



Manual of Good Hygiene Practice for Fishing Boats and Fish Landing Sites in Small Scale Fisheries



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

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FOREWORD

Cambodia Fisheries is one amongst the prioritized sectors that is clearly determined in the Rectangular Strategy of the Royal Government of Cambodia. This sector plays very important role in food security and nutrition, livelihoods of the people, and national economic development. Particularly, Post-Harvest Fisheries is considered as a very important subsector in contributing to poverty alleviation, economic growth, and public health protection.

At present, Post-Harvest Fisheries is actively and notably supplying fishery products to meet domestic demand and to promote export to international markets, but the main challenge is currently facing concerned with the quality and safety of fishery products that could have a possible impact on public health, and product value, especially in small scale fisheries. The Fisheries Administration of the Ministry of Agriculture, Forestry and Fisheries, subordinated by the Department of Fisheries Post-Harvest Technologies and Quality Control has undertaken efforts towards the improvement of the quality and safety of fishery products through promoting Good Hygiene Practice (GHP) and Good Manufacturing (GMP) in fish processing cooperative associations and other relevant stakeholders.

The handbook titled “Manual of Good Hygiene Practice for Fishing Boats and Fish Landing Sites in Small Scale Fisheries” is a technical documentation prepared by the Department of Fisheries Post-Harvest Technologies and Quality Control, Fisheries Administration in cooperation with the Food and Agriculture Organization of the United Nations through the Regional Fisheries Livelihood Programme in South and Southeast Asia funded by the Kingdom of Spain. This handbook is aimed to disseminate technical information about good hygiene practices on fishing boats and landing sites in small scale fisheries in order to improve capacity of fishery communities, fish processing cooperative associations, and others stakeholders to produce fishery products in compliance with safety standards. Furthermore, this handbook is prepared with clear examples and drawing illustrations to be simple and easily understood by the target users.

On behalf of the Fisheries Administration, I would like to express my sincere admiration to the technical working team of the Department of Fisheries Post-Harvest Technologies and Quality Control for their effort and great collaboration with the Food and Agriculture Organization of the United Nations to produce this important handbook successfully.

The Fisheries Administration strongly hopes that this handbook will be widely disseminated to all target users and used as a manual for transferring from the technical text into actual practical implementation. With this it is firmly believed that the quality and safety of fishery products are assured for consumers and can be widely exported to international markets.

Phnom Penh, February 18th, 2012



Dr. NAO THUOK

Delegate of the Royal Government of Cambodia,
Director General of Fisheries Administration

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First of all, we, the technical working team who prepared and produced the handbook titled “Manual of Good Hygiene Practice for Fishing Boats and Fish Landing Sites in Small Scale Fisheries”, would like to express our deep thanks to the Regional Fisheries Livelihood Program in South and Southeast Asia (RFLP) of the Food and Agriculture Organization of the United Nations (FAO) for their close cooperation and financial support.

Especially, we hereby wish to extend our heartfelt gratitude and truthful thanks to H.E Dr. Nao Thouk, Delegate of the Royal Government of Cambodia, and Director General of Fisheries Administration, for his invaluable support and encouragement to our efforts in producing this technical handbook successfully. At the same time, we would like to express our special thanks to Mrs. Kaing Khim, Deputy Director General of Fisheries Administration, and National Project Director for her kind coordination and facilitation in preparing this handbook smoothly. Special thanks to Mr. John Esser, International Advisor of FAO for his genuine ideas and useful comments to improve the quality and meanings of the handbook.

We would also like to express our sincere thanks to all the leaders and officers of the departments under the Fisheries Administration, the leaders and officers from other relevant ministries, local authorities, community fisheries representatives and other fisheries stakeholders for their kind cooperation in discussing and sharing their knowledge and experiences to furnish this handbook successfully and satisfactorily.

Finally, we strongly hope that the handbook will provide benefit to relevant users, especially small scale fishers, fish processors, and fish traders and contribute to promoting quality and safety of fishery products towards achievement of the common goal of ensuring consumers’ health protection, leading to increased competitiveness in both national and international markets and so contributing to national economic growth and rural poverty alleviation.

Phnom Penh, February 18th, 2012

Department of Fisheries Post-Harvest
Technologies and Quality Control

Definitions and Terms

Cleaning: Means the removal of soil, food residues, dirt and grease of other objectionable matter (Codex).

Clean Water: Means water from any source where harmful microbiological contamination, substances and/or toxic plankton are not present in such quantities as may affect the health quality of fish, shellfish and their products (Codex).

Cross-contamination: The transfer of bacteria from contaminated food (usually raw) to ready-to-eat food by direct contact, drip or indirect contact using vehicle such as hand or a cloth (management of hygiene).

Chemicals: Includes any substance either natural or synthetic which can affect the live fish, its pathogens, water and equipment used for production or the land within the aquaculture establishment (Codex).

Disinfection: The reduction by mean of chemical agent and /or physical methods, of the number of micro-organisms in the environment, to a level that does not compromise food safety or suitability (Codex).

Fishery Products (FP): Products exploited from nature, including aquatic plants, fish, coral, seaweed etc. and processed products e.g. fish paste, fermented fish, smoked fish, dried fish, dried shrimp, dried seaweed etc. Canned and hermetically sealed bottled products are not included in this definition. (Law on Fisheries, 2006)

Fishing boat: Refers to any water vehicle, which is equipped with fishing gears for fishing (Fisheries Law, 2006).

Fish landing site: Refers to fish stand, which floats close to the riverbank or on land, which collects and distributes FP for commercial purpose (Law on Fisheries, 2006).

Good Hygiene Practice (GHP): Refer to procedures that must be undertaken and hygiene Pest-refer to objectionable animal or insect include but not limited to bird, rodent, flies, and larvae capable of directly or indirectly contaminating food (Turlejska H., 2003).

Hygiene: The science of preserving health and involving all measure necessary to ensure the safety and wholesomeness of food (management of hygiene).

Hazard: A biological, chemical or physical agent in, or condition of, food with the potential to cause an adverse health effect (Codex).

Potable water: Is fresh water fit for human consumption. Standards of portability should not be lower than those contained in the last edition of the “International standards for drinking water” World Health Organization (Codex).

Raw Material: Are fresh and frozen fish, shellfish and/or their parts which may be utilized to produce fish and shellfish products intended for human consumption (Codex).

Acronyms and Abbreviations

Codex	Codex Alimentarius Commission of FAO/WHO
DFPTQ	Department of Fisheries Post Harvest Technology and Quality Control
FAO	Food and Agriculture Organization of the United Nations
FP	Fishery Products
GHP	Good Hygiene Practice
RFLP	Regional Fisheries Livelihood Programme

I. Introduction

1.1 Background

This Manual has been produced for fishers, workers handling fishery products (FP) and FP producers engaged in the capture, onboard handling and landing of FP at small-scale landing sites. The manual is intended as a guide to good hygiene practice (GHP) for the small-scale fishery sector, to assist the sector in producing FP that are safe to eat and of high quality. It has been compiled in accordance with the recommendations as prescribed in Regulation 852/2004/EC on the Hygiene of Foodstuffs, 853/2004/EC on FP, EC, and the Recommended International Code of Practice General Principles Food Hygiene CAC/RCP 1-1969, Rev.4 2000 which provides for the development of guides to GHP and fish handling.

