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Processing and marketing of small-sized pelagics in Eastern and Southern Africa



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PREFACE

Post-harvest losses are highest among the small-sized pelagic fisheries in Eastern, Central and Southern African (ECSA) countries. The species include *Rastrineobola argentea* (Omena/ Daga/Mukene), Haplochromines (Fulu, Nkejje), *Limnothrissa moidon* and *Stolothrissa tanganicae* (Kapeta) *Poecolthrissa mweruensis* and *Poecolthrissa bangweluensis* (Chisense), *Brycinus nurse* and (Ragoge) *Neobola bredoi* (Muziri). These small-pelagic species are basically processed by the traditional method of sundrying, which is a nature-dependent method and highly ineffective during the rainy season. Spoilage of harvested fish is common and partly caused by inadequate preservation methods and storage facilities. Also the shelf life of the processed products is shortened by inadequate packaging, which results in fragmentation of product and loss of quality. Consequently, most products are processed for animal feeds rather than for human consumption. For example, within the Lake Victoria Basin, 80% of the total Daga catch is transformed into animal feeds and only 20% enters the direct human consumption value chain.

The preparation of this simplified manual is driven by the need to promote regional fish trade and to address the imbalances in fish distribution, access, availability, security and nutrition to the consumers across various the trading blocks. Although the region is rich in fisheries resources, the utilisation options of the catches are generally poor. The purpose of this manual, therefore, is to adapt the traditional preservation methods to minimise impact of climate change and weather dependence and thus improve trade in fish for human consumption.

The Lake Victoria Fisheries Organization (LVFO) is a specialised body of the East African Community (EAC) established in 1994 by the Partner States to jointly manage the fisheries of Lake Victoria. The LVFO works in partnership with the fisheries institutions, fisher communities, the industry and development partners to improve fish handling, processing and marketing of fish and fishery products.

In 2006, the LVFO national and regional status reports on Daga identified slow adoption of recognised processing techniques was due to lack of knowledge and a premium market. The Regional Working Group on Fish Quality, Safety, Product Development and Marketing (FIQA RWG) under LVFO prepared a draft training Manual for Daga processing, that was designed to increase supplies for human consumption. The improved methods include sundrying, salting, smoking, frying, milling and fermentation. The methods were tested and demonstrated with the participation of the processors and traders at various fish landing beaches/sites in Kenya, Tanzania and Uganda. The products were tested at various market outlets to show potential adopters, that with a small investment and improvement in processing techniques, the products can be profitably bought at a premium price.

EXECUTIVE SUMMARY

This simplified manual is a genesis of the technical training manual and directed at the end-users to allow for the easy application of improved techniques by the fish processors and traders. Customers are urged to demand better quality products as a means of promoting the wider use of improved processing techniques and enhancements to regional fish trade. Use of the Manual will enhance trade in quality and safe Dagaa products.

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The Food and Agriculture Organisation (FAO), Rome is thanked for initiating and supporting activities to reduce post-harvest losses in the tropical fisheries that led to the improvement of various traditional processing techniques in Africa and in particular, Eastern Africa, without which this manual would not have been prepared.

The European Union is specifically appreciated for providing a grant for the Implementation of a Fisheries Management Plan (IFMP) Project for Lake Victoria, a project managed by the LVFO, through which the processing techniques have been tested and demonstrated and this document was prepared.

The EU-funded SmartFish Programme (Implementation of a Regional Fisheries Strategy (IRFS) for the Eastern Southern African and Indian Ocean), coordinated by the Indian Ocean Commission (IOC) in Mauritius, is specifically thanked for supporting the final technical inputs as well as the publication and distribution of this manual.

1. INTRODUCTION

This manual is a detailed version of a technical manual for trainers, which has been prepared for self-administration for targeted users who may include small and medium sized fishers, processors and traders. It has been designed to guide the users in the handling, processing and marketing of small-sized pelagic fishes such as *Rastrineobola argentea* (Omena/Dagaa/Mukene), Haplochromines (Fulu, Nkejje), *Limnothrissa moidon* and *Stolothrissa tanganicae* (Kapeta) *Poecolthrissa mweruensis* and *Poecolthrissa bangwelensis* (Chisense), *Brycinus nurse*, (Ragoge) and *Neobola bredoi* (Muziri) and similar low-value pelagics commonly used as supplements in the manufacture of animal/fish feed.

For the purposes of this manual, *Rastrineobola argentea* (Omena/Dagaa/Mukene), has been used as an example because of its abundance, popularity and commercial importance in the fisheries of the Eastern, Central and Southern African (ECSA) region. Consequently Dagaa is referred to throughout this manual, but with the understanding that the techniques and information presented can be similarly applied to other small pelagics from the region.

This manual has been prepared to show different improved methods that can be used to process Dagaa. The methods are aimed at reducing the reliance on weather conditions for processing the fish and will also improve its quality, reduce the post-harvest losses, widen its use and meet consumer demands of local and regional markets. The simplicity of the methods and the minimal inputs required will attract artisanal processors and traders in the industry. Their involvement and increased empowerment will increase their incomes and competitiveness. This user-friendly manual has also been designed to increase the knowledge-base of the users through self-administration due to limited extension services within the region. The use and adoption of the suggested methods and practices will increase the supply, incomes, nutrition, food security, per capita fish consumption and livelihoods of the region.

The manual has been prepared in 11 sections,:

- | | |
|------------------|--|
| <i>Section 1</i> | Introduction |
| <i>Section 2</i> | Provides an introduction to Dagaa (the species) and the processing and marketing of Dagaa in the Eastern Central and Southern African (ECSA) region. It also assesses the current situation pertaining to Dagaa processing, general aspects of fishers' livelihoods at landing sites, major constraints and opportunities. |
| <i>Section 3</i> | Highlights the importance of personal hygiene as well as the cleanliness of the processing area (landing sites/beaches). It also gives the theoretical background information on proper handling, processing and marketing of Dagaa in relation to sanitation and hygiene. Other related topics that may arise will also be discussed. |
| <i>Section 4</i> | Looks at the different methods of maintaining Dagaa quality and provides information on the chemical composition of Dagaa, how fish becomes spoiled and how it affects the quality of fish. It |

also provides information on practices that can be applied to reduce fish spoilage, which may be closely related to major factors that affect fish processing.

- Section 5* Provides guidelines for construction or putting in place processing facilities such as drying racks, the Chorkor kiln and fuel saving stoves. The facilities are constructed from locally available materials to reduce costs.
- Section 6* Describes various processing methods used to preserve Dagaa namely sun-drying, deep-frying, smoking, salting, fermentation and icing/freezing. Each processing method is described step-by-step for ease of understanding. These steps are simplified in product flow charts with the help of diagrams and pictures. It is also encourages the processor to try it out on their own.
- Section 7* Shows how other value-added products can be made from products described in *Section 5*. For example, weaning food and health supplements can be produced from milled Dagaa mixed with flours from other food items.
- Section 8* Provides information on marketing of Dagaa products, existing and potential markets including the distribution chain for Dagaa. It also offers guidance on requirements for trading in Dagaa products.
- Section 9* Presents business tips for a successful Dagaa enterprise targeting fish processors and traders.
- Section 10* Outlines the basic cost-benefit analyses for the Dagaa processing methods and the respective products. The processors and traders are encouraged to record all the expenditures incurred and diligently cost their labour inputs for each product made, although the idea is not familiar to Dagaa processors/traders.
- Section 11* Emphasizes the sharing of information between the Dagaa processors and traders on products, existing and potential markets, consumer requirements and quality specifications.

2. DAGAA

2.1. THE FISH AND FISHING

Silver fish (*Rastrineobola sp*) is known by different local names in each riparian state: “Omena” in Kenya, “Dagaa” in Tanzania and “Mukene” in Uganda. Dagaa is the term recognised internationally and is therefore used in this document. Dagaa is a small pelagic fish measuring about 5cm in length at maturity, found in several lakes within Eastern, Central and Southern Africa, such as Lake Victoria, Nyasa/Malawi, Tanganyika, Kyoga and Albert. There are many other similar species of small pelagic fish in various water bodies within the region. Lake Victoria, the largest freshwater lake in Africa covering approximately 68,800 km² is the major commercial inland fishery in Africa. It is shared by Tanzania (51% by area), Uganda (43% by area) and Kenya (6% by area). It is a source of livelihood for up to 2 million of the 30 million or so residents in the Lake Victoria Basin. In recent years, Dagaa is the major commercial fishery of Lake Victoria comprising 60% of the total catch but the quantities vary with different water bodies.

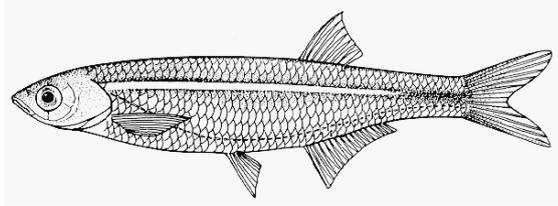


Figure 1 Dagaa (*Rastrineobola argentea*)

The catching of Dagaa is largely based on the attraction of fish by an artificial light source often provided by kerosene pressure lamps. Dagaa nets are of small mesh, which can be operated as seine nets, boat seines, lift nets and scoop nets. The minimum net mesh size is 10mm on Lake Victoria allowed by law in Kenya, Tanzania and Uganda for fishing for Dagaa. There are seasonal variations in catches linked to the lunar cycle. During full moon, the catches are very low and catches are highest during the darkest nights with little or no moon. After capture the Dagaa is traditionally processed mainly by sun drying on bare ground, which leads to high post-harvest losses especially during the rainy season.

