



Secure Fisheries  
Secure Futures



# REGIONAL TRAINING WORKSHOP ON IMPROVED FISH SMOKING USING THE THYARORE SYSTEM

Tanzania



INDIAN OCEAN  
COMMISSION





REPORT/RAPPORT: SF-FAO/2013/27

Regional Training Workshop on  
Improved Fish Smoking Using  
The Thyarore System

Tanzania

*GCP/RAF/466/EC SmartFish Project*

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## Acknowledgements

The Fisheries Education and Training Agency (FETA), wishes to thank the FAO/Smartfish programme for financing the current training workshop on the Thyarore fish smoking and drying system. We would like to extend our thanks to participants from the East African countries, Regional Government and local communities, for their unwavering support for the training programme. We would like to extend our vote of thanks to the FAO/Smartfish staff in Mauritius and Mrs Oumoul Khary Ndiaye from Senegal for making the training a success.

## Executive summary

The Indian Ocean Commission through the SmartFish programme, in collaboration with the Food and Agriculture Organization of the United Nations (FAO), is implementing a regional fisheries strategy programme aimed at improving the sustainable regional supply of fish and fishery products. The programme has five different result areas, the fifth one being food security, which primarily focuses on the implementation of activities geared at reducing post-harvest fish losses that occur in small-scale fisheries.

Regarding post-harvest fish loss reduction, the approach of SmartFish is to build on what has already been done in the region. More specifically, to build the capacity of various key institutions in the region in terms of a systematic application of fish loss assessment methodologies in small-scale fisheries as a precondition for rational intervention, and indeed to find practical ways to reduce such losses.

In line with the above, the Fisheries Education and Training Agency (FETA), in collaboration with FAO-SmartFish, organized a regional training workshop on improved fish smoking using the Thyarore system, which was held in Mwanza, Tanzania, from 04 – 08 November 2013. Seventeen participants from Kenya, Burundi, Rwanda, United Republic of Tanzania, and Uganda took part in the training. Participants were Fisheries Officers from the respective countries.

The competency-based training programme had two main learning outcomes: participants are able to design and construct a Thyarore system oven/kiln; participants are able to smoke fish using the Thyarore system.

The training was conducted by experienced experts from FETA and Senegal who employed a variety of hands-on type training methods and practical sessions.

The pre- and post-evaluation suggested that the teaching-learning process was appreciated. Likewise, the participants' perception of the training was generally high and observations from the post training evaluation indicated that many are now planning to introduce FAO-Thyarore Technology systems in their respective countries.

## Résumé exécutif

Le Programme SmartFish de la Commission de l’océan Indien, en collaboration avec l’Organisation des Nations Unies pour l’alimentation et l’agriculture (FAO), met en œuvre un programme régional de stratégie de pêche. Ce programme a pour but d’améliorer durablement la disponibilité du poisson et des produits de la pêche dans la région. SmartFish comporte cinq résultats. Le cinquième est sur la sécurité alimentaire et se concentre sur la mise en œuvre d’activités visant à la réduction des pertes après captures dans la pêche à petite échelle.

L’approche de SmartFish pour la réduction des pertes après capture est construite sur ce qui a déjà été réalisé dans la région. Il s’agit spécifiquement de renforcer les capacités des institutions clés pour une application systématique des méthodologies de réduction des pertes après capture, précondition à une intervention rationnelle et à la définition de solutions pour réduire les pertes.

Au regard de ces éléments, le FETA (*Fisheries Education and Training Agency*) a organisé, en collaboration avec la FAO sur SmartFish, un atelier régional sur l’amélioration du système Thyarore de fumage du poisson. Cet atelier s’est tenu à Mwanza en Tanzanie du 4 au 8 novembre 2013. Il a attiré 17 participants venant du Kenya, du Burundi, du Rwanda, de la Tanzanie et de l’Ouganda. Ces participants étaient des officiers des pêches de leur pays respectif.

Cette formation basée sur les compétences avait deux objectifs principaux: permettre aux participants de créer et construire un four de type Thyarore ; et leur permettre de fumer du poisson en utilisant ce système.

La formation a été facilitée par l’expérience des experts de FETA et du Sénégal qui ont utilisés une variété de techniques de formations et sessions pratiques.

L’évaluation avant/après suggère que le processus de transmission des connaissances a été apprécié. De manière générale, les participants ont eu une haute estime de la formation et les observations de l’évaluation post formation suggèrent que de nombreux participants ont l’intention d’introduire de tels systèmes dans leur pays respectif.

