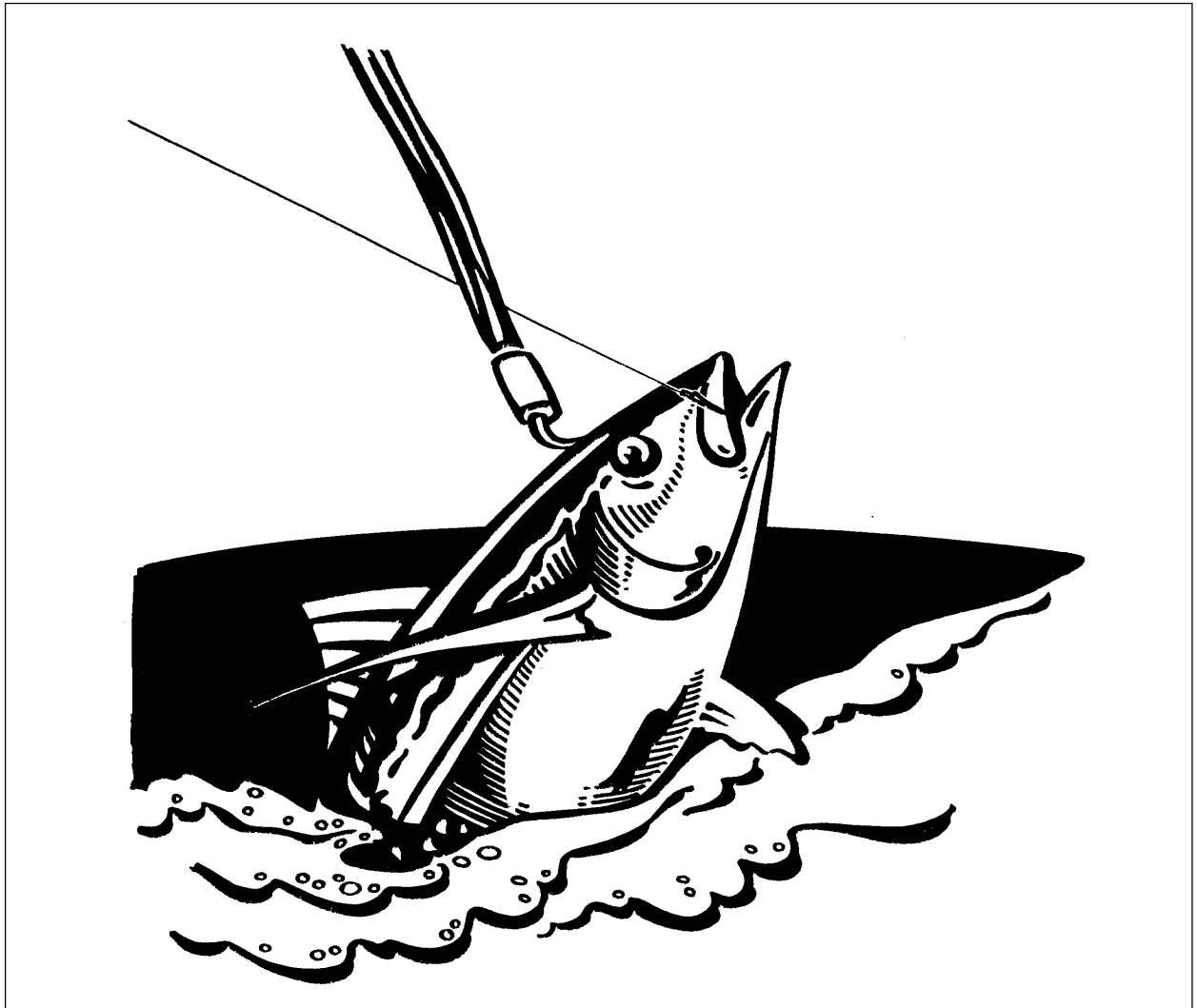


Module 3

FISH HANDLING AND CHILLING



INTRODUCTION

The price a fisherman obtains for his catch 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 a wholesaler), supply versus demand, and most important, the **quality of the fish**.

In this module, we will explain the concepts of fish quality and fish spoilage, and will teach the handling and chilling techniques that every FAD fisherman should follow to ensure that he gets the maximum return for his catch.

