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SUSTAINABLE FISHERIES MANAGEMENT PROJECT (SFMP)

Training Manual on use and maintenance of improved ovens

December 2015

THE UNIVERSITY OF RHODE ISLAND GRADUATE SCHOOL OF OCEANOGRAPHY | CRC COASTAL RESOURCES CENTER

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Cover Photo: Morrison Improved Brick Chokor Smoking Oven at Elmina-Ayisa (Photo Credit: CEWEFIA).

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ACRONYMS

CEDECOM	Central Region Development Commission
CEWEFIA	Central and Western Region Fishmongers Improvement Association
CLaT	Child Labour and Trafficking
DAA	Development Action Association
DSW	Department of Social Welfare
FoN	Friends of Nation
SFMP	Sustainable Fisheries Management Program
SNV	Netherlands Development Organization
USAID	United States Agency for International Development
WFCL	Worst Forms of Child Labour

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INTRODUCTION

Fish is an important source of food and income to many people in the developing world. In Africa, 5 percent of the population, about 35 million people, depend wholly or partly on the fisheries sector, mostly artisanal fisheries, for their livelihood. Various traditional methods are employed to preserve and process fish for consumption and storage. These include smoking, drying, salting, frying and fermenting and various combinations of these. In Ghana, smoking is the most widely practiced method: practically all species of fish available in the country can be smoked and it has been estimated that 70-80 percent of the domestic marine and freshwater catch is consumed in smoked form. The advantages of smoking fish are manifold. Fish smoking prolongs shelf life, enhances flavor and increases utilization in soups and sauces. It reduces waste at times of bumper catches and permits storage for the lean season. It increases protein availability to people throughout the year and makes fish easier to pack, transport and market. Fish smoking in Ghana is traditionally carried out by women in coastal towns and villages, along river banks and on the shores of Lake Volta. In most fishing communities, in fact, the main economic activity of women is fish processing.

Until the end of the 1960s, the ovens most used for smoking fish in Ghana were cylindrical or rectangular and made of mud or metal. Using these ovens had considerable disadvantages, however, such as excessive handling of fish during smoking, a problem more severe when smoking small species of fish such as anchovies. The ovens had a low capacity, were inefficient in fuel usage and could not cope with the large volumes of fresh fish landed during bumper fish seasons. This contributed to high post-harvest losses and, since the fish season also coincided with the rainy season, the fish could not be sun-dried. Because traditional ovens were inefficient, more firewood than necessary was used for the smoking process, which contributed to forest depletion. The health of the women fish smokers was at risk, because the smoke entered their eyes and lungs, they burned their fingers and they were exposed to direct heat. The fish smoking procedure was very laborious and poor-quality smoked fish was produced. In the early 1950s, awareness of the shortcomings of traditional ovens had stimulated development work on new and improved smoking ovens. In the light of lessons learned from the constraints and disadvantages associated with these earlier ovens, an improved traditional fish smoking oven, the Chorkor, was developed and introduced in 1969. This innovative model, developed by the Food and Agriculture Organization of the United Nations (FAO) and the Food Research Institute of the Council of Scientific and Industrial Research (CSIR) in Ghana, has since demonstrated the potential of traditional technologies in meeting current challenges. The Chorkor oven, named after a small fishing hamlet on the outskirts of Accra, has numerous advantages. It is cheap to make and can be assembled using locally available materials. Easy to use, with large capacity, low firewood consumption and short smoking times, it produces high quality smoked fish.

However, under the Sustainable Fisheries Management Project (SFMP), CEWEFIA's several interactions and observation with fishmongers in its catchment areas revealed that, the chorkor smoker had health implications. Excessive smoke from the stoves was giving them eye, heart problems, headaches and respiratory diseases. SNV in 2013 carried a comprehensive survey on improved fish smoking stoves available locally and internationally and identified a number of improved stoves including AWEP, Morris, Frismo, KOSMOS, FTT, etc. Energy assessment was conducted to determine the wood utilization efficiencies of some of the stoves available in the country. This knowledge was shared with SFMP partners, including CEWEFIA. Subsequently, CEWEFIA held an open forum on improved stoves available (AWEP stove, Morrison stove, KOSMOS sponsored stove and FTT oven). Out of

these, three ovens were selected and constructed for demonstration in the three targeted communities. These are AWEP stove, Morrison Clay and Morrison Brick oven.

The purpose of this training manual is to train the processors on the use and maintenance of the demonstration stoves for easy adoption.