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## Acronyms and abbreviations

<b>ANFTS</b>	African Network on Fish Technology and Safety
<b>CEO</b>	Chief Executive Officer
<b>EU</b>	European Union
<b>FAO</b>	Food and Agriculture Organization of the United Nations
<b>FETA</b>	Fisheries Education and Training Agency
<b>FTT</b>	FAO-Thyare Technology
<b>MLFD</b>	Ministry of Livestock and Fisheries Development
<b>PHLA</b>	Post-Harvest Loss Assessment

## 1. Background

Polycyclic aromatic hydrocarbons (PAHs) are organic chemical compounds found in oil, tar and coal deposits. They are also by-products of fuel combustion. As a result they are found in smoked, processed food substances.

PAHs are thought to be a cause of cancer in humans. Consequently there is an issue with traditional small-scale fish smoking methods and the consumption of smoked products. In the European Union there are standards as to the maximum level of PAHs allowed in food products such as smoked fish. Benzo(a)pyrene is one PAH used as an indicator and the maximum levels allowed in fish products are 2 to 5 µg/kg depending on the type of product.

Current smoking processes and practices can lead to high PAH levels in fish. Smoking using firewood and involving the incomplete combustion of wood; burning fish fats during smoking; and burning certain types of fuel wood are all linked to higher PAH levels in the final products. Clearly, final products with acceptable levels of PAH have a clear advantage in terms of market access and consumer safety.

The Thyarore fish smoking and drying system was developed in Senegal as a means to produce safe smoked products with low levels of PAH. The system has been tested and found useful in West Africa, in particular in Senegal. It was decided by FAO that there are opportunities to introduce and popularize this technology in East Africa where fish smoking is also common. A first training workshop on the Thyarore system was held for Fisheries Officers from the region in Mwanza, Tanzania from 4 – 8 November 2013.

## 2. Objectives of the training

The overall aim of the training workshop was to train regional fisheries officers in the construction and use of the Thyarore system. The workshop was specifically aimed at teaching participants how to design, construct and use the improved fish smoking Thyarore system.

## 3. Organization of the training

The workshop was organized by FETA in collaboration with the FAO/Smartfish programme.

## 4. Programme, venue and participants

### 4.1 Participants

The workshop drew participants from various East African countries: Kenya, Uganda, Rwanda, Burundi and Tanzania. A full list of the participants can be found in Annex 1.

## 4.2 Venue

The training workshop was conducted at FETA, at the Nyegezi campus in Mwanza, Tanzania. The campus has various modern and traditional fish processing facilities used for training at different levels.

## 4.3 Programme

The workshop programme can be found in Annex 2.

The CEO of FETA started by thanking the Guest of Honor for accepting to officially inaugurate the Regional Training Programme on the Thyarore System. He gave a brief background on the course highlighting the fact that the origin of the training workshop was the situation analysis on fish technology status in Africa which was undertaken during an FAO sponsored expert consultation meeting held in Mahe, Seychelles, from 22 to 25 November 2011. The consultation meeting raised a number of resolutions including the vision for regional collaboration which focuses on the '**Promotion of appropriate fish technologies for market accessibility**'. He went on to further explain that FAO/smartfish initiatives would fulfill this vision. He also explained the various aspects of the programme including how Tanzania and the regional as whole is benefiting from it. The full speech can be found in Annex 3.

The Guest of Honor welcomed participants to Mwanza city by giving explanation on important historical sites found in the region. He outlined various challenges facing fishery industry in developing countries including high post harvest losses. He further pinpointed the importance of new fish smoking system to the livelihoods of local communities who most are fishers. The whole speech is attached in Annex 3. The Director of FETA – Nyegezi campus gave a vote of thanks to the Government of Tanzania for continued support and to the FAO for financing various regional initiatives on reducing post harvest losses including the regional course on improved fish smoking using Thyarore system.

The opening ceremony was conducted at FETA Nyegezi Campus in Mwanza Tanzania. Top officials from the Regional Government Authority of Mwanza, Tanzania and Governments Institutions and FETA attended the opening ceremony.

## 4.4 Training Sessions

The training sessions were divided into theoretical sessions conducted in the classroom, aimed at providing participants with background knowledge on the Thyarore system followed by practical sessions, aimed at equipping participants with practical skills on the design, construction and operation of the system.

