

Business Name

Special points of interest:

- Improved fish smoking
- Marketing of solar and smoke dried fish
- Improved solar drying.

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Post harvest fish processing

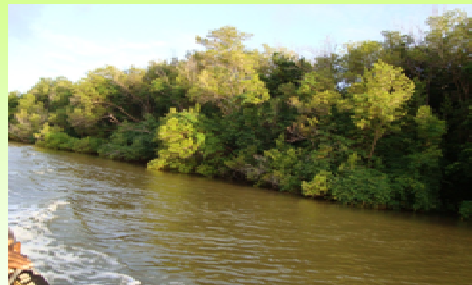
Integrated indigenous and modern fish processing and marketing

Introduction

Tana Delta District is one of the worst poverty hit districts in Kenya; however it hosts various natural resources in its biodiversity-rich delta. The delta is about 1,300 sq Km. in size and includes a wide variety of habitats including riverine forest, grassland, woodland, bush land, lakes, mangroves, dunes, beaches, estuaries and coastal waters. Mean annual rainfall ranges from 523 mm to about 733 mm, while the average temperature is about 27.1 °C (Temper, L and Martinez-Allier, J- Unpublished).

The delta is home to uncounted plant and animal species including over 350 birds species, endangered marine turtles, two endangered primates-Tana River Red Colobus and the Crested Mangbey monkey, hippopotamus, elephants and the Nile crocodile. There are also varied fish species in the coastal waters and fresh water lakes and ponds

The main economic activities in the region are farming and fishing. Livestock is also kept. Limited crops are grown including rice and fruits (mainly mangoes). Fishing in the delta targets



both fresh water and marine fisheries.

According to Tana Delta District Fisheries Office, there are about 215 fishermen and fish dealers

organized into 3 Beach Management Units (BMUs) namely; Ozi, Kipini and Chara. There are about 64 registered fishing vessels. Ozi and Kipini BMUs are unique as they share most of the fishing grounds and other resources.

Recently, there have been resource-use conflicts between the BMUs. As a long-term solution the Eco-Ethics –Kenya has supported the Fisheries Department to develop a community-owned conflict management plan.

“Integrated indigenous and modern fish processing and marketing” is a project funded by Regional Program for the Sustainable Management of the Coastal Zones of Indian Ocean countries (ReCoMaP) and implemented by Eco-Ethics – Kenya. Kipini and Ozi are the target points of this project.

The project sites are hit by a number of challenges including amongst others; poor transport and communication, low literacy levels and exposure to opportunities of learning, low aspirations, lack of electricity supply and poor management of natural resources. The results have been to heavy post harvest loss of fish and mangoes, lower prices of fish and crops, poor living standards, destruction of natural resources including forests, wild animals and food insecurity.

The objectives of the project include:

- Improving fish smoking through use of energy saving kilns
- Improving solar drying of fish by using solar tunnel dryer
- Improving marketing of dried and smoked fish

Improved fish smoking

Although catfish (*Clarias*) is the most common smoked fish in the Tana delta, other fish species can be smoked as well which include Tilapia and Lungfish (*Protopterus*), marine catfish (*Galeichthys*). In order to improve the quality of fish smoked, 4 important stages must be taken into consideration; construction of the smoking kilns, pre-smoking preparation of fish, smoking stage and post smoking storage.

Construction of the smoking kilns

In fish smoking, it is the smoke that is responsible for the drying. Therefore, the kilns should be constructed such that it can contain enough volume of hot smoke. In this project, we have used two types of kilns- double kilns and single kilns. Single kilns have only one combustion chamber and one open space for fixing the fuel wood whereas double kilns have two combustion chambers and two open spaces for the wood. They were adopted from KMFRI.

An average size of a double kiln is recommended to be 92 inches long by 46 inches wide by 24 inches high although we slightly reduced the sizes. The width and height of the smokehole is about 15 inches while the fire pit is 5 inches. There are trays where the fish is spread, made of wood and wire mesh. The trays should be 88 inches long and 40 inches wide for the double kiln. The single kiln is almost half the size of the double one. The kilns are made of building blocks. Plans are underway to keep the smoking protected from wind, crawling mammals and insects.

Pre-smoking preparation of fish

From the fish landing site fish is checked for its freshness and cleaned with fresh water. The fish is then gutted to remove the intestines and washed again. It is recommended to sort the gutted fish into respective sizes. The fish is then salted to human taste i.e. 220g of salt to 5kgs of fish. This treatment is left to stand for about 30 minutes and then put in clean plastic basins or containers at an angle of more than 100° for about 1 hour for complete drainage. Personal hygiene must be observed at all times.

Smoking process

Smoking is done with proper care under the recommended conditions. The wire-meshed rack is carefully treated with vegetable oil. This will ensure that the fish muscles do not get stuck during the process of turning to reduce quality. The fish is then laid on the wire seasoned wire-mesh while placing the larger fish at the center closer to the fire whereas the smaller ones towards the edges of the trays. It is recommended that to have at most five trays completed for one kiln. The first tray is fitted on the kiln top and the rest of the trays on top of each other. Fuel wood is

then fixed and the fire is set to light while covering the top tray with plywood to contain the smoke. It is possible to control the amount of smoke by uncovering the top tray. The trays are regularly rearranged until the fish is ready (between 10% to 25% moisture content). In order to add flavor and colour, we have decided to use specific trees and additives such as rice husks. Fish smoked with mangrove woods are tastier but care should be taken against environmental implications of cutting down mangrove trees.