MODULE 1: INTRODUCTION OF PARTICIPANTS, INTRODUCTION TO THE TRAINING COURSE AND HOUSE RULES

Session One: Overview of the Training Workshop

Time: 20mins

Objectives:

- To enable facilitators and the participants to establish the atmosphere for learning
- Facilitators and Participants get to know each other
- Expectations and Fears are examined

Expected Outputs:

- Participants are able to actively participate in the workshop
- Participants know themselves

Materials: Flip chart, paper, projection materials, facilitation cards, markers, pins and

Workshop programme

Method and Approach: Discussions and Adult Learning

Learning Activities

Step 1: Prayer: Ask one participant to say a prayer

Step 2: Self Introductions: Ask participants to introduce themselves – to mention their names, how they want to be called and any other information about themselves.

Step 3: Expectations and Fears: Give each participant two cards to write on what he/she expects from and fears about the training programme. Collect and pin the cards on a board and explain to participants the workshop objectives against the expectations and fears

Step 4: Workshop Rules and Norms: Ask participants to also mention some rules that will guide the training programme and support participants to indicate training rules and norms to guide the conduct of the training programme

Step 5: Time Table: Introduce and discuss with participants the training programme emphasising on start times and closing times for the workshop.

Facilitator's Notes

Workshop Introductions are extremely crucial in the organisation of training programmes. It establishes the atmosphere for learning and enables participants to know themselves. In this session the following must be done:

- **Background Information***:* Provide a detailed background information on the training workshop to participants to enable them appreciate why they are participating in the programme

- **Self-Introductions***:* Participants introduce themselves by mentioning their names.To make the exercise interesting, participants should indicate how they want to be called throughout the workshop

- **Workshop norms***:* Together with participants, agree to a set of workshop rules and norms. These are to guide participant's behaviour during the workshop. Whilst these could be varied, the following may be adopted:

    - *All participants are equal and important*
    - *All ideas are important and should be subjected to the same level of discussions*
    - *Ideas once expressed become a " public good"*
    - *No intimidations and shouting on others*
    - *No interruptions when another has the floor*
    - *There shall be strict adherence to workshop times/schedules*

- **Workshop Times***:* Agree with participants the starting and closing times as well as break times for a day's workshop

- **Course Coordinator/Prefect***:* Allow participants to select a course Coordinator/ Prefect. The Coordinator/Prefect must be informed that he/she will be required to present a brief write up on the entire workshop at the end of the training programme.

MODULE 2: IMPROVING FISH PROCESSING AND MARKETING

Session One: Overview of the Training

The training is aimed at exposing or deepening fishmonger's knowledge on various methods of fish processing and preservation. It is also to upgrade their skills and knowledge on how to effectively use modern fish smoking facilities.

Time: 45mins

Objectives:

- To enable participants appreciate what fish processing is, its importance and what the various methods are.
- To promote the desire for participants to develop their skills in attracting new market for their produce.
- To provide a common approaches and methods the fishmongers can use in processing fish

Expected Outputs:

- Participants are able to appreciate the relevance of using appropriate and environmentally friendly methods of fish processing and preservation.
- Participants' skills in fish processing and fish waste management enhanced

Materials: Flip chart, projection materials, knives, boxes and baskets and ice blocks

Method and Approach: Interactive discussions and practical lectures

Learning Activities:

Step 1: Ask participants to narrate and explain what they know about fish preservation and its importance to their businesses

Step 2: General Discussions: Participants are asked to mention and explain methods of fish processing they use.

Step 3: Facilitator **c**omplements the above list by outlining what is involved in fish processing and explaining various methods of fish processing

Step 4: Provide common and cost effective ways of processing and marketing fish

Step 5: Explain how to attract and maintain new clients by adding value to their produce

Step 6 Draw conclusions on the subject and close the session.

Fundamental Questions to Ask

- What is fish processing?
- What handling methods are used in processing fresh fish?
- How helpful are the methods of preservation in processing wholesome fish?
- How do you sell your processed fish

Facilitator's Notes on fish processing

The participants are made aware that, the term fish processing refers to all the processes associated with fish and fish products between the time fish are caught or harvested, and the time the final product is delivered to the customer (from net to plate). Although the term refers specifically to fish, in practice it is extended to cover any aquatic organisms harvested for commercial purposes, whether caught in wild fisheries or harvested from aquaculture or fish farming. It was stressed that fish are highly perishable and a central concern of fish processing is to prevent fish from deteriorating, and this remains an underlying concern during other processing operations.

