



Ethiopian TVET System



Animal Production Level-II

Training Module –Learning Guide 31-34

Based on Version 3 March 2018

Occupational Standard (OS)

Unit of Competence: Assist Fish Production

Module Title: Assisting Fish Production

TTLM Code: AGR APR2 M 10 0919 V1

October 2019



Module Title: Assisting Fish Production

TTLM Code: AGR APR2 M 10 0919 V1

This module includes the following Learning Guides

LG31 :Prepare materials, tools and equipments for fish farming

(LG Code: AGR APR2 M 10 LO1-LG31)

LG32: Body parts of fish.

(LG Code: AGR APR2 M 10 LO2-LG-32)

LG33: Undertake fish farming work.

(LG Code: AGR APR2 M 10 LO1-LG-33)

LG34: Handle materials and Equipment.

(LG Code: AGR APR2 M 10 LO1-34)



Instruction Sheet	Learning Guide - 31
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This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:–

- Prepare materials, tools and equipment for fish farming
- Identify, check and report materials, tools and equipment
- Report of all materials, tools and equipment
- use manual handling techniques for loading or unloading materials
- Select & check suitable Personal protective equipment (PPE)
- Apply Occupational Health and Safety (OHS) requirements

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

- Required materials, tools and equipment are identified according to lists provided and/or supervisor instructions.
- Checks are conducted on all materials, tools and equipment, and insufficient or faulty items are reported to supervisor.
- Correct manual handling techniques are used when loading and unloading materials to minimize damage
- Suitable PPE are selected and checked prior to use.
- Work task is provided according to OHS requirements and supervisor instructions.

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheet 1, Sheet 2, Sheet 3 and Sheet 4”.
4. Accomplish the “Self-check 1, Self-check 2, Self-check 3 and Self-check 4” in **page -6, 9, 12 and 14** respectively.



INTRODUCTION TO FISH FARMING

It has been stated that Ethiopia could produce about 40 million kg of fish per year in a sustainable manner from different lakes and rivers. Despite the availability of a considerable big fish resource, production so far could not exceed 15-20% of the potential available for exploitation

However, with the growing realization of the importance of fish as high quality food, and food shortage due to the increased population pressure. Intense exploitation of fish resource not only from the natural water bodies such as lakes and rivers, but also from the artificially fish cultured ponds, dams and reservoirs is very essential.

Therefore, this unit of compliance focus on the preparing materials tools and equipments , body parts of fish, undertake fish rising activates and clean up on accomplishments of the work.

Definitions

Fish- is an aquatic-vertebrate cold-blooded animal that breathes oxygen by means of gills, and moves and keep balance by fins, reproduce by laying eggs and its body covered by skin and scale.

Fish farming (culture) – is the large scale rearing or raising of fish in artificially prepared ponds and reservoirs on controlled and manageable manner for commercial purpose.

Fish farming is the intensive production of fish from artificially prepared ponds or reservoirs. Its main objective is to produce large amount of fish with a minimum cost so as to increase profitability of the business.

Fresh water (Inland water)-is a water contained in rivers, lakes, underground, rain water and streams.

Why fish are farmed?

Nowadays there is an increasing population pressure throughout the world with a steadily increasing demand for protein. This forced people to exploit the natural resources of the aquatic environment, mainly fish which is the largest single source of animal protein and the fastest growing food commodity from natural or artificial water bodies. Thus, the reason why fish are farmed is summarized as follows.



- Fish are a high-value, marketable product used to generate high income even at the subsistence level.
- Fish is primarily used as food. From fish one can get abundant nutrients such as proteins, fats, vitamins and minerals, for this reason. Fish protein is described as first class protein.
- Fish farming could be integrated with livestock and crop production sectors that can help for efficient utilization of our resources.
- Part of the fish is used for the preparation of fish meal which is the best source of animal protein for ruminants & poultry.
- Fish farming is the best alternative because the exploitation of fish from natural water bodies is becoming less and less profitable.



Information Sheet-01	Identifying and checking of all materials, tools and equipment
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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.

Before starting fish farming activity the necessary materials, *tools and equipment* should be identifies and prepare as follow:-

- Polyethylene bag
- Lime
- Feed
- Fertilizer
- Stocking materials(fry, fingerlings, egg, larvae) fishing nets
- buckets
- Ice box, refrigerator
- Weighing balance
- Measuring board
- various needles
- knives
- Thermometer
- pH meter
- Do meter
- Wooden ladle with long handle,
- Hoe
- Rake
- Litmus paper
- Conductivity meter
- Secchi desk
- Ammonia and Nitrate test Kits
- Plankton nets
- Benthic sampler
- loaders and vehicles
- spades, forks, rakes and hoe
- harvesting and storing equipments
- Spray equipment etc



Self-Check 1	Written Test
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Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

1. Write the functions of at least 3 equipments ? (5 points)

2. Write at least 5 equipments

Note: Satisfactory rating - 10 points Unsatisfactory - below 10 points

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

Short Answer Questions

All materials , tools and equipments will be checked and reported their proper functions before going to the activates here are some equipments will list dawn how it works.

A. Water Quality testing equipment

Water-quality testing is one of the most important jobs in aquaculture. If the water quality of a culture structure, such as a pond or tank, is poor, stock can suffer from health problems such as damage and diseases. A range of tools and test kits are used to test water-quality parameters such as the level of dissolved oxygen, pH, alkalinity, water hardness, and ammonia levels and so on.

1. Dissolved oxygen meter

Description-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.



Calibration and use

Follow these steps to calibrate and use a dissolved oxygen meter:

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

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.

2. P^H meter

Description-A pH meter is used to measure the *pH* in water. It consists of a probe and a meter. The probe is lowered into the water sample and the pH of the sample will be displayed on the meter.



Calibration-Follow these steps to calibrate a pH meter:

- Turn the meter on.
- Connect the probe to the meter.
- Place the probe in *buffer 7* solution and wait for the reading to stabilize.
- Press the "Cal" button to enter the calibrate mode.
- Press the "Con" button to set the meter to pH 7.
- This method can be repeated for a buffer 4 and/or a buffer 10 solution.
- Press the "Meas" button and Measure will appear on the display screen.
- Rinse the probe with distilled water.
- The pH meter is now calibrated and ready for use.

The methods of calibration are very similar for most pH meters. However, you should always check the user manual for the meter you are using to find out how to calibrate it.

Use-To use the pH meter:

- place the probe in the sample to be measured
- wait for a stable reading to appear on the meter
- Record that reading.

3. Salinity meter

Description-A salinity meter is used to measure the *salinity* of water. A salinity meter has a probe that detects the salinity of a water and a meter that displays the salinity of the water in parts per



sample,

thousand.

Calibration-Most salinity meters don't require calibration. However, some salinity meters require the temperature of the water sample to be set on the meter before it can measure the salinity of the water sample.

Use-To use a salinity meter:

- insert the probe into the water sample so that the probe is completely submerged
- allow time for the reading on the meter to become stable
- Record the value of the reading on the meter once it stops changing.



4. Thermometer

A thermometer is used to record the *temperature* of water. To use it, lower the thermometer into the water and wait a minute or two. Then take the thermometer out and read the temperature recorded on it.

5. Ammonia test kit

Description and use-An ammonia test kit is used to measure the level of *ammonia* in a water sample. It comes with two separate reagents that are added to the water sample.



To use the ammonia test kit:

- fill the container with the water sample
- add the first reagent to the water sample
- add the second reagent, then wait for the water to change color
- compare the color of the water sample to the color chart that comes with the test kit
- Find the color on the chart that matches the color of the water sample, and take a reading of the value on the chart. This is the amount of ammonia in the water sample.

Safety-Ammonia test kits can contain chemicals that can be harmful to you, to stock, or to the environment. Adopt the following guidelines when using an ammonia test kit:

- Always wear clean gloves when using the test kit.
- Always store used waste reagents in a suitable container for disposal later.
- Avoid contact with skin and eyes.

- Do not swallow reagents.
- Do not smell the reagents.

6. Nitrite test kit

Description and use-A nitrite test kit is used to measure the amount of nitrite in a water sample. The test kit often comes with two reagents and a sampling container.



To use the nitrite test kit:

- fill the container with the water sample
- add the first reagent to the water sample
- add the second reagent and wait for the sample to change color
- compare the color of the water sample to the color chart that comes with the test kit
- Find the color on the chart that matches the color of the water sample, and take a reading of the value on the chart. This is the level of nitrite in the water sample.

Safety-Nitrite test kits can contain chemicals that can be harmful to you, to stock, or to the environment. Adopt the following guidelines when using a nitrite test kit:

- Always wear clean gloves when using the test kit.
- Always store used waste reagents in a suitable container for disposal later.
- Avoid contact with skin and eyes.
- Do not swallow reagents.
- Do not smell the reagents.
- Secchi disk

The secchi disk is basically a painted disk attached to a length of cord, or a rod. It is used to measure the *turbidity* of water. The cord or rod is often graduated so that the depth the disk has sunk to can be measured.



To use a secchi disk:

- I. hold the cord or rod and slowly lower the disk into the water
- II. keep lowering the disk until it is just no longer visible
- III. note the depth of the disk by checking where the water level is on the cord or rod
- IV. Record this depth.



Self-Check 2	Written Test
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Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

1. Write the functions of pH meter, Ammonia test kit, thermometer, Dissolved oxygen meter? (15 points)

Note: Satisfactory rating - 15 points

Unsatisfactory - below 15points

6Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

Short Answer Questions



Information Sheet-02	Using manuals during loading and unloading materials
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During fish loading and unloading the following are required ;

- Fish handling equipments will be ready
- The vehicles will required a cooling facilities since fish are highly perishables products
- Inside of the vehicles shall be clean and neat to avoid contaminations
- If possible unwanted parts of fish first removed before transportation to the processing site
- Add preservatives if the journey is too long
- Fish shall be inside the materials no contact with the vehicles
- If the fish is transported by draft animal or a person it shall be removed the gut and using salt for preservatives.



