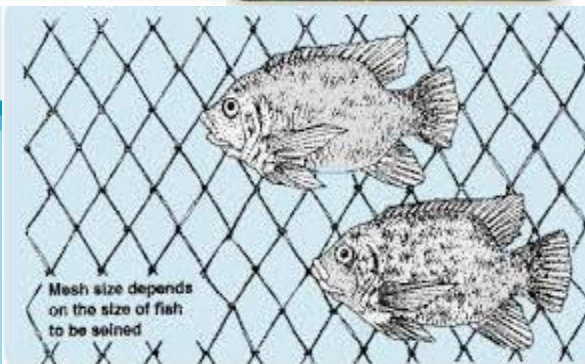
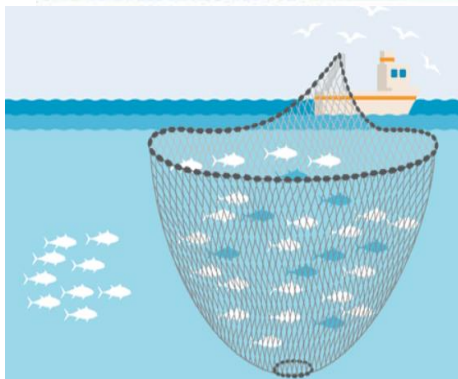


FISHERY AND AQUACULTURE

Level – II

Based on July 2022, Version- I Occupational Standard



Module Title: Performing Fish Harvesting

LG Code: AGR FAQ2 M05 LO (1-3) LG (18-20)

TTLM Cod: AGR FAQ2 TTLM 0123V1

January, 2023

Addis Ababa, Ethiopia

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Introduction to the Module

This module covers the knowledge, skills and attitude required to perform fish harvesting techniques from aquaculture, prepare facilities, proper harvesting of fish from aquaculture fish farm and handle harvested fish

Terminology

Fish: are diverse group of animals that live and breathe in water (any aquatic animal) (or cold-blooded), typically ectothermic covered with scales. All fish are vertebrates (animals with backbones) with gills for breathing. Most fish have fins for swimming, scales for protection, and a streamlined body for moving easily through the water.

Aquaculture: is the farming of freshwater and saltwater organisms including molluscs, crustaceans and aquatic plants. Unlike fishing, aquaculture, also known as aqua arming, implies the cultivation of aquatic populations under controlled conditions.

Fish farming: is the principal form of aquaculture; it involves raising fish commercially in tanks or enclosures, usually for food. Fish species raised by fish farms include salmon, catfish, tilapia, cod, carp, trout and others.

Hygienically: With care to keep free of germs. This will require rodent control, dust management, no rat or bird fecal contamination of feeds or raw ingredients, and feed not being wet.

Occupational health and safety (OHS): actions to be taken to ensure safe operation and maintenance of machinery and equipment

A fishery is a unit, engaged in raising and/or harvesting fish, which is determined by an authority or other entity to be a fishery. Typically, the unit is defined in terms of the following: people involved species or type of fish, area of water or seabed, method of fishing, class of boats and purpose of the activity.

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LG #18

LO #1- Prepare for fish harvest

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Preparing Material, tools and equipment
- Harvesting schedule
- Labor and resource requirements
- Occupational health safety (OHS)
- Risk factors and mitigation procedures

This guide will also assist you to attain the learning outcomes stated in the cover page.

Specifically, upon completion of this learning guide, you will be able to:

- Prepare Material, tools and equipment
- Harvest schedule
- Labor and resource requirements
- Occupational health safety (OHS)
- Risk factors and mitigation procedure

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information Sheets
4. Accomplish the Self-checks
5. Perform Operation Sheets
6. Do the “LAP test”

Information sheet -1

1.1. Identifying and checking materials, tools and equipment

Fish farming require some essential materials, tools, equipment and facilities which are used for varies purposes. Such equipment may be used for:

- maintenance and repairs,
- harvesting the fish,
- monitoring and maintaining water quality,
- packaging stock,
- excluding predators and pests, and
- Other miscellaneous facilities for maximizing the use of various inputs.

This information sheet provides you detail description on materials, tools, equipment and facilities which are used in a variety of categorized tasks in fish farming.

1.2 Preparing Material, tools and equipment





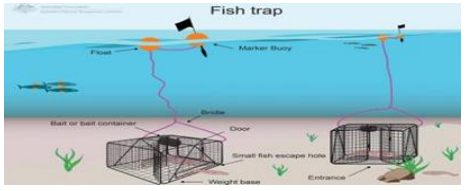
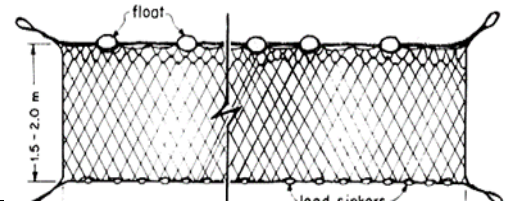
Fish farming require some essential equipment and facilities which are used for varied purposes. Such equipment may be used for maintenance and repairs, harvesting the crop, monitoring and maintaining water quality, excluding predators and pests, and other miscellaneous facilities for maximizing the use of various inputs.

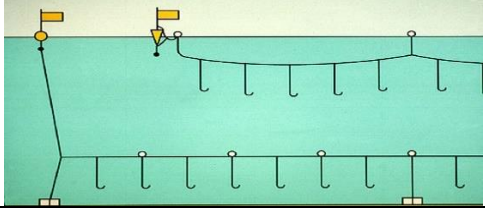
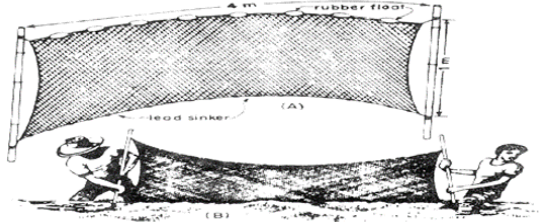
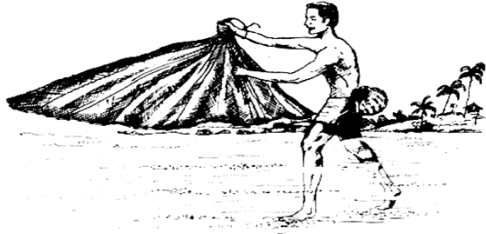


Important materials, tools and equipments in fish harvesting activities includes:-



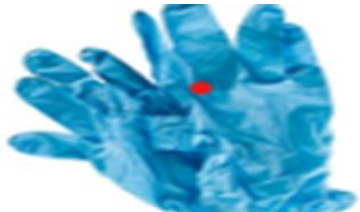

- Fishing gears and nets
- Fishing boats
- Trucks
- Wheel barrow
- Longline
- Seine net
- Plastic bucket
- Overall
- Life jacket
- Fish trap
- Rain coat
- Boots

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Table 1.1. Types Material, tools and equipment

| No | Name | Function | Figure/images |
|----|--------------------------|--|--|
| 1. | Dissolved oxygen meter | To measure water oxygen level |  |
| 2. | Fishing Boats | For fish harvesting |  |
| 3. | Truck | To transport harvested fish |  |
| 4. | Wheel barrow | To transport feed, fertilizer, waste |  |
| 5. | Fish trap | Used to catch finfish species that live on or near the sea floor. |  |
| 6. | Gillnet (bottom gillnet) | Used to catch fishes at bottom and shallow sea. harvesting net of about 1.5 to 2.0 m wide to 50 m by 30 long |  |

| | | | |
|-----|------------------|--|--|
| 7. | Longline | Long lining is used to capture demersal or pelagic fish. harvesting fish of high individual value, |  |
| 8. | Fingerling seine | Used for catching milkfish fingerlings. Shrimps juveniles the net has meshes of 0.5 to 1.0 cm square mesh. used to hold fingerlings during counting or before transport. |  |
| 9. | Cast net | monitor growth or used for sampling stock of fish |  |
| 10. | Plastic bucket | used in the food processing (fish, shrimp & meat) for storage & keeping product fresh. |  |
| 11. | Overall | For fish harvesting industry in general |  |

| | | | |
|-----|-------------|--|--|
| 12. | Boots | For fishery farm in general |  |
| 13. | Life jacket | To float on water,swimming |  |
| 14. | Gloove | For fish harvestking |  |
| 15. | Rain coat | To protect from bad weather(rain) during fish harvesting |  |

1.2 Harvesting schedule

1.2.1 Time of Harvesting

Deciding when to harvest the decision to harvest the fish from a pond is made for three main reasons:

- a. The fish has attained the right size at which it gives maximum profit in the market and any further waiting may reduce the profit.

b. When the prevailing market opportunities (like Christmas and Easter) offer the highest profit and the opportunity may be lost with delay.

c. Temperature. Harvesting should be done at the coolest time of the day to avoid stress to the animals and the quality of the harvest will be better. The early hour is better to haul up live animals to the market.

When harvesting large ponds, draining should start 2-3 days in advance and draining should be continuous to coincide with the pre-fixed time or the harvest.

If draining is stops in-between the animals tend to re-disperse in the pond and get stranded in dry patches. Feeding has to be stopped about 24 hours before harvesting. Fish and shrimp fed till the day of harvest spoil faster than those that are starved for about 24 hours.

In case of shrimp and crabs farms, harvesting should not be done when molting has taken place. A molted shellfish has a soft outer cover; this condition is known as soft shell condition. Such shellfish get damaged very easily during harvesting and handling and fetch a low market price. Since molting synchronizes with new moon and full moon days, and molts are easily recognizable, harvesting should be avoided during this period.

Using information from regular sampling of fish In order for the farmer to decide that the fish has attained optimum size for harvest, the farmer must have been sampling and weighing the fish; and analyzing the data.

1.3 Labor and resource requirements

1.3.1 Forklift Operator

Forklift operators will need to transport valuable items, requiring diligence and good hand-eye coordination.

- Forklift Operator Responsibilities:
 - ✓ Loading, unloading, shipping, and receiving warehouse items.
 - ✓ Transporting materials to different locations within the facility.
 - ✓ Optimizing loads to ensure operational efficiency.

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- ✓ Securing loads to the machine before transportation.
- ✓ Inspecting for damages to vehicles.
- ✓ Scheduling vehicles for maintenance and repairs.
- ✓ Operating and managing technical equipment.
- ✓ Managing inventory by utilizing RF scanning equipment.
- ✓ Picking and wrapping orders for shipment.
- ✓ Identifying workplace safety hazards.
- ✓ Adhering to safety management standards.
- ✓ Adhering to production schedules.
- Forklift Operator Requirements:
 - ✓ High school diploma
 - ✓ Valid fork-lifting certificate.
 - ✓ Excellent hand-eye coordination.
 - ✓ Proficiency in operating technical machinery and RF scanners.
 - ✓ Good physical condition.
 - ✓ Skills. Mathematical aptitude.
 - ✓ Good organizational
 - ✓ Attention to detail.
 - ✓ Good written and verbal communication.

1.3.2 Fish harvest worker (Fisherman) Responsibilities

The commercial fisherman's responsibilities include preparing the caught fish for sale, examining the caught fish for any defects or signs of poor health, and unloading the caught fish off the vessel.