2.2. DAGAA POST-HARVEST SUB-SECTOR

The Dagaa fisheries in ESA is characterized by high postharvest losses, low product quality, narrow product base, limited market access against a background of food insecurity and low incomes. Dagaa is caught in large quantities which make it difficult to hygienically handle on board. During fishing several hauls are made in one night and the first batch may stay longer in the canoe, spoil faster and cross-contaminates the rest of the batches. Under artisanal conditions, it is difficult to preserve Dagaa using ice. Sometimes fishermen will stand on the fish and crush it, which damages the texture and resultant products. Dagaa is usually spread on bare ground for drying and because of that the fish picks up sand, dirt and other contaminants like dust, animals, birds and other pests. Flies will also lay eggs on the fish. During the rainy season drying takes a long time and spoilage increases. This results in low quality products and low market value.

During storage and transportation, the dried fish may get wet either from rain or lake water or exposure to high humidity and spoilage may occur. During storage insects can also attack the dried fish and cause damage.

Marketing of Dagaa is done by the processors themselves, agents or middlemen. Dagaa may be traded at the local, national and regional markets like DRC, Burundi, Rwanda, South Sudan and others (e.g. Zambia and Malawi). It may be sold as food for human consumption or animal feed manufacture. Currently, 20% of Dagaa goes for human consumption while 80% is processed for animal feed.

3. HYGIENE AND SANITATION

3.1. REQUIREMENTS FOR PERSONAL HYGIENE

Personal hygiene is meant to ensure that those who come directly or indirectly into contact with Dagaa minimise contamination by:

- Maintaining an appropriate degree of personal hygiene
- Behaving and operating in an appropriate manner

Why do you have to maintain personal hygiene?

It is to prevent contamination of Dagaa and the likelihood of transmission of illness to consumers.

a) Health Status

- If a person is suffering from any disease (diarrhoea, vomiting, fever, sore throat with fever, visibly infected skin lesions (boils, cuts, etc.) and discharges from the ear, eye or nose) should not enter Dagaa handling area.
- Any person so affected should immediately report illness or symptoms of illness to the management and should be treated by recognised health facility.

b) Personal Cleanliness

- Dagaa handlers should maintain a high degree of personal cleanliness and where appropriate, wear suitable protective clothing (apron, overcoat and wrapper), head covering and footwear.
- Protective clothing should be worn and maintained in a sanitary manner.
- Cuts and wounds, where personnel are permitted to continue working, should be covered by suitable waterproof dressings.
- Personnel should always wash their hands:
 - At the start of Dagaa handling activities;
 - Immediately after using the toilets; and
 - After handling raw fish or any contaminated material, where this could result in contamination of other fish.

c) Personal Behaviour

- People engaged in Dagaa harvesting and handling activities should refrain from eating, use of tobacco or chewing gum or unhygienic practices such as spitting, sneezing, unguarded cough, picking nose and ear. All the above bad practices should be prohibited in fishing vessels, landing sites and processing sites.

- All persons entering Dagaa handling and processing designated areas should remove jewellery and other objects that could fall into or otherwise contaminate Dagaa. Jewellery that cannot be removed, such as wedding bands and medical alerts, should be covered.
- Personal effects such as cloth, bags and shoes should not be kept within Dagaa handling and processing areas.

d) Passengers/Visitors/Cargo

- Fishing vessels should not carry passengers and other cargo.
- Unauthorised person should not enter Dagaa boats, handling and processing area

3.2. HYGIENIC REQUIREMENTS FOR LANDING SITES

a) Hygienic conditions for landing sites/beaches

- Fish should be landed only on gazetted landing sites/beaches.
- Landing beaches should be established with the consent of the Competent Authority (CA), if or other available body
- Operational guidelines for approved and established landing beaches should be in place.
- Fish handling should be carried out in such a manner as to avoid damaging or bruising the Dagaa flesh.
- Transfer of Dagaa from fishing vessels to weighing sheds should be done quickly to prevent spoilage.
- The containers (trays/crates, buckets, etc.) used for transferring fish from the fishing boat to a weighing shed should be made of washable and non-corrosive material.
- The handlers should wear approved working uniforms.
- Landing sites shall be fenced off from other activities and a gate installed at the main entrance.
- Landing sites should have good, adequate and well separate sanitary facilities.
- Smoking, spitting, eating, drinking, sleeping, washing of personal effects including laundry, fish processing and trespassing should not be allowed within the fenced area of the landing site.
- Vehicles, fishing boats and engines should not be repaired or serviced within the fenced area of the landing site.
- Off-loading and loading of engines, fuel, passengers and any cargo except fish should not be allowed within the fenced landing site.
- Where available, Beach Management Units should assist in the enforcement of sanitary standards

4. MAINTAINING DAGAA QUALITY

4.1. WHAT IS DAGAA MADE OF?

Like other fish species, Dagaa is made up of the usual food constituents namely; water, proteins, fats, vitamins, minerals and some small amounts of carbohydrates.

Due to the small size of Dagaa and its high moisture content, the fish is easily attacked by bacteria that cause spoilage. High ambient temperatures and exposure to air (oxygen) are particular factors which increase the spoilage rate of the fish.

4.2. WHAT IS FISH SPOILAGE?

Fish is an extremely perishable foodstuff. Spoilage or decomposition is the change in fish, which can cause loss in quality. Spoilage starts immediately after fish dies. It involves a series of complicated changes brought about by mainly enzymes and bacteria. However, prolonged exposure under high ambient temperatures can also initiate fat deterioration known as oxidative rancidity in addition to enzymatic and bacteria spoilage.

By and large, spoilage as a process is exacerbated by several factors, which include high temperatures, fishing methods, handling practices/facilities and the microbiological load along the handling and marketing chain. The level of deterioration determines the sale ability of the product and whether the fish is sold for human consumption, or fed to animals.

4.3. WHAT IS FISH QUALITY?

Quality refers to the aesthetic appearance and freshness or degree of spoilage, which the fish has undergone. Drying Dagaa on bare ground inevitably introduces sand soil and other domestic waste, which characterizes a poor quality final product and undoubtedly fetches a low price. However, drying on raised racks ensures that the quality of Dagaa is maintained and ultimately fetches higher prices.

In Lake Victoria a parasite called Ligula intestinalis is quite common in Dagaa. It is unsightly but generally when Dagaa is salted and spread out to dry, it crawls out. With more salt and higher solar heat the rate at which the parasite leaves the fish is increased. When birds and chickens invade a drying surface, more often than not they prefer the dried form of the parasite to fish.

4.4. DAGAA SPOILAGE

a) What causes Dagaa to spoil?

Dagaa spoils very quickly because of spoilage bacteria. The situation is worsened by high temperatures, poor handling practices and inadequate preservation facilities.

b) How can you know that Dagaa has spoiled?

- The fish muscles soften and when pressed with a finger, the depression remains showing texture damage
- The eyes become unclear and sunken
- The scales are easily removed
- The skin colour becomes dull
- Fish easily breaks (fragments)
- Offensive bad smell

c) How can we minimize spoilage in Dagaa fishery?

There are several low cost ways by which spoilage can be minimized in Dagaa.

- Lower temperature by sprinkling cold water or keeping catch under shade with gentle breeze to slow down spoilage bacteria and/or chemical processes. Use melting ice is recommended. Use of crushed block ice directly on the fish, damages fish texture and expose it to spoilage.
- Rinse each haul of fish, apply dry salt (1Kg of salt to 20Kgs of fresh Dagaa) and place in shallow containers with small holes to allow drainage of water. Containers may be woven baskets, large plastic buckets or meshed hessian bags. Applying dry salt on Dagaa facilitates the subsequent sun-drying process.
- Undertake short fishing trips and avoid prolonged fishing trips to reduce spoilage
- Land catches early in the morning when temperatures are still low
- Preserve fish immediately by either sun-drying or any other method of choice
- Never step on fish as it damages the fish.

5. PREPARATION OF PROCESSING FACILITIES

This section gives guidelines for preparing the facilities required for Dagaa processing.

5.1. CONSTRUCTION OF THE DRYING RACKS

a) Materials required

Tree poles or metallic angle bars (preferably aluminium), nails, etc.

Points to note

- The racks should be at least 1 m from the ground to hasten the drying process.

- The racks should be slanted to avoid water pools that would otherwise affect the drying rate.
- The racks may be overlaid with old mosquito nets or hessian sheets that have been stitched together from ripped bags.
- If wire mesh is overlaid on racks, salted products should not be allowed to come in contact with it because of corrosive effect of salt.
- If poles have been treated with some form preservative, Daga product should not be allowed to come in contact with it.
- The racks may also be constructed with a roof covered with polythene sheets

Overall, the structure should be similar to figure below

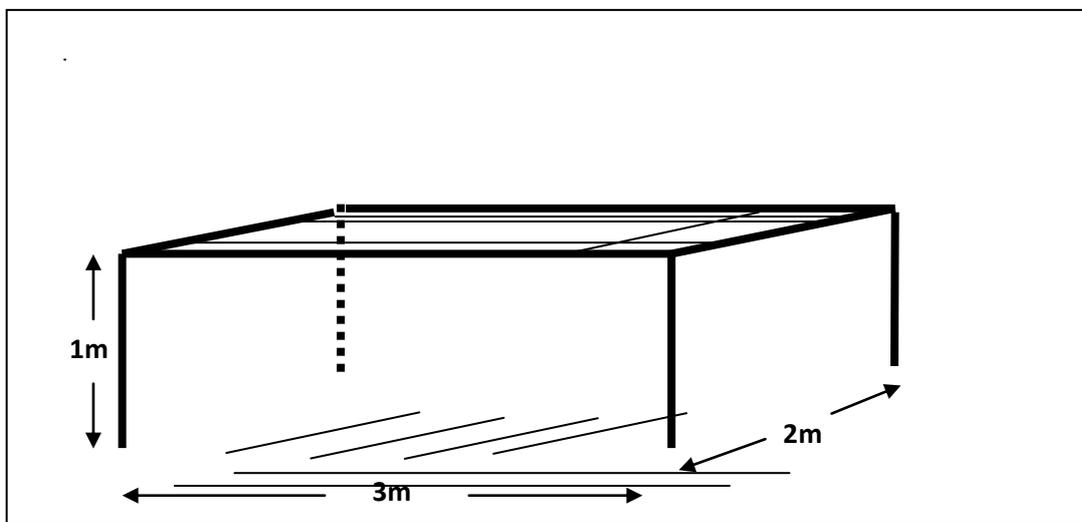


Fig.2 Schematic of typical drying rack

5.2. CONSTRUCTION OF CHORKOR OVEN

The Chorkor oven and smoking trays should be constructed as shown below:

a) Tray construction

Materials include the following:

- Wood planks
- Wire net
- About 50 nails

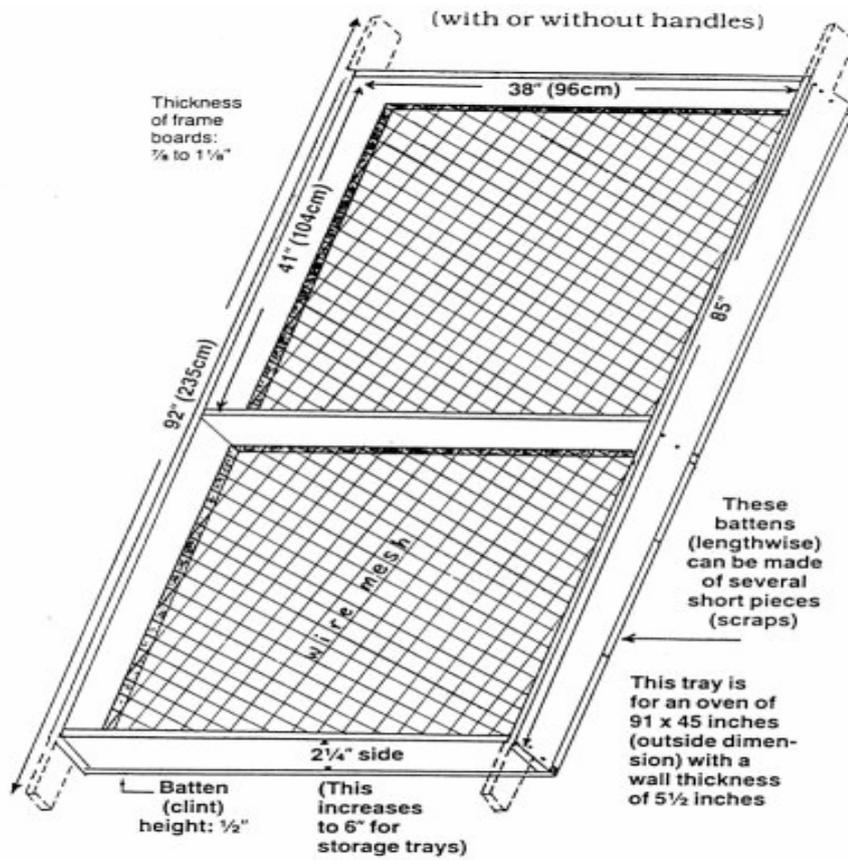


Fig. 3 Tray for Chorkor kiln

b) Chorkor Oven construction

Materials include the following:

- Unbaked or baked bricks.
- Clay mud to be used as mortar.
- Metal blades –30cm length and 5 cm width to support a smoke spreader.
- Perforated iron sheet for a smoke spreader

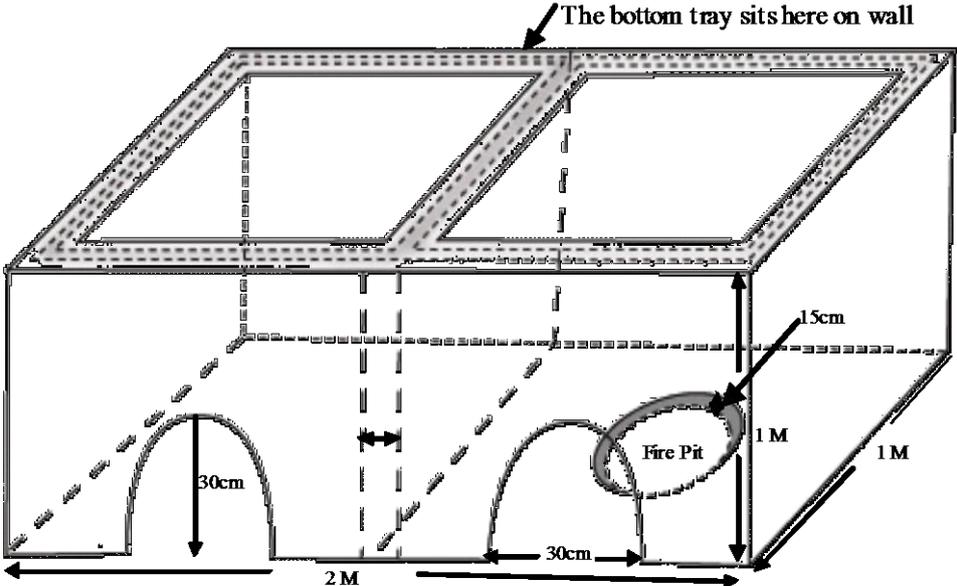


Fig. 4 Design and measurements for a battery of two-chambered Chorkor kiln

6. PROCESSING METHODS

There are several processing methods that may be used to preserve Dagaa namely:

1. Sun-drying
2. Deep frying
3. Smoking
4. Salting
5. Fermentation
6. Icing/Freezing

NB: Salt is applied to enhance the quality of the product and facilitates the drying process.

Dagaa is preserved for several reasons:

- Extension of product shelf-life
- Reduction of post-harvest losses.
- Responding to market demands
- Meeting consumer preferences and choices
- Product diversification and increasing utilization options for Dagaa

6.1. SUN DRYING

This is a method of processing involves drying freshly caught Dagaa in the sun for about 4 to 6 hours.

a) **Materials required for the production of high quality sun-dried Dagaa**

- Use raised racks as in Fig. 2
- Freshly caught high quality Dagaa
- Containers (buckets or basins)
- Clean water
- Packing materials (cleanable bags)
- Well ventilated and vermin-proof store
- Labour force (at least 2 people)

b) Steps to follow when processing sun-dried product from Dagaa

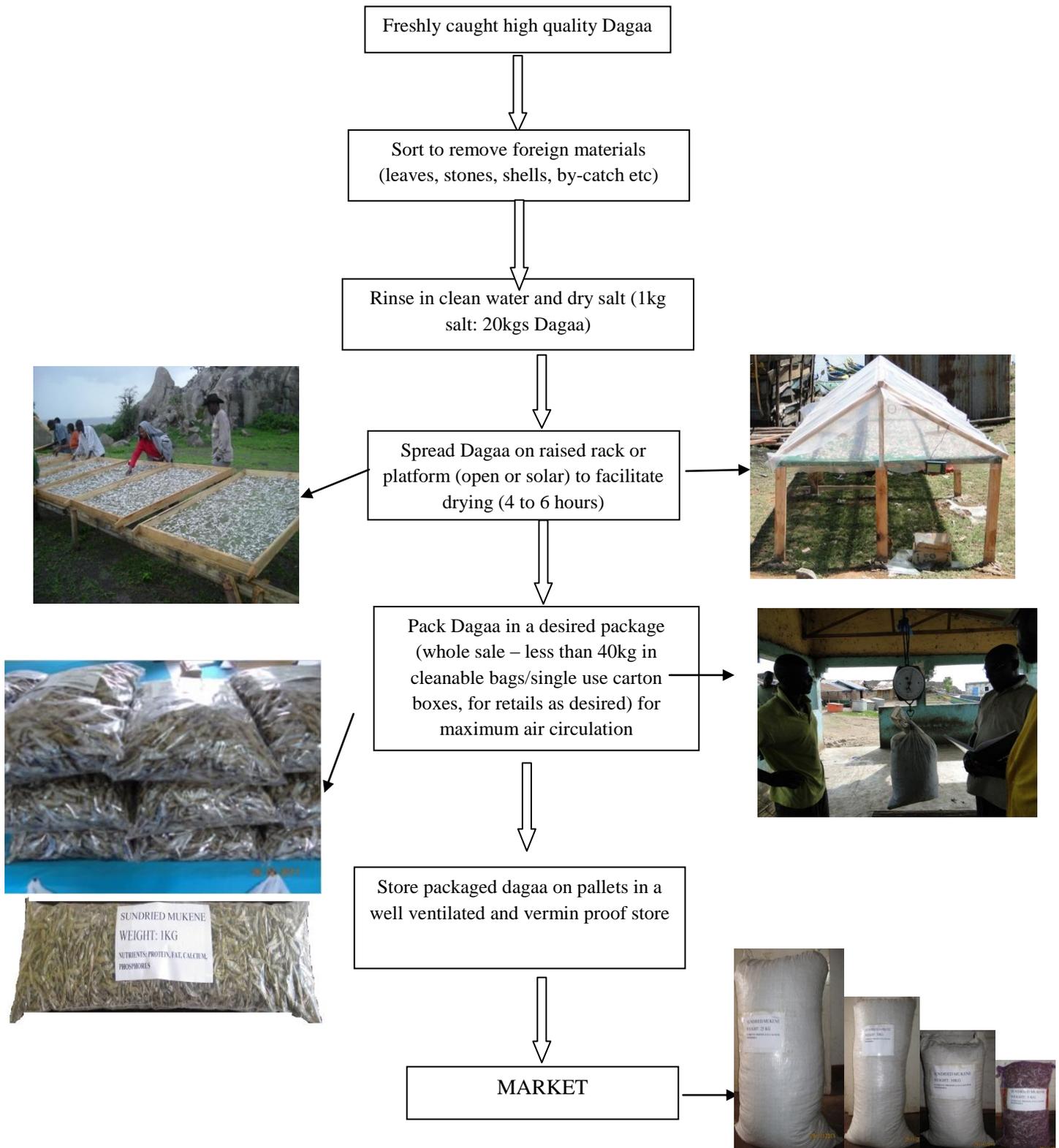


Fig. 6. Process flow diagram for sun-dried Dagaa product

c) Storage life

High quality sun dried Dagaa can be kept for up to 6 months provided the following points are observed:

- Storage containers like plastic or hessian bags should be adequately secured to avoid moist air and insects entry and stored in a well-ventilated store
- Dagaa may be re-dried periodically (every 2 months) to discourage development of moulds, fungi, bacteria and insect larvae.