Self-Check 3	Written Test
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Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

1. What are the requirements during of loading and unloading ? (5 points)
2. What do we do before loading of fish ? (7 points)

Note: Satisfactory rating - 13 points Unsatisfactory - below 13 points

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

Short Answer Questions



Information Sheet-03	Selecting and checking personal protective equipment (PPE)
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- Using appropriate Personal Protective Equipment (PPE);-It is important to reduce the possible hazard at work operation. Personal Protective Equipment (PPE) The equipment designed to protect handlers from injury. This equipment should be selected based on the procedures to be accomplished, referring to manuals or supervisors if in doubt of its appropriateness.

PPE commonly includes

- ❖ Aprons
- ❖ Gloves [rubber or latex to protect from caustic or toxic substances, leather or canvas to protect from abrasion, disposable plastic to maintain bio-security];
- ❖ Boots [heavy leather or rubber for protection and disposable plastic for bio-security];

**Self-Check 4****Written Test**

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

1. What is the purposes of PPE? (5 points)

2. Write some PPE ? (5 points)

Note: Satisfactory rating - 10 points

Unsatisfactory - below 10 points

Answer Sheet

Score = _____

Rating: _____

Name: _____





Date: _____

Short Answer Questions

Information Sheet-04	Providing work support according to occupational health and safety (OHS)
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Many workers in the Agriculture and Fishing industry get injured every year because they fail to observe correct workplace health and safety procedures. This topic provides information to help you keep your work place free from injury.

Hazard Signs - What do them mean in the next table:

Sign	Description	Examples
	Explosives are materials that have very fast chemical reactions. They release large quantities of gas in the form of an explosion.	Ammunition, fireworks, and flares.
	Flammable gases can burn when they come into contact with oxygen or a source of heat. In some conditions they can even explode! Since these gases can burn they cause other normally non-hazardous materials to burn.	Methane, acetylene, and propane.
	Non-flammable and non-toxic gases are non-flammable and non-poisonous.	Nitrogen, oxygen and medical air.
	Also called poison gases , toxic gases are dangerous because they can mix with air and can easily enter the lungs to make you	Carbonmonoxide, chlorine, ammonia, and hydrogen

	<p>very sick or even kill you. Some poison gases can also be absorbed through the skin.</p>	<p>sulphide.</p>
	<p>Flammable liquids are liquids that can burn. Once flammable liquids burn, they can cause other substances to burn.</p>	<p>alcohols, methylated spirits and solvents.</p>
	<p>Flammable solids burn very easily. All it takes is a bit of exposure to a heat source. Even friction can cause these solids to burn. Flammable solids come in powdered, granular, or pasty form.</p>	<p>Safety matches, camphor, and naphthalene.</p>
	<p>Spontaneously combustible substances can burn by themselves, without being exposed to a heat source. Because of this, they can cause other materials to burn.</p>	<p>White phosphorous.</p>
	<p>There are certain substances that are classified as dangerous when wet. When these substances come in contact with water they can give off flammable gases that can explode.</p>	<p>Calcium carbide and sodium.</p>
	<p>Oxidizing substances are chemicals that contain one or more oxygen atoms. They are not particularly hazardous on their own but become dangerous when mixed with other hazardous chemicals.</p>	<p>Hydrogen peroxide, calcium hypochlorite (pool chlorine), and ammonium nitrate.</p>
	<p>Also called poisonous substance, toxic substance are products and materials that can make you very ill or even kill you. Many substances found in workplaces are poisonous.</p>	<p>Pesticides (not most herbicides), heavy metal products, and rat poison.</p>



Self-Check 6	Written Test
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Name: _____ **Date:** _____

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

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

1. What is meant to be OHS ? (5 points)

2. What is the purposes of putting sign in work places ? (5 points)

Note: Satisfactory rating - 10 points Unsatisfactory - below 10 points

Answer Sheet

Score = _____

Rating: _____

Name: _____

Date: _____

Short Answer Questions



INSTRUCTION SHEET

Learning Guide 32

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

- Preparing for fish raising activities
- Identifying body parts of fish
- Undertaking fish farming work
- Handling and cleaning material and equipment

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

- Prepare for fish raising activities
- Identify body parts of fish
- Undertake fish farming work
- Handle and clean material and equipment

Learning Instructions:

5. Read the specific objectives of this Learning Guide.
6. Follow the instructions described below 3 to 6.
7. Read the information written in the information “Sheet 1, Sheet 2, Sheet 3 and Sheet 4”.
8. Accomplish the “Self-check 1, Self-check 2, Self-check 3 and Self-check 4” in **page -6, 9, 12 and 14** respectively.



1.1. Parts of fish body, location, structure and function

1. **Snout-** The snout is the part of the head of the fish that is in front of its eyes.
2. **Operculum-**The operculum is the bony flap that covers a fish's gills.
3. **Lateral line-**The lateral line runs along the sides of a fish's body. It is used as a sensory organ by the fish.
4. **Dorsal fin-**The dorsal fin is the main fin located on the back of the fish. Fish, like the one shown above, can have one or more dorsal fins. Fish with more than one dorsal fin can have:
 - i. A dorsal fin with spines
 - ii. A dorsal fin with soft rays.

Take care when handling fish with spines in its fins. Wear protective gear such as gloves and wading boots when dealing with such fish.

5. **Pectoral fin-**Pectoral fins are located near the gills of fish.

6. **Adipose fin-**The adipose fin is found on some fish. It is usually located on its back, after the dorsal fin.

7. **Caudal fin-**The caudal fin is the fin on the tail of the fish.

8. **Anal fin-**The anal fin is located after the fish's anal or reproductive organs. Anal fins can be soft, or they may have spines.

9. **Pelvic fin-**The pelvic fin is located under the fish, between its mouth and its anus.

10. **Keel-**The keel is the fleshy or bony ridge located at the end of the fish's body, just before the tail.

11. **Skin-**The skin is the fish's first line of protection against the outside environment. It keeps out bacteria, viruses and fungi and, if it is damaged, the fish is very vulnerable to infection. The skin also keeps out water and keeps salt in or out according to whether the fish is in the fresh water or salt water. Fish's skin secretes mucus which makes it slippery during handling. The skin is also responsible for the external colour and appearance of the fish. Throughout the skin there are colour pigment cells.

12. Scale- the scales are solid calcareous structures embedded in pocket in the tough lower dermal layer of the skin. The 'root' part of the scale is characterized by concentric circular lines reflecting the growth of the fish.

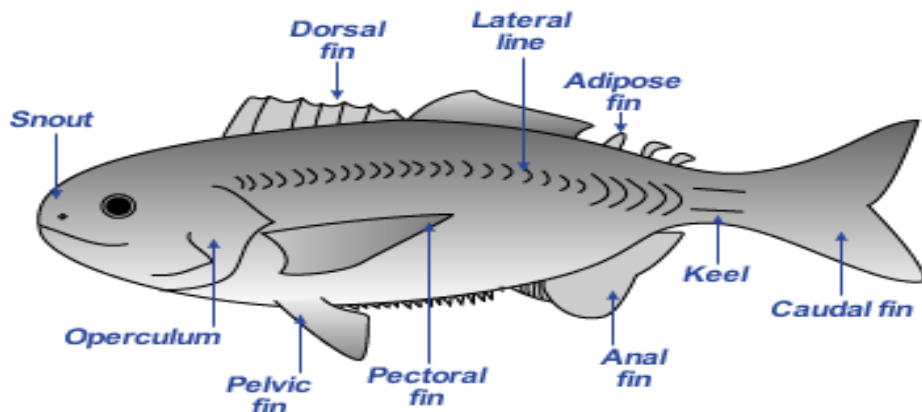


Figure 1. This diagram shows main parts of a fish.

1.2. Functions of body parts of fish

- ✓ **Anal Fin** - fin located near the anal opening; used for balance and steering.
- ✓ **Caudal or Tail Fin** - fin at the tail of a fish; used for propulsion.
- ✓ **Circulatory System** - delivers blood and oxygen throughout the body via the heart.
- ✓ **Digestive System** – breaks down and processes proteins, carbohydrates and fats.
- ✓ **Dorsal Fin** – backside (top) fin on a fish; used for balance and protection.
- ✓ **External Anatomy** - the outside body parts, such as, fins, scales, mouth.
- ✓ **Gills** – organ used to obtain oxygen from the water and rid carbon dioxide.
- ✓ **Gill Rakers** – filter feed tiny prey; appendages along the front edge of the gill arch.
- ✓ **Gonads** – the sex organs; males have testes, females have ovaries. Some fish are hermaphroditic, meaning having both sets of gonads (male & female) in one fish.
- ✓ **Lateral Line** – organ of microscopic pores that sense low vibrations and water pressure.
- ✓ **Nares** - organ to smell; similar to nostrils.
- ✓ **Nervous System** - organs receiving and interpreting stimuli for nares, eyes, lateral line, muscles, and other tissues.
- ✓ **Pectoral Fin** - fins on the sides; used for balance and assist turning.
- ✓ **Pelvic Fin** - belly fins on a fish; used for balance and steering.



- ✓ **Pyloric Caeca** – “finger-like” organ that aids in digestion, using bile from the liver.
- ✓ **Reproductive System** – the organs and tissues involved in reproduction, including gonads, eggs, sperm.
- ✓ **Respiratory System** – organs and tissues involved in the oxygen & carbon dioxide gas exchange, including gills, gill rakers, and gill filaments.
- ✓ **Scales** - protective cover on a fish; similar to skin.
- ✓ **Slime** – slippery covering on scales, protecting fish from bacteria, parasites, etc.
- ✓ **Swim bladder** – found only in “ray-finned” fish; a double sac used to assist in buoyancy.
- ✓ **Urinary System** – the kidneys remove nitrogen (ammonia) from the blood and regulate water balance in the blood and tissues.
- ✓ **Vertebrate** – an organism with a backbone or spine.



