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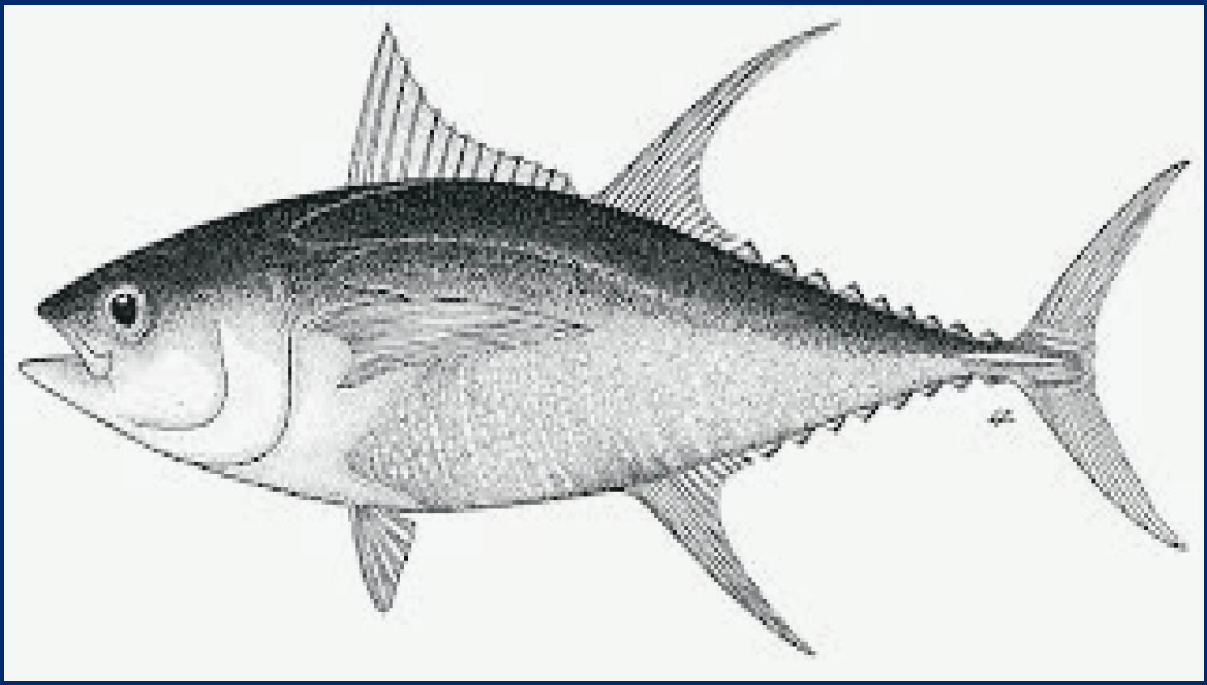
SUSTAINABLE FISHERIES MANAGEMENT PROJECT (SFMP)

Manual on Improved Post-Harvest Processing of Fish



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THE UNIVERSITY OF RHODE ISLAND
GRADUATE SCHOOL OF OCEANOGRAPHY
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For more information on the Ghana Sustainable Fisheries Management Project, contact:

USAID/Ghana Sustainable Fisheries Management Project
Coastal Resources Center
Graduate School of Oceanography
University of Rhode Island
220 South Ferry Rd.
Narragansett, RI 02882 USA
Tel: 401-874-6224 Fax: 401-874-6920 Email: info@crc.uri.edu

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Detailed Partner Contact Information:

USAID/Ghana Sustainable Fisheries Management Project (SFMP)
10 Obodai St., Mempeasem, East Legon, Accra, Ghana

Telephone: +233 0302 542497 Fax: +233 0302 542498

Maurice Knight	Chief of Party	maurice@crc.uri.edu
Kofi Agbogah	Senior Fisheries Advisor	kagbogah@henmpoano.org
Nii Odenkey Abbey	Communications Officer	nii.sfmp@crcuri.org
Bakari Nyari	Monitoring and Evaluation Specialist	hardinyari.sfmp@crcuri.org
Brian Crawford	Project Manager, CRC	brian@crc.uri.edu
Ellis Ekekpi	USAID AOR (acting)	eekekpi@usaid.gov

Kofi.Agbogah
kagbogah@henmpoano.org
Stephen Kankam
skankam@henmpoano.org
Hen Mpoano
38 J. Cross Cole St. Windy Ridge
Takoradi, Ghana
233 312 020 701

Resonance Global
(formerly SSG Advisors)
182 Main Street
Burlington, VT 05401
+1 (802) 735-1162
Thomas Buck
tom@ssg-advisors.com

Andre de Jager
adejager@snvworld.org
SNV Netherlands Development Organisation
#161, 10 Maseru Road,
E. Legon, Accra, Ghana
233 30 701 2440

Victoria C. Koomson
cewefia@gmail.com
CEWEFIA
B342 Bronyibima Estate
Elmina, Ghana
233 024 427 8377

Donkris Mevuta
Kyei Yamoah
info@fonghana.org
Friends of the Nation
Parks and Gardens
Adiembra-Sekondi, Ghana
233 312 046 180

Lydia Sasu
daawomen@daawomen.org
DAA
Darkuman Junction, Kaneshie Odokor
Highway
Accra, Ghana
233 302 315894

For additional information on partner activities:

CRC/URI:	http://www.crc.uri.edu
CEWEFIA:	http://cewefia.weebly.com/
DAA:	http://womenthrive.org/development-action-association-daa
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ACRONYMS

DAA	Development Action Association
FtF	Feed the Future
MOFAD	Ministry of Fisheries and Aquaculture Development
SFMP	Sustainable Fisheries Management Project
URI	University of Rhode Island
USAID	United States Agency for International Development