You should also be able to perform minor repairs on fishing gear and equipment as needed.

- Appropriately planning all fishing operations by identifying the best fishing grounds, assessing weather and sea conditions, and estimating the duration of each fishing trip.
- Utilizing fish-finding equipment to locate fish and other aquatic animals.

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- Positioning nets, fishing lines, traps, and dredges to catch fish, crustaceans, and other aquatic animals.
- Measuring caught fish to determine whether they meet legal size requirements and releasing all illegal catches into the water.
- Cleaning the caught fish, sorting them, and storing them in refrigerated or ice-filled holds.
- Operating trawl winch systems and similar machinery to hoist captured fish onto the vessel.
- Ensuring that all hoisting machinery is in good working order.
- Performing basic cleaning duties on board the vessel as needed.

1.3.3 Boat Operator Duties

- Operates a boat in sea and inland coastal waters.
- Makes fishing trips in coastal waters; Carries passengers to and from the mainland.
- Maintains boats and fishing equipment, including shrimp nets, and dock areas.
- Performs related work as required.
- Ability to operate sea-going boats and obtain ample collections
- Ability to understand and follow oral and written instructions.
- Skill in making necessary minor and emergency repairs to marine equipment and docks.

1.4 Occupational health safety (OHS)

1.4.1 OHS Legal Responsibilities

The Occupational Health and Safety (OHS) act and regulations makes mussel, oyster and finfish growers, their workers and contractors all responsible for ensuring the safety of the aquaculture workplace.

This includes growers who may be working on aquaculture leases, at their farm buildings or on their own property; and lease owners who do not personally operate the lease. Employers,

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workers, self-employed persons, and suppliers all have responsibilities under the Occupational health and safety act.

Everyone working on the aquaculture farm is responsible, to the extent of their influence, for the health and safety of all persons at the workplace. This is commonly referred to as the Internal Responsibility System.

The concept of hygienic behavior consists of simple, hygienic actions that individual fishers and people who handle fish products can adopt.

These principles apply both to the people who handle the catch and the equipment and surfaces that the fish products come into contact with.

- The basic hygiene concepts covered include:
- Personal hygiene rules for people handling and catch fish.
- Production hygiene,

All these objects must be regularly cleaned to avoid contamination of the fish products.

Simple steps that can prevent pathogens from contaminating fish products include

- avoiding fishing in polluted waters,
- keeping the boat and fishing gear clean,
- observing good personal hygiene and keeping animals away from the boat.
- Keeping body clean and wearing clean clothing before starting work or fishing,
- washing hands with soap and clean water after going to the toilet,

The following should not be permitted in areas where fish products handled:

- Smoking;
- Spitting;
- Chewing or eating;
- Sneezing or coughing over the product;
- Wearing personal effects such as jewellery, watches, pins or other items that, if dislodged, may pose a threat to the safety.

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1.4.2 Employers' Responsibilities

The duties and responsibilities for all employers can be found in Section 12 of the Occupational health and safety act. Employers are responsible to take every reasonable precaution to protect the health and safety of their workers and any person on or near the workplace.

- Employers must also:
 - ✓ Provide and maintain machinery, equipment and materials in a safe condition
 - ✓ Provide adequate information, instruction and training to enable workers to work safely
 - ✓ Ensure workers are adequately supervised
 - ✓ Ensure workers are familiar with the task at hand
 - ✓ Ensure workers are familiar with the proper use of all personal protective equipment and devices (e.g., guarding) required for their health and safety
 - ✓ Consult with workers on health and safety matters
- Employers must also post in a prominent place the following information:
 - ✓ A current copy of the Occupational Health & Safety Act and Regulations
 - ✓ Any relevant Code of Practice
 - ✓ All information and reports recommended by an Occupational Health and Safety
 - ✓ Officer
 - ✓ All chemicals in the workplace. Employers must prepare a list of all chemical substances in the workplace which may be a hazard to the health or safety of the worker.

1.4.3 Workers' Responsibilities:

Workers (including independent contractors) must take reasonable care to protect their own safety and health, as well as that of others on or near the aquaculture operation.

- To ensure health and safety, workers must:
 - ✓ Cooperate with their employer and use all protective devices, equipment and clothing required by the employer

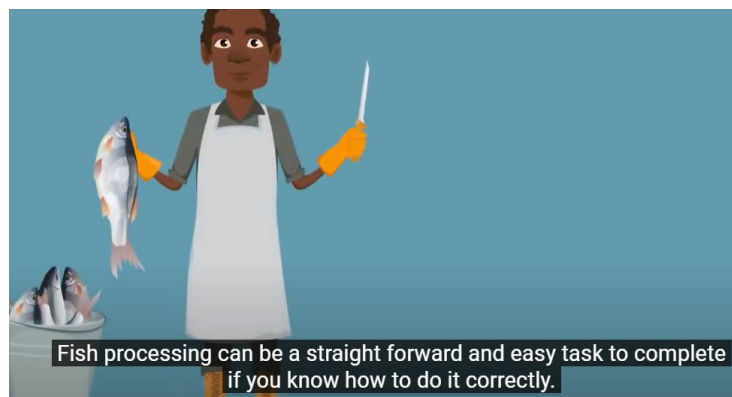
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- ✓ Consult and cooperate with the employer and other workers on workplace health and safety issues
- ✓ Comply with the Occupational Health and Safety Act
- ✓ Cooperate with any Occupational Health and Safety officials
- ✓ Report any potential workplace hazards or dangers to a supervisor.

1.4.4 Fishing Boats Hygiene Requirements

Before leaving to the fishing ground, the boats/canoes should meet the following requirement

- Safety and efficiency of the fishing boat/canoe for operation
- Fisher-folk should maintain personal hygiene in the boat/canoe
- The boat and equipment should be thoroughly cleaned using clean water and approved detergent,
- The boat and equipment should be inspected for damage and necessary maintenance carried out.
- Landing site water should not be used for cleaning, as this water will be polluted;
- Avoid animals into the fishing boat and using the boat for transport of products other than fish products because it increases the contamination risks;
- Fishing boats should be used for fishing only;
- Use tap water from the public water supply or clean well/borehole water that has been treated with chlorine to clean boats and equipment;
- Do Not use water that may be contaminated with sewage;
- Allow the fishing boat and equipment to sun dry



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Figure 1.1. OHS in fish harvesting and processing
source:<http://youtube.com/watch?v=UP3gwGauWrg>

1.5 Risk factors and mitigation procedures

1.5.1 Identify Hazards and the Associated Risks

Job tasks which involve hazards that could cause physical harm need to be examined. The following information will assist in identifying the hazards and putting procedures in place to deal with the associated risks on an aquaculture operation.

A hazard is any situation, activity, procedure, piece of equipment/machinery or fish that may cause harm or injury to a person.

Common hazards that mussel, oyster and finfish growers face in the routine operation of their leases and farms are covered in the Prince Edward Island Aquaculture Occupational Health and Safety Code of Practice. These include:

- The work environment (inclement weather, heat, cold, sun)
- Machinery and equipment (hydraulics, boat stability)
- Navigation
- Diving
- Fish handling (needle-stick injuries, cuts)
- Electricity
- Workplace layout (ladders, decks)
- Combustible materials (gas, diesel)
- Working alone

The following steps are a practical and effective way of controlling hazards:

Step 1: Identify the Hazard

All tasks, equipment and substances should be examined. When listing hazards use:

- Information from past incidents and workplace injuries
- Information from your families, workers, neighbors
- Product literature and information from suppliers
- Best industry practices

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- Sight, smell, touch and hearing senses
- Close examination of areas or activities where children or visitors may be present

Step 2: Assess the Risk

If a hazard has been identified, assess the risk by examining;

- The likelihood of the hazard resulting in injury to the crew or other persons - is it likely or unlikely to occur?
- The likelihood of the hazard resulting in damage to the boat or equipment, and
- The severity of the incident - could it cause death, serious injury, or minor injury?

Step 3: Eliminate or Control the Hazard

There are several ways to control a hazard. Pick the way(s) that is reasonable and practical for the circumstances.

- Eliminate hazards posed by equipment, animals, and the environment if at all possible. For example, get rid of a faulty machine.
- Substitute something safer by using a different machine, material or work practice that poses less risk to perform the same task. For example, use a safer chemical instead of a more dangerous chemical.
- Use engineering/design controls when it's not possible to eliminate hazards.
- Engineered controls include machinery guards and PTO shields. Design controls, such as locked fences, isolate the worker from the hazard.
- Protect workers if other controls are inadequate.

| | |
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| Self-check 1 | Written test |
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Name..... ID..... Date.....

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

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Part I: Say True or False for Questions based on statements.

1. One of the criteria for fish harvest schedule is market demand.
2. Level of dissolved oxygen in water is not affect fish harvesting task.
3. Fish handling method will influence on productivity.

Part II. Fill in the black space

1. _____ is equipment worn by a fish worker to minimize exposure to specific hazards.
2. Performing a _____ of the workplace to identify and control physical and health.

Part III. Short Answer Questions

1. Define Fish.
2. Define Aquaculture.
3. Write at least 3 tools equipment & materials necessary for fish harvesting.

LG #19 LO #2- Perform Fish Harvesting from Aquaculture

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Fish harvesting techniques and principles
- Occupational Health and Safety Requirements

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- Positioning, Calibrating and Operating Equipment
- Set Fishing net
- Fish harvest technology
- Seining Pond and lifting Cages
- Packing and transporting harvested fish
- Process and store harvested fish

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Fish harvest techniques and principles
- Occupational Health and Safety Requirements
- Position Calibrat, and Operat Equipment
- Set Fish net
- Fish harvest technology
- SeinPond and lift Cages
- Pack and transport harvest,ed fish
- Process and store harvested fish

Learning Instructions:

- Read the specific objectives of this Learning Guide.
- Follow the instructions described below.
- Read the information written in the information Sheets
- Accomplish the Self-checks
- Perform Operation Sheets
- Do the “LAP test”

Information Sheet- 2

2.1 Fish harvesting techniques and principles

2.1.1 Choice of fishing method and gear

Many factors enter into the choice of the method and gear used to catch a particular species in a particular area.

- Principally, the choice will depend on:

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- ✓ The depth of water
- ✓ The characteristics of the bed of the lake or stream if gear is to be worked in contact with the bottom
- ✓ The species being fished
- ✓ The season of year and the flow regime in the case of rivers
- ✓ Individual value of the species to the fisherman

Depth of water

The various types of fishing gear are designed to be operated within particular depths of water, typically: at the surface of deep lakes, on the lake bed in shallow areas, or between surface and bottom where depth is not too great. Depth of water will therefore exert considerable influence on the choice of suitable gear.

Characteristics of lake and river bed

Some types of fishing gear, particularly those that rely on their movement over the bottom, are susceptible to damage from hard, uneven or rough lakebeds, and it is often impossible to use them due to the unsuitability of the bottom topography. In many cases static gear can be placed on the bed of lake or river with little problem.

