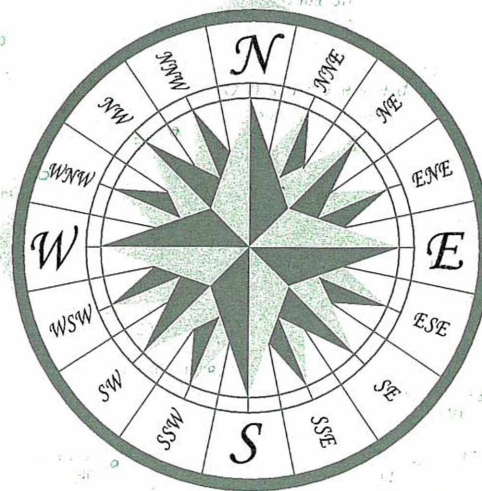


Pacific Island Qualified Fishing Deckhand



MODULE 19

Introduction to Fish Handling



Coastal Fisheries Program
Training Section



South Pacific Commission

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Module 19

INTRODUCTION TO FISH HANDLING

OBJECTIVES

- By completion of this module the student will be able to:
- Explain the importance of good quality fish and how to assess fish quality
- Recognise the main causes of fish spoilage and explain how to control fish spoilage
- Explain the importance of ice and the different methods of chilling fish
- Explain how to handle fish on board and on shore
- List the basic steps of tuna handling for the sashimi export market

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- Fish quality
 - What is quality?
 - The importance of quality
 - The assessment of quality
- Fish spoilage
 - The main causes of spoilage
 - The control of fish spoilage
- Principles of fish chilling
 - Importance of ice
 - Types of ice
 - The methods of chilling fish
- Principles of fish handling
 - Handling the catch on board
 - Handling the catch on shore
- Handling sashimi grade tuna for the chilled overseas market.
 - Gaffing and landing
 - Killing
 - The Tanaguchi method
 - Bleeding
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INTRODUCTION

The price obtained for fish depends on many factors including, the final destination of the product (local or overseas), the marketing process (fish sold directly to local customers, or to a retailer or to a wholesaler), supply versus demand, and most important, the quality of the fish.

This module explains the concepts of fish quality and fish spoilage and explains the handling and chilling techniques that fishers should follow to ensure maximum prices are obtained.

The last section will cover the basics of tuna handling for fish which will go to the sashimi market.

FISH QUALITY

WHAT IS QUALITY?

Whenever a customer buys a product, whether it is a meal, a nice shirt or a new car, she makes an assessment of that product in her mind. If it is a car she may ask if it will meet her needs: Can it pull a trailer or a boat? Can all the family fit in it? Is this product suitable for all of my needs? Thus quality is a measurement, made by the customer, of the suitability of a product for its proper use.

Similarly when a customer buys your fish she may ask you:

- "Will this fish be good to eat?"
- "Will it keep for a few days in the fridge?"
- "Will it be easy to cook?"
- "Will this product meet my expectations?"

If your customer buys your fish and keeps it in the fridge for two days and it does not smell, and then she cooks it and finds the flavour was good and it is easy to cook, she will say that your fish was of good or high quality. It was suitable for its use, which was to store, cook, nourish and enjoy.

THE IMPORTANCE OF QUALITY

Quality is important for both export and domestic markets.

- **Export Markets**

More and more Pacific Island countries are becoming involved in exporting highly priced fish and fish products such as sashimi type tunas, snappers and prawns. To succeed in such markets the exporting country must meet the quality standards of the importing country. Any shipment of fish that does not meet these standards may mean that the importing country may stop buying from the supplying company or country.

Fish export markets require the shipment of product of sustainable high quality.

- **Domestic Market**

In many tropical countries there is a need to improve the quality of fish for home consumption. These improvements should try to ensure that more edible fish are available for the home market. This can be achieved by:

- reducing wastage (from poor handling)
- preservation.

Very often, the fisherman's customer is not the person who eats the fish. The fish market, wholesaler or retailer who buys the fish from the fisherman is the fisherman's customer. Because fish deteriorates with time, the quality required by this customer may be different from the housewife and is usually very high.

The wholesaler or fish market knows that high quality fish will be easy to sell because it looks attractive and will last a long time when stored in ice before it starts to deteriorate.

THE ASSESSMENT OF QUALITY

For the average person purchasing fish for use at home, 'quality' means that the fish looks good, feels good, smells good and makes a satisfying meal (tastes good).

"Looks good" means that the fish looks alive, as if it had just come from the sea. Its colours are bright and clear, the flesh is glossy and transparent, and the body is undamaged. The fish does not look dull and dried out, with faded colours.

"Feels good" means that the flesh is firm and pliable, rather than soft. If pushed in with a thumb it springs back into shape rather than a dent remaining.

“Smells good” means that there is little smell other than a slight sea smell. If it has a strong “fishy” odour, it has already started to spoil.

“Tastes good” means just that and that the texture of the flesh is firm and tender, the fish is juicy and not dry. Of course, poor cooking can spoil even a perfect fish.

- **Quality Assessment Form**

During this course a practical exercise will be held to show you how to assess fish quality using the parameters listed in Figure 19.1 below.

ASSESSMENT OF FISH QUALITY

	HIGH QUALITY	MEDIUM QUALITY	POOR QUALITY
Eyes	Eye clear, black stands out from head, surface of eye convex.	Eye about 50% cloudy. Surface of eye slightly concave.	Eye opaque/brown. Severely sunken.
Body colour	Body colours bright.	Body colours dulls.	Body colours dark - not visible.
Gill colour	Gills bright pink/red. No slime.	Gills brown, small or medium amount of slime (clear).	Gills brown/putrid.
Smell	No ‘fish’ smell or slight ‘seawater’ smell.	Definite ‘fish’ smell.	Pronounced putrid odour.
Flesh texture	Firm and elastic (springs back quickly on pressing).	Flesh soft (doesn’t spring back fully on pressing).	Flesh falling away from carcass. Very soft texture.

Figure 19.1

FISH SPOILAGE

Unlike quality, spoilage is not a measure; it is a process and a result. The fish starts to deteriorate from the minute it comes from the sea and the process of spoilage is the last stages of quality deterioration.

Once the quality is gone completely and the product is unsuitable for the purpose or use, it is now spoiled. When we are talking about a fish that is intended for enjoyable eating, then a spoiled fish is that which is unfit for consumption.

Fish is one of the most perishable of foods. As soon as it is taken from the sea, a series of changes start to occur and, if the circumstances are favourable, deterioration will occur quickly and eventually the fish will be spoiled.

THE MAIN CAUSES OF FISH SPOILAGE

Spoilage of fish occurs for two main reasons:

- **Microbial Spoilage**

Micro-organisms (called bacteria) are present on the gills, in the surface slime and in the guts and intestines of all fish. They are not present in the flesh itself, which is sterile. After death, this bacteria starts to multiply rapidly, the warmer the temperature the more rapidly the bacteria multiply. The bacteria will eventually enter the flesh itself spoiling the fish, especially if the flesh is torn or the stomach lining is ruptured. The bacteria cause the gills to become discoloured and slimy and produce a strong smell, all of which are indications of spoilage.

- **Autolytic Spoilage (self digestion)**

While the fish is alive, the fish's body is supplied with oxygen which maintains the health of the fish and the muscle structure. When the fish dies this no longer happens and the flesh starts to change its chemical structure, caused by the action of the enzymes which are always present in the flesh. This enzyme action causes the fish to spoil resulting in discoloration, off flavours and changes to the texture of the flesh.

THE CONTROL OF FISH SPOILAGE

Understanding the reasons why fish deteriorate in quality and become spoiled will help in formulating methods to reduce spoilage. With this knowledge techniques can be used to preserve the freshness of fish or to process them by

methods which will make them suitable as consumer products. Canning, smoking, salting and drying fish might create such consumer products.

GENERAL METHODS OF PRESERVING FISH

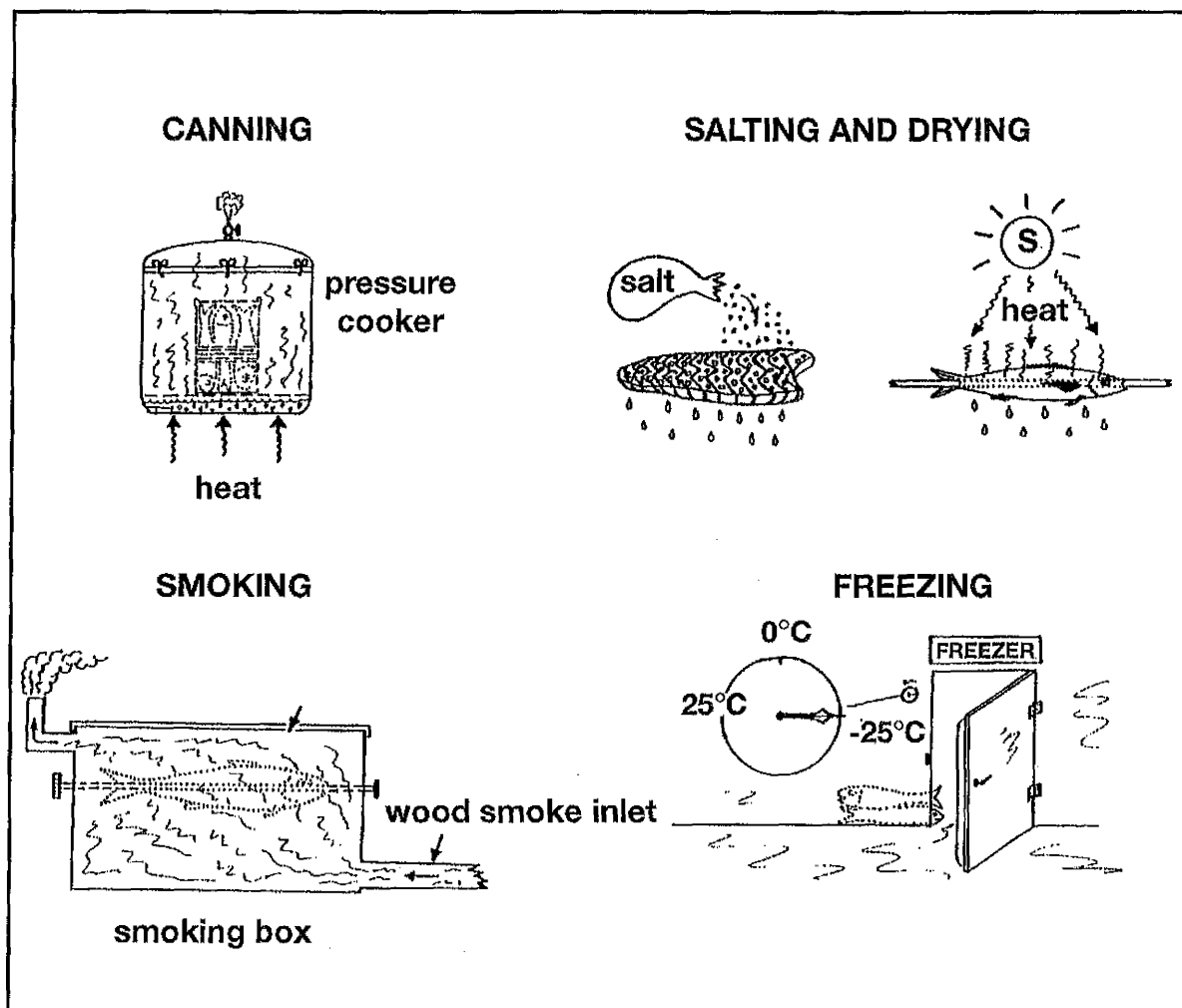


Figure 19.2

On the other hand, by controlling temperature, it is possible to preserve raw fish, in a condition similar to which it was caught, for relatively long periods of time. It is this method with which we are primarily interested. The four main factors in the preservation of freshness of fish are **temperature, time, care, and hygiene**.

- **Temperature**

We measure temperature by means of a thermometer. Some of these are glass, some are metal with dials or digital electronic readouts, and some, which we use for measuring the temperature of the fish itself, have sharp probes for inserting into the flesh of the fish.

THERMOMETERS

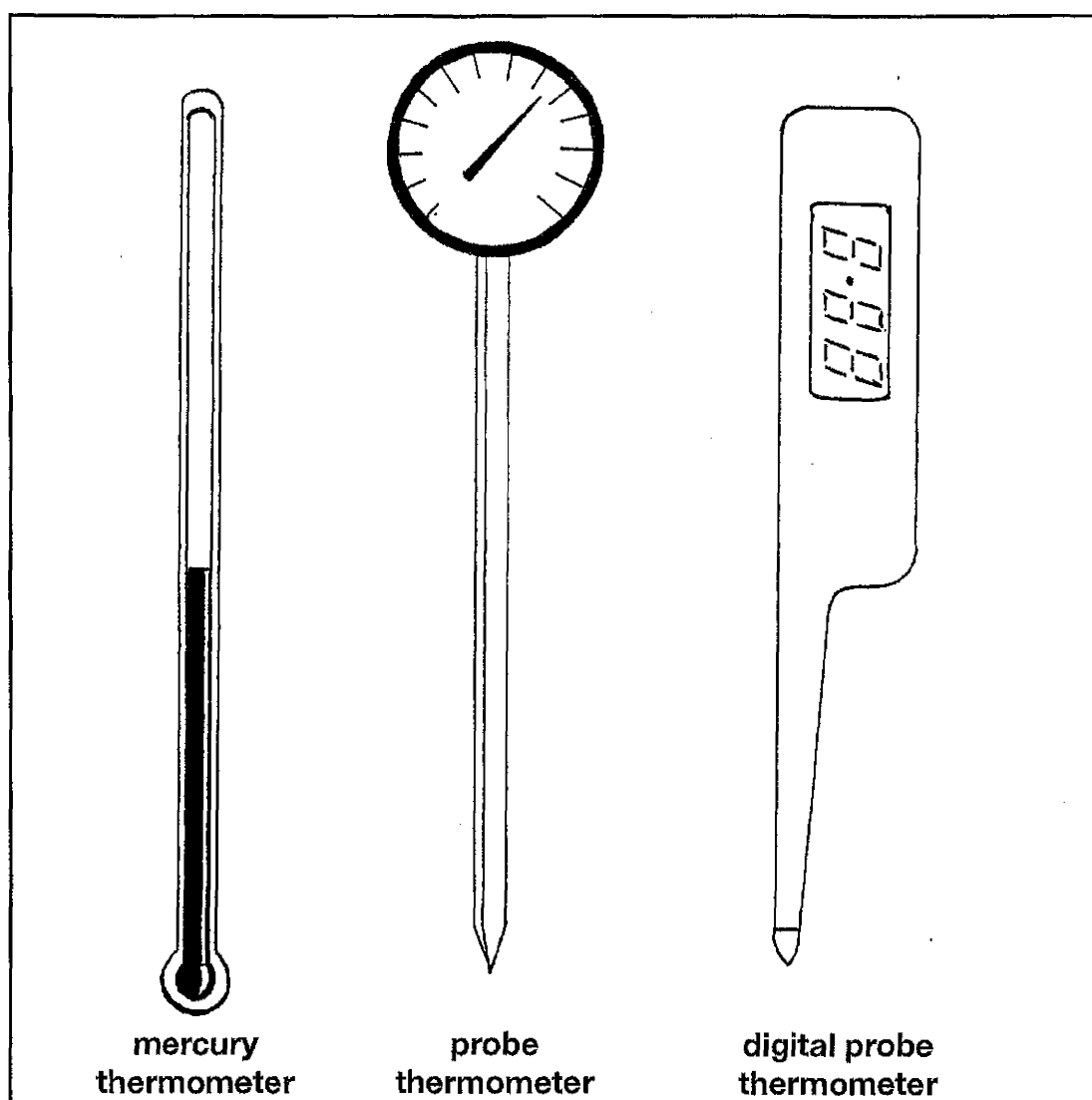


Figure 19.3

Fresh water turns to ice, or correspondingly, ice melts at 0°C ; the temperature of the sea varies but in the tropics will be around 25°C , while the human body is 37°C .