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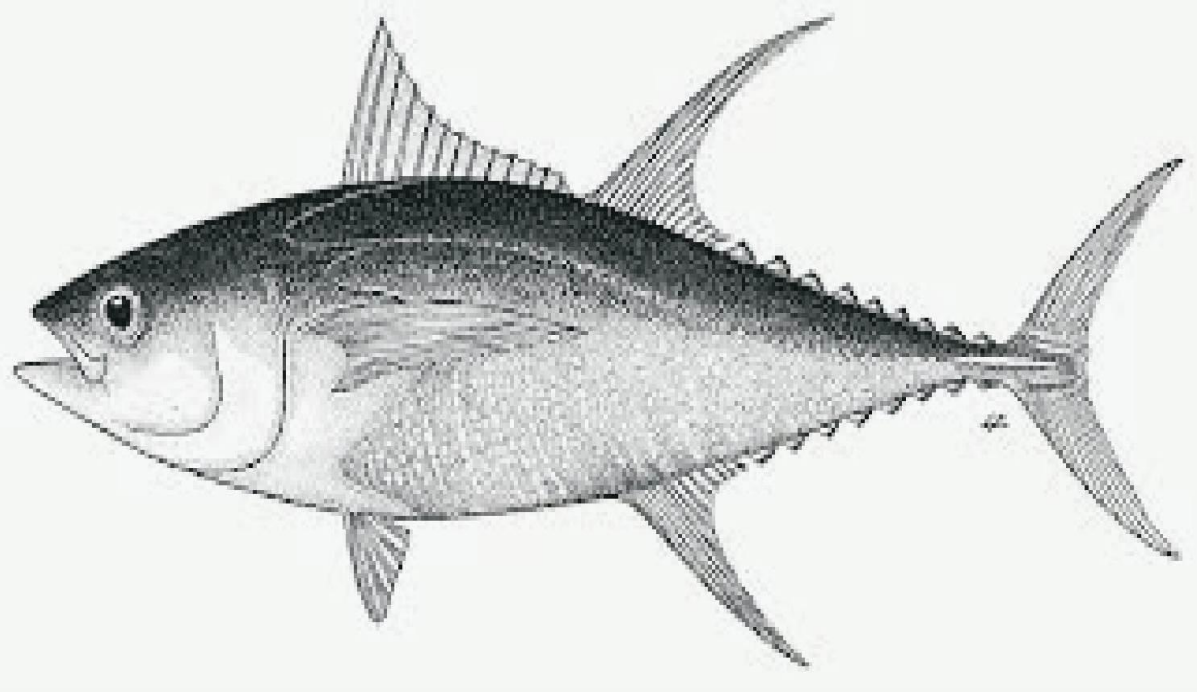

Figure 1: Fish

Welcome to the start of your career in fisheries. A career in fisheries has never been as popular as it is now; competition is strong and the standards are getting high. So you must aim higher, particularly if you want to build up your lifelong career as an actor in the fisheries value chain.

Congratulations for making the decision to start a career in fishery. You have taken the first step towards a very interesting and satisfying career. On completion of this unit, you will acquire knowledge on the fisheries industry in Ghana, nutritional value of fish, how fish contribute to food security and the occupational hazards in the fish value chain.

1.1 Demonstrate Knowledge of Fisheries Industry in Ghana

On completion of this Learning Outcome, you will be able to:

- Define fisheries terms.
- List the types of fish in Ghana.
- List types of fish in in Ghana and where they can be found
- Describe types of fisheries in Ghana. e. State fisheries activities in Ghana

To acquire the requisite skills, knowledge and attitude to establish a viable fisheries business, you first need to understand what pertains in the fisheries industry in Ghana. Let us now understand some basic terms in fisheries.

1.1.1 Define Fisheries Terms

- Fish: A fish is an animal with back bone (Vertebra Colum) living permanently in water and usually has scales on the body.

Figure 2: Example of fish

- **Fish Stock(s):** A fish stock describes one kind or species of fish in a water body.

Figure 3: Fish Stock

Fishers/Fishermen: **A person whose livelihood or occupation is catching fish**

Figure 4: Fishers or Fishermen

- **Fishing:** Fishing is the act of hunting for fish using some kind of gear in a water body.

Figure 5: Fishermen engaged in a fishing activity

- **Fishing Gear:** It is any tool that is used to trap or catch fish in a water body.

Figure 6: Fishing gears; harvesting net, hooks and traps

Figure 7: Some fishing gear such as nets, canoe with paddle

Figure 8: Some Fishing gear

- **Fisheries:** It refers to all the studies and activities we do that are related to fish.

Figure 9. Off-loading fish to market

- **Fish farmer:** Is a person whose main occupation is to rear fish for sale.

Figure 10. Fish Farming

- **Fish Catch:** It is the period of time during which the fish is caught and the tool that is used by the fisher to catch the fish.

Figure 11. Fish catch in a river

- **Fish handler:** Is a person who is involved in fisheries activities; from the landing site to the fresh fish market or a processing location. Their activities include cleaning, degutting, washing and packing the different fishes.

Figure 12. Fish handler

- **Fish processing:** Fish processing includes all the activities undertaken to convert fresh fish into fish products to prevent it from spoilage and improve its shelf life.

Figure 13. Fish Handler

- **Fish processors:** Are those who process fish from its fresh state into finished product.

Figure 14. Fish Processor

- **Fisheries laws:** They are the set of rules that have been written by the government to order the way fisheries activities are done in Ghana.
- **Fisheries Regulations:** It is an official rule that gives meaning and effect to control what has been outlined in the fisheries laws.
- **Fisheries Management:** It is the organization and control of the activities of the
- fisheries business for maximum profit without adverse effect on the fisheries resources.
- **Fisheries Extension:** It is the spread out of information on fisheries to fisher folk to enable them grow and increase the income of their business.

Now that we know the meaning of some of the basic terms in the fisheries industry, let us look at the types of fish in the fisheries industry of Ghana.

1.1.2 List types of fish in Ghana

There are varied kinds or species of fishes in the sea and in other water bodies. Fishes found in Ghana include herrings, grouper, sole fish, tilapia, African cat fish and mud fish, round Sardinella, Atlantic bumper, Ribbon fish, Lesser African threadfin, Shine-nose, Common threadfin, Jack mackerel, King fish, Skip jack tuna, Crevalle jack, Senegal Left-eyed tongue-sole and Daisy sting ray.

Figure 15. Snapper

Figure 16. Grouper

Figure 17. Barracuda

Figure 18. Mud fish/cat fish

Figure 19. Bumper fish

Figure 20. Threadfin fish

Figure 21. Croaker

Figure 22. Ribbon fish

Figure 23. Herring

Figure 24. Mackerel

Figure 25. King fish

Figure 26. Skipjack Tuna

Figure 27. Tilapia

Figure 28. Sardinella fish

Figure 29. Sole fish

Figure 30. Shine-nose

Figure 31. Crevalle Jack fish

Figure 32. Spotted Trigger

Figure 33. Senegal Left Eyed Tongue Sole

Figure 34. Daisy Sting Ray

Fishing is carried out in most of the coastal communities in Ghana, let us look at some of the major fishing communities in Ghana and the types of fish stock in these communities

1.1.3 List types of fish in the various communities in Ghana

There are many fishing communities in Ghana with different types of fish stock. Listed below are some of the major fishing communities with their respective types of fish include:

Table 1. Showing some fishing communities in Ghana and fish commonly known there

Fishing Community	**Type of fish**
Keta (Volta Region)	Keta Anchovies (Keta School boys)
Chorkor (Greater Accra)	Horse Mackerel
Cape Coast (Central Region)	Jack Mackerel, Crevalle jack, Senegal Left-eyed Tongue-Sole
Elmina (Central Region)	Jack Mackerel
Afram Plains (Eastern Region)	Herrings, Groupers, Sole fish, Tilapia, African Cat/Mud fish

Fisheries in Ghana can be grouped by type of water body where fish is caught. Let us now consider the types of fisheries in Ghana.