Fishery supply chain stakeholders, particularly fishers and landing site operators, can use this manual as an aid to implementing GHP and, where appropriate, achieving compliance with national food safety regulations. In terms of food safety, high standards of hygiene are important to the control of seafood hazards and ensuring public confidence in seafood as a safe and wholesome food. The food safety hazards most often associated with seafood are physical hazards e.g. glass, wood splinters, metal fragments; chemical hazards e.g. pesticides, heavy metals, unapproved colouring agents; and biological hazards e.g. pathogenic bacteria, viruses, moulds, parasites, toxic fish species. In addition to presenting a food safety hazard, bacteria are an important cause of fish spoilage, will affect product quality.

Beyond the basic requirements for hygiene standards that ensure food safety, high standards of care are necessary when handling seafood, which is of a delicate and perishable nature, in order to achieve a level of product quality that will meet consumers expectations.

The manual is designed to raise awareness of basic hygiene issues in small-scale fishing communities, but is not intended to be used as a training guide; a separate training guide is being developed by the FAO/RFLP to accompany this manual.

The manual was produced by the Department of Fisheries Post Harvest Technology and Quality Control (DFPTQ), with the support of the FAO Regional Fisheries Livelihood Programme (RFLP).

1.2 Purpose of this Manual

This manual provides small-scale fisheries stakeholders with guidance on how to handle FP hygienically and carefully to produce food that is safe to eat and of high quality. It is intended for use by small scale fishers and other stakeholders in community based FP supply chains. It is a working manual and aims to raise awareness of hygiene and quality standards and how to achieve them.

The overall aim of the manual is to provide small scale fisheries stakeholders with the basic knowledge to improve food health quality of FP, reduce post harvest losses and so increase income from small-scale fishery operations.

1.3 Seafood Hazards and Fishery Products Quality

1.3.1. Types of Hazard

A hazard is a biological, chemical or physical agent in, or condition of food, with the potential to cause harm (an adverse health effect) to the consumer. Hazards in FP are typically

classified according to their nature as chemical, biological and physical. Some hazards, particularly hazards originating from the source of production, are highly specific to the species of FP (species related hazards). Others are more generic in their nature (for example in relation to post-harvest contamination) and may be encountered in other foodstuffs (process related hazards)¹.

Biological hazards in fish and fish products are primarily associated with pathogenic bacteria, viruses and parasites. **Chemical** hazards in FP include natural toxins, agricultural pesticides, unapproved colourings, heavy metals and veterinary drugs used in aquaculture. **Physical** hazards include glass, metal, wood or other potentially dangerous solid materials.

Examples of adverse health effects caused by hazards include:

- Food poisoning caused by pathogenic bacteria, viruses, natural toxins;
- Chronic illness caused by pesticides, other chemicals, heavy metals, parasites;
- Cuts to mouth and internal injury caused by glass, metal; and,
- Choking as a result of swallowing physical hazards.

In extreme cases, a food hazard, such as the toxin produced by the pathogenic bacteria *Clostridium botulinum*, can result in death.

Biological hazards

Food-borne biological hazards include microorganisms such as bacteria, viruses, fungi, parasites, and toxic fish species. Pathogenic (disease causing) microorganisms may be found in the fish's natural environment, but are usually present in FP as a result of contamination during handling and processing. Most microorganisms are killed by proper cooking, and numbers can be reduced by adequate control of handling and storage practices (hygiene, temperature and time).

There are several important types of biological hazard associated with FP that fisheries stakeholders should be aware of. These are:

- Pathogenic bacteria from aquatic, general environments and human / animal sources;
- Viruses;
- Moulds;
- Parasites; and,
- Toxic fish species.

Physical Hazards

A physical food safety hazard is posed by the contamination of fish or FP with objects or materials that can cause adverse health effects such as choking, cuts to the mouth, throat, stomach and damage to teeth. Typical physical hazards associated with FP include glass, metal, wood splinters, bones, stones, shell, plastic and fish hooks (Picture 1). Some of these may be found in the fish itself after harvesting, such as stones and fish hooks, other hazards

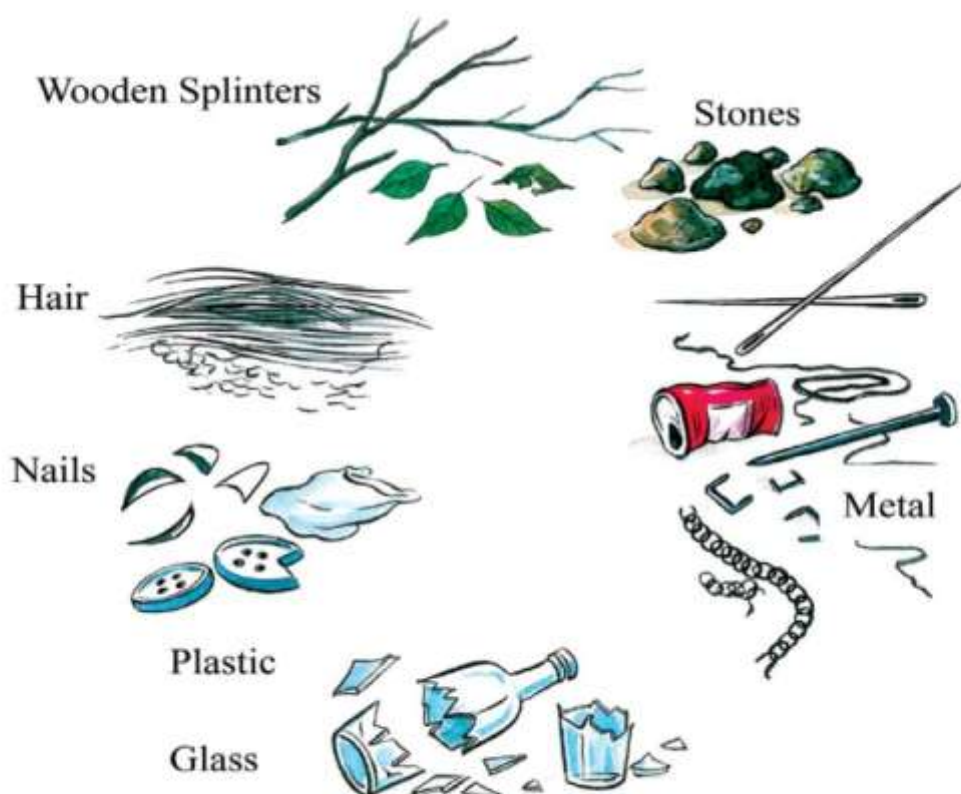
¹ The source of this information is the "Food Quality and Safety Systems - A Training Manual on Food Hygiene and the Hazard Analysis and Critical Control Point (HACCP) System", Food Quality and Standards Service Food and Nutrition Division, FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, Rome, 1998, ISBN 92-5-104115-6

may come from people handling FP, from buildings in which fish are processed and stored, and from equipment and packaging materials that FP come into contact with.

Control of Physical Hazards

The application of simple hygienic practices such as good housekeeping and monitoring will reduce the risk of contamination of FP with physical hazards. In some processing establishments that produce FP for export markets, sophisticated equipment such as metal detectors may be used to screen products for metal contaminants.

Picture 1: Physical hazards



Chemical Hazards

Another important food safety hazard associated with FP is chemical contamination as a result of:

- Environmental chemical contaminants found in the aquatic environment, such as agriculture pesticides, heavy metals and industrial pollutants;
- Improper use of veterinary drugs used in aquaculture;
- Use of unapproved food additives or unregulated use of approved additives; and,
- Build up of natural toxins in FP.