Self-check-1	Multiple choose
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

- 1. Which of the following fin is located on the tail of the fish? (3pts)
A. Anal fin B. Caudal fin C. Pectoral fin D. Adipose fin
- 2. One is different from the other? (3pts)
A. Anal fin B. Caudal fin C. Gills D. Adipose fin
- 3. _____ found only in “ray-finned” fish; a double sac used to assist in buoyancy.(3pts)
A. Urinary system B. Slim C. Respiratory system D. Swim bladder

Note: Satisfactory rating – 5 points Unsatisfactory - below 5 points
You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

Short Answer Questions

Proper handling is required during harvesting (capturing), sorting, loading transporting and marketing. Fish after harvest must be sorted according to size and species (if they are captured from natural water bodies), because market price and consumer preference may depend very much on size and type of fish. Thus, after harvesting the initial handling are bleeding and gutting.

- ❖ **Bleeding**- it is the process of removing blood from the fish's body .By cutting the arteries just behind the gills and in front of the heart. The fish are then allowed to bleed in container with water for about 10-15 minutes.
- ❖ **Gutting**- after bleeding, the fish may be gutted (removing the internal organs) by cutting (opening) from the anus to thorax, and then removing internal organs, gills and eyes of the fish. After removing the organs wash with clean water and scrape the fish inside and outside to remove all trace of blood & wastes.
- ❖ Bleeding and gutting helps to prevent spoilage of the fish by bacteria that reduces the quality of the product.

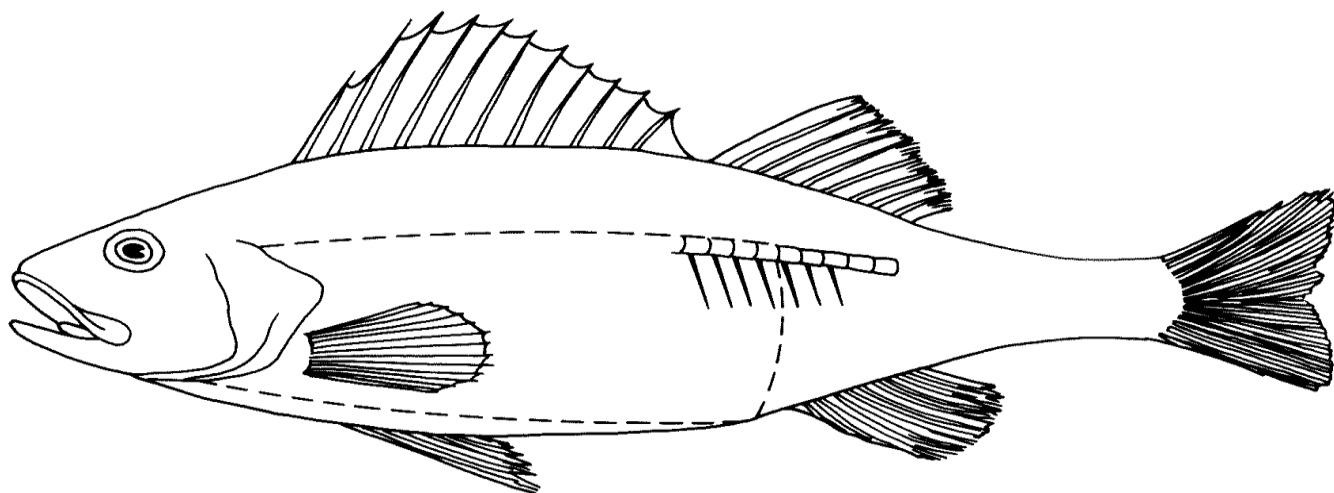


Fig.2 **Dissection lines**

- 1. Incision at anus.** Begin by inserting a fine scalpel blade into the anus (also called the vent) of the fish. The anus is located just anterior to (in front of) the anal fin, on the ventral (lower) side of the fish in most fishes.



Fig.3

- 2. Cutting anteriorly.** The incision is then extended anteriorly along the fish's belly towards the head.



Fig.4

- 3. Cut between pelvic fins.** The incision passes anteriorly between the pelvic (ventral) fins. Depending on the type of fish, these paired fins are used to stabilise the fish when swimming and also for braking. The pelvic fins are supported by the bones of the pelvic girdle which are anchored in the belly muscles.

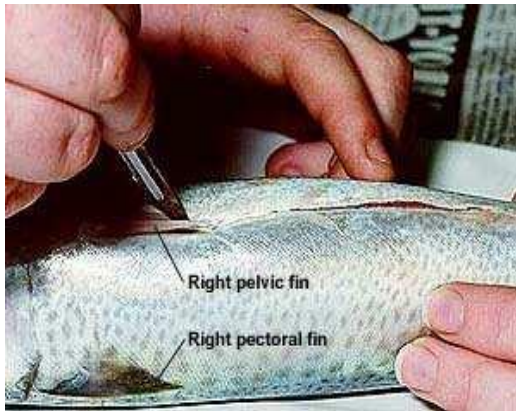
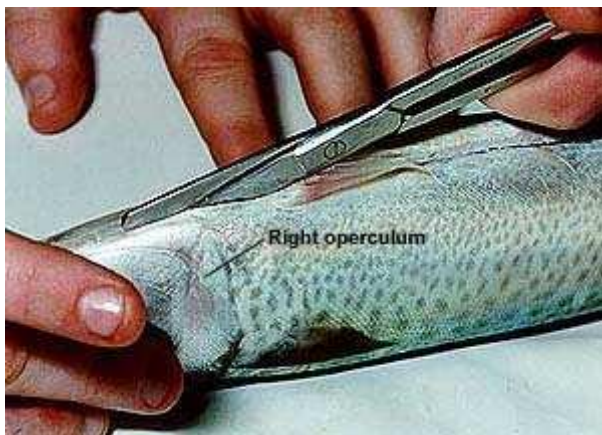


Fig.5

- 4. Cut along isthmus.** Use scissors to cut anteriorly through the bones attached to the pelvic fins. Cut forward along the narrow, fleshy space beneath the head and between the gill covers. The gill covers (also known as operculae) are flaps which lie along both sides of the head and protect the underlying gills.



- 5. Body cavity.** Pull apart the two walls of the body cavity and expose the internal organs (see next image for names). The neat incision now runs from the anus forward between the two pelvic fins and along the isthmus.



Fig.6

6. Internal organs. Some of the ventrally located internal organs: 1 heart, 2 Liver, 3 Pyloric caecae, 4 adipose (fatty) tissue

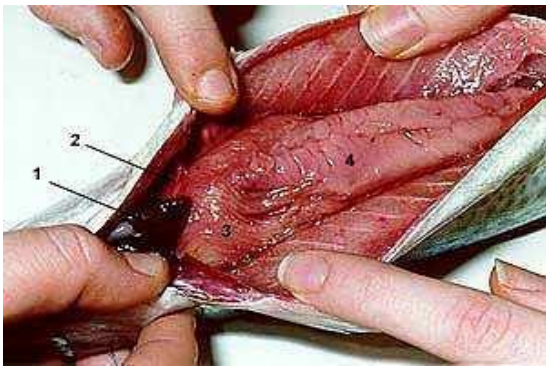


Fig.7

7. Pull aside gut. Here the adipose tissue (1) and gut (2) are pulled aside to expose the swim bladder (3), gonads (4) and kidneys (5). As a general rule, carnivorous fishes have short guts. Herbivorous fishes have much longer guts. The gonads and kidneys are paired. One of each can be seen on both sides of the swim bladder.



Fig.8

8. Cut posterior end of gut. The gut is severed at the posterior end of the body cavity, near the anus. The gut and other organs attached to it are pulled forward out of the way, or removed entirely.

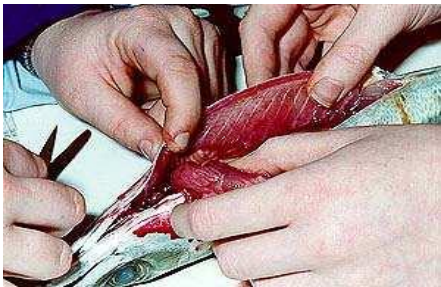


Fig.9

9. Pull gut forward. Pulling the gut forward exposes the swim bladder (1), gonads (2) and kidneys (3) in position dorsally (at the top) in the body cavity. A larger portion of the liver is now visible (4). The kidneys are paired organs located in the body cavity ventral to (below) the vertebral column. They are one of the organs involved in excretion and regulation of the water balance within the fish.

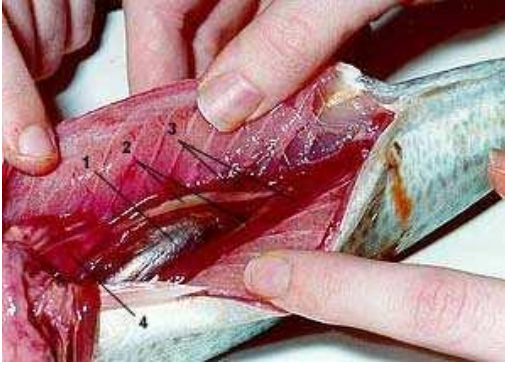


Fig.10

10. Swim bladder exposed. The other organs have been removed to expose the swim bladder at the top of the body cavity. The swim bladder (also called the gas bladder or air bladder) is a flexible-walled, gas-filled sac located in the dorsal portion of body cavity. This organ controls the fish's buoyancy and is used for hearing in some species.

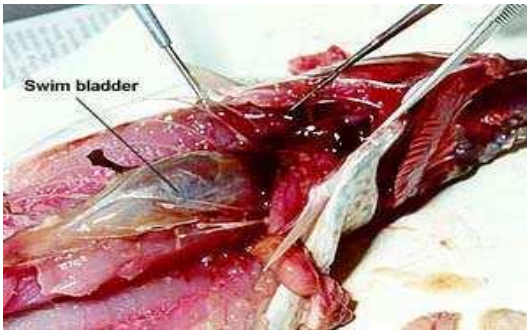


Fig.11

11. Cutting operculum. Here, the right gill cover (operculum) is being removed to expose the underlying gills. Most bony fish have the characteristic of having a single opening behind each operculum (the branchial aperture). Water passes in through the mouth, over the gills and out through the branchial aperture. In contrast, the sharks and rays have five to seven branchial apertures on each side of the head.