1.1.4 Describe types of fisheries in Ghana

Fisheries refer to all studies and activities related to fish. In Ghana fisheries activities are categorized according to the type of water body where the fish id found.

These include:

Marine Fisheries: They are all issues about fishes that live in salty water such as Sea,

Figure 35. Some fishermen fishing in the ocean

- **Inland Fisheries:** This refers to fish in waters on land (ponds).

Figure 36. Fish pond

- **Freshwater fisheries:** This is fisheries that occur in waters that do not have salt, e.g. Rivers, Lakes and Streams.

Figure 37. Fish farm on the Volta Lake

- **Brackish water fisheries:** This type of fisheries is found between sea water and freshwater. Brackish waters usually are made up of a mixture of sea salty water and river freshwater.

- **Capture Fisheries:** This is type of fisheries where fish is capture and reared with the help of gears and tackles like nets and long lines. It can be practiced in both land and marine waters.
- **Culture Fisheries**: This is the rearing of fish from young stage to marketable stage, usually in a controlled environment like pond, tank and small water bodies

Figure 38. Harvesting fish from cage culture.

Figure 39. Hunting for fish in the Volta River

There are many business activities within the fisheries value chain in Ghana. Let us look at some of the major fisheries activities in the fish value chain in Ghana.

1.1.5 Fisheries activities in Ghana

There are many activities within the fisheries value chain. The following are the main fisheries activities in the fish value chain in Ghana.

They include:

- Fishing
- Fish Processing
- Fish Marketing
- Fish Preservation
-
- Fishing

Figure 40. Some fishermen engaging in a fishing activity

Fish Processing

Figure 41. Fish smoking

Figure 42. Fish fermentation

Figure 43. Sun Drying of fish

Fish Marketing

Figure 44. A scene from a fresh fish market in Ghana

Fish preservation

Figure 45. Salting of fish

Figure 46. Fish on Ice

1.1.6 Self-Assessment

- Define the following fisheries terms
- Fish
- Fish stock
- Fish management
- Fisheries
- Name five types of fish in Ghana
- Identify four fishing communities and indicate the type of fish in each community
- List four types of fisheries in Ghana
- List two main fisheries activities in Ghana

No.	Fishing communities	Type of fish
1		
2		
3		
4		

1.2 Demonstrate knowledge of fish for food and nutritional

On completion of this Learning Outcome, you will be able to:

- State the importance of eating fish as food.
- State the importance of eating fish for nutrition.
- List the nutrients derived from fish.
- State functions of the nutrients derived from fish to the human body.

There are many reasons for eating fish, in this learning outcome, let us understand why fish is a source of food and nutrients for the human being. Let us now identify the major contribution of fish nutrients to the human body.

1.2.1 The importance of eating fish as food

Research has shown that eating fish regularly is beneficial to our bodies in many ways; here are ten great reasons to introduce a little more fish into your diet.

- Eating fish reduces your exposure to heart disease; Fish is low in saturated fat and high in omega-3, which can protect the heart from diseases and lower the amount of cholesterol in the blood.
- Eating fish improves the circulation of blood in your body and boosts your immunity.
- Eating fish as a regular part of a balanced diet repairs and builds your immune system to protect the body against chronic diseases.
- Eating oil-rich fish regularly keeps your eyes bright and healthy.
- Eating fish help to protect the skin, keeps it firm and flexible.

Eating fish regularly is beneficial to the body in many ways, let us identify some of the importance of eating fish for nutrition.

1.2.2 The importance of eating fish for nutrition

The benefits of eating fish for nutrition include the following:

- It provides essential nutrients.
- It provides you with good vision to see well.
- It promotes good health of your heart.
- It helps you to fight against depression.
- It improves the functions of your immune system against diseases.

Are the benefits clear? Can we continue the lesson? Every human being requires some essential nutrients to stay healthy, let us now identify some major nutrients derived from fish to the human body

1.2.3 List nutrients derived from fish

Fish provides the body with many essential nutrients which keeps healthy. These nutrients are:

- Vitamins.
- Protein.
- Minerals.
- Fats and oil.

Now that we know the various nutrients derived from fish to the human body. Let us identify the key role of each nutrient to the human body in the next heading.

1.2.4 The function of nutrients derived from fish to the human body

- Vitamins: It helps us to develop a healthy eye sight to see well as well as healthy skin and also proper growing of bones in the body.
- Proteins: it reduces the chances of heart attack, stroke, obesity, and hypertension. It also provides essential elements for infants and children to grow healthy.
- Minerals: It protects our body cells against damage to our immune system.
- Fat and oil: It helps our teeth and bones to grow strong.

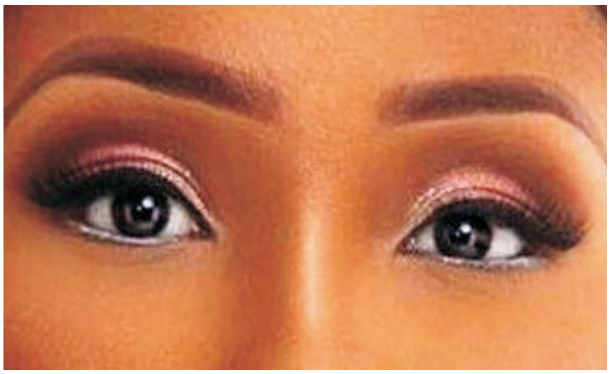

Figure 47. Healthy eye sight

Figure 48. Healthy teeth

Figure 49. Children to grow healthy

Figure 50. Boosts Immune system

In every work, there are some conditions that have the ability to cause harm to you. Let us identify some of the dangers that you may come across in the fisheries industry in the next learning outcome of this unit.

1.2.5 Self- Assessment

- State three reasons of eating fish as food?
- State three benefits of eating fish for nutrition?
- Mention three nutrients you can get from eating fish?
- Write three functions of the nutrients we get from eating fish to the human body?

1.3 Demonstrate knowledge of occupational hazards in fisheries

On completion of this Learning Outcome, you will be able to:

- Define occupational hazards in fisheries.
- State the types of occupational hazard in fisheries.
- Describe how to prevent occupational hazards in fisheries.

Before we consider the types of hazard in the fisheries industry, let us try to understand what a hazard is. Do you have any idea? Look at what the next lesson has for you.

1.3.1 Demonstrate knowledge of occupational hazards in fisheries

Hazard is defined as the presence of a material or condition that has the ability to cause harm or damage to your health in your fisheries business.

Are you clear? Now that we know the definition of hazard, let us identify the types of hazards in the fisheries industry in the next lesson.