The participants are made aware that when fish are captured or harvested for commercial purposes, they need some preprocessing so they can be delivered to the next part of the marketing chain in a fresh and undamaged condition. This means, for example, that fish caught by a canoe or a fishing vessel need handling so they can be stored safely until the boat lands the fish on shore. Typical handling processes are;

- transferring the catch from the fishing gear (such as a trawl, net or fishing line) to the fishing vessel
- holding the catch before further handling
- sorting and grading
- bleeding, gutting and washing
- chilling
- storing the chilled fish
- unloading, or landing the fish when the fishing vessel returns to landing sites for example Elmina

The number and order in which these operations are undertaken varies with the fish species and the type of fishing gear used to catch it, as well as how large the fishing vessel is and how long it is at sea, and the nature of the market it is supplying. It is explained to the fishmongers that, modern ways of performing these activities are available and so they must adopt them to improve upon the quality of their processed fish products.

They are also told that to get the best products from the fish they process, there will also be the need for the fishmongers to preserve the fish appropriately since it is a highly perishable food item. The methods used to preserve fish participants are told includes;

- the control of temperature using ice, refrigeration or freezing,
- the control of water activity by drying, salting, frying, smoking or freeze-drying
- the physical control of microbial loads through microwave heating or ionizing irradiation
- the chemical control of microbial loads by adding acids

Time is taken to extensively explain the first two methods which are mainly used by the women in Elmina Moree and Anlo. Modern as well as the old methods are discussed

The marketing skills and the sources of market for the processed fish are highlighted and the women encourage following the strategies taught in handling and processing the fish to produce wholesome product which will attract several clientele.

MODULE 3: BEHAVIORAL CHANGE COMMUNICATION (BCC)

Session One: Overview of the Training

This training aims at guiding the processers to adapt new and improved ways of processing fish.

Time: 40 mins

Objectives:

- ✓ To enable participants to understand the need for Behavioral Change Communication.
- ✓ To ensure that processers move from talking about problems to solutions.

Expected Outputs:

Participants will be able to outline the need to adapt the new technology.

Method and Approach:

Interactive and practical adult learning discussions

Learning Activities:

Step 1: Participants narrates and explain the technologies they have used the past decades

Step 2: Discuss with the processers why they are using the chorkor stoves now.

Step 3: Facilitator take participants through the discussion on behavioral change communication

Step 4: Conclude by reviewing what has been discussed

Facilitator's Note

BEHAVIORAL CHANGE COMMUNICATION

This attempts to bridge the gap between information, a person's knowledge, attitudes and subsequent behavior.

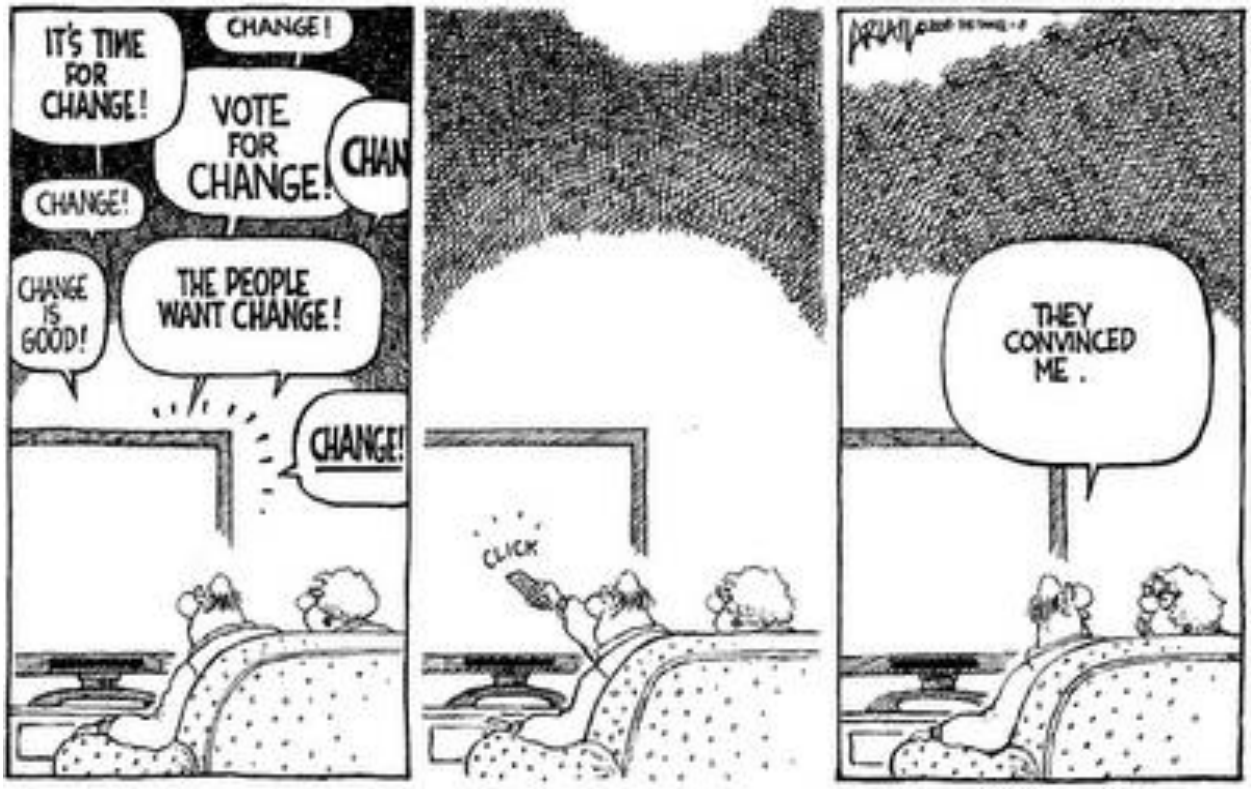
This approach addresses the knowledge, attitudes, practices and skills of individuals, families and communities as they relate to specific program goals.