Species being fished

The various species of commercially important aquatic organisms have differing habits, movements, and reactions to stimuli; freshwater shrimps and most mollusks are found living on or in the lake or riverbed as are a wide range of fish species. Demersal species of this type are usually caught by fishing gear worked on the lakebed.

Pelagic species may be found anywhere between the bed and the surface, and these are normally taken by fishing gear that is not in contact with the bottom. In certain circumstances, such as during spawning, fish tend to congregate in shallow waters and may be caught by various types of fishing gear used in conjunction with light

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The distribution and movements of each species are controlled by external factors such as water temperature, salinity, and flow regime. They are also conditioned by behavioral factors including spawning habits, location of available food resources, and avoidance of stressful environments. Many species cope with seasonal changes by migrations of long or short duration between spawning, shelter and feeding habit.

Season of year and the flow regime

Seasonal migrations are highly significant for fisheries. In rivers the movements of species along river channels and between the river channels and adjacent floodplains provide increased opportunities for capture due to the predictability of the event and the high concentrations of fish sometimes observed. Events in lakes where fish ascend inflowing rivers to spawn and in the sea where anadromous and catadromous fishes move between the salt water and freshwater environments present similar opportunities.

2.1.2. Common methods for harvesting

A. Using lift nets

The lift net is a net made into a sack with one open end that is dipped into the pond to scoop up fish. The mouth of the lift net is made of a ring made from a cane or a metal rod. The length of the rod or cane is about 1 1/2 to 2 m long before bending into a ring.

The wider ends are tied to the metal ring. The two open edges of the net are seamed together to make an inverted umbrella and the two pieces closed by tying. The lift net can be braided by hand (after training) or are bought and trimmed into a cone with one wider end and one narrow an end. The wider ends are measured to half the length of the ring for each net.

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Figure 2.1. Fish harvesting lift net.

The lift net can harvest a reasonable quantity of fish, as much as 30 kg at a go and therefore can be applied for commercial production. The method does not bruise or stress fish, and fish can be delivered to the market very fresh. The lift net, however, is not suitable for ponds larger than 2000m².

It cannot harvest all the fish. Finally the pond should be drained so as to complete the harvest. To operate the net it is dipped into the water and food is placed around the net. The net is left for 30 minutes for fish to gather above it while feeding, then quickly; the net is lifted with the fish that was in the water above

B. The seine net

The seine net is the conventional pond net. It is like an open curtain made of a net with small meshes. The top side of the net is tied to a rope on which plastic round spheres (floats) are attached at about 1 m interval. The seine net is a large curtain-like net.

It has floats on one side that keeps the net above water surface. It has heavy cement balls on another side that keeps the net at the bottom of the pond. Therefore, the net remains open during fishing. One wing of the net Metal or wooden ring. 1m long folded into a ring. The bottom side is tied to another rope on which small stones are attached at about 1 m interval.

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The length of the net should be longer than the width of the pond by an extra 3 to 5 m to make a curve when it is operated.

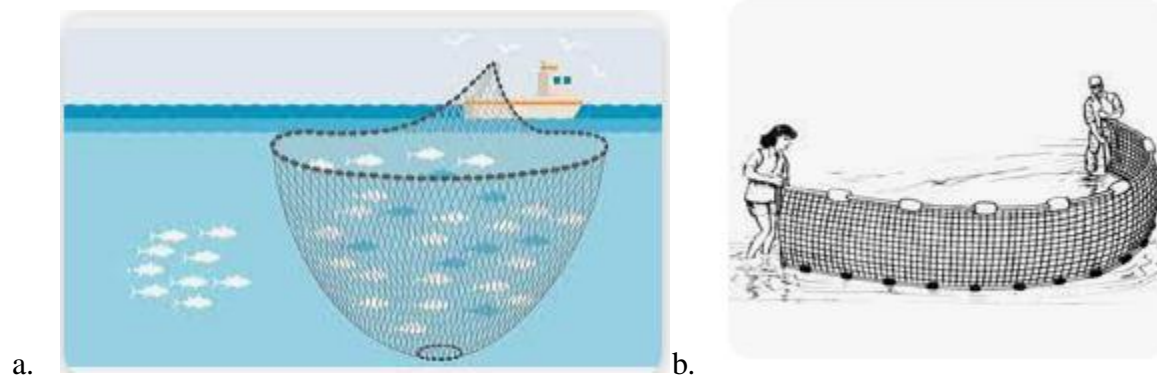


Figure 2.2. a) Purse seine net

b) Fish harvesting seine net

It has trapped fish in the middle Seine net attributes are:

- It makes bulk harvests (harvesting up to 90 percent of the fish stock in the pond when fished four to six times repeatedly).
- It is expensive (about UGX 10 000 per m length), but it lasts long (up to five years with minor repairs).
- It requires more labour to operate (ranging from 4 people for 10 m x 20 m pond to as many as 12 people for a 20 m x 50 m pond).
- It is most appropriate for large size ponds

C. Harvesting using gill nets

The gill nets are nets with varying mesh sizes. It is operated by setting it well spread in the pond and left there. It is checked after about an hour or longer.

Fish is caught when it pushes its head through the meshes and gets trapped. The gill net is highly selective and the size of fish caught depends on the size of the net. The gill net cannot harvest all the fish in the pond.

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Figure 2.3. Fish harvesting using gillnets.

Gill net attributes are:

- The gill net is expensive for small scale farmers (UGX 15 000 for 4” mesh).
- It may catch many fish, but cannot be used to harvest all the fish.
- It is easy to operate but the farmer has to enter the pond; only one person can set it.
- It harms fish and is not suitable for catching and returning some fish

D. Harvesting using cast nets

A cast net is a net made like an umbrella. It is tied on a rope. It opens out when cast over the pond. As it sinks deep into the pond the mouth is closed, trapping whatever fish that will be in the water

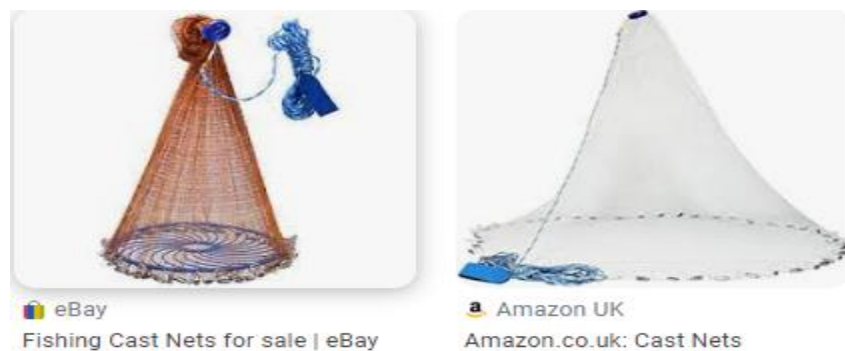


Figure 2.4. Cast nests

Cast nets attributes are:

- It is simple to operate, but requires training in the skills.
- Does not require large labour force (only one person)
- Catches by chance and the operator does not have much choice of the fish to catch.

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- It does not harm fish, the fish can be returned into the pond. space enclosed. Advantages of cast:
- The cast nets are cheap.

E. Using hooks

Hooks are bought from shops selling fishing equipment. They vary in sizes from number 1 (the largest) to number 10 (the smallest). A hook is fixed to a rope tied to a handle. The hook and its rope (hook acid line) are very cheap, simple to make and use. However, a hook catches one fish at a time. The hook and line cannot harvest all the fish from the pond. Most of the fish still remain in the pond. The pond should finally be drained to completely harvest the pond.



Figure 2.5. Different types of hooks.

Hook and line attributes:

- It depends on luck and the operator cannot choose the fish to catch.
- It is not very selective and smaller fish may be caught leaving the larger ones.
- It injures fish and may not be suitable for sampling fish that will be returned into the pond.
- It catches a few fish at a time, depends on luck. Finally the pond must be drained to remove all the fish.
- Only suitable for small ponds (up to 10 m x 20 m)



Fig 2.6. Fish harvesting method in Ethiopia

2.2. Occupational Health and Safety Requirements

Some safety precautions for harvesting fish include:

- Harvest early in the morning or late in the evening
- Do not feed fish prior to harvest
- All equipment and personnel must be present
- Scoop a little at a time to grade and for estimation
- Keep fish in water
- Minimize stress from excessive handling
- Wear gloves to handle fish

Take good care of the fish you catch. Fish will turn rotten very quickly if they get too warm or if they are kept in a dirty place. The best way to keep fish fresh is to keep cool by putting them in a clean, covered box with plenty of chopped ice.

If you cannot get ice, keep the fish fresh by protecting them from the sun and by putting them in a clean place.

Fish that are going to be dried or salted must also be kept fresh until you are ready to begin the salting or drying.

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2.3. Positioning, calibrating and operating equipment

Dissolved oxygen meter calibrate method

A dissolved oxygen meter is used to measure the level of dissolved oxygen in water. It consists of a probe and a meter. The probe is lowered into water and gently moved from side to side, and then a reading is taken from the meter.

The methods of calibration can be very similar for different types of dissolved oxygen meters, but you should always check the user manual for the specific dissolved oxygen meter you are using for the correct way to calibrate it.

Material necessary for dissolved oxygen meter calibration

- | | |
|---------|----------------|
| ✓ PPE | ✓ Probe holder |
| ✓ Probe | ✓ Water |

- **Steps/procedures**

- Turn the meter on and inspect the probe for damage.
- Place the probe in a holder that contains a sponge which has been moistened with distilled water.
- Allow time for the probe to "warm up" and for the air in the probe holder to become saturated with water vapor.
- Set the altitude on the meter.
- The probe will now be calibrated to 100% saturation.
- Set the salinity of the water sample that you want to measure on the meter.
- Put the probe into the water sample and gently move it from side to side.
- Wait until the reading on the meter becomes stable, and then record the result.

2.4 Set fishing net

The contents describes how to set different kinds of nets, how to use the nets, and tells about equipment that can be used to make fishing easier.

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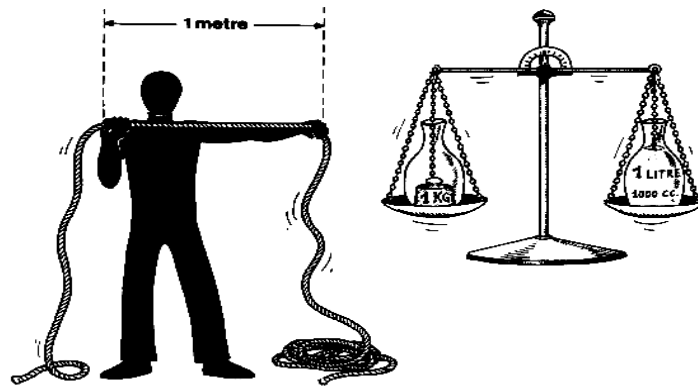


Figure. 2.7. Setting fishing nets

The measurements in the part are all given in the metric system. For the big measurements (like the length of nets or the weight of sinkers) it is all right to say that a meter is the distance from your left shoulder to your right hand and that a kilogram is the weight of a 1-litre bottle full of water.