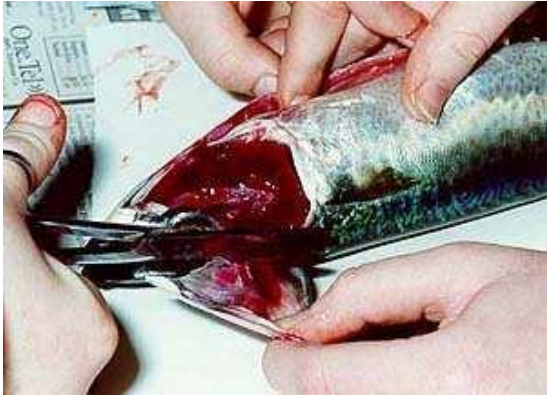


Fig.12

12. Gills exposed. Most gills consist of gill filaments (1), gill rakers (2) and gill arches (3). Gills of fishes are the sites where oxygen is absorbed and carbon dioxide is removed. In addition, the gills are responsible to a varying degree for regulation of the levels of various ions and the pH of the blood. Gill rakers are bony or cartilaginous projections that point forward and inward from the gill arches. They aid in the fish's feeding.

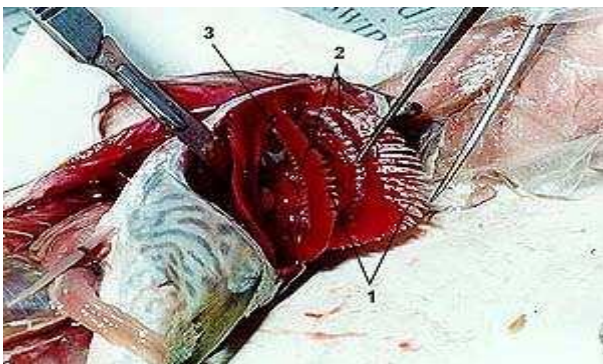


Fig.13



3.1. Determining the sex of fish

Figuring out the sex of a specific fish can be quite difficult if you don't know much about fish anatomy, but it's definitely doable. To figure out the sex of a fish, you'll have to observe the fish's size, shape, appearance, and behavior. For more information on your fish, you can consult books, videos, and fish experts.

3.1.1. Compare the size of the fish during spawning season.

With many fish, like koi, females tend to be larger than the males. This is especially true during spawning time, when females have large abdomens. To check the size of a fish in the same species, you can look at them when they're near each other, take a picture of each one, or catch one in a net to quickly use a ruler to measure its length and width.

- This is often caused by the fact that the female carries the eggs in her abdomen. Once the eggs are laid during spawning season, the females and males can return to the same size.
- If you catch a fish with a net to measure it, try to keep the fish in the water and place the ruler in the water to measure it. You will likely be able to get a general idea of the length and width.

3.1.2. **Look for a bump on the forehead of the fish to identify a male.** Look carefully at the face of the fish just between the eyes and above the mouth. If it has a large, protruding bump, there's a good chance that the fish is a male. This bump is called a "nuchal hump," and its present on many types of fish, like the tilapia, angelfish, oscar, and discus.

- Some species of fish don't have a nuchal hump, but the presence of one is normally a great indicator that you have a male fish.

3.1.3. **Watch for designs and growths during mating season.**

Behavior shown by male during breeding period

- Body colour change
- Construct nest
- Chase female
- Tremble caudal fin to shed sperm

Behavior shown by female during breeding period

- Enlargement of belly/abdomen
- Rub the body against stone or aquatic vegetation
- Jump highly from the water to spawn/lay eggs
- Stay in nest or hole or cave silently for a long time without feeding

3.2. Differentiate male and female perch

Male perch are usually larger than females of the same age. To tell the difference between male and female fish, compare the illustrations in Fig. 2, which show the differences between the external appearances of the sex organs of a mature fish.

The **male** has two body openings situated just forward of the anal fins, of which one is the anus. The other is the opening of the urethra, at the end of the genital papilla (an oval-shaped lobe just rearward of the anus), from which milt (sperm) and urine are discharged.

The **female** has three body openings, of which one is the anus. The genital papilla of the female has two openings. They are the urethra, which is hardly visible to the naked eye, and the opening of the oviduct (a crescent-shaped slit), from which eggs are released.

These features are more visible and identifiable when the fish have grown to 10–20cm in length and 100–150g in weight. Mature Nile perch can also be distinguished by their colouration under the jaw — reddish in males and greyish in females.

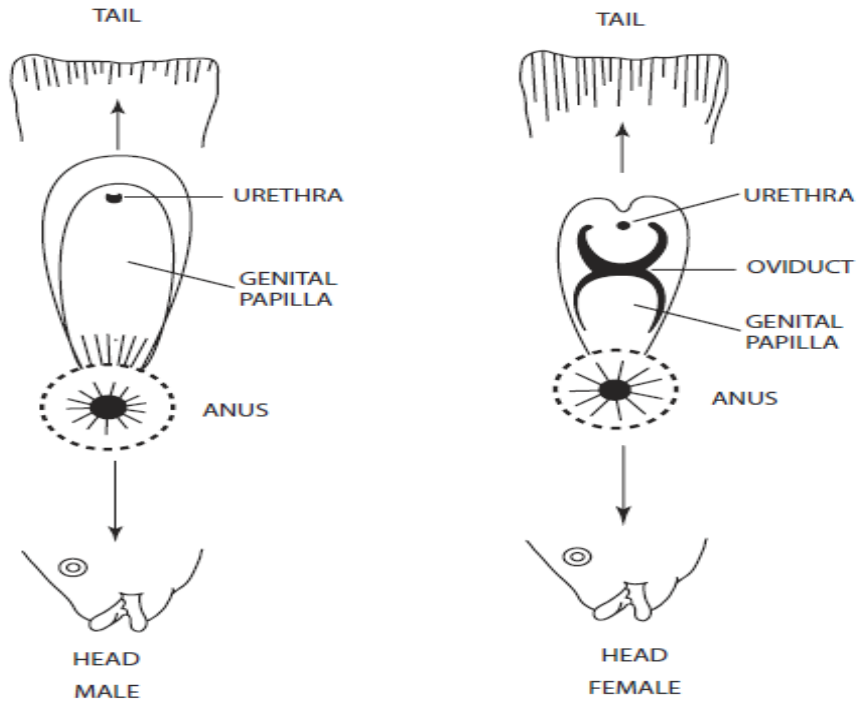


Fig. 2 Male (left) and female (right) sex organs of tilapia



Self-check-1	Written test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Which part of body can be observe to differentiate mature male fish from female? (3pts)
2. Assume female fish has three body openings, anus and genital papilla used to determine sex. So, in what growth stage of length and weight to be visible? (5pts)

Note: Satisfactory rating - 4 points

Unsatisfactory - below 4 points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

Short Answer Questions



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

- Follow and clarify instructions and directions
- Undertake fish farming

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

- Instructions and directions provided by supervisor are followed and clarification is sought when necessary.
- Fish farming activity is undertaken in a safe and environmentally appropriate manner and according to enterprise guidelines

Learning Instructions:

9. Read the specific objectives of this Learning Guide.
10. Follow the instructions described below 3 to 6.
11. Read the information written in the information “Sheet 1, Sheet 2, Sheet 3 and Sheet 4”.
12. Accomplish the “Self-check 1, Self-check 2, Self-check 3 and Self-check 4” in **page -6, 9, 12 and 14** respectively.
13. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1, Operation Sheet 2 , Operation Sheet 3 and operation 4” in **page -18,19,20,and 21**.
Do the “LAP test” in **page – 22** (if you are ready).



General principles of undertaking fish farm

Good management Equals Successful culture and High yields of Fish, therefore:

- ❖ It is a good idea to pay at least one visit a day to the ponds in the morning if possible another visit to be made in the late afternoon to have full control. Hence, the following points should be checked every day.
 - Check the water level and see that no water is running through the outlet. If there is any leakage repair it.
 - Carry out necessary daily feeding after checking the food is eaten.
 - Watch them carefully to see that they are healthy & swimming strongly.
 - If you find any dead fish floating in the pond, take them out, and investigate the causing factors and change some of the water with new water, this is the first measure to be taken. Again if the fishes are coming to the surface and gasping for air, these is due to shortage of oxygen then add some water.
 - Avoid if any weeds are growing in the pond.

There are certain management aspects that are undertaken weekly or monthly.

- Add some manure as fertilizer every month to maintain high fish productivity by growing natural food of fish.
- Add some amount of Limestone every month to reduce disease incidence and to kill parasites of fish.
- Weekly release some water and let water into the pond slowly, never make like a fall.
- When the fishes reach market size about one year of age drain some of the water and harvest them with the appropriate net.
- ❖ Generally speaking, strictly following appropriate management
- ❖ Practices help the fish farm run profitably by raising (growing) large amount of fish by the most economical means.



Information Sheet-01

Following and clarifying instructions and directions

Instructions and directions provided by supervisor are followed and clarification is sought when necessary. Any employee who works in industry which fish raising or any farmer who raise his own stock must follow the following instruction and direction:-

- Enterprise policies and procedures
- Manufacturer instructions
- Material safety data sheets (MSDS)

The MSDS is a detailed informational document prepared by the manufacturer or importer of a hazardous chemical. It describes proper handling and raising activities of fish.

MSDS's contain useful information such as:

- Flash point
- Toxicity
- Procedures for spills and leaks and
- storage guidelines.

Information included in a Material Safety Data Sheet aids in the selection of safe products, helps you understand the potential health and physical hazards of a chemical and describes how to respond effectively to exposure situations

- *OHS standards and procedures*
- *Specifications for tools, equipments and materials*
- *Standard Operating Procedures (SOP)*

It is a set of step-by-step instructions compiled by an organization to help workers carry out complex routine operations. SOPs aim to achieve efficiency, quality output and uniformity of performance, while reducing miscommunication and failure to comply with industry regulations

- Verbal directions from manager or supervisor
- Work instructions and standards
- Work notes



Instructions and directions provided by supervisor must be followed and if we have any question we can ask when necessary. And also employee must observe and follow Enterprise policies and procedures in relation to workplace practices in the handling and disposal of materials



Self-Check 1	Written Test
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Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

1. what is OHS ? (5 points)
2. What is MSDD ? (5 points)

Note: Satisfactory rating - 10 points Unsatisfactory - below 10 points

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

Short Answer Questions



3.2.1. Site selection of fish farm

Site selection: is the process by which various factors indicated are considered to enable one to decide on the right site for a specific production (culture) system. Success or failure of any fish culture venture largely depends on the right selection of the site for it. In choosing a site several factors other than the physical aspect of the site are to be considered.