The temperature scale is also used to measure temperatures well below the freezing point of water. Tuna for the sashimi market which is frozen at sea can be frozen as low as -60°C .

The activity of the agents, which cause spoilage (bacteria and enzymes), increases with temperature. Fish caught in the sea at 25°C and brought onto the deck at 35°C will immediately start to deteriorate as the bacteria multiply in the higher temperatures and the enzyme action accelerates. Cooling the fish down to lower temperatures, which the bacteria and enzymes do not like, will slow down the reaction and the spoiling will also slow down.

For example, when cooling is properly done, for every drop in temperature of 50°C the rate of spoilage is halved. Fish can last up to ten days (or more) if put in ice at 0°C straight away and spoilage is almost completely stopped in the -60°C temperatures of freezer boats, although it takes very expensive freezer equipment to get these very low temperatures. Even if a fisherman is unable to take ice with him, the simple step of covering his fish with a wet sack or banana leaves will give some reduction in temperature and consequently slow down the rate of spoilage.

STORAGE LIFE OF FRESH FISH

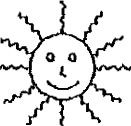


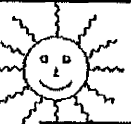


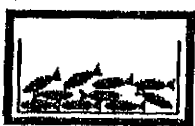

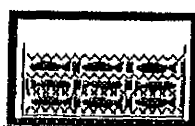

fish left in the sun	 25-35°C 	 6-8 hours		
fish covered with banana leaves	 15-20°C 	 12-16 hours		
chill store (no ice)	 5-10°C		 4-5 days	
chill store (with ice)	 0°C			 10-12 days

Figure 19.4

- **Time**

At tropical temperatures, fish can deteriorate in a very short time and can even spoil within 8 to 10 hours. Leaving fish waiting on deck at these temperatures will heat the fish further, especially if they are in direct sunshine. It is essential they are chilled quickly. Delays in handling and cooling can raise the temperature and speed up spoilage.

- **Care**

We know that enzymes and bacteria are found in large numbers in the gut of a fish as well as on the skin (the fish becoming slimy after catching is a sign of the bacteria multiplying on the skin). The skin itself and the gut lining help stop the entry of bacteria. However, when a fish is damaged, by being gaffed carelessly, thrown on the deck, or stepped on, the flesh will be bruised, the gut cavity and skin may be squashed or split. All of these allow the bacteria to enter the flesh more easily.

A badly damaged fish is worth little; it also will spoil quicker and in so doing assist in spoiling other fish.

- **Hygiene**

Germs, which cause fish spoilage, are found everywhere but particularly in places that have not been cleaned. Blood, slime and pieces of rotting fish have millions of bacteria growing on them. Equipment that is not cleaned will often transfer bacteria onto good fish.

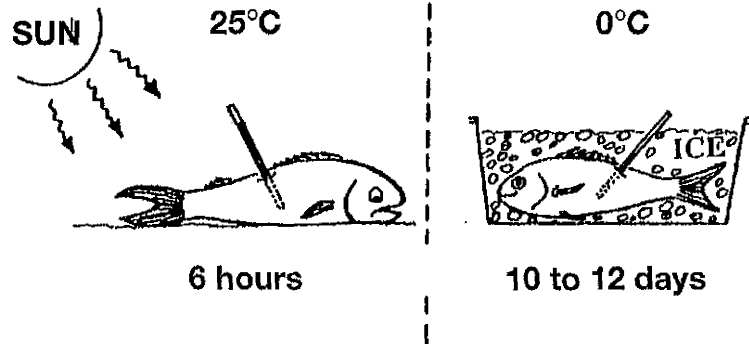
Although many bacteria only increase the rate of spoilage, some other types produce toxins that are harmful to health. This is another reason for keeping all handling and processing equipment and areas very clean, by washing regularly with strong detergents.

Personal hygiene is equally important as we use our hands in many handling and processing steps. Dirty hands and clothing will help transfer spoilage bacteria, and very often these are the type of bacteria that can make people sick.

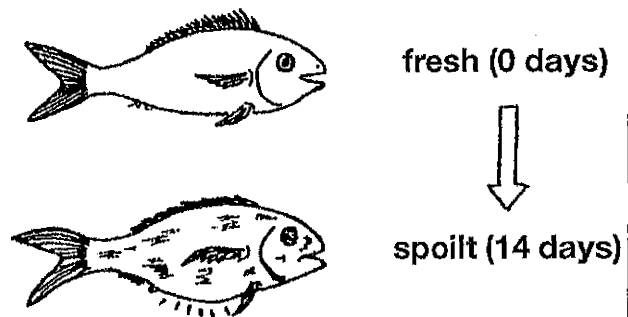
Remember that loss of quality is a one-way street and what has been lost can never be retrieved.

FOUR FACTORS AFFECTING FRESHNESS

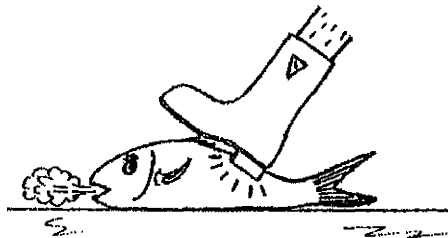
1. TEMPERATURE



2. TIME



3. CARE



4. HYGIENE

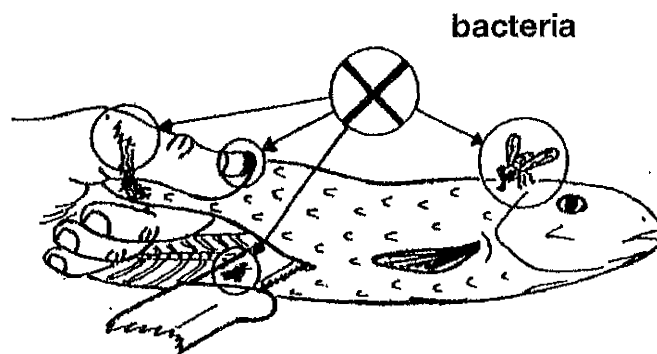


Figure 19.5

PRINCIPLES OF FISH CHILLING

If the temperature is reduced below zero (actually to -1.5°C) the water in the fish will commence to freeze. However if the fish is stored in ice or in a chiller which does not go below zero the fish will not freeze. Chilling can thus be defined as reducing the temperature of a product to 0°C while freezing is reducing the temperature below zero. Freezing a fish to low temperatures will extend the time it can be kept, the lower the temperature the longer the time. However keeping a fish just under 0°C actually can increase the spoilage as the bacteria and enzymes become concentrated in the unfrozen or semi frozen parts in the centre of the fish.

IMPORTANCE OF ICE

Clean ice is the easiest and best way to chill fish.

The advantages of using clean ice to chill fish are the following:

- it is efficient at chilling fish quickly
- it is usually fairly cheap and accessible
- it is harmless (as long as it is made from clean water)
- it keeps the fish moist, shiny and attractive
- it is easily transportable.

However, it must be pointed out that the shore facilities required to make ice are not always available.

TYPES OF ICE

Ice can be purchased in a number of forms

- block ice (ranging in size from 10kg to 50 kg blocks);
- crushed block ice (block ice crushed into small pieces);
- flake ice (very small flakes of ice)

TYPES OF ICE

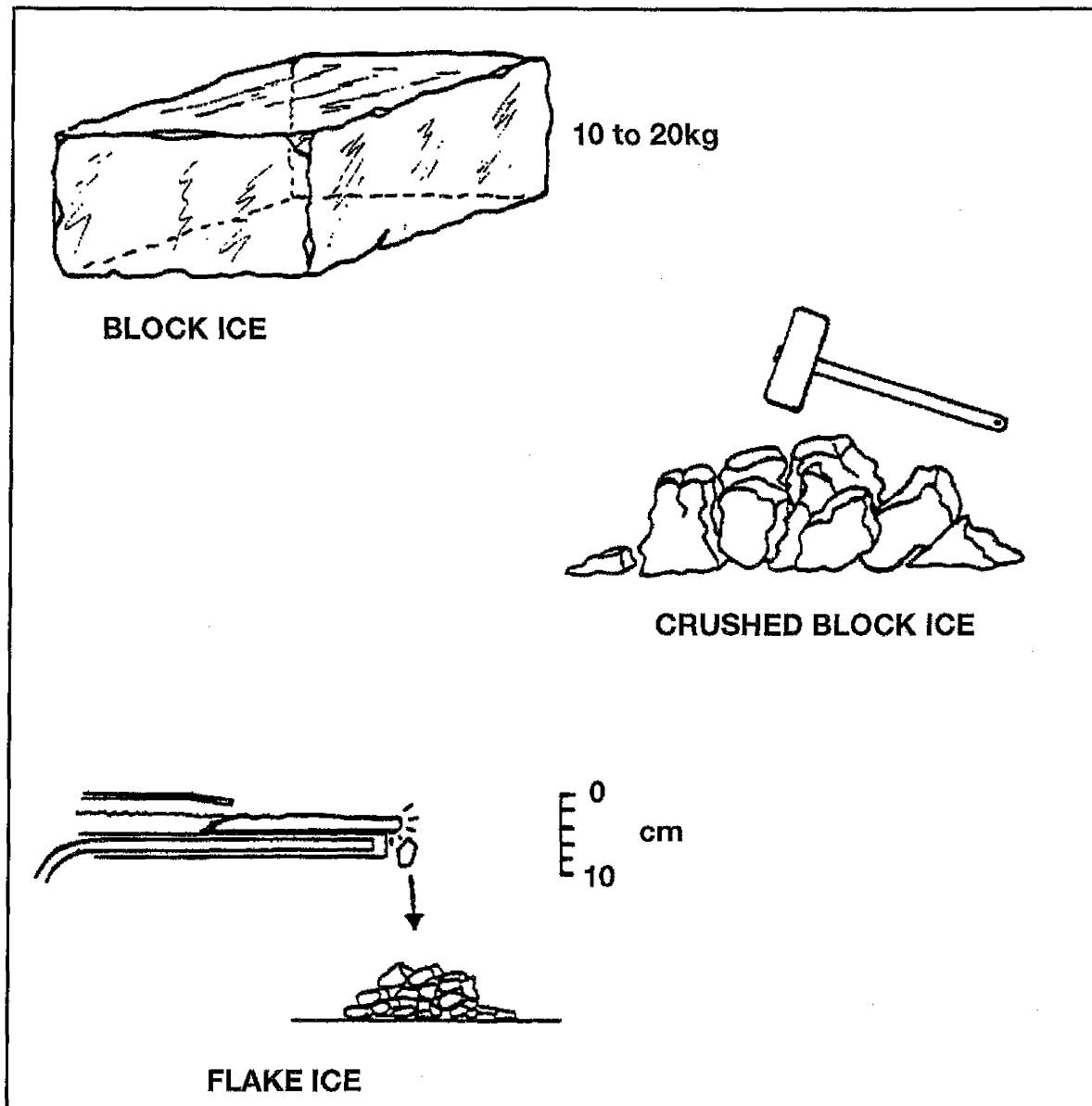


Figure 19.6

- **Block ice**

The advantages of block ice are that it does not melt so quickly due to a smaller surface area and a greater amount can be packed into a smaller space. Therefore if it has to be transported over long distances, it is the ice to buy.

The disadvantages are that it has to be broken up before it can be used. Care must be taken to break the blocks into small pieces, as larger pieces do not wrap around the fish leaving air spaces and leads to poor heat transfer and poor chilling. Also sharp edges can push into the fish and damage the flesh.

- **Flake Ice**

The advantage of flake ice is that the small pieces make it easy to handle, it wraps around the fish close giving very rapid chilling. Flakes present the maximum cooling surface for a given amount of ice.

The disadvantages of flake ice are that it is not so good for transporting over long distances, it melts quicker and takes up more space.

THE METHODS OF CHILLING FISH

- **Chilling fish in plain ice**

Fish and ice must be packed together in the icebox so that each fish is completely surrounded by ice. The fish should not be touching each other or the side of the container.

The first step is to put a layer of ice into the container followed by a layer of fish. Fish, whether it has been gilled and gutted or not, should be placed in the box belly down.

A layer of ice then covers the fish and a second layer of fish is added. Cover again with ice and repeat the process until the container is full.

As a general rule, to properly chill fish requires a ratio of one part of fish to one part of ice (e.g. 10kg of fish will require 10kg of ice).

CORRECT METHOD OF PACKING FISH IN ICE

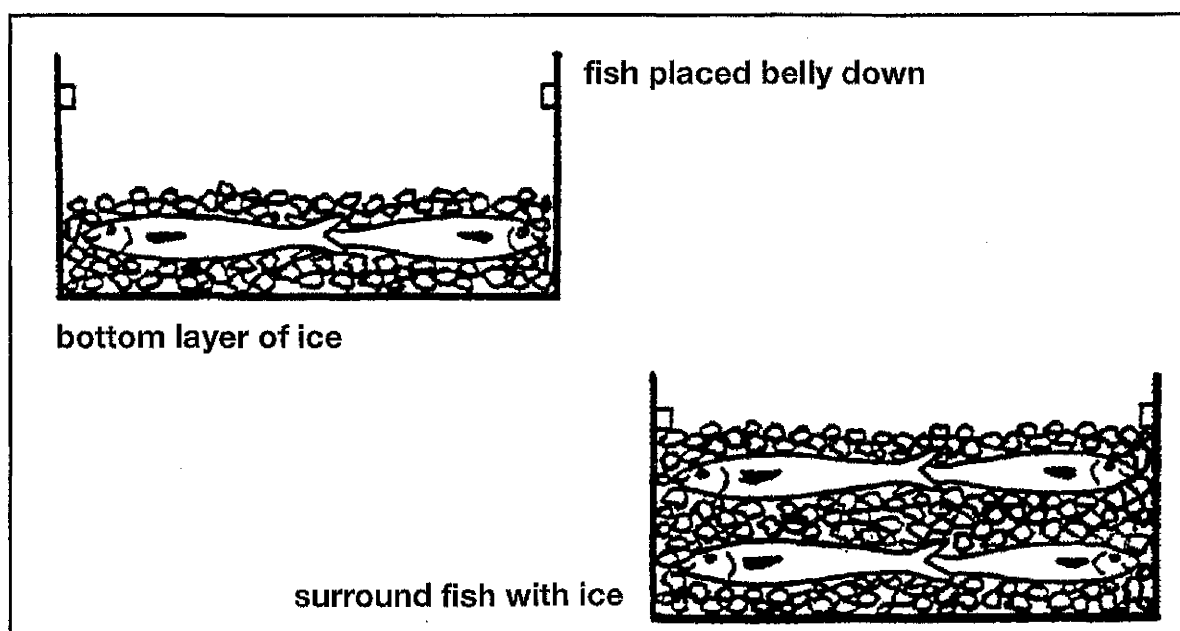


Figure 19.7

Common mistakes in icing include, placing the fish on top of the ice only or using large pieces of ice to chill fish which leave too many air gaps, reducing the effectiveness of the ice. Perhaps the most common mistake is simply not using enough ice.

