BUSINESS DEVELOPMENT SERVICES (BDS)

FOR ACTORS WITHIN THE FISH VALUE CHAIN MICRO, SMALL & MEDIUM ENTERPRISES

FISH PROCESSING, VALUE ADDITION AND FOOD SAFETY

GIZ Responsible Fisheries Business Chains Project (RFBCP)

german cooperation
DEUTSCHE ZUSAMMENARBEIT

Implemented by:

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Post-harvest Handling, Management and Value Addition

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Lastly, we recognize the efforts of the GIZ-RFBCP team for their invaluable contribution to this manual. As authors of this manual, we hope that the contents provided will catalyse the adoption of best knowledge and skills coupled with appropriate use of technologies by the value chain actors and make the Fisheries and Aquaculture sub sector more competitive.

The Manual was developed by;

UGANDA NATIONAL WOMEN'S FISH ORGANIZATION (UNWFO)

DISCLAIMER

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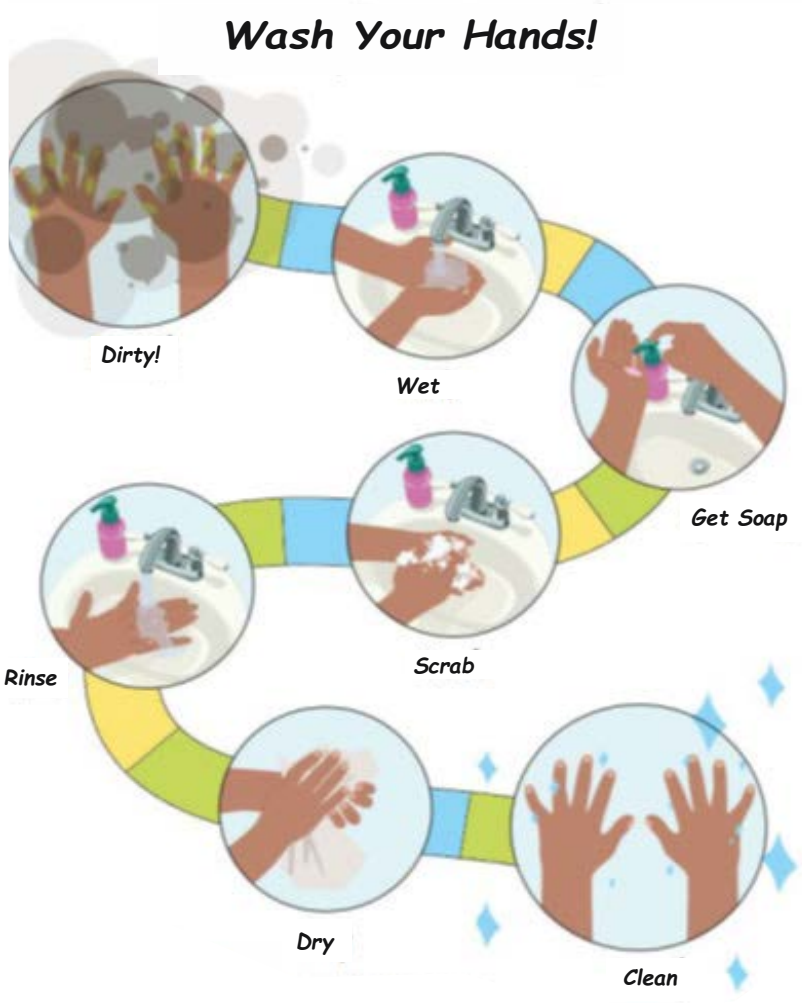
MODULE 1: PERSONAL HYGIENE

Personal hygiene practices and hygienic production processes are equally important to ensure that fish products are safe to eat. Poor personal hygiene refers to irresponsible behaviour and attitude on hygiene practices used by the beneficiaries (fishermen, processors, transporters, and fish traders/retailers) in their workplace.



Hygiene practices in fisheries

As explained earlier, hygiene involves practices, here are some of the good practices you can undertake in your fisheries business to maintain good health.

To follow the hygiene practices, you must:

Dispose of fish waste properly from the working area

- Keep your work surfaces and utensils clean and dry.
- Not throw garbage around work areas. Use cans or bins for collecting garbage
- Not spit or urinate closer to work areas
- Not wipe your hands on your clothing during work as this can easily transfer microbes and bacteria to your fish
- Wear clean hair cap, apron, nose mask and hand glove during fish processing to minimize contamination
- Wash your hands as often as possible when handling your fish because lot of the things you touch may be very unclean.

Self-assessment

1) What is hygiene?

2) Mention three reasons for observing hygiene in fish?

3) Mention three impacts of hygiene on fisheries?

4) Write three hygiene practices in fisheries

MODULE 2: FISH QUALITY AND SPOILAGE

The quality of the fish product affects the price.

High quality = High price

Poor quality = Poor price

Once the quality of the fish product is allowed to deteriorate it can never be regained. This means that everyone involved in the fishing business, from the fisherman at the point of capture, through the processor to the vendor at the point sale, must understand how to maintain quality in order to get the best possible price. There are four basic requirements for maintaining fish product quality.

- ✓ Thoroughly chill the fish product and keep it as cool as possible prior to processing or selling
- ✓ Do not damage or crush the fish product
- ✓ Keep the fish product clean
- ✓ Work quickly

MODULE 3: FISH FRESHNESS AND QUALITY PRESERVATION

Quality can be measured by chemical or sensory methods. Trainees will be explained how sensory evaluation can be done as indicated in the table below.

Sensory Evaluation: We can quickly check quality by using (i) our eyes to look at the appearance of the fish product, (ii) our hands to feel the texture of the product, (iii) our noses to smell it and (iv) our tongues to taste it. The following table gives a numerical value for differing qualities of fresh finfish. It can be a useful tool in assessing quality. We simply describe what we see (appearance, colour), feel (texture), and smell.

Table 1: Quality evaluation of fresh finfish using sensory evaluation

Class	Gills	Eyes	Body appearance	Texture	Quality
5	Dark red colour, some thin clear slime , marine smell	Bright, metallic Clear pupils, convex eyes	Natural colour, Iridescent, Firm scales, Little/or no slime	Firm before or in rigor	Excellent
4	Red colour, some slime, but still thin and clear, no smell	Bright metallic, slightly cloudy pupils, slightly convex eyes	Natural colours, firm scales, some slime	Firm	Good
3	Red-brown colour, some thick slime, beerly/ mousely/warm smell	Dull, white spot pupils, a little concave, bloody	Scale loose, more thick slime	Firm	Average
2	Brown colour, a lot of slime, stinky smell	Dark, pupils cloudy, concave or swelling out, bloody	Red/yellow colour, scales missing, dry skin, a lot of slime	Soft	Poor
1	Brown colour, a lot of slime, Bad/ammonia smell	Dull ,pupils cloudy, concave eyes with blood	Red/yellow colour, few scales, dry skin, a lot of thick yellow slime	Very soft, mark of finger left if pressed	Very poor

MODULE 4: FISH PROCESSING PRACTICES

Fish processing refers to a series of actions applied by the fisher-folk and other actors of the value chain to preserve their fish products from the time fish is caught until it reaches to the consumer.