#### **4.4.1 Theory session**

The theoretical part of the training focused mainly on the different components making up the Thyarore system. In addition, detailed training was also given on the advantages of Thyarore over other smoking techniques especially concerning its ability to reduce the level of polycyclic aromatic hydrocarbons (PAHs) to between 2 µg/kg and 5 µg/kg, which is the internationally acceptable level. The system has other advantages such as being easier to operate, quicker, as well as using less energy (firewood) than the common charcoal oven. It was explained that the system's ability to reduce PAHs comes from a smoke filter, complete with coconut husks or other material, which extracts some of the smoke contents, including the PAHs.

It was also explained that the presence of an oil collector in the system helps reduce the rapid burn time of firewood caused by the oil produced during the smoking process. The oil collected can also be used for other things such as the production of detergents; added to fish feed; and after refining has the potential to provide a source of Omega 3.

Furthermore, the trainer explained that the air blower allows a continuous stream of air to circulate in the system, thereby ensuring enough heat to enable the rapid drying of the fish being smoked. The facilitator stressed the need for strong bricks to construct the system because of the weight of the different components that it must hold. Another important aspect to be considered is the levelling and concreting of the area surrounding the unit that will allow for easy movement of the heating component. It was explained that to get better quality smoked fish, it is important to choose good quality fresh fish and use firewood which is known for its fish smoking quality. The theoretical session included a presentation of the equipment necessary for the construction of the system.

#### **4.4.2 Practical session**

The participants took part in various practical training activities. The first part of the practical session involved taking measurements and the construction of the system, the second part was about preparing the fish for smoking using the system followed by the actual smoking process.

During the first practical session, participants took note of the various measurements required for the different components of the system, cutting aluminium sheets and joining pieces together to form the required components. Components included the smoke generator, the smoke filter, the oil collector, the fish tray, the heating component and the top cover. The construction of the components took two and half days. Participants also built a brick oven. The oven was built in two parts, one for smoke impaction and the other for drying. The floor around the oven was also levelled and laid with concrete.

The second practical session involved the preparation of fish for smoking. The fish used was Nile Perch and Lake Victoria Sardine. The participants washed the larger fish and removed the guts, gill, and scales. A portion of the dressed fish was split and the other portion was cut into reasonable sized pieces. The fish was then allowed to drip dry in the shade for about one hour.

The final practical session involved the actual smoking process, in which participants assembled and lit the fire in the smoke generator and controlled the complete smoking process. Hardwoods were used for smoking, and a little water was added to the smoke filter to ensure effective filtration of the PAHs. The smoke impaction process took one hour and drying took one and a half hours. Drying was done in another section of the Thyarore system using burning charcoal as the source of heat. The air blower helped to ensure constant air circulation for the fish to dry. Upon completion of the smoking process, the final product was assessed and tested by the participants.

#### **4.5 Training evaluation**

An understanding of learning for this training course was conducted using a pre- and post-evaluation of the participants' knowledge. The results indicated that participants were satisfied with the way in which the programme was arranged, managed and disseminated. However, the time allocated for the whole programme was rated as too short, especially in terms of the practical skills for a new technology. It was suggested that similar training programme should allow for a few more days in the future. Teaching materials, methodology and tutorage were highly rated, and the trainees were very interested in the construction and operation of the system. Pre- and post-evaluation tables can be found in Annex 4.

### **5. Closure of the training workshop**

The training workshop was officially closed by the organizers, who thanked everybody for their good work and cooperation. Participants were urged to finalize their action plans and to go back and immediately adopt the FAO-Thyarore Technology (FTT) system in their respect countries. A representative for the participants gave a vote of thanks and appreciation. Certificates were awarded to participants before their departure.