The last section of the module will cover the basics of tuna handling for the sashimi market. It is intended for those fishermen whose countries export sashimi-quality tuna overseas.

1.1 What is quality?

Often you may talk about quality fish as being fresh or being safe to eat. You may also say that quality fish is fish in good condition, and choose to select quality fish to eat. However, none of these references to quality indicate what quality is.

Whenever a customer buys a product, whether it be a pair of shoes, a meal or even a car, he makes an assessment of that product in his mind. If it is a car, he may ask if it will meet his needs: Can it pull a trailer or boat? Can all the family fit in it? Is this product suitable for my needs? etc.

POINT TO NOTE!

Quality is a measurement made by the customer on the suitability of a product for its purpose or use.

Similarly, when a customer buys your fish he 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 the customer buys your fish and keeps it in his fridge for two days and it does not smell, and then he cooks it and finds the fish has good flavour and is easy to cook, he will say that your fish was of ‘good or high quality’: it was suitable for the use, which was to store, cook and enjoy.

1.2 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 marketing operations the exporting country must meet the quality standards of the importing country.

Any shipment of fish which does not meet these quality standards may mean that the importing country will stop buying from the supplying company or country.

POINT TO NOTE!

Fish export markets require the shipment of products of **sustainably high quality**.

Domestic markets:

In many tropical countries there is a need to improve the quality of fish for home consumption. These improvements should aim to ensure that more 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 is different and usually very high.

This customer (the wholesaler or fish market) knows that high quality fish will be easy to sell because it looks attractive and will last for a long time **stored in ice** before it starts to deteriorate.

POINT TO NOTE!

For a fish market or wholesaler to meet the quality needs of their customers, the quality of the fish they receive must be of a high standard.

1.3 The assessment of quality

As mentioned previously, for the average person purchasing fish for cooking at home, 'quality' means that the fish looks good, feels good, smells good, and makes a satisfying meal.

Looks good means that the fish looks alive—as if it has just come from the sea. Colours are **bright and clear**, the flesh is **glossy and transparent**, the body is **undamaged**. It does not look dull or dried-out.

Feels good means that the flesh is **firm and pliable**, rather than soft.

Smells good means that there is either **no smell** or a very slight '**sea**' smell. There is no strong 'fish' smell or bad odour.

The ultimate test comes with the eating of the fish. 'Quality' here means that it tastes good and has no ill-effects afterwards.

Tastes good means that it not only has a **delicious taste**, but also that the texture is right. The flesh is **firm, yet tender**. Of course, poor cooking can ruin the meal—no matter what the quality of the fish.

Seafoods, like other meats, are subject to **bacterial contamination**, and care must be taken in selection, handling, preservation and cooking. Also, some species of fish are known to be **ciguatera** which means they carry a poison very harmful to human beings. Only reef fish have been found to carry the ciguatera poison, so most fish caught around FADs are safe to eat (however, big barracudas can be poisonous, even if hooked nearby a FAD!).

PRACTICAL on the assessment of fish quality

Material required:

- a first lot of 'high' quality fish;
- a second lot of 'medium' quality fish;
- a third lot of 'poor' quality fish;
- large sheets of paper;
- markers;
- masking tape.

Procedure:

1. Split the trainees into smaller groups (max. 4 groups), and distribute to each group one fish from the three lots. Ask trainees to grade the three fish ('high', 'medium', 'poor' quality) and to list, for each quality, the characteristics of the following parameters: eye, body colours, gill colour, smell, flesh texture.
2. One trainee of each group to read the list of characteristics as found by his group. Attach lists to the wall of classroom.
3. Photocopy and distribute Quality Assessment Form (AV 3.1), compare with trainees' lists and discuss.

AV 3-1

QUALITY ASSESSMENT FORM

	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 dull.	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.

2 FISH SPOILAGE

Unlike quality, spoilage is not a measure. It is both a process and a result. The process of spoilage starts in the last stages of quality deterioration. In other words, **spoilage starts when quality is low**.

Once the quality is gone completely (the product is unsuitable for the purpose or use), it is usually spoiled.

When we are talking about a fish which is intended for enjoyable eating, then a spoiled fish is that which is unfit for consumption.

POINT TO NOTE!

In general we can describe spoilage as:

‘the combined effect of all deteriorative processes which result in products becoming unacceptable for human consumption’.