Factors to be considered in site selection

There are several factors to be considered in site selection among these are;

1. Water Supply

Adequate supply of good quality water must be available year round in the site for fish culture.

- The water sources must be **reliable and adequate**
- Good quality water is rich in oxygen, nutrients and free from pollutants. The most important sources of water for fish ponds are; Perennial streams, Lakes, Rivers, Springs and wells, and, Water reservoirs and dams.
- If there is no enough water all the year round, it is no good making ponds, as they will dry up and the fish will die. And also the water loss due to evaporation, leakage and percolation should be considered in determining the amount of water required.

2. Soil Type & Quality

- Many soil characteristics, especially those related to texture, determine its suitability for fishpond purposes.
- Soil texture refers to the relative proportion of sand, silt and clay content of the soil.

Types and Characteristics of soils

- **Sandy soil** - this soil can't be used for constructing fishpond, because it can't keep water. Its clay content <12.5%, sand content >87.5%.

Clay soil- This soil can be used for constructing fishpond, but it has much poor aeration. Clay conserves water well. It can be used on the pond bottom; however, because it cracks when dry, it is unsuitable for dike construction.

Clayey soils are preferable because they are superior material for diking and holding water. They have good compaction characteristics and low permeability. A very simple general rule can be followed: As a clay content of the soil decreases, its suitability for fishpond construction also decreases.

Loamy soils are also recommended. They have good organic matter content which favor the culture and growth of natural fish food.

Desirable soil texture for ponds-Soils belonging to the following textural classification are desirable for fishpond development: clay, clay loam, silty clay loam, silty loam, loam and sandy clay loam. These types of soils are characterized by;

- *High water retention (holding) capacity*
- *Good aeration*
- *Adequate nutrient*
- *Favorable chemical properties.*

Soil characteristics greatly affect the quality of pond construction and influence fish yields. Therefore, soil quality should be carefully determined. In determining soil quality, it is insufficient to just examine the topsoil. Enough samples must be taken from various representative spots. The sampling depth should be 1 m. The soil should ensure that pond dikes would not leak or collapse.

Soil Quality Testing

There are several methods to test the quality of soil for pond construction, the most easy and practical methods includes;

The ball method

- ◆ Dig about 50cm deep pit, take a handful of soil from the bottom of the pit, and moisten it with some water. And squeeze it into a ball (fig.1)
- ◆ Throw the ball of soil into the air and catch it (fig 2).

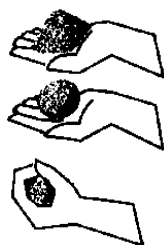


Fig 1



Fig 2

Conclusion: Bad soil with too much sand or gravel in it will not stick together and the ball will fall apart then *reject the site*. If the ball sticks together well the soil maybe be good, but you can't be sure. Now you should make a second test to be sure that the soil is good.

The pit method

1. Dig a hole as deep as your wrist early in the morning (Fig 1) fills it with water to the top (Fig 2).
2. By evening some of the water will have sunk into the soil (Fig 3).
3. Then fill the holes with water to the top again (Fig 4). Cover the hole with boards or leafy branches (Fig 5).
4. The next morning if most of water is still in the hole at least 60%, the soil hold enough water, therefore the soil is suitable to build fish pond(Fig 6).If there is some or no water remaining reject the site.

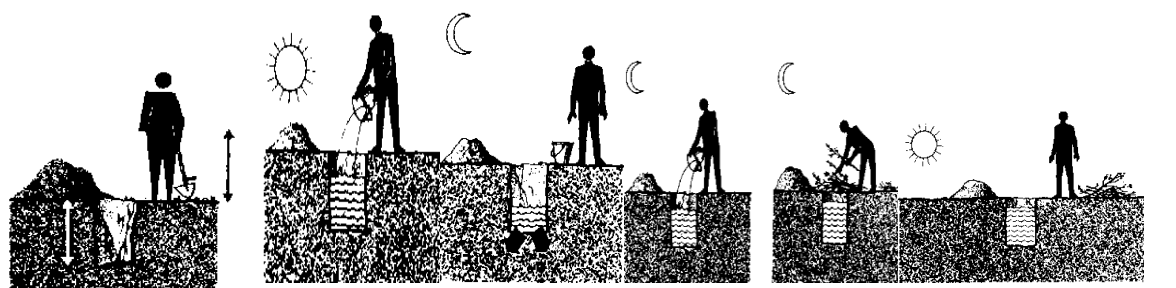


Fig 1

Fig 2

Fig 3

Fig 4

Fig 5

Fig 6

3. Topography of the site

Topography refers to the “lay of the land” or the changes in the surface elevations of the ground whether flat, rolling or sloping, undulating, and hilly. Fishpond design, layout and specifications are made largely in accordance with the land topography.

A suitable site for fishpond has a topography that can be converted into a pond economically. The cost of construction can be greatly reduced if the surface features of the land are used to advantage.

It is desirable or ideal to construct a fish farm on **flat land with moderate slop**. However, there is no problem in setting up a farm on sloppy side of hills or valley areas. The topography should be suitable for;

- Gravitational flow of water can be exploited (water can easily enter into the pond)
- Reduce soil excavation and energy consumption, and
- Easy to drain water from the pond

4. Other criteria

There are other factors which are significant in fishpond site selection. These are equally as important as those previously mentioned and likewise require the same careful evaluation during the survey.

- a. *Accessibility.* This is important for the transport of construction equipment and material, and for production inputs required for daily operations. Transporting costs can considerably increase if materials are manually carried through long distances. It is better if the site is accessible throughout the year by means of land and water.
- b. *Availability of labour.* The cheapest sources of labour are those which can be provided by the local residents, or people living within or near the area. It is important that the customs and tradition of local laborers are known. The pattern of labour distribution and utilization should be considered as this is important in preparing the calendar of activities.
- c. *Availability and cost of material.* In fishpond production, it is important that critical production inputs such as fish seeds, fertilizers, pesticides and other related materials are readily available when needed. For some inputs, especially inorganic fertilizers, the supply is restricted and the cost is uncontrolled for non-agricultural uses. Other inputs like organic manures are difficult to obtain, or may be available only at certain times of the year.
- d. *Availability of marketing outlets and prices.* Aquaculture products are highly perishable. Immediately upon harvest, products must be disposed of to maintain good quality and for better prices. If marketing outlets are located at a distance, larger quantities must be harvested and transported requiring some post-harvest marketing practices. If so, then the required support facilities especially ice-making plants must be available.
- e. *Availability of credit and technical assistance.* Fishpond operations require high initial capital investment. In this respect, credit at reasonable terms play a major role in providing the needed cash outlays. Technical assistance may be obtained from government extension services, public or private university research stations and lending institutions. The services rendered by these agencies are important especially in cases of emergency.

- f. *Pattern of land and water use.* It is important to assess the pattern of land and water use in the area to determine the impact of this on the project. Activities such as navigation, fishing, industries, public utilities, and recreation and nursery areas must be included in the overall assessment. It is best that a complementary rather than competitive relationship between these various uses and the project be established.
- g. *Peace and order situation.* Good peace and order conditions at site are favorable for both public and private interests.

3.2.2. Pond preparation

After deciding on the site or location and design of fish pond the pond's shape size and depth has to be determined.

Pond shape: the easiest and perhaps best shape is the rectangular with a length twice the width. However, the shape could be modified based on the topography of the area.

Pond size: depend on the objective of the fish producer. If it is for home consumption then smaller size may be used(E.g. 20m by 10m).For commercial purpose large size is needed(more than 40m by 20m).

Pond depth: pond should be deeper near the outlet for easy drainage. The average depth of fish pond could be 1m to 1.5m.

Once the pond shape, size, and depth is decided, then the procedure to construct fish pond is:

- Measure the length and width of the pond on the ground and mark it. Then, clear any vegetation grown. This is illustrated in Fig.1&2
- Begin the excavation (digging).It could be done by machine or manpower. This is illustrated in Fig.3
- The earth that comes out should be thrown upon the sides to form embankment (dyke).
- The pond dyke should be well compacted and strong enough to withstand the greatest water pressure exerted on them, and to avoid water seepage This is illustrated in Fig.4
- The dyke should be sloppy that face the water to avoid sliding of earth.
- Then make the water inlet, outlet, and canal(Fig.5)

Pond water inlet: is the place water can be let into the pond. There should be a screen (wire net) to prevent wild fish entering pond and gate to open or close when water is needed or not.

Pond water outlet: water can be let out of the pond .This is usually a pipe fitted with screen and valve to avoid escaping of fish.

Canal: long and narrow pit leading water from the source into the inlet of the pond.

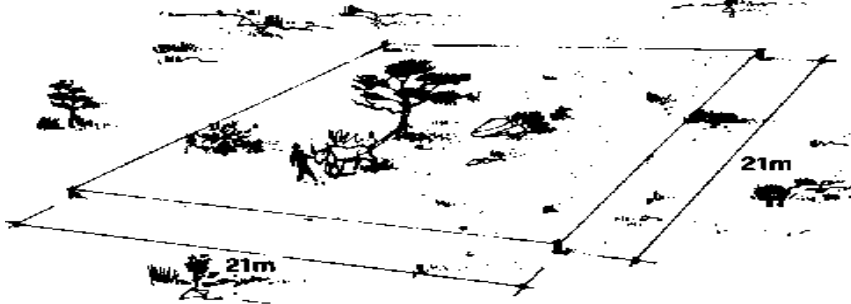


Fig.3 Measuring and marking the selected site for construction.