Within a participatory communication framework, individuals and communities gain knowledge, appreciations and skills that motivate them to develop positive, healthy and protective practices

BCC requires a sound understanding of the audience and the use of an appropriate mix of communication channels- interpersonal, group, community and mass media

BCC has proven to be more effective when complemented by well-planned and implemented advocacy and social mobilization

How Do We Initiate and Sustain Behavior Change?



SHIFT FROM TALKING ABOUT PROBLEMS TO SOLUTIONS

PROBLEM	SOLUTION
Too many	Limited
Not enough time, money, people	We have enough
Weak and afraid	Proud
Angry	Happy
Blame	Work as Partners
We separate	Encouraged to continue
Will never go away	

Why Do People NOT Change Behavior?

People may not

- ✓ understand the message
- ✓ see themselves as vulnerable
- ✓ trust the bearers of the message

People may

- ✓ Think the short- term benefits of current behaviors outweigh the long term risks
- ✓ Some "healthy choices" are costly
- ✓ Recommended behavior may conflict with beliefs

ADKAR

A- Awareness on the need to change

D- Desire to participate and support the need to change

K- Knowledge of how to change (what the change looks like)

A- Ability to implement the change

R – Reinforcement to keep the change in place

Live, love and make a difference

MODULE 4: SAFETY AND HEALTH

Session One: Overview of the Training

This training aims at encouraging fish processers to cultivate the habit of keeping health and safety measures to avoid domestic accident at the work place.

Time: 45mins

Objectives:

- ✓ To enable participant understand the need to keep to safety and health precautions

Expected Outputs:

- ✓ Participants will be able to outline the need to protect themselves at their work places.

Method and Approach:

Interactive and practical adult learning discussions

Learning Activities:

Step 1: Participants will outline some of the health and safety precautions they know.

Step 2: Guide participant to come out with the right safety and health measures.

Step 3: Facilitator take participants through proper sanitation and hygiene at the workplace.

Step 4: Conclude by reviewing what has been discussed.

Facilitator's Note

Safety and health

- Be required to train your employees on the Health and Safety measures
- Provide training on proper use of equipment.

- Provide personal safety equipment to all workers (i.e. hard hats, goggles, steel-toed boots, gloves, dust masks).
- Provide firefighting equipment/measures.
- Provide medical services (access to a first aid kit).