6.2. DEEP FRYING

This is a method of processing which involves frying freshly caught Dagaain hot oil. The resultant product is crispy and ready to eat as a snack.

a) Materials required

- A tray for drip drying made of hardwood planks
- Freshly caught high quality Dagaa
- A charcoal stove/kiln and fuel source.
- A container for washing and salting.
- Frying pan and ladle.
- Vegetable oil
- Salt and spices of choice.
- Packaging material and a sealing facility.
- Muslin cloth/sieve for draining excess oil.

(a) Charcoal stove



(b) Kiln



Fig 5 Deep-frying Dagaa using locally available facilities (Charcoal stove and Kiln)

b) Steps to follow when processing deep frying product from Dagaa

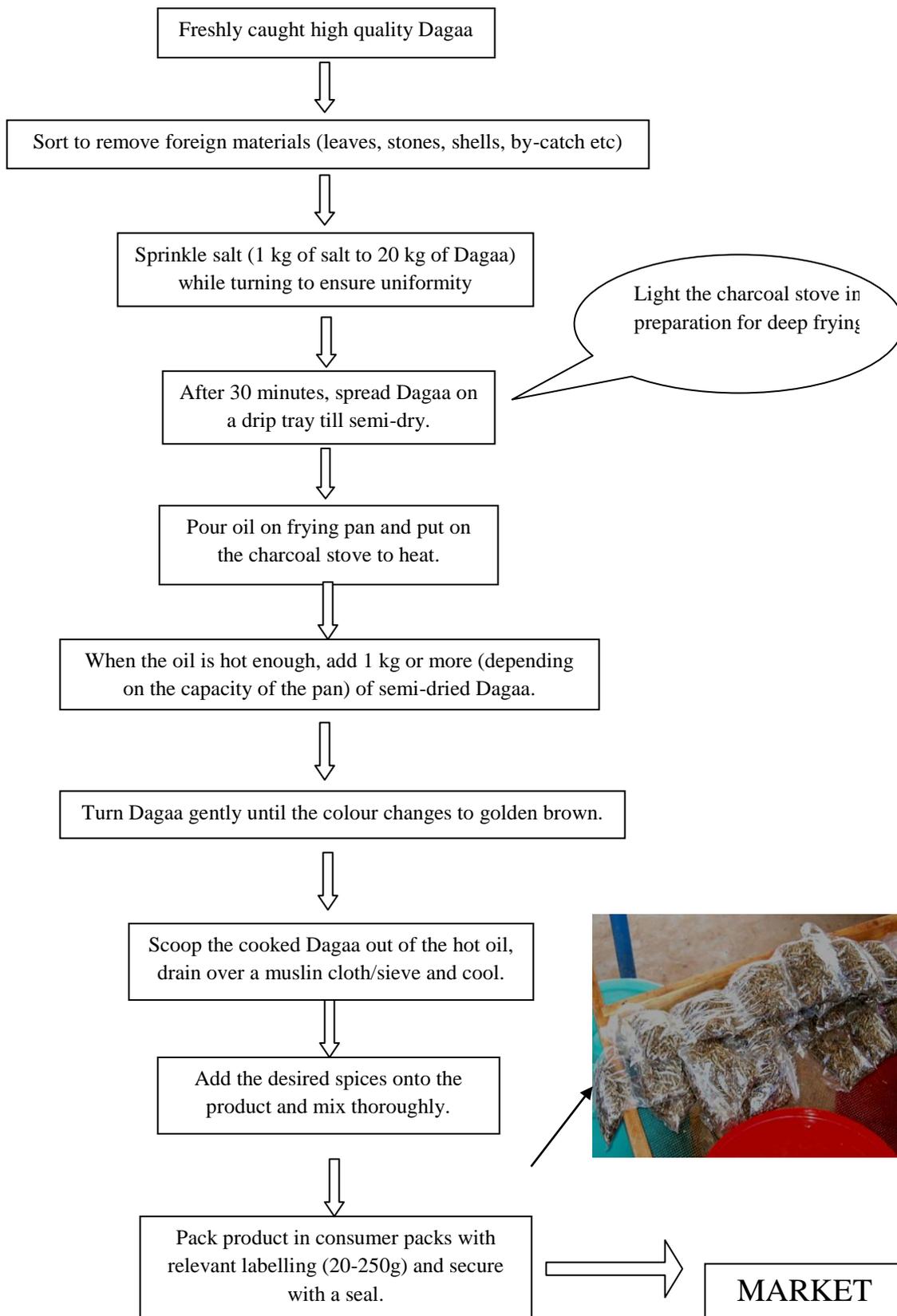


Fig.7: Processing steps for salted fried Dagaa

c) Points to note

- The Dagaas must be allowed to drip dry sufficiently so that it is crispy. Also if not sufficiently drained the water can cause the spraying of hot oil that can burn processor.
- The draining of excess oil over the sieve/ muslin cloth should be thorough.

d) Shelf life

Deep fried Dagaas can be kept for up to 6 months provided the following points are observed:

- Storage containers like plastic or hessian bags are adequately secured to avoid moist air and vermin (insects, pests etc.).
- Dagaas may be re-dried periodically (every 2 months) to discourage development of moulds, fungi, bacteria and insect larvae.
- Exposure to air may cause Dagaas to go bad giving bad flavours, taste etc.

e) Packing for market

- Pack fried Dagaas in polythene bags of various quantities and then transport to the market place.
- Avoid putting heavy objects on the products.

f) Marketing

- Fried Dagaas has ready markets locally (super markets, shops) for snacks and regionally.

6.3. SMOKING

Smoking dries, preserves and imparts a smoky flavour to Dagaas. Smoking can be done using a smoking kiln/oven such as Chorkor oven and trays.

a) Materials required for production of high quality Dagaas smoked product

- Freshly caught high quality Dagaas
- Clean water
- Containers (buckets or basins)
- Vegetable oil
- Iodized salt free from chemical contaminants
- Trays (5-10) depending on available quantities
- Kiln with multiple fire chambers
- Packing materials (cleanable bags)
- Well ventilated and vermin-proof store
- Labour force (at least 2 people)