INCORRECT METHOD OF PACKING FISH IN ICE

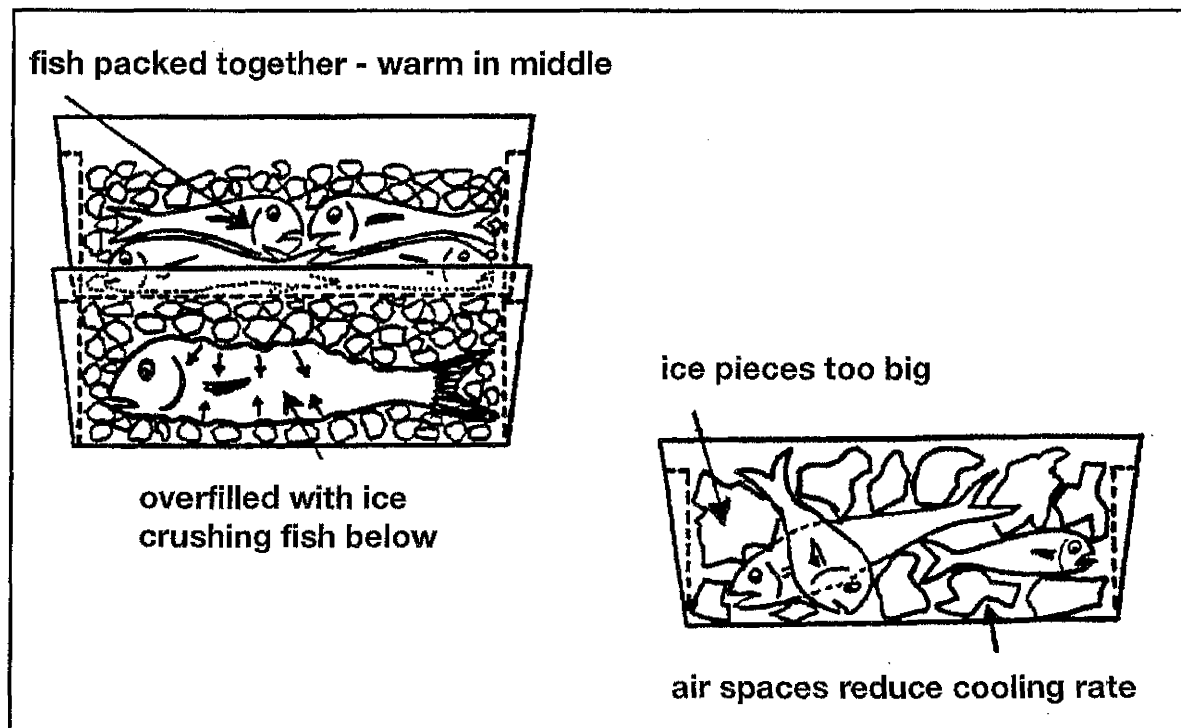


Figure 19.8

- **Chilling fish with a sea water/ice slurry.**

Another quick and effective way of chilling fish is to use a sea water/ice slurry. To make the slurry mix two parts of ice to one part of water. Only use crushed or flake ice.

To make a good slurry:

- use crushed or flake ice
- mix two parts of ice to one part of water
- make the mixture when the fish are first caught
- add more ice to the mixture as ice melts
- stir the slurry from time to time to avoid warmer spots developing

SEA-WATER/ICE SLURRY

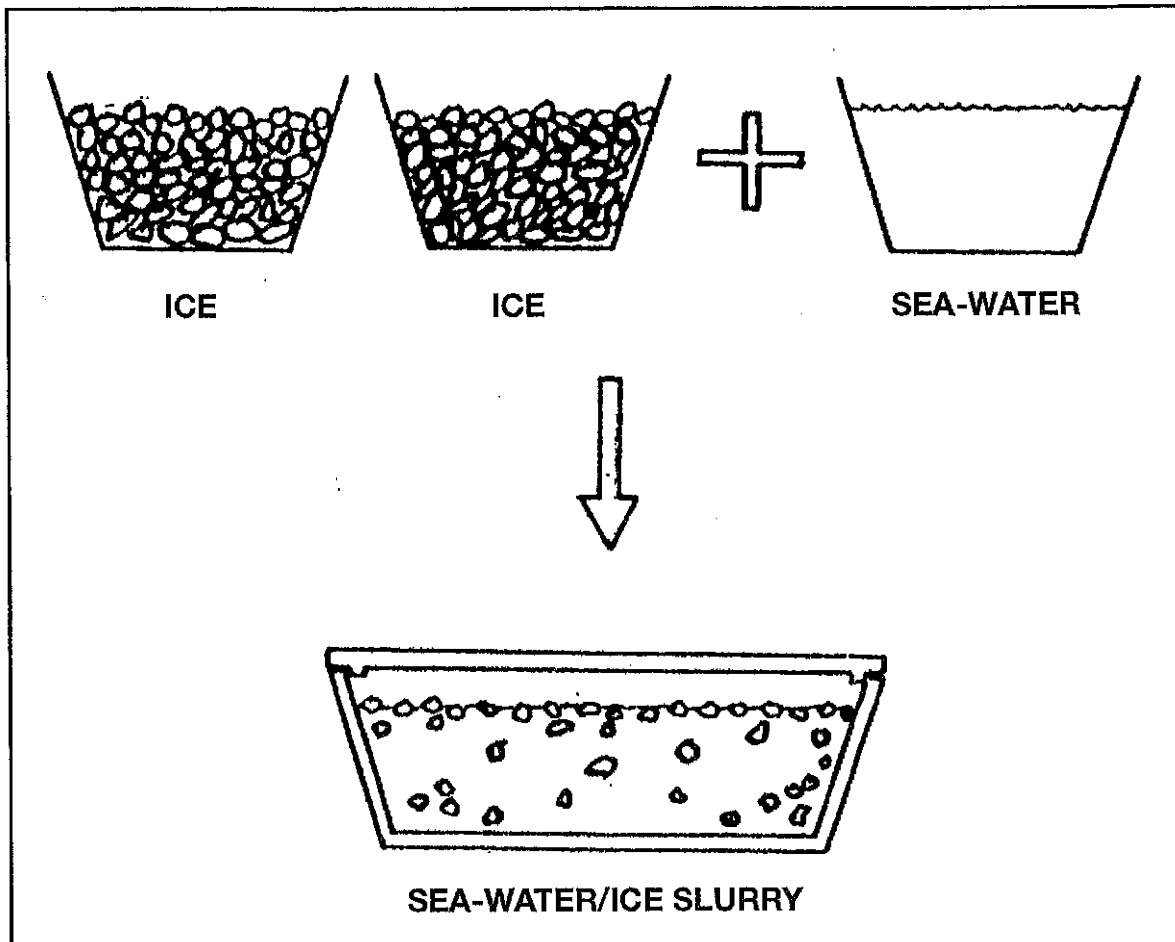


Figure 19.9

The advantages of a slurry are that the fish can be dropped directly into the slurry as it is caught, giving almost instant cooling. This saves time especially if the fish is biting. Slurry gives very fast chilling because there is 100% contact with the fish and the slurry is at an ice melting temperature of 0°C

Do not store your fish in a slurry for more than 12 hours, as the fish will then start to lose its bright colours and the eyes will turn white. After that period, you must repack the fish in ice.

During this module you will receive practical instruction on chilling methods.

PRINCIPLES OF FISH HANDLING

The points made earlier in these notes can now be brought together and related to the handling of the catch.

The fisherman is the first person in a chain in which every link must be maintained to ensure top quality. Being the first link in the chain he is also the most important as loss of quality is irreversible and any loss of quality at this time is handed on down the chain.

HANDLING THE CATCH ON BOARD

- **Fish caught round FADs**

The fish caught around FADs can generally be divided into two groups:

- Fish caught by trolling, mainly tunas such as skipjack and small yellowfin, which will usually be sold on the local market

and

- Big deep-swimming fish, mainly adult yellowfin and big-eye tunas, which may qualify for the export market.

Because the fishing method and the market requirements are different for these types, different approaches to handling must be taken. Surface schools are often aggressive and stay on the bight for a fairly short time, which often means, the fisherman cannot lose fish by stopping to spend too much time on handling the fish. The most convenient way for chilling fish at this time is to use an icebox with a slurry mixture. If this is made immediately before reaching the FAD the fish can then be slipped into the mixture as they are caught or as soon as there is a pause in the catching. The cold temperature will kill the fish immediately.

Sharp-toothed fish (wahoo, barracuda) and mahi mahi require special care: these fish must be gaffed (preferably in the head to avoid damaging the flesh) and killed (by stunning or spiking) before they are placed in the slurry.

If ice is not available, all fish should be killed after unhooking, and then be protected from the sun.

The larger deep-water fish will command a better price, especially in an overseas market and require special care.

To ensure high quality for the end product, big tunas must be gaffed carefully, spiked, bled and then quickly placed in the slurry. These handling procedures are described in a later section.

- **Bottom Fish**

The handling of bottom fish will to some extent depend on the market into which they are being sold. While most markets will accept the fish green, i.e. not gilled and gutted, some will require the fish to be gilled and gutted.

There are some basic principles to follow. In both cases temperature control is the most important aspect.

For fish which are not being gilled and gutted, the fish should be spiked on being caught and placed in an ice slurry immediately. Depending on the size of the fish and the time you will be out fishing, after the fish has been chilled, it should be repacked in ice as described in this module. This will maintain the bright colours.

Fish that have to be gilled and gutted should be spiked on catching, then gilled and gutted straight away. If the fishing is too good to stop, and gutting cannot be done straight away, the fish should be put in the slurry and gutted later, possibly when transferring from the slurry to the icebox. When gutting the fish it is extremely important all parts of gut and gills are removed and all blood is washed or brushed out. Gutting and cleaning practices across the Pacific are often very poor. A fish which is gilled and gutted and not cleaned properly gives the bacteria which is prolific in the gut, more easy access to the flesh and it will spoil quicker than fish which is not touched, even when stored in ice.

Not all markets require the fish to be spiked (iki jimi) but it is a good thing to do anyway as it reduces the time the fish is in rigour and gives a better quality fish. To iki jimi the fish, insert a spike, which can be made out of a sharpened screwdriver, into the brain of the fish. You will know if you have hit the brain as the fish will shudder, become ridged and the mouth will gape open. It takes some practise to find the brain which is situated an inch or so behind the eyes as its position varies a little from species to species. Cutting the head in two halves will give you an idea of where the brain is generally situated in relation to the eyes.

HANDLING THE CATCH ON SHORE

Ideally, the fisherman returning from a fishing trip will arrive on shore with the catch chilled to around 0°C Handling the catch ashore must be done quickly to avoid the fish warming up, which in turn would speed up the spoilage process.

When unloading, the fish should be carried, not thrown, as dumping or throwing the catch on roads or jetties or on the decks of trucks will damage the fish and reduce the value.

Fish should never be left in direct sunlight and should be taken rapidly to a shaded and clean area for further handling.

In some places the fish may be sold whole but in others they need to be gutted. If gutting is required:

- do this in a clean and shaded area
- have plenty of water, wash your hands and utensils
- gut fish on a clean surface
- completely remove the gills and guts, do not leave any pieces inside.

After gutting, the fish must be cleaned carefully to avoid bacterial contamination and preserve its freshness:

- Using plenty of water, wash and carefully brush the fish inside and outside to remove slime and blood. Rinse the fish well.
- Clean water should always be used to clean the fish.
- When completely clean and scrubbed, pack the fish in ice and deliver it to the customer.

HANDLING SASHIMI-QUALITY TUNAS FOR THE OVERSEAS MARKET

Sashimi is a traditional Japanese dish, prepared from high quality raw fish and cut into thin slices. The fish most often used in the preparation of sashimi are those species with red meat, particularly tunas. The word sashimi means much more than "raw fish", it also implies a high standard of freshness, appearance, presentation, texture and taste.

The market for sashimi tuna is large and lucrative, but only top quality fish are likely to get high prices on the Japanese market. Several factors, both biological and non-biological determine the quality of the tuna:

- The biological factors are those over which the fisherman has no control. This includes the species of the fish, the age, the size, the degree of sexual maturity and the presence of parasites or diseases. The size, species, and sexual maturity are very important as they determine the fat content of the fish. Tuna with the highest fat content get the highest prices on the sashimi market.
- The non-biological factors are those, which the fisherman controls directly. They include the fishing method used and the handling and cooling techniques applied to the fish after its capture.

This section summarises the handling procedures suitable for sashimi quality tunas for the fresh fish market. Fishermen who have spent time on long-liners which freeze the fish may have used slightly different methods.

More details on these techniques can be found in the SPC manual, *On-board handling of sashimi grade tuna*. This handbook is available from the South Pacific Commission.

Practical lessons on how to prepare tuns for the sashimi market will be given as part of this module.

Characteristics of Sashimi Tuna

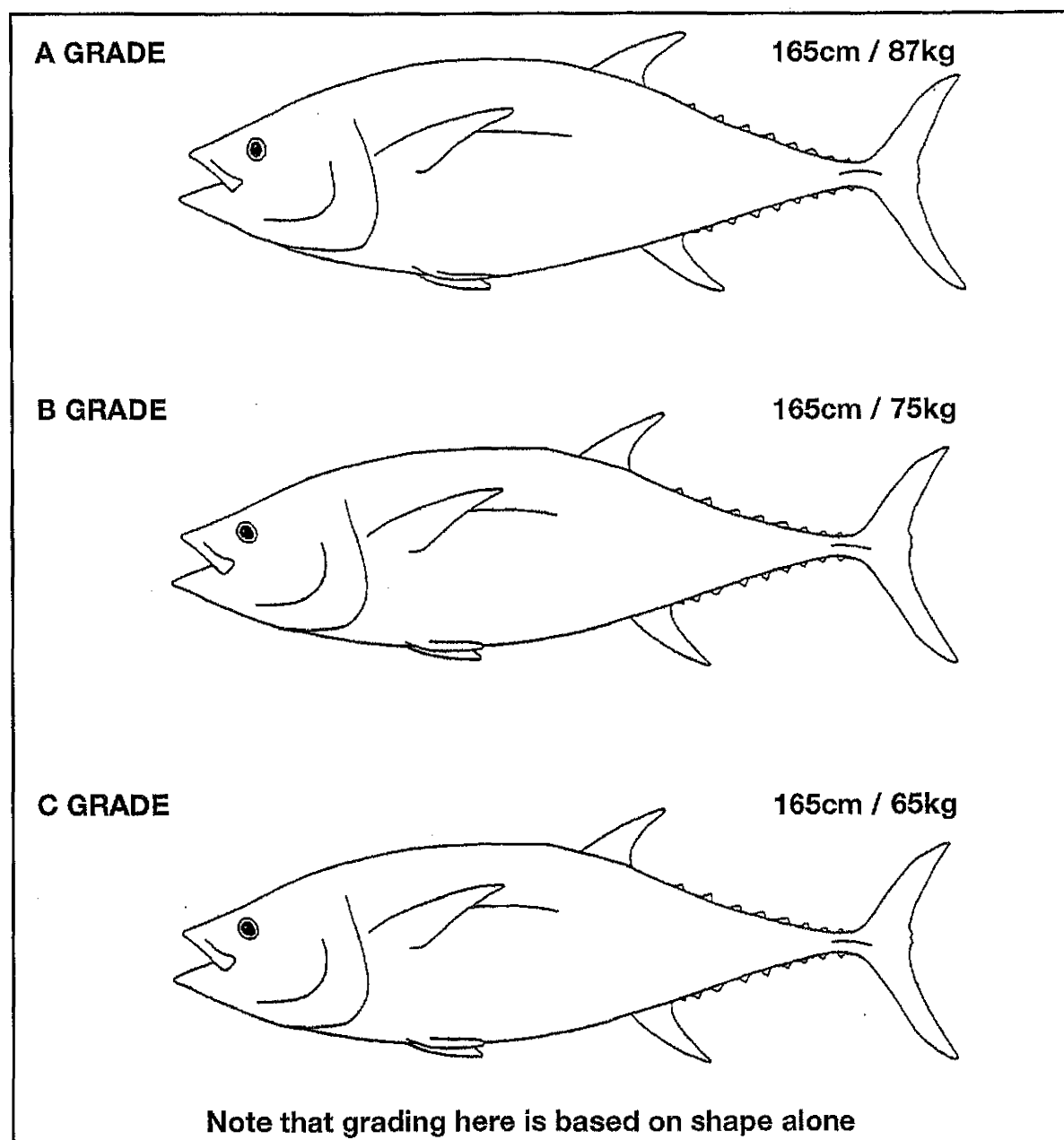


Figure 19.10 Grading Tuna by Size and Shape

- Size:** Fish less than 30kg are generally not considered to be sufficiently large to be of sashimi grade, although this varies according to species and market demand.
- Shape:** A deep, well-rounded body is more likely to return a higher price at auction due to potentially larger quantities of prime meat.
- Fat:** Fat fish attract better prices at auction. Not all parts of the fish are of equal value in restaurants, with higher fat portions being more expensive.
- Flesh:** The colour of the flesh is important. Bright red flesh colours attract better prices.
- Location:** Buyers know that the quality of tunas changes seasonally. The fishing ground and the time of the year will produce differing qualities of fish.