## Annex 1. List of participants

Name	Title	Country	Location	Email	Phone
Seraphin Niyonsenga	Acting Director of Planning	Rwanda	Kigali	niseraphin@yahoo.fr	+250 78 856 90 37
Gregoire Dusabemungu	Researcher	Rwanda	Kigali – RAB	gregoiredusabe@yahoo.fr	+250 78 886 56 53
Sara Bawaye	Fisheries Inspector	Uganda	Entebbe	sbawaye@yahoo.co.uk	+256 772 665626
James Mulamba	Senior Fisheries Inspector	Uganda	Entebbe	muljames@yahoo.co.uk	+256 772 515780
Grace Namukasa	Fisheries Inspector	Uganda	Entebbe	anatseba@yahoo.com	
Peter Enyagu	Fisheries Inspector	Uganda	Entebbe		
Anrnold Mbunda	Fish Technologist	Tanzania	Bagamoyo	mbundaarnold@yahoo.com	+255 755 191833
Wenceslaus Rugonzaiye	Fisheries Officer	Tanzania	Mwanza	rugonzaiye@yahoo.ca	+255 767 47 11 42
Esau Kakwezi	Fisheries Technologist	Tanzania	Mwanza		
Evariste Rumbete		Burundi	Bujumbura	evru2002@yahoo.fr	+257 79 475 777
Joseph Ndikumana		Burundi	Bujumbura	ndikumana2008@yahoo.fr	+257 77 780 553
Khadija Mghamba	Fisheries Technologist	Tanzania	Mwanza	nimkhadija@yahoo.com	+255 755 30 60 62
Melkizedek Koddy	Senior Fisheries officer	Tanzania	Dar es Salaam	koddymk@gmail.com	+255 754 20 95 35
Albert Mwangi	Consultant	Kenya	Siaya	albmwangi@yahoo.com	+254 722 658470
Ronald Deche	Assistant Fisheries Officer	Kenya	Ukunda	ronald.deche@gmail.com	+254 735 24 24 21
Simon Munguti	Principal Fisheries Officer	Kenya	Migori	Kaloki2005@yahoo.com	+254 728 75 57 95
George Otieno	Principal Fisheries Officer	Kenya	Homa Bay	Gotieno2001us@yahoo.com	+254 733 32 46 93
Yahya Mgawe	Chief Executive - FETA	Tanzania	Bagamoyo	ymgawe@yahoo.com	+255 492 2988
Oumoul Khary Ndiaye		Senegal	Dakar		
Ambakisye Simtoe	Principal Fisheries Officer	Tanzania	Bagamoyo	ambakisyes@yahoo.com	+255 784 443566

## Annex 2. Workshop agenda

Day 1, 4 November 2013		
08.30 - 9:00	Registration of Participants	Secretariat
	<b>Session 1 Opening remarks</b>	
09.00 - 9.30	Welcoming address by FETA CEO	Yahya Mgawe, CEO FETA
9:30 - 10:00	Welcoming address by SmartFish	
10:00 - 10:30	Opening speech by Government of Tanzania	RC - Mwanza
10:30 - 11:00	<i>Coffee/tea break and group photo</i>	Secretariat
	<b>Session 2: Introductory presentations</b>	
11:00 - 11:30	Pre-training evaluation	Secretariat
11:30 - 12:30	Introduction to African fish processing techniques	Yahya Mgawe CEO FETA
12:30 - 13:00	Video presentation of FTT System	Yahya Mgawe
13:00 - 14:00	<i>Lunch break</i>	Secretariat
	<b>Session 3: Thyarore System</b>	
14:00 - 15:30	Introduction to the Thyarore System	Mrs Ndiaye
15:30 - 16:00	<i>Coffee/tea break</i>	Secretariat
16:00 - 16:45	FTT design and preparation	Mrs Ndiaye
16:45 - 17:00	Wrap up and closure of the first day	Yahya Mgawe,
Day 2 – Day 4, 5 - 7 November 2013		
08.30 - 9:00	Recap of previous day	Participant
09.00 - 10.30	Design and construction of an FTT System	Mrs Ndiaye
10:30 - 11:00	<i>Coffee/tea break</i>	All participants
11:00 - 13:00	Design and construction of an FTT System	Mrs Ndiaye
13:00 - 14:00	<i>Lunch break</i>	All participants
14:00 - 15:30	Design and construction of an FTT System	Mrs Ndiaye
15:30 - 16:00	<i>Coffee/tea break</i>	All participants
16:00 - 16:45	Design and construction of an FTT System	Mrs Ndiaye
16:45 - 17:00	Wrap up and closure for the day	Secretariat

<b>Day 5, 8 November 2013</b>		
08.30 - 9:00	Recap of previous day	Participant
09.00 - 10.30	FTT system operations	Mrs Ndiaye
10:30 - 11:00	<i>Coffee/tea break</i>	All participants
11:00 - 13:00	FTT system operations	Mrs Ndiaye
13:00 - 14:00	<i>Lunch break</i>	All participants
14:00 - 15:00	FTT planning and budgeting African Network on Fish Technology and Safety (ANFTS) awareness	Yahya Mgawe
15:00 - 15:30	Testing FTT processed products	All participants
15:30 - 16:00	<i>Coffee/tea break</i>	All participants
16:00 - 15:00	Post-learning test / training evaluation Closing ceremony	Secretariat