Other Chemicals

Various chemicals are used during fishing and at landing sites e.g. fuel, lubricants, cleaning agents. If these chemicals are not handled properly, or if FP are not handled according to the

principles of GHP e.g. isolating FP from fuel / lubricant spillages by placing in a fish box, keeping the boat clean, then there is a risk of FP being contaminated.

Control of Contamination by Other Chemicals

Applying GHP reduces the risk of contamination of fish and FP by chemicals such as fuel, disinfectants and detergents.

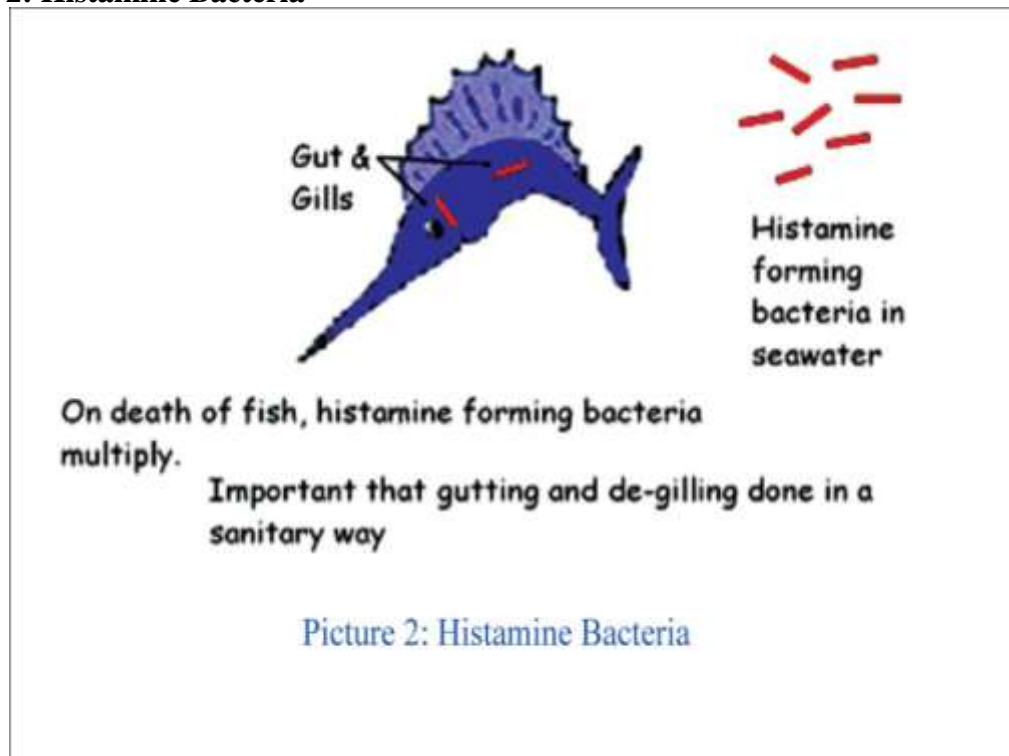
Examples of chemical hazards affecting FP:

- Pesticides/herbicides/fungicides/fertilisers;
- Heavy metals;
- Antibiotics/hormones (aquaculture FP);
- Histamine / scombrototoxin;
- Biotoxins;
- Industrial chemicals;
- Engine fumes;
- Cleaning chemicals; and,
- Packaging e.g. plasticisers migrating from packaging that is not designed for use with food products.

Scombrototoxin / Histamine Poisoning

Scombrototoxin / histamine is a toxin produced by bacteria found in seawater and the guts of some fish species e.g. tuna, mackerel, sardines, anchovies (Picture 2). The toxin builds up when fish are not kept cool. Once formed, scombrototoxin cannot be removed from the product by cooking. Symptoms of scombrototoxin poisoning include tingling feeling in the mouth, dizziness, skin rash, headache, shortness of breath and, sometimes death. Scombrototoxin formation can be controlled by keeping fish at low temperatures.

Picture 2: Histamine Bacteria



Shellfish Poisoning

Shellfish poisoning is caused by poisons (biotoxins) that accumulate in the tissues of filter feeders such as mussels, clams, oysters and scallops. Filter feeders eat plankton that contains the poison. Symptoms of shellfish poisoning include numbness of the lips and limbs, poor muscle coordination. Symptoms develop within an hour of eating contaminated shellfish. Shellfish poisoning can be prevented by avoiding fishing in polluted waters and only purchasing product from a reputable supplier.

Ciguatoxin Poisoning

Ciguatoxin poisoning is caused by eating fish that contain the ciguatera toxin, which originates in toxic algae found in tropical waters. Fish that may contain the toxin include reef fish, grouper, snapper, mackerel and barracuda. Prevention is difficult as cooking does not destroy the toxin. Fishers should avoid fishing in waters where there is a known risk of the problem occurring.

1.3.2 Fishery Products Quality

A definition of quality is "the degree of excellence". For FP it is a standard which will determine saleability and financial value - it will affect the selling price.

High quality FP will fetch higher prices; poor quality FP will fetch a lower price.

Physical Damage and Quality

Physical damage to FP may allow bacteria and enzymes present in the gut to penetrate other parts of the fish, thus causing further spoilage; physical damage can also introduce other bacteria from the surrounding environment.

We can prevent spoilage due to physical damage by handling FP carefully, not crushing or piling FP up too high, and packing them properly.

Spoilage and Quality

Spoilage in fish is usually rapid since FP, being highly nutritious (high protein content), and having a high moisture content and a relatively neutral pH value, provide an excellent medium for bacterial growth. Fresh FP spoilage is mainly bacterial in nature, aided by enzymatic activity. Good icing practice and careful handling are the main ways of reducing spoilage and loss of quality.

Bacteria and Quality

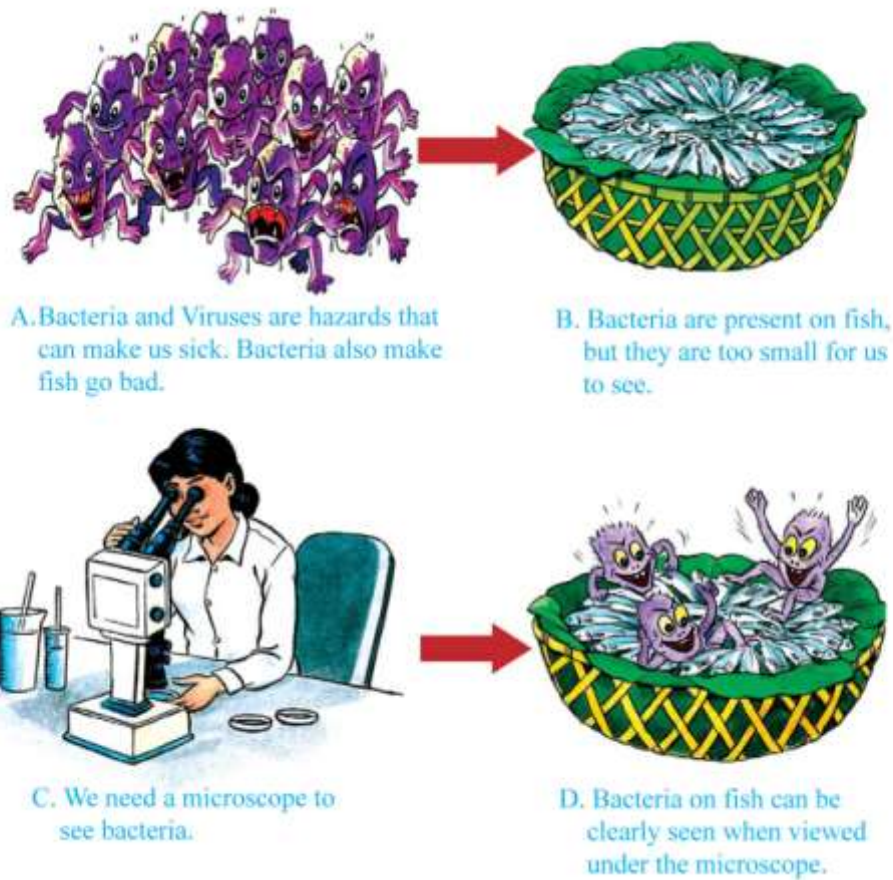
Bacteria are microscopic, one-celled organisms which are found almost everywhere in the environment. The flesh of FP is sterile (free from bacteria) when they are alive, but large numbers of bacteria are normally present in the surface slime, on the gills, and in the guts.