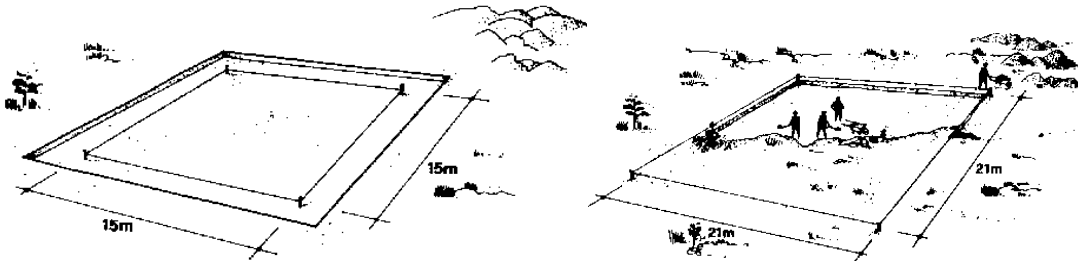


Fig 4. After clearing the area Fig.5 Excavating(digging) the pond.



Fig .6 Compacting the pond dyke(embankment)

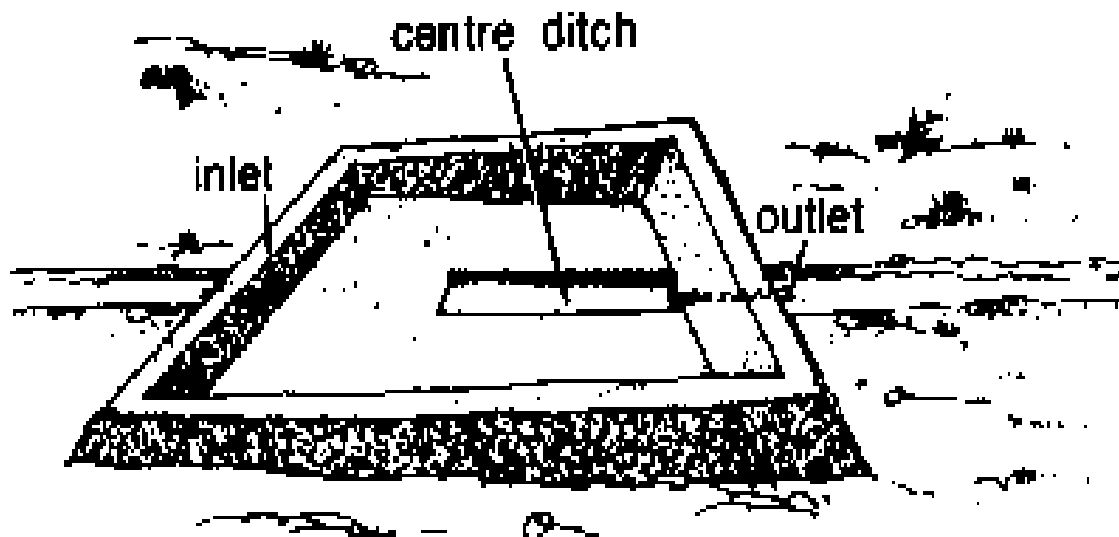


Fig.7 Body parts of a fish pond indicating water inlet, outlet and dyke

3.2.3. Carryout liming, fertilizing, feeding and water quality test

3.2.3.1. Liming fish pond

The main roles of liming are showed in the following:

- Lime is anti-parasitic. It destroys parasites (eggs, larvae) living in the water or the inter-medium hosts. Kill the fry enemies such as insects, frog and their larvae.
- Regulate the acid water to slightly alkaline (pH 7-8.5), which is suitable for fish growing and stabilize the pH value.
- Fertilize the pond because many algae fed by fishes need Ca^{2+} as nutrient element.
- Make the ooze of the bottom loosen sediment (or precipitate) material floating and muddy in the water and make water clear and transparency.

Types of lime

- ◆ The most common liming materials are agricultural limestone, hydrated or slaked lime and or quick lime.
- ◆ Liming materials differ in their ability to neutralize acid.
- ◆ Pure agricultural limestone is the standard against which other liming materials



are measured.

- ◆ The neutralizing value of agricultural limestone is 100 percent..
- ◆ Generally calcium oxide (CaO) called slaked lime or quicklime, and calcium carbonate (CaCO₃) called chalk or limestone is used as the liming material.

Disinfecting the pond

It's very important to disinfect the pond for preventing fish from getting diseases and getting high fish productivity.

Besides the limestone, some another materials can also be used for disinfecting the fishponds.

There are three methods of pond disinfection: -

- i. Using quick lime to sterilize the pond without water.
- ii. Using quick lime to disinfect the pond with water.
- iii. Using bleaching powder to sterilize the pond with water.

3.2.3.2. Fertilizer application

- Fertilization supplies the phytoplankton (free floating plants) with the materials essential for photosynthesis.
- As the phytoplankton photosynthesize and reproduce, zooplankton (floating organisms that is made up of microscopic animals), which feed on phytoplankton, flourishes.
- In turn, the fish, which feed on zooplankton, phytoplankton, and benthos, also flourish.
- Therefore, the importance of pond fertilization lies in the cultivation and propagation of various food organisms for the cultural fish.

Fertilizers can be divided into two:

Chemical fertilizers

According to composition, chemical fertilizers can be divided into three groups: nitrogenous, phosphoric, and potash fertilizers.

Organic manures

- Organic manures are mainly farm animal excrement.
- Generally; the term refers to manures containing organic matter.

- Faeces and urine of livestock and poultry, green manure, night soil, compost, and silkworm dregs are some of the organic matters.
- Fertility of ponds, therefore, is achieved by application of inorganic and organic fertilizers or a combination of both.
- Fertilization supplies the phytoplankton (free floating plants) with the materials essential for photosynthesis.
- As the phytoplankton photosynthesize and reproduce, zooplankton (floating organisms that is made up of microscopic animals), which feed on phytoplankton, flourishes.
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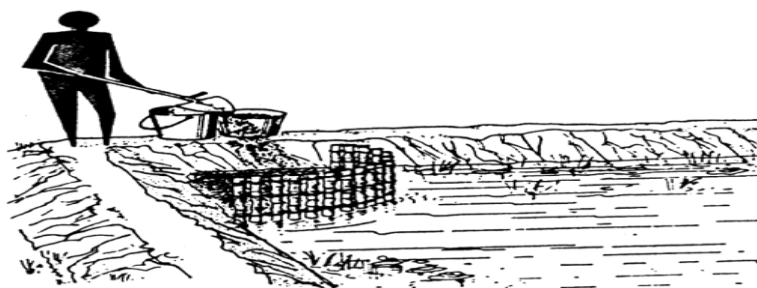


fig 8 . compost bin in the pond

3.2.3.3. Fish feeding

Natural fish feedings

plankton is a collective term applied for very small (microscopic largely) extremely diverse forms of organism, both plants and animals that are floating forms, drifting into currents. The plankton occurs in all natural water as well as in artificial ponds, reservoirs, irrigation channels, etc.

Phytoplankton: the organisms are exclusively of plant origin and are thus autotrophs belonging to the first trophic level (producers).



Zooplankton: the organisms are exclusively animals, and are therefore heterotrophs, belonging to the second trophic (primary consumer) level.

The objective of feeding fish is to provide the nutritional requirements for good health, optimum growth, optimum yield and minimum waste within reasonable cost so as to optimize profits.

Every farmer should be particular about the quality of feed fed to the fish because it is the feed that determines the:

- (i) Nutrient loading (and ultimately carrying capacity) in the pond, hence water quality within the culture system
- (ii) Fish growth rate,
- (iii) Economic viability of the enterprise. 60-70% of variable production costs in a normal production cycle is due to feed.
- (iv) Health status of the fish.

Feeding fish correctly means:

- ❖ Giving feed of the correct nutritional quality for the specified age of fish,
- ❖ Feeding the right feed size for easy consumption,
- ❖ Feeding the correct amounts,
- ❖ Feeding at the right time(s) each day. When fish are fed correctly, growth rates are good and uniform across the population, feed conversion ratios (FCRs) are low and pond water quality is better managed.

The physical attributes of a good feed, therefore, are:

- The ingredients used in the feed should be finely ground. The pellets will have uniform color and you should not be able to distinguish morsels of maize for example.
- The feed must be without fines or dust. If too many fines are in the feed, too much will be wasted in the form of a powder that floats on the water surface. Tilapia may eventually consume this powder but larger catfish will not.
- The pellet should be firm with a water stability of at least 30 minutes. The pellet's water stability refers to the time it takes for the pellet to completely fall apart in water.
- The pellets should be of uniform size and of correct size so the fish can swallow them. A size of about $\frac{1}{4}$ the gape of the mouth is advised.

- The feed should be palatable to the fish with a good taste, smell and feel. Fish will spit out or only slowly consume feed that is not palatable.

Floating feed

provides an added advantage in that the farmer not only knows when the fish have started feeding, but the farmer will know when the fish have stopped feeding. Even though catfish are thought to feed on the pond's bottom, they are easily trained to feed wherever the food is, even at the surface. Therefore, it is much easier for the farmer to evaluate feeding response when using a floating feed. However, floating feed often costs more. It is therefore up to the farmer to decide if floating feed is worth the added expense by evaluating fish performance and feed conversion.



fig. 11 fish feed

Example: If there are 1000 young fishes in a pond, and each weighs about 10 grams, then the total amount of food to be given will be:

$$10\text{grams} \times 1000 \times 4/100 = 400\text{grams of food is required}$$



When do we feed fishes?

- Always try to feed your fish at the same time every day preferably early in the morning and late in the afternoon when the pond is cooler by dividing the food into two.

Where do we provide feed to fishes?

- The food should not be spread all over the surface of the water, but on a certain side of the pond on feeding platform(prepared from bamboo by cutting into 4 pieces of 150cm in length and joining each corner and fixing with rope or wire to form a square).