2.4.1 Gillnet operation

A gillnet catches fish that swim into it. It has a float line along the top and a lead line along the bottom. The netting hangs straight up-and-down in the water like a good fence. A gillnet catches fish by their gills. The twine of the netting is very thin, and either the fish does not see the net or the net is set so that it traps the fish. The meshes of the net hang wide open. When the fish swims up to the net it sticks its head right into one of the meshes.

If the fish is too small for the mesh it will swim right through and get away. If the fish is too big for the mesh it might tear the net and get away. If the fish is the right size it pushes its head and body tightly into the mesh, but it is too big to fit through.

When the fish tries to pull its head out of the mesh the thin twine cuts into its skin; its gills and fins get caught in the mesh. The fish stays in the net until you pull it up (Fig. 2c). Fish are also caught when the net wraps around them.

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Fish harvesting with a bottom-set gillnet

Material required

- PPE
- Net
- Knife
- Floating wooden ball
- Bucket
- Boat
- meter

Procedures

Gill netting requires time for preparation, time for setting nets, waiting time, and time for retrieving nets. The time each one of these tasks takes to complete will vary with the number of nets you will be setting and how long you leave them in the water

Step 1: Equipment and Materials



Figure 2.8. Gillnet operation

Step 2: Preparation and Organization



Figure.2.9. Net preparation

Step 3: Choosing net based on purpose and fish size.

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Step 4: Determine your mesh size

Gill nets have the ability to be very selective to both size and species of fish. One way this is done is by changing the size of the nets mesh holes. A gill net catches a fish when its head goes through the mesh hole and gets stuck around the widest part of their body.

It may be any size from 1 x 1 m up to 4 x 4 m. smaller nets are sometimes made more circular in shape. Mesh size is usually small, about 10 to 20 mm bar size according to the fish to be harvested.

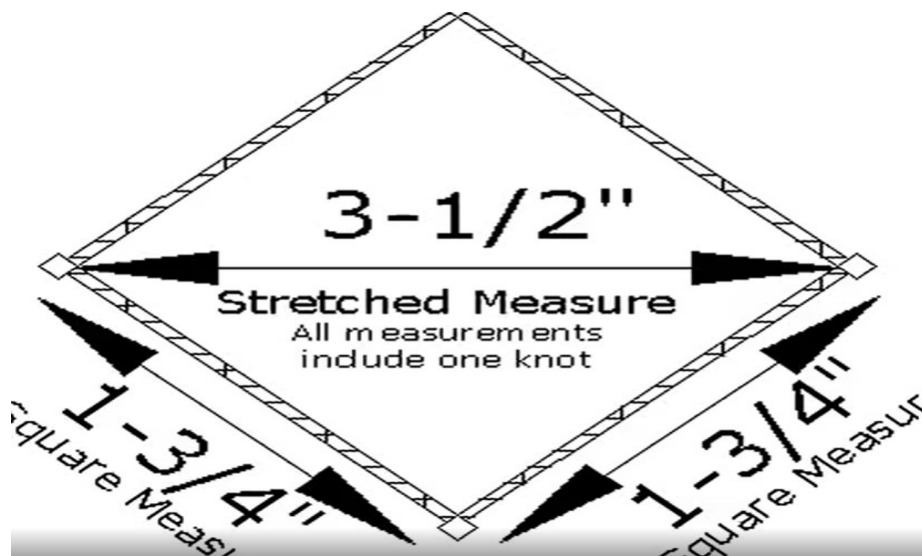


Figure. 2.10. Mesh Size

Step 5: Net placement: The right place at the right time.

Step 6: Setting the net: After you have completed all the preparation, it is time to set the net.

- Approach the area where you will set the net (in this case a rock shoreline)
- Attach float marker and anchor.
- Throw the anchor and float marker near shore.
- Reverse the boat and feed out the net.

Step 7: Attach Float and Anchor



Figure. 2.11. Attach Float and Anchor

Step 8: Waiting Gam

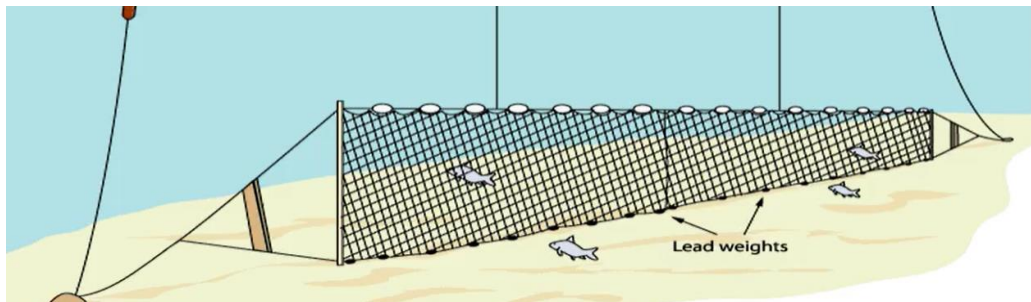


Figure. 2.12. Waiting Gam

Step 9: Pulling in the Net



Figure 2.13. Pulling in the Net

Step 10: Remove Fish from the Net



Figure 2.14. Remove Fish from the Net

2.5 Fish harvest technology

2.5.1 Gillnets

The gillnet is a large wall of netting which may be set either just above the bottom when fishing for demersal species, or anywhere from mid-water to the surface when pelagic fish are being sought.



Figure 2.15 Harvesting using gillnets

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2.5.2 Long Lines

Long lining is used demersal or pelagic fish. The gear is rigged to suit the species sought and the area used to capture fished; it is of particular importance in harvesting fish of high individual value, but is also widely used by subsistence fisheries.

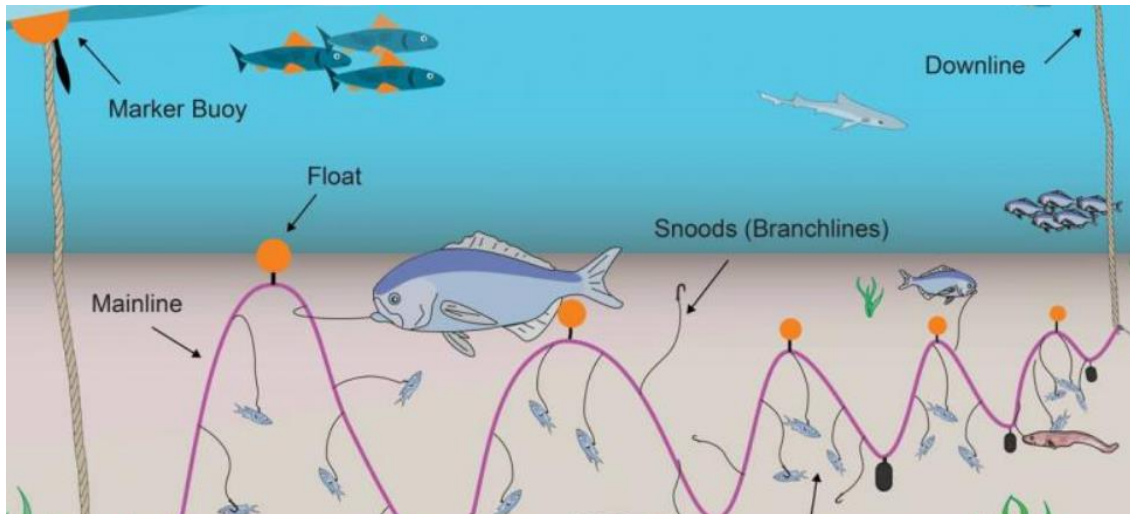


Figure 2.16. a. Bottom longline

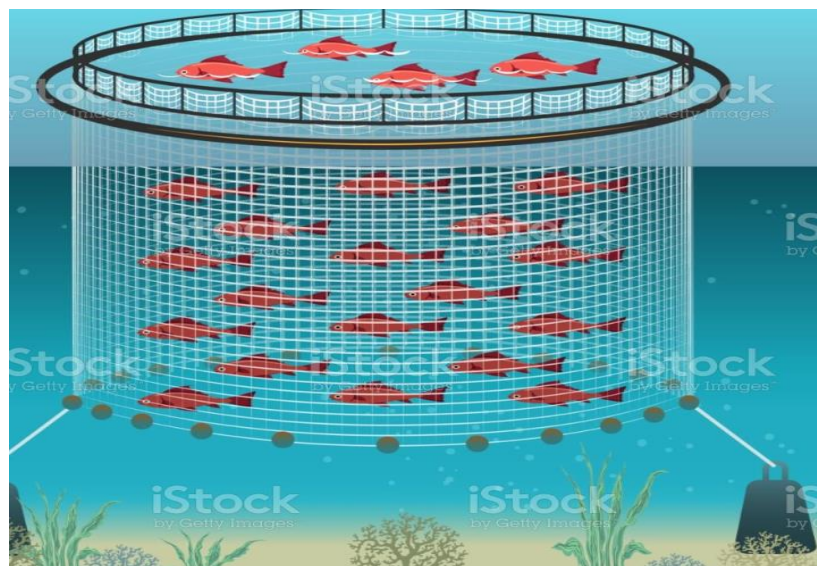


Figure 2.16. a. Floating

Source: <https://www.istockphoto.com/vector/floating-farm-illustration-gm1341577178-421272345>

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2.6 Seining pond and lifting cage

2.6.1 Seining

Seining is done in water less than 12 feet in depth. Seining works well when aquatic plants and algae are not at nuisance levels. Bottom structures, stumps, and large rocks may interfere with the success of seining. A sandy beach with a gradual slope works best for the staging area when conducting seining.

The seining method uses a large net on two poles (one pole on each side of the net). Seines are typically pulled from the shoreline with a boat in a circular quadrant area, though this is dependent on several factors including but not limited to: location, bottom type, substrate, and targeted fish species.

Aquatic Biologists Inc. utilizes many different seines for sampling fish. They may include a small 100 foot seine with a 12 foot depth to our 200 foot seine that can fish down to a depth of 22 feet. Most often we use multiple seines and use one seine as a barrier or wall to further improve the success of our seining.

Seining can be very labor intensive as it takes a fair amount of muscle to drag and pull a large seine through the water. Often times, when the staging area allows, we may use a four wheeler in addition to our boats to manipulate the seine.

Seining is normally scheduled for 4-8 hours on site depending on the size of the lake or pond. Multiple draws occur during that time frame.