Fish is one of the most perishable of all foods. From the moment it is taken from the water a series of deteriorative changes start to occur. These changes occur rapidly and will eventually render the fish ‘spoiled’.

2.1 The main causes of fish spoilage

AV 3-2.1

Spoilage of fish occurs for **two** main reasons:

Microbial spoilage

This is by far the most significant type of fish spoilage.

Some microorganisms (called **bacteria**) are present on the **gills**, in the surface **slime** and in the **intestines** of live fish, but not in the flesh which is sterile. Soon after death, bacteria on the skin, surface slime and intestines multiply rapidly and start entering the flesh. The bacteria continue to multiply inside the flesh, producing a strong unpleasant odour, and thus the fish becomes spoiled.

POINT TO NOTE!

The spread of bacteria into the flesh is more rapid if the fish has been **damaged** (e.g. gaffed through the flesh, thrown on the deck) or **carelessly gutted and cleaned**.

Autolytic spoilage (or 'self digestion')

This type of spoilage is caused by the **digestive enzymes** of the fish itself. These substances are present in the living fish and serve in a controlled manner to assist in the digestion of food. However, when the fish dies the enzymes continue to operate in an uncontrolled manner, so that the gut cavity lining is eventually broken down and the surrounding flesh is attacked.

This type of spoilage results in discoloration, off-flavours, and changes in the texture of the flesh. Ultimately, the belly area will go brown and soft and may even split (giving the condition known as '**belly burn**').

POINT TO NOTE!

As with microbial spoilage, the risks of autolytic spoilage is higher with damaged and carelessly gutted fish.

2.2 The control of fish spoilage

As mentioned previously, fish and other seafood spoil very quickly if they are not handled and treated properly. Understanding the reasons why fish deteriorate in quality and then become spoiled helps us to formulate methods to fight these factors. With this knowledge we can use techniques to either preserve the freshness of fish, or treat fish by processing them into consumer products.

Processed products have been treated in such a way that they do not resemble the fresh raw material any longer. Such **processing methods** include canning, smoking, salting, drying, and to some extent freezing.

AV 3-2.2a

POINT TO NOTE!

Canning, smoking, salting, drying, and to some extent freezing are various methods of processing fish into consumer products.

On the other hand, it is possible to preserve fresh raw fish so that it remains fresh, just like when it was caught, for a long period of time. The four key factors to monitor for preserving the freshness of fish are **temperature, time, care** and **hygiene**.

2.2.1 Temperature

Instruments for measuring temperature

Let us first look at the method of expressing different temperatures and some of the instruments that we can use to measure these.

AV 3-2.2b

To understand temperature changes it is convenient to use a measuring scale that indicates a certain number for that temperature. It is common to use the **Celsius** scale (sometimes called the Centigrade scale), often shown as a number followed by °C (degrees Celsius), for example:

100 °C = the temperature of boiling water;
37 °C = the temperature of a healthy adult human;
0 °C = the temperature at which water starts to freeze or ice begins to melt.

This temperature scale is also used to measure temperatures well below the freezing point of water, for instance $-30\text{ }^{\circ}\text{C}$ (minus 30 degrees Celsius) for frozen foods, and much lower.

We can use a number of different instruments for measuring temperature, e.g. a mercury-in-glass thermometer, a dial thermometer, or an electronic one with digital readings. Some of these have long sharp probes that can be inserted into a fish to check its temperature.

The effects of temperature

We know that fish in the tropics are caught in warm ocean waters (for example 25 to $30\text{ }^{\circ}\text{C}$). The agents that cause spoilage (**enzymes** and **bacteria**) like to live in these warm conditions. By cooling the fish, conditions are induced that enzymes and bacteria do not like; they therefore react much slower, and the spoiling procedure will also slow down.

POINT TO NOTE!

Cooling slows down the spoiling procedure and thus preserves the freshness of the fish for longer.

AV 3-2.2c

For example, when cooling is properly done, for every drop in temperature of $5\text{ }^{\circ}\text{C}$, the rate of spoilage is **halved**, which means that the shelf life of the fish is **doubled**. Practically, 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 result in some reduction in the fish temperature, and consequently, in its rate of spoilage.

2.2.2 Time

At tropical ambient temperatures (about 25 to $35\text{ }^{\circ}\text{C}$) fish can deteriorate in a very short time and can even spoil within 8 to 10 hours. Leaving fish waiting in direct sunlight will heat up the fish further, producing ideal conditions for enzymes and bacteria to attack the flesh.