b) Steps to follow when processing smoked product from Dagaa

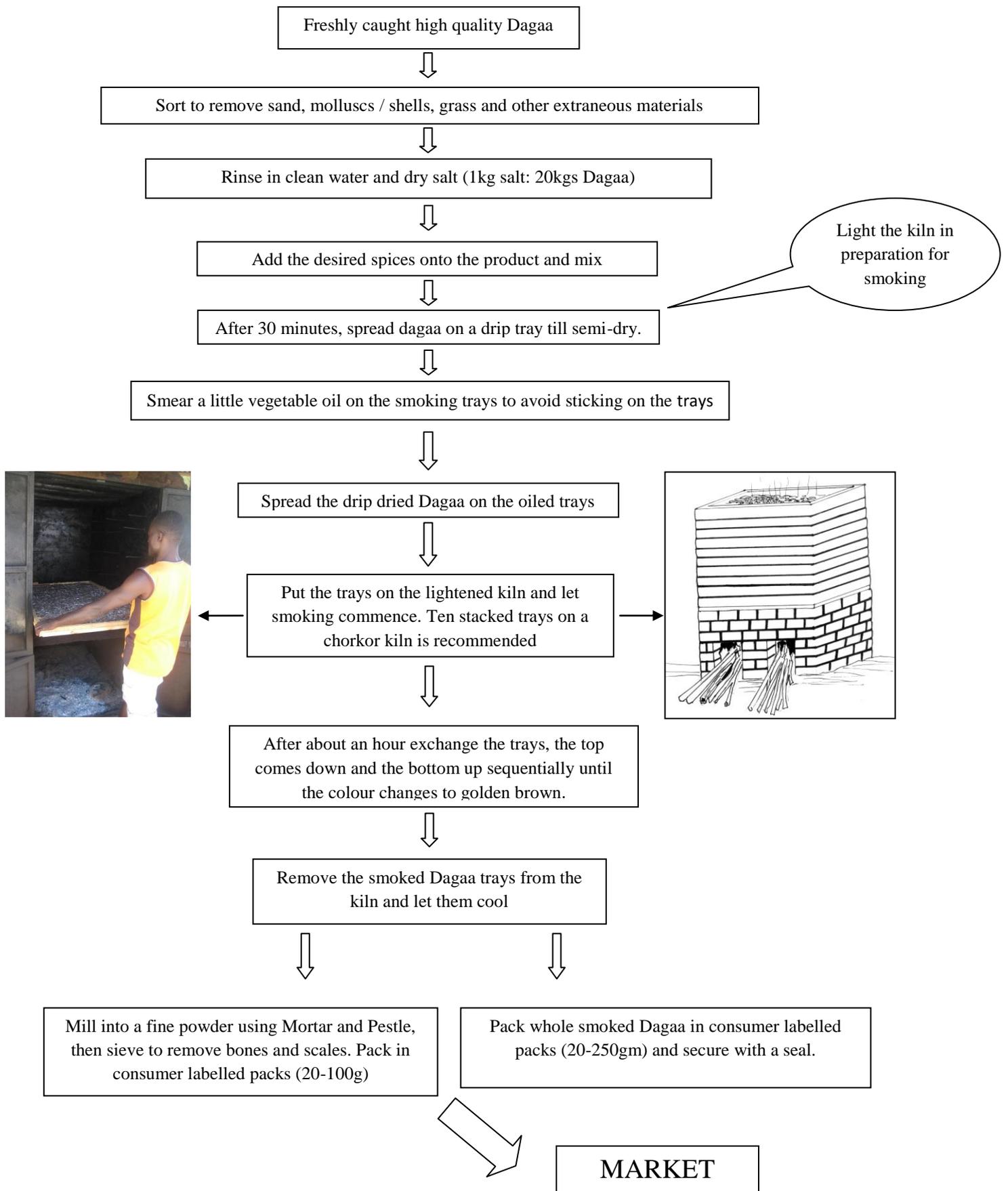


Fig. 8 Process flow diagram for smoked Dagaa product

c) Points to note

- Do not use water collected from the shoreline instead collect water from off shore (at least 100m from shoreline)
- Ensure that foreign materials including sand and mud are removed completely.
- Use large containers for washing Dagaa to avoid breakage and spillage.
- Do not pick Dagaa when it spills on contaminated surfaces
- Ensure that the salt procured for salting should be clean, iodized and free from chemical contaminants
- Buy salt from recognized retailers
- Ensure that contact time of 10 - 15 minutes is maintained for all Dagaa batches to be smoked
- Do not use rusted trays for drip-drying Dagaa
- Ensure that the trays are off the ground.
- Keep turning over the Dagaa to facilitate drip-drying.
- Protect Dagaa from birds and domestic animals
- Evenly spread Dagaa on trays to ensure maximum capacity.
- Ensure that the wooden framework of the tray 'sits' on the brickwork to avoid unnecessary kiln fires
- Ensure that consecutive trays fit closely to avoid loss of smoke and heat.
- The stacking height should not exceed 10 trays otherwise they will topple over and sometimes it is cumbersome whilst stripping the kiln.
- The trays should be changed regularly to avoid burning of the product
- Do not put the trays on the ground instead rest the hot trays on a raised platform while changing them (stripping)
- Do not hurry to remove Dagaa from the smoking trays but instead leave it to cool for at least 30 - 45 minutes
- Empty Dagaa onto a clean container for subsequent packaging and storage
- It is recommended that retail packs of milled smoked Dagaa should not exceed 100gm because no profit will be made.
- Dagaa that is properly salted and smoke-dried can be kept for up to 6 months

d) Packaging for local or regional markets

- Pack cooled Dagaa as soon as possible,
- Avoid multiple handling of Dagaa.
- Storage containers like plastic or hessian bags should be adequately secured to avoid moist air and insect entry and stored in a well-ventilated store.
- Do not stack heavy luggage on top of packed Dagaa during transportation.
- At the market stall, use storage containers that can be adequately sealed against the introduction of moist air and insects

6.4. SALTING

Salting is a preservation method achieved by adding dry salt to the fish (dry salting) or dipping the fish to a strong solution of salt brine (wet salting). The salted Dagaa is then dried on a raised rack.

a) Materials required for production of high quality salted Dagaa product

- Freshly caught high quality Dagaa
- Clean water
- Containers (buckets or basins)
- Iodized clean salt free-from impurities
- Raised racks overlaid with old fishing nets or platforms (number varies with available quantities)
- Packing materials (cleanable bags)
- Well ventilated and vermin-proof storage
- Labour force (at least 2 people)

b) Steps to follow when processing salted product from dagaa

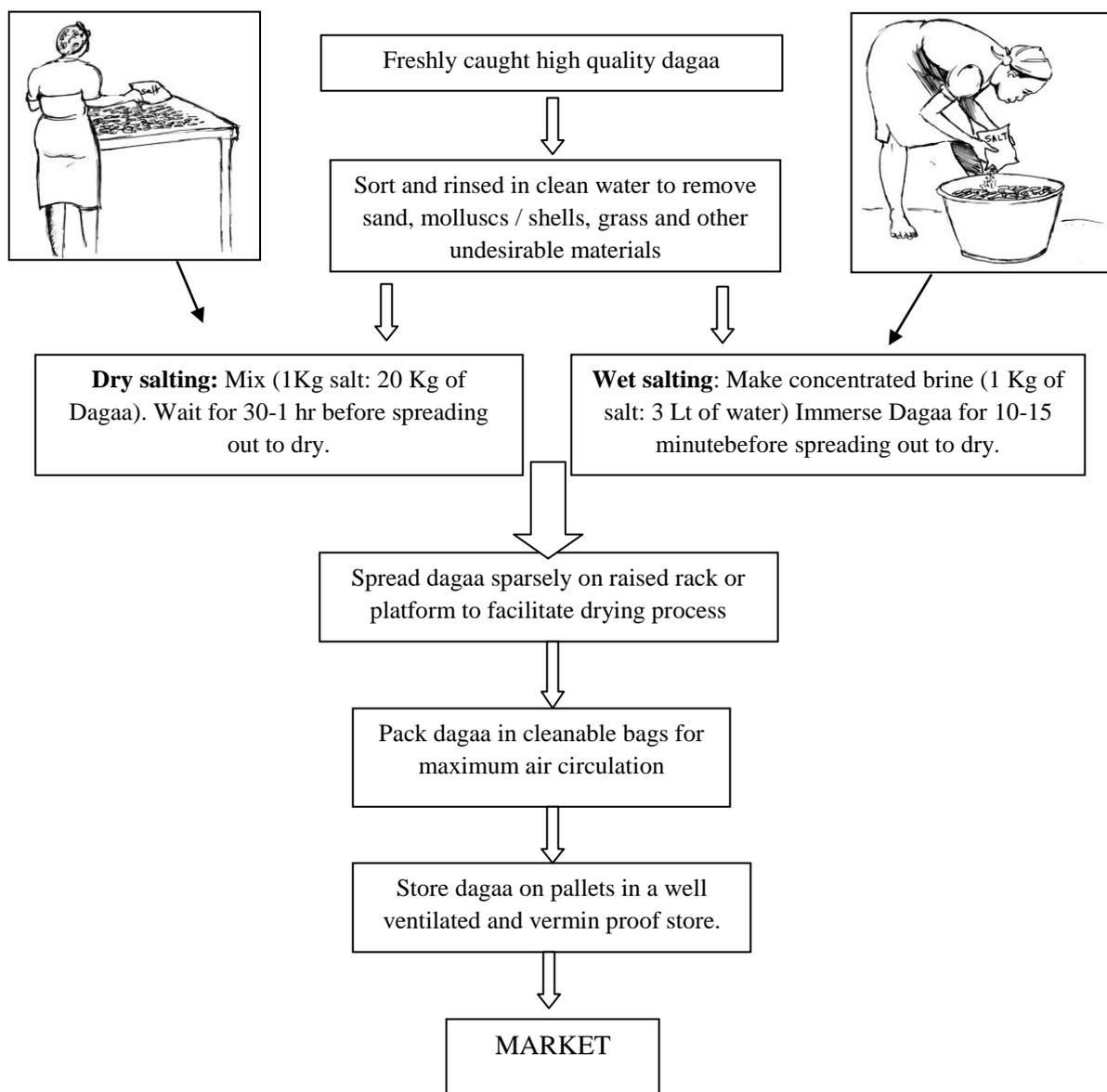


Fig. 9. Process flow diagram for salted Dagaa product

c) Storage life

Salted Dagaa can be kept for up to 9 months provided the following points are observed:

- Clean salt free from sand and chemical contaminants is used
- Storage containers like plastic or hessian bags are adequately secured to avoid moist air and insects' entry.
- Dagaa may be re-dried periodically to discourage development of moulds and, fungi.

d) Packing for market

Salted Dagaa may be packed in sisal or jute bags for easy transportation to market.

e) Marketing

The processed Dagua may be marketed for various purposes such food for human consumption, as well as weaning foods for babies and those who require high nutritional supplements.

There is potential for local and regional market for salted Dagua.

6.5. FERMENTATION

Fermentation is a method of Dagua preservation that allows the breaking down of protein and fats to a porridge-like form by using enzymatic action.

a) How does it preserve?