Bacteria are extremely small living organisms (Picture 3). In fact we need a very powerful microscope to see them. There are many types of bacteria; they are found virtually everywhere-in air, in water, the ground and inside (and outside) living creatures. Bacteria that cause fish to go bad are called spoilage bacteria. Bacteria that make people sick are called pathogenic bacteria. Growth (multiplication) of both types of bacteria is reduced by icing the fish properly.

As well as bacteria being found on FP, they are also found in lots of other places, especially dirty and wet places (Picture 4). If FP come into contact with anything in these environments

then more bacteria will be added which will increase the risk of the fish going bad or spoiling and increase the risk of food poisoning for the consumer.

Picture 3: Bacteria



Picture 4: Bacteria are found everywhere, especially in dirty places

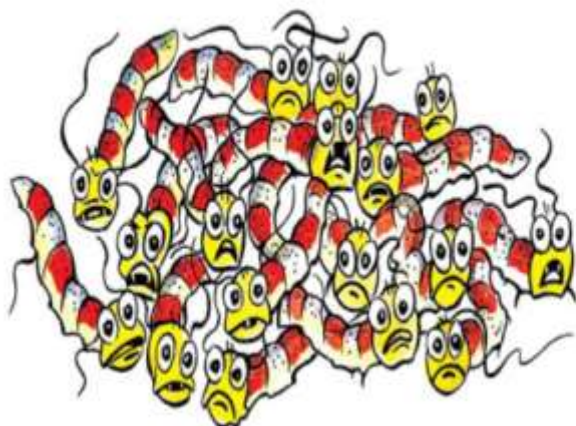


Enzymes and quality

Enzymes are proteins which speed up chemical reactions in the gut and muscle of FP. Enzymes present in the gut (digestive enzymes) play an important role in the spoilage (Picture 5) of whole, ungutted fin-fish. Physical damage and failing to control fish temperature after capture can result in enzymes being released from the gut and spoiling the flesh.

Spoilage by bacteria and enzymes can be reduced by washing fish in clean water (Picture 6), carefully removing the guts, lowering fish temperature by chilling or freezing, heating fish to high temperatures, drying fish, as well as careful handling to avoid contamination.

Picture 5: Enzymes spoil fish



Picture 6: Washing fish in clean water removes bacteria and enzymes



Quality

The quality of our FP will affect the sale price we get.

High quality = High price

Poor quality = Poor price

Once the quality of the FP is allowed to deteriorate it can never be regained.

This means that everyone involved in the fishing business, from the fisher at the point of capture, through the processor to the vendor at the point sale, must understand how to maintain quality in order to get the best possible price for the FP.

There are four basic requirements for maintaining quality of FP:

- Thoroughly chill the FP and keep it as cool as possible prior to processing or selling;
- Do not damage or crush the FP;
- Keep the FP clean; and,

- Work quickly.

1.3.3 Measuring FP quality

Quality can be measured by chemical or sensory methods. We are actually doing this ourselves when we look at a fish and decide how much we want to pay for it.

- **Chemical Testing:** We can use chemical analysis to measure the concentration of chemical produced during spoilage of FP.
- **Sensory Evaluation:** We can quickly check quality by using eyes to look at the appearance of the FP, our hands to feel the texture of the product, our noses to smell it and our tongues to taste it. The following table gives a numerical value for differing qualities of fresh fin-fish. It can be a useful tool in assessing quality. We simply describe what we see (appearance, colour), feel (texture), and smell.

Quality table for fresh fin-fish (sensory evaluation)

Class	Gill	Eyes	Body appearance	Texture	Quality
5	- Dark red colour - Some thin clear slime - Marine smell	- Bright, metallic - Clear pupils - Convex	- Natural colour - Iridescent - Firm scales - Little or no slime	- Firm before or in rigor	Excellence
4	- Red colour - Some slime, but still thin and clear - No smell	- Bright metallic - Slightly cloudy pupils - Slightly convex	- Natural colours - Firm scales - Some slime	Firm	Good
3	- Red-brown colour - Some thick slime - Beery/mousey/warm smell	- Dull - Pupils cloudy - Flat - Some blood	- Slight red colour - Scale loose - More thick slime	Firm	Average
2	- Brown colour - A lot of slime - Slight 'off' smell	- Dull - Pupils cloudy - Slightly concave - Bloody	- Red/yellow colour - Scales missing - Dry skin - A lot of yellow slime	Soft	Poor
1	- Brown colour - A lot of slime - Very bad smell/ammonia smell	- Dull - Pupils cloudy - Concave or bulging out - With blood	- Red/yellow colour - Few scales - Dry skin - A lot of thick yellow slime	- Very soft - Mark of finger left if pressed	Very poor

Class 5 is the top quality and class 1 is the poorest quality

(Source: Sheelagh Johnson and Ivor Clucas, Maintaining fish quality an illustrated Guide, 1996)

FP that is not handled carefully or hygienically can have a lower sale value and cause illness when consumed (Picture 7).

Picture 7: Problems caused by eating contaminated fish



II. Good Hygiene Practice Requirements

2.1 Personal Hygiene Requirements

Personal hygiene practices and hygienic production processes are equally important to ensuring FP are safe to eat washed in clean water remove any chemical or biological hazards that may be present.

The concept of hygienic behavior consists of simple, hygienic actions that individual fishers and people who handle FP can adopt. These principles apply both to the people who handle the catch, and the equipment / surfaces that the FP comes into contact with. The basic hygiene concepts covered in this manual include:

- Personal hygiene rules for people handling the catch along the supply chain, from capture, or harvest to consumption, including personal hygiene and dress codes; and,
- Production hygiene, which covers the things that come into contact with FP. All these objects must be regularly cleaned to avoid contamination of FP.

Simple steps that can prevent pathogens from contaminating FP include avoiding fishing in polluted waters, keeping the boat and fishing gear clean, observing good personal hygiene and keeping animals away from the boat.

Keeping your body clean and wearing clean clothing before starting work or fishing, washing your hands with soap and clean water after going to the toilet, being aware of your personal appearance and keeping your fingernails and hair well trimmed are all examples of good personal hygiene.

The following should not be permitted in areas where FP are handled:

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

Examples of good and poor personal hygiene can be seen in Picture 8.

Picture 8: Good and poor personal hygiene



If we don't wash our hands properly after using the toilet or use dirty water to clean FP we can contaminate the product with bacteria that make us sick.