Points to note on fish processing

- ✓ It is advisable for the fisher-folk and other beneficiaries to process their fish products in a proper place with good hygienic condition.
- ✓ Prior to fish processing, fish are sorted/graded, washed and cleaned, then heads, tails, scales, fins, slimes are removed fish are then gutted and cut into steaks/pieces.
- ✓ Any waste products from fish processing areas/centre must be disposed in a friendly way that does not harm the environment neither aquatic ecosystem (water) nor terrestrial ecosystem (land).
- ✓ Fish waste should be kept and get rid of in a closed place that does not allow flies, rats and other pests to breed and be a nuisance.
- ✓ Finished products must be packaged and handled in a careful way to avoid contamination

Poor fish processing practices include:

- ❖ Fish processing done at poor hygienic location
- ❖ Fail to clean and wash fish prior to processing
- ❖ Fail to quickly remove viscera and gills
- ❖ Uses of inappropriate metals such as dirty knives, broken glass to process fish products
- ❖ Fish processed with dirty utensil and equipment
- ❖ Fish waste products disposed around the processing workplace encouraging presence of flies and other insects
- ❖ Use of chemicals such as pesticides or insecticides on the equipment during the final stage of fish processing

Maintaining fish processing areas

Specific procedures must be followed to minimize the risk of such hazards causing illness to consumers:

- The processing area should be closed: have a compound wall and gate to prevent the entry of wandering animals to the premises
- Sweep and clean the processing area regularly to ensure that there is no rubbish lying around attracting flies, rats and other pests
- Use clean equipment and utensils at the fish processing area
- The processing area should have a separate washing facility for utensil
- Floor and walls of the peeling shed should be tiled to enable easy washing
- The processing area should have a raised receiving area for the unloading of fish products
- Make sure there are good toilet facilities, and these are kept clean
- Ensure that there are no trees or vegetation near the processing place as these are good places for insects and vermin to live

Good fish processing practices

Good fish processing practices refers to appropriate skills and knowledge being used by the fish processors in processing fish products after harvesting. Hence good fish processing ensures a higher quality fish product. The required condition for good fish processing includes the following:

- Fish that should be processed should be fresh and in good condition
- Fish should be washed in clean water thoroughly to remove blood, slime and scales
- Fish should be sorted/graded accordingly; large fish are separated from small fish;
- Equipment and utensils used for fish processing should be kept clean in good condition
- Waste fish products should be kept in a closed place that does not allow flies, rats and other pests to breed
- Any waste products from processing must be disposed of in way which does not
- harm the environment either the water or land

Finished products must be packaged and handled in a careful way to avoid contamination and so they remain safe to eat;

MODULE 5: FISH MAW PROCESSING AND HANDLING

The fish maw is also called a swim bladder, gas bladder, or air bladder. It is an internal gas-filled organ that contributes to the ability of many bony fish to control their buoyancy, and thus to stay at their current water depth without having to expend energy in swimming.

The handling of fish maws include:

- Soak fish maw in fresh water for about 10-15 minutes until it softens
- Splitting open the maw
- Soaked fish maws should be stored in the refrigerator at below 0ºC if not cooked
- Washing and drying it in the sun

Minimum requirements for processing fish maw in Uganda

- Fish maw products should be packaged in packages that meet the international hygienic standards
- No fish maw processing establishment should use additives
- All fish maw from markets and fish processing establishments should have a fish maw inspection certificate among others.

CODES OF PRACTICE/MANUAL FOR FISH MAW EXTRACTION, HANDLING AND PROCESSING

1.0 Introduction

What is Fish Maw?

Fish maw is the dried swim bladder that comes from a large fish like Nile perch, croaker or sturgeon.

In Asian culture, it is considered to be one of the top four delicacies of the sea (abalone, sea cucumber, shark fin, and fish maw). In appearance, dried fish maw is light, white in color, and have a spongy texture.

In Uganda, Fish maws or swim bladder is a product that is extracted from Nile perch and is processed and traded on the international market. Originally in the early 1990s it was treated as a byproduct with no economic value but in the last couple of years this outlook has had a dramatic turn around with the Nile perch fish maw becoming a high value product that is on high demand on the international market.

Over the years the quantity and value of fish maw exports from Uganda has grown steadily and has become a significant contributor to the national social economic development. Despite this positive development, the national and international sanitary controls that are usually associated with fish and fishery products trade are not observed or enforced when handling and processing the fish maws hence affecting the quality and value of Nile perch fish maws on the international market.

In order to continually reap its benefits, it is of paramount necessity good codes of practices are followed during extraction, handling, transportation, preservation, processing, Packaging and marketing of the fish maws to ensure wholesome and safe fish maw production and to adhere to acceptable national and international standards.

Source: LVFO Fish maw guidelines 2021

2.0 Fish maw establishments / handling / processing facilities

2.1 Location

When deciding on the location of the establishment or facility, one should give serious consideration to potential sources of contamination to the product. In particular the fish maw processing facility should normally be located away from;

- Environmentally polluted areas
- Areas likely to be affected by flooding
- Areas prone to pest infestation
- Areas where waste or undesirable discharge cannot be removed efficiently

2.2 Design and layout

There should be a fenced perimeter zone, which should be free from accumulation of rubbish, packaging materials, raw materials, pallets and redundant equipment so as to avoid harborage and proliferation of pests

The internal design of the establishment or the layout should allow for good hygiene practices in order to protect against cross contamination during operations. The following conditions should specifically be adhered to;

- The surfaces of walls, partitions, and floors should be made of impervious materials;
- Walls and partitions should have smooth surfaces up to a height suitable to the operation;
- Floors should be constructed to allow for adequate drainage and cleaning;
- Drainage entry and exit points into the building should be pest proof
- In any room where the fish maws are exposed, ceilings and overhead fixtures should be constructed in such away as to minimize the buildup of dirt and condensation, and the shedding of particles;
- All windows should be kept closed and those that require opening should have vermin proof cleanable screens;
- All interior windows should be clear and properly fixed to prevent insect entrance. The frames should not be made of wooden or corrosive material;
- All doors to production areas should be self closing to prevent vermin entry and environmental contamination. They should be close fitting on all sides and the door frames and corners should be given protection against damage. They should be durable and easy to clean and disinfect;
- The working surfaces that come into direct contact with the fish maws should be durable and easy to clean, maintain and disinfect. They

should be made of smooth non-absorbent materials;

In addition to meeting all the above requirements the establishment should be inspected and get approved by the competent authority and have an operational license.