The fermentation process produces an alcohol which creates a hostile environment for spoiling bacteria as a result it preserves Dagua.

b) Materials required

- Raw materials - Dagua
- Polyethylene sheets
- A dug hole or container that can be sealed to exclude air
- A container for washing and salting
- Salt
- Packaging material

c) **Steps to follow when processing fermented product from Dagua**

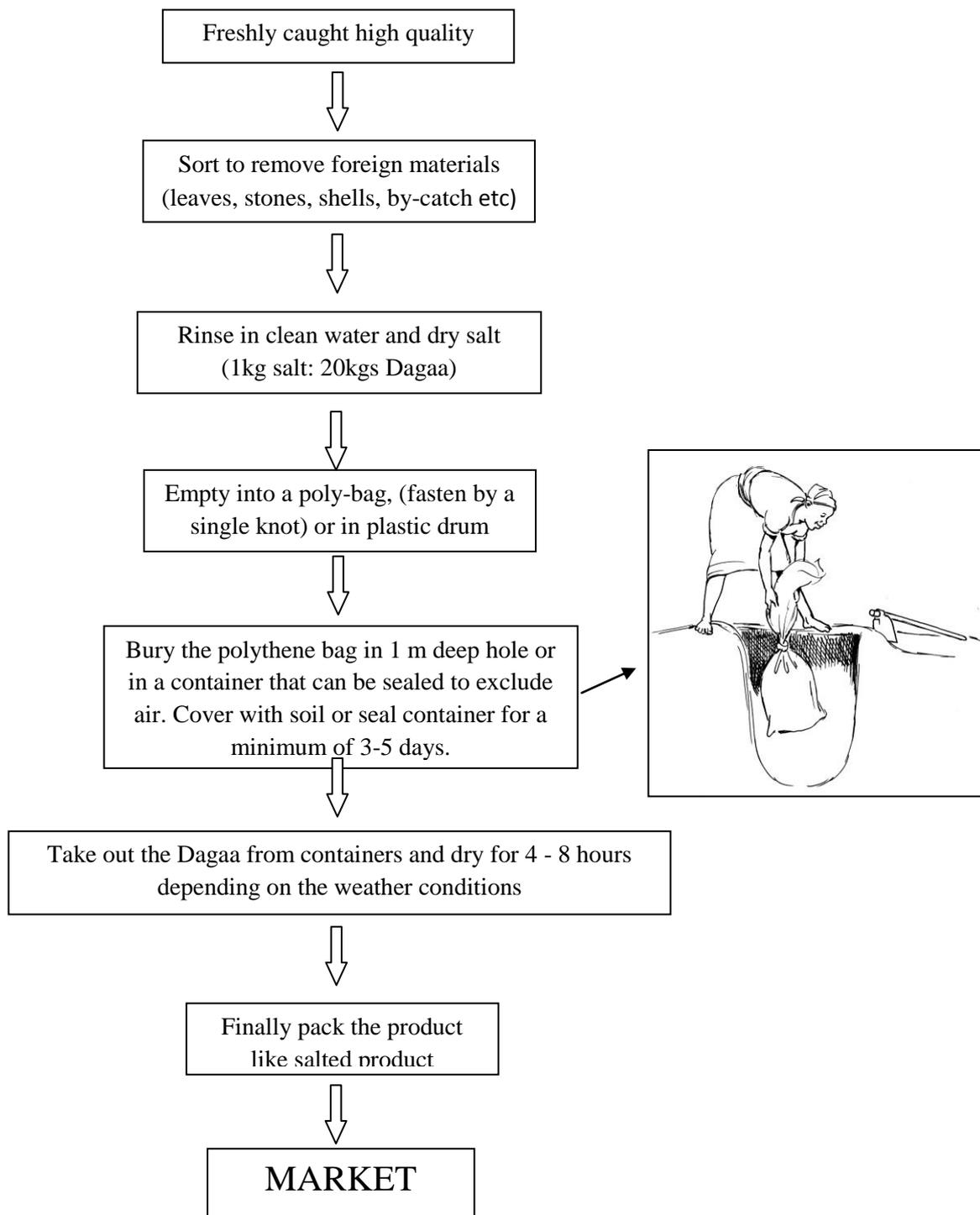


Fig. 10 Process flow diagram for sun-dried Dagua product

d) **Points to note**

- The racks should be at least 1 m from the ground to hasten the drying process.
- The racks should be slanted to avoid water pools that would otherwise affect the drying rate.
- The racks may be overlaid with old mosquito nets or hessian sheets that have been stitched together from ripped bags.

- If wire mesh is overlaid on racks, salted products should not be allowed to come in contact with it because of corrosive effect of salt.
- If poles have been treated with some form preservative, Dagaa product should not be allowed to come in contact with it.
- The dug hole should be protected from rain down pour that may wash out salt. (Note: sandy soils are better than loamy soils with respect to seepage)
- If a container is used, it should completely exclude air and be protected from water entry.

e) Storage life

Fermented Dagaa can be kept for up to 9 months provided the following points are observed: -

- Storage containers like plastic or hessian bags are adequately secured to avoid moist air and insects
- Dagaa may be re-dried periodically (every 2 months) to discourage development of moulds, fungi and halophilic (salt-loving) bacteria.

f) Packing for market

Fermented Dagaa can be packed in hessian or polythene bags for transportation to the market.

g) Marketing

Fermented Dagaa has ready markets locally and holds regional potential.

7. OTHER VALUE ADDED PRODUCTS

Dagaa flour can be produced by grinding/milling and pounding salted dried or smoked dried Dagaa.

Materials required:

- Cooking facility
- Manual/motorised mill/Mortar and Pestle
- Sieve
- Packaging material
- Carbohydrate flour; millet, sorghum, maize or corn, or other protein-based ingredients like groundnut.

7.1. SMOKED / DRIED DAGAA/GROUNDNUT MIX

a) Process steps

- Weigh the desired quantity of the already smoked/dried Dagaa.
- Mill Dagaa into flour.
- Sieve to remove the coarse component (if desired)

- Mix 1 Kg of Dagaal flour with 6 Kg of roasted powdered groundnuts for sauce (depends on the cost of groundnuts and the purpose for composite flour)
- Pack in 100 - 250g packs for marketing

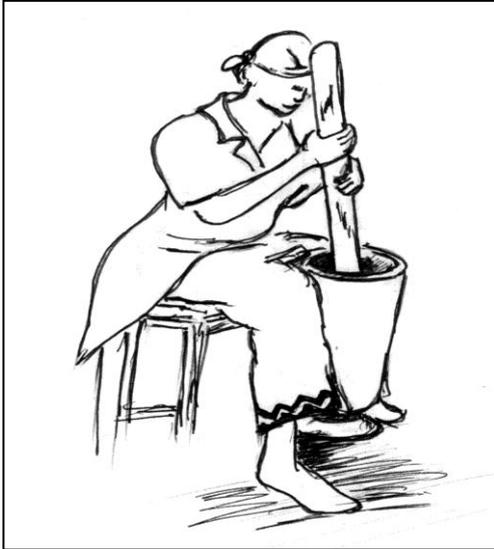


Fig. 11 Milling smoked Dagaal to flour using mortar and pestle

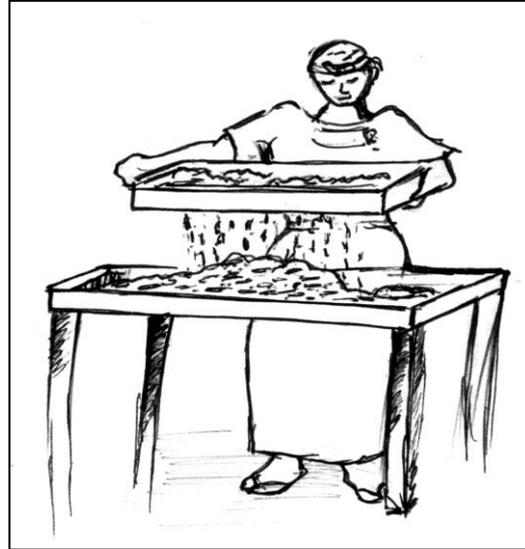


Fig. 12 Sieving Dagaal flour to remove coarse materials

7.2. BOILED AND SUN-DRIED DAGAA / MAIZE FLOUR OR SOYA MIX

a) There are two processing methods

- Cook for 15 minutes
- Cook until a paste is achieved.

b) Steps to follow when processing Boiled and sun-dried Daga / maize flour or soya mix