Sanitation at the Processing Site

Processing areas should:

a. Have a person responsible for cleanliness

b. Be kept tidy and free from waste fish and trash

c. Have a supply of clean water

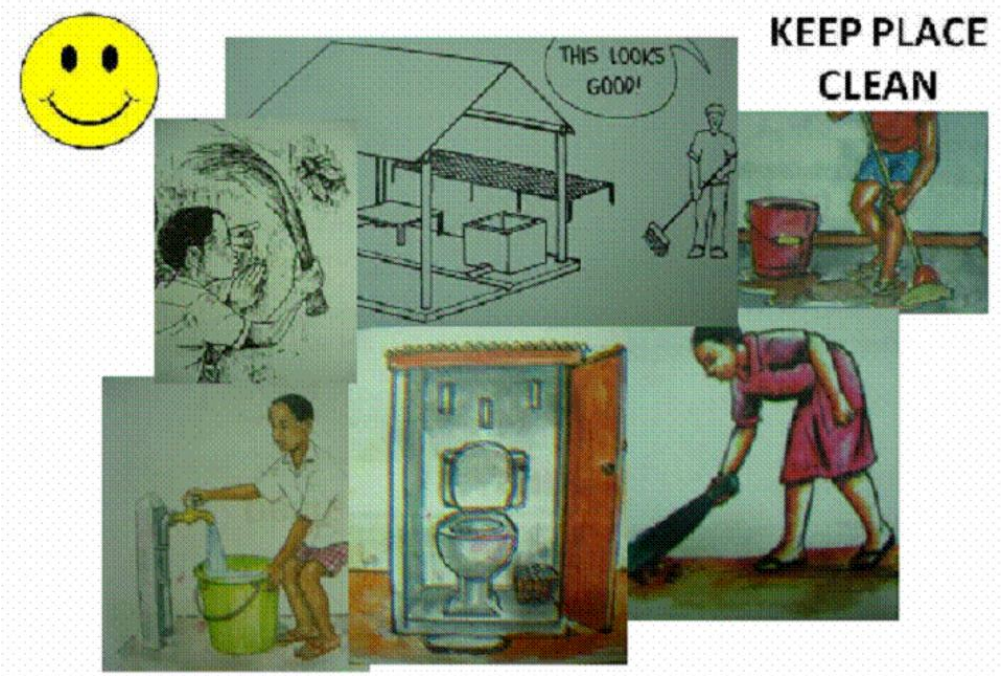
d. Be washed with clean water and detergent

e. Be protected against entry of animals and pests

Dirty water can put bacteria onto fish. Clean water should be used for:

1. Washing fish
2. Making ice
3. Washing equipment

You can use seawater, but it must be clean



MODULE 5: PRACTICAL LESSONS ON IMPROVED FISH SMOKING METHODS

Session one: Overview of the Training

This training aims at building upon the fish smoking knowledge of the fishmongers and to suggest ways of improving upon it. This session will also demonstrate the use and maintenance of the improved smoking ovens.

Time: 180 mins

Objectives:

- To enable participants produce quality fish from using appropriate smoking methods.
- To promote the desire for participants to develop their skills in using innovative methods of smoking.
- To demonstrate how to use and maintain the improved smoking stoves.
- To enhance participants understanding on the need to conserve energy (woodfuel)
- To educate participants on what constitutes an improved stove

Expected Outputs:

- Participants will be able to appreciate the relevance of using less stressful methods of fish smoking.
- Participant's skills in using improved fish smoking methods enhanced.
- Participant's maintenance culture improved.
- Participant's understanding on fuelwood conservation improved.
- Participant's understanding on improved stoves enhanced.

Materials: Morrison and AWEP improved smokers, knives, fish, and firewood and head pans

Method and Approach: Interactive and practical adult learning discussions

Learning Activities:

Step 1: Participants narrate and explain the various fish smoking methods

Step 2: General Practical Lessons: Participants are asked to demonstrate step by step process of preparing fish before smoking

Step 3: Participants asked why the need for improved stoves

Step 4: Facilitator complements their contribution by explaining how using the improved smoking ovens could help them have quality product, ensure their health which will eventually help them get and maintain attractive markets.

Step 5: Conclusion is drawn after educative practical lessons on the use and maintenance of improved smokers is completed

Facilitator's Note

The fish must be washed primarily to clean the fish and remove accumulated bacteria as well as removing accumulated slime on the surface of the body. Tools for scaling such as table knife must be used to process the fish before smoking them. Processes like gutting must be done in order to remove those fish body parts most likely to reduce product quality and sometimes the swim bladder. Gutting is carried out by cutting open the belly and removing the internal organs. The body cavity is cleaned of the peritoneum, kidney tissue and blood. The fish is cut longitudinally up to the anal opening on a table which is hard, easy to wash and does not absorb fluids.

