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CODE OF HYGIENIC PRACTICE FOR FRESH FISH

SRI LANKA STANDARDS INSTITUTION

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SLS 974 : 1992

Gr. 20

SRI LANKA STANDARDS INSTITUTION
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Sri Lanka.

Sri Lanka Standards are subject to periodical revision in order to accommodate the progress made by industry. Suggestions for improvement will be recorded and brought to the notice of the Committees to which the revisions are entrusted.

This standard does not purport to include all the necessary provisions of a contract.

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SRI LANKA STANDARD
CODE OF HYGIENIC PRACTICE FOR FRESH FISH

FOREWORD

This standard was finalized by the Sectoral Committee on Fish and Fishery Products and was authorized for adoption and publication as a Sri Lanka Standard by the Council of the Sri Lanka Standards Institution on 1992 - 12 - 17.

This standard is an adoption of Codex Alimentarius Commission/Recommended International Code of Practice for fresh fish CAC/RCP - 9 - 1976. The text of CAC/RCP - 9 - 1976 was considered suitable for adoption as a Sri Lanka Standard without major changes.

Handling and processing of fish for the fresh fish market should be carried out by adopting recommended technological and hygienic practices on vessel and shore and using correct equipment from the time of catching until fish reaches the market.

This code is intended to provide useful guidelines to assist those concerned with catching, handling and processing of fresh fish for the market.

Guidelines and essential requirements for frozen fish are covered in a separate Sri Lanka Standard Code of Practice.

During the formulation of this Code due consideration has been given to the relevent provisions made under the Sri Lanka Food Act. No. 26 of 1980 and the regulations framed thereunder.

1 SCOPE

1.1 This code of practice applies to fresh fish, chilled but not frozen, intended for human consumption. It contains the technological guidelines and the most essential requirements of hygiene for the handling and processing of fresh fish at sea and on shore.

1.2 The special requirements for retailing of fresh fish and their products or the use of food additives are not included.

1.3 Although the code does not deal specifically with the fresh water fish and fisheries, most of the recommendations made would apply.

2 REFERENCES

SLS 614 Potable water

3 DEFINITIONS

For the purpose of this code following definitions should apply:

3.1 auction : First sale of the catch at a fishing port, by competitive buying. In some fisheries this involves unloading and display of the catch, in others only the representative samples are displayed.

3.2 boxed stowage : The storage of fish on board the vessel in boxes.

3.3 bulk stowage : The mass storage of fish in pounds on board the vessel.

3.4 chilling : The process of cooling fish to a temperature approaching that of melting ice.

3.5 chilled sea water : Clean sea water whose temperature is $0^{o}C$ or slightly below.

3.6 clean sea water : Sea Water which meets the same microbiological standards as potable water and is free from objectionable substances.

3.7 cleaning : The removal of objectionable matter froms surfaces.

3.8 contamination : Direct or indirect transmission of objectionable matter to the fish.

3.9 disinfection : The application of hygienically satisfactory chemical or physical agents and processes to clean surfaces with the intention of eliminating microorganisms.

3.10 fillet : A slice of fish of irregular size and shape removed from the carcase by cuts made parallel to the backbone.

3.11 fish : Any of the cold-blooded aquatic vertebrate animals commonly knowr as such. This includes Teleosts and Elasmobranchs. Aquatic mammals, invertebrate animals and amphibians are not included. It should be noted, however, that many of the recommendations given here also apply to certain invertebrates, particularly Cephalopods.

3.12 fresh fish : Freshly caught fish which have received no preserving treatment or which have been preserved only by chilling.

3.13 gutted fish : Fish from which the guts have been removed.

3.14 keeping time : The length of time that fish will remain wholesome and acceptable as human food.

3.15 **market** : An area or building used for the display and first sale of the catch.

3.16 **packaging materials** : All those materials such as foils, films, waxpaper, cartons and boxes, used for covering and protecting the fresh fish or fresh fish products, and which are approved by the official agency having jurisdiction.

3.17 **plant or establishment** : The building or buildings, or part therof, used for, or in connection with, the manufacture or holding of food for human consumption.

3.18 **potable water** : Water of such chemical and bacterial quality that it is wholesome and fit for human consumption.

3.19 pounds or pens : Areas in the fish hold and on deck, divided off by stanchions and portable or fixed board structures for the storage of fish.

3.20 **refrigerated brine** : Solution of food grade salt (sodium chloride) in potable water of about the same salinity as sea water which is cooled in the same manner as refrigerated sea water.

3.21 **refrigerated sea water** : Clean sea water cooled by the addition of ice prepared from potable water or clean sea water and/or a suitable refrigeration system. Its salt content is normally about 3 percent.

3.22 **rigor mortis** : The stiffening of the muscles of an animal which results from a series of complex changes that take place in the tissues shortly after death. Immediately after death, the muscles are soft and limp and can be easily flexed. At this time, the flesh is said to be in pre-rigor condition. Soon the muscles begin to stiffen and harden and no longer contract by stimulation. The animal then is in rigor. After some hours or days, the muscles gradually begin to soften and become limp again. This is called the post rigor condition.

3.23 **shelf stowage** : The storage of fish on board the vessel in single layers, on shelves.

3.24 **steak** : A section of fish, removed by cutting approximately at right angle to the backbone.

3.25 **suitable corrosion-resistant material**: Impervious material, which is free from pits, crevices and scale, is non-toxic and unaffected by sea water, ice, fish slime or any other corrosive substance with which it is likely to come in contact. Its surface must be smooth and it must be capable of withstanding exposure to repeated cleaning, including the use of detergents.

3.26 **whole fish** : Fish as captured, ungutted.

4 RAW MATERIAL REQUIREMENTS

4.1 General Considerations

4.1.1 FRESH FISH ARE AN EXTREMELY PERISHABLE FOOD, AND SHOULD BE HANDLED AT ALL TIMES WITH GREAT CARE AND IN SUCH A WAY AS TO INHIBIT MULTIPLICATION OF MICRO-ORGANISMS

Fish quality deteriorates rapidly, and the potential keeping time is shortened if they are not handled and stored properly. Much of the fish landed for human consumption is unfortunately subjected to fairly rough handling treatment which should be avoided. Fish should not be exposed to direct sunlight or to the drying effect of winds, or any other harmful effects of the elements, but should be carefully cleaned and cooled down to the temperature of melting ice, 0°C, as quickly as possible. Any careless treatment or delay in reducing the temperature of the fish will have a marked effect on their potential keeping time.

4.1.2 FISH INTENDED FOR MARKETING AS FRESH FISH SHOULD BE OF THE HIGHEST POSSIBLE QUALITY

Although there are many aspects that might be taken into account when defining what is meant by the "highest possible quality" fish, there are two major ones that should concern the fisherman as a primary producer :

1. quality of fish when caught, and
2. quality of fish on delivery to the buyer or the processor.

The first one is determined by the physical condition of the fish, and includes appearance, size, percentage of fat, amount of feed, damage to skin, presence of disease and of harmful substances. The second one will result from the methods and techniques employed in fishing, practices in handling and conditions of storage while on board the fishing vessel.

The fisherman should discard any fish that is diseased or is known to contain harmful substances or has undergone deterioration or any process of decomposition or which has been contaminated with foreign matter to an extent which has made it unfit for human consumption.

5 HANDLING OF FRESH FISH AT SEA- FISHING VESSEL FACILITIES AND OPERATING REQUIREMENTS

5.1 General considerations

5.1.1 THE FISHING VESSEL SHOULD BE DESIGNED FOR RAPID AND EFFICIENT HANDLING OF FISH, EASE OF CLEANING AND DISINFECTION, AND SHOULD BE OF SUCH MATERIAL AND CONSTRUCTION AS NOT TO CAUSE ANY DAMAGE OR CONTAMINATION OF THE CATCH.

In designing a fishing vessel many other factors, apart from the vessel's performance as a harvesting unit, should be considered. The fisherman's earnings are determined not only by the quantity of the fish caught but, to a great extent, by the quality of the catch delivered to auction or the processing plant.

Fishing vessels should be designed and constructed so as not to cause contamination of fish with bilge, water, sewage, smoke, fuel, oil, grease or other objectionable substances. Fish should be protected against physical damage, exposure to high temperatures and drying effects of sun and wind.

All surfaces with which the fish might come in contact should be of suitable corrosion resistant material which is smooth and easily cleanable.

If a vessel is engaged in the processing of fish, then its design, layout, construction and equipment should meet the requirements of shore establishments and the processing should be carried out under similar hygienic conditions.

5.2 Fishing vessel construction and sanitary design

5.2.1 DECK POUND OR PEN STANCHIONS AND DIVIDING BOARDS SHOULD BE CONSTRUCTED OF SUITABLE CORROSION RESISTANT MATERIAL. THEY SHOULD BE ADEQUATE IN NUMBER AND HEIGHT TO PREVENT MOVEMENT OF THE FISH, DUE TO THE VESSEL'S MOTION.