POINT TO NOTE!

Delays in handling and cooling can raise the temperature of the fish speeding up spoilage.

2.2.3 Care

We know that enzymes and bacteria are found in large numbers in the gut of a fish. When a fish is **damaged**, by being gaffed carelessly, thrown on the deck or stepped on, the contents of the guts may spread out and contaminate that fish. The contaminated fish will deteriorate in quality quickly.

Any fish that is damaged is not only worthless—it can cause other good quality, undamaged fish to lose their quality and become spoiled.

2.2.4 Hygiene

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

Although many bacteria will increase the rate of spoilage, some other types of bacteria produce toxins that are harmful to humans. This is another good 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 the harmful bacteria, that can make people sick.

POINT TO NOTE!

The four factors affecting freshness:

- **Temperature:** low temperatures slow down bacteria and enzymes that spoil fish.
- **Time:** delays in handling and cooling can increase the spoilage rate.
- **Care:** fish should be carefully handled and damaged fish removed.
- **Hygiene:** clean fish, clean equipment and clean people will help prevent the action of harmful bacteria.

AV 3-2.2d

POINT TO NOTE!

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

3 PRINCIPLES OF FISH CHILLING

Chilling can be defined as reducing the temperature of a product to **0°C**, that is to the melting point of ice.

As we have seen earlier, the lower the temperature at which we can store the fish the longer it will keep, and therefore the more time is available for getting the fish to market, or for processing it properly. However, the temperature must not be allowed to drop very far below 0°C, or the fish will start to freeze. Fish actually starts to freeze at -1.5°C .

POINT TO NOTE!

Freezing at a negative temperature close to 0°C will damage the quality of the fish.

3.1 Importance and advantages of ice

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

TEACHING HINT!

Emphasis	Importance of ice.
Question	Do fishermen in your area use ice for chilling their fish?
Discussion	If not, why? What are the problems? How can these be solved?

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

- it is efficient at chilling fish **quickly**;
- it is usually fairly **cheap**;
- it is **harmless** (as long as it is made from **clean water**);
- it keeps the fish **moist**, shiny and attractive;
- it is easily **transportable** from the place where it is made to the fisherman's boat (works best if ice is carried in good insulated boxes).

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

3.2 Types of ice

AV 3-3.2

Ice can be purchased in a number of formats:

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

Block ice

Advantages:

- Does not melt as quickly as crushed or flake-ice, therefore if ice is to be transported over long distances, this is the right ice to buy;
- For the same container, more block-ice (in weight) can be packed than with the other types of ice.

Disadvantages:

- Before it can be used with fish, ice blocks must be broken up to make crushed ice;
- Care must be taken to break the ice blocks into small pieces as large pieces would not wrap well around fish in a container, and would result in **air gaps** around the fish leading to poor chilling;
- **Sharp edges** of crushed ice blocks may also cut and damage fish.

Flake ice

Advantages:

- Wraps very closely around fish, giving **very rapid** chilling;
- Flakes present the maximum cooling surface for a given amount of ice.

Disadvantages:

- Flake ice **melts quicker** than the other types of ice, therefore it is not so good for transporting over long distances to where it is needed for chilling fish.

3.3 The methods of chilling fish

Chilling fish in plain ice

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

AV 3-3.3a

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 **belly down**.

The fish are then covered by a layer of ice, and a second layer of fish is added. Cover again with ice and repeat the process until the container is full. The **advantages of using a slurry** to chill your catch are the following:

POINT TO NOTE!

As a general rule, to properly chill fish to 0 °C, a ratio of **one part ice to one part fish** is needed (e.g. 10 kg of fish will require 10 kg of ice).

Common methods of **improperly packing** fish in ice are:

AV 3-3.3b

- to place **ice over a pile of fish** in a fish box—only the fish next to the ice will get cold, while the fish on the bottom of the container will remain warm;
- using **large pieces of ice** to chill fish—too many air gaps are formed around the fish reducing the effectiveness of the ice.

Chilling fish with sea-water/ice slurry

Another effective method for chilling fish is to use a sea-water/ice slurry. To make the slurry, mix **two parts of ice to one part of sea water**. Only use crushed ice or flake ice.

AV 3-3.3c

POINT TO NOTE!