GAFFING AND LANDING

The appearance of the fish is an important factor. Always treat your fish with great care and always wear cotton gloves. Handling without gloves will leave marks on the tuna due to the heat and fatty substances of the palms of the hands.

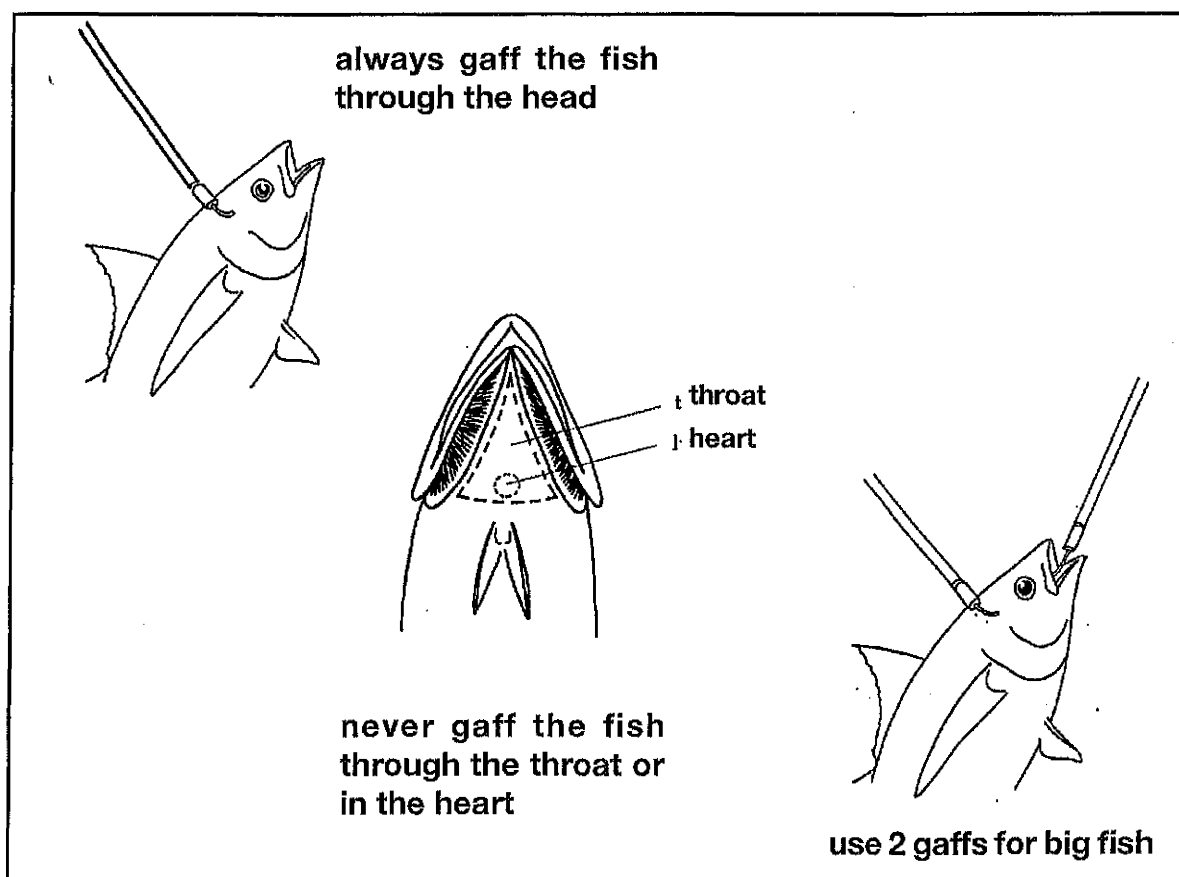


Figure 19.11 Gaffing

Follow these procedures:

- always gaff through the head
- never gaff through the body, the throat or the heart,
- use two gaffs for big fish, the second through the mouth,
- it is advisable to lift the fish's tail to help haul it on board,
- carry out all subsequent handling on the foam pad or mat.

KILLING

On arrival in Japan, each sashimi-grade tuna will be very closely inspected. Any fish which has not been killed in the way described below, will inevitably be downgraded.

- Once the fish is on board it should be killed immediately
- Stun the fish with a sharp blow to the top of the head, between the eyes, using a fish club or baseball bat.

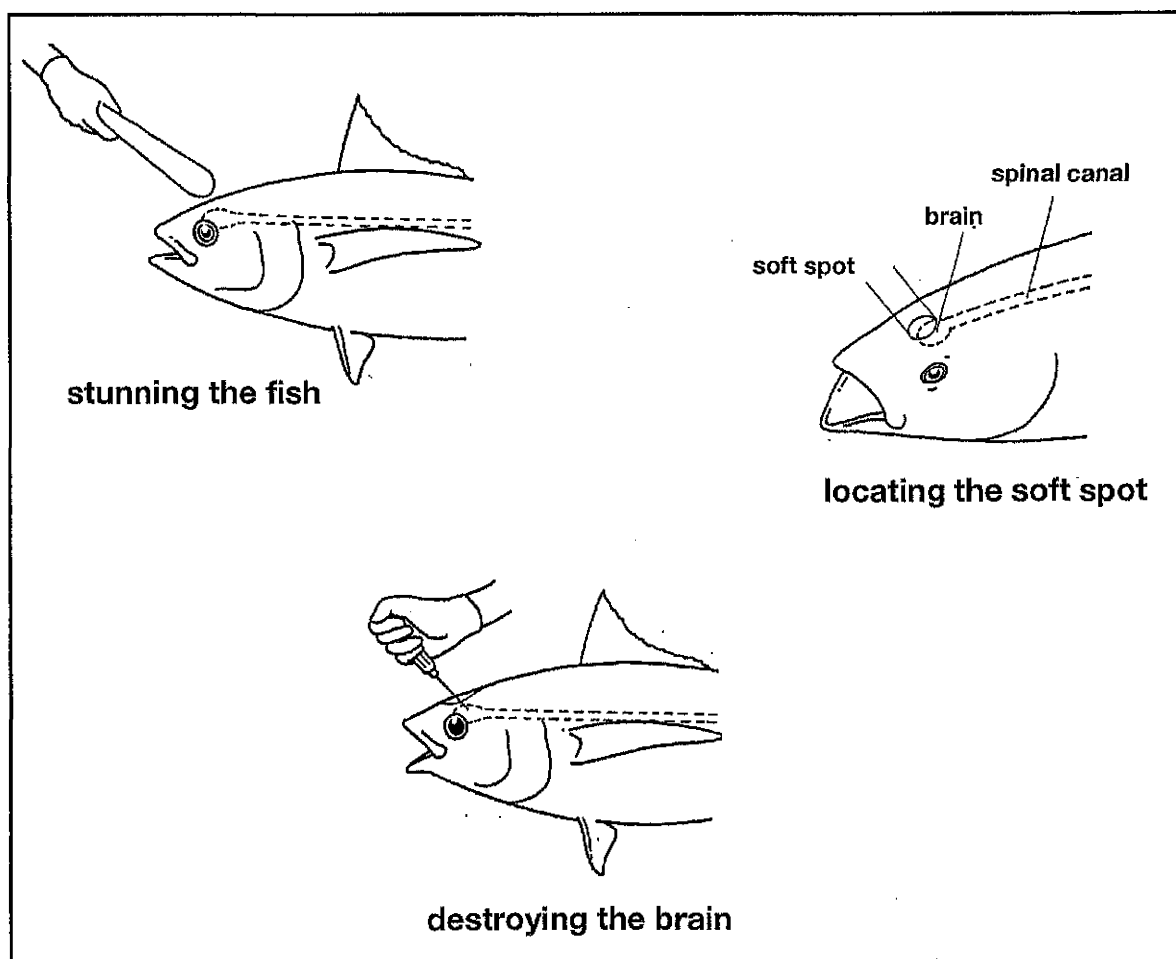


Figure 19.12 Killing

- Locate the soft spot by running your thumb over the top of the head.
- Insert the spike into the soft spot at an angle of 45° . If the spike is inserted in the right place, the fish will give one last shudder (the body will stiffen, the mouth will fall open and the first dorsal fin will open) before going limp. If this does not happen the spiking should be done again.
- The spike should be moved around to destroy the brain until the body stops moving and the jaw goes slack.

THE TANAGUCHI METHOD

Some markets require that you "pith" the fish. To pith the fish means that you insert a wire into the spinal cord as a means of destroying the fish's nervous system. This stops the biochemical reactions that contribute to deterioration of the flesh. This is called the Tanaguchi method, which is done as follows:

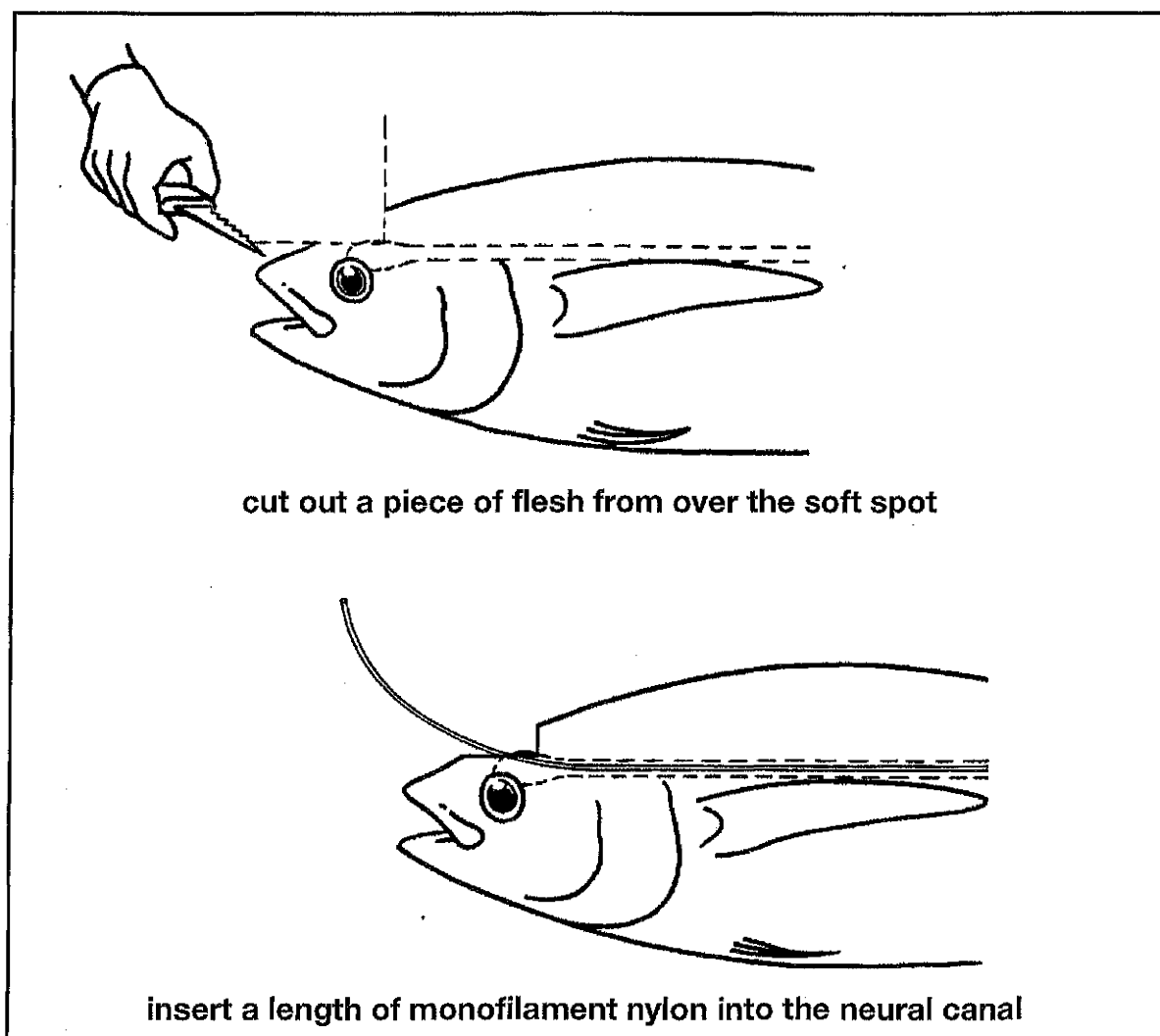


Figure 19.13 The Tanaguchi Method

- Using a saw-edged knife or a small saw, cut out a piece of flesh from over the soft spot to expose the brain.
- Insert a length of ridged monofilament nylon into the brain then drive it further into the neural canal. The fish should give one last shudder.
- Leave the monofilament in the canal but cut it off so that ten centimetres are left exposed, this will prove you have used the Tanaguchi method.

A second method makes it possible to kill and core the fish in a single operation. It may be required in some markets. In this method, instead of using a saw to cut out a portion a sharp knife is used to make a cut 3 to 4 cm long over the soft spot then the wire is inserted as before. With this method the cut on the top of the head is less obvious and the fish therefore has a better appearance.

BLEEDING

Bleeding the fish immediately after killing improves the appearance of the flesh of the fish and helps to keep it fresh. During the tuna's struggle before it is hauled on board the blood becomes "heated" and attains a high organic waste (lactic acid), the temperature of the blood rises up to 35°C in some cases. Bleeding gets rid of the lactic acid and the hot blood, allowing the fish to cool quicker. The flesh will have a better colour and texture and will taste better.

After the brain has been destroyed the heart continues to beat for a few minutes. The bleeding cuts should therefore be made as quickly as possible to allow the last heartbeats to pump the blood out through the cuts.

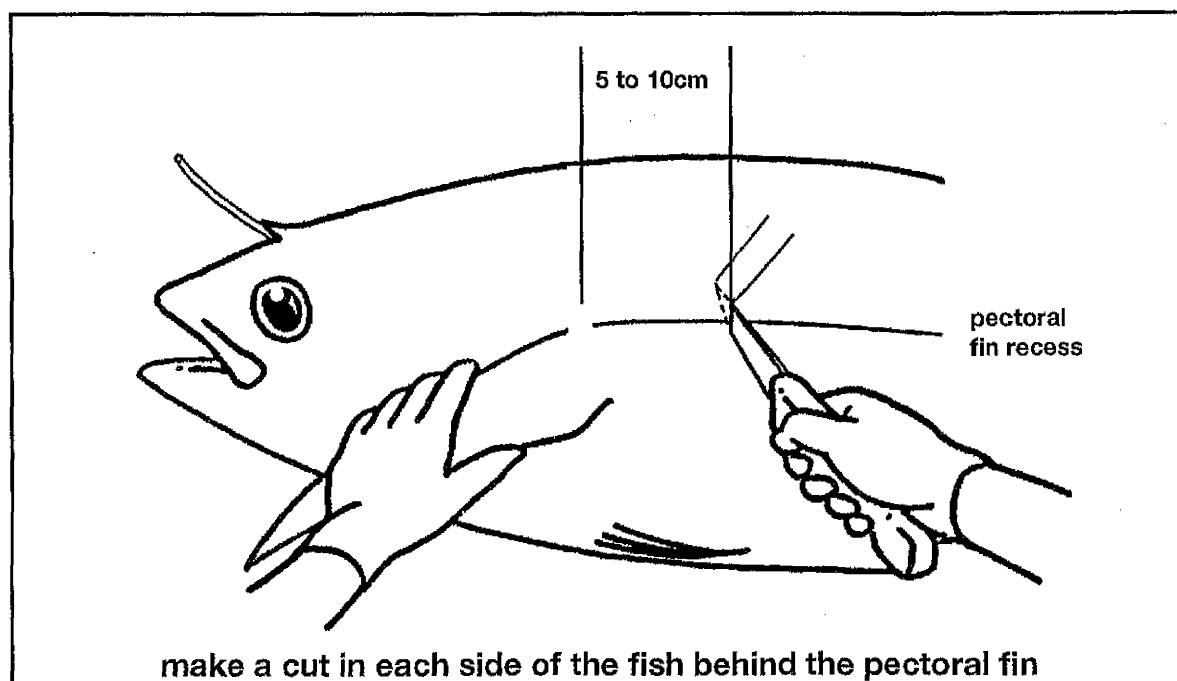


Figure 19.14 Bleeding

Any sashimi-grade tuna specialist will recognise a tuna that has not been properly bled through the presence in the flesh of dark red veinlets.