In practice, wood is still used in many fisheries for deck pound boards and steel for stanchions and other fixtures. Where this is the case, the wood should be treated to prevent the entry of moisture and should be coated with a durable paint or other non-toxic surface coating that is smooth and readily cleanable. Steelwork should be coated with anticorrosion and non-toxic paint. Whenever possible, suitable corrosion-resistant materials should be used.

5.2.2 DECK POUND OR PEN DIVIDING BOARDS SHOULD BE FITTED TO ALLOW FOR EASY REMOVAL, AND SHOULD HAVE HAND GRIPS. BOARDS SHOULD HAVE GATES FITTED, AS REQUIRED, AND DRAIN NOTCHES CUT IN THE LOWER EDGES.

Gates are required to be fitted to the boards so that offal can easily be disposed of. Drain notches allow water, slime and blood to flow away from fish lying in the pounds.

5.2.3 FISH HOLDS OR TANKS SHOULD BE ADEQUATELY INSULATED WITH A SUITABLE MATERIAL. ANY PIPES, CHAINS OR CONDUITS PASSING THROUGH THE HOLD SHOULD, IF POSSIBLE, BE SUNK FLUSH OR NEATLY BOXED IN AND INSULATED

Adequate insulation will reduce the amount of heat entering the fish hold and consequently the rate of ice meltage. If the quality and structure of the insulation is poor, considerable ice meltage will take place near bulkheads and shipside. This may cause excessive leaching of the fish and if the amount of ice is not sufficient, this will allow fish temperatures to rise, and any fish which come in contact with the ship's structure may develop a particularly offensive smell.

5.2.4 FISH HOLD OR TANK LININGS SHOULD BE COMPLETELY WATER TIGHT. THE INSULATION LAYER SHOULD BE PROTECTED BY A LINING MADE OF CORROSION-RESISTANT METAL SHEETS OR ANY OTHER EQUALLY SUITABLE MATERIAL HAVING WATER-TIGHT JOINTS.

It is most important to prevent water carrying fish slime, blood, scales and offal to parts of the vessel where effective cleaning is virtually impossible. The melt water seeping through the fish hold lining will also reduce the efficiency of the insulation and this will, in turn, lead to an increase in the temperature of the fish. The insulation should be covered with corrosion-resistant metal sheets or any other equally suitable material having water-tight joints to ensure protection from such contamination. An effective drainage system should be able to remove the melt water into a sump as fast as it accumulates.

5.2.5 WOODEN FISH HOLDS OR WOODEN HOLDING TANKS SHOULD BE LINED WITH A SUITABLE MATERIAL

The lining of wooden fish holds should be similar to that described above. They should be sealed and coated with a suitable impervious and non-toxic material which is easy to keep clean and not difficult to repair.

5.2.6 PORTABLE BOARDS OF SUITABLE CORROSION RESISTANT MATERIAL OR IMPREGNATED AND PAINTED WOOD SHOULD BE USED FOR MAKING SHELVES AND VERTICAL DIVISIONS IN THE FISHROOM.

The use of portable boards, which are a good fit in the stanchions, allows the shelf and dividing structure to be dismantled and removed for cleaning. Wooden boards should be treated to prevent the entry of moisture and should be coated with a durable non-toxic paint or other equally suitable surface coating that is smooth, readily cleanable and repairable. Whenever possible, the shelving and the partitioning boards should be interchangeable in size.

5.2.7 SHELVING BOARDS SHOULD BE DESIGNED TO ALLOW ADEQUATE DRAINAGE

A continuous trickle of melt water will help to carry away slime, blood and micro-organisms which should not be allowed to collect on the shelves. Corrugated boards of corrosion-resistant material are most suitable for this purpose.

5.2.8 THE SHELVES SHOULD BE INSTALLED SO THAT THE MAXIMUM DEPTH OF FISH, WHEN BULK STOWING, DOES NOT EXCEED 1 METRE

This is considered to be a maximum depth, and may be excessive for certain types of fragile fish. Experience has shown that the pressure caused by piling iced fish in greater depth results in weight losses and damages to the fish at the bottom of the pile. Where iced fish is stowed in deep pounds, shelves should be fitted at frequent intervals, to transfer the weight of the load to the hold structure and hull, without undue pressure on fish stowed below.

5.2.9 THERE SHOULD ALWAYS BE AMPLE DRAINAGE SPACE BETWEEN THE LOWEST SHELVES AND THE FLOOR OF THE FISH HOLD. THIS SPACE SHOULD BE OPEN TO A CENTRAL DRAIN, DISCHARGING DIRECTLY INTO ONE OR MORE SUMPS OR WELLS, LOCATED SO THAT THE HOLD CAN BE EFFICIENTLY DRAINED AT ALL TIMES. BILGE PUMP CONNECTIONS TO THESE SUMPS SHOULD BE FITTED WITH COARSE SCREEN FILTERS.

Proper drainage facilities are required to prevent a build-up of large quantities of melt water, blood and slime. If drainage is inadequate, the bottom layers of the fish in the hold will be contaminated by this dirty liquid, especially during any periods of severe motion of the vessel.

5.2.10 WHERE BOXING AT SEA IS CARRIED OUT THE STANCHIONS AND DIVIDING STRUCTURE SHOULD BE DESIGNED TO ACCOMMODATE BOXES OF FISH WITHOUT LEAVING LARGE AIR GAPS.

If the structure is not designed to suit the box dimensions, large gaps will be left where air can circulate, causing excessive ice meltage. Unless these spaces are filled with extra ice the fish temperature will rise.

5.2.11 IF COOLING GRIDS ARE FITTED IN THE FISH HOLD THEY SHOULD BE PROPERLY INSTALLED AND OPERATED

Cooling grids, fitted in the fish hold, can be used to prevent excessive ice meltage during the voyage to the fishing grounds. They are valuable in cooling the fish hold and absorbing heat leak especially in tropical waters. To be effective they should be fitted under the deckhead and on the ship side, and once fish has been stowed in the hold, control must be such that the hold temperature does not fall below 0°C. If it does, the top layer of ice may freeze into a solid crust, resulting in the top layer of fish being frozen slowly, on a long voyage, thus affecting their quality.

When the ice stops melting because of low temperature, its effectiveness as a cooling agent diminishes considerably. The frozen crust of ice and fish will act as an insulating blanket preventing the fish below from being adequately chilled. Only when the ice is melting and the resulting ice-cold melt water percolates downwards through the layers of fish, the removal of heat (chilling) takes place. The cooling grids alone, fitted into the well insulated fish hold, will not cool the fish or maintain them in a chilled condition.

5.2.12 EXCEPT FOR TANK STOWAGE IN REFRIGERATED SEA WATER OR REFRIGERATED BRINE, THE STOWAGE OF FISH FOR HUMAN CONSUMPTION IN HOLDS THAT ARE NOT DIVIDED INTO POUNDS IS NOT RECOMMENDED. THE HOLDS OF SMALL VESSELS CARRYING SUCH FISH AS HERRING SHOULD BE FITTED WITH AT LEAST ONE LONGITUDINAL AND ONE BULKHEAD, WHICH CAN BE REMOVED IF THE VESSEL CONVERTS TO OTHER TYPES OF FISHING. SUCH BULKHEADS SHOULD BE CONSTRUCTED OF SMOOTH, NON-ABSORBENT, EASILY CLEANABLE MATERIAL.

The fitting of removable type bulkheads increases the versatility of fishing vessels and prevents movement of the stowed fish. They also permit rapid conversion to other types of fish stowage.

5.2.13 HOLDS THAT ARE NOT DIVIDED INTO POUNDS OR PENS SHOULD HAVE AN ADEQUATE NUMBER OF DRAIN LINES LOCATED AT INTERVAL ALONG THE HOLD, DISCHARGING TO A CENTRAL DRAIN OR BILGE. VERTICAL DRAIN SLOTS SHOULD BE LOCATED ALONG BOTH THE FORWARD AND AFTER BULKHEADS, RUNNING FROM DECKHEAD TO BILGE.

As has already been stated, holds which are not divided into pounds are not to be recommended. Those which do exist in very small vessels also require adequate drainage facilities.

In a hold containing tanks, floor troughs should be installed, draining from all areas of the hold to a bilge sump. Fish hold bilge sumps should have separate piping and valves so that fish juices and slime do not flow into the other bilge lines.

5.2.14 THERE SHOULD BE NO SHARP CORNERS OR PROJECTIONS IN THE HOLD OR TANK AS THESE WILL MAKE CLEANING DIFFICULT AND MAY DAMAGE THE FISH.

Contamination with fish slime, blood, scales and guts will build up rapidly on surfaces, in corners or around projections which are not smooth and impervious.

Any ledges or projections resulting from the encasement of pipes, wire, chains and conduits, that are passing through the fish hold, should be so constructed as to allow free drainage, ease of cleaning and not to cause any physical damage to the fish.