2.3 Equipment

The design and layout of the factory and equipment should ensure efficient production of safe products and allow access to adequate cleaning and pest control as well as easy movement of personnel.

Equipment and containers should be made of materials with no toxic effect to the product and where necessary equipment should be durable and movable or capable of being dismantled to allow for maintenance, cleaning, disinfection and monitoring.

Equipment used in different areas of the establishment should be colour coded to designate different sections and prevent the risk of cross contamination.

2.4 Water supply

Adequate supply of water with appropriate facilities for its storage and distribution should be available whenever necessary

All water used in the establishment should be potable or compliant with the National Standards for drinking water. Where non potable water is used for specific purposes, it should have a separate reticulation system which is easily identifiable.

2.5 Drainage and waste disposal

Adequate facilities for drainage and waste disposal should be provided. They should be designed and constructed so as to avoid contaminating the products or potable water supply. Waste must not be allowed to accumulate in product handling, product storage and other working areas and the neighboring environment.

2.6 Cleaning

Adequate facilities, suitably designated should be provided for cleaning utensils and equipment. Such facilities should have adequate supply of cold and hot potable water where appropriate. All utensils used in the establishment should be thoroughly cleaned and where necessary disinfected after use and stored in a clean place.

2.7 Pest/vermin control

The company should either contract the services of an approved pest control

organization, or have trained on site personnel, for the regular inspection and treatment of the premises to deter and destroy infestation by insects, birds or animals.

Safe and hygienic disposal of pests is required after capture or fumigation. Documented procedures are therefore required from the contractor or for the business.

Detailed records of the pest control inspections shall be kept on site in the company report book.

3.0 Personnel requirements

3.1 Staff Training

All employees should be notified of their legal obligations especially on personal hygiene prior to commencing work, with periodic updates as necessary. An induction course explaining the relevant legislation should be designed and implemented.

All personnel should be appropriately trained for the job they do and in compliance with the existing legislation.

All production and quality assurance managers should have prerequisite qualifications and be fully trained in the HACCP based quality management system.

Posters outlining the key hygiene requirements should be developed and displayed at strategic points to keep reminding the workers of their obligations.

Training records should be kept on each individual member of staff and the effectiveness of training monitored to confirm that designated procedures are being followed.

3.2 Health requirements

All employees both full time and part time should complete a medical questioner and undergo a medical examination before being employed.

Persons directly involved in processing or packing of fish maws should be healthy and capable of discharging their duties effectively.

People known or suspected to be suffering from any infectious disease or illness (particularly gastro-intestinal disorders, vomiting, diarrhea, skin infections nasal or ear disorders) likely to be transmitted through food, should not be allowed to work in contact with or to come in contact with other food handlers.

Any person suffering from an infectious disease should be declared fit by medical personnel before being allowed to return to work. Full records should be kept for each individual case.

The company should ensure that all employees undertake medical examinations as required by law.

No person having untreated sores, cuts or bruises should be allowed to work in contact with food.

3.3 Personal cleanliness

Food handlers should maintain a high degree of personal cleanliness and where appropriate, wear suitable protective clothing, head covering and foot wear.

All food handling persons who enter the production areas for any reason, should be provided with clean protective clothing which should be worn at all times.

Items of personal clothing should not be worn over protective clothing and undergarments should not protrude below sleeves and cuffs.

3.4 Hand washing and disinfection

Provisions should be made to ensure that hands are kept clean, washed and disinfected at frequent intervals using non-perfumed soap or alcohol based sanitiser. Hands should be thoroughly dried and nails kept short.

Hands should be washed and disinfected;

- Immediately before putting on protective clothing
- Immediately before commencing work or entering production areas
- After handling debris, refuse or food waste
- If they become soiled or visibly contaminated
- After visiting the toilet
- After blowing the nose and touching the mouth.

Sufficient hand wash and disinfection stations should be provided in toilet areas and at entrances to production areas.

Notices reminding staff of the hand washing and disinfection requirements should be posted in each toilet, hand wash sinks and by the urinal area and on entrance doors to the production areas.

3.5 Personal behavior

People engaged in food handling activities should refrain from behavior that could result in contamination of food, for example;

- Smoking
- Spitting
- Chewing or eating
- Sneezing or coughing over unprotected food

Personal effects such as jewellery, watches pins or other items should not be worn or brought into food handling areas if they pose a threat to the safety of food.

3.6 Screening for visitors

All visitors to the establishment should be adequately screened. On arrival they should report to the reception, sign the visitors' book and complete a medical questionnaire.

If the information given raises concern, then access to the factory should be denied and an alternative appointment made.

3.7 Staff facilities

Adequate lockers shall be provided to all personnel for the safe storage of personal effects such as outdoor clothing. This will eliminate the risk of them being brought into the production areas.

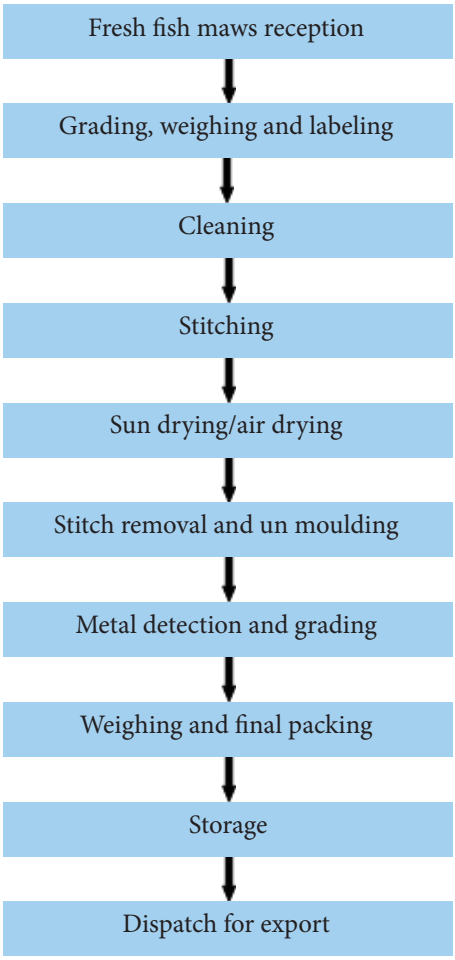
Food and drinks should be served in designated areas within the premises separate from the production areas.

Rest rooms should be should be provided, properly maintained and cleaned and provide adequate seating facilities to meet the maximum usage.

All workers should remove protective clothing before entering the canteen and rest room facilities.

Separate male and female toilet facilities should be provided which are adequate for the number of workers on site and should conform to requirements of the national laws.