1.3.2 Define occupational hazards in fisheries

The fisheries industry has many occupational hazards which can be put into the following groups as:

Physical Hazard:

It is minor cuts and scrapes that are experienced from sharp edges during fish processing that involves the use of knives, stainless steel basins and other sharp tools for cutting fish.

Some examples are listed below:

Falls Injury: This is caused by slippery floors and stairs when carrying loads and materials during fish processing. Sprain and fracture could arise if you fall on a slippery floor.

Sting from fish spines: This arises during fish handling without appropriate protective gear. It may cause severe pains and can result in tetanus/ infection or whitlow.

Figure 51. Sting from fish spines

Whitlow: Whitlow is a bacterial or fungal infection of the tip of the finger. The common symptoms are swelling around the fingernail with a noticeable pain.

Figure 52. A whitlow infection of the hand

Eye Injury (Red eyes): Eye redness may be due to swelling of the eye, which causes the surface of the eye to look red or bloodshot. This may be due to the direct smoke contact with the eye when smoking fish especially, when using the local smoking kiln that uses fuelwood.

Figure 53. Swelling of the eye which causes the surface of the eye to look red or bloodshot

Burns Injury: Most fish processors suffer burns because they are exposed to naked flames especially when smoking fish. Most of these burns may affect top layer of the skin (epidermal tissue)

Figure 54. Burns of the skin

Biological Hazard Parasites

Pathogens: Examples include: leeches in ponds which attack individuals that get in contact with them unprotected. Also nematode, cestodes and other parasites are hazards when handling fishes: Risk of fungal and other pathogenic infections such as vibrio are a high likelihood in intensively manure ponds.

Figure 55: Leeches in ponds

Figure 56. Fungal infections -vibrio

Chemicals Hazard:

Smoke: Smoke inhaled by processors when smoking or frying fish is serious health risks, as it can cause asthma and other respiratory ailments.

Disinfectant: Sometimes you may inhale or come into contact with harmful or poisonous substances from fish handling activities: Some of these disinfectants used by fish processors to disinfect equipment and holding units are Formalin, and Gamalin 20. These are harmful if it gets into contact with the body. If the chemical touches the fish and it is consumed, it will affect the consumers' health because of residual effect.

Figure 57. Smoke inhaled

Figure 58. Disinfectants effect

Mechanical Hazard: It is a harm that is caused by bad handling of fisheries tools and equipment. Examples are: wire mesh

Internal injuries: Internal injuries, especially those involving the liver, stomach, colon, pancreas and blood vessels as a result of motor vehicle accidents that may occur when transporting fish.

Broken bone or dislocation: It may be caused by falling from height or sudden hit by heavy objects and equipment during fisheries activities.

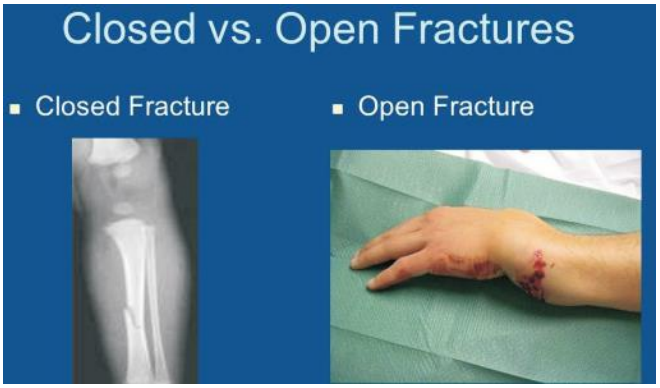

Figure 59. Broken bone or dislocation

Psychosocial Hazard: It is a harm that affects the correct functioning of your brain.

An example is Depression: This may be caused by working for a long periods of time or doing extra hours of work.

There is the need for us to develop skills in managing the various occupational hazards in the fisheries industry. Let us now identify the key steps in managing the various hazards in the fisheries industry.

1.3.5 Describe how to prevent occupational hazards in fisheries

In order to manage the various occupational hazards in your fisheries business, you must ensure that:

- You are well-informed and trained on the associated hazards you are likely to come across in your fisheries business.
- You apply all safety rules that are related to your fisheries business.
- You wear personal protective clothing to reduce your exposure to injury when working.
- You have first aid kits at all your working areas with instructions on how they should be used.

Now let us see how each of the various hazards described earlier can be avoided below.

Physical Hazards

Minor cuts: Care must be taken when using sharp objects to prevent cuts. All cuts and scrapes, even minor ones, should receive attention immediately as any delay may increase the risk of infection.

If it is necessary to clean the wound, avoid washing the actual wound to avoid infections. If the injury becomes inflamed, or painful, seek medical attention immediately.

Falls Injury: Be careful when you are walking on slippery floors and stairs and when carrying heavy loads or materials

Sting from fish spines and Whitlow: Always use appropriate safety devices and personal protection devices such as hand gloves when handling fish.

Burns Injury: Burns should be treated by flushing the affected part with plenty of cool clean water before applying a sterilized dressing or a clean towel. Where the burn is large or deep, simply apply a sterilized dressing.

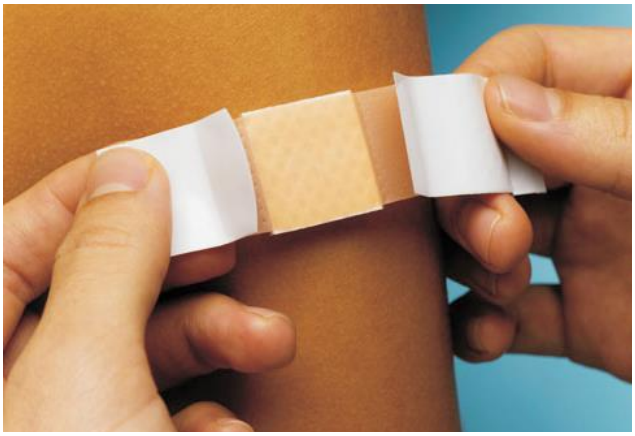

Figure 60. Dressing cuts

Figure 61. Hand gloves

Figure 62. Falls boots

Figure 63. Nose cover or mask

Figure 64. Sterilized dressing

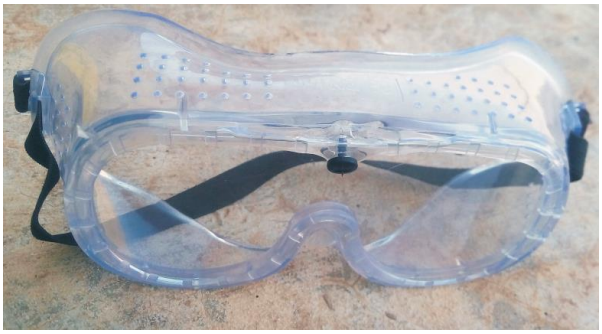

Figure 65. Eye glass

Do not burst blisters or remove clothing sticking to the burn.