Harvesting fish using the seine net

a. Materials required

- seine net
- Boat

b. Procedure for seining pond

- Pull The Seine from Both Sides of the Pond

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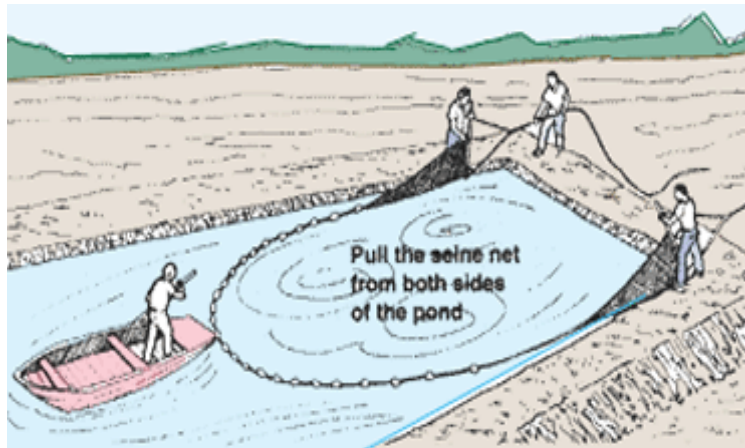


Figure 2.17. Pulling seine net in pond

- Keep the fry in the net and move it towards the bank

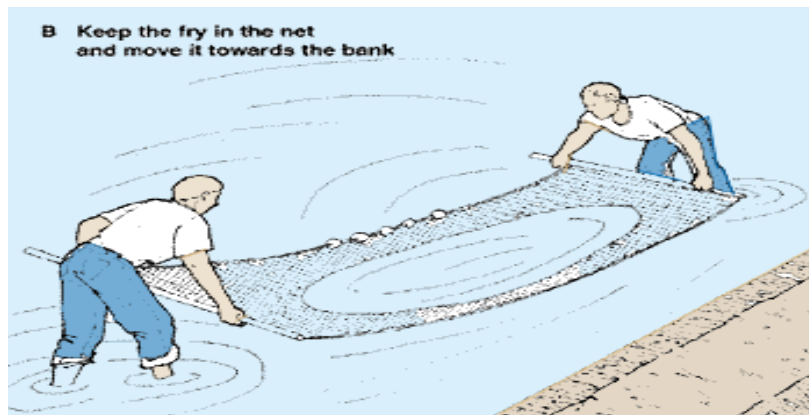


Figure 2.18. Keeping the fry in the net

- Takes the net & encloses the fry in pocket

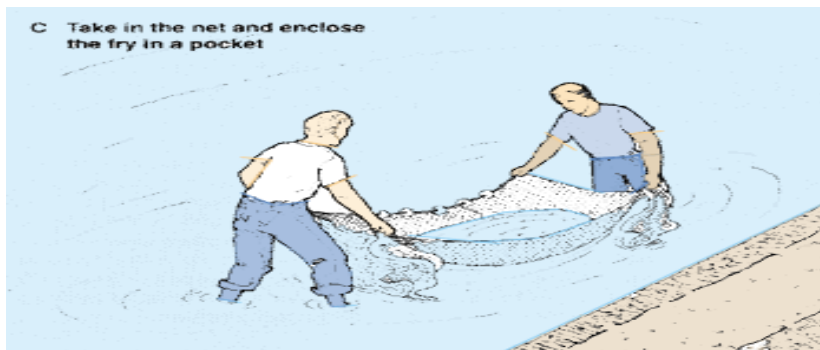


Figure 2.19. Taking and inclosing the fry in the pocket

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- Transfer the fry to container using dip net



Figure 2.20. Transferring fry to the container

2.6.2 Fish harvesting from cages

a. Materials required for fish harvesting using cages includes

- All necessary PPE
- Bucket
- Boat
- Scoop
- nets,
- bins,
- divers
- gear and
- Air cylinders.
- ice

b. Procedures

I. Pre-harvest preparation

Sampling the fish, if a cage is going to be harvested for the first time, it is a good practice to sample the fish a few days before the harvest to check the mean weight and size distribution.

Sampling will verify that the sampled weight corresponds to the expected weight.

This will avoid harvesting a batch of fish that have not yet reached the required market size.

II. Starving the fish

It is important to starve the fish before harvesting to keep the process as clean and stress-free as possible. Starving the fish will serve the following purposes:

- ✓ Prevent partly digested feed from being regurgitated into the transport bins, or faecal matter being released, which can foul the ice or brine slurry.
- ✓ Remove residual feed from the intestine, which increases shelf-life because undigested feed will decompose.

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- ✓ Reduce the overall stress of the stocked fish:

III. Preparing the equipment

IV. Set Purse seine harvesting system

The purse seine technique is appropriate for harvesting large quantities of fish or when the cage needs to be completely harvested.

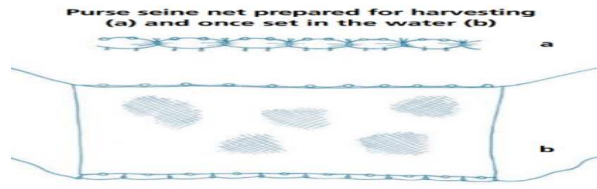


Figure 2.21. Prepared seine net for harvesting.

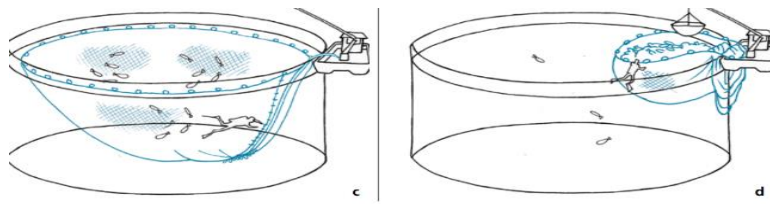


Figure 2.22. Purse harvesting system

V. Divers check to ensure that the net is properly set and that it is not tangled or twisted

VI. The next phase consists of closing the seine net lead-line by pulling on the pursing line

VI. Scooping fish from a floating farm cage.

Once the required quantity of fish has been secured, and the net is fastened on the handrail, fish are harvested with a special scoop net (also known as a “brailing net” or “landing net”



Figure 2.21. Scooping fish from the floating farm

Source: <https://www.youtube.com/watch?v=2XogN7ORAM4>

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2.7 Packing and transporting harvested fish

Soon after harvest aqua crops need to be properly packed and preserved 'until consumption. They must reach the consumer's table or processing factory with minimal losses of initial freshness. For this reason special care is taken to pack the' fish in suitable containers that prevent further handling. Freshly harvested fish is generally packed in rectangular wooden or plastic boxes where both salting and icing are done before transportation.

The degree of insulation provided by the packing material, and the stacking pattern is to be considered before packing.

The traditional wet-lock box and plastic boxes lined with or without .Styrofoam are often used while shipping the fish with ice. A common feature of all packing boxes should be that provision be made for adequate waterproofing of the insulation material so that it does not become waterlogged due to condensation of water vapor on the outer walls or due to meltdown. A typical container for transportation of fish. Transportation of fish can be done by three routes: air water or rail.

The method of operation and design of transport adopted must suit the peculiar requirements of the product. Moreover, for freshly harvested fish, the cold-chain must continue up to the consumer or processor level.

The vehicles used for transport of fish on land must have an insulated cabin at the rear end with facilities for maintaining cold temperature en route and drainage of melt water. Apart from this proper air circulation prevents development of warm spot.



Figure.2.23. Fresh fish packaging

Source:<https://www.ulmapackaging.com/en/packaging-solutions/fish-seafood/fresh-fish/fresh-whole-fish-packaging-in-flow-pack-hffs>.

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2.8 Process and store harvested fish

Handling of harvested fish

The retention of nutritional properties and product quality of fish is dependent on proper handling of the catch after it has been harvested from its aquatic environment.

Processing activity and storage condition

Chilling

Harvested fish must be immediately stored in a low-temperature environment such as ice or refrigerated seawater. This chilling process slows the growth of microorganisms that live in fish and inhibits the activity of enzymes.

Because fish have a lower body temperature, softer texture, and less connective tissue than land animals, they are much more susceptible to microbial contamination and structural degradation. If immediate chilling is not possible, then the fish must generally be sold and eaten on the day of the harvest.

Ice cooling and holding normally requires a one-to-one or one-to-two weight ratio of ice to fish, depending on the specific geographic location and the time it takes to transport the fish to the processing plant.

Refrigerated seawater cooling and holding causes less bruising and other structural damage to the fish carcasses than ice cooling. However, fish cooled in refrigerated seawater absorbs salt from the water.

For this reason fish that is destined for sale on the fresh or frozen market may be held in refrigerated seawater for only a limited amount of time. The addition of salt during canning or smoking processes is adjusted in order to compensate for any absorbed salt.

Preprocessing

Preprocessing of fish prepares raw material for final processing. It is often performed on shipboard or in a shore-based plant and includes such operations as inspection, washing, sorting, grading, and butchering of the harvested the fish.

The butchering of fish involves the removal of nonedible portions such as

- ✓ Fins.
- ✓ the viscera,

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- ✓ head,
- ✓ tail, and

On the butchering process, as much as 30 to 70 percent of the fish may be discarded as waste or reduced to cheap animal feed. The lower figure applies when the fish is canned or sold as “whole.” The higher figure applies when the fish is filleted or made into other pure meat products; in these cases the skeleton is discarded with as much as 50 percent of the edible flesh attached. Efforts to utilize this discarded fraction for the production of alternative food products have begun in the fish industry. (See below Total utilization of raw materials. Final processing of fish

The four basic procedures used in the final processing of fish products are

- ✓ heating,
- ✓ freezing,
- ✓ controlling water activity (by drying or adding chemicals), and
- ✓ Irradiating.

All these procedures increase the shelf life of the fish by inhibiting the mechanisms that promote spoilage and degradation. Each of these procedures also has an effect on the nutritional properties of the final product.

Heating

Heat treatment can significantly alter the quality and nutritional value of fish. Fish is exposed to heat during both the cooking process and the canning process.

Cooking

Fish is cooked in order to produce changes in the texture and flavour of the product and to kill pathogenic microorganisms. Heating fish to an internal temperature above 66 °C or 150 °F (i.e., pasteurization conditions) is sufficient to kill the most resistant microorganisms. The cooking time must be closely regulated in order to prevent excessive loss of nutrients by heat degradation, oxidation, or leaching (the loss of water-soluble nutrients into the cooking liquid).

Canning

The canning process is a sterilization technique that kills microorganisms already present on the fish, prevents further microbial contamination, and inactivates degradative enzymes.

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In this process fish are hermetically sealed in containers and then heated to high temperatures for a given amount of time. Canned fish can be stored for several years. However, sterilization does not kill all microorganisms, and bacterial growth and gas production may occur if the products are stored at very high temperatures.

Freezing

Of the many processing methods used to preserve fish, only freezing can maintain the flavour and quality of fresh fish. Freezing greatly reduces or halts the biochemical reactions in fish flesh. For instance, in the absence of free water, enzymes cannot react to soften and degrade the flesh.

Cold storage

Once fish is frozen, it must be stored at a constant temperature of -23°C (-10°F) or below in order to maintain a long shelf life and ensure quality. A large portion of fresh fish is water (e.g., oysters are more than 80 percent water). Because the water in fish contains many dissolved substances, it does not uniformly freeze at the freezing point of pure water.

Instead, the free water in fish freezes over a wide range, beginning at approximately -2°C (28°F). The amount of remaining free water decreases until the product reaches a temperature of approximately -40°C (-40°F).

Fish held below that temperature and packaged so as not to allow water loss through sublimation can be stored for an indefinite period. Unfortunately, there are relatively few commercial freezers capable of storing fish at -40° because of the tremendous variation in energy costs. Fish are therefore normally stored at -18 to -29°C (0 to -20°F), resulting in a variable shelf life ranging from a few weeks to almost one year.