Process Flow diagram for dried fish maws



4.0 Fish maw handling/processing/packing

4.1 Fish maw extraction

There should be a designed place for the extraction of the fish maws

Extraction should be done immediately after gutting of the Nile perch and care should be taken to avoid puncturing of the maws

If the maws are to be exported when wet, they should immediately be cleaned by removing adipose tissue, washed with potable water , graded and iced or frozen to maintain the quality. If the maws are to be sold to another company they should be graded immediately after extraction and weighed. They should be iced immediately after weighing.

Fish maw extraction

4.2 Transportation

Fresh fish maws should be transported in appropriate containers which are properly covered to avoid spillage and cross contamination. They should be sufficiently iced to maintain quality. In general the containers should be designed in such a way that;

- They do not contaminate the product;
- Can be effectively cleaned and disinfected;
- Provide effective protection from contamination, including dust and fumes;
- Can effectively maintain the temperature, humidity, atmosphere and other conditions necessary to protect the product from undesirable microbial growth

The vehicle used for transporting the fish maws should be cleaned and if necessary disinfected and shouldn't carry any other goods that may lead to cross contamination of the product. The vehicle should be approved and licensed by the competent authority.

Where necessary according to the national legal requirements a movement permit should be secured for every consignment that is transported.

4.3 Reception, sorting and weighing

At the reception the fresh fish maws should be organoleptically checked for quality compliance and the accompanying documentation (eg delivery note and movement permit) verified.

If there are any pieces that are not compliant, they should be removed immediately

If found compliant, the fish maws should be weighed and graded according to the company requirements and details of the delivery recorded.

If the maws are not t o be worked on immediately they should be parked in clean containers and iced adequately.

4.4 Cleaning

Cleaning should take place on clean and disinfected working surfaces and potable water should be used

The process starts with cutting of the maw to create access to its inner part and then followed by removal of adipose tissue which should be done carefully to avoid puncturing the fish maw

This should be followed by washing with potable water. The washing should cover both the outer and the inner surfaces of the fish maw.

The maws are then graded basing on size

4.5 Moulding and stitching

The wooden/plastic moulds should be thoroughly cleaned and where necessary disinfected before re-use;

The cleaned maws should be checked for any damage and the damaged pieces be separated from the good ones

The cleaned maws should be carefully fitted on the moulds and the broken or pierced parts stitched with noncorrosive pins or threads as per operational guidelines provided

Fish maw molding

Fish maw stitching

4.6 Sun drying

The sun drying of fish maws should be done in an open yard that is environmentally clean and protected from pests

The drying racks should be raised from the ground and made of noncorrosive material and easy to clean and disinfect

The racks should always be cleaned and where necessary disinfected before reuse

The maws should be carefully arranged on the racks with adequate spacing to allow for full exposure to the sun

The establishment should have in place alternative drying methods and facilities to be used during periods of unfavourable weather

During drying, competent (trained) staff should be assigned to supervise and monitor the drying process so as to conform to good hygiene practices and the market requirements

Fish maw drying

4.7 Air drying or Room drying

Air –drying of fish maws should be carried out in a special room that is warm and dry with an induced air current to remove moisture from the product. Adequate temperature, humidity and dust control measures should be provided. The key factors that have to be manipulated to increase the rate of drying of the product are, air velocity, air temperature and relative humidity.

The products must be spread out on raised clean surfaces to allow for free movement of air and the room should be free from dust or fume contamination. Additionally the room should be vermin proof.

4.8 Un molding and stitch removal

After attaining the required level of drying, the fish maws should be unstitched by removing the pins/ threads and subsequently removed from the moulds

Where pins are used for stitching the dry maws should go through a metal detector to ensure absence of any metals

4.9 Grading, weighing and packing

Before grading, the dry fish maws should be checked for quality (colour, odour, texture and any other indicator of spoilage).

The dried fish maws should then be graded basing on the market specifications;

The graded maws should then be weighed and packed into clean bags according to customer specifications

The weighing and packing should be carried out in a designated place which is clean and free from possible cross contamination.

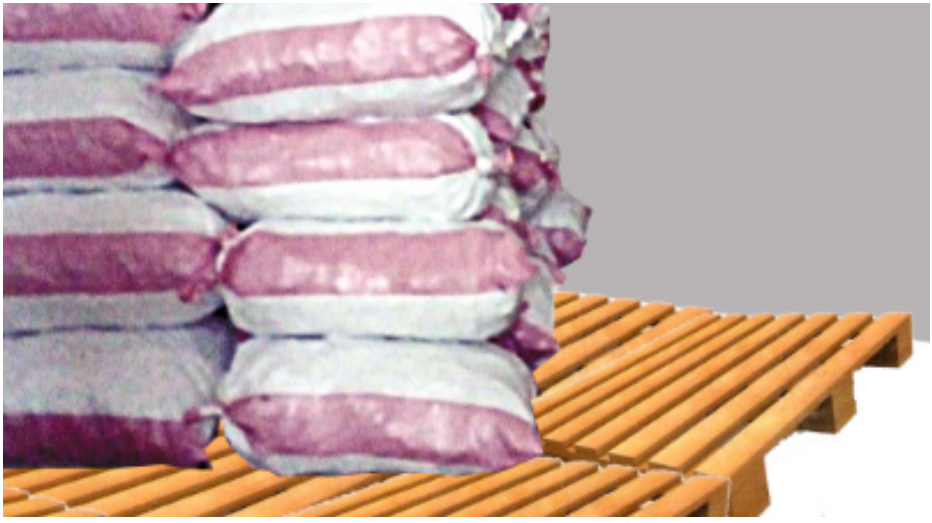
4.10 Labeling/traceability

The management of the establishment should ensure that effective procedures are in place to effect complete product tracing and rapid recall of any lot of the maws from the market. Appropriate records of procurement, processing and distribution should be kept and retained for a period that exceeds the self-life of the product.

The packages should be labeled and coded in compliance with the national legal requirements for labeling fish and fishery products as well as export market requirements.

4.11 Storage of finished product

The finished product should be stored in a clean, dry and dust free closed room, which is protected from pests. The packages should be placed on pallets and never on the floor. The store should be well ventilated to allow for air circulation and temperature regulation.



5.0 Quality and market requirements:

Size: The larger and thicker the maw the better the quality and the reverse is true. The minimum allowed size of Nile perch maw should be based on maw extracted from Nile perch fish of at least 50cm total length;

Shape: Maw that are damaged due to improper extraction, moulding or cleaning methods is of poor quality;

Colour: Quality fresh maw is whitish in colour which turns golden yellow when properly processed by drying. Discoloration is an indication of inadequate cleaning, microbiological spoilage, improper handling, preservation and processing;

Smell/Odour: Good quality maw should have a natural fishy smell. Off-odours is an indication of microbiological spoilage of the maw;

Texture: Good maw should be firm, matured enough and thick. Spoilage of maw due to microbial attack affects both colour and texture. Improper handling and preservation techniques affect the quality and acceptability of the maw;

Water content: The lower the amount of water contained in the fresh maw, the better the quality of the resulting dry maw and the shorter the drying time. Moisture content is a major quality characteristic of the final product (dried maw).