5.2.15 REFRIGERATED CLEAN SEA WATER OR REFRIGERATED BRINE MAY ALSO BE CONSIDERED FOR SOME FISHERIES

The storage temperature achieved by refrigerated clean sea water or refrigerated brine makes it possible to chill large quantities of fish quickly, in tanks, and maintain the fish in a chilled condition. Fish are chilled more rapidly by this immersion process than when iced, and if stowed at the correct density are in close contact with the cooling medium at all times.

This type of stowage has been found successful where very large quantities of small fish are caught in each haul and where it would be difficult to stow the catch quickly in ice. It has so far only proved successful for very short voyages. A storage time of more than a few days can affect the appearance of certain species, and the scouring effect of fish rubbing together in a tank of water can also remove the scales from some species.

There is as yet insufficient evidence to recommend refrigerated sea water or refrigerated brine for every type of fishery but experience has shown that for some species, notably Pacific halibut, Pacific salmon and tuna, it is a good method of preservation at sea.

5.2.16 REFRIGERATED SEA WATER OR REFRIGERATED BRINE SYSTEMS SHOULD BE PROPERLY DESIGNED TO GIVE ADEQUATE COOLING CAPACITY

If the use of a refrigerated brine system is considered, the system should be the subject of much research before an investment of money is made. The system should be designed by refrigeration experts having a knowledge of the fishery, including catching and stowage rates,fish, water and ambient temperatures. The cooling capacity must be related to catching rates in the fishery involved. The system must be capable of rapidly chilling large quantities of fish.

5.2.17 IN ALL SHIPS USING REFRIGERATED SEA WATER OR REFRIGERATED BRINE SYSTEMS FOR PRESERVATION OF THE CATCH, TANKS, HEAT EXCHANGERS, PUMPS AND ASSOCIATED PIPING SHOULD BE MADE OF OR COATED WITH SUITABLE CORROSION-RESISTANT MATERIAL . THEY SHOULD BE DESIGNED SO THAT THEY CAN EASILY BE CLEANED AND DISINFECTED

With hard, non-porous surfaces such as stainless steel, aluminium-alloys or plastics, spoilage microorganisms together with all the debris deposited during storage of the fish can be easily removed, thus reducing the risk of contaminating later catches. It is important to avoid corners and edges in which filth can lodge.

The whole system should be so designed as to allow an easy introduction and effective circulation of the cleaning and disinfecting solutions. There should be no place where a proper cleaning cannot be carried out.

It is important to remember that with ice storage only part of a load may spoil but with refrigerated sea water or brine, any malfunctioning of the stystem or neglect on the part of operators, can result in the whole catch being rejected for spoilage.

5.2.18 WHERE CLEAN SEA WATER OR BRINE AND ICE MIXTURES ARE USED FOR COOLING AND STORING THE CATCH, THERE SHOULD BE ADEQUATE CIRCULATION OF THE LIQUID.

Effective means of circulating the cold liquid round the mass of fish should be provided. If pumping facilities are inadequate some of the load may not be cooled properly, resulting in fish with highly unpleasant odours and flavours.

The fish hold-tanks should be equipped with suction screen arrangements which are strong enough to withstand the pressure exerted by the brine - fish mixture as well as negative pressure (suction) created by the circulating pump. Such screens should be so designed and located as to allow a constant and unobstructed flow of cold brine or sea water.

5.2.19 REFRIGERATED SEA WATER OR REFRIGERATED BRINE TANKS SHOULD BE INSULATED TO MINIMIZE HEAT LEAKAGE FROM THEIR SURROUNDINGS

The temperature of the refrigerated sea water will be more uniform throughout the tank and more easily controlled if the heat leak from other sources is reduced by effective insulation.

5.2.20 REFRIGERATION PLANT AND SEA WATER OR BRINE CIRCULATING EQUIPMENT SHOULD BE ADEQUATE TO MAINTAIN THE TEMPERATURE OF THE FISH AT - 1 ^{o}C

In fresh fish maximum delay of spoilage is obtained at this temperature. If the temperature is reduced below - 1 ^{o}C the fish may be damaged because of partial freezing. In practice it is extremely difficult to control the temperature so precisely, but a range of - 1 ^{o}C to + 2 ^{o}C is achievable.

There should also be a sufficient compressor capacity to prevent a significant rise in temperature of the prechilled sea water or brine solution when the holding tanks are being loaded with the freshly caught fish.

Rapid cooling of fish is the primary task of the system. Once the initial cooling of fish is accomplished, the subsequent maintenance of constantly low temperature requires only a fraction of the compressor's load. Thermal inertia of large body of chilled fish and brine should prevent sudden and significant fluctuations in temperature.

5.3 Sanitary facilities

5.3.1 AREAS OF THE DECK WHERE FISH ARE UNLOADED AND HANDLED, OR THE FISH HOLD WHERE FISH ARE STOWED BE USED EXCLUSIVELY FOR THESE PURPOSES

All such areas should be well defined, be readily capable of being maintained in a clean condition and should be kept clean.

Storage of fuel and other petroleum products or of different cleaning and sanitizing agents should be so arranged that there is no possiblility of contamination of surfaces with which fish come in contact.

Any exposure, even for a short time, of fish to petroleum products, very often results in rejection or eventual destruction of the whole load. The odour and the taste of fish contaminated with fuel or other similar compounds are very persistent and difficult to remove during the subsequent processing, and such fish should therefore be discarded.

5.3.2 AN AMPLE SUPPLY OF COLD POTABLE WATER CONFORMING TO SLS 614 OR CLEAN SEA WATER UNDER ADEQUATE PRESSURE SHOULD BE AVAILIBLE AT A SUFFICIENT NUMBER OF POINTS THROUGHOUT THE FISHING VESSEL. ON LARGE VESSLES ENGAGED IN FISH PROCESSING A SUPPLY OF HOT WATER AT A MINIMUM TEMPERATURE OF 82 ^{o}C SHOULD ALSO BE AVAILABLE

Only potable water or clean sea water should be used on fish and on surfaces with which fish might come in contact. Even if the fish is caught in polluted waters, as occasionally happens, that water should not be used for washing fish or for the preparation of refrigerated sea water, or refrigerated brine.

Fish when alive is relatively resistent to a polluted environment but looses its natural defences when it dies after being caught.

5.3.3 A SYSTEM FOR INJECTING CHLORINE INTO THE LINES OF SEA WATER WHICH IS USED IN THE PROCESSING OF FISH OR FOR THE CLEAN-UP OF THE VESSEL SHOULD BE PROVIDED WHERE PRACTICABLE

It has been established in the fish processing industry that the injection of chlorine into a supply of cold water, used for general wash-up, helps to control microbial contamination.

The fishing vessels involved in handling or processing large quantities of fish might gain considerably in sanitation by having chlorine introduced into the water lines. Chlorine dosage should be around 10 ppm during the normal use and 100 ppm of residual concentration during the clean-up.

As a word of caution, the use of strongly chlorinated water in confined spaces such as a vessel's hold could prove objectionable to the operator. For that reason, a system for injecting chlorine should be capable of varying the amount of chlorine delivered.

There are a number of relatively inexpensive an easily operable instruments on the market that will perform this task with the minimum of cost and maintenance.

The installation of a chlorine injection system might not be practical for small fishing boats.

5.3.4 DECK HOSES SHOULD BE SUPPLIED WITH CLEAN SEA WATER, AT ADEQUATE PRESSURE, BY A PUMP USED ONLY FOR CLEAN SEA WATER

A good supply of clean sea water, at adequate pressure, with an addition of chlorine, if possible, should be available for washing fish and for flushing and rinsing of decks, holds, gear and other equipment which comes in contact with the fish.

The intake for sea water should be well forward of and on the opposite side of the vessel from the toilet waste and engine cooling discharge. Sea water should not be used while the vessel is in harbour nor in areas where there is a danger of it being polluted. Clean sea water should be taken in while the vessel is in forward motion.

The piping for the clean sea water supply should have no cross-connections with the engine or condenser cooling system. It should be so constructed as to prevent any possibility of back-siphonage from the kitchen sink or toilets.

5.3.5 ICE USED IN EVERY FISHERY SHOULD BE MADE FROM POTABLE WATER CONFORMING TO SLS 614 OR CLEAN SEA WATER AND SHOULD NOT BE CONTAMINATED WHEN MANUFACTURED, HANDLED OR STORED

Ice made from water which is neither potable nor clean sea water may contaminate the fish with water-borne microorganisms or other objectionable or even harmful substances. Such contamination will result in the loss of quality, reduced keeping time or might create a definite health hazard.

Some of the larger fishing, collecting or fish processing vessels might have their own ice making machines. The water used in the ice manufacture should be potable water or clean sea water. The sea water intake for the pump should be located on the opposite side away from the waste discharge and engine cooling water outlets of the boat. Chlorine injection into the lines or water storage tanks, or the use of UV lights for continual flow purification should be provided. Both systems are easy and inexpensive to operate. The sea water for ice manufacture should only be taken from areas known to be relatively unpolluted and without any visible discolouration or suspension.

The ice making plant should be cleaned regularly and maintained in a clean, hygienic condition at all times.