## Annex 3. Speeches

### **Welcoming remarks by FETA Chief Executive, Alhaj. Y. Mgawe.**

Hon. Regional Commissioner, Evarist Ndikilo,  
FETA Nyegezi Centre Director, Mr Charles Swai,  
FETA, Director of Training, Mr Ambakisye Simtoe,  
Workshop Facilitator, Mrs Oumou Khairy Ndiaye,  
Head of the National Fish Quality Laboratory, Mr Stephen Lukanga,

Distinguished Participants, Colleagues, Ladies and Gentlemen,

On behalf of the Fisheries Education and Training Agency (FETA) and on my own behalf, I would like to take this opportunity to welcome all of you to FETA-Nyegezi Campus for the opening ceremony of the Regional Training Workshop on Fish Processing Technology organized jointly by the FAO/SmartFish Programme and FETA. Before I proceed, Ladies and Gentlemen, please allow me to thank our Regional Commissioner for heeding our invitation to grace this occasion despite being overloaded by numerous administrative duties. We thank you sir for your continued support.

Distinguished Participants, Ladies and Gentlemen, my obligation here is to narrate the genesis of this Regional Training Workshop, and of course to invite our Chief Guest to open the Workshop. Indeed, being a poor politician, I feel I should stick to what I have been asked to do instead of wandering into a field that I am not skilful.

Ladies and Gentlemen, the origin of this Training Workshop was the situation analysis on fish technology status in Africa conducted during FAO sponsored expert consultation meeting held in Mahe, Seychelles, from 22 to 25 November 2011. The consultation meeting in discussion came out with a number of resolutions including the vision for our regional collaboration which focuses on "Promotion of appropriate fish technologies for market accessibility".

During the meeting it was noted that the business environment for fish and fishery products in the world is changing rapidly. The market is expanding as a function of population growth, which in turn drives increased demand for fish. Certainly, high fish price in global fish market is an opportunity for fishers to secure greater benefits. Unfortunately, accessibility to rewarding markets is being curtailed by stringent quality demand. In view of this situation, there is an urgent need to do our homework; that of assisting fishers to mitigate the challenges.

Currently, most of the fish landed in rural areas of sub-Saharan Africa is preserved by curing methods. The market for cured fish products is growing all over the world including in Europe where there is an increasing population of people in the Diaspora. However, selling cured fish in this lucrative market would require one to meet emerging EU regulations on cured fish coming into force between 2012 and 2014.

In a nutshell, the competitive cured fish market compels effective improvement of traditional fish processing techniques employed in our region.

Consequently, participants to the Seychelles meeting agreed to strengthen inter-regional collaboration through sharing of experience and learning from each other. Good enough, during the same meeting participants were informed that the Institute of Technological Research in Senegal under an FAO-sponsored programme have innovated improved fish smoking technique.

The technique, which is named FAO-Thyarore Technology (FTT), can control the concentration of Poly Aromatic Hydrocarbon (PAH) in smoked fish. Hence, using FTT improves quality of smoked fish for successful accessibility to rewarding international markets such as the EU, and also protects domestic consumers. Indeed, the cost-effectiveness and suitability of this technology in Small-scale Fisheries coupled with proven initial laboratory test results were highlighted.

The meeting made a strong recommendation that other countries should look into the possibility of testing and use the FTT as one way of mitigating post-harvest challenges. It is on this premise that The Fisheries Education and Training Agency (FETA) requested FAO/SmartFish Programme to facilitate the organization of this important Regional Training Workshop. The request was granted and we are here today - Thanks to the FAO/SmartFish Programme for their generosity. The main objective of this training is to internalize practical aspects of the FAO-Thyaroye Technology before its wide dissemination in our region.

We are indeed, very fortunate in having with us here Madame Oumou Khairy Ndiaye, a renowned fish processing expert from Senegal, who would provide basic frames of reference with regards to construction and use of the FAO-Thyaroye Technology - You are most welcome to East Africa Madame Ndiaye.