Fish handlers (fishers, landing site workers, fish processors) should not be allowed to come into contact with FP when they are ill, especially when they suffering from diarrhea and/or vomiting. They should seek medical help if necessary and only return to work when fully recovered.

2.2 Water and Ice Quality Requirements

2.2.1 Water

Clean water is essential for washing FP. Normally this is fresh water obtained from the municipal supply, but sea water can be used, provided it is clean and not taken from polluted sources e.g. fishing harbours, close to the beach. Ideally, water obtained from wells and boreholes should be disinfected with chlorine to kill harmful bacteria that may be present. Chlorination should only be done by fully trained person, to avoid the risk of harmful levels of chlorine being present in the water. The amount of free chlorine remaining in water after treatment should not exceed the national standard for drinking water.

2.2.2 Ice

Ice is normally manufactured in ice factories or large scale fish processing plants, and is often used on semi-industrial fishing vessels. In order to meet the sanitary requirements stipulated in international and national fisheries legislation and those of public health services, ice must be manufactured either from fresh water of drinking quality i.e. potable water or, in the case of slush ice, from unpolluted sea water. Ice intended for preservation of FP in small- scale fisheries must be manufactured, handled, transported, stored and applied in the most hygienic manner possible in order not to expose the ice to any physical, chemical or biological contaminants. Ice used to chill FP should only be purchased from government approved suppliers.

Storing FP in ice immediately after capture is the best way to maintain quality of the catch and thus keep its value.

Ice performs two jobs:

- It cools the FP to the temperature of melting ice (about 0°C); and,
- It keeps the FP cool for long periods.

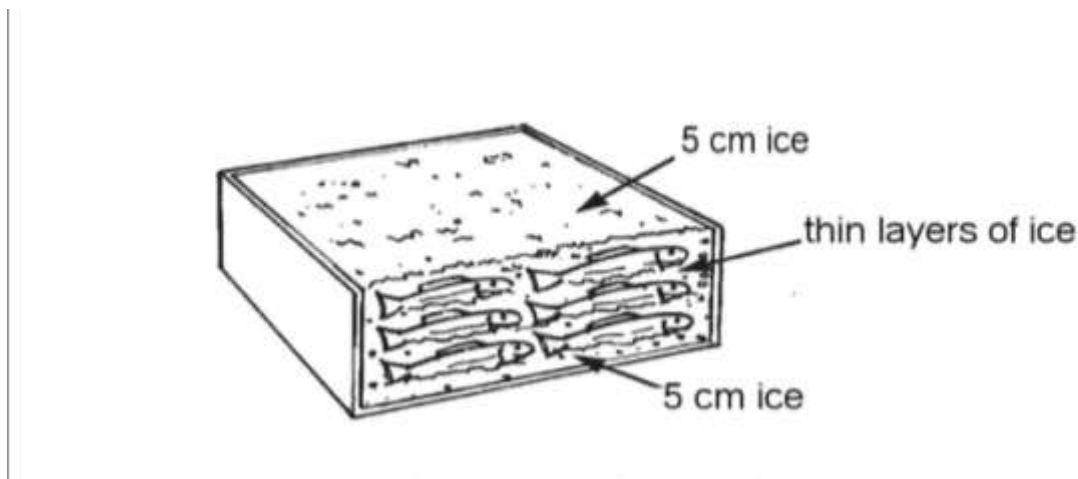
Normally, you need 1kg ice for each 1 kg of fish to cool the FP well. The longer the storage time, or larger the catch, the larger the quantity of ice will be required. With experience you will be able to judge the amount you require; it is important that some ice should remain in contact with the FP at the end of the fishing trip.

It is very easy to use ice correctly. Ideally, flake ice will be used, but if only block ice is available it will be necessary to break the ice into to small pieces as large lumps can physically damage FP and cool the fish less efficiently than small pieces. It is best to use flake ice or mechanically crushed block ice obtained from an approved supplier.

Firstly a thick layer of ice (about 5 cm thick) is placed on the floor of the fish box. A single layer of FP is then placed on the ice (Picture 9).

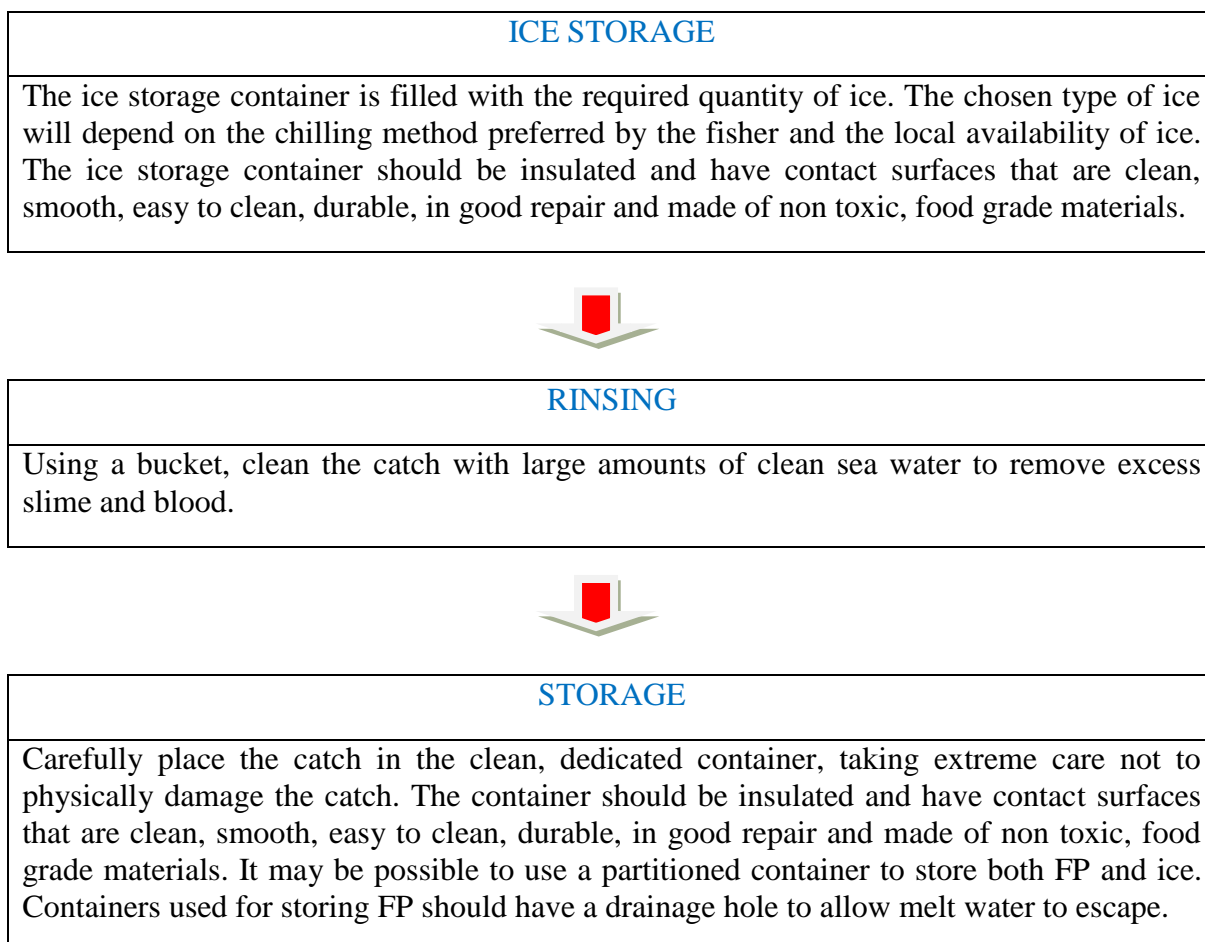
A layer of ice is placed on the first layer of fish and the process repeated until the box is full, finishing with a thick top layer of ice. The fish box should then be closed with a tightly fitting lid.