Controlling water activity

Reducing the water activity of fish inhibits the growth of microorganisms and slows the chemical reactions that may be detrimental to the quality of the fish product. The control of water activity in fish is accomplished by *drying, adding chemicals, or a combination of both methods*.

- **Drying**

The principal methods of drying, or dehydrating, fish are by

- ✓ forced-air drying,
- ✓ Vacuum drying, or vacuum freeze-drying.

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- **Curing**

Curing reduces water activity through the addition of chemicals, such as salt, sugars, or acids. There are two main types of salt-curing used in the fish industry: dry salting and pickle-curing. In dry salting the butchered fish is split along the backbone and buried in salt (called a wet stack). Brine is drained off until the water content of the flesh is reduced to approximately 50 percent (the typical water content of fresh fish is 75 to 80 percent) and the salt content approaches 25 percent. In heavy or hard-cure salting, an additional step is taken in which warm air is forced over the surface of the fish until the water content is reduced to about 20 percent and the salt content is increased to approximately 30 percent. Most dry-salted fish products are consumed in warm, humid countries or in areas that have few means of holding products in refrigeration or cold storage

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Self-check 2

Written test

Name.....ID..... Date.....

Directions: Answer all the questions listed below

Test I: Choose the best answer

1. _____ is a type of fish harvesting net used to done in water less than 12 feet in depth.

- b. cast net
- c. scoop net
- d. seine
- e. gill net

2-----is used to store Harvested fish in a low-temperature environment.

- A. chilling
- B. freezing
- C. heating
- D. waste disposal

3. -----is a method used to reduces water activity by adding salt.

- A. curing
- B. freezing
- C. heating
- D. waste disposal

2. -----is fish stored in a low-temperature environment

- A. curing
- B. freezing
- C. heating
- D. waste disposal

Test 2: Matching questions

A

B

- | | |
|--------------|-----------------------------------|
| 1. Seine net | A. Cheap, simple to make and use. |
| 2. Cast net | B. Fish storage method |
| 3. Hook | C. Covering pond for harvest |
| 4. Curing | D. Catches fish by their gills. |
| 5. Long line | E. Used demersal or pelagic fish. |

Operation sheet 1

1.1. Methods of seining the pond

A. Tools and equipment' needed to seine the pond

- All necessary personal protective equipment's
- Net
- Heavy wood
- Rope
- pole
- knife

B. Procedures of seine the pond

Step 1: pull the seine from both sides of the pond

Step 2: keep the fry in the net and move it towards the bank

Step 3: take the net & enclose the fry in pocket

Step 4: transfer the fry to container using dip net

Operation sheet 2

1.2. Fish harvesting from cage

A. Tools and equipment' needed to seine the pond

- Nets
- Bins
- Divers
- Gear and
- Air cylinders
- Ice

B. Procedures

- Pre-harvest preparation
- Starving the fish
- Preparing the equipment
- Set purse seine harvesting system
- Divers check to ensure that the net is properly set and that it is not tangled or twisted
- The next phase consists of closing the seine net lead-line by pulling on the pursing line
- Scooping fish from a floating farm cage

LAP Test

Name..... ID.....date-----

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within **1** hour. The project is expected from each student to do it.

Task 1: Perform seine the pond

Task 2: Perform fish harvest from cages.

| | |
|--|---|
| LG#20 | LO#3: Clean up on the completion of work |
| Instruction sheet | |
| <p>This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:</p> <ul style="list-style-type: none"> • Handling and cleaning harvested fish from aquaculture • Transport of live fish stock • Checking harvested fish • Recording harvested fish • Handling Waste material | |
| <p>This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:</p> <ul style="list-style-type: none"> • Handle and clean harvested fish from aquaculture • Transport of live fish stock • Check harvested fish • Record harvested fish • Handle Waste material | |
| Learning Instructions: | |
| <p>7. Read the specific objectives of this Learning Guide.</p> <p>8. Follow the instructions described below.</p> <p>9. Read the information written in the information Sheets</p> <p>10. Accomplish the Self-checks</p> <p>11. Perform Operation Sheets</p> <p>12. Do the “LAP test</p> | |

Information sheet-3

3.1 Handling and cleaning harvested fish

The primary objective of good fish handling techniques is to preserve the quality of fish. However, factors such as delay in handling the catch, poor control of fish temperature, poor standards of gutting are often deleterious on the quality of fish and results in reduction of shelf life and loss of weight.

Fish handling after harvest maintaining the quality of fish begins with harvest and transport of the fish products. It is advisable for the fisher-folk to carefully handle their fish products on canoe/boat during transport.

This will allow the fisher-folk to maintain high quality of the fish product.

Factors affecting fish handling on canoe/boat, mostly

- the biological,
- chemical and
- Physical factors that cause degradation of fish products.

3.1.1 Handling of freshwater fish before processing

The quality of the raw material and its usefulness for further utilization in processing is affected by the fish capture method. Unsuitable fishing methods e.g., catching too many fish in one haul, cause not only mechanical damage to the fish, but also create stress and the conditions which accelerate processes which begin after fish death.

In many countries consumers are used to buying live fish: this assures the highest quality. This habit takes different forms, e.g., the consumer buys live fish, for instance carp or trout and processes it at home. Very often the fish bought live can be partly processed by the shop assistant; for example, it can be filleted.

In some restaurants the customer can choose the fish from an aquarium and have it prepared for consumption. Thus the tradition, the quality, and the resultant price, constitute the reason why the preparation of fish for transportation, and the transportation itself, are the preliminary

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operations of processing of freshwater fish like trout, carp, eel, etc. However, producers should remember that not all fish are suitable for transportation alive. Therefore, just after fishing, fish should be sorted and only those in good condition, healthy and not damaged be destined for sale as live fish. Fish so classified is first conditioned in water of appropriate quality.

The conditioning process reduces stress, inhibits metabolism and at the same time food remains are removed from the alimentary ducts and the oxygen demand reduced. During the conditioning process fish is not fed which further inhibits metabolism and also limits the excretion of ammonia and carbon dioxide. In the short conditioning process 1 m³ of water is sufficient for 50-60 kg of carp, 30-40 kg of pike, 20-25 kg of trout or pike-perch.

Water provided for conditioning must be properly oxidized. For example, in the case of 1 kg of fish at a temperature of 10° C the oxygen demand is: eel 25 mg, carp 45 mg, pike 50 mg. Young fish need more oxygen than older fish. Oxygen consumption depends also on the liveliness of fish.

The amount of oxygen dissolved in water depends on water temperature which should be rather low. But for stenothermal species such as carp water temperature should be not less than 10-12° C in summer and 5-6° C in spring and autumn. Optimal temperature for conditioning and transportation of trout is 5-6° C in summer and 3-5° C in spring. During winter fish tolerates temperatures of 1-2° C.

Nowadays, special tanks with aeration system and often with cooling and filtering (activated coal, biological filters) systems are used for transportation of live fish. In simple solutions water is cooled by ice. Cooling is especially important during summer and in transportation over long distances.

If all parameters, i.e., temperature, oxygenation, are properly maintained, and when the temperature does not exceed 10° C, the weight loss varies from 1 to 6%, and about 10% of carp and 20% of trout die during a six-day transportation in winter. At present, large valuable fish species are transported via air in which case they are placed in big plastic bags with aeration system.

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3.1.2 Equipment for preliminary processing of freshwater fish

Preliminary processing of freshwater fish usually consists of the following steps or unit processes:

- evisceration,
- de heading,
- scaling,
- cutting of fins and belly flaps,
- slicing of whole fish into steaks,
- filleting,
- skinning,
- grinding of skinned fillets and different combinations of the above

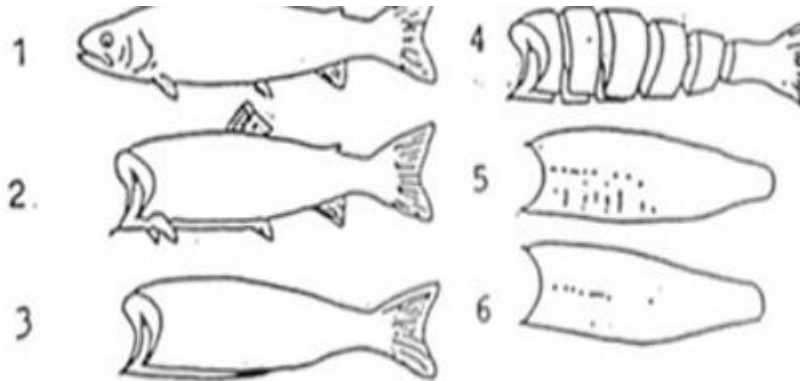


Figure 3.1 Cleaning process

- **Stunning of fish**

In many freshwater species the method of stunning is critical for final product quality because prolonged agony of fish causes production of undesired substances in the tissue. Oxygen deficiency in blood and muscle tissue results in accumulation of lactic acid and other reduced products of catabolic processes and consequently in a paralysis of the neural system. Red spots appear on the surface of the skin and in the muscle tissue near the backbone; these reduce quality.

Stunning of freshly caught fish or fish delivered live to a processing plant is best done with an electric current. First, the fish are placed in a tank of water and an electric current is then passed through the water to stun or kill the fish. Live fish are also slaughtered by cutting the aorta and bleeding to death when technological or ritual reasons require the removal of blood from the tissue before further processing.

In some plants, water in the fish tanks is saturated with carbon dioxide which renders the animals unconscious or dead.

- **Grading**

The processing sequence starts from grading the fish by species and size. Sorting by species or on the basis of freshness and physical damage are still manual processes, but grading of fish by size is easily done with mechanical equipment. Mechanical graders yield better sorting precision for fish before or after rigor mortis than for fish in a state of rigor mortis.

Size grading is very important for fish processing (i.e., smoking, freezing, heat treatment, salting, etc.) as well as for marketing. Automated sorters are rarely used in small plants processing freshwater fish because the raw product is usually already sorted on delivery and because of their high costs.

Automated grading is 6-10 times more efficient than manual grading. The sorting speed of different graders varies and depends on the type of device and size of fish sorted. Sorting capacity is 1-15 t/hour, and usually into three size groups.

A combination of conveyor belt and automated sorter shown in Figure 3.2 is used by fish processing plants in the USA. This machine has an interesting design: two smooth rotating rollers are installed above the surface of the conveyor belt and the distance between the rollers and belt can be adjusted according to the maximum thickness of the sorted fish. Thinner animals fall off the belt while the thick ones are retained on it until the end of line. Therefore, one device serves simultaneously as a grading machine and a conveyor.

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- **Removal of slime**

Slime accumulating on the skin surface of dying fish is a protection mechanism against harmful conditions. In some freshwater species slime constitutes 2-3% of body weight. Slime excretion stops before rigor mortis. Slime creates a perfect environment for micro-organism growth and should be removed by thorough washing. Eel, trout and carp require special care with regard to slime removal. Even small amounts of slime, which frequently remain after manual cleaning, result in visible yellowish-brown spots (particularly in smoked eel).

Drum-washing with a horizontal rotation axis does not remove slime from some fish, e.g., eel. Eel are best washed in machines which originally serve as scalers (Figure 3.5a, b). The device is loaded with 30 kg of eel and several kilograms of salt, and after about 2-3 minutes the slime is completely removed from the fish skin. This procedure is more efficient than manual washing.