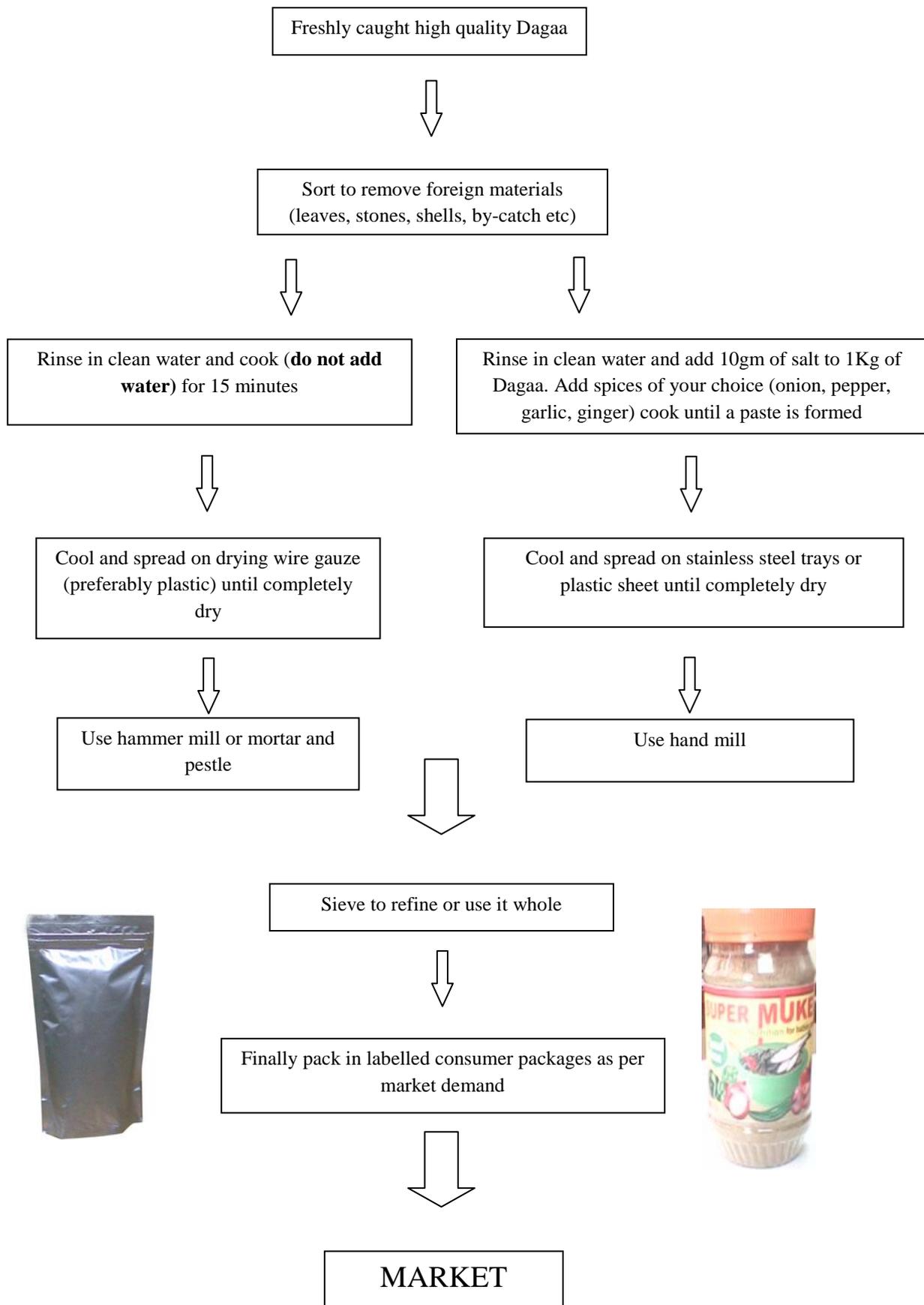


Fig. 13 Process flow diagram for boiled and sun-dried Daga / maize flour or soya mix

c) **Storage life**

The different mixtures of Dagaa-based products can be kept for various periods of time depending on the type of food ingredients included. The following factors should be considered: -

- Storage containers like plastic or hessian bags should be adequately secured to avoid moist air and insects.
- Milled mixtures should be kept in dry stores.

d) **Packing for marketing**

- Powdered Dagaa may be packed in various quantities and then loaded into cartons for transportation to market.

e) **Marketing**

- The processed Dagaa may be utilized for various purposes, such as food for human consumption (weaning foods for babies and nutritional supplements).
- These products have ready markets locally and regionally

7.3. ANIMAL FEEDS

Sun dried Dagaa is sold as a protein supplement for animal feeds manufacture. During rainy season when catch is high and drying is incomplete, the Dagaa may be made into fish silage for animal feed preparation.

Fish silage for animal feed is an alternative way of utilizing Dagaa without contamination with unwanted materials, which would solve quality problems in feed manufacturing. The production yield is 100% for liquid silage and 35% for stabilized version to which maize or rice bran is added to solidify before sun-drying.

a) **Steps to follow when processing Dagaa silage**

There are two methods available.

Method 1

Weigh 200 parts of clean and washed Dagaa to 2 parts of carbohydrate (cassava flour) and add 1 part of thinly sliced raw cabbage. Then mince the mixture into paste and keep in air tight container for 5 days.

Method 2

Weigh 200 parts of clean and washed Dagaa minced and add 7ml formic acid. Keep in air tight container for 2 - 3 days.

Both methods produce liquid silage can be directly used for animal feeds. Alternatively maize or rice bran can be added to thicken the mixture before sun-drying. The dried mixture is packed in hessian bags for transportation to market.



Fig. 14 Bottled liquid silage and packed a solid version

8. MARKETING OF DAGAA PRODUCTS

Upon identification of the type of the Dagaa product, it is important for the processor to determine the shelf life of the product so as to provide ample time for the trader to test and market the product. The onus is on the Dagaa trader to conduct reconnaissance trips to existing and potential markets to determine the market outlets, target group, consumer preference, product specification, price, distribution channel, mode of operations, competing products and regulations. Although the type of packaging material dictates the shelf-life of the product, it is the market that influences how the product should be packaged. The trader must know the seasonality of supply and demand to maintain the market access and position. It is important that all these issues are decided upon earlier on in the business. It is always important for the processor and/or the trader to conduct a market survey before starting a Dagaa-based business.

Marketing therefore includes

- Finding out the needs of the customer;
- Producing a product or service that best meets the need of the customer;
- Pricing the product appropriately;
- Distributing the product or placing it within reach of the customer;
- Promoting the product using such means as advertising, and finally;
- Selling the product or service.

8.1. WHAT IS A MARKET?

A market is a place where buyers and sellers meet to do business. “The market”, also stands for the people who are interested and willing to buy your products or services. Therefore your market is

- The customer you have now;

- The customers you hope to get in the future, and;
- The customer you lost but hope to get back.

What do you need to know from your market?

- Who are your customers?
- Where are they located?
- What are their specific needs? – product demand
- What preference do they have with regard to your product? - product demand
- How often and how many products do they buy? - product supply
- When do they buy – what particular times of the day, the month or year?
- How much are they willing and able to pay for the product?
- How will the product reach the customer?
- Who are your competitors? What is the quality of their products and their prices?
- What is your competitive edge over your competitors? - identify your comparative advantage

8.2. POTENTIAL MARKETS FOR DAGAA PRODUCTS

The cost and increasing demand for table fish has contributed to increased demand for sundried Dagaa products within Eastern, Central and Southern Africa. There is potential to sell Dagaa in other countries as well. Sundried Dagaa products from Tanzania and Uganda go to DR Congo, Burundi, Rwanda, Southern Sudan, Central African Republic, Zambia, Zimbabwe and South Africa.

The major customers are supermarkets, the military, humanitarian organisations (International Organisation of Migration (IOM), World Food Programme (WFP), UNICEF), restaurants, hotels, schools, hospitals, and the general public.

8.3. REQUIREMENTS FOR TRADING IN DAGAA PRODUCT

Different countries have different legal and policy frameworks that govern trade. It is therefore important for the Dagaa trader to consult the relevant Government institutions dealing with trade, fisheries and customs with regards to requirements such as fishing licenses, movement permits, traders licenses, health certificates (traders and products).

8.4. DISTRIBUTION OF DAGAA

Marketing and distribution in the Dagaa fishery vary from country to country and from landing site to landing site. Demand and infrastructure determines the accessibility of the landing site involved in Dagaa processing. Most of the Dagaa landing sites are poorly networked and processed Dagaa in transit has to be transported to the nearest landing site handling other commercial fish species, where storage facilities are sometimes available at a cost.

Dagaa landing sites that are easily accessible by road are more regularly visited by traders to the benefit of the residing artisanal processors than their counterparts at inaccessible sites. Storage facilities are rarely used due to the high-turnover, to the extent that, dried products may be purchased right from the drying surface.

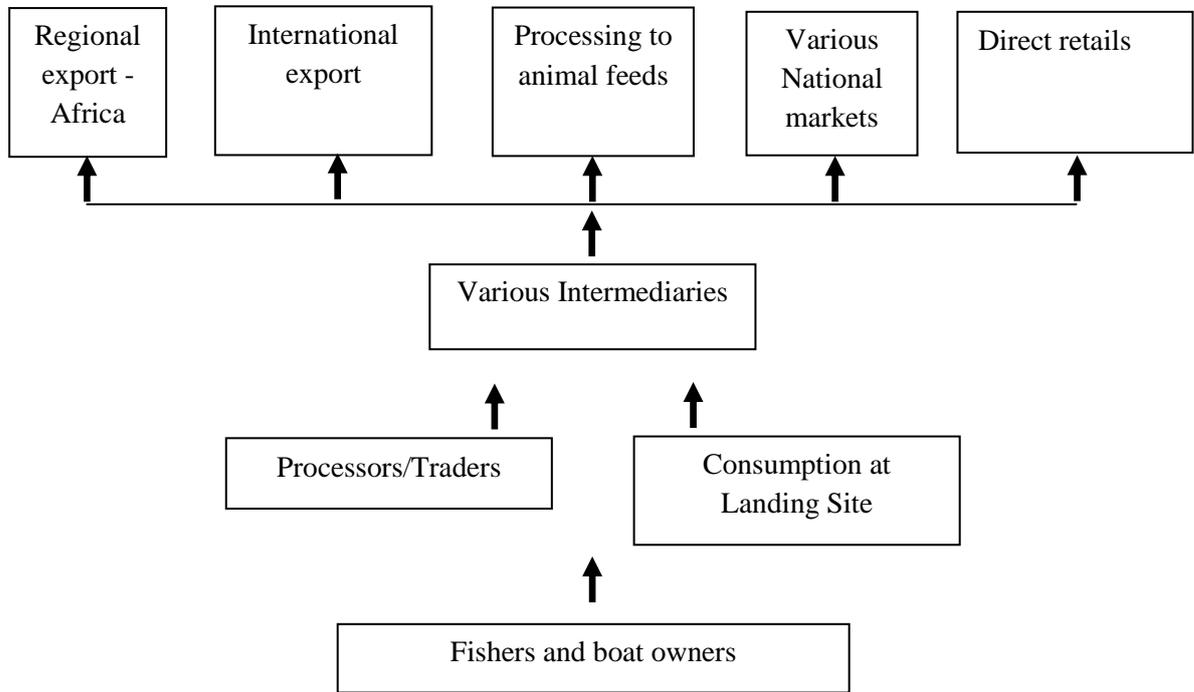


Fig. 15 Distribution Channels for Dagaa products

9. HOW TO SUCCEED IN DAGAA BUSINESS

Before setting up any business, a processor or trader must first get as much information about the business as possible.

9.1. IDENTIFY YOUR ADVANTAGES AND DISADVANTAGES IN THE BUSINESS

The processor/ trader should identify his/her strong points, weak points, the chances to succeed and what can stop or hinder him/her to succeed in undertaking the business. This process is called SWOT (the strengths, weaknesses, opportunities and threats) analysis and is done to see the effect of each aspect on his/her business.

He/she should develop plans to gain from the strengths and opportunities and to deal with those weaknesses and threats.