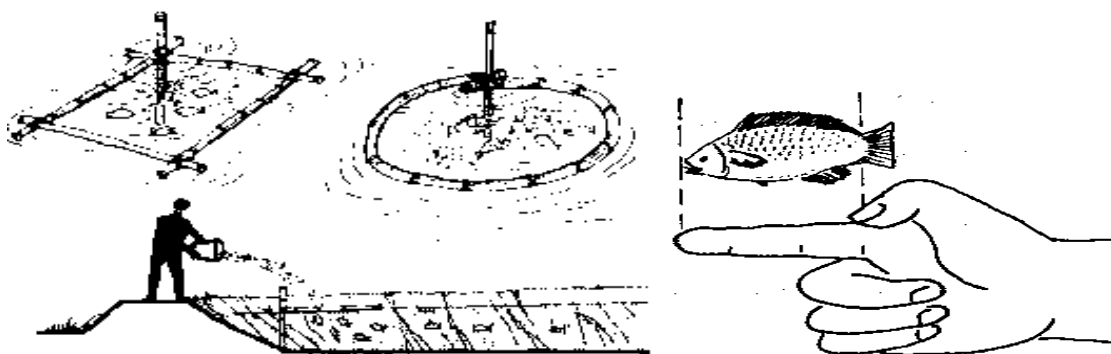


Fig. 12 Structure of feeding platform and method of feeding Fig.13 A fish at fingerling stage

3.2.4. Filling fish culture with water

- After renovating and disinfecting fishponds, the freshwater can be filled into the pond.
- The water must be nontoxic.
- In order to prevent the wild fishes and another harmful animals enter the ponds, dense net or filter should be installed in the pond inlet.
- After or before filling the water, base manures should be put into the pond.
- The dosage of base manure is 200 kg/ha for dry cow dung, or 6000kg/ha for fresh grass or another fresh manures.
- One week later, the pond water will be changed into green or brown color and plankton grow well.
- When filling the water into pond, at first one-third of water needed should be filled gently.
- Then other water can be added until the full of pond when the water color has been changed to green or brown.

3.2.5. Type and size of fish culture

Culture systems found in Africa include semi-intensive and intensive culture of Nile tilapia (*Oreochromis niloticus*), African catfish (*Clarias gariepinus*), and common carp (*Cyprinus carpio*). The species used at any given site are commonly found in the region and more or less



appropriate to the agro-climatic zone. They are warm water fish species and are mainly cultured in a freshwater environment.

Desirable characteristics for cultured fish species include:

- Ease of reproduction
- Attainment of market size prior to reaching sexual maturity
- Acceptance of supplemental and/or manufactured feeds
- Feeds low on the food chain, i.e., eats plant material
- Rapid growth
- Efficient feed conversion
- Resistance to diseases
- Tolerance to relatively high stocking density and poor environmental conditions
- Is highly desired in the marketplace.

Few species have all of these characteristics, but the Nile tilapia, carp and the African catfish have enough of them that their popularity in the market and the ready availability of technical information about their culture make them suitable candidates for warm water fish farming in Africa.

There are two options in the production of fish in artificial ponds. These are starting with parent fishes and fish seed collection method.

Starting with parent fishes

In this production system one small pond called nursery pond is prepared. This pond may have size of 10 m length, 5 m width and about 1 m depth. After filling with water, disinfecting and fertilizing the pond. Now you are ready to put four fully grown males and 10 females' tilapia fish or 1 male and 2 female carp fish in nursery pond. After one or two weeks they will start to reproduce. For instance, one mature female tilapia may produce from 1000-3000 fish seeds every month and carp may produce from 200,000 to 500,000 fish seeds every four months. The newly born fish seeds will stay for two months in this pond then they are collected and transferred into production or growing pond.

Stocking fish seed should be 120 seeds/m² until 20 gram weighs each fish then reduce the stocking rate to 30 young fish/ m² for growing from 20-60 grams usually this is at the age of 3 months. After this reduce the stocking rate 4 fish/ m² until marketable size is attained.



Fish seed collection

Other option is collecting fish seeds from lakes, rivers or fishery research centres (such as Sebeta fishery research centre) and growing in artificial ponds until they are marketed.

From these two options starting with parent fishes is more appropriate because fish seeds are obtained when needed but collecting fish seeds from natural water bodies may be unreliable, seasonal and insufficient for the fish farm.

3.2.6. Stocking

Stocking fish seed should be 120 seeds/m² until 20 gram weighs each fish then reduce the stocking rate to 30 young fish/ m² for growing from 20-60 grams usually this is at the age of 3 month. After this reduce the stocking rate 4 fish/ m² until marketable size is attained.

- It is usually expressed as the number of weight of fish per ha.
- The stocking density must be reasonable because it is inversely proportional to the quality of marketable fish under the same pond condition and culturing measures.
- The optimum stocking density for silver carp and bighead carp is 150 000-180 000 fry per 1000 m²; for grass carp and black carp 120 000-150 000 fry per 1 000 m²; for tilapia 200 000-300 000 fry per 1 000 m².
- Lower stocking density rate will decrease yield and increase production costs though fry grows faster. Stocking density can be optimized with skillful farming and careful management.

3.2.7. Predator and disease control

Various animals including fish are harmful to fish cultivation so far as they either live upon the cultivated fish species or their eggs and fry, even compete them for food. To this category of fish enemies belong all groups of vertebrates as well as insects. Depending upon the population of any of these a control becomes necessary as part of pond management. Some measures taken are as follows:

- Periodical drainage of pond
- Use of quicklime treatment to pond
- Destruction with quicklime or removal with scoop net of eggs keeps a control on

multiplication of harmful amphibians.

- Use of traps is an effective measure against harmful amphibians, birds and mammals.
- Shooting when permitted is especially effective against harmful birds.
- Use of toxic substances is quite effective in certain cases. Notonectids (back swimmers) can be easily controlled by spraying an emulsion of various oils (mustard, castor, etc.) in washing soap with the ratio of 3:7 and at the rate of 66 pounds per acre of water surface.

Control of fish diseases in farm ponds

Diseases are caused by parasites and infectious pathogens. Disease can significantly decrease the productivity of fish farm by:

- Minimizing the productive & reproductive performance of fish
- Marketing is delayed due to slowed growth
- Increasing cost of production incurred for treatment. Due to the above effect of disease to the fish and fish farm. It is much better to prevent disease. “Prevention is cheaper than disease treatment”, and avoids lose due to poor growth and death.

Factors Affecting Fish Health

1. Nutrition- proper nutrition (feeding) is required for fast growth and to avoid nutritional deficiencies. Adequate nutrition enable the fish defend itself against diseases.

2. Physical & environmental stress – this increase susceptibility of the fish to diseases. Some of physical & environmental stress includes:

- Very high or low environmental temperature
- Low dissolved oxygen content of the water
- Increase in acidity or alkalinity of the water
- High stocking rate (overcrowding)
- Very turbid water due to silt and/or waste from the fishes.
- Rough handling (poor management practice)



3.2.8. Harvesting and measuring fish

As in any other type of farming the final phase in the fish farming cycle is the catching /harvesting and use or sale of the product. There are two ways that a farmer can harvest his product, he can either take out the whole population from a pond at the same time or he can selectively catch fish from the pond throughout the year. For this, different capturing techniques have been employed.

Passive Fish Capturing Methods

In these fish capturing methods catching is dependent on the movement of the fish. The fishes should move into the trap or net by themselves.

- ✓ **Fishing With Traps:** Fishes can be caught with simple locally made traps such as basket from bamboo made in conical shape. In this method it allows the fish to enter easily but prevent its escape by means of a valve net. Farmers put food inside to attract fish in the non-return valve trap .It is common in lake and rivers the fish are used for home consumption.
- ✓ **Gill Net:** The principle in this method is that if a net is hung in a pond or lake the fish will attempt to swim through the net by selecting the appropriate mesh size the farmer can make sure that any fish smaller than he wishes to harvest will swim through the net while the larger fish will get stuck. Fish are caught by the operculum (gill cover), and because of this the net is called a gill net, which rank first in tropical small scale fisheries.
- ✓ **Hook and Line (Angling):**The principle used in hook and line fishing is to offer the fish a bait (food) fixed to hook and at the end of a line (rope) Which is attacked to a short bamboo or wooden pole. The fish while trying to bite the bait (food) swallows the hook and then gets caught. The bait may be small animals as earthworms, insects, small fish, and pieces of bread. With this method several hooks could be attached to a long rope fitted with float to catch more fish at one time.

Active Fishing Methods

In these methods the catching process involves the movement of the net than the fish. The net is moved by manpower to encircle a group of fish and bring it on the shore.

- ✓ **Seine Nets:** Seine nets are the most common and effective to collect all the fish in ponds. During Operation, one end of the net is fixed either by means of a stick or by anchoring to the bottom. The free end of the net is moved or pulled along to surround a certain area making a semicircle and finally brought to the fixed stick end(i.e. the starting point) the net



is then dragged or pulled into the bank(dyke) enclosing the fish. This can be used in lakes one standing on the shore and other person standing on boat holding the other end and making a circle and then collect them.(This is the method mostly used in different Ethiopian lakes such as lake Ziway, Lake Tana, Lake Awassa.

- ✓ **Cast Nets** The cast net is thrown over a group of fish either from land as in ponds or from a boat. The net encircles the fish. The hand line (rope) fatted with lead (weight) and then slowly pulled closing the net, which is then lifted up with the fish.
- ✓ **Hand (scoop) Net:** This net consists of bag of netting materials with the mouth of the bag kept open by circular framing with iron fixed to wooden pole or stick. This method usually used to take out alive fish for sample from the pond.

Harvesting by complete and partial draining of the pond if the ponds are small and have convenient inlet and draining system and enough water resource, it is the best measures for harvesting by complete draining of the pond. The correct harvesting time should be determined according to marketable requirement and size and age of fish.

The following times are the best for harvesting:

- i. Good marketable price of fish
- ii. Size of fish just meets consumer's need (e.g. over 200g for tilapia; 0.5—0.6kg for common carp).
- iii. Age of fish has reached or surpassed the one of biggest growth speed or sexual mature.
- iv. Pond's other need.

Pond management after harvesting

- ❖ Dry the pond bottom until the cracks
- ❖ Plough the bottom of pond
- ❖ Put lime on the bottom, wall and dyke of the pond
- ❖ Wait two weeks
- ❖ Add water
- ❖ Check the water quality

Mesh size of the net—means the size of each square parts of the net, usually for Tilapia species the recommended size is 10cmx10cm mesh size for larger species such as Nile perch the size could be increased.