To make a good slurry:

- use **crushed ice** or **flake ice**;
 - mix **two parts of ice** to **one part of clean sea water**;
 - make the mixture when the first fish are caught;
 - **add more ice** to the mixture when necessary;
 - **circulate the slurry** from time to time to avoid temperature stratification.
- the fish can be **dropped directly** in the slurry after it is caught, instead of taking much longer to properly pack the fish in ice. This saves time, particularly when fish are biting;
 - chilling is **very fast** because there is 100% contact between the fish and the chilling medium of around $-1\text{ }^{\circ}\text{C}$.

POINT TO NOTE!

Do not store your fish in the slurry for more than **12 hours** because it will start to lose its bright colours and its eyes will turn white!

After that period you must pack the fish properly in ice.

PRACTICAL on chilling methods

Objective:

To compare ice and sea-water/ice slurry as methods of chilling fish.

Material required:

- two ice boxes;
- fresh fish;
- ice (crushed or flake ice if possible);
- bucket;
- probe thermometer (if available).

Procedure:

1. Show the trainees how to prepare the slurry, insisting on the following:
 - use a bucket to measure volumes of ice and water;
 - two volumes of ice for one volume of water (if possible use **clean sea water**);
 - the volume of the slurry should not exceed half the volume of the ice box.
2. Compare temperature of ice versus slurry. To do this, ask one trainee to immerse his hands in both ice boxes (one in the slurry, the other under the ice) and leave them as long as possible. No doubt the trainee will quit the slurry first!
3. If a probe thermometer is available, we can compare the effectiveness of both chilling methods by measuring the core temperatures of fish. To do this:
 - Measure and record the core temperatures of two fish (not yet chilled). This is done by pushing the thermometer through the flesh until it is in the middle of the fish;
 - Put one fish into the ice box with plain ice and the other into the ice box with slurry;
 - Measure and record the core temperature of both fish every five minutes;
 - Which is the fastest method of chilling fish?

-
4. If more fish are available, show the trainees how to properly pack fish in ice, insisting on the following:
- start with a layer of ice, then put a layer of **big fish, belly down**;
 - cover fish with a layer of ice, then add a second layer of fish;
 - carry on until all the fish are covered with ice.

4 PRINCIPLES OF FISH HANDLING

Now it is time to bring together the main points discussed in previous chapters and relate them to **the catch handling**.

The fisherman is the first person in the chain in which every link must help maintain top quality. But because he is the first link, he is also the most important. Loss of quality at this early stage can greatly reduce the acceptable shelf life of the fish.

4.1 Handling the catch on board

The fish caught around FADs can basically be divided into two groups.

Small- to medium-sized fish mainly tunas, caught near the surface:

These fish are essentially caught by **trolling** and will be sold on the local market.

Because surface school tunas are often aggressive and may stay on the bite for a fairly short time, the fisherman cannot lose too much of his fishing time handling the fish he has just caught. In these conditions, fish handling on board the boat will be reduced to a minimum which means **quick chilling of the catch**.

The most convenient method for chilling fish when trolling around FADs is to store the fish in an ice-box containing a **slurry** made of sea water and ice. The slurry should be prepared when the boat is approaching the FAD or just after the first fish have been caught. Small tunas and skipjacks are immersed **in the slurry straight after unhooking**. This operation kills fish immediately (due to the cold temperature of the slurry) and allows the fisherman to put his trolling lines in the water very quickly.

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 on the head) before they are placed in the slurry.

If ice is not available, **all fish** must be killed after unhooking and protected from the sun. To do this, cover the fish with a wet sack and pour sea-water on it regularly.

Big deep-swimming fish, mainly adult yellow-fin and big-eye tunas:

POINT TO NOTE!

When trolling around a FAD very little time can be spent handling the catch on board. The best handling method is to place the fish **in a slurry straight after unhooking**.

These fish are primarily caught with the **vertical long line** and **drop stone** techniques.

Big tunas will either be sold on the local market or exported overseas. In both cases, the fisherman can expect a high return from his catch and therefore must handle it with 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 section 3.5.

4.2 Handling the catch on shore

Ideally, the fisherman returning from a trip to a FAD will arrive on shore with his catch **chilled to around 0 °C**.

Handling the catch on shore will have to be carried out quickly to avoid fish warming which in turn would speed up the spoilage process.

POINT TO NOTE!

Handling the catch on shore must be done **quickly** so that fish quality is preserved longer.