When vessels are taking ice to sea, only fresh clean ice should be taken on board at the beginning of each voyage. Ice left from the previous voyage should be discarded and removed from the vessel.

5.3.6 THE USE OF CLEAN SEA WATER ICE CANNOT BE GIVEN UNQUALIFIED RECOMMENDATION

The use of clean sea water ice may be necessary in some areas, where there is a shortage of potable water, and there may also be some advantage in using clean sea water to manufacture ice at sea. The initial melting temperature of clean sea water ice may be as low as $-5^{\circ}C$ to $-6^{\circ}C$, but due to the leaching away of salt in the melt water, the melting temperature may rise again to nearly $0^{\circ}C$. Temperature, therefore, is variable. There is a risk that some of the fish stored in clean sea water ice will become partly frozen or too salty. Some experimentation prior to deciding on the kind of water for ice production is recommended.

5.3.7 THE VESSEL'S TOILET FACILITIES, ALL PLUMBING AND WASTE DISPOSAL LINES SHOULD BE SO CONSTRUCTED AS NOT TO CONTAMINATE THE FISH.

All the plumbing and waste disposal lines servicing the vessel's toilets, hand wash basins or kitchen sinks should be large enough to carry peak loads, be watertight and preferably should not go through the fish holds where fish is being handled or stored.

5.3.8 WHERE BAIT IS CARRIED, IT SHOULD BE HELD IN SUCH A MANNER THAT IT WILL NOT CONTAMINATE THE CATCH

Fishing vessels which depend on bait for their fishing activities should have a separate pound or special container where the bait could be held well protected and away from the catch. When fishing is finished, the ice used for bait preservation should be discarded rather than re-used on fresh fish intended for human consumption.

5.3.9 ON LARGE FISHING VESSELS, ENGAGED IN FISHING AS WELL AS FISH PROCESSING, SUITABLE WASHING FACILITIES SHOULD BE PROVIDED

Such facilities should be located in toilets and close to the fish handling or processing areas. They should be supplied with clean water, soap and towels (preferably disposable).

5.3.10 THE FISHING VESSEL SHOULD BE EQUIPPED WITH BRUSHES, SCRAPERS, WATER HOSES, SPRAY NOZZLES AND OTHER SUITABLE WASHING AND SANITIZING EQUIPMENT

Although there is a variety of cleaning and sanitizing equipment available on the market, good quality hand brushes of several sizes and shapes are still the most inexpensive and versatile tools for cleaning operations. Brushes should be kept in a clean and sound condition, disinfected after each use (dipping in 50 ppm chlorine soltuion is recommended) and when not used should be stored in a dry state. Brushes could spread dirt and microorganisms. Microorganisms will proliferate in a dirty brush when stored in a wet condition. The use of steel-wool for scouring should be avoided as there is a constant danger of introducing small, sometimes hardly visible, bits of wire into the final product. If for some reason cleaning cannot be done effectively with a good brush, then plastic, brightly, coloured scouring pads might be used.

The high pressure and high frequency oscillating water or detergent spraying equipment has been found to be quite effective in cleaning, but it usually requires an experienced operator to prevent damage to painted surfaces.

5.3.11 IF POISONOUS AND HARMFUL MATERIALS, INCLUDING CLEANING COMPOUNDS, DISINFECTING MATERIALS, AND PESTICIDES ARE STORED ON BOARD THE VESSEL, THEY SHOULD BE KEPT IN A SEPARATE COMPARTMENT, RESERVED AND MARKED SPECIFICALLY FOR THIS PURPOSE

Extreme caution must be exercised to prevent poisonous or harmful materials from contaminating the fish. All such materials should be prominently and distinctly labelled so that there can be no confusion between these and edible materials used aboard the vessel. Such compartments should be kept locked and the materials contained in it should be handled only by personnel trained in their use.

5.4 Equipment and utensils

5.4.1 ALL FISH HANDLING, CONVEYING AND STORAGE EQUIPMENT, USED ON BOARD FISHING VESSELS, SHOULD BE DESIGNED FOR THE RAPID AND EFFICIENT HANDLING OF FISH, BE SUITABLE FOR EASY AND THOROUGH CLEANING AND SHOULD BE CONSTRUCTED AS NOT TO CAUSE CONTAMINATION OF THE CATCH

Some of the equipment currently used in the fishing industries is quite unsuitable for the purpose in which it is employed. More thought should be given to the design and layout of fixtures and plant used for the handling, conveying and storage of fresh fish. When obtaining equipment, only equipment which can readily be disassembled for thorough cleaning should be considered.

5.4.2 FISH WASHING AND CONVEYING EQUIPMENT SHOULD BE CONSTRUCTED OF SUITABLE CORROSION RESISTANT MATERIAL AND SHOULD BE EASY TO DISMANTLE FOR CLEANING PURPOSES AND BE FITTED WITH CHUTES OR SIMILAR MEANS OF CONVEYING FISH INTO THE HOLD. CHUTES SHOULD BE OF SUFFICIENT LENGTH AND FITTED IN SUCH A MANNER THAT FISH DO NOT HAVE TO DROP MORE THAN 1 METRE INTO THE HOLD

Washers should, when possible, be fitted with chutes or conveyors for efficient handling purposes and to prevent bruising or other damage to the fish, which often occurs when rough manual methods are used. Washers should be designed to given an adequate washing period, and should have a copious and continuous supply of cold clean sea water. The water should enter the washer through a number of jets, placed so that a water swirl is formed in the washer, allowing dirty water and scum to spill off and drain away. Water used in fish washing and cooling should not be recirculated.

5.4.3 CONVEYORS USED IN THE FISH HOLD SHOULD BE MADE OF CORROSION-RESISTANT MATERIAL AND SHOULD BE EASY TO DISMANTLE AND REMOVE FOR CLEANING PURPOSES

Fish holds are difficult to clean thoroughly and any board structures or any conveying equipment should be capable of easy removal, so that access can be gained to all areas of the fish hold.

5.4.4 ALL TUBS, TANKS, BARRELS AND OTHER CONTAINERS USED FOR HANDLING AND CONVEYING FISH SHOULD BE OF CORROSION-RESISTANT MATERIAL AND EASY TO CLEAN

In many areas wicker baskets are used for handling fish on deck. These are very difficult to clean properly, as slime, blood, scales and small pieces of offal or parts of fish body become lodged within the framework. Containers with smooth, waterproof surfaces which are easy to clean and disinfect are recommended for handling quantities for fish on deck.

5.4.5 WHERE SIZEABLE QUANTITIES OF FISH ARE HANDLED ON BOARD LARGE FISHING VESSELS, THE USE OF MACHINERY DESIGNED TO CARRY OUT GUTTING AND CLEANING SHOULD BE CONSIDERED

In many fisheries there is a growing need to save manpower but this cannot be accomplished without the introduction of more mechanical aids for working the fishing gear and handling the catch. These two principal tasks have to be performed by the same crew.

Gutting, which is usually the most time consuming operation, could easily be carried out by a gutting machine. Such machines have been developed and have been used by some fishermen in various countries.

It is advisable, before large expenditure of capital is made, that such machinery should be tested, bearing in mind that it will be operating under extremely rigorous conditions with limited possibilities for proper maintenance or immediate repair.

5.4.6 ALL CONTAINERS USED FOR ICE STOWING OF FISH SHOULD BE OF UNIFORM AND SUITABLE SIZE, EASY TO HANDLE WHEN LOADED, AND SHOULD BE CONSTRUCTED OF SUITABLE CORROSION RESISTANT MATERIAL

Such containers should be capable of accommodating the larger fish without bending and, when fully loaded, should be easy to handle by one or two men without tilting, tipping or jerking.

If wooden boxes are used, they should be of a smooth construction and of durable non-toxic and waterproof finish.

Baskets should not be used for handling fish on board the vessel or on shore, as they are difficult to clean and disinfect.

5.4.7 SHOVELS AND RAKES USED IN THE HANDLING OF FISH SHOULD ALSO BE MADE OF A SUITABLE CORROSION-RESISTANT MATERIAL AND SHOULD BE KEPT CLEAN

These implements are used frequently in many stages of fish handling and therefore should meet the same hygienic specifications as other equipment and utensils.

5.5 Hygienic operating requirements

5.5.1 BEFORE ANY FISH COMES BOARD, AND BETWEEN EACH HAUL OF THE GEAR, DECKS, BOARDS, STANCHIONS AND ALL OTHER DECK EQUIPMENT WHICH WILL COME IN CONTACT WITH FISH SHOULD BE HOSED DOWN WITH CLEAN SEA WATER AND BRUSHED TO REMOVE ALL VISIBLE DIRT, SLIME AND BLOOD.

The purpose of this washing is to remove all traces of contaminating matter, such as slime, blood, tar, oil, etc. which may cause discolouration and offensive odours in the fish. In most fisheries this cleaning can be carried out while the net is in the water.