Slime can be removed from eel, trout and other freshwater species by soaking fish in a 2% solution of baking soda and then washing in a cylindrical rotating washer.

- **Scaling**

Many freshwater species are routinely scaled; this is extremely labour-intensive when done manually. Some sources estimate that manual scaling of larger animals requires almost 50% of the total time necessary to produce headed and gutted fish without fins. Fish destined for skinning and filleting or to be smoked or minced in mincing/deboning separator is not scaled. Tools used for manual scaling are shown in Figure 3.6. Tools are moved over the body of fish from tail fin towards the head, pulling out the scales.

- **Washing**

Washing is intended primarily to clean the fish and to remove accumulated bacteria. The effectiveness of the washing procedure depends, inter alia, on the kinetic energy of the water stream, ratio of fish volume to water volume and on the water quality.

A proper fish: water volume ratio for achieving the desired level of cleanliness is 1:1, however, in practice more water is usually used (twofold). Washing of gutted and headed fish should be

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done on termination of the processing operation. To improve the effectiveness of the cleaning procedure, various mechanized scrubbing devices are utilized which can remove up to 90% of the initial bacterial contamination. Potable water is used for washing in freshwater fish processing plants.

The operation cycle for these machines is 1-2 minutes. The vertical drum washer is frequently used because of its conveniently small size. The most common is the horizontal tumbler washer. A rotating perforated drum constitutes the main component of this device; the drum is usually 2-4 m long, with round holes 10 mm in diameter.

Inside the drum there are metal or rubber bars which facilitate tumbling and mixing of fish. Rotation of the drum, its tilted axis and the arrangement of internal bars result in a movement of fish towards the outlet of the device. Washing is continuous and is accomplished by spraying pressurized water through the perforated pipe installed inside the drum. Dirty water collects in the waste basins.

- **De heading**

The head constitutes 10-20% of the total fish weight and it is cut off as an inedible part. Although many mechanized de-heading machines had been developed for processing marine fish, freshwater fish are usually de-headed manually. The main reason is the lack of inexpensive equipment offering minimal tissue loss during this procedure.

3.1.3. Method of cleaning the fish

Procedures

Step 1: Gather Materials

- Materials:
- Fillet Knife
- Cutting board (at least the length of the fish; double the length will work best)
- Fish
- Bowl of Cold water

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Step 2: Evisceration,

Step 3: de heading,

Step 4: Scaling,

Step 5: Cutting of fins and belly flaps,

Step 6: slicing of whole fish into steaks,

Step 7: Filleting,

Step 8: Skinning,

Step 9: Grinding of skinned fillets and different combinations of the above.

3.2 Transport of live and dead fish stock

3.2.1 Transport of live fish stock

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 centers/areas. Transport can be done by means of vehicles of all kinds: cars, trucks, boats/canoes, motorcycle, bicycle or by foot.

Factors to be consider when transporting live fish

A. Maintain Optimum Water Quality within Transport Container

- Do not use water from ponds with heavy plankton blooms
- Use only water of good quality as described above. Dissolved oxygen levels should be at saturation (minimum above 5 mg/l) water temperature between 25°C to 30°C ammonia –zero suspended solids negligible.
- The volume of water should be adequate to hold fish and dilute wastes.
- Add salt (preferably ‘magadi’ salt that has bi-carbonate) to the water in order to prevent fish losing salts help control nitrite and pH levels.
- Conditioning fish for 48 hours before transportation does a lot to

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control ammonia build-up during transportation. However, if levels of ammonia do go up in transport tanks above 0.1 mg/l then zeolite can be added to adsorb it.

- Do not overload containers. A general rule is 2 kg of fish for every 20 liters of water. Oxygen utilization is extremely high during transportation. Levels of aeration or oxygenation should be adjusted to ensure that optimum dissolved oxygen levels (+ 5 mg/l) are maintained during the journey.
- Keep containers out of direct sun. Cover containers or polythene bags at the back of open trucks to prevent this with papyrus mats or gunny bags if one is travelling a long distance.

B. The Fish's Condition

Only handle package and transport healthy fingerlings in good condition.

- Fry and fingerlings in good condition are:
 - ✓ Not emaciated (not thin)
 - ✓ Alert and active
 - ✓ Look bright
 - ✓ Have no physical deformities
 - ✓ No signs of disease and
 - ✓ The right size
 - ✓ Uniform size.
 - ✓ No signs of fish stress.

Methods for Live Fish Transportation

Materials required

- Polythene Bags
- Salt
- Water
- Delivery tube
- Oxygen gas
- bucket

Procedures

a) In Closed Polythene Bags

- A 300-400 gauge plastic tube is recommended because it is thick enough to withstand pricks from fish fin and is pliable enough to be folded over and tied in a close knot to prevent loss of air.
- Cut off about 3 meters from the roll and tie a simple reef knot half-way so

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that finally the packaging will be double layered.

- Having a double layer is done to safeguard against loss of air in the event of a puncture.
- Set the tied bag in a basin or basket] open it up and fill it a third –way with water (10 – 15 liters of water depending on the length). The water temperature in the bag should about that of the holding water or not more than 2°C above or below it.
- Add some salt (magadi salt can be used) at the rate of 0.05% of the volume of water. Stir the salt in and ensure it is properly dissolved before fish are added into the bag.
- Add fingerlings at the rate of 0.5 to 1 kg total biomass for every 10 litres of water into the bag. Use 0.5 kg for every 10 liters if fish are 5 g or less because smaller fish have a higher metabolic rate. Do not exceed 1 kg for every 10 liters of water for fingerlings.
- Immediately close the inner bag over and squeeze out all the air in the bag that is above the water.
- Insert the delivery tube from the oxygen cylinder into the bag while still holding the top close to prevent air entering the bag.
- Release oxygen into the bag and fill the bag with oxygen..
- Twist the top of the inner bag tight as you pull out the delivery tube from the cylinder.
- Place the sealed bag in a cardboard box] bucket] or within any container that can provide it support and protection from puncture during transportation

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Figure.3.6 Packaging live fish in bags for transportation



Figure 3.7 Packed bags ready for transportation

- **Transport the fish**

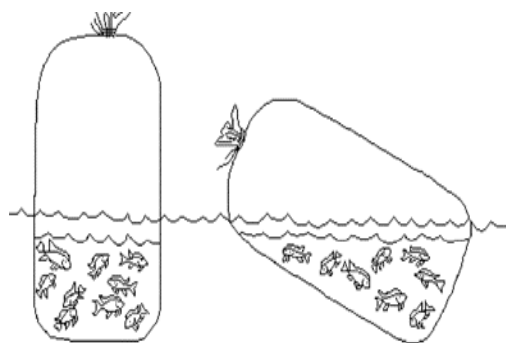


Figure 3.8: Float transport bags where the fish will be stocked

- Immerse the bag and allow fish to swim out. This is better than scooping them out with a net. Do not dump or pour the fish in.

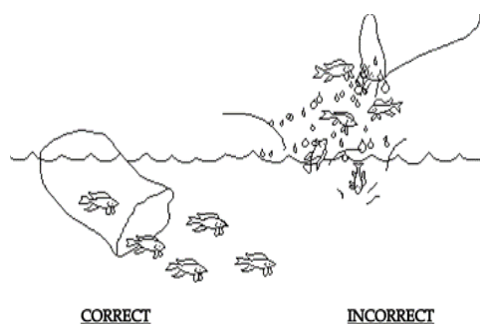


Figure 3.8. Fish swimming in the bag

3.2 .2 Transport and packaging of dead stock

Packaging

Different food-grade packaging materials are available on the market.

- The choice of packaging depends on:
 - ✓ Wholesale or retail market
 - ✓ Type of product (e.g. better to pack fatty smoked products in silver foil rather than sealed plastic as the former reflects heat whereas the latter contains heat — especially where cold storage may not be available).
 - ✓ Consumer preference for pack sizes
 - ✓ Storage facilities (e.g. fridge] freezers] outdoors)

Examples of packaging used for aquaculture products

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Figure 3.9. Packaged Aquaculture Products

b.



Figure 3.10a. Soaked fish



Figure 3.10b. Salted and packed fish

3.3 Checking harvested fish

Measuring quality of fish product Quality can be measured by chemical or sensory methods.

We are actually doing these ourselves when we look at a fish and decide how much we want to pay for it.

- Chemical Testing:

- Sensory Evaluation: We can quickly check quality by using

- ✓ our eyes to look at the appearance of the fish product,
- ✓ our hands to feel the texture of the product,
- ✓ our noses to smell it and
- ✓ Our tongues to taste it.

The following table gives a numerical value for differing qualities of fresh fin-fish.

Table 3.1. Quality evaluations of fresh fin fish using sensory evaluation

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| Class | Gills | Eyes | Body appearance | Texture | Quality |
|-------|--|--|---|--|------------|
| 5 | Dark red colour <ul style="list-style-type: none"> • Some thin clear slime • Foul smell | Bright, metallic <ul style="list-style-type: none"> • Clear pupils • Convex eyes | Natural colour <ul style="list-style-type: none"> • Iridescent and firm scales • Little/or no slime | Firm before or in rigor | Excellence |
| 4 | Red colour <ul style="list-style-type: none"> • Some slime, but still thin and clear • No smell | Bright metallic <ul style="list-style-type: none"> • Slightly cloudy pupils • Slightly convex eye | Natural colours <ul style="list-style-type: none"> • Firm scales • Some slime | Firm | Good |
| 3 | Red –brown colour <ul style="list-style-type: none"> • Some thick slime • Beery/mousey/warm smell | Dull <ul style="list-style-type: none"> • Pupils cloudy • Flat • Some blood | Slight red colour <ul style="list-style-type: none"> • Scale loose • More thick slime | firm | average |
| 2 | Brown colour <ul style="list-style-type: none"> • A lot of slime • Slight off smell | Dull <ul style="list-style-type: none"> • Pupils cloudy • Slightly concave eyes • Bloody | Red/yellow colour <ul style="list-style-type: none"> • Scales missing • Dry skin • A lot of slime | soft | poor |
| 1 | Brown colour <ul style="list-style-type: none"> • A lot of slime • Bad/ammonia smell | Dull <ul style="list-style-type: none"> • Pupils cloudy • Concave eyes • With blood | Red/yellow colour <ul style="list-style-type: none"> • Few scales • Dry skin • A lot of thick yellow slime | Very soft <ul style="list-style-type: none"> • Mark of finger left if pressed | Very poor |

3.4 Recording harvested fish.

3.4.1 Monitoring and record keeping

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Proper management consists of monitoring your fish ponds regularly, keeping good records and planning ahead for the operation of your farm. On this basis, you can for example decide when to fertilize your ponds and how much to feed your fish. You can also judge how well supplementary feeds are being utilized and how fast your fish are growing, and you can plan the stocking, transfer and harvesting of your fish. Above all, you can be well informed on how much you spend for or gain from fish farming.