Hon. Regional Commissioner, Ladies and Gentlemen, let me remind you that this would not be the first time for us to borrow a technology from Senegal. As a matter of fact, back in the early 1990s we did a similar move on insulated fish containers. I am glad to inform you that the Senegalese insulated container was successfully adopted and is widely used in Lake Victoria Nile Perch fishery. Therefore, we are optimistic that the FAO Thyaroye Technology would also gain acceptance among small-scale fishers in our region and thus improve their competitiveness in fish trade for sustainable socio-economic wellbeing of fishers and consumers.

With these remarks, Ladies and Gentlemen, I now welcome the Mwanza Regional Commissioner, Hon. Evarist Ndikilo to open our workshop.

Thank you for your attention.

**Guest of Honor Speech: Hon. Eng. Evarist Ndikilo, Mwanza Regional Commissioner**

The CEO of the Fisheries Education and Training Agency (FETA);

The International Expert on fish processing technology;

The SmartFish Representative;

Distinguished local and international participants;

Ladies and Gentlemen.

It is an honour and pleasure for me to have the opportunity to officially open this very important regional training workshop on Post Harvest fisheries technology. This training comes at a time when different countries, particularly in sub-Saharan Africa are striving to ensure food security and nutrition for their people, in addition to enhancing revenue-generation from fish and fisheries products.

Before I proceed, I would like to welcome all participants to this workshop, particularly those who have come from countries in the region. I am made to understand that participants have come from 6 countries of the region. And these include: Burundi, Kenya, Rwanda, Uganda, Senegal and the host Tanzania. Your presence at this workshop is not taken for granted, in view of the various commitments you have back home. Please feel at home in this pearl of peace of Africa, and in particular this lakeshore city of Mwanza - we fondly call, Rock City. I also extend a special welcome to the Senegalese expert, who has come to facilitate this workshop.

Ladies and Gentlemen,

I have been informed that the specific aim of the workshop is to develop the capacity of fisheries officers in post-harvest fish processing technology, especially using a '*Thyarore*' technology which was innovated in Senegal through technical partnership between FAO and the Senegalese government.

The importance of this workshop, therefore, cannot be overemphasised in view of the significant role fisheries play in the socio-economic development of the countries in the Region. As a case example, Tanzania statistics show fish play a crucial role in terms of providing food fish supply, income generation, employment and foreign exchange earning to the country. According to available statistics, the industry employs over 200,000 fishers in primary industry and millions in secondary sub-sector including: net-making, fish handling, processing and marketing. On average, we harvest about 360,000 tonnes of fish per annum from our marine and inland water sources.

Ladies and gentlemen,

Ladies and gentlemen, we are all aware of the fact that harvesting sector of small-scale fisheries in sub-Saharan Africa is faced with a number of challenges including over-fishing, over-capacity, illegal fishing, and environmental degradation.

In addition, the post-harvest sub-sector is highly affected by high post-harvest fish losses and marketing bottlenecks. All these factors combined together have made fishers in our region remain poor despite the rich fishery resources we have.

Wealth in our region is increasing; food import bills have been increasing as well. If fishers are to benefit from opportunities presented by the growing food fish demand from urban populations, market channels between rural areas and cities must be significantly improved. Simply, fish standards and grades offer potential benefits all the way down the supply chain, from price premiums for fishers to better health and safety for consumers. Getting there, we have to help small-scale fishers to become better able to compete internationally through technology transfer.

Likewise, we all know that global food fish insecurity is most acute today than before. Fisheries productivity growth has been low for many years compared to global population growth and increased demand for nutritious fish. As a recent FAO report (FAO: 2012 Annual report) noted, global fisheries faces the biggest challenge in achieving long-term productivity growth to feed the growing population. Hence, this could be a blessing in disguise; our fishers can access better fish markets and secure greater post-harvest benefit from the increased global demand.

However, regional and international fish trade is becoming increasingly competitive. Currently, many fishers are unable to obtain good prices for their fish just after harvesting due to the glut. Consequently, they incur market forces loss because they hardly know how to process and preserve their products until their actual sale and delivery at the most opportune time to gain the highest price. Simply, our fisheries suffer high post-harvest losses.

Participants, Ladies and Gentlemen,

It is disheartening to learn that despite the efforts that have been deployed, our fisheries still face significant challenges of post harvest fish losses on a rampant scale. In Tanzania, fish post harvest losses are estimated at about 10% - 20% of the fish catches. For example, fishers engaged in Lake Victoria sardine fisheries, locally known as *dagaa*, suffer astronomical high post-harvest losses during rain season when sun drying processing method becomes ineffective.