To bleed the fish follow these steps:

- Bleed the tuna by making a cut in the side of the fish with a knife, five to ten centimetres behind the base of the pectoral fin. The cut, two centimetres deep at most, should be made perpendicular to the pectoral fin recess, on both sides of the fish. Blood should flow freely from these cuts.
- Leave the fish to bleed for five to ten minutes.
- Making an additional cut through the membrane located behind the gills can facilitate bleeding.

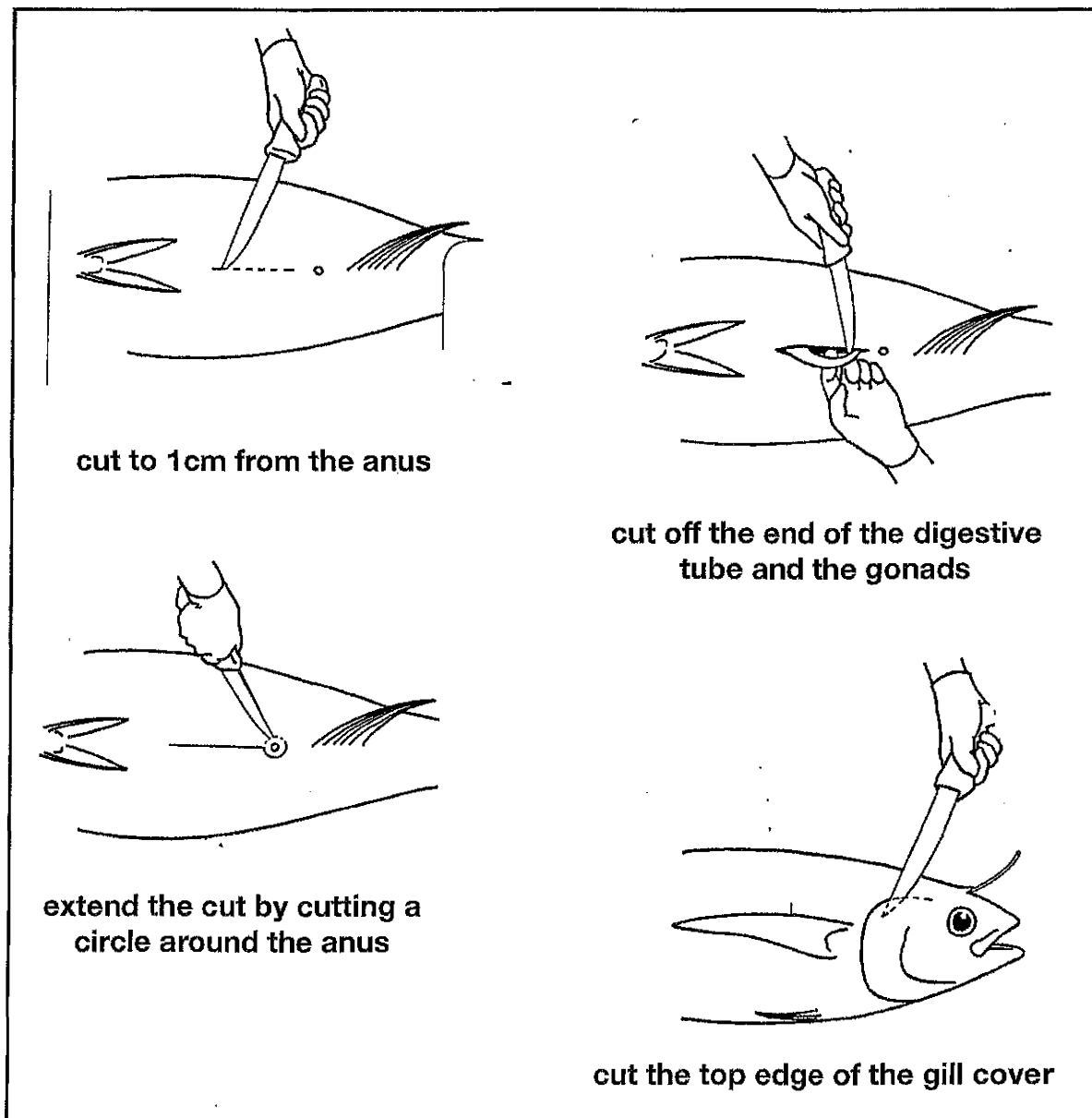


Figure 19.15 Gutting - Belly Cut

GUTTING

The internal organs, intestines and gills etc. contain a lot of bacteria that accelerate spoilage. They should be removed completely as quickly as possible as follows:

- Make a cut ten to fifteen centimetres long in the fish's stomach up to one centimetre in front of the anus. This cut should be made in the direction, in which the scales lie, in other words, towards the anus.
- Pull the digestive tube and gonads out through this cut.
- Cut the end of the digestive tube and gonads close to the anus.

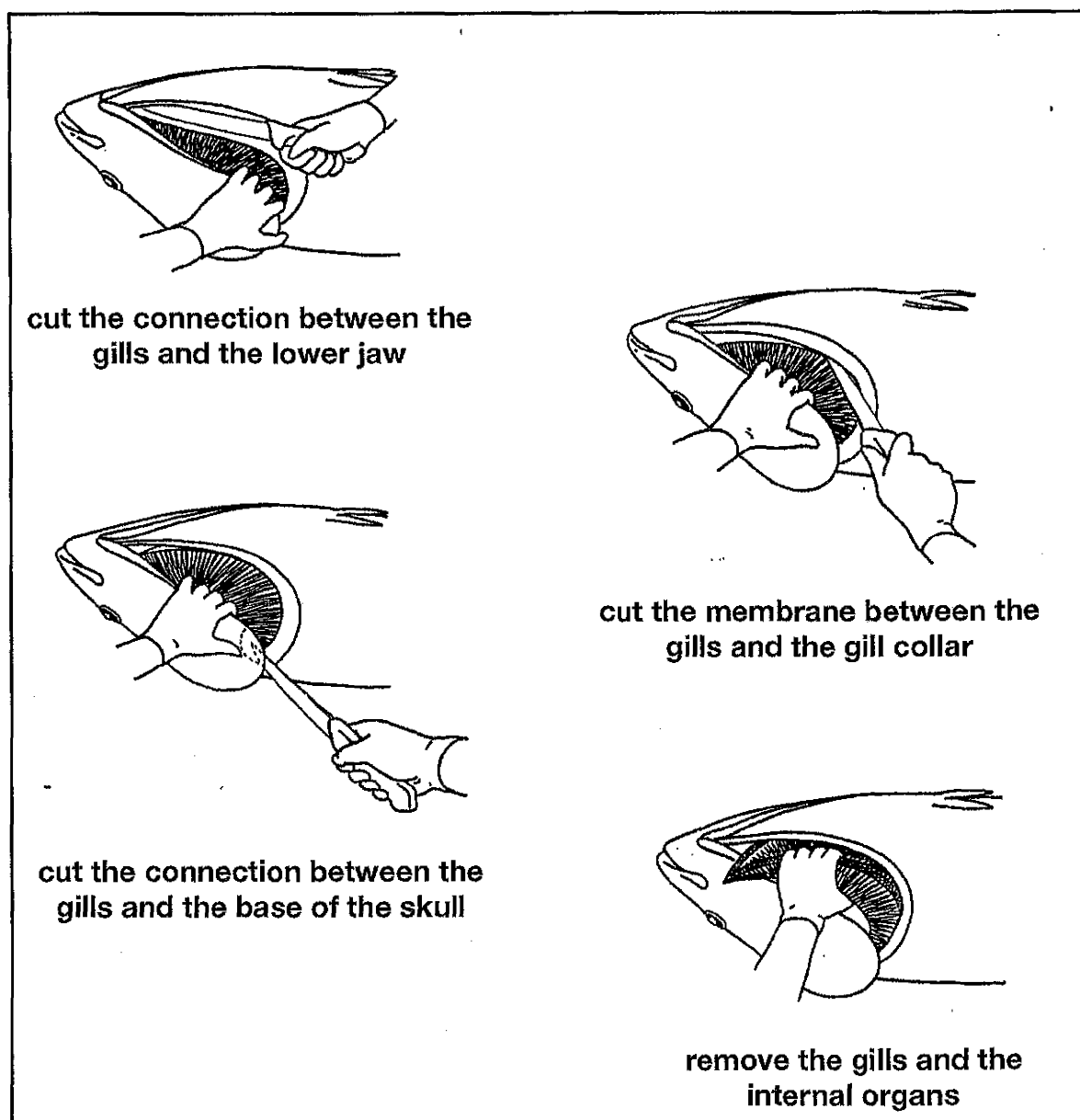


Figure 19.16 Gutting - Gills and Guts Removal

- Another method involves making a ventral cut the same length as above but instead of stopping at the anus the cut is extended to circle the anus which is removed without severing the tube and gonads. This method means you don't have to cut the intestines and thus reduces the spread of bacteria from inside the guts where they are plenty of them.
- With the gonads and digestive cut, insert a knife behind the gill cover and slide it about 10 cm towards the eye, then repeat the procedure the other side. Having these cuts will give better access to the gill cavity.
- Cut the connection between the gills and the lower jaw.
- Cut the membrane between the gills and the gill collar along its whole length on both sides of the fish.
- Cut the connection between the gills and the base of the skull
- Remove the gills and internal organs in one piece through the gill opening. This stage is sometimes made difficult by the presence of membranes connecting the gonads to the abdominal wall.
- Rinse thoroughly.

CLEANING

It is now important to ensure all the blood and parts of intestines, gills etc are completely removed and the interior of the fish is clean. To do this:

- Carefully cut the membrane adhering to the gill collar. With the knife, scrape the edge of the collar until you get down to the white bone. This membrane turns black if it is not removed, giving the fish an unhealthy appearance.
- Remove all pieces of flesh, tendon and membrane from the gill cavity.
- Scrub the base of the skull and the vertebrae with a brush, so as to remove all coagulated blood and kidneys.
- Scrub the inside of the abdominal cavity without removing the white membrane that covers the backbone.
- Carefully rinse the fish inside and out
- The fish is now ready to be placed in slurry or ice.

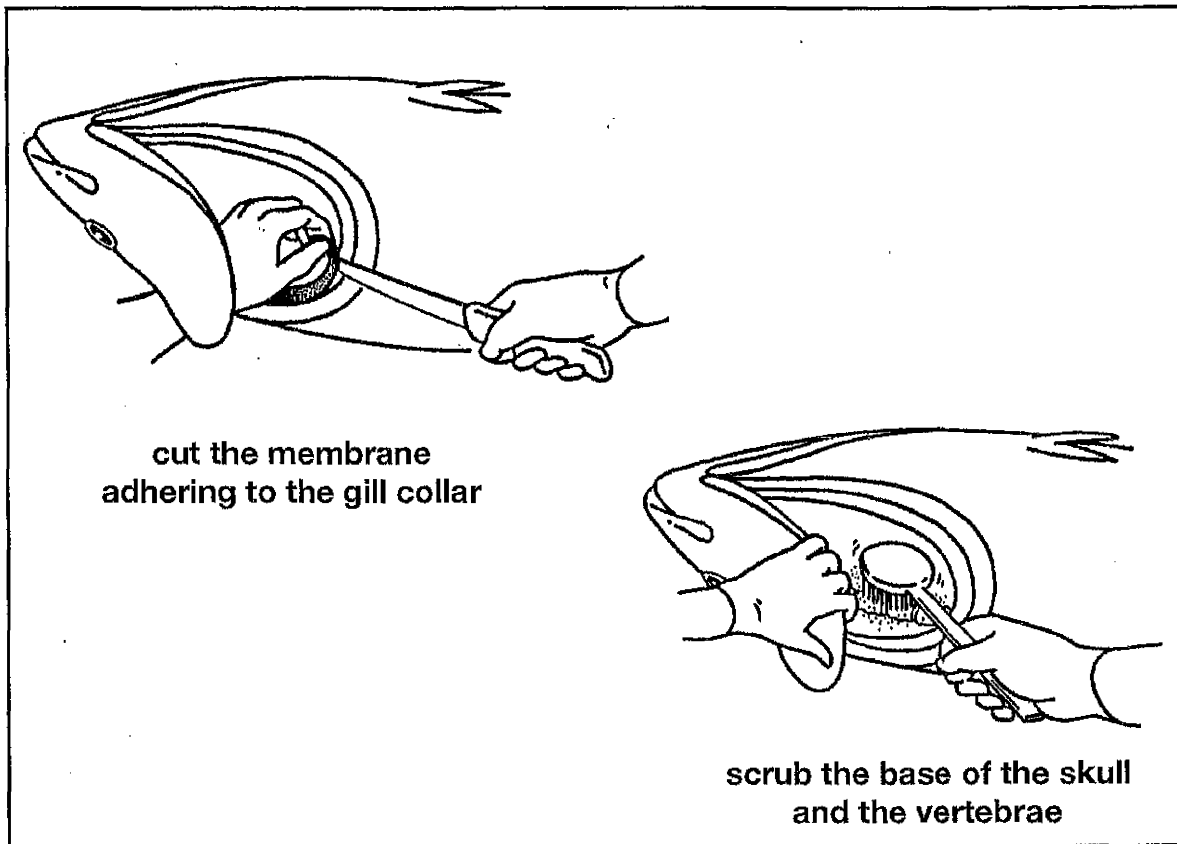


Figure 19.17 Cleaning

CHILLING

To obtain a top quality product it is essential to chill the big tuna as soon as possible. As we have seen in earlier sections the quickest way of reducing the temperature is to use ice slurry. As the tuna are big fish they will take a lot of cooling so it will be necessary to continually check the slurry, add more ice as it melts and stir the slurry. Some practices wrap the tuna carcass in mutton cloth to protect the skin from blemish. Remember do not leave the fish too long in the slurry before repacking it in ice as this would cause the eyes to go white.

During this module you will receive practical instruction on chilling and handling sashimi quality fish.

TEACHING NOTES

MATERIALS

Videos:	An icy tale. (SPC)
	On-board Handling of sashimi grade tuna. (SPC)
Poster:	SPC poster, "Assessment of quality."
Fish:	Some general fish species are needed for quality assessment, chilling and slurry sessions and some tuna are needed for the sashimi sessions. For the assessment practical exercise some fish should have been left out of ice for some days in such a way that some are fresh, some not so fresh and some are spoiled.
Ice:	A good quantity of good quality flake ice. If block ice is available, use a couple of blocks to show the difference.
Iceboxes	
Thermometer	
Buckets	
Suitable knives	
Scrubbing brush	
Cotton gloves	
Tanaguchi monofilament	
A good source of clean water	

LESSON PLANS

This module, including practical sessions, can be taught over one complete day or over two separate half days. The contents of this module have been extrapolated from the SPC manual "Fish Handling and Chilling". Teachers may follow this as it is written or, an alternative method of delivery might be:

Session 1.

- Start by showing the video, "An Icy Tale" This will give them a laugh and lead into what follows
- Define quality and explain why it is important on all boats regardless of the market they are servicing.
- Using OHP Fig 19.2 to explain that there are several ways of preserving fish, from canning, salting, drying and marinating to chilling and freezing and it is the latter we will deal with. During this part of the lesson emphasise the differences between what we are doing on inshore boats and what will be done on commercial and foreign boats. (i.e. longliners freezing at sea and purse seiners using refrigerated sea water)
- Explain the causes of spoilage and how reducing the temperature can control it, use OHPs Fig 19.3 to Fig 19.5. Explain the differences between chilling and freezing and the relative temperatures of each.
- Explain that we have to be able to determine how badly a fish is spoilt and assess the condition. Use OHP Fig. 19.1 to list the indicators of spoilage.
- Conduct a short practical session on assessing the quality of fish. Split the class into groups of four and have them grade several fish using the assessment guide.