Picture 9: Icing fishery products



2.2.3 Use of Ice in Small-Scale Fisheries

The flow diagram below illustrates step-by-step the actions to be undertaken by fishers. The personal and production hygiene rules and actions of this manual must also be followed during icing.



CHILLING

Chill the catch using ice as quickly as possible.

For direct chilling put approximately 5 cm of ice at the bottom and place a layer of FP on top. Cover the catch with approximately 5 cm on top and 5 cm on the sides. Repeat for each layer of FP and ice. Make sure the catch, in the case of fin-fish, is stored in a straight position and is not bent.

If using the Chilled Sea Water (CSW) method, place the catch carefully into the solution of ice and seawater, ensuring complete submersion.

Check for ice melt at regularly at intervals. Replenish ice as necessary to compensate for ice melt and drain melt water as and when required.



TRANSPORT

When returning from the fishing grounds to the landing site, check for ice melt and keep the ice uniformly distributed over the catch. If weather conditions are rough, take measures to prevent the catch from moving inside the container, to avoid damage.



HANDLING

Treat the fish with utmost respect and care to avoid physical damage to the flesh, as the FP may have turned rigid due to the rigor mortis effect.

It is recommended to use thermally insulated boxes e.g. Cool Man or similar or containers, which are fitted with lids to reduce the heat impact on the catch, as well as shielding the catch from contact with flies and other insects, rodents, other animals, dust and other potential hazards of contamination. It is important that the inner lining of the box is made of food grade material.

(Source: Manual on hygienic ice production for the small-scale fisheries in Timor-Leste, Module 3)

III. Good Hygiene Practice on Fishing Boats

3.1 Fishing Boats Hygiene Requirements

The boat and equipment should be thoroughly cleaned using clean water and approved detergent, followed by rinsing with clean water before each fishing trip. In addition, the boat and equipment should be inspected for damage and necessary maintenance carried out.

Water close to the fishing beach, or harbour water should not be used for cleaning, as this water will be polluted (Picture 10).

Allowing animals onto the fishing boat and using the boat for transport of products other than FP increase the risks contamination. Fishing boats should be used for fishing only.

Only tap water from the public water supply, clean well / borehole water that has been treated with chlorine, or clean seawater should be used to clean boats and equipment. Do not use water from the harbour or beach.

- Do not use water that may be contaminated with sewage;
- If clean water is not available at the landing site, then boat cleaning may be done using clean sea water away from the beach; and,
- Allow the fishing boat and equipment to sun dry.

Picture 10: Boat cleaning



]

- Ensure that all fishers maintain a high standard of personal hygiene;
- Hands and other exposed body parts should be thoroughly washed before handling the catch;
- Always wear clean, protective clothes;
- Cover cuts and wounds with waterproof plasters;
- Wash hands with soap and clean water after going to the toilet;
- Do not cough or sneeze on FP or ice; and,
- Do not smoke or eat when FP are being handled on the canoe. (Picture 11).

Picture 11: Good and poor hygienic practices when handling fish



Use of ice on fishing boats

FP spoilage starts immediately after death. Spoilage is the result of a whole series of complicated changes brought about in the FP by its own enzymes, by chemical action and by bacteria. A rise in temperature speeds up spoilage of FP. The spoilage rate at 5°C is twice as fast as that at 0°C. So it is very important to keep the temperature of FP low, preferably around 0°C. Icing is the cheapest and simplest method of preserving fresh FP. Ice as a cooling medium for FP has a great role in preserving its recovery; it has a very large cooling capacity for a given weight or volume, it is harmless when made from uncontaminated water, portable and relatively cheap. The amount of ice required to cool fish and keep it cool will depend upon level of insulation, FP species, ambient temperature and storage time.

Advantages of proper icing on Fishing Boats

- Helps to maintain the temperature of the catch at about 0°C, thereby slowing down microbial and enzymatic spoilage process;
- Keeps FP moist, thereby preventing surface dehydration and weight loss; and,
- Prolongs shelf life of FP.

Effective Icing

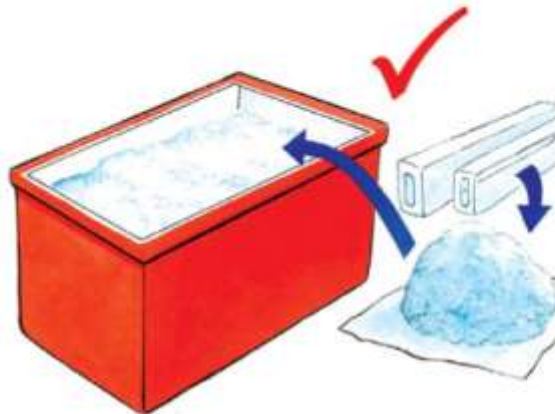
- Use only good quality ice, made of potable water by an approved supplier;
- Always store ice in clean containers. Never drag it along floor as this causes contamination;
- Avoid large and sharp edged pieces of ice which can damage the fish;
- Ice the fish immediately after capture;
- Use at least 1kg of ice to preserve 1 kg of FP;
- Ice and FP should be placed in layers in an insulated container;
- Ensure proper drainage of melted ice water from boxes; and,
- Keep the FP cool at all steps in the supply chain.

Ice is very important in small-scale fisheries. It is a very effective and cheap way of maintaining FP quality while fishing and transporting fish. Ice lowers the temperature of FP and hence slows down bacterial and enzyme action. However, for ice to be effective it must be used properly (Picture 12) and it must be made from clean water. We will get a high price if we ice FP correctly.

- Sort the catch as early as possible in order to protect FP on the fishing boat from sun and wind. It is desirable shade FP from the sun while sorting;

- If possible, do not store FP in block ice (Picture 13). Block ice has sharp edges on the heavy pieces that can damage fish; and it does not pack closely around FP (i.e. large air spaces between pieces means poor cooling); and,
- Block ice (from an approved supplier) should be hygienically broken into small pieces before use.

Picture 12: Good and poor icing practices



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Use of Hygienic Fish Containers

Boxes used for onboard storage of FP or ice (Picture 14) should be clean, easily cleaned, strong, have smooth surfaces, be in good repair and lined internally with food grade material.

Wooden boxes are impossible to clean properly and contain large numbers of bacteria which will contaminate any FP that come into contact with them. Additionally, wooden boxes may produce splinters that present a physical hazard.

Picture 14: Hygienic containers should be used for storage of fishery products and ice on fishing boats and canoes



Conduct thorough, regular cleaning of the boat and equipment to prevent bacterial build up. Cleaning with clean water and detergent should be done just before and immediately after each fishing trip.

- Clear and clean all equipment and fishing gear thoroughly after each operation; and,
- Cleaning equipment is very simple and only requires buckets, brushes, clean water, water and detergent;

Wash all surfaces, utensils and all equipments with clean sea/fresh water. Scrub using a detergent and rinse with clean sea/fresh water. Allow to dry in the sun and store in clean and dry place (Picture 15).