Biological Hazard

Parasites and Pathogens: Use recommended drugs to control nematode, cestodes, pathogenic infections and other parasites that live in ponds which attack or leech your body when it is not protected. Use hand gloves and protective clothing when handling fishes.

Figure 66. Nematode

Figure 67. Cestodes

Chemicals Hazard

Smoke: Use nose cover to prevent inhaling the smoke particles that contain potential or carcinogens when you are smoking and frying fish.

Disinfectant: Avoid the use of unapproved disinfectants used to disinfect equipment and holding unit like formalin, Gamalin 20 which are harmful, on contact with the body.

Figure 68. Using Gamalin 20 or DDT

Figure 69. Use nose cover or

Internal injuries: Be extra careful when using mechanical devices in fishery activities and seek medical attention in case of an accident.

Broken bone or dislocation: Dislocations are usually recognizable, do not attempt to move a casualty with suspected broken bone or injured joints until the injured parts have been supported. Secure the injured parts so that it cannot move and seek medical attention immediately.

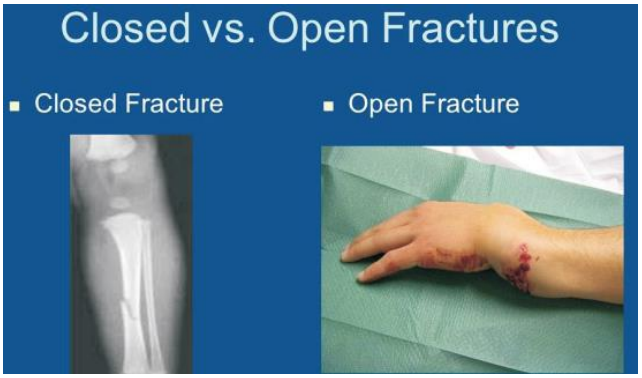

Figure 70. Broken bone or dislocation

Psychosocial Hazard

Prolonged work: Avoid prolonged work and have enough rest after work.

Figure 71. Rest after work

1.3.6 Self-Assessment

- What is occupational hazard in fisheries?
- State three types of occupational hazard in fisheries?
- Write three ways of preventing occupational hazards in fisheries?

SECTION 2: FISHERY HYGIENE, SANITATION AND HEALTH

On completion of this unit, you will be introduced to knowledge and attitudes and the importance of good hygiene and sanitation practices in your daily fisheries work and their impact on fisheries communities in Ghana.

This unit will also help you to acquire knowledge and attitudes of what is meant by human health care, its importance and impact on health care issues such as malaria, fever, cholera and diarrhea in fisheries so that you can find ways to improve on them in our communities

2.1 Demonstrate Knowledge of Hygiene

2.1.1 Define hygiene

What are some of the things you do to maintain your health? The things you do regularly to maintain your health is what is called hygiene.

Hygiene is defined as a set of practices that you perform in other to preserve your health. The World Health Organization (WHO) defines hygiene as the conditions and practices that help you to maintain your health and prevent the spread of diseases.

2.1.2 State importance of observing hygiene in fisheries

Good hygiene is important for you and your business to be accepted in the community, because most people don't want to be around those who are dirty or smelly.

Therefore, good hygienic practices will enable you to run a successful fisheries business.

Hygiene:

- Protects you from getting sick.
- Protects your businesses and earn respect with customers.
- Prevents the spread of diseases.
- Destroys the breeding grounds for bacteria and viruses in your surroundings.
- It provides a sound mind in a sound body. This increases your productivity.

Are the statements above true about the importance of hygiene?

- How does hygiene affect our fisheries work?

2.1.3 The impact of poor hygiene on fisheries

Poor hygiene practices really affect your health and the business you are running.

Some of the impacts are listed below:

- It may cause outbreak of a deadly disease such as cholera and diarrhea.
- It repels (put-off) your customers from doing business with you.
- It causes the entire surrounding /environment of your business to stink or smell.
- It causes body odor that produces a stinking smell on your body which may be unpleasant to your customers or your working friends.
- It makes you fall sick which can lead to death and will adversely affect the productivity of your fisheries business.

2.1.4 Hygiene practice in fisheries

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

To follow the hygiene practices, you must:

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

You must understand that **Hygiene, Sanitation and Health** practices are attitudes you have to apply in the day to day handling of your fish. Therefore, the way you apply the practices will be assessed in all your fisheries activities in this National Qualification Certificate Program.

2.1.5 Self-assessment

- What is hygiene?
- Mention (3) three reasons for observing hygiene in fish?
- Give (3) three impact of hygiene on fisheries?
- Write (3) three hygiene practice in fisheries?

2.2 Demonstrate skills of sanitation

2.2.1 Define Sanitation

The understanding people have about hygiene and sanitation are all most the same because they serve the same purpose; to maintain and preserve good health. The difference however is that sanitation takes into account the environment of the fisheries community.

Sanitation in fisheries is very important because it minimises loss in the quality and value of your fish.

Sanitation is defined as the proper disposal of human waste (faeces and urine) as well as keeping your environment free of harmful substances which can cause diseases.

It can also be seen as the act of taking away waste water and other waste products way from the surrounding environment in the fisheries community in order to protect your health.

Can you tell the difference between hygiene and sanitation now?

2.2.2 The Importance of Observing Sanitation in Fisheries

Applying your knowledge on sanitation in your fisheries business will give you a lot of advantages over your colleagues, some of the importance of practising sanitation in your fisheries community are:

- It helps you to maintain the natural resources such as rivers, lakes and bushes in your environment.
- It makes it possible for you to enjoy a healthy life.
- It provides you with a more secure future for your fisheries business in your community.
- It helps you to destroy the breeding grounds for bacteria and viruses that cause sickness in your community.
- It makes your fisheries community attractive place to market your products (fish) and services.

2.2.3 The Impact of Poor Sanitation On Fisheries

Poor sanitation practices affect your fisheries business to the extent that it reduces your overall production result. Some of the results of not applying good knowledge and attitudes on sanitation practice in your fisheries business are:

- It makes your business surrounding stink, affecting the quality of the air you breathe and may cause you to fall sick.
- Throwing of sewage (waste water) directly into streams, rivers and lakes destroys the habitat (house) of animals. You must know that when the house of an animal is destroyed it dies.
- It damages the environment and exposes you and people in the fisheries community to different diseases such as diarrhea and cholera.
- It may become the breeding ground for insects or animals to carry disease from one place to another if the air, water and soil in your fisheries surrounding is dirty.
- It may cause flooding that will displace (move) you from your fisheries environment especially when your canals or gutters are not properly constructed or chocked with plastic waste materials or sand.