Different needs for monitoring and record keeping

The extent of monitoring and record keeping required depends on several factors such as:

- The level of education and skill of the fish farmer;
- The interest of the farmer in good management and profit;
- The size and organization of the fish farm;
- The external assistance available to the farmer.

It is important to define the best approach for your circumstances. Generally, the larger and more commercial the farm and the more technically qualified the staff, the more detailed the management system will be. However, it is most important that the management system is appropriate for your farm and is properly carried out. There is no point in setting up an elaborate system if it is not completely or properly used.

As you have already learned in a previous manual farm size, level of production and culture system may greatly vary. Small-scale fish farming, the main subject of this manual, may be undertaken by:

- subsistence farmers;
- commercial farmers; and
- Semi-commercial farmers.

Subsistence farmers: typically produce fish part-time as part of several other part-time agricultural activities. Their main objective is to produce protein food for their families. Any surplus fish may be bartered with neighbors or sold on the local market to obtain cash.

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Commercial farmers: consider their fish farm as a small business enterprise. Their main objective is to earn money by selling fish at a profit.

Other farmers have a fish farm to provide protein food for their family and cash to buy other commodities. Producing fish at a profit usually remains their main objective, but on a reduced scale compared to fully commercial farmers. For the purpose of this manual, they will be referred to as **semi-commercial farmers**.

Table.2 Sample of small scale fish farm record

TABLE 41
Typical characteristics of small-scale farmers and their fish farming activities

| Characteristics | Subsistence | Semi-commercial | Commercial |
|-----------------------------------|--|---|---|
| Farmer's basic education | Some primary schooling | Full primary schooling | Preferably some secondary schooling |
| Purposes of fish production | Mainly for own family; surplus bartered locally | Regular family consumption and cash income with neighbours | Mostly cash income, some fish regularly consumed by family |
| Management level | Extensive | From extensive to semi-intensive | Semi-intensive |
| Culture system | Very simple | Very simple to simple | More elaborate |
| Individual pond size | 100-200 m ² | 200-400 m ² | 300-1 000 m ² |
| Size of fish farm | At most 600 m ² | At most 2 000 m ² | Over 2 000 m ² but usually less than 5 000 m ² |
| Pond construction | By farmer and relatives, by hand | With casual labour (piece-work contract); mostly by hand | By contractor; mostly with machinery |
| Financial loan | None | Sometimes; limited | Usually; may be important |
| Daily management | Farmer and family members | Farmer with possibly one worker | Farmer with several workers |
| Full-time labour | None | Regular salary in cash | Regular salary in cash |
| Part-time labour | Paid in kind, with fish from ponds | Paid in kind and/or cash | Paid mostly in cash |
| Farm inputs | None or little; mostly compost and own farm/household wastes | Limited use of inputs, mostly for supplementary feeding and/or organic manuring | Regular inputs (fertilizers/feeds/supplies); stocks are kept in store |
| Expenditures | Very limited | Some cash regularly spent | Cash regularly spent |
| Cash incomes | Very limited | Some income from fish sales | Regular incomes from fish sales |
| Integration with animal husbandry | None or limited | Possibly, on small scale | Possibly, on larger scale |
| Sections | 161 and 164 | 162, 163 and 165 | 162, 163, 166-169 |

Weighing

Weigh scales should be periodically calibrated with a standard mass to ensure accuracy.

Standard for quick frozen blocks of fish fillets, minced fish flesh and mixtures of fillets and minced fish flesh.

Fish flesh should be clear of the seam area. Packaging material should be inspected prior to use to ensure that it is not damaged or contaminated. Packaging integrity of the finished product should be inspected at regular intervals by appropriately trained personnel to verify the effectiveness of the seal and the proper operation of the packaging machine. Following sealing, products should be transferred carefully and without undue delay to chilled storage. Ensure that adequate vacuum is attained, and the package seals are intact.

Labeling

Prior to their application, labels should be verified to ensure that all information declared meets, where applicable, the general standard for the labeling of prepackaged foods, labeling provisions of the appropriate standard for products and/or other relevant national legislative requirements. In many cases, it will be possible to re-label incorrectly-labeled products. An appropriate assessment should be carried out to determine the reason(s) for incorrect labeling and the DAP plan should be modified where necessary.

Wrapping and packaging

Packaging material should be clean, sound, durable and sufficient for its intended use and of food-grade material. The packaging operation should be conducted to minimize the risk of contamination and decomposition. Products should meet appropriate standards for labelling and weights.

Reception – packaging, labels and ingredients

Only ingredients, packaging material and labels complying with the specifications of the processors should be accepted into the processing facility. Labels that are to be used in direct contact with the fish should be made of a non-absorbent material and the ink or dye used on that label should be approved by the official agency having jurisdiction. Ingredients and packaging material not approved by the official agency having jurisdiction should be investigated and rejected at reception.

Storage – packaging, labels and ingredients

Ingredients and packaging should be stored appropriately in terms of temperature and humidity.

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A systematic stock rotation plan should be developed and maintained to avoid out-of-date materials. Ingredients and packaging should be properly protected and segregated to prevent cross-contamination.

3.5 Handling waste material

Preprocessing of fish prepares raw material for final processing.

It is often performed on shipboard or in a shore-based plant and includes such as:

- operations as inspection,
- washing,
- sorting,
- grading, and
- Butchering of the harvested the fish.
- The butchering of fish involves the removal of non-edible portions such as
 - ✓ the viscera,
 - ✓ head,
 - ✓ tail, and
 - ✓ Fins.

On the butchering process, as much as 30 to 70 percent of the fish may be discarded as waste or reduced to cheap animal feed.

Cleaning the work area

Cleaning products can now be taken out of the locked closet or locker where they are kept. It is important that you are trained in the proper way to use cleaning products in a fish processing area.

Before you start, read the label and follow the instructions for use. The cleaning solution should be mixed with warm water around 49°C (120°F). If it is too cold or too hot, it may not work properly.

Cleaning solution should be used on all work surfaces, including tables, floor and equipment. Use a scrub brush to make sure all waste is removed.

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Keeping your work area clean can help prevent contamination of fish and fish products and give you a better product once you are finished. A clean work area is also easier to work in than a messy or poorly organized area.

It is easy for waste to build up in the work area. If it is not cleaned up right away, it is harder to wipe or rinse off slime, offal and other waste. If fish or fish products come into contact with equipment or surfaces that are covered in this waste, they could become contaminated and unsafe to eat. Packaging could also become contaminated. So it is important to keep your work area clean.

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Self-check 3

Written test

Name..... ID..... Date.....

Directions: Answer all the questions listed below.

Test: I choose the correct answer for the following questions

- Which one is the first step for cleaning/removal of unnecessary fish part.
 - Gather Materials
 - Separate the Spine from the Fillet
 - Separate the Spine and Ribcage From the Fillet
 - Separate the Fillet from the Skin
- One of the following is criteria for quality evaluation of fish gill using sensory evaluation considered as excellent?
 - Dark Red Colour
 - Red Colour
 - Red –Brown Colour
 - Brown Colour
- Which of the following factor for the choice of fish packaging materials.
 - Whole sale market
 - Type of product
 - Consumer preference
 - Storage facilities
- Which one is the cleaning method that can be partially disassembled and cleaned.
 - CIP
 - COP
 - mechanical cleaning
 - A&B

Test II: Short Answer Questions

- How do you identify visually that a fish specimen is spoiled and not edible?
- What are the factors that cause spoilage of fishes?

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3. Why do fishermen take out the gut as soon as fishes are caught?
4. What do the smoking and freezing processes do to the fish flesh?
5. What is thawing and what is its purpose?

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Operation sheet 3

- **Techniques of transporting live fish**

A. Materials required

- Polythene Bags
- Salt
- Water
- Delivery tube
- Oxygen gas
- Bucket

B. Procedures/step

- Making and using plastic bags:
- Cut the plastic bag material to the dimensions shown.
- Cut the plastic bag
- Fold one end.
- Melt and fuse the tied end
- Insert oxygen hose into bag
- Squeeze bag closed while removing oxygen hose, and tie bag securely.
- Transport the fish
- Float transport bags where the fish will be stocked.
- Immerse the bag and allow fish to swim out.

Lap test-3

Performance Test

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Name.....

ID.....

Date.....

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 1hrs minute. The project is expected from each student to do it.

Task- 1 Conduct live fish transport.

Reference materials

Books

Abebe Getahun, 2013. Fisheries and Aquaculture (Biol. 4062).

Agents in Uganda January 2020.

| | | | |
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| Page 69 of 73 | Ministry of labor and Skills Author/Copyright | Fishery and Aquaculture level II | Version |
| | | | January, 2023 |

Aquaculture Training Manual for Extension, January, 2020

Asare A. 2017 . Development Action Association. Manual on Improved Post Harvest Fish Processing.

Department of Fisheries Post-Harvest Technologies and Quality Control (DFPTQ), Fisheries Administration (FiA), Cambodia (2012

FAO, 2003. Guidelines For Handling And Preservation Of Fresh Fish For Further Processing In Vietnam

Francesco Cardia, 2015. Aquaculture operations in floating HDPE cages A field handbook.

Ministry of Agriculture, 2011. Fish harvesting and post-harvest handling, Uganda

Steven T. Summerfelt *, John Davidson, Grover Wilson, Thomas Waldrop (2008). Advances in fish harvest technologies for circular tanks

Web Address

<http://youtube.com/watch?v=2XogN7ORAM4>

[http://youtube.com/watch?v=E17njNcDSe0,](http://youtube.com/watch?v=E17njNcDSe0)

<http://youtube.com/watch?v=ujV6MdyuOp0>

<http://youtube.com/watch?v=UP3gwGauWrg>

https://commercialvehicle.in/wp-content/uploads/2017/01/IMG_5489-copy.jpg

https://www.123rf.com/photo_120638669_female-fish-farm-worker-fishing-with-net-sturgeon-at-reservoir.html (access

<https://www.afma.gov.au/fisheries-management/methods-and-gear/traps>

[https://www.alibaba.com/product-detail/Insulated-Plastic-Fish-Tub-Plastic-Insulated_60651873103.html?spm=a2700.7724857.0.0.1596188aI0KhOS#8.](https://www.alibaba.com/product-detail/Insulated-Plastic-Fish-Tub-Plastic-Insulated_60651873103.html?spm=a2700.7724857.0.0.1596188aI0KhOS#8)

<https://www.amazon.com/Waterproof->

<https://www.fao.org/3/e7171e/E7171E07.htm> (access date 17/2023)

https://www.fao.org/fishery/docs/CDrom/FAO_Training/FAO_Training/General/x6709e/x6709e16.htm

<https://www.floridagofishing.com/fishing-beach-seining.html>

<https://www.instructables.com/>

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|---------------|---|-------------------------------------|------------------------------|

<https://www.instructables.com/Running-a-Gill-Net-to-Collect-Fish-Samples/>

<https://www.msc.org/what-we-are-doing/our-approach/fishing-methods-and-gear-types/longlines>

<https://www.outdoorlife.com/story/gear/best-life-vest/>

<https://www.researchgate.net>

<https://www.shutterstock.com/image-photo/people-cut-red-fish-on-table-591966566>

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