Picture 15: Cleaning equipment



IV. Good Hygiene Practice at Landing Sites

Landing sites are the places where the catch is landed from boats for sale or onward distribution. It is absolutely essential that fishers and other people who handle FP at the landing site follow the basic principles of hygiene and sanitation.

By practicing both personal and production hygiene at sea during fishing and at the landing site, the risk of contamination and spoilage is greatly reduced.

4.1 Hygiene requirements for landing sites (Pictures 16 - 19)

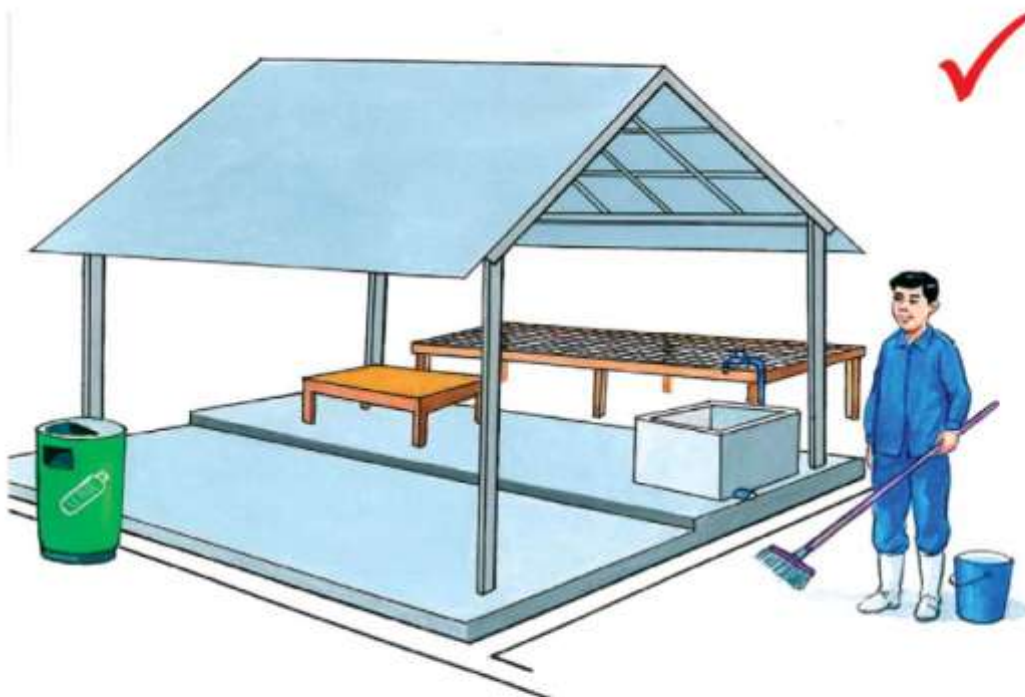
- Always keep the landing site clean;
- Cleaning should be done correctly, if possible use potable water from the municipal water supply, clean sea water, or borehole water that has been disinfected with chlorine. Polluted water collected from near the shore or landing site should not be used for cleaning and washing;
- Landing sites should be washed with safe water and detergents at least once a day;
- Waste products should be stored in covered containers and disposed of hygienically;
- FP contact surfaces should be free of all type of contaminants like oil, grease, etc;
- Cutting, cleaning and processing FP should only be done in areas designed for that purpose;
- Handlers/workers should wear clean, protective clothing to reduce contamination risk;
- FP should be stored with ice in clean plastic containers to reduce spoilage and contamination;
- Landing sites should be fenced and unauthorized access forbidden;
- Transfer of FP to a clean trucks should be performed quickly;

- Animals e.g. dogs, pigs, ducks should be kept away from the landing site to reduce contamination risk;
- Landing sites should be kept clear of waste to discourage pests e.g. rats;
- Hygienic toilet facilities should be available to FP handlers;
- Workers should wash their hands with soap and water after using the toilet;
- Clean, safe water must be available for cleaning the site and equipment;
- Hand washing facilities, clean water and soap should be present; and,
- Persons suffering from contagious diseases, cuts and open wounds should not enter the landing site.

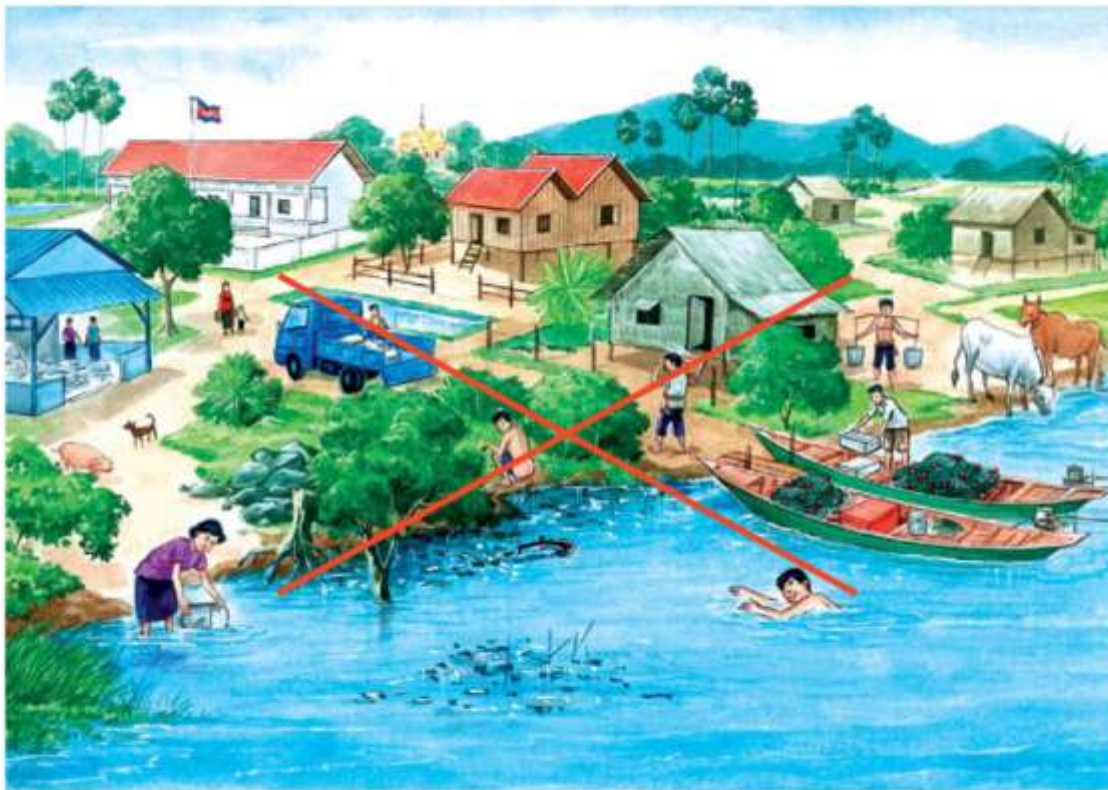
Picture 16: Good hygienic practices at the landing site



Picture 17: Good landing site



Picture 18: Bad hygienic practices at the landing site



Picture 19: Poor landing site



4.2 Hygiene Requirements for Unloading FP (Pictures 20 & 21)

- During loading and unloading, FP should not come into contact with unhygienic surfaces and materials;
- Only clean plastic containers should be used to store FP;
- The catch should be unloaded onto either a clean raised platform or a clean plastic sheet. FP should never be allowed to come into contact with the ground;
- FP containers should be insulated and provided with a cover. A drainage hole should be provided on bottom of the container to allow draining of melted ice and blood;
- FP should be chilled to a temperature of around 0°C by using good quality ice using a 1:1 ice to FP ratio;
- FP intended for onward transport should be stored with sufficient ice to keep the product at 0°C for the entire journey; and,
- Smoking, spitting, chewing pan, eating, etc when handling fish should be strictly avoided.