Unloading:

Unloading fish from the boat should be carried out with care. **Dumping or throwing** the catch on roads, jetties or on decks of trucks **will damage and contaminate** the fish.

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

POINT TO NOTE!

Unloading fish from the boat must be carried out **carefully** and **quickly**.

Fish should be handled gently and never be left in the sun for too long.

Gutting:

In some places fishermen may sell their fish whole, but more often they are required to provide gutted fish.

If gutting is required:

- do this in a **clean** and **shaded** area;
- **wash your hands** and **all utensils** (knives, gutting board, brush) you will use;
- gut fish on a **clean surface**;
- **remove gills and guts** completely.

Cleaning:

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

- carefully **brush** the fish inside and outside to remove **slime and blood**;
- **uncontaminated clean water** should always be used to clean the fish. Very often, it is preferable to use fresh water from the tap than doubtful sea water;
- pack your fish **in ice** and deliver it to your customer.

POINT TO NOTE!

When gutting and cleaning fish, ensure that:

- all utensils and water used are **clean**;
- gills and guts are **completely** removed;
- fish are handled **fast** to avoid warming.

TEACHING HINT!

Emphasis	Price improvement with good handling.
Questions	What is the price increase for a better quality fish in your local area?
ty fish?	Do tourist hotels pay more for better quality fish?
Discussion	How can we make local buyers demand better quality fish?

VIDEO: 'An Icy Tale – Chilling fish on-board'
(17 mins 30 secs) – SPC

1. Introduce the video

This video examines what fishermen have to do in order to provide top quality fish to fish markets, and hence increase the returns for their work.

2. Participants to identify major points

- Fish not handled **carefully** are rejected by the fish markets.
- The Fisheries Department Officer points out what the fisherman is doing wrong:
 - fish dropped onto the floor of the boat, fish container not utilised;
 - fish left in direct sunlight;
 - cutting board is not cleaned regularly;
 - boat is covered with dirt and rotten bait which attract flies.

- The differences between a good fish and a bad fish:

Good fish

- firm flesh
- bright colours
- eyes full and shiny
- blood removed
- properly cleaned

Bad fish

- soft or rubbery flesh
- dull colours
- eyes dull and sunken
- brown blood present
- not properly cleaned

- Importance of clean ice; crushed block ice or flake ice are best.
- Slurry made of ice and sea water provides the best chilling of fish:
 - use two buckets ice/one bucket sea water;
 - cold shock knocks out fish quickly;
 - good overall contact;
 - fish should be left in slurry for only 6 to 8 hours.
- Packing fish in ice:
 - put a layer of ice for each layer of fish;
 - make sure that fish are completely surrounded with ice;
 - poorly crushed ice causes air gaps and has sharp edges.

-
- Gilling and gutting:
 - clean inside with water and a scrubbing brush;
 - clean slime off skin surface as well.
 - A top quality fish will attract a better price from the fish market.

3. Discussion

- How strict are fish markets in your area on quality assessment of the raw product?
- Does the local Fisheries Department provide advice on how to achieve a top quality product?
- If you were a Fisheries Department Officer, what advice would you give to a fisherman who was bringing poor quality fish into the market?
- If you were a Quality Control Officer working at the fish market, what characteristics would you be looking for in order to grade the raw product?

VIDEO: 'A Chilling Story – Handling fish in the processing plant' (14 mins) – SPC

1. Introduce the video

This video examines what the causes of contamination are, and what steps should be taken to reduce the effects of spoilage and maintain a higher quality product in the processing plant.

2. Participants to identify major points

- The video first highlights bad practices in the processing plant.

These are:

- rough handling – fish being thrown and kicked;
- hygiene – guts (attract flies), cigarettes, dirty walls and knives etc;
- temperature in plant is too hot – fish spoil more rapidly;
- lack of supervision and discipline;
- fish placed in the chill room without ice;
- poor quality product – lose customers.

- The video then gives the recommended features for a processing plant and shows the good practices :

- plant design features: smooth wall coatings, good lighting, good ventilation, safe electrical outlets etc;
- wear clean uniforms that cover most of the body;
- do not smoke;
- keep fish iced at all times and completely surrounded with ice;
- keep surfaces clean;
- remove waste regularly;
- record species name and weight and grade according to quality;
- place chilled fish in the chill store, labelled and dated;
- never leave the chill store open;
- after filleting each fish, wash the cutting board;
- at end-of-day use detergent and water to clean all surfaces.