Post smoking –packaging and storage

Proper storage and packaging is required for smoked fish. The fish should have sufficient air circulation to avoid formation of moulds. Insects and rodents should also be kept away. For the purposes of marketing it is advisable to ensure attractive packaging. Most smoked fish have a shelf life of between 14 -28 days depending on the lipid content.



Benefits of the project

- Increased shelf life of fish
- Reduced postharvest losses
- Less fuel wood used compared to traditional kilns i.e. half the amount of fuel wood is used compared to the traditional kilns and twice the amount of fish is smoked
- Improved quality of fish – nutrient content, colour and flavor
- Enhanced hygiene in the processing and handling

Improved solar drying

A variety of fish species can be dried in the sun. Like in fish smoking, the quality of solar dried fish depends on three main stages: Dryer design and fabrication, drying process and packaging and storage.

Dryer design and fabrication

There are many types of solar dryers including tunnel dryer and greenhouse-like dryer amongst others. Our project selected the solar tunnel dryer having tested it in Gazi fish landing site in the south coast. There are four important parts of the solar dryer. First is the solar collector which is a tunnel 7m long, 2m wide and 0.4m above the ground. The tunnel height can be up to 300mm and 450mm at the center from the base of the collector. While other materials like glass can be used on the top outer cover of the tunnel, two layers of UV treated polythene (0.05mm). A 2mm thick black metal sheet forms the base for heat absorption and is encased in a sand layer for heat storage. About 50mm thick coconut husks or sawdust is used for insulation. The walls must be made of black metals for enhanced heat absorption. The air is let in by a open space at the rare part.

The second part is the drying chamber which is made like a cabinet of about 2m by 2m by 1.4m and 0.5m above the ground. 25 mm thick plywood forms the sides of the cabinet and is painted black on the outside for heat absorption. The sides are then lined with 0.05mm galvanized iron sheets or aluminum for reflection and a lining of 50mm coconut husks or sawdust layer for reflection. Racks made of wire mesh are fitted in the cabinet while the top of the cabinet is covered with 4mm thick glass to allow solar heat into the cabinet. A cabinet of this size can hold a maximum of 200kg of fish.

The third section is the photovoltaic system which is composed of a solar panel, cycle battery and an axial DC fan. The last section is the instrumentation panel charge controller and switch-gear.

Preparation for drying

For quality dried fish , we ensure that personal hygiene and proper sanitation is maintained. After weighing, sorting and recording of the fish weight, the scales, gills and gut is properly removed. To increase the surface area for drying, the fish is split open. We recommend that fresh is used for cleaning the fish. Like in smoking, the fish is slated to human taste and put at an angle to complete drainage.

Drying process

On average, fish has 80% moisture content. When the moisture content falls to about 25%, contaminating agents cannot survive leading to a great reduction in the autolytic activity. There are two main factors that affect the drying rate of fish namely: humidity and temperatures. The other factor is wind speed. Fish dries faster in low humid conditions with higher temperatures.

The tunnel dryer has higher temperatures (35^oc-80^oc) and very low humidity. During drying, fish is carefully laid on the trays and put in the drying chamber. Hot air trapped in the solar collector is pumped by the axial DC fan when switched on to the drying consistently to dry the fish over a given period. However care is taken so that the temperatures do not exceed 85^oC. in order to avoid moulds formation on the fish during storage, the moisture content of the fish should be lowered to about 15%.

Benefits of improved solar drying

Marketing of solar and smoke dried fish

One of the main challenges of growth of artisanal fisher folk is poor marketing of fish. Although the quality of fish is improved through improved smoking and solar drying, absence of stable markets will discourage the fisher folk to adopt the technologies. Nearly all artisanal fisher folk rely only on the local markets or middlemen. Local fish dealers in Ozi and Kipini confirm that there are great opportunities for smoked and solar dried fish at the coast. Whereas the fisher folk often make a mistake of having the fish first then look for the market, proponents of business planning insist that market identification must be a key issue of concern before production. Having gone through a business

planning training, the fisher folk have shown a desire for more organized fish business than ever before.

At least five factors can be cited to affecting fish markets in Ozi and Kipini amongst other fishing communities of the Tana Delta district. These include: climatic factors (changing weather conditions), exploitation from the middle men, proximity to the end-market (requires transport), the state of the infrastructure (road condition), capital for investment (fishing gear, equipments)

According to the smoked and dried fish

market survey commissioned by Eco-Ethics –Kenya, there are at least six challenges facing markets for smoked and dried fish from Kipini and Ozi namely;



poor transport, fluctuating market prices, poor/unhygienic handling during processing, inadequate capital for investment, reduced fish catches and low quality fish due to insect infestation and breakages .

PICTORIAL



1. Fish Banda at Ozi



2. Solar tunel dryer



3. Smoking kilns



4. Gutted fish for solar drying



5. Fish smoking in progress



6. Smoked fish

Eco Ethics International Union Kenya Chapter

Eco-Ethics International Union Kenya (EEIU-Kenya) is a not for profit organization implementing various sustainable and uplifting community projects along the entire coast province of Kenya.

Based in Mombasa, EEIU- Kenya commenced its operations as registered non governmental organization (NGO) on the 16th of September, 2002.

Eco-Ethics aims at having a world of human communities that value and are adequately informed about their actions on the natural environment.

Our Mission

EEIU-K has a mission to investigate, demonstrate, promote and enhance harmonious relationships between human communities with their natural or environmental resources building on the principle of sustainability.

Long Term Goal

Having human communities that are responsive to new research findings and are willing to adapt to alternative livelihoods for sustainability of

world coasts' and environmental resources.

Our Vision

To have a world of human communities that value and are adequately informed about their actions to the natural environment.

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Pride in harmonizing the relationship between human and nature