2.2.4 Sanitation Practice in Fisheries

Overcoming the numerous problems sanitation presents to the success of your fisheries business can be solved by one more of the following.

Please, try as much as possible at scheduled times to:

Figure 72. Sweep, gather and collect rubbish or waste generated in the fishery environment.

Figure 73. Provide decent toilet facilities to avoid open defecation in your fisheries community

Figure 74. Keep canal, gutters for waste water to drain around fisheries community at all times.

Figure 75. Clean the water supply areas which you use to wash your fish and the processing area

Figure 76. Wash or sweep regularly the solid or cemented floors in your working areas

2.2.5 Self-Assessment

- What is your understanding of sanitation?
- Write (3) three benefits on practicing sanitation in fisheries?
- Mention (3) three impacts of sanitation on fisheries in Ghana?
- State (3) three sanitation practices in Ghana fisheries?

2.3 Demonstrate knowledge of human health care in fisheries community

2.3.1 Define human health care in fisheries

Have you really thought of what health means in your daily activities?

Can you explain it in your dialect?

It is the act of keeping or making better one's health by recognizing, treating, and preventing the diseases or illness in human beings. Human healthcare is delivered by trained and licensed health professionals.

Identify the key words in the definition of healthcare in the above PC.

Key words:

2.3.2 State importance of human health care in fisheries

Is this saying true? He, who has health, has hope; and he who has hope, has everything.

If it is true, it is because healthcare:

- Protects you from unexpected high medical costs.
- Gives you peace and security in your fishery business.
- Prevents unexpected illness or sickness, so you can live long.
- Ensures a healthy body, a healthy workplace, a healthy community and a healthy nation.

2.3.3 Poor health care problems in fisheries Community

Poor attitude towards healthcare causes problems to our well-being as humans in a fishery business. Some of these problems are:

1. **Fever:** It is a rise in body temperature above the normal as a result of a disease or illness.	 **Figure 77. A person with fever** •
1. **Cholera**: It is a serious infection of the bowels caused by drinking infected water or eating infected food, causing solid waste to become more liquid than usual, vomiting and often death.	 **Figure 78. A person with Cholera**
2. **Diarrhoea:** It is an illness in which the bowel movement becomes loose or watery and comes out of the body more often.	 **Figure 79. A person with diarrhea**

Do you have an idea of the effect of health care problems on us in our fisheries business?

2.3.4 Impact of poor health in fisheries Community

Poor health is a serious matter in our fisheries communities.

Some of the impacts of poor health care;

- Reduces the productivity of human beings in the fisheries business.

- Causes death due to improper treatment of illness.
- Increases the cost of running your fisheries business because of the money you spend after treatment.
- Causes emotional, spiritual, physical and mental disturbance which affect the smooth running of your fisheries business.
- Makes you weak and unhealthy to carry out your fisheries business easily.

I hope you got them clear? Do you want to ask any question?

2.3.5 State ways to improve poor health care problems in fisheries Community

There are ways by which you can improve on your health in fisheries communities. To achieve this, you have to:

- Register on the National Health Insurance Scheme to enable you to access timely medical treatment and reduce the cost of your medical bills.
- Attend training programs organized by health professionals in your community or district to acquire knowledge on best practices to prevent illness.
- Visit the nearest health center to check your health status or if you are experiencing any sign of discomfort in your body as a result of illness for medical treatment. Note that self-medication is very dangerous to your health.
- Apply hygiene and sanitation practices in your daily fisheries activities.
- Consult health professionals for advice and direction on issues of poor health affecting you and your staff in your fisheries business.

Write 1(one) other way you think you can improve on poor health in your community?

Thank you for your answer.

2.3.6 Self-assessment

- What is health care in fisheries?
- Write (3) three reasons for taking care of your health in fisheries?
- Mention (2) two problems of poor health care in fisheries community?
- Write (3) three impacts of poor healthcare problems in fisheries community?
- Mention (3) three ways of improving on poor health care problems in fisheries community?

SECTION 3: FRESH FISH PRESERVATION

3.1 Demonstrate knowledge of fish handling

On completion of this unit, you will acquire knowledge on the importance of handling fresh fish, bad practices of people when handling fresh fish - from catch to landing site and how to identify a spoilt fish.

This unit will also help you to know how to use icing and freezing as a preservation method, considering the materials and the procedures required for each method to prevent spoilage.

3.1.1 Define fish handling

How do you hold, touch or move your fish when you want to work on them? Do you know that the way you work on your fish with your hands can cause it to spoil?

Fish handling is defined as the activities that involve touching, holding or moving the fish with your hands to make it safe to eat and prevent spoilage.

Are you clear? Handling your fish safely is very important in your fishery business, let us see some of the importance of handling your fish properly.

3.1.2 Importance of fish handling

Can you think about some of the reasons why we need to handle our fish well?

Handling your fish well, will benefit you and your business in the following way;

- It reduces the contamination of fish by dirt particles and other living things that cause diseases.
- It reduces the rate at which your fish gets spoilt.
- It reduces the danger of fish-borne illness.
- It preserves the quality of the fish.
- It enhances the quality of the fish for processing and storage.

3.1.3 List Materials Used for Handling Fish

You need some items or materials in other for you to handle your fish well. They include;

Figure 80. Woven Basket

Figure 81. Metal Basin

Figure 82. Crate

Figure 83. Clean packaging paper

Figure 84. Ice box

3.1.4 List Places of Handling Fish in Fisheries

Do have an idea of the places where fish handling can take place in your fisheries business? The main places where handling takes place are;

- Fish catch points
- Landing sites.
- Processing center
- Fresh fish market

Figure 85: Landing beach

Figure 86. Fish processing center

Figure 87. Fresh Fish market

3.1.5 Bad Handling Practice in Fisheries

Bad handling of your fish will cause them to spoil, can you list two bad ways that we handle our fish?

- Using dirty canoes, equipment, fish boxes and baskets.
- Placing your fish on dirt surfaces.
- Washing your fish in dirty water.
- Keeping your fish catch in the fishing gear for a long time.
- Throwing and trampling of fish when transporting them.