It is also important to have the surface of the deck and deck pounds well precooled by hosing them down with cold clean water before the fish is unloaded. During the warm weather, the surface temperature of the deck could be very high. It would be bad practice, therefore, to dump the catch on such a deck without any concern for the quality of the fish, especially those from the bottom layer which, in all probability, will remain for a longer time in direct contact with the hot surface of the vessel's deck.

5.5.2 ALL TUBS, TANKS, BARRELS AND OTHER EQUIPMENT USED IN HANDLING, GUTTING WASHING AND CONVEYING OPERATIONS SHOULD BE THOROUGHLY CLEANED, DISINFECTED AND RINSED AFTER EACH CYCLE OF OPERATIONS

Any filth, slime, blood or scales if allowed to dry and accumulate on surfaces with which fish comes in contact will be very difficult to remove later and will thus contaminate the subsequent loads of fish.

5.5.3 DURING FISHING TRIPS THE FISH HOLD BILGE SUMP SHOULD BE DRAINED REGULARLY. THE SUMP SHOULD BE ACCESSIBLE AT ALL TIMES

Bilge water containing blood and slime, if not regularly pumped out, will provide a perfect medium for the multiplication of micro-organisms and give rise to offensive odours in the fish hold.

5.5.4 COD ENDS AND OTHER PARTS OF THE FISHING GEAR WHICH COME IN CONTACT WITH FISH SHOULD BE FREED OF DEAD FISH AND ORGANIC MATERIAL AFTER EACH HAUL. ALL GEAR SHOULD BE THOROUGHLY CLEANED WHEN FISHING HAS CEASED.

Dead fish and organic matter left in the nets will decompose and contaminate later catches.

5.5.5 SEA WATER WHICH HAS BEEN USED FOR COOLING ENGINES, CONDENSERS OR SIMILAR EQUIPMENT SHOULD NOT BE USED FOR WASHING FISH, DECK, HOLD OR ANY EQUIPMENT WHICH MIGHT COME IN CONTACT WITH FISH

The water used for cooling engines is usually at a higher temperature than fresh sea water and might be contaminated with oil or other petroleum products or contain rust and other by-products of metal corrosion.

Such water, therfore, will accelerate considerably the spoilage of fish by raising their temperature and might impart objectionable taste, odour or undesirable discolouration.

5.5.6 WHEN CLEANING AND HOSING OPERATIONS ARE CARRIED OUT WHILE THE VESSEL IS IN PORT, POTABLE WATER OR CLEAN SEA WATER SHOULD BE USED.

The water should always be free from objectionable contamination. The total number of microorganisms in it should be low, and it ought not to contain any microorganisms of public health significance. Contamination of the fish by water-borne microorganisms and other undesirable substances will result in the loos of quality and might become a health hazard. Harbour water is usually heavily polluted, and should never be used for cleaning purposes. This is also true for water in the close vicinity of towns, villages, industrial plants, fish processing establishments and factory ships.

5.5.7 IMMEDIATELY AFTER THE CATCH IS UNLOADED, THE DECK AND ALL DECK EQUIPMENT SHOULD BE HOSED DOWN, BRUSHED, THOROUGHLY CLEANED WITH A SUITABLE CLEANING AGENT, DISINFECTED AND RINSED

Fish blood, guts, slime and dead fish left on the deck will support multiplication of microorganisms which may contaminate future catches. If allowed to dry, slime, blood and scales are very difficult to remove.

It is important to realize that thorough cleaning should always procede disinfection especially when chlorine is used as the disinfecting agent. Any organic matter, which if not removed from the surfaces that are to be disinfected, will rapidly combine with and neutralize the microorganism killing ability of chlorine or any other disinfectant.

5.5.8 IMMEDIATELY AFTER THE CATCH IS LANDED THE FISH HOLD AND BILGE SUMP SHOULD ALSO BE EMPTIED COMPLETELY. ALL SURFACES IN THE HOLD, POUND BOARDS AND SUMP SHOULD BE THOROUGHLY CLEANED WITH A SUITABLE CLEANING AGENT, DISINFECTED AND RINSED

This is necessary to remove all fish slime, blood and other residue as soon as the catch is landed, in order to avoid multiplication of microorganisms, offensive odours and the drying of residues on the hold or other surfaces. Cleaning should be completed before the fresh ice is taken on board for the next trip.

5.5.9 IN SHIPS USING REFRIGERATED SEA WATER OR REFRIGERATED BRINE SYSTEMS FOR THE PRESERVATION OF THE CATCH, ALL TANKS, PUMPS, HEAT EXCHANGERS AND OTHER ASSOCIATED EQUIPMENT SHOULD BE CLEANED IMMEDIATELY AFTER DISCHARGING THE CATCH. POTABLE WATER OR CLEAN SEA WATER CONTAINING A SUITABLE CLEANING AGENT SHOULD BE CIRCULATED THROUGH ALL PARTS OF THE SYSTEM. TANKS SHOULD BE INSPECTED CARFULLY AND CLEANED OUT BY BRUSHING IF NECESSARY

Since anaerobic microorganisms are particularly active under tank storage conditions, a very high standard of sanitation is required to avoid their build up and the spread of infection from one tank to another.

Immediately after unloading, when surfaces are still wet, the holding tanks should be washed with cold potable water or clean sea water under adequate pressure then scrubbed with a brush using an alkaline detergent solution, then followed by a rinse with warm and cold water.

All pumps, pipes and heat exchangers should be thoroughly flushed with clean cold potable water or clean sea water, then followed by circulating through the system either a hot alkaline solution or cold water to which a strong cleaning agent has been added. After rinsing with potable water or clean sea water, a suitable disinfectant should be circulated through the system. It has been regarded by many fishermen as good practice to leave a weak solution of a non-corrosive disinfectant in the system. This of course must be drained and rinsed out thoroughly with potable water or clean sea water before filling the tanks.

5.5.10 WHERE REFRIGERATED SEA WATER IS USED FOR THE PRESERVATION OF FISH, ONLY CLEAN SEA WATER SHOULD BE USED AND SHOULD BE CHANGED AS OFTEN AS POSSIBLE TO PREVENT THE ACCUMULATION OF CONTAMINATING MATERIALS

Use of sea water contaminated with sewage or industrial discharges will affect the quality of the catch or render it unfit for human consumption. It is advisable for fishermen to check with the local authorities which areas are likely to be free of pollution. The intake for the vessel's sea water pump should be located on the oppposite side away from sewage, waste discharge and engine cooling water outlets of the boat. Clean sea water should be taken in while the vessel is in forward motion.

5.5.11 WHERE CUTTING BENCHES ARE INSTALLED THESE SHOULD BE PROVIDED WITH CHANNELS OR CHUTES WHICH HAVE A CONTINUOUS SUPPLY OF CLEAN SEA WATER TO CARRY THE GUTS OVER THE SHIPSIDE OR TO A SUITABLE COLLECTING CONTAINER

Where fish are contaminated by offal and filth from the gutting operations, the spoilage rate will be increased and all surfaces with which the guts come into contact will also become contaminated. The installation of gutting benches makes the task easier, but care should be taken to ensure that the benches are kept in a hygienic condition.

In disposing of offal into the surrounding water, some consideration should be given to the possibility of a serious pollution problem, especially if this is done in sheltered waters, close to public benches or inhabited areas.

5.5.12 ADEQUATE PRECAUTIONS SHOULD BE TAKEN TO ENSURE THAT HUMAN AND OTHER WASTES FROM THE FISHING VESSEL ARE DISPOSED OF IN SUCH A MANNER AS NOT TO CONSTITUTE A PUBLIC HEALTH AND HYGIENIC HAZARD

With man's increased concern for the protection of his environment, in some countries the disposal of any waste from any boat into the surrounding water is restricted by law.

The fishermen should be fully aware of their responsibilities in this regard. Discharge of animal, human or any other wastes from the fishing vessel into the sheltered waters close to man inhabited areas, or over the shellfish growing areas should not be practised.

5.5.13 EFFECTIVE MEASURES SHOULD BE TAKEN TO PROTECT THE FISHING VESSEL AGAINST INSECTS, RODENTS, BIRDS OR OTHER VERMIN

Rodents, birds and insects are potential carriers of many diseases which could be transmitted to man by contamination of fish. Fishing vessels should be regularly examined for evidence of infestation and, when required, effective control measures should be taken.

All rodenticides, fumigants, insecticides and other harmful substances should be used only in accordance with the recommendations of the appropriate official agency having jurisdiction.

5.5.14 DOGS, CATS AND OTHER ANIMALS SHOULD BE EXCULDED FROM AREAS OF THE VESSEL WHERE FISH IS RECEIVED, HANDLED, PROCESSED AND STORED

Because of public health hazards and for aesthetic reasons, no surface of the fishing vessel and of the equipment thereon which come in contact with fish should be exposed to contamination with animal hair or excreta.