3. Discussion

If you were a Quality Control Officer in the processing plant, what factors would you be trying to emphasise to the processors in order to attain a better quality product?

5 HANDLING SASHIMI-QUALITY TUNAS FOR THE OVERSEAS MARKET

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

The market for sashimi-quality tuna is large and lucrative, but only **top quality fish** are likely to secure high prices on the Japanese market. The quality of tuna is determined by several factors, both biological and non-biological:

- the biological factors are those over which the fisherman has little or no control. They include the species of 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 reach the highest price** on the sashimi market.
- the non-biological factors are those which the fisherman controls directly. They include the fishing method used and handling and cooling techniques applied to the fish after its capture.

This section summarises the **handling procedures** suitable for sashimi-quality tunas. Its aim is to help FAD fishermen whose countries export tunas to the demanding Japanese fresh fish market. 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.

**Distribute
manual**

POINT TO NOTE!

Characteristics of sashimi tuna:

- **Size:** fish less than 30 kg are generally not considered to be sufficiently large to be of sashimi grade, although this varies according to species and market demand;
- **Body 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 content:** fat fish attract better prices at auction. Not all parts of the fish are of equal value in restaurants, with the higher fat portions being more expensive;
- **Flesh colour:** bright red flesh attract better prices;
- **Location of fishing grounds:** buyers know that fish quality changes seasonally. Various fishing grounds produce differing qualities of fish during the year.

5.1 Gaffing and landing

POINT TO NOTE!

The appearance of the fish is an important factor in the price which can be obtained for it. Always treat your fish with great care and **always wear gloves** when you are handling it.

Handling without gloves will leave marks on tuna due to heat and the fatty substances on the palm of the hand.

- always gaff the fish through the head;
- never gaff the fish through the body, the throat or the heart;

AV 3-5.1

POINT TO NOTE!

Gaff marks in the tuna's body make its appearance less attractive and therefore reduce its retail value; the throat is too fragile an area; the heart is a small blood pump which must continue to function during bleeding for the fish's blood to be properly drained out.

- 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;

POINT TO NOTE!

It is recommended to land the fish on a foam pad or a mat to protect the fish's skin from bruising and scale loss.

- carry out all subsequent handling on the foam pad or mat.

5.2 Killing

POINT TO NOTE!

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 down-graded.

To avoid such loss of value, the destruction of the brain by spiking and neutralisation of the nervous system by the **Tanaguchi method** should be performed on all sashimi tunas (yellowfin and bigeye weighing over 30kg).

Once aboard, the fish should be killed **immediately**:

POINT TO NOTE!

If the fish is killed quickly in this way, its struggling will end and damage due to thrashing around on the deck will be avoided.

AV 3-5.2

- stun the fish with a sharp blow to the top of the head, between the eyes, using a **fish club**;
- locate the **soft spot** by running your thumb over the top of the head;
- insert a **spike** into the soft spot at a 45° angle. 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 soft spot should be spiked again;
- the spike should be moved around to destroy the brain until the body stops moving and the jaw goes slack.

5.3 The Tanaguchi method

It is advisable to pith the fish (destroy its nervous system by using the **Tanaguchi method**) after killing it :

AV 3-5.3

POINT TO NOTE!

To pith means the complete destruction of the nervous system running in the neural canal (**the spinal cord**). This stops the biochemical reactions which contribute to deteriorating the flesh. Pithing therefore produces a higher-grade tuna.

- 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 rigid monofilament nylon into the brain and drive it as far as possible into the neural canal. The fish should give one last shudder;

POINT TO NOTE!

The use of a length of nylon monofilament 2 to 2.5 mm in diameter is recommended for the 'Tanaguchi' method.

- leave the length of monofilament in the neural canal but cut it off to leave ten centimetres outside the fish's head.

POINT TO NOTE!

Leaving the monofilament nylon in the fish will prove to the buyer that it was killed using the 'Tanaguchi method'.

5.4 Killing the fish – other method

A second method makes it possible to kill and core the fish in a single operation. Cleaner and quicker, it may be required by some Japanese buyers.