Figure 88. Old and dirty canoe

Figure 89. Dirty bowl

Figure 90. Dirty equipment

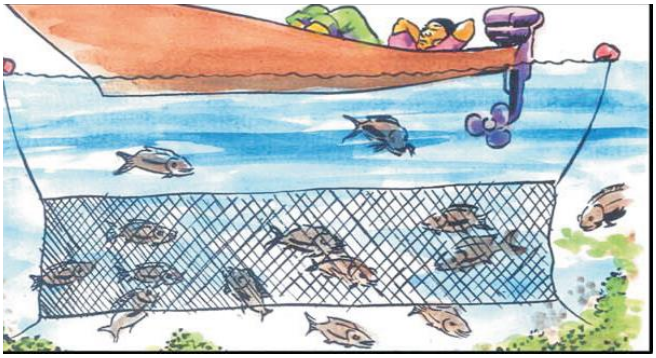

Figure 91. Storing fish in fishing gear for a long time

Figure 92. Tramping of fish

Figure 93. Fish on dirty floor

3.1.6 Self-Assessment

- What is fish handling?
- Mention (3) three reasons why fresh fish handling is necessary in fisheries?
- Name (5) five materials you can use to handle fish?
- Name (3) three places in fisheries where fish handling takes place?
- Write (4) four practices that you have to avoid when you are handling fresh fish?

3.2 Demonstrate Skills to identify spoilt of fish

3.2.1 Define Fish Spoilage

What comes into your mind when you hear "spoilage"? Let us try to discuss it and see what it means. In our daily handling of fish, we touch the fish frequently, which may cause the fish to deteriorate.

Fish spoilage can be defined as any change in your fish which causes a loss in its quality and commercial value. Note that a spoilt fish cannot be good for human beings to eat, they can only be thrown away or be used to feed animals. Spoilt fish causes loss to your fisheries business when they are thrown away.

3.2.2 Factors That Cause Fish Spoilage

The various changes that take place in the handling of fish that cause losses, are influenced by several factors. Some of these factors are:

Time: The time between the death of the fish to its final use or consumption. Delay in the process will cause the fish to spoil. Naturally, quality processed fish also deteriorates over a period of time.

Temperature: It is the degree of hotness or coldness the fish is exposed to. High ambient temperatures, such as 20°C and above, easily create favorable conditions for fish spoilage while temperatures below 5°C help slow down the action of bacteria and the rate of spoilage, thereby helping to reduce losses.

Bad Handling Practices: Poor handling practices lead to sustained and increased microbial contamination, speeding up the spoilage rate of fish.

Such practices include:

- Using dirty canoes, equipment, fish boxes and baskets
- Not washing fish
- Washing fish in dirty water
- Placing fish on dirty surfaces
- Physically damaging fish by throwing or standing on them
- Throwing away catch fish at sea because fish is too small or not good enough to land for sale.
- Poor processing techniques damages fish
- Animal predation and insect infestation
- Poor packaging and storage practices lead to damage the .fish

3.2.3 List Signs Use to Determine Spoilt Fish

There are signs on a fish that can help you determine if the fish is spoilt. These include can:

- Sunken eyes.
- Dark gills
- Presence of flies
- Burst stomach
- Bad smell

Figure 94. Sunken eyes fish

Figure 95. Good -Bright red gills and Bad- Dark gills

Figure 96. Fish with flies

Figure 97. Burst stomach

Figure 98.Smelly fish

3.2.4 Identify Spoilt Fish

Activity 1

For your practical exercise, take I (one) basket full of fish and separate the spoilt fish from the good ones, use the guidelines above to assess the spoilt fish you identified.

3.2.5 Self-Assessment

- What is a spoilt fish?
- Describe (2) two conditions that can cause your fish to spoil?
- Name (4) signs you can use to identify spoilt fish?
- Pick 1 (one) basket full of fresh fish and select the spoilt ones from the good ones.

Table 2. Fish Condition

Practical Assessment Guidelines	Yes	No
Sunken eyes		
Dark gills		
Presence of flies		
Bad smell		
Other signs considered		
Apply hygiene practices		

3.3 Demonstrate Skills of Icing Fish

On completion of this Learning Outcome, you will be able to:

- Define icing of fish
- State importance of icing fish
- State factors to consider in icing fish
- List materials required for icing fish
- State procedures for icing fish
- Perform icing of fish

3.3.1 Define Icing of Fish

What is ice and how is it produced? Do you have any idea?

Ice is blocks of water frozen in a refrigerator. Ice is used to preserve fish. Icing fish is basically the process of using ice to preserve fish immediately of capture. It is considered to be the best way to maintain the quality of the catch fish and keep its market value.

3.3.2 State Importance of Icing Fish

When you place ice blocks on your fish with the aim of keeping it, it gives you the following benefits.

- It cools the fish to a temperature of zero degrees to delay spoilage.
- It keeps the fish cool for long period.

3.3.3 State Factors to Consider in Icing Fish

There are a lot of factors you have to consider, when you want to preserve your fish with ice, Some of them are:

- Size of fish
- Time
- Temperature
- Type of fish

3.3.4 List Materials Required for Icing Fish

What are some the materials you will need to ice your fish? Can you list them?

Let us look at the ones mentioned below and their use.

- Insulated box or container
- Ice breaker
- Ice block

Figure 99. Insulated box

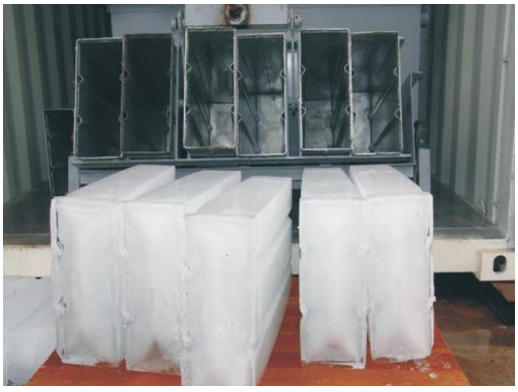

Figure 100. Ice block

Figure 101. Cold store facility

Figure 102. Ice Breaker

3.3.5 Procedures for Icing Fish

Have you ever thought of the correct steps you have to follow to preserve your fish with ice? Let us see the steps below. As standard practice, preparing your fish for icing must start with:

- Selection of a good fish.
- Splitting the fish and removing the guts if necessary

Figure 103. Captured pond fish

Figure 104. Harvested sea fish

Figure 105. Scaling fish

Figure 106. Splitting open to remove gut of fish

Figure 107. Fish gut removed

- Washing the fish well in a clean water

Figure 108. Washing fish for processing

- Allow the fish to drain for a while.

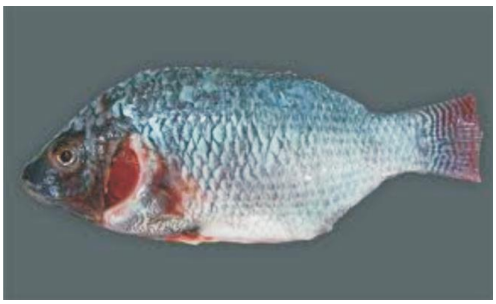

Figure 109. Cleaned fish

For you to apply ice to your fish for preservation, proceed as follows:

- Break the ice into fine pieces to make good contact with the fish.
- Put a thick layer of ice, 5 cm thick on the base and on the sides of the insulated box.