5.5.15 WHEN A VESSEL CONVERTS TO STORING FISH IN ICE FOR HUMAN CONSUMPTION, AFTER CATCHING SPECIES SUCH AS HERRING FOR REDUCTION PURPOSES, THE HOLD AND BILGE MUST BE THOROUGHLY CLEANED, DISINFECTED AND RINSED

Cleaning should be carried out with high pressure potable water or clean sea water containing a suitable cleaning agent, followed by a thorough rinsing. A suitable disinfectant should then be applied to all surfaces and remain in contact long enough to complete the disinfection. Always, when using commercial products, the manufacturer's recommendations as to the concentration and treatment time should be followed. Finally the hold should be thoroughly rinsed with potable water or clean sea water.

5.5.16 FOOD SUPPLIES FOR THE SHIP'S KITCHEN OR FOR THE CREW'S MESS SHOULD NEVER BE STORED IN ICE BINS WHERE FISH ARE KEPT

Storage of such materials in ice intended for fish might contaminate the ice and the fish.

5.6 Handling the catch on board

5.6.1 DURATION OF THE FISHING TRIP FOR A FISHING VESSEL SHOULD BE DETERMINED BY THE FACILITIES AVALIABLE ON THE VESSEL FOR HANDLING AND KEEPING THE CATCH WELL CHILLED, DISTANCE FROM THE PROCESSING PLANT AND THE LOCAL ENVIRONMENTAL CONDITIONS

From the time the fish are caught there is a continual and irreversible deterioration in quality. The progress and degree of such deterioration are governed mainly by the time the fish are held and the temperature at which they are handled and stored on board a fishing vessel. With short distances from the processing plant or market more time could be spent on the fishing grounds providing the boat is equipped with adequate facilities to handle, effectively chill and hold the catch at a low temperature.

5.6.2 HANDLING THE CATCH SHOULD BEGIN AS SOON AS IT COMES ON BOARD. ANY FISH UNSUITABLE FOR HUMAN CONSUMPTION SHOULD BE REMOVED FROM THE CATCH AND KEPT SEPARATE

Sorting the catch should be done as soon as the fish are taken on board, to remove as quickly as possible fish unsuitable for human consumption. Mixed species catches should also be sorted rapidly not only for the reason stated above but also to avoid possible damage due to abrasion, particularly where the catch contains spiny and rough skin species and to prevent transferring undesirable odours and tastes which may affect the organoleptic quality of the differing species.

5.6.3 WHERE IT IS REQUIRED TO KEEP SPECIES UNSUITABLE FOR HUMAN FOOD THESE SHOULD ALWAYS BE SORTED FROM THE EDIBLE CATCH AND KEPT SEPARATE AT ALL TIMES

If fish, unsuitable for human food, are brought back to port as, for example, for fish meal manufacture, care should be taken to avoid contamination of the edible catch.

5.6.4 FISH SHOULD NOT BE TRAMPLED OR STOOD UPON, AND SHOULD NOT BE PILED DEEPLY ON DECK

Any physical damage, whether by crushing, bruising, rubbing or scraping assists spoilage and reduces the value of the fish for subsequent food processing purposes.

5.6.5 ALL FISH ON DECK SHOULD BE PROTECTED FROM SUN, FROST, AND THE DRYING EFFECTS OF WIND

It is essential to prevent the fish temperatures from rising. Each degree of rise in temperature increases the rate of spoilage. If the catch is to be on deck for any length of time, it should be protected by an awning, ice, or even a wet, clean canvas or burlap. Drying will lower market value by spoiling the appearance and possibly inducing rancidity. Slow freezing of the catch on deck, in areas where very low temperatures are encountered, should also be avoided.

If the vessel is undecked, then a clean container, preferably insulated and lidded, should be provided for the protection of the catch.

5.6.6 LINE CAUGHT FISH SHOULD, WHEREVER PRACTICABLE, BE STUNNED AS SOON AS THEY ARE TAKEN ON BOARD THE VESSEL

If fish are allowed to struggle and thrash about on deck, they may not only be badly bruised, but may become exhausted before they die, and their quality impaired. It is of course recognized that the stunning of small fish is impracticalbe.

Stunning should be done only on the head and, with some fish, preferably while the fish is still in water. Fish should be landed by hooking under the gills rather than gaffing in the body or lifting by the tail. With heavy fish the spine might break when the fish is lifted by its tail thus resulting in local flesh discolouration and muscle separation.

5.6.7 WHEN FISH ARE TO BE BLED, THIS SHOULD BE DONE IMMEDIATELY AFTER THE FISH ARE LANED ON DECK

Bleeding is usually quicker and more effective when carried out at a relatively low temperature or when the fish are still alive.

It is good practice with some fish to bleed them prior to gutting. On the other hand, in some fisheries, the fish are bled by gutting. In the latter case, the fish may bleed better if they are freshly caught. For this purpose the fishermen should take short hauls in order to bring the fish on board alive.

If bleeding and gutting is done on dead or "spent" fish, the fillets cut from such fish will have a pronounced discolouration rather than the appearance of properly bled fish.

5.6.8 GUTTING SHOULD COMMENCE AS SOON AS THE CATCH COMES ON DECK

The reasons for prompt gutting are, firstly, to sever some of the main blood vessels allowing the fish to bleed and, secondly, to remove the stomach and gut which would otherwise cause a softening of the flesh and accelerate spoilage. Fish in which the guts are full of food will spoil even more rapidly. Although immediate gutting is desirable with most species, the catch in certain fisheries cannot be handled rapidly enough, and advantages gained by gutting may be offset by quality loss resulting from rises in fish temperature. In such circumstances it would be preferable to get the fish under cover and to chill quickly, rather than delay the chilling operation by gutting.

5.6.9 WHERE RAPID GUTTING IS NOT PRACTICABLE WHOLE FISH SHOULD BE WASHED AND CHILLED AS SOON AS IT COMES ON DECK

This helps to remove filth, particularly gut contents squeezed out of the fish and it helps to prevent excessive contamination during subsequent gutting and handling.

A thorough washing of the fish will reduce considerably the number of spoilage microorganisms and remove some of the protein digestive ensymes which come from the viscera of the fish.

5.6.10 IT IS USUALLY IMPRACTICABLE TO GUT VERY SMALL FISH. THESE SHOULD THEREFORE BE PLACED IN CHILLED STORAGE QUICKLY

Any delay in chilling very small whole fish will have an adverse effect on their quality. Failure to stow these fish quickly may expose them to the effect of weather as well as to physical damage.

5.6.11 GUTTING SHOULD BE COMPLETE AND CARRIED OUT WITH CARE. BAD CUTTING MIGHT BE WORSE THAN NO GUTTING AT ALL

Pieces of gut or liver, if not completely removed, wil act as centres from which spoilage will develop. Enzymes from pieces of gut and liver will digest the flesh and facilitate the entry of micro organisms. Careless gutting, for example, cutting beyond the vent of a fish will also allow the entry of microorganisms into the flesh. Nevertheless, cuts should be adequate to allow easy access to the belly cavity and complete removal of guts.

5.6.12 FISH GUTS SHOULD NOT BE ALLOWED TO CONTAMINATE OTHER FISH ON DECK

Fish guts contain digestive enzymes and spoilage microorganisms. If allowed to foul the rest of the catch, the spoilage rate will be increased. This contamination can be prevented by dropping guts into suitable watertight containers or chutes discharging over the ship side.

In disposing of offal into the surrounding water, some consideration should be given to the possibility of a serious pollution problem, especially if this is done in sheltered waters, close to public beaches or inhabited areas.

With bigger boats handling larger quantities of fish the resulting offal could easily be processed into fish meal. Such machines have been developed for installation on board fishing vessels and are commercially available.

5.6.13 SEPARATE AND ADEQUATE STORAGE FACILITIES SHOULD BE PROVIDED FOR THE FISH ROE, MILT AND LIVERS IF THESE ARE SAVED FOR LATER UTILIZATION

In some fisheries certain by-products of gutting operations are saved either for human food, like fish roe and milt, or for utilization in pharmaceutical industry, like fish liver used in vitamin extraction.

All these by products should be stored separately from the fresh fish intended for human consumption and should be kept well chilled and protected from sun, rain, wind and frost. Partial freezing of roe might damage it.

5.6.14 IMMEDIATELY AFTER GUTTING, FISH SHOULD BE WASHED WITH CLEAN SEA WATER OR POTABLE WATER CONFORMING TO SLS 614

Fish should be thoroughly washed with clean sea water or potable water before being placed under refrigeration to remove all blood, slime and pieces of gut. Fish blood coagulates rapidly and washing will facilitate more complete bleeding, which in turn will improve the appearance of the product. If tanks are used for washing gutted fish, a continual flow of potable water or clean sea water should be provided to prevent the accumulation of contaminating materials. The practice, common in some inshore fisheries, to gut and wash the fish close to land involves the risk of using polluted sea water, and should therefore be discouraged.

Harbour water, which is always polluted in some way, should never be used for washing fish.

5.6.15 ON COMPLETION OF WASHING THE FISH, FURTHER HANDLING SHOULD BE CARRIED OUT WITHOUT DELAY.

Any further postponement in handling the washed fish before it is chilled, reduce its potential keeping time.