AV 3-5.4

- stun the fish with a sharp blow to the top of the head, between the eyes, using a fish club;
- locate the soft spot by running your thumb over the top of the head;
- use a very sharp knife to make **a cut 3 to 4 cm long over the soft spot**. The incision must be deep enough to expose the skull;
- insert a length of monofilament nylon into the skull to destroy the brain and then push it as far as possible into the neural canal;
- leave the length of monofilament in the neural canal but cut it off to leave ten centimetres outside the fish's head.

POINT TO NOTE!

With this method, the incision on the top of the head is less obvious and the fish therefore has a better appearance.

5.5 Bleeding

Bleeding the fish immediately after killing it improves the aspect of the flesh and keeps it fresh. This is an important stage for the quality of the fish and its value on the sashimi market.

POINT TO NOTE!

- 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 these wounds;
- Any sashimi-grade tuna specialist will recognise a tuna which has not been bled (or which has only been partly bled) through the presence in the flesh of unaesthetic dark red veinlets;
- During the tunas struggle before it is hauled aboard, the blood attains a high organic waste (lactic acid) content and rises in temperature (up to 35° centigrade in some cases). Bleeding removes the waste and cools the blood. The fish can then be refrigerated more quickly and will have better quality flesh.

- 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;

AV 3-5.5

POINT TO NOTE!

A pair of major blood vessels run along the pectoral fin recess immediately under the tuna's skin. These vessels will easily be severed if the knife is inserted at 90° to the recess.

- leave the fish to bleed for five to ten minutes;
- bleeding can be facilitated by making an additional cut through the membrane located behind the gills.

5.6 Gutting

The internal organs (intestines, gills, etc.) contain a lot of bacteria which accelerate the process of deterioration in fish. They should therefore be removed as quickly as possible.

AV 3-5.6a

- 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 the gonads out through this cut;
- cut off the end of the digestive tube and the gonads near the anus;
- another method involves making a ventral cut the same length as the one described above but, instead of stopping before the anus, the cut is extended by **a circle around the anus**, without severing the digestive tube and the gonads;

POINT TO NOTE!

This other method makes it possible to remove the intestines without having to cut them out. It is therefore recommended because it avoids spreading bacteria around the fish's abdominal cavity.

- insert a knife behind the gill cover and slide it about 10 cm towards the eye, then repeat the procedure on the other side. These cuts will give better access to the gill cavity;

AV 3-5.6b

- cut the connection between the gills and the lower jaw.

POINT TO NOTE!

For aesthetic reasons, it is very important not to cut the connection between the fish's throat and its 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.

5.7 Cleaning

AV 3-5.7

- carefully cut the membrane adhering to the **gill collar**. With the knife, scrape the edge of the collar until you get down to white bone;

POINT TO NOTE!

This membrane turns black if it is not removed, giving the fish an unhealthy appearance.

- remove all the 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 which covers the back bone;
- carefully rinse the fish, inside and outside;
- the fish is now ready to be placed in slurry or ice.

5.8 Chilling

To obtain a top quality product it is essential to chill the big tunas as soon as possible. As we have seen earlier in this module, the best chilling method is to place the fish in a **sea-water/ice slurry**.

POINT TO NOTE!

To fit a big tuna in the slurry box, it is sometimes necessary to cut its tail. The tail will be kept in the slurry box as it will be exported with the fish.

POINT TO NOTE!

A big sashimi-grade tuna can be worth several thousand dollars if exported overseas. To obtain a high price from the local tuna exporter, you need to handle your fish very carefully: do not forget to **kill, bleed and chill the big tunas, especially big-eyes, as quickly as possible**.

TEACHING HINT!

Emphasis Handling big tunas for the overseas sashimi market

Question How do you handle big tunas caught around FADs

Discussion Is this the *sashimi way*? If not, why?

PRACTICAL on handling big tunas for the export market

Objective: to demonstrate the method of killing, bleeding, gutting, cleaning sashimi-grade tunas.

List of required tools and utensils:

- some good-size tunas
- club
- spike
- sharp knife
- lengths of monofilament nylon
- brush
- cotton gloves

Procedure:

1. Show the trainees how to properly handle a tuna for the export market, insisting on the following:
 - killing: follow instructions as per section 5.2, 5.3, 5.4;
 - bleeding: follow instructions as per section 5.5;
 - gutting: follow instructions as per section 5.6;
 - cleaning: follow instructions as per section 5.7;
2. Each trainee to handle one tuna.

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 dull.	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.