Session 2

- Explain how temperature controls spoilage and the four parameters of care. (temperature, time, care and hygiene)
- Explain, although larger boats working away from port for long periods will freeze fish, most local boats will use ice.
- Explain the advantages of ice and the types of ice (OHP, Fig. 19.6).
- Explain how to make up a sea-water/ice slurry and explain the advantages and disadvantages of this (OHP Fig. 19.9)

- Explain the way to ice fish properly. (OHPs Fig 19.7 and 19.8)
- Go over the various preferred ways of handling fish when using different fishing methods e.g. when trolling, FAD fishing, bottom fishing and catching larger fish for overseas markets. Explaining how spiking, slurry and icing is used in each case.
- Explain about care after catching.
- Conduct a practical to compare the effectiveness of slurry against straight ice, as follows:
 - Show the students how to prepare a slurry. Use a bucket to demonstrate a ratio of two buckets of ice to one of water. Indicate that the icebox should only be half filled to allow space for fish and the chance of circulation.
 - Compare the effectiveness of slurry against ice by having the students put their hands in each and seeing which gets colder faster. If a thermometer is available measure the core temperature of two similar sized fish then put one in slurry and one in ice. Measure the core temperature every ten minutes to demonstrate the effectiveness of the slurry.
 - If more fish are available have the students pack a complete icebox insisting on the correct procedure as previously described (i.e. put a layer of ice then big fish first. Put them belly down, then completely cover with ice and repeat until box is filled, ensuring no fish touch the sides of the box or each other.)
- If time permits, to finish a half day session, re-show the video "An Icy Tale" then split them into small discussion groups to answer the questions:
 - What did the fisherman do wrong?
 - When buying fish from the market how can you tell good fish from bad?
 - What is the purpose of slurry and how do you make it up?
 - What happens if you leave the fish in the slurry too long?
- Post the results to the questions around the class, confirm the correct answers and sort out any errors and misinterpretations.

Session 3

- Show the SPC video, "On-board Handling of Sashimi Grade Tuna"
- Explain the value of fish on the sashimi market and the desired species.
- Explain what makes a fish valuable, both biological and non biological (OHP Fig 19.10)
- Using OHPs Figs. 19.11 to 19.17 explain the procedures under the headings:
 - Gaffing and landing.
 - Killing.
 - The Tanaguchi method.
 - Bleeding.
 - Gutting.
 - Cleaning.
 - Chilling.

Session 4

Conduct a practical on how to handle tuna. This will depend on how many fish are available, although they must be tuna they need not be large sashimi-grade tuna. As much as possible each student should have the opportunity to participate.

STUDENT ASSIGNMENTS

Depending on the literacy of the group these assignments may be done as written exercises on an individual basis or in small groups as described in session 2.

- 1 What are the main reasons a fish spoils?
- 2 How quickly will a fish spoil?
- 3 What is the main way we stop fish spoiling at sea?
- 4 List four steps to take to keep spoilage at a minimum.
- 5 List the advantages and disadvantages of ice.
- 6 Why do we use an ice slurry rather than ice?
- 7 What will happen if we leave the fish in a slurry for too long a time?
- 8 List the things that will tell you a fish is becoming spoiled.
- 9 Explain how you will ice fish and what ratio of ice to fish you will use.
- 10 Explain how you will handle and chill fish when:
 - Trolling,
 - Bottom fishing,
 - Catching big fish for the overseas markets.
- 11 What is iki-jimi and why is it important?
- 12 What is sashimi and what fish are suitable for sashimi?
- 13 What characteristics make one yellowfin tuna better for sashimi than another?
- 14 Describe how you would handle and process a sashimi grade tuna under the headings
 - Gaffing and Landing
 - Killing
 - The Tanaguchi method
 - Bleeding
 - Gutting
 - Cleaning
 - Chilling

LIST OF OHP'S

- Fig 19.1 Assessment of fish quality
- Fig 19.2 General methods of preserving fish.
- Fig 19.3 Thermometers
- Fig 19.4 Storage life of fresh fish
- Fig 19.5 Four factors affecting freshness
- Fig 19.6 Types of ice.
- Fig 19.7 Correct method of packing fish in ice
- Fig 19.8 Incorrect method of packing fish in ice.
- Fig 19.9 Sea-water/ice slurry.
- Fig 19.10 Grading sashimi tuna - size and shape.
- Fig 19.11 Gaffing
- Fig 19.12 Killing
- Fig 19.13 The Tanaguchi Method
- Fig 19.14 Bleeding
- Fig 19.15 Gutting - belly cut
- Fig 19.16 Gutting - gills and guts removal.
- Fig 19.17 Cleaning.

	HIGH QUALITY	MEDIUM QUALITY
Eyes	Eye clear, black stands out from head, surface of eye convex.	Eye about 50% cloudy. Surface of eye slightly concave.
Body colour	Body colours bright.	Body colours dulls.
Gill colour	Gills bright pink/red. No slime.	Gills brown, small or medium amount of slime (clear).
Smell	No 'fish' smell or slight 'seawater' smell.	Definite 'fish' smell.
Flesh texture	Firm and elastic (springs back quickly on pressing).	Flesh soft (doesn't spring back fully on pressing).

OHP 19.1

ASSESSMENT OF FISH QUALITY

POOR QUALITY

Eye opaque/brown.
Severely sunken.

Body colours dark -
not visible.

Gills brown/putrid.

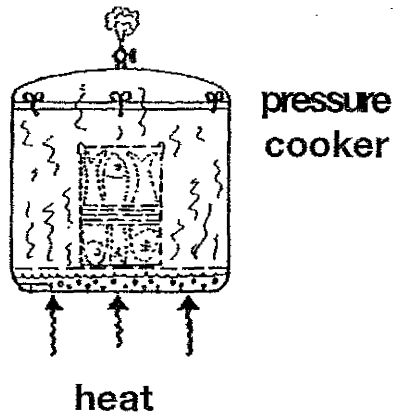
Pronounced putrid
odour.

Flesh falling away
from carcass. Very soft
texture.

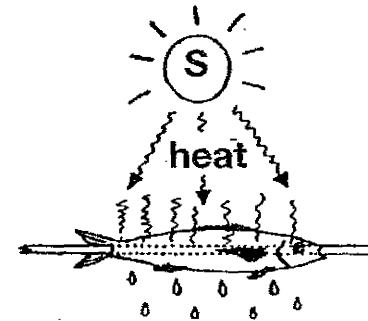
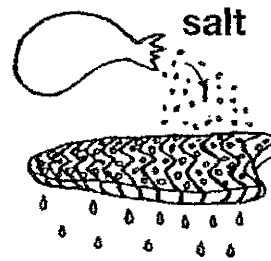
OHP 19.2

GENERAL METHODS OF PRESERVING FISH

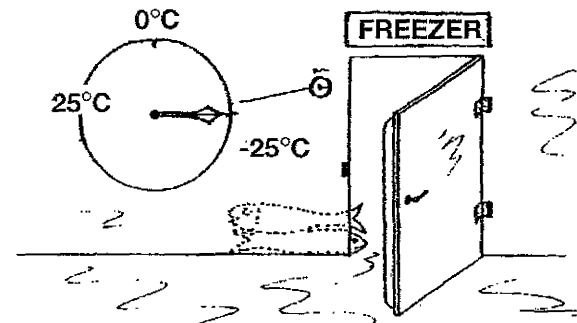
CANNING



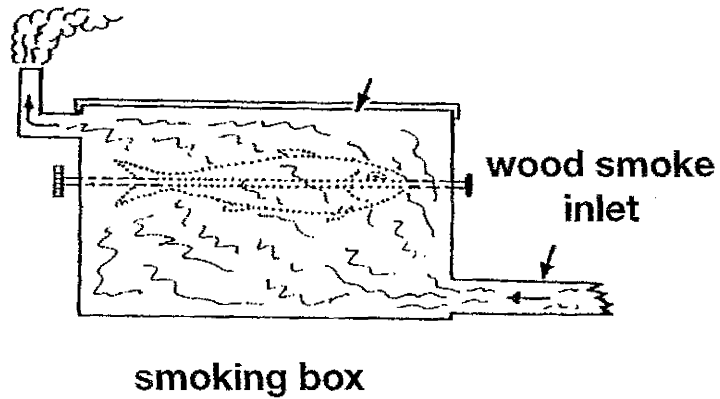
SALTING AND DRYING



FREEZING

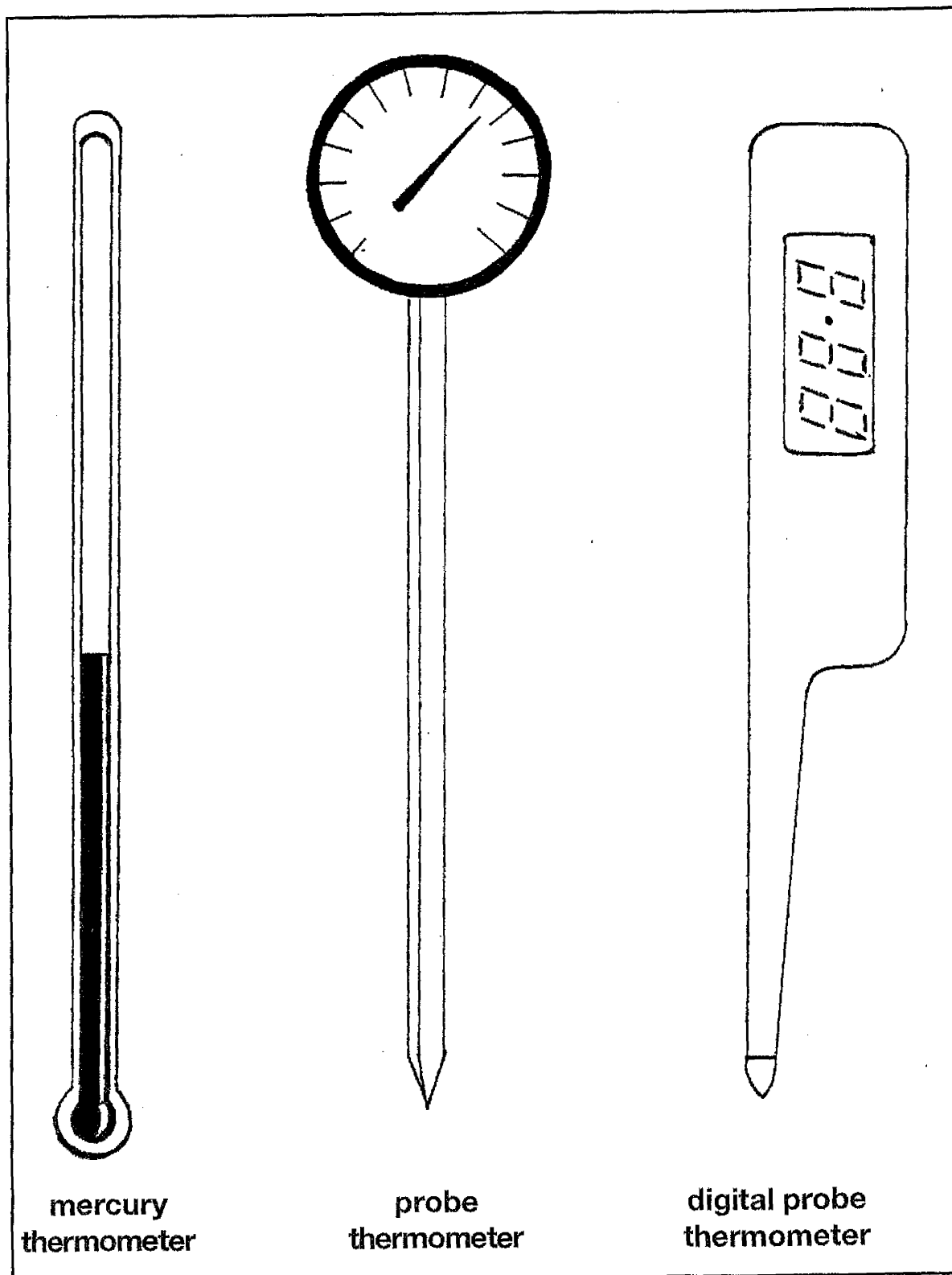


SMOKING



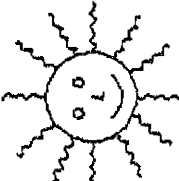

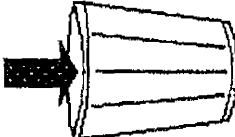
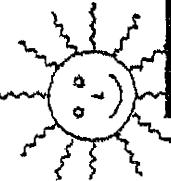

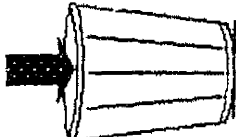




OHP 19.3

THERMOMETERS



OHP 19.4

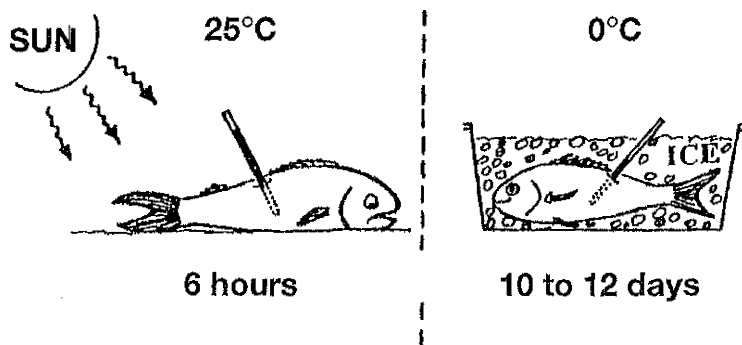
STORAGE LIFE OF FRESH FISH

fish left in the sun	 25-35°C 	 6-8 hours		
fish covered with banana leaves	 15-20°C 	 12-16 hours		
chill store (no ice)	 5-10°C		 4-5 days	
chill store (with ice)	 0°C			 10-12 days