Market requirements:

The following are the parameters that are considered when judging quality of dried fish maw in the market:

i. **Size:** The markets prefer the large sized maw obtained from bigger fish
ii. **Source Species:** The quality of fish maw in the international market depends on the type of fish. Fishes such as sturgeon, hake, conger-pike, croaker and carp get high price for their fish maws followed by Nile perch maw and fetch relatively better prices in the marke
iii. **Thickness (related to gender):** The market commands higher prices for thicker maw. The thickness of the maw depends on the sex and geographical area;
iv. **Colour:** A good fish maw has a rich yellow colour which may be maintained during extended period of cooking
v. **Age**: the older the fish from which maw is obtained, the better is the maw due to the fact that older fish has less oil and less fishy taste

compared to the younger ones

vi. **Aroma:** Aroma is not an influential factor with dried fish maw in comparison to other dried seafood, however fish maw with unexpected aroma (could be due to spoilage, contamination etc.) may not be acceptable

vii. **Texture:** Well dried maw should not be soft and brittle.

viii. **Taste:** In terms of taste, dried fish maw is tasteless, which make it a good complementary addition to many dishes since it can absorb the flavors of other ingredients it is cooked with.

ix. **Preparation:** Dried fish maw must first be rinsed and then soaked in a large bowl of water to soften the texture before use. There should be enough water to allow room for the fish maw to expand. The period of soaking typically ranges from 6 to 12 hours or until it becomes softened. Afterward, squeeze out the water from the fish maw to rid it of any smell. Next, the fish maw can be cut into smaller pieces to make it easier for consumption. Now it's ready to be cooked or added to the soups or dishes of your choices. After being cooked, the fish maw will have a soft and slippery texture.

x. **Health Benefits:** Fish maw is a good source of collagen, proteins, and nutrients. Collagen provides a wide variety of skin benefits, such as helping to improve your skin tone, and tissue health.

Uses of fish maw:

a. Fish maws are used in a variety of ways. Customers in Hong Kong and Mainland China utilize fish maw for its traditional medicinal benefits and nutritional values.

b. In addition, they are used in manufacture of certain plane and space shuttle body parts, car parts, surgical stitching threads and anesthetic drugs.

c. Fish maw is also used in the preparation of isinglass which is widely used commercially in the clarification of beers and wines.

d. Furthermore, many Chinese people considered fish maw as a traditional delicacy that represents fortune and health. Therefore, it is popularly served during special occasion such as Chinese New Year, birthdays, and weddings.

Examples:

Fish Maw in Brown Soup:

Fish Maw in Brown Soup menu is prepared by boiling fish maw in a large pot of soup for around 12 hours with spring onions, shrimp, and Chinese mushrooms. This long boiling time will allow the fish maw to develop a rich flavor of the soup. Then you taste the softness of the fish maw and the delicious aroma of the broth.

Fried Fish Maw with Oyster Sauce:

Fried Fish Maw with Oyster Sauce is prepared by stir-frying fish maw with shrimp, mushroom, Chinese ham, and mixed with special sauces from Ruenros Restaurant. When the dish is served, you will enjoy the taste and crispness of the Fish maw.

Market prices:

The international prices of maw vary and depend on the sources, where some species of fish have sought-after maws of high quality than others. The international prices for Nile Perch fish maws are reported to range from $80 to $1000 per kg of dry maw; but some reports indicate prices of some types of maw rise up to more than $3000 per kg.

The larger the maw the higher the price.

MODULE 6: HANDLING AND PROCESSING OF SMALL PELAGICS (MUKENE)

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

How can you know that Mukene 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

Steps to minimize spoilage of Mukene

- 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 Mukene) 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 Mukene 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 y Never step on fish as it damages the fish

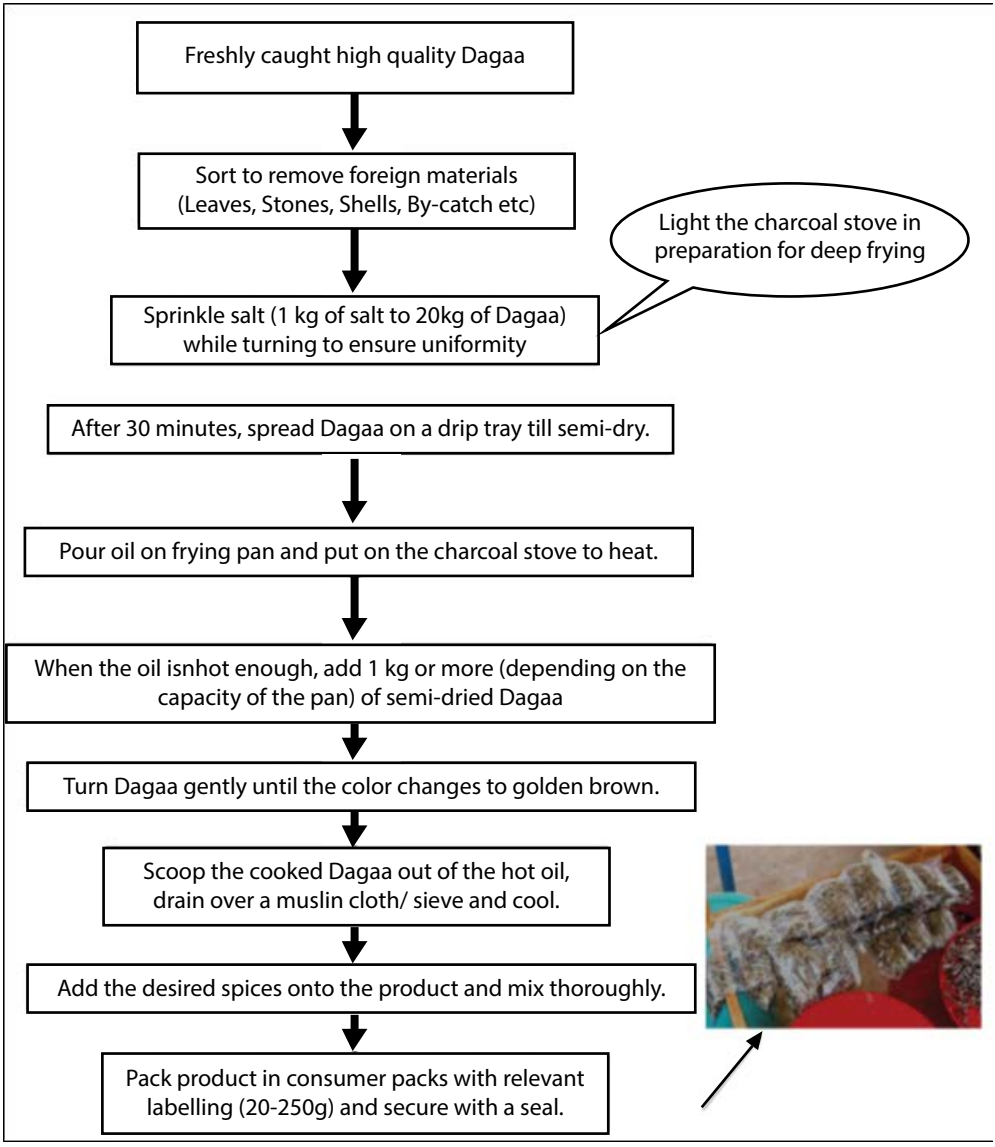
Main processing methods for Mukene

1) **DEEP FRYING**

This is a method of processing which involves frying freshly caught Mukene in 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



