> As in straight Drying	

APPENDIX 5

FISH USED FOR DRYING & SMOKING

COUNTRY	REGION/ DISTRICT	TOWN/ VILLAGE	T T P E O F F I S H
			Freshwater
Malawi	Mangochi in Southern Region	Namiasi	<u>For Drying</u> Tilapia, Catfish, Haplo- chromis spp., Lethrinops spp. <u>For smoking Only</u> Ramphrochromis spp., Bagrus metidonatis, Sarkella engraulicypris.