It is reported that such high post harvest fish losses seem to be the norm for sub-Saharan Africa, rather than an exception, especially in small-scale fisheries production. Indeed, this is an unacceptable situation in a continent marked by food shortages, malnutrition and widespread vulnerability factors, while its population is on the increase. Therefore, the reduction of post-harvest fish losses is of vital necessity if the aim of reaping greater socio-economic benefits from fisheries, hinged on a sustainable exploitation, is to be achieved. Such an effort would ensure enhancing fish availability, access, supply stability, and, health safety in utilization.

Ladies and gentlemen,

It is true that we are faced with a number of challenges. Taking fish from the fishing ground to consumers is rather complex because fish is among the most perishable food stuff we have. But what I am saying is; we cannot surrender to these challenges sitting as if there are no technical solutions to the problems. That means, we have to do our homework to ensure that we harvest our resources reasonably, handle and process our fish adequately to reduce losses, and meet product specifications as stipulated by domestic, regional and international fish markets.

In this context, dissemination of appropriate technology based on experience of those who have been successful, is a prerequisite to enable fishers to preserve the fish adequately. This would enable them time their sales right and get the best price while reducing risk associated with post-harvest fish losses. It is against this background that strong networking among fisheries practitioners in Africa is crucial.

I am indeed delighted to hear that you are going to share knowledge, skills and experience from Senegal. I am told that this would not be the first time East African region and Tanzania in particular has borrowed a fisheries technology from Senegal. The first time was back in 1990s when the Senegalese insulated container was introduced in our Lake Victoria Nile perch fishery. To date that technology has been widely adopted in improving fish quality and reducing post-harvest fish losses. We look forward to another success story from this training workshop.

Also, I have been made to understand that through FAO patronage fish processing experts in Africa have established an African Network on Fish Technology and Safety (ANFTS) with Tanzania hosting its secretariat. I commend the collaborative initiative and urge the Fisheries Education and Training Agency (FETA) who have been entrusted with the responsibility of running the secretariat to play their part and not to let us down.

Although it would not be realistic to expect that we can tackle all the challenges in a short span of time, but I am optimistic such technical collaborative arrangements would enable us make the difference. The use of improved fish processing technology would enable fishers produce standard products which can be preserved for relatively longer period of time or to time their sales right to get the best prices. Again, with shared technology and improved ICT we should be able to place our fish beyond regional frontiers to secure greater post harvest benefits and reduce socio-economic vulnerability in our communities.

Ladies and gentlemen,

It has to be noted that quality standards are essential for improved fish trade in our region and beyond. Hence, technological knowledge on how to meet these standards would enable fishers to comply with them through out the chain from harvesting to retailing.

Therefore it is important to ensure we disseminate appropriate fisheries technologies to enable our fishers become competitive. We have to enable them deliver uniform identifiable products to lucrative markets and get better prices and in so doing increase their income and improve socio-economic livelihood in communities.

Similarly, fishers with well-preserved fish can deposit their produce in a reliable warehouse, obtain receipt and, when prices rise, sell that receipt to someone further down the chain. The one with receipt can then pick up the fish from the warehouse for onwards selling at a profit. Further, the owner of the receipt can use it as collateral to borrow from a bank. Indeed, such structured fish trading is one way we can use in transforming our small-scale fisheries in the region.

Ladies and gentlemen,

Please, allow me to conclude by repeating once again, that our ambitious objective is to secure greater post-harvest benefits in fishing communities. To reach this objective, however, our great concerted effort is imperative. There is a need for a higher focus on management of existing fish resources by reducing waste, adding value, and improving the efficiency of handling, processing and marketing of fish.

It is with this thought and expectation that I believe you would be able to bring to light many significant findings and ideas that will undoubtedly be mutually beneficial. I pray that you have pleasant training, fruitful discussion and more important internalize the 'thyarore' fish smoking technology. I appeal to you to be active and contribute fully in the sessions so that you acquire the requisite skills and knowledge as a basis for conducting productive field assignment back home.

Ladies and Gentlemen,

On behalf of the countries represented here, I commend FAO for its commitment on issues of food security and socioeconomic development of rural communities in our region. Also, let me take this opportunity to thank the EU-funded FAO/SmartFish Program for enabling us hold this regional training workshop in Tanzania. Let me assure FAO and SmartFish of continued support from the Tanzanian Government through provision of the requisite enabling environment.

A special message to the participants from other countries; please feel free, Tanzania is the pearl of peace of Africa, take this opportunity of coming to this workshop, as a window to learn and enjoy the Rock City.