Processing steps for salted fried Dagaa/Mukene: (Source: LVFO,2012)

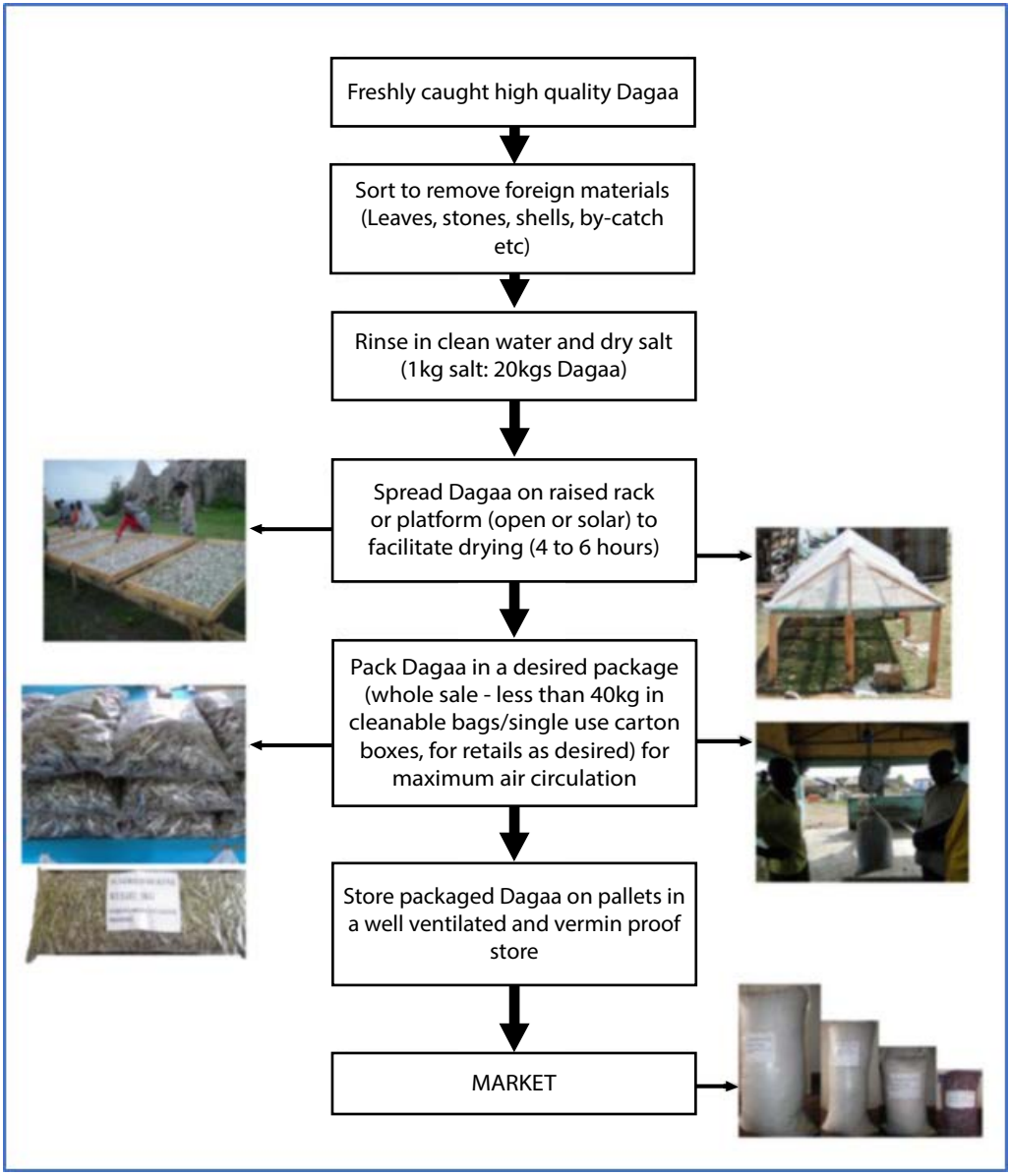
1) SUN DRYING

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

a) Materials required to produce high quality sun-dried Mukene

- ❖ Use raised racks as in figure below .
- ❖ 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)

Drying racks suitable for Mukene : Photo Courtesy by Dr. Nasser Kasozi



Flow diagram for sun-dried Dagaa/Mukene: (Source: LVFO,2012)

MODULE 7: TRANSPORTATION AND MARKETING OF FISH PRODUCTS

Fish transport refers to a system or means of conveying fishery products from fishing villages /camps to the landing site and to the fish markets or established fish processing centres / area. Transport can be done by means of vehicles of all kinds: cars, trucks, boats /canoes, motorcycle, bicycle or by foot.

Traditional fish transport

Traditional fish transport includes the use of local materials such as jerry can, basket and sisal sacks without ice. It also refers to the following means of transport: motorbikes, bicycles or by foot. The traditional fish transport offers several disadvantages to the fisheries stakeholders

- ❖ Fish is exposed to high temperature during the transport
- ❖ Fish transporters fail to use ice and insulated boxes/containers
- ❖ Fish is subject to damage due to poor handling during the transport

Improved fish transport

Improved fish transport refers to the appropriate use of equipment and facilities such as cooler boxes, refrigerated/insulated trucks and boats loaded with ice to ensure preservation of fish during transport to the end consumers. Improved fish transport has several advantages to fisheries).

MODULE 8: 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 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)
- 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.

Advantages of keeping records

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

1) Make good decisions concerning your business after knowing its performance (profits, income, amount in debt, loans etc.) and take corrective actions in time.
2) 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.