Therefore, with the least possible delay th fish should be thoroughly iced or immersed in ice water to bring its temperature down to 0°C as quickly as possible.

At higher temperatures a delay of one hour can have a serious effect on the quality of the final product.

Chilling of fish in bulk by cold air or by top icing only should be avoided. It should be mentioned that the rapid chilling of the freshly caught fish will also slow down the onset, duration and relaxation stages of the rigor mortis phenomenon. Although this problem concerns mostly the quality of frozen fish, it could also affect the quality of freshly caught fish when they are left uprotected on the deck exposed to a high temperature. At such a temperature the stiffening of the muscles is accelerated, thus creating strong internal stresses which might result in a break-down of the muscular tissue. In some species of fish the severity and rapidity of this reaction will have a detrimental effect on the quality. Also to many buyers the sign of rigor is equated with freshness. When the rigor is over the muscles become flabby and the fish "pits" easily on application of a slight pressure.

5.6.16 DECK HATCHES SHOULD NOT BE LEFT OPEN LONGER THAN NECESSARY TO LOAD THE FISH

Only one fishroom hatch should be opened to allow the loading of fish and to prevent undesirable heat leak into the hold. Where two or more hatches are open at the same time, a current of warm air may flow through the fishroom, causing undue ice meltage.

5.6.17 FISH SHOULD BE ALLOWED TO SLIDE DOWN CHUTES INTO THE HOLD OR BE LOWERED IN SUITABLE CONTAINERS

Fish can be damaged and their market value reduced if they are thrown or dropped into the hold.

Heavy fish should never be lifted by their tails or dropped on their tails into the hold.

Indiscriminate use of e.g. hay-forks, shovels, rakes and gaffs for handling of fish should be discouraged. Physical damage caused by these sharp instruments will result in shortening of the shelf life of fish, deterioration in quality and diminishing recovery as the fish go through the processing.

Fish are extremely perishable food and should be handled with utmost care at all times.

5.6.18 FISH SHOULD BE CHILLED RAPIDLY IN MELTING ICE AND SHOULD BE STORED SO THAT THE TEMPERATURE DOES NOT RISE. FOR SHORT TERM STORAGE, HOWEVER, REFRIGERATED SEA WATER OR REFRIGERATED BRINE MAY BE USED

It is well known that temperature is the most important single factor influencing the keeping quality of fish. It has been shown that food spoils about 5 1/2 times as fast at 10°C, and about 2 1/2 times as fast at 4.4 °C, as it does at 0°C. Expressing this in another way, cod that would remain edible for about 14 days stored at 0°C would be edible for only 6 days if stored at 4.4°C and for less than 3 days if stored at 10°C. It is also known that the effects of increasing temperature are cumulative; that is, some potential keeping time is lost each time the temperature of the fish is allowed to rise. The extent of this loss depends both on the degree of temperature rise and the length of time the fish remains at the higher temperature. It is, therefore, most important to chill quickly the fish to the temperature of melting ice, soon after capture, and maintain it in a chilled condition until it reaches the consumer. In some areas refrigerated sea water or refrigerated brine is used for chilling and storing the fish. Here again the chilling should be rapid and the system should be capable of maintaining the fish at -1°C.

5.6.19 FISH IN ICE SHOULD BE STOWED IN SHALLOW LAYERS

The best bulk stowage is the shallowest, with the fish well mixed with finely divided ice. It is appreciated that in some fiheries a compromise is necessary, because it is rarely possible to stow all the catch in very shallow layers, a few fish deep, between shelves. It is perhaps not sufficiently recognized that fish at the bottom of a deep pile an lose considerable weight. It has been observed, for instance, that haddock at the bottom of a pound 1 metre deep can lose as much as 15 percent of its initial gutted weight after about two week's storage.

5.6.20 THE PRACTICE OF SHELF STOWAGE IS NOT TO BE RECOMMENED, UNLESS THE SINGLE LAYERS OF FISH ARE COMPLETELY COVERED WITH LAYERS OF ICE

In practice, shelf stowage involves the laying out of single layers of fish side by side and head to tail, belly down on a bed of ice, but with no ice among or on top of the fish. Single fish laid out in this manner are only cooled from one side, and therefore cool down less rapidly than fish well mixed with ice. The backs and heads of the fish can remain quite warm through out the storage period, and microorganisms originating in the gills can spread rapidly along the backbone. It has been found that these shelf stowed fish are inferior in quality compared with fish which have been shallow bulk stowed at the same time.

Where fish are shelf stowed, ice should always' be added, around and on top of each layer.

5.6.21 FISH SHOULD BE SURROUNDED BY ADEQUATE QUANTITIES OF ICE

Sufficient quantities of ice are necessary, not only to cool the fish, but to maintain it in a cool condition. There should be enough ice to cope with any heat leaking into the fish room and the ice should be properly distributed. If, at the end of a voyage, fish are no longer completely surrounded by ice, then insufficient quantities of ice have been used. It is difficult to lay down precise quantities required, but icing should be heaviest against shipsides and bulkheads. The heat leak into the hold will depend on its construction, the temperature of the surrounding sea and areas of the vessel adjacent to the fish hold. In warm waters it will be necessary to use greater proportions of ice than in colder climates, and the quantity will also depend on whether the hold is insulated. It must be emphasized that the correct quantities of ice require to be worked out for individual vessles by trial and error. In the final analysis the best way to determine correct ice quantities is to measure the temperature of the fish from time to time. In many countries fishery research organizations are available to give advice on how to measure these temperatures.

Stowage of fish in ice is generally practiced on fishing vessels making trips of a few days or more, but many small inshore vessels do not use ice or any other form of preservation, and consequently there is often considerable and unnecessary loss of fish quality.

5.6.22 ICE SHOULD ALSO BE USED TO PREVENT CONTACT WITH ALL SURFACES IN THE FISH HOLD

It is good practice to prevent fish from coming in contact with ship sides, bulkheads and all fishroom structures. If fish are pressed against those surfaces, or even against one another, so that air is excluded, a peculiarly offensive type of microbial spoilage takes place, and fish which otherwise appear to be in good condition are rendered quite inedible, because of the development of foul odours and flavours. Inadequate icing may result in fish coming in contact with these surfaces.

5.6.23 FINELY DIVIDED ICE SHOULD ALWAYS BE USED TO GIVE CLOSE CONTACT WITH THE FISH

To maintain close contact with the fish at all times, ice used for chilling and preservation should always be finely divided in one form or another. Any large lumps of ice can cause damage to fish, and will be less effective in cooling because of poor surface contact with the fish. Various forms of ice are used in many fisheries; the important factors are that they should be made from potable water or clean sea water and should consist of finely divided particles to increase their cooling effectiveness.

5.6.24 WHERE BOXED STOWAGE IS USED, THE FISH SHOULD BE PROPERLY ICED AND THE BOXES NOT OVERFILLED

The packing of fish with ice,into containers at sea, in some areas, offfers a number of advantages for certain fisheries. When properly iced the fish can remain undisturbed in the containers until they reach the processor. Unloading the catch can become a simple operation, and more ice can be added to the containers on landling, without disturbing the fish.

Generally, properly boxed iced fish should be of a higher quality than fish caught the same day and stored in other ways. Each day's catch can also be separated more easily. Since boxes are stacked one on top of another in the fish hold, overfilling with ice or fish will result in crushing and damage to the fish. For efficient cooling, each box should contain a layer of ice on the bottom, then some fish and ice mixed together, and lastly a top layer of ice. Boxing should not be mixed with other methods of stowage during the same trip.

5.6.25 FISH SHOULD NOT BE PACKED IN REFRIGERATED SEA WATER OR REFRIGERATED BRINE TO A DENSITY OF MORE THAN 800 KG PER CUBIC METRE

If too much fish is loaded into the tanks, there will not be sufficient space for the free circulation of refrigerated sea water or brine throughout the load, and therfore some fish will not be cooled efficiently. This practice of overloading the tanks will also add an extra load on the refrigeration equipment in which case it will take a longer time to attain the desired temperature conditions or, in extreme cases, these might never be reached. The density of the fish given above is an upper limit and may be high for certain species.

5.6.26 WHERE SEA WATER OR BRINE STOWAGE TANKS ARE COOLED BY THE ADDITION OF ICE, SALT CONCENTRATION SHOULD BE MAINTAINED AT ABOUT 3 PERCENT

In practice this can be achieved by the addition of salt, the quantity being regulated by the amount of ice used. If the sea water or brine is too diluted, the fish can absorb water and hence quality can suffer.

5.6.27 A STOWAGE PAN SHOULD BE KEPT ON ANY VESSEL FISHING FOR MORE THAN A DAY OR TWO

A well prepared stowage plan enables the various day's catches to be kept separate when unloading. Fish from different day's catches should never be stored mixed together.

5.7 Unloading the catch

5.7.1 UNLOADING THE CATCH SHOULD BE CARRIED OUT IN A CAREFUL MANNER, AND WITHOUT DELAY

In most fisheries the catch is landed after being separated from the ice in the fish room. Any undue delay at this stage allows the fish temperature to rise, thus increasing the rate of spoilage. For this reason, the landing of boxed iced fish is to be recommended.