Picture 20: Good hygienic practices during u



Picture 21: Poor hygienic practices during unloading

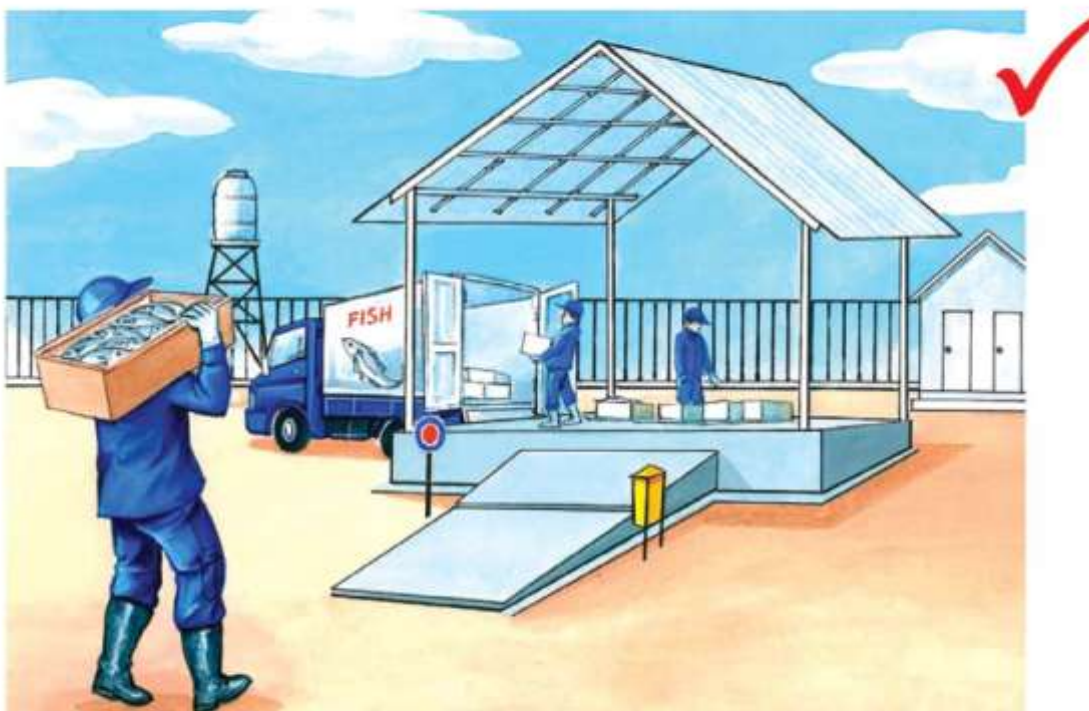


4.3 Hygiene Requirements for Handling FP at Landing Sites

Always use proper FP handling techniques, starting with using clean equipment, using clean, preferably, potable water for equipment cleaning, and observe hygienic behavior at all stages in the FP supply chain.

- All boat FP workers who handle the fish at the landing site should practise good personal hygiene;
- Hands should be washed before handling FP;
- Clean protective clothing should be worn while handling FP;
- Persons suffering from contagious diseases should not enter the landing site;
- Cuts should be covered with waterproof plasters;
- Smoking, spitting, chewing pan, eating, etc should be strictly avoided;
- After landing, the boat should be cleaned with detergent and clean water;
- Chilling should be commenced as soon as possible;
- Handling should not cause physical damage;
- All equipment used for handling should be constructed from smooth, easy to clean materials and kept in a good repair;
- Handlers should avoid eating, drinking, using tobacco, chewing gum in production areas, and sneezing and coughing over unprotected food;
- FP handlers should wash and sanitize their hands at the start of food handling activities and immediately after using the toilet; and,
- Before handling any FP, wristwatches, necklaces, rings or other jewelry should be removed. This will reduce the potential for physical contamination.

Picture 22: Good handling practices at landing sites



Picture 23: Poor handling practices at landing sites



4.4 Hygiene Requirements for Storage of FP at Landing Sites

It is important to arrange adequate storage space and conditions for the catch from harvest throughout every handling stage along the supply chain, until the catch reaches the consumer.

Bearing in mind the problems associated with storing FP, particular attention should be paid to the construction of the stores themselves. A fresh fish store area should be shaded, airy and easily cleaned.

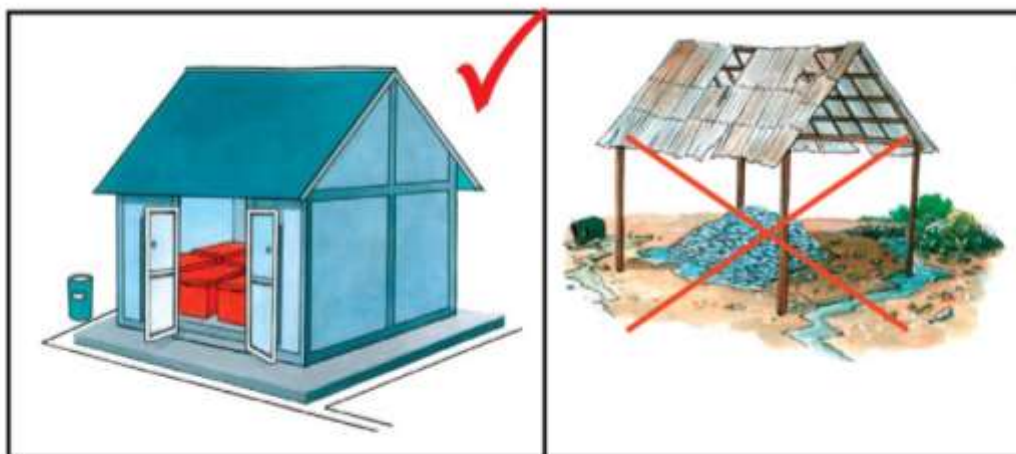
The FP storage house (Picture 23) should have:

- A corrugated iron roof, brick walls;
- Easy to clean surfaces;
- Good ventilation;
- No access to animals or pests;
- A lockable door; and,
- Closeable, insulated containers for FP and ice storage.

Chemicals and cleaning agents should not be stored in the same place as FP. Rubbish should not be present in the storage area.

If the level of insects in the store becomes too high, then the store will have to be professionally fumigated. Always keep the store clean and tidy.

Picture 24: Fishery product storage at landing sites



4.5 Hygiene Requirements for FP Transport

When returning from the fishing grounds to the landing site, check for ice melt, and keep the ice uniformly distributed over the catch. If the weather conditions are rough, take measures to prevent the catch from moving around inside the storage area, to avoid damage.

General conditions for transport boats and trucks (Picture 25) are as follows:

- FP storage rooms containers / compartments must be designed to avoid contamination of fish and spoilage;

- FP containers / compartments must be insulated, and lined with strong, smooth, easy to clean materials;
- Storage containers / compartments must be closeable to keep the FP at a low temperature during transport;
- The weight of ice should be equal to the weight of FP being transported;
- FP should be handled carefully to avoid being damaged;
- Transporters should be washed with clean water and approved detergents;
- Transporters must only be used for the transport of fish; and,
- FP temperatures should be recorded at the start, during, and at the end of transport.

Picture 25: Fish transport vehicles



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