Types of Records

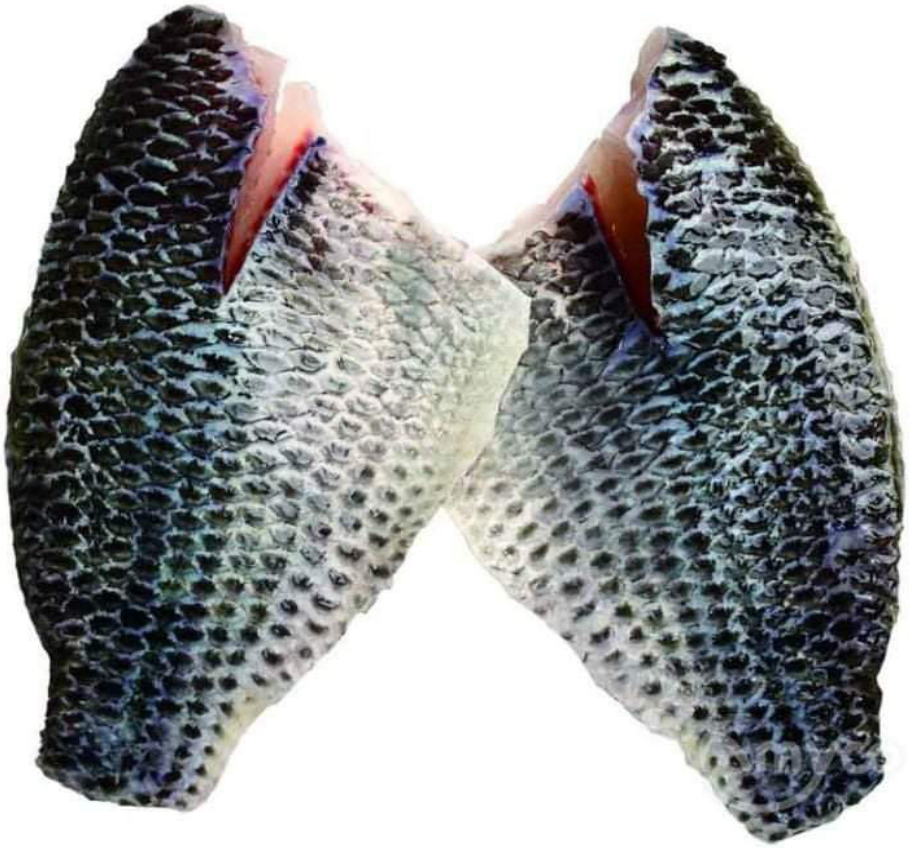
1) ***Cash records***

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)

2) ***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.



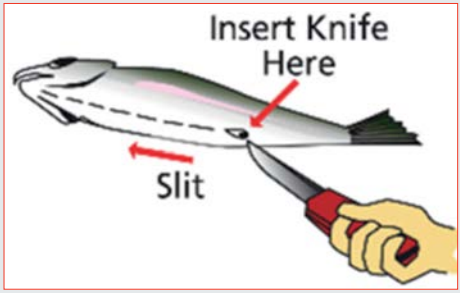
DRESSING OF FISH

Dressing reduces rate of fish deterioration while in storage. The gills and guts are major point of contact for deterioration. Always use quality fish of either grade A or grade B.

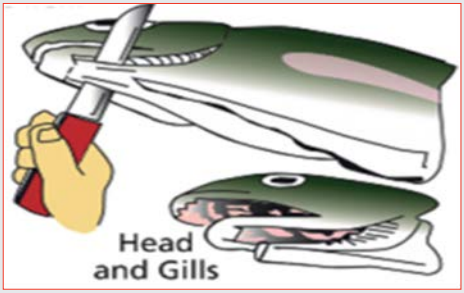
- Materials for fish dressing: Safe and potable water supply, stainless steel working tables, stainless steel knives, plastic bucket for collecting fish guts and waste, and cutting board.

Procedures for dressing

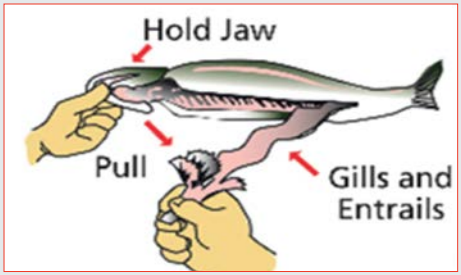
- Ensure that the working area, materials and personnel are well sanitized
- Split the trunk to remove the guts; cut the throat to separate the gills from the head, then widely open the fish and scrap off the kidney
- Wash the fish well in a clean water
- Allow the fish to drain for a while

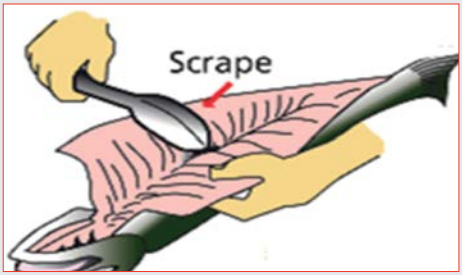


Slit to remove guts



Cut the throat to separate gills from the head





Widely open the fish and scrap off the kidney

Chilled Fish

- Follow process for fish dressing then put the fish between ice layers at 5^{o}C.
- Put in food grade packaging materials like Styrofoam insulator boxes with ice to store below 5^{o}C and to avoid deterioration
- *Some actors do not dress before chilling, and this enhances deterioration of fish during storage.*

Food grade insulator box with fish below below 5^{o}C

Frozen Fish

For longer storage period, dressed fish can be frozen below 0^{o}C to retain the freshness, nutritional value, and taste. Freezing stops microbial and enzymatic activities that enhance fish spoilage.

Materials: Insulated container, deep freezer, ice breaker break big blocks of ice into smaller pieces, ice block, flaked ice maker, weighing scale, safe and potable water supply, and plastic wrappers or sealable bags or aluminium foil.

Procedure

- Tightly wrap quality dressed fish individually in plastic wrap.
- Place the individually wrapped pieces into a sealable freezer bag or wrap tightly in aluminium foil. Do not pack more than 1Kg of fish for fast freezing
- Place the wrapped fish packages in freezer. When placing fish in the freezer, do not stack a lot of packages together in one area.
- Periodically check to ensure that your freezer is working well.
- Once frozen, label and dispatch to the market. Keep it frozen at all time during transportation and marketing

Fish wrapped in aluminium foil

Fish Fillet

A fish fillet is the flesh of a fish which has been cut or sliced away from the bone by cutting lengthwise along one side of the fish parallel to the backbone.