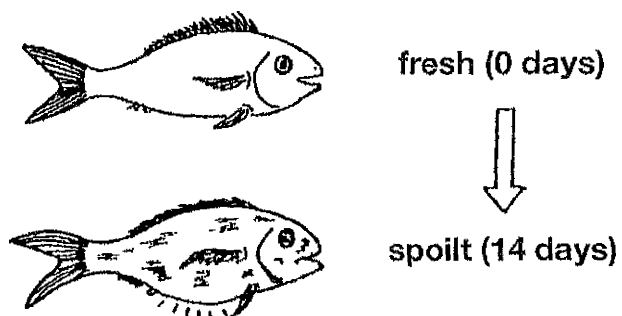
OHP 19.5

FOUR FACTORS AFFECTING FRESHNESS

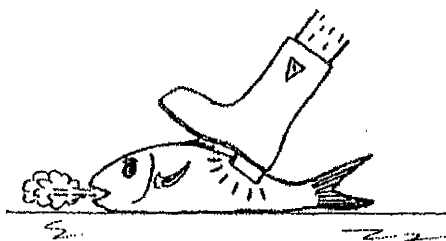
1. TEMPERATURE



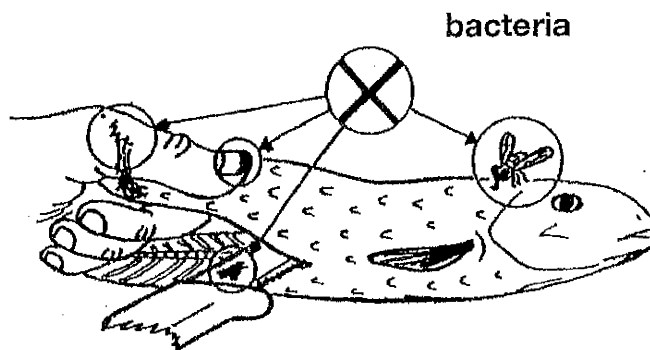
2. TIME



3. CARE



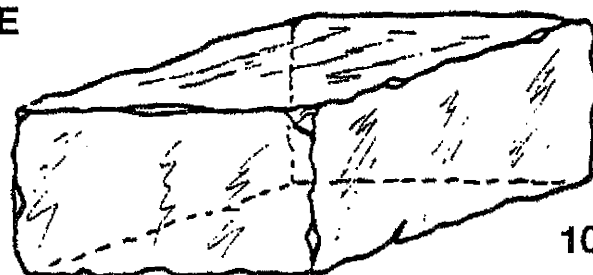
4. HYGIENE



OHP 19.6

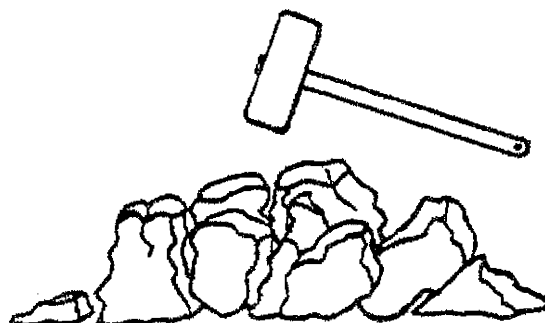
TYPES OF ICE

BLOCK ICE

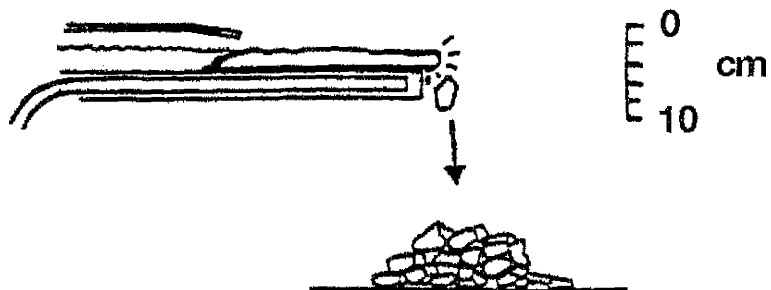


10 to 20kg

CRUSHED BLOCK ICE

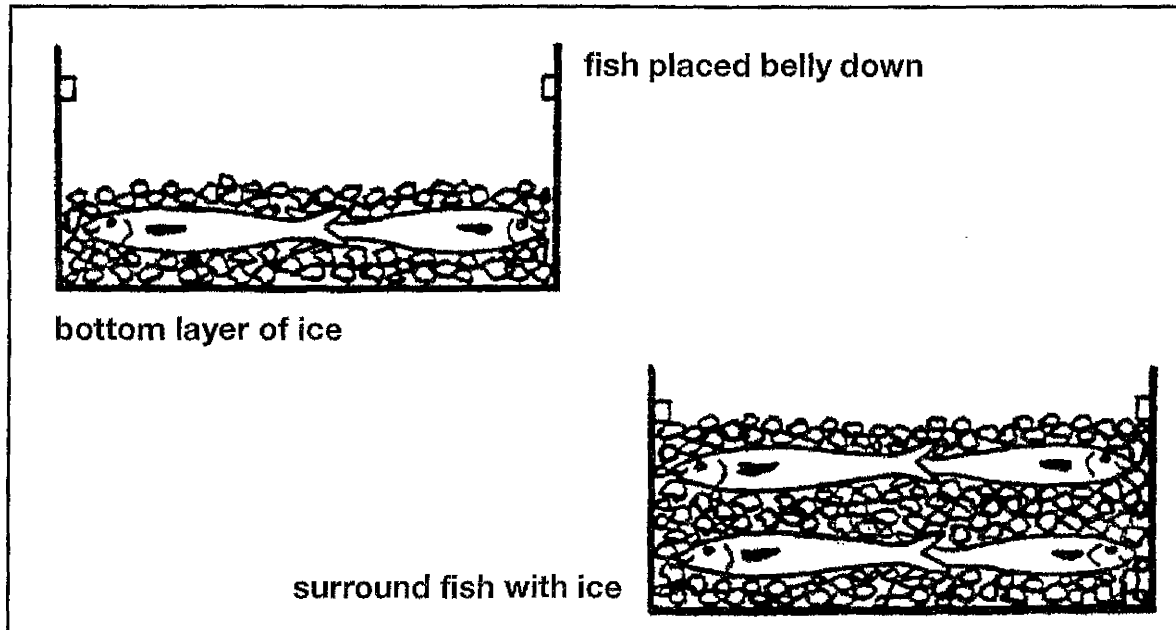


FLAKE ICE

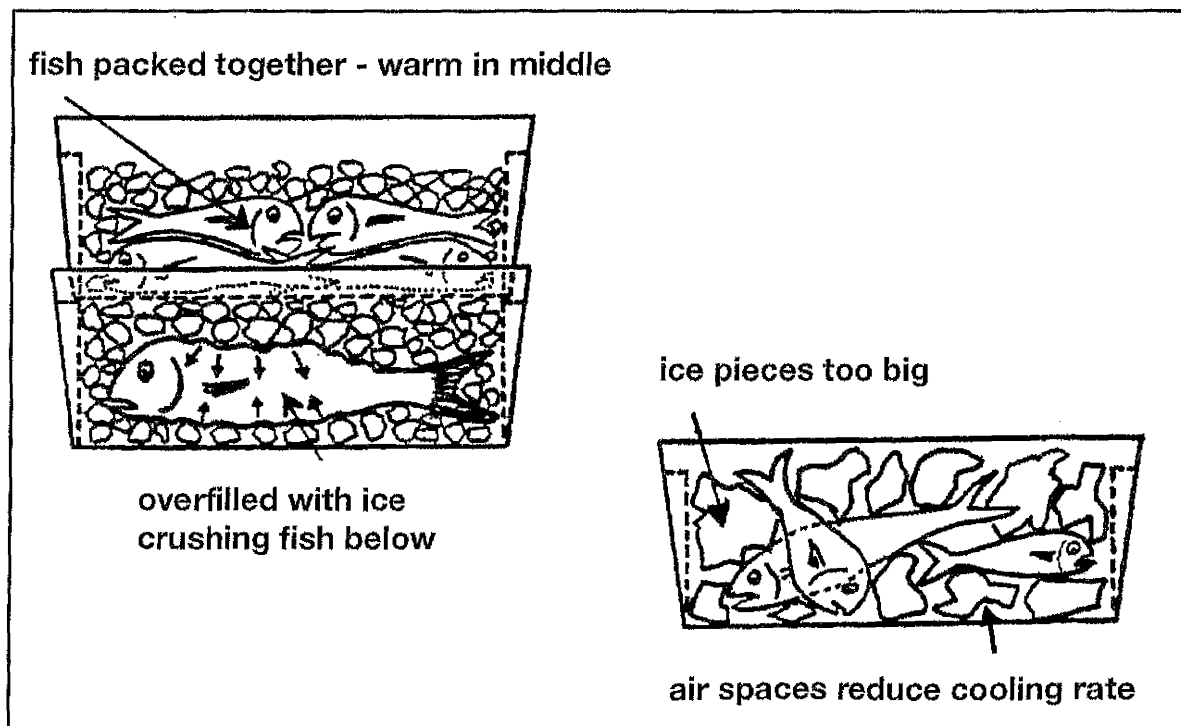


OHP 19.7/19.8

CORRECT METHOD OF PACKING FISH IN ICE

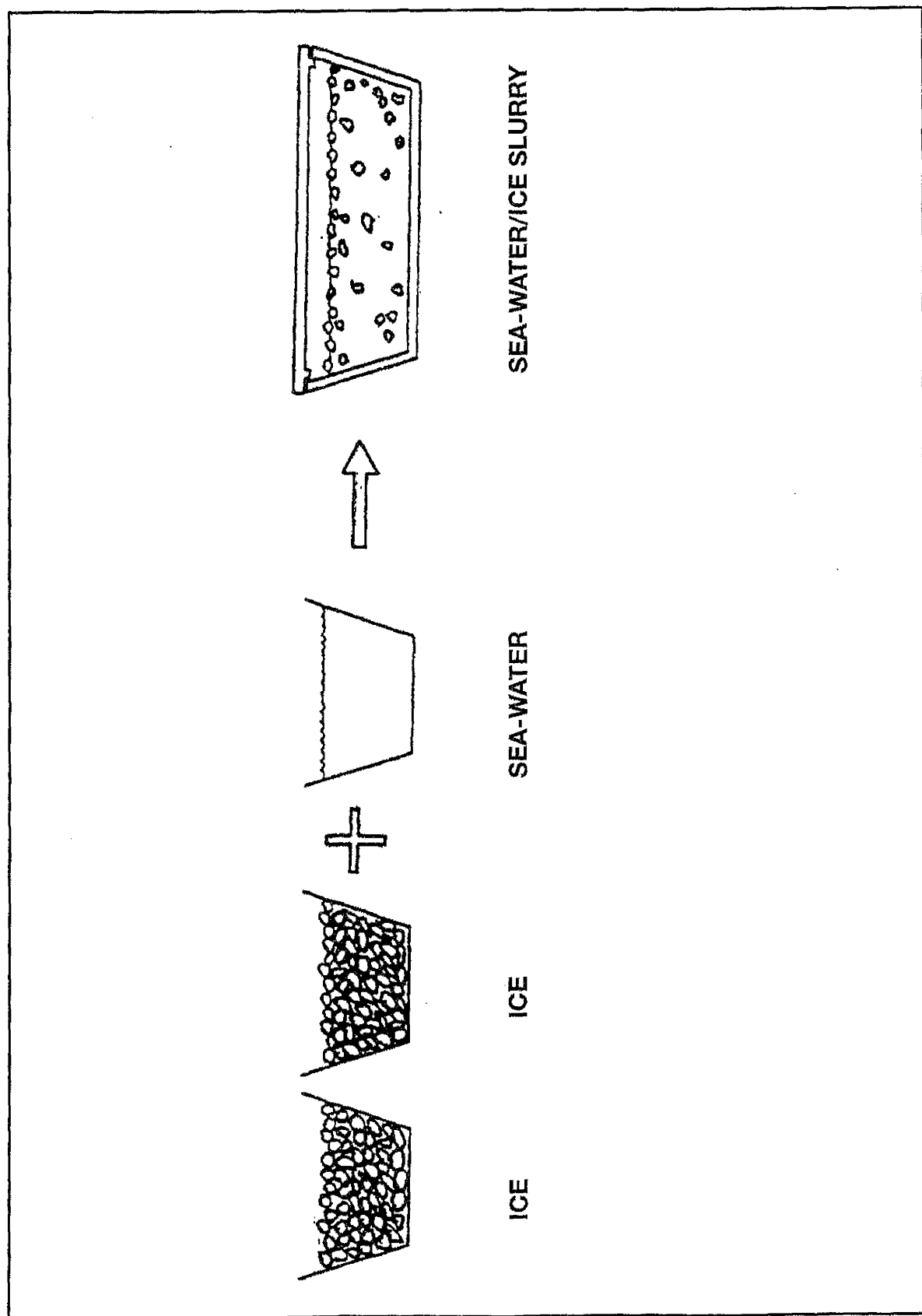


INCORRECT METHOD OF PACKING FISH IN ICE



OHP 19.9

SEA-WATER/ICE SLURRY

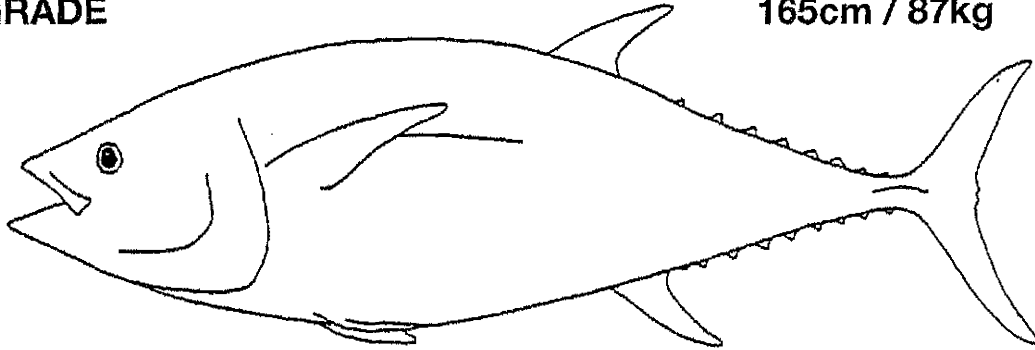


OHP 19.10

GRADING SASHIMI TUNA - SIZE AND SHAPE

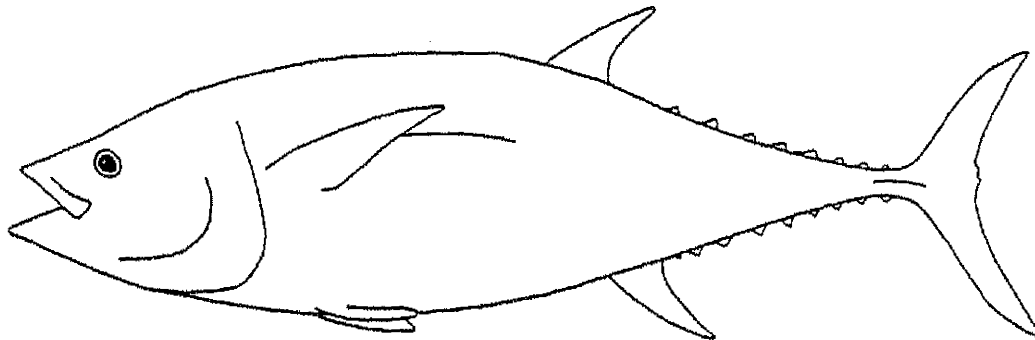
A GRADE

165cm / 87kg



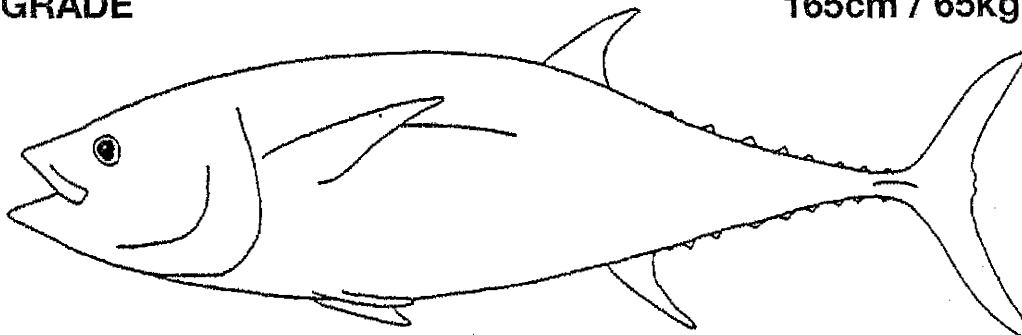
B GRADE

165cm / 75kg



C GRADE

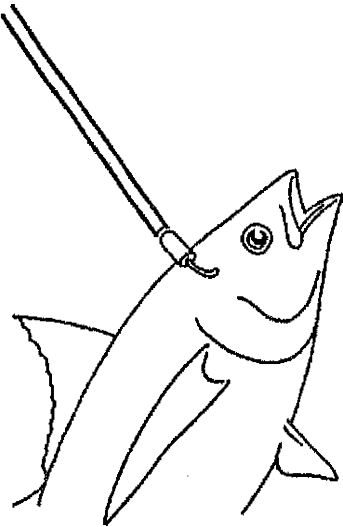
165cm / 65kg



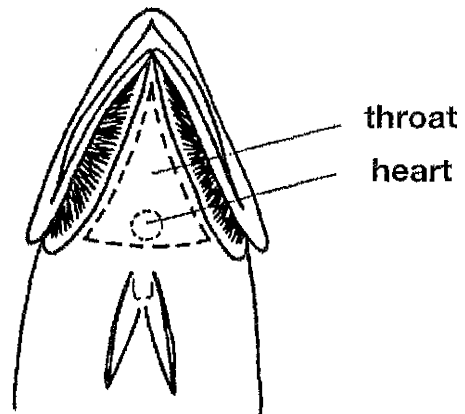
Note that grading here is based on shape alone