With these remarks, Ladies and Gentleman, I declare this workshop officially opened.

Thank you for your attention.

## Annex 4. Workshop training and evaluation

### Pre-training evaluation

Pre-course evaluation (average score and comments)						
	AREA/LIKERT SCORE	1 (Poor)	2 (Rather poor)	3 (Average)	4 (Good)	5 (Excellent)
1	Arrangement for transport				Good	
2	Pre-training information delivery				Good	
3	General organization				Good	
4	What are the main traditional fish processing methods in your country? <ul style="list-style-type: none"> <li>Smoking and sun drying: 53%</li> <li>Salting and fermentation: 25%</li> <li>Other: solar drying</li> </ul>					
5	What are the most common post harvest losses in your country? <ul style="list-style-type: none"> <li>Quality loss: 68%</li> <li>Physical loss: 16%</li> <li>Chemical loss: 10%</li> <li>Other losses: market and economic losses</li> </ul>					
6	What contributes to high post harvest loss in your locality? <ul style="list-style-type: none"> <li>Poor handling and inadequate storage facilities: average 90%</li> <li>Lack of market information: average 85%</li> <li>Poor processing methods: average 32%</li> </ul>					
7	Mention any four compounds impacted by smoke during smoking which lowers quality of fish? <ul style="list-style-type: none"> <li>PAHs</li> <li>Volatile fatty acids</li> <li>Sulphur compounds</li> <li>Phenols</li> </ul>					
8	What do you expect to gain from this training programme? <ul style="list-style-type: none"> <li>Emerging technology on improved fish smoking</li> <li>Safe smoking principles</li> </ul>					

## Post-training evaluation

<b>Course evaluation (average score and comments)</b>					
<b>AREA/LIKERT SCORE</b>	<b>1 (Poor)</b>	<b>2 (Fair)</b>	<b>3 (Good)</b>	<b>4 (Very Good)</b>	<b>5 (Excellent)</b>
Overall Impression of the Teaching materials	-	16%	42%	42%	-
Time allocated for the whole program	42	16%	42%	-	-
Tutorage and practical arrangements	6	36%	42%	16%	-
Quality of training aids	6	36	32%	16%	16%
Food and refreshments	-	6%	36%	42%	16%
Balance between practical and theories	-	20%	42%	22%	6%
<b>Future improvements</b>					
<ul style="list-style-type: none"> <li>Allocate more time in the future especially when training involves the application of new technology</li> </ul>					
<b>Did the training meet your expectations?</b>					
<ul style="list-style-type: none"> <li>Expected outputs: average 92%</li> <li>The training will improve my work: average 85%</li> </ul>					
<b>Any other comments</b>					
<ul style="list-style-type: none"> <li>Materials and FTT accessories should be prepared in advance</li> <li>Include time for sight-seeing in the time-table</li> <li>More practical sessions required for the successful adoption of the FTT system</li> <li>Prepare technical drawings for FTT system for easy construction</li> </ul>					



## Annex 5. Photo

**Photo 2: Participants taking various measurements from the smoke filter**



SmartFish is a regional fisheries project managed by the Indian Ocean Commission, funded by the European Union and co-implemented by the Food and Agriculture Organization of the United Nations. SmartFish, which operates in 20 countries throughout the East and Southern Africa - Indian Ocean region, focuses on fisheries governance, management, monitoring, control and surveillance, trade, and food security.

The business environment for fish and fishery products worldwide is rapidly changing. The market is expanding as a result of population growth and higher fish prices on a global level highlight an opportunity for fishers to secure greater returns. However, access to the more profitable markets requires stringent quality standards that fishers in the region have not yet attained.

Most of the fish landed in rural areas of sub-Saharan Africa is preserved by curing methods and the international market for cured fish products is growing, together with market competition. In order to enable fishers from the region to access and compete in the growing market appropriate technologies must be shared.

This report highlights the contents of a regional training workshop on improved fish smoking using the Thyarore System that was conducted in Mwanza, Tanzania in November 2013. This technique, known as the FAO-Thyarore Technology, can control the levels of Poly Aromatic Hydrocarbon in smoked fish. The use of such technology can improve the quality of smoked fish for international markets and at the same time will protect domestic consumers. Participants from six African countries (Burundi, Kenya, Rwanda, Uganda, Senegal and Tanzania) took part in the training and have returned home to promote this new technology for greater market gains in the future.



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