9.2. QUALITIES OF A GOOD DAGAA BUSINESS PERSON

A good Daga business person should:

- Believe in his/ her own ability to make things happen
- Make decisions based on careful planning
- Be ready to take risks and accept failure as part of the learning experience
- Have a vision on what he/she wants to achieve in the business today and in future
- Provide leadership in all situations
- Be flexible and willing to adjust to the conditions in the market for Daga products
- Focus on what he/she can do best and on activities that are important to his/her goals
- Wisely manage his/her time and spend enough time on planning
- Desire to be successful and try to learn from successful people he/she know.

9.3. SKILLS

Good business requires personal and technical skills. Technical skills can be gained from learning.

a) Personal skills

These provide the steering and direction to the business person. These skills include:

- Personal presentation: How do you appear in public?
- Negotiation skills: can you influence others to agree with you for the benefit of your business?
- Public relations skills: Do your customers or potential customers find it easy to talk to you?
- Communication skills: When you speak, are you clear and convincing to your customers, prospective customers, suppliers and general public?

b) Technical skills

These are the skills that provide the power to move forward in business. These include:

- Skilled in the production processes of your business
- Record keeping skills / financial management
- Marketing skills

The success of Dagua business is determined by how much money has been gained compared to how much has been spent. To be successful a Dagua trader/processor must plan, budget, implement and monitor and control his business and finances.

9.4. RECORD KEEPING

The key to the proper management of a business is record keeping. Record keeping is a general term used in the management of funds and goods. It simply means writing down correctly:

- How much money your business receives on a daily basis from selling products;
- How much money your business pays out on a daily basis for purchases supplies, and other contributors to the operations, and;
- The goods you have produced and those you have in stock
- Records of what is sold, what is lost, etc.

To follow the progress of the activities of your business or project you need written proof every sale or payment you make. For instance:-

- copies of receipts you give to customers, when they buy from you (cash sales), and;
- receipts or invoices you get when you buy goods and raw materials or when you pay rent, electricity or water;

If there is no written proof, use an exercise book to write down the information you need and record the following

- when the transaction happened (date);
- the person or company involved in the transaction (who bought or who sold the item);
- the amount of money involved in the transaction (the price and total amount)

Receipts and invoices provide proof of transactions. All records should be kept safely and together.

a) Advantages of keeping records

With correct records, as a processor or trader you can:

- Make good decisions concerning your business after knowing its performance (profits, income, amount in debt, loans etc.) and take corrective actions in time.
- Successfully apply for a loan (from finance institutions, such as banks or the government) because you can show how well your business is doing and how organized it is.

b) Types of Records

There are two major types of records:

- Cash records – these are about items (e.g. Dagaa) bought and sold; and,
- Physical records – these are about other issues concerning the business like the details on how many items of a good have been produced (e.g. dried Dagaa), when they were produced, when and where they were taken to the market, and how many are in stock.

c) Cash Records

These records contain details of income and expenditure. There are three types of cash records:-

- Expenditure records (money spent);
- Income records (money received), and
- Commitment records (goods sold on credit or bought on credit).

d) The Inventory

The inventory is a record of all the goods that you have in stock at any one time – as well as value.

e) Records of debtors

Debtors are those people and companies that owe you money. They could have bought your goods or services on credit.

In order to fully understand what record keeping for small businesses is all about, it is important to learn the meaning of the following business terms:

- Sales, Income or Revenue:** This is the total amount of money that you get from selling your goods or services
- Costs or Expenses:** This is the money that leaves your business, to pay workers, raw materials, machines, rent, electricity, etc.
- Profit:** When the amount of money you get in sales (Revenue) is higher than what you spend (costs), the difference between the two is a profit
- Loss:** If your expenses are higher than your sales (revenue), the difference between the two is a loss
- Transactions:** When money changes hands, this is known as a transaction, e.g. when you sell an item in your business or when you make a payment for raw materials
- Stocktaking:** This is the physical check and confirmation of the numbers and values of goods you have in stock at any one time.

10. COSTING AND PRICING

It is important to calculate what production of your final product costs. This is critical to determining the price at which it is sold, and will ensure profits are made, rather than losses. If costs of production are higher than the price achieved in the market, then the business will lose money.

10.1. COSTING

a) What is costing?

Costing is a process of giving a value to your Dagaa product and this forms a basis for pricing the product. The price will depend on:-

- Cost of production for the Dagaa product (raw /fresh Dagaa, wages, ingredients, water, power, packaging, transport to market, etc.)
- The current market price (you may not want to put it higher as people may not buy)
- The amount of profit you would like to add after the cost.

b) What are Costs

Costs refer to whatever you spend to produce and sell the Dagaa product. For example:

- Your salary for running your business and your employee's salary are costs to your business.
- Bills of electricity and water used in your business premises are costs to your business.
- Rent for your business premises or levy for your market stall are costs to your business.

c) Types of costs

Direct costs

Direct costs are those that directly relate to the production or sale of one specific product. For example, in Dagaa fish trade the direct costs include

- purchase of fresh Dagaa
- bags, packaging for each batch produced
- the cost of the time spent processing the Dagaa
- temporary labour employed when product is being prepared

Indirect costs or overhead

These are costs that you incur for running your business that are there whether you are producing Dagaa or not each day

- rent of land, vehicles or other items
- electricity and fuel
- costs for drying racks, cooking equipment, smoking ovens
- salaries and wages which are paid, whether producing Dagaal or not
- transportation
- trading license and other permits
- health certificates and insurances
- repairs and maintenance (processing equipment and facilities and vehicles)

10.2. PRICING

a) What are the important things to consider when fixing a price?

- Total costs of production
- The price offered by your competitors
- The ability of your customers to pay. Is your business in a slum where incomes are low? Is it in a rich neighbourhood, where people can afford to pay more?
- Total Sales (Revenue) – Total Costs (Expenditure) = **Profits** (If Total Costs are higher than Total Sales = **Losses**).
- Total Sales = Total Costs = **Break-even point**. From that break-even point, any extra product you sell earn you profits. If your sales are below the break-even point you are making losses because you are not able to cover all your costs.

10.3. TIME MANAGEMENT AND COMMUNICATION

Time management is very important in any business. Customers of good quality Dagaal products require that it is at the market at the right time and that it is always available. Delivering Dagaal on time requires the processor and trader to manage their time properly. Communication becomes an important ingredient to a successful business and managers need to always be in touch with their suppliers, customers, and employees to ensure things work smoothly

11.SHARING INFORMATION

Effective trade thrives on reliable information.

- Flow of information from trader to processor about the market allows adjustments to meet market demands
- The trader should have mutual trust with processor based on accurate and reliable information regarding product acceptability, trade, markets and value including future prospects.

- The trader should gather as much information as possible that he/she can use to sell and convince the customers to buy the product.
- The processor should do his/her best to have a label and this should include information about the product (nutritional content, keeping conditions, date of manufacture, expiry date, and weight/volume) that complies with national/regional safety and quality standards.

La bonne gouvernance et la bonne gestion des pêches et de l'aquaculture permettent d'améliorer la contribution du secteur à la sécurité alimentaire, au développement social, à la croissance économique et au commerce régional ; ceci en assurant par ailleurs une protection renforcée des ressources halieutiques et de leurs écosystèmes.

La Commission de l'Océan Indien (COI) ainsi que la COMESA (Common Market for Eastern and Southern Africa), l'EAC (East African Community) et l'IGAD (Inter-Governmental Authority on Development) ont développé des stratégies à cette fin et se sont engagés à promouvoir la pêche et l'aquaculture responsable.

SmartFish supporte la mise en œuvre de ces stratégies régionales en mettant l'accent sur le renforcement des capacités et des interventions connexes visant à :

- la mise en œuvre d'un développement et d'une gestion durables des pêcheries ;
- le lancement d'un cadre de gouvernance pour les pêcheries durables dans la région;
- le développement d'un suivi-contrôle-surveillance efficace pour les ressources halieutiques transfrontalières ;
- le développement de stratégies commerciales régionales et la mise en œuvre d'initiatives commerciales;
- l'amélioration de la sécurité alimentaire à travers la réduction des pertes post-capture et la diversification.

SmartFish est financé par l'Union Européenne dans le cadre du 10ème Fond Européen de Développement.

SmartFish est mis en œuvre par la COI en partenariat avec la COMESA, l'EAC et l'IGAD et en collaboration avec la SADC. Une collaboration étroite a également été développée avec les organisations régionales de pêche de la région. L'assistance technique est fournie par la FAO et le consortium Agrotec SpA.

By improving the governance and management of our fisheries and aquaculture development, we can also improve food security, social benefits, regional trade and increase economic growth, while also ensuring that we protect our fisheries resources and their ecosystems.

The Indian Ocean Commission (IOC), the Common Market for Eastern and Southern Africa (COMESA), the East African Community (EAC) and the Inter-Governmental Authority on Development (IGAD) have developed strategies to that effect and committed to regional approaches to the promotion of responsible fisheries and aquaculture.

SmartFish is supporting the implementation of these regional fisheries strategies, through capacity building and related interventions aimed specifically at:

- implementing sustainable regional fisheries management and development;
- initiating a governance framework for sustainable regional fisheries;
- developing effective monitoring, control and surveillance for trans boundary fisheries resources;
- developing regional trade strategies and implementing regional trade initiatives;
- contributing to food security through the reduction of post-harvest losses and diversification.

SmartFish is financed by the European Union under the 10th European Development Fund.

SmartFish is implemented by the IOC in partnership with the COMESA, EAC, and IGAD and in collaboration with SADC. An effective collaboration with all relevant regional fisheries organisations has also been established. Technical support is provided by Food and Agriculture Organization (FAO) and the Agrotec SpA consortium.

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