Measuring fish length

Total length: This length represents the maximum elongation of the body from end to end.. For this measurement, mouth is kept closed and caudal fin squeezed/compressed. For forked fin, tip of the longer lobe is used.

Fork length or Ac length: It represents the length of fish from the anterior terminal to the notch of the forked caudal fin i.e., the tip of the media fin rays. It is regarded as the most convenient length.

Standard length or A.D length: It represents the length of the body from the tip of snout to the base of the caudal fin. This is the commonest length used for fishery work, head length, trunk length and tail length.

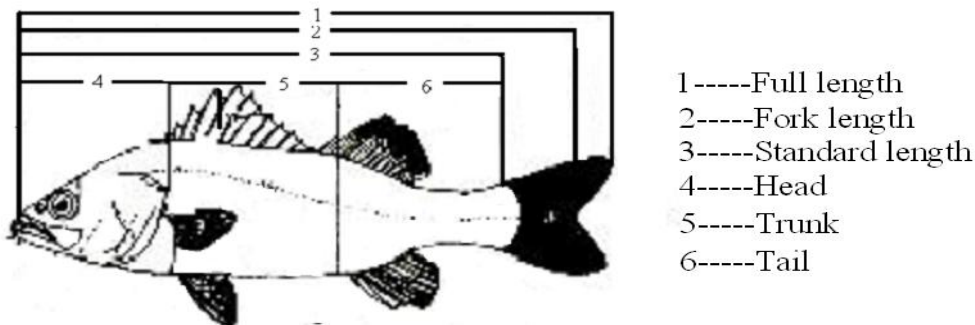


Fig 1.1 External Feature of a Perch

Standard length= head length+ trunk length+ tail length



Self-Check 2	Written Test
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Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

1. What are the requirements of fish farm site selection? (3 points)
2. What is the difference between liming and fertilization of pond? (2 points)
3. What is the role of lime in fish culture? (3 points)
4. Why is mandatory to conjugate fish pond farming with other agricultural activities? (3 point)
5. Write some pond management activity after harvesting? (5 points)
6. How do you control fish from disease and predator? (4point)

Note: Satisfactory rating - 19 points Unsatisfactory - below 19points

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

Short Answer Questions

**pond liming****procedures : procedures of pond liming.**

1. Select and fulfill personal protective clothing's.
2. Arrange all necessary materials tools and equipment
3. use calcium oxide (CaO) called slaked lime or quicklime, and calcium carbonate (CaCO₃) called chalk or limestone is used as the liming material
4. Calculate the quantity of lime required.
5. Weigh the liming material and convert it into powder.
6. Take the powdered lime in a bucket and spread it evenly in the pond.
7. Wash your hand thoroughly.
8. Using quick lime to disinfect the pond with water.
9. add the lime until the pH of acid water to slightly alkaline (pH 7-8.5)
10. Check the result of disinfecting pond with indicator fish or other aquatic creature after 7 days.
11. Find out the pH value of the pond with the help of litmus paper or pH strips
12. Clean work areas and dispose wastes

**Fertilizing of pond with organic fertilizer****Procedures**

1. Put PPE
2. Arrange all necessary materials tools and equipment
3. Use Faeces and urine of livestock and poultry, green manure, night soil, compost, and silkworm dregs .
4. prepare compost bin inside the pond around the corner of the pond so as to pour the compost
5. Apply this fertilizer with the proportional amount of the pond water
6. Apply 10 -15kg/ 100m² for dry cow dung or 2-3 kg/m² poultry manure around the corner of fish pond
7. Leave it at least a week
8. Check and report changes on the pond



Operation Sheet- 3	Water filling
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Water filling

Direction: Perform the following the Procedure given below.

1. Put PPE
2. Arrange all necessary materials tools and equipment
 - A. renovating and disinfecting fishponds,
 - B. Fill the freshwater into the pond.
 - C. The water must be nontoxic.
 - D. Base manures should be put into the pond.
 - E. The dosage of base manure is 200 kg/ha for dry cow dung, or 6000kg/ha for fresh grass or another fresh manures.
 - F. One week later, the pond water will be changed into green or brown color and plankton grow well.
 - G. When filling the water into pond, at first one-third of water needed should be filled gently.
 - H. Then other water can be added until the full of pond when the water color has been changed to green or brown.



Operation Sheet- 4	Water quality measurement using pH
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Direction: Perform the following the Procedure given below.

1. Put PPE
2. Arrange all necessary materials tools and equipment

Calibration-Follow these steps to calibrate a pH meter:

- A. Turn the meter on.
- B. Connect the probe to the meter.
- C. Place the probe in *buffer 7* solution and wait for the reading to stabilize.
- D. Press the "Cal" button to enter the calibrate mode.
- E. Press the "Con" button to set the meter to pH 7.
- F. This method can be repeated for a buffer 4 and/or a buffer 10 solution.
- G. Press the "Meas" button and Measure will appear on the display screen.
- H. Rinse the probe with distilled water.
- I. The pH meter is now calibrated and ready for use.
- J. Measure the pH of the pond



LAP Test	Practical Demonstration
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Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within --- hour.

Task 1- liming

Task 2- fertilizing

Task 3- Water filling

Task 4- Water quality measurement using pH



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

- Handling waste material
- Handle and transport materials, tools and equipment
- Dispose and return material
- clean ,maintain and store materials, tools and equipment

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

- Waste material produced during work is handled according to supervisor instructions.
- Materials, tools and equipment are handled and transported according to supervisor instructions and enterprise guidelines.
- Materials are returned to store or disposed of according to supervisor instructions.
- Tools and equipment are cleaned, maintained and stored according to manufacturer specifications and supervisor instructions.

Learning Instructions:

14. Read the specific objectives of this Learning Guide.
15. Follow the instructions described below 3 to 6.
16. Read the information written in the information “Sheet 1, Sheet 2, Sheet 3 and Sheet 4”.
17. Accomplish the “Self-check 1, Self-check 2, Self-check 3 and Self-check 4” in **page -5,6,7 and 8** respectively.



Information Sheet-01

Handling waste material

The proper handling of the things we throw away in a manner that does not harm anyone or anything, be it human, animals or the environment. Proper handling includes the collection, transport, processing, recycling or disposal of waste materials produced by human activity in order to reduce their negative effect on the environment. Unwanted materials or substances produced by human activity, which is usually referred to as rubbish, trash, garbage or junk i.e. waste.

Fish Waste - Large amounts of fish guts deposited in an enclosed area can produce foul odors and impair water quality through decreased dissolved oxygen and increased bacteria levels.

Waste handling techniques

- Provide facilities for fish cleaning and carcass disposal.
- Provide a stainless steel sink equipped with a garbage disposal that is connected to a sanitary sewer. (Note: fish heads, large carcasses, and fish skin will clog up the disposal.)
- Provide garbage containers for fish carcasses.
- Empty garbage containers regularly (especially on hot days).
- Prohibit fish cleaning outside of designated areas.
- Implement fish composting where appropriate.
- Use a grinder to make chum out of fish carcasses. Sell the chum at your store.
- Arrange for crabbers to take fish carcasses.
- Prohibit fish cleaning at your marina.
- Educate people on the water quality problems associated with excess fish waste in lake waters.
- All hazardous waste should be sent to a disposal facility that is permitted, licensed, or registered by the state to dispose of hazardous waste.



Self-check -1	Written test
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Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

1. Write waste handling techniques ? (15 points)

Note: Satisfactory rating - 15 points Unsatisfactory - below 15points

6Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

Short Answer Questions



Information Sheet-02	Handling and transporting materials, tools and equipment
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- materials ,tools and equipments required to handle and transported properly .
- it requires to use guidance for proper handlings and transporting.
- during transporting career should necessary for some fragile and toxic materials and equipments.
- Whenever we are going to our work area we have to handle and transport our equipment materials and tools safely. And also after completing our task we have to take them back to their place (store) safely without any damage on the equipment and ourselves by cleaning and maintaining if necessary.
- materials should handle in a good manner
- put the same material on the same area don't mix with other
- transport carefully for fragile and toxic material



Self-check -2	Written test
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Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

1. Write proper handling methods

Note: Satisfactory rating - 15 points Unsatisfactory - below 15points

6Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

Short Answer Questions

**Information Sheet-03****Disposing and returning material accordingly**

Materials should be returned to store or disposed according to the condition. After the accomplishment of task all necessary materials, tools and equipment must be stored properly or if there is need to be disposed should be done accordingly.

Remove waste from living area and dispose of according to facility policy and procedures (Note: Toxic gases such as carbon dioxide, hydrogen sulfide and ammonia may build up to lethal levels. Never enter storage tank unless absolutely necessary and then with professional assistance on site.) Utilize PPE. Select equipment appropriate for size and type of area to be cleaned.

Review safety procedures with supervisor and follow all safety guidelines. Provide maximum ventilation when store perishable materials. Other facilities and equipment require more frequent inspection. Enter storage tank only when absolutely necessary and only with adequate safety training, Precautions, and equipment, and professional assistance on site. Wear self-contained breathing equipment and be certified in its use.

methods of disposing waste :

- recycling
- burning
- fermentation (used as bio fuel)



Self-check -3	Written test
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Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

1. write some toxic gases 5 point
2. write methods of disposing waste 10 points

Note: Satisfactory rating - 15 points Unsatisfactory - below 15points

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

Short Answer Questions



Information Sheet-04	Cleaning, maintaining and storing tools and equipment accordingly
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- Cleaning refers to removal of matter from a surface on which it is not acceptable. Soil surface should be contact with a cleaning agent for adequate time and sufficient pressure should be applied, if required, to remove the soil.
- Cleaning involves two steps: wash step and rinse step. Equipment should be carefully selected and, washed, and maintained before they can be sanitized
- Use keizen principles



Self-check -4	Written test
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Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

1. write two steps of cleaning? (3points)

Note: Satisfactory rating 3 points unsatisfactory-below 3 points.

You can ask your teacher for the copy of the correct answer

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

Short Answer Questions