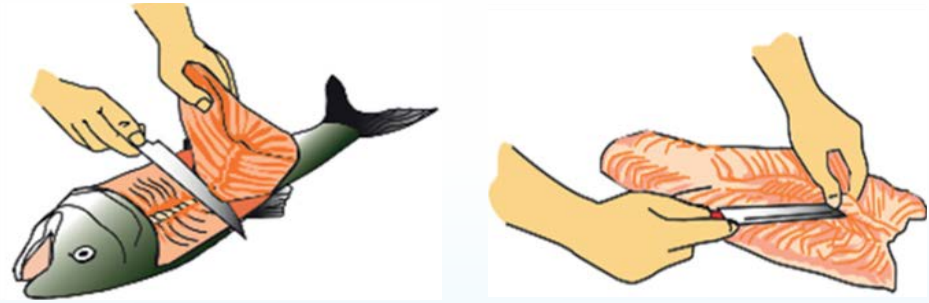
Materials: Safe and potable water supply, stainless steel working tables, stainless steel knives, cutting board, knife sharpener, plastic bucket for collecting fish guts and waste

Procedure:

- Rinse the slime off the fish to obtain more grip of the fish during filleting
- Lay the fish on its side on a cutting board. Cut the fish behind its gills and pectoral fin down to, but not through, the backbone.
- Without removing the knife, turn the blade and cut through the ribs toward the tail. Use the fish's backbone to guide you. Turn fish around and finish cutting fillet away from the backbone.
- Turn the fish over and repeat on the other side.
- Remove rib cage after the fillet is cut.
- To skin the fish fillet, place its skin side down on the cutting board, insert the knife blade about a 1.3 cm from the tail. Grip the tail firmly and run the knife blade at an angle between the skin and the meat.
- Wash the fillet with cold safe potable water, let it drain a little and immediately chill it in ice at a ratio of 1 to 1 (fish to ice) in clean Styrofoam or any other insulated container. Then label and dispatch to the market.

Split to remove guts

Skinning the fillet



Removing the rib cage

Fish Sausages

There are various types of fish sausages depending on the processing procedures and ingredients used. Common types include fresh, cooked smoked and uncooked smoked sausages.

Key ingredients: Fish flesh, pure and finely granulated salt, quality fresh seasonings and spices, nitrates and nitrites, binders and/or extenders, fresh water, ice and sausage casings.

Equipment: Digital thermometer, weighing scales to measure the weight of fish in Kg and of the ingredients in grams, grinders, bowl cutter, stuffer, freezer, stainless steel working tables and knives, insulated plastic boxes, holding Buckets, and protective clothing

Procedure

- Wash the fillets in chilled clean potable water then hold the fillets in ice flakes at below 5^{o}C.
- Check the fillets for any pieces of bones and remove them when found.
- Weigh the fish and other ingredients while keeping each item separately in individual labeled containers.
- Grind or mince the fillets with a mincer
- Mix the fillet with other ingredients in the bowl cutter until you cannot identify / isolate a single ingredient from the rest.
- **Stuffing:** Fit the ready casing onto the stuffer horn and continue pumping the stuffer until all the batter is stuffed into the casing.
- Carefully twist the stuffed casing to form appropriately sized single sausages.
- Pack the sausages in appropriate polyethylene bags, seal them and attach your label.
- Keep the packed fresh fish sausages in the cold room or freeze at -10^{o}C.
- The product can now be dispatched to the market.

Ready to eat fish sausages

Salted Dried Fish

Fish can either be wet or dry salted.

Equipment /utensils: Clean salt containers, clean containers for making brine, insulated containers for holding fish, containers for wet salting, plastic bucket, woven or perforated containers for dry salting, polyethylene sheets, heavy weight wood planks, drying racks, solar drier or sun drying stands, weighing scale, digital thermocouple probe thermometer

Procedure for salting

Weigh the cleaned fish; and calculate the right amount of salt for brining or dry salting.

WET SALTING

- Prepare brine by mixing four parts of clean water with one part of salt.
- Submerge the dressed fish in the brine solution.
- Stir the mixture every 20 minutes.
- Brining takes about 30 minutes for light salting, or upto 24 hours for medium salting.

Preparing brine solution

Dressed fish in brine solution

DRY SALTING

- Prepare a ratio of fish to salt of 2 parts fish to 1 part salt.
- Put salt on the fish but allow the juices and brine (pickle) to drain away.
- Using a perforated container with slats, layer the fish with the first layer being flesh-side upwards, and the next layer of fish being flesh-side down
- Separate the layers of fish by layers of salt, while final layer should be salt.
- Place the container lid on top of the stack and ensure that the lip presses the fish down for faster salt penetration and water removal.
- Restack the fish every 24 hours, so that the fish previously on top end up on the bottom.
- Salting time varies from 3 days to a week, depending on the type and size of fish.

Dry salting

Dried Fish

- Drying is often used in combination with salting for additional preservation.
- It can be sun dried or by using solar or mechanical means. Solar or mechanical dryers allow drying regardless of weather conditions. They also produce more uniform products but their costs are higher than that of drying racks for sun drying.
- Dry on raised platform. Do not sun dry on dirty surface like bare ground to avoid foreign matter contaminating the drying fish.

Sun drying fish

Smoked Fish using improved Kiln

Smoking prolongs shelf life, and increases enhances fish flavour

Requirements: Smoking trays, smoker (smoking) unit and packaging material

Procedure:

- Use quality dressed fish, and if big, split it longitudinally and spread it out.

DO NOT use leftover fish after days selling as this produces poor quality smoked fish.

- Wash the fish again to clean off all the dirt and blood.
- Place the fish on smoking trays wiped with vegetable oil and allow it to dry for about 1 hour.

Smoking kiln

Advantages of improved techniques for fish smoking

- ✓ Efficient firewood use
- ✓ Improved heat and smoke circulation
- ✓ Reduction of smoking time
- ✓ Increase of quantities that can be smoked at once
- ✓ Use of trays reducing tediousness of the process
- ✓ The trays form a chimney to trap the smoke and heat
- ✓ Heat and smoke required during the smoking process can be regulated
- ✓ Uniformly smoked product of better quality in terms of colour, shape and taste
- ✓ Handling of the fish during the smoking process greatly reduced
- ✓ The product acquires a higher market price

Food Safety

- Control hazards associated with food process chain ensuring safe and wholesome product while minimizing negative impact on environment and workers
- All fish products should conform to food safety standards as described by UNBS. Thus, Good Hygienic Practices, Good Manufacturing Practices and Hazard Analysis Critical Control Systems MUST be adhered to.

Product branding

For easy market penetration, loyalty and traceability, use unique product brand and packaging which adhere to UNBS standards for packaging and labelling.

Product traceability

Use product batch numbers and bar codes for identification and tracing of the specific products movements.

Product certification

- Product certification certifies that a product has passed performance test, quality assurance tests and meets qualification criteria as described in the standard.
- It gives confidence to customers that the product is safe and of good quality. and provides a competitive edge compared to other competing products
- In Uganda, for product certification, it should meet the UNBS quality Mark (Q -Mark).
- Certification procedure, requirements and cost can be obtained from UNBS website (www.unbs.go.ug) or visit their head quarter or regional offices for more information.

UNBS mandatory quality mark for all processed foods