OHP 19.11

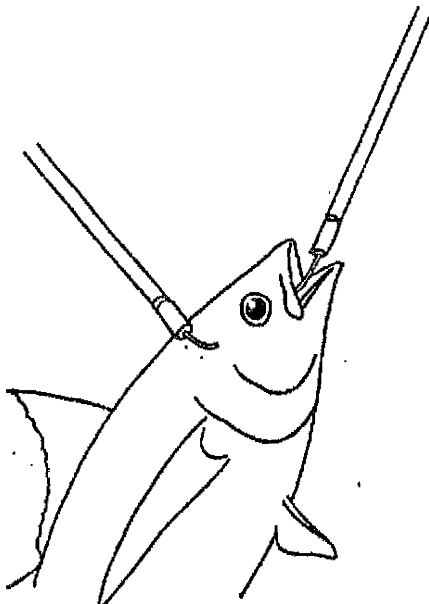
GAFFING



**always gaff the fish
through the head**



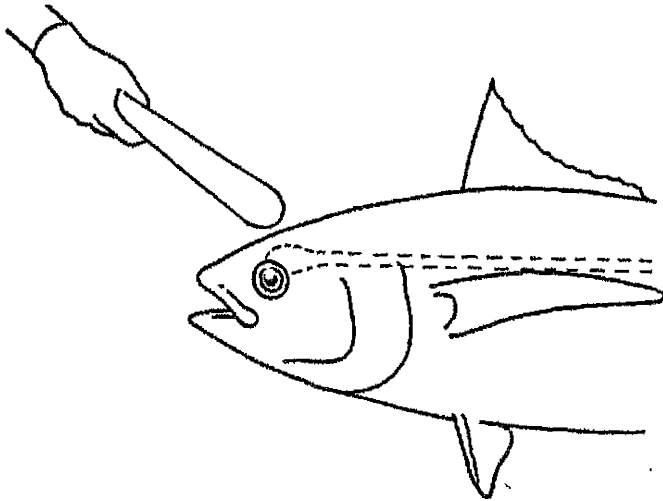
**never gaff the fish through
the throat or in the heart**



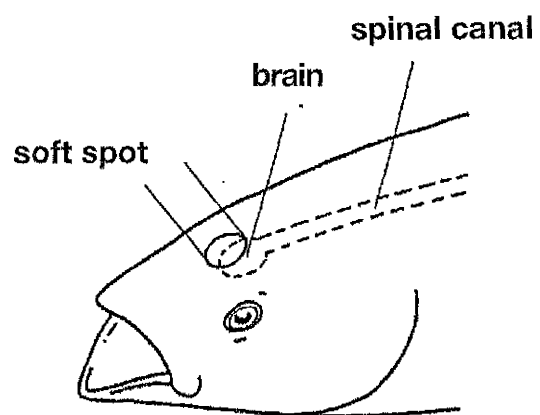
use 2 gaffs for big fish

OHP 19.12

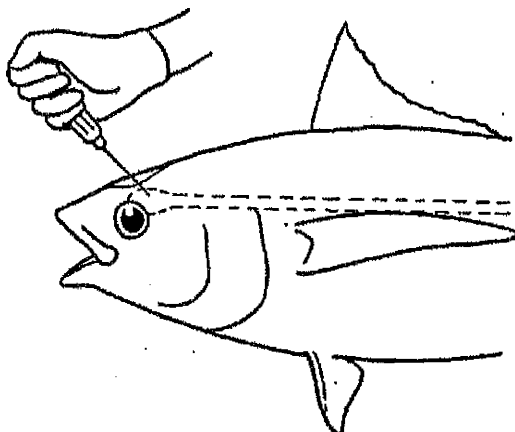
KILLING



stunning the fish



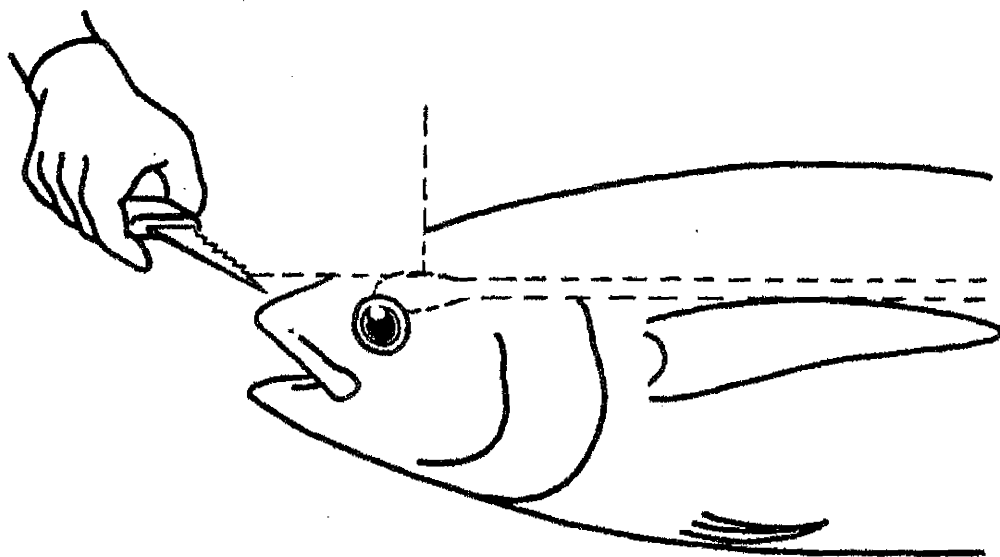
locating the soft spot



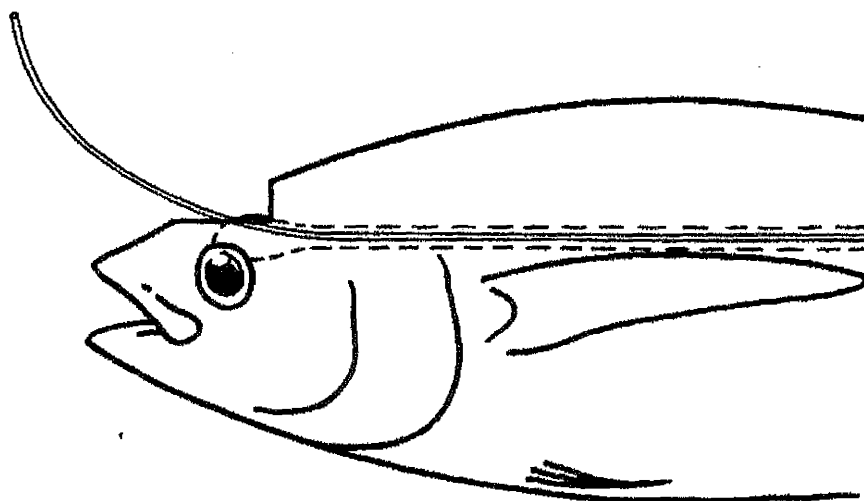
destroying the brain

OHP 19.13

THE TANAGUCHI METHOD



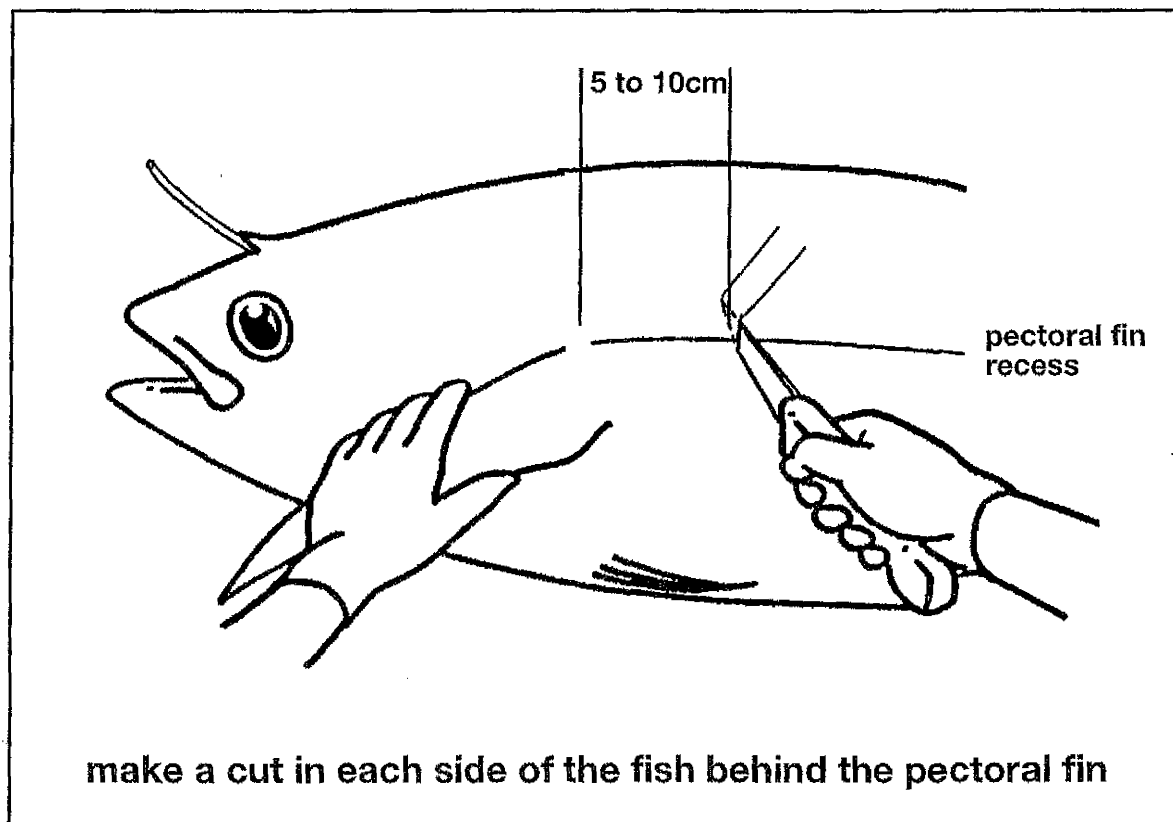
cut out a piece of flesh from over the soft spot



insert a length of monofilament nylon into the neural canal

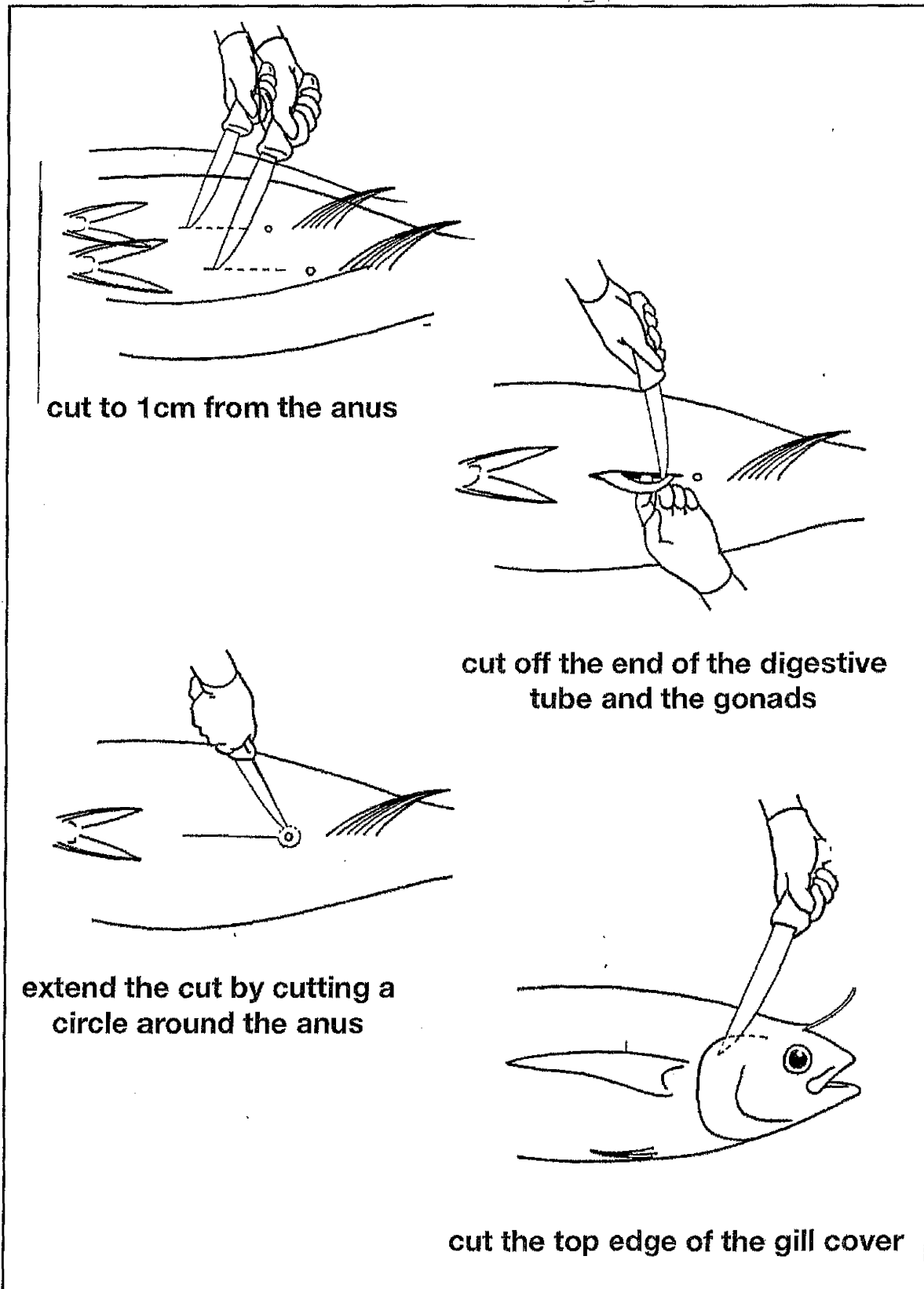
OHP 19.14

BLEEDING



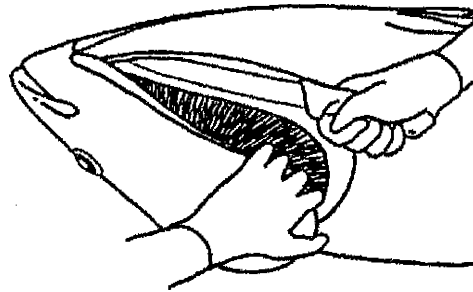
OHP 19.15

GUTTING - BELLY CUT

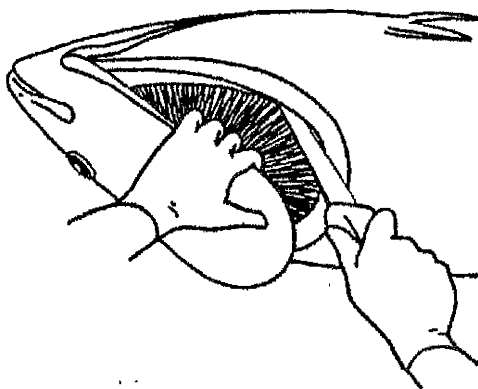


OHP 19.16

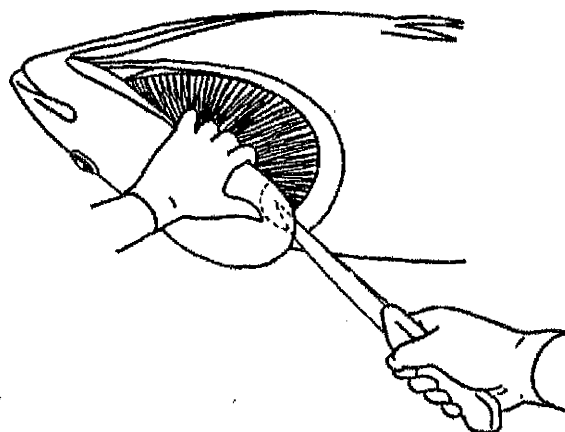
GUTTING - GILLS AND GUTS REMOVAL



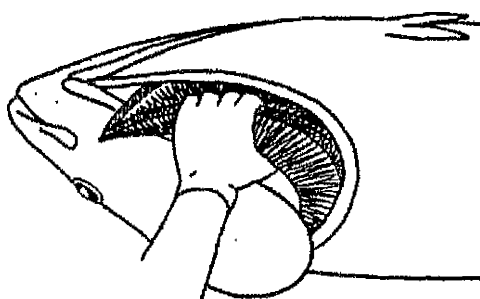
cut the connection between
the gills and the lower jaw



cut the membrane between
the gills and the gill collar



cut the connection
between the gills and the
base of the skull



remove the gills and the
internal organs

OHP 19.17

CLEANING