Figure 110. Ice blocks

Figure 111. Broken ice ready for use

Note: Use 1 kg of ice to 1 kg of fish, remember also that the longer the storage time, the larger the quantity of ice.

- Place a single layer of your prepared fish unto the ice on the bottom of the insulated box or container.
- Place another thick layer of ice on the first and place another fish on it. Repeat this process until the insulated box is fully fill with ice block and fish.

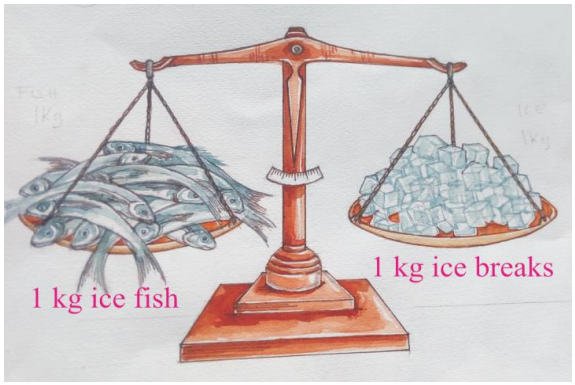

Figure 112. Weighing Ice and Fish

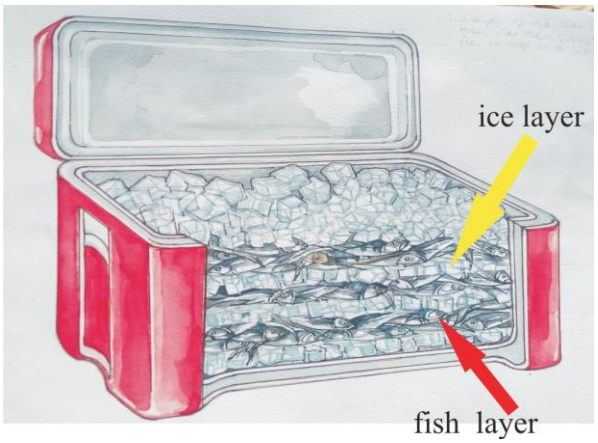

Figure 113. Layers of ice and fish arranged

- Finally, firmly close the lid of the insulated box and put the fish to store.

Figure 114. Ice and fish layer in a basket

Figure 115. Ice and fish layer in ice chest

Figure 116. Ice chest firmly closed

3.3.6 Perform Icing of Fish

Activity 2

Prepare 25 pieces of fish and ice them for preservation.

3.3.7 Self-Assessment

- Describe icing of fresh fish?
- Write (3) three reason for icing fresh fish?
- Mention (3) three factors you will like to consider when you are icing fresh fish?
- Write (2) two materials you will need for icing your fresh fish?

- Outline the procedures for icing your fresh fish?
- Pick (1) one basket full of fresh fish and carry out icing.

Practical Assessment Guidelines	**Yes**	**No**
Selection of good quality fish		
Selection of right material		
Fish stunned, gutted and scaled		
Washing of fish with clean water		
Break and pack ice into layers		
Placing of fish layer and ice layer one after the other		
Apply hygiene practices		
Apply processing principles		

3.4 Demonstrate skills of freezing fresh fish

On completion of this Learning Outcome, you will be able to:

- Define freezing of fish
- State importance of freezing fish
- State the factors to consider in freezing fish
- List of materials required for freezing fish

3.4.1 Define freezing of fish

Freezing is the act of lowering the temperature of your fresh fish at zero degrees or below causing it to become cold and often hard to prevent the fish from spoiling. This activity is very successful when the fish is fresh, packaged and stowed away in a deep freezer.

Can you tell the difference between freezing and icing?

3.4.2 State importance of freezing fish

Freezing your fish is very important because of the following benefits it serves

- It prevents the fresh fish from spoiling.
- It slows down or destroys the activities of micro-organisms in your fresh fish that cause spoilage.
- It makes your fresh fish retain its natural value and taste.
- It protects your fresh fish from being exposed to any air because air cannot penetrate through the ice. This guards your fresh fish against freezer burn as compared to icing.
- It also provides available space for storing your fresh fish for some days in the freezer.

Can you mention some of the factors you will consider when you want to freeze your fish in the space provided?

3.4.3 State the factors to consider in freezing fish.

There are many factors to consider when you want to freeze your fish but the major ones are

- Size of fish
- Type of fish: either whole fish, large cuts or fillets
- Temperature
- Packaging method
- Available space in the freezer
-

What are the materials that you will need to freeze your fish?

3.4.4 List of materials required for freezing fish

- Packaging material.
- Deep freezer.
- Container.

3.4.5 State procedure for freezing fish

Figure 117. Plastic wrapper

Figure 118. An aluminum foil

Figure 119. A freezer

Figure 120. A bowl of fish

3.4.6 How to prepare fish for freezing

What are the steps you have to follow to freeze your fish? Can you mention the steps?

To freeze your fish, follow the steps listed below:

- Wrap the fish individually in plastic wrap. Wrap as tightly as possible.
- Wrap tightly again with another layer of wrap.
- Place the individually wrapped pieces into a sealable freezer bag or wrap tightly in aluminum foil. If you are using a bag, be sure to press out excess air from the bag.
- Do not package more than one pound in each bag. This will allow the fish to freeze more quickly.
- When placing your wrapped fish in the freezer, do not stack a lot of packages together in one area. Try to spread them out in the freezer so they will freeze quicker. Once they are frozen, they can be stacked neatly on top of each other.
- Periodically check to ensure that your freezer is working well.

Can you freeze your fish using the steps above?

3.4.7 Self-Assessment

Activity 3

Figure 121. Take a bowl of fresh fish and freeze it for 24 hours

Figure 122. Fish wrapped in aluminum foil

Figure 123. Wraps of fish

Figure 124. Wrapped fish in plastic bag

Figure 125. Wrapped fillet fish

Figure 126. Frozen fish in deep freezer

Self-Assessment

- What is freezing of fresh fish?
- Write (3) three reasons for freezing your fresh fish.
- What are the (3) three factors you will like to consider when you want to freeze your fresh fish?
- Write (3) three materials you can use to help you freeze your fish?
- Write the steps you have to follow to freeze your fresh fish?
- Pick (1) one basketful of fresh fish and carry out freezing.

Note: The Checklist below to mark your performance in this activity.

Practical Assessment Guidelines	Yes	No
Selection of good quality fish		
Selection of right material		
Fish stunned, gutted and scaled		
Washing of fish with clean water		
Wrap tightly with plastic wrapper		
Place the individually wrapped pieces into a sealable freezer bag or aluminum foil		
Place your wrapped fish in the freezer and		

Practical Assessment Guidelines	Yes	No
allow it freeze for at least 24 hours		
Apply hygiene practices		
Apply processing principles		