The fish are then placed in smoking trays wiped with vegetable oil and allowed to dry for about 1 hour. This is done outside the smoking chamber or before the fire is set to reduce smoke inhalation by the processor. It is advisable to ensure that the fire is ready before arranging the trays on the stove to avoid the level of black carbon contamination with fish. A shiny-like layer formed on the fish surface seals the surface and prevent loss of natural juices during smoking. Sun drying of the smaller fishes is done directly under the scotching sun. The fish are either sun dried whole or split open ventrally and laid on mats to dry. The smoking process begins with the clearance of all combustible materials around and under the smoking area. A small bed is formed of coal and fire made and the coals covered with damped hardwood chips to avoid flaming. The use of plastic and rubber materials as a source of fuel for smoking is not encourages. The fish are laid on the wire gauze in the oven and fired from below and are smoked for about 2-4days.When smoking is complete fish are removed and allowed to cool. Later they are stored in containers where they are protected from dust and insects.

Specific instructions on the smoking procedures are given below:

- Acquisition of the fish

The final product is of greatest quality and has the longest shelf life when the fish is smoked fresh. Frozen fish can also be smoked while thawing. In some cases, post-harvest processors smoke whatever is left over after a day’s selling. The resulting product is of poor quality.

- Preparation of fish smoking

After degutting, fish is washed with fresh or salt water and carefully arranged on the trays

- General

Depending on the type of fish being smoked (species, thickness, way of cutting it), its uses, and the length of time it has to be stored, the smoking process can take among 1 hour to 2 days, at temperatures above 80°C, which are high enough to cook the fish. Wet hot smoking usually takes about 1-2 hours and yields a moist, versatile product with about 40-55 percent moisture content but a limited shelf life of 1-3 days. Dry hot smoking, which is usually preceded by the former process, takes about 10-18 hours, sometimes days, yielding fish with 10-15 percent moisture content, sometimes even below 10 percent. Fish smoked by this process have a shelf life of 6-9 months when stored properly. Fish is turned and the orientations of the trays are changed 2-4 times during the smoking cycle. The upper trays are placed close to the fire, while the lower ones are moved higher. After 2-5 hours of hot smoking, the contents of 2 or 3 trays of partly smoked fish can be combined in one tray. Then it can be smoked over a moderate fire (below 60°C) to continue the drying process. This second stage is the most important from a preservation standpoint, and may last as long as 2 days, yielding a very dry (10-15% moisture) product with a potential shelf life of 6-9 months

- The fire

Due to the chimney, formed by the stacking of the trays on the oven and covered at the top, the heat and smoke constantly circulate inside.

- Using Morrison and AWEP stoves

Morrison and AWEP stoves are improvements over the Chorker stove. Their usage does not deviate so much from the operations of the traditional chorker stove. However, it is prudent to take note of some features of the improved stoves to enable the attainment of maximum output.

- The Base

It is made up of clay and other coarse materials to strengthen the texture and structure. The base has high heat resistant capacity and constructed with heat resistant materials to enhance heat retention capacity, thereby reducing fuelwood consumption. It is easy to replicate.

- The Tray

The trays are designed to interlock with each other to trap heat and smoke for effective wood utilization. Restrained heat dries fish faster and therefore reduces smoking time. The interlocking trays also check smoky environment by channeling excess smoke above through the chimney, making stoves extra user friendly.

- Smoking with the Improved Stoves
- After fish is cleaned, it is laid on trays outside the smoking chamber to reduce smoke inhalation during fish preparation

- This setup is left for 20 minutes to drain fat and blood from fish. This reduces fat and blood dropping into the fire during smoking. During this period the fire can be set to warm the stove
- Trays are arranged in the smoking chamber with the cover open for 30 minutes to ensure that moisture content in the fish is considerably reduced (this step is very important for fatty fishes)
- Trays are then covered with the chimney fitted until the smoking process is complete
- Note that trays are interchanged intermittently to ensure even smoking

MAINTENANCE OF THE STOVE

- Use cutlass / knife to open up cracks.
- Pour water on the open cracks.
- Fill the crack with mud-clay.
- Polish clay base stove at least once every week.

HOW TO USE STOVE

- Wash fish with clean water
- Arrange fish on trays / racks
- Spread trays / racks on floor to allow fish to dry for 30 minutes
- Set fire in fire chamber
- Arrange racks on stove
- Put cover on last tray / rack
- Put long metal chimney on short metal chimney
- Inspect fish within short intervals
- Interchange trays / racks to ensure even smoking

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