There are fish landing installations where the catch could be unloaded from a vessel to dock side conveyor within a relatively short time. Such a conveyor will provide for cursory inspection of the catch, and will de-ice the fish, spray-wash it and convey the load through the automatic weight recording scale or individual fish counter device.

Such installations should be constructed of suitable corrosion-resistant material and so designed as not to contaminate or damage the fish or to cause its temperature to rise. A large amount of cold potable water or cold clean sea water would be required for de-icing and washing of fish.

5.7.2 AT THE CONCLUSION OF EACH FISHING TRIP, ALL UNUSED ICE SHOULD BE DISCARDED BEFORE CLEANING BEGINS

Ice left in the fishroom, even if it has not been used on the previous trip, may be contaminated with fish spoilage microorganisms. If this ice is used on any subsequent trips, for cooling fish, it may accelerate spoilage of the catch.

5.7.3 MIXING OF DIFFERENT DAYS' CATCHES DURING UNLOADING SHOULD BE AVOIDED

Batches of fish, of mixed quality, may often fetch a lower price on the market. Poorer quality fish will soon contaminate any of higher quality if they are mixed together. A good stowage plan, showing the position of each day's catch in the hold may avoid mixing.

5.7.4 FISH SHOULD NOT BE DAMAGED DURING UNLOADING

As has been mentioned before, the use of hooks, shovels, forks and other such implements for unloading the catch should be avoided, in order that the fish suffer no damage. Where these implements are used they should be handled with great care. Tearing of the flesh reduces the value of the fish and accelerates spoilage.

5.7.5 MECHANICAL UNLOADING EQUIPMENT SHOULD BE USED WHERE POSSIBLE

Properly designed systems employing mechanical conveyors, fish pumps or other such equipment can increase the unloading rate and cause less damage than the traditional manual methods. With faster unloading, the time that the fish are exposed to the outside environment may be decreased, thus delaying spoilage. Some effective fish pumps are available for large and small fish and should only be used with potable water or clean sea water. They are not yet suitable for handling all species.

5.7.6 BULK OR SHELF STOWED CATCH SHOULD BE UNLOADED INTO CLEAN CONTAINERS AND IMMEDIATELY PLACED IN A SUITABLE COVERED AREA. WHILE LAYING IN THIS AREA THE CATCH SHOULD BE MAINTAINED IN A CHILLED CONDITION

No fish should be allowed to lie on floors or other unclean surfaces and they should not be exposed to direct sunlight. The use of clean containers and a sufficient quantity of ice will increase keeping time.

5.7.7 CARE SHOULD BE TAKEN THAT FISH ARE NOT DAMAGED OR CONTAMINATED DURING SORTING, WEIGHING AND TRANSFER TO CONTAINERS

Physical damage can increase spoilage rate and badly torn fish are useless for processing purposes.

5.7.8 WHEN REFRIGERATED BRINE OR SEA WATER BOATS ARE UNLOADED BY MEANS OF PUMPS AND SIPHONS THE COMPENSATING OR SO CALLED 'MAKEUP' WATER SHOULD BE OF THE SAME TEMPERATURE AND HYGIENIC QUALITY AS THE ORIGINAL BRINE

The unloading of the refrigerated sea water boats could be accomplished either by brailing or by the use of fish pumps or syphons.

If a pump or a syphon is used, a fair amount of refrigerated sea water, as the conveying medium for the fish, will be lost at the outlet end of the system.

To retain the necessary level and volume of water in order to complete the unloading, additional ("makeup") water from an outside source should be added to the system.

Only cold, clean sea water or brine, or potable water should be used to compensate for the loss of the original brine unless a method of

5.8.1 IT IS DESIRABLE THAT EACH FISHING VESSEL SHOULD DEVELOP ITS OWN SANITARY CONTROL PROGRAMME BY INVOLVING THE WHOLE CREW AND BY ASSIGNING TO EACH MEMBER A DEFINITE TASK IN CLEANING AND DISINFECTING THE BOAT

A permanent cleaning and disinfection schedule should be drawn up to ensure that all parts of the boat and equipment thereon are cleaned appropriately and regularly.

The fishermen should be well trained in the use of special cleaning tools, methods of dismantling equipment for cleaning and should be knowledgeable in the significance of contamination and the hazards involved.

6. HANDLING FRESH FISH ON SHORE PLANT-FACILITIES AND OPERATING REQUIREMENTS

6.1 PLANT CONSTRUCTION AND LAYOUT

6.1.1 *General Considerations*

FRESH FISH PROCESSING PLANTS SHOULD BE SPECIALLY DESIGNED FOR THE PURPOSE

Raw fish spoils considerably faster than raw meat of warm blooded animals. The keeping time of fish delivered to processing plants has been already reduced by time and conditions of handling and storage on the fishing vessel. Nothing can be done by the processor to improve the quality of fish delivered to him by the fishermen.

Because of the highly perishable nature of fish, the processing plant demands special facilities and material which, as compared to other food processing establishments, are in some cases rather unique.

The technological and hygienic operating and production requirements also differ in being often more demanding and critical.

The fresh fish processing plant, therfore, should be designed to process the fish with the minimum of delay and of any further reduction in fish quality.

6.1.2 PLANT CONSTRUCTION AND SANITARY DESIGN

6.1.2.1 THE PLANT AND SURROUNDING AREA SHOULD BE SUCH AS CAN BE KEPT REASONABLY FREE FROM OBJECTIONABLE ODOURS, SMOKE, DUST OR OTHER CONTAMINATION. THE BUILDING SHOULD BE SUFFICIENT IN SIZE WITHOUT CROWDING OF EQUIPMENT OR PERSONNEL, WELL CONSTRUCTED AND KEPT IN GOOD REPAIR. THEY SHOULD BE OF SUCH DESIGN AND CONSTRUCTION AS TO PROTECT AGAINST THE ENTRANCE AND HARBOURING OF INSECTS, BRIDS OR OTHER VERMIN AND TO PERMIT READY AND ADEQUATE CLEANING

The location of a fresh fish processing establishment, its desgin layout, construction and equipment should be planned in detail with considerable emphasis on the hygienic aspect, sanitary facilities and quality control.

National or local authorities should always be consulted in regard to building codes, hygienic requirements of the operation and sanitary disposal of sewage and plant waste.

The food handling area should be completely separate from any part of the premises used as living quarters.

6.1.2.2 FLOORS SHOULD BE HARD SURFACED, NON-ABSORBENT AND ADEQUATELY DRAINED

Floors should be constructed of durable, waterproof, non-toxic, non-absorbent material which is easy to clean and disinfect. They should be non-slip and without crevices and should slope evenly and sufficiently for liquids to drain off to trapped outlets fitted with a removable grill.

If floors are ribbed or grooved to facilitate traction, any grooving of this nature should always run towards the drainage channel.

The junctions between the floors and walls should be impervious to water and should be coved or rounded for ease of cleaning.

Concrete, if not properly finished, is porous and can be affected by animal oils, strong brines, various detergents and disinfectants. If used, it should be dense of a good quality and with a well finished waterproof surface.

6.1.2.3 DRAINS SHOULD BE OF AN ADEQUATE SIZE, SUITABLE TYPE, EQUIPPED WITH TRAPS AND WITH REMOVABLE GRATINGS TO PERMIT CLEANING

Suitable and adequate drainage facilities are essential for removal of liquid or semi-liquid wastes from the plant. There should not be any floor area where water might collect in stagnant pools. Drains should be constructed of smooth and impervious material and should be designed to cope with the maximum flow of liquid without any overlfowing and flooding. Each drainage inlet should be provided with a deep seal trap which is appropriately located and easy to clean.

Drainage lines carrying waste effluent except for open drains, should be properly vented, have a minimum internal diameter of 10 cm and, if required, run to a catch basin for removal of solid waste material. Such a basin should be located outside the processing area and should be constructed of waterproof concrete or other similar material, designed to the local specifications and should meet the requirements of the official agency having jurisdiction.

6.1.2.4 INTERNAL WALLS SHOULD BE SMOOTH, WATERPROOF, RESISTANT TO FRACTURE, LIGHT COLOURED AND READILY CLEANABLE

Acceptable materials for finishing walls inside are cement render, ceramic tiles, varous kinds of corrosion-resistant metallic sheeting such as stainless steel or aluminium alloys and a variety of non-metallic sheetings which have adequate impact resistance, desirable surface qualities and are easily repairable.

All sheeting joints should be sealed with a mastic or other compound resistant to hot water, and cover strips should be applied where necessary.

Wall-to-wall and wall-to-floor junctions should be coved or rounded to facilitate cleaning.

walls should be free from projections and all pipes and cables should be sunk flush with wall surface or neatly boxed in.

6.1.2.5 WINDOW SILLS SHOULD BE KEPT TO A MINIMUM SIZE, BE SLOPED INWARD AT 45°AND BE ATLEAST 1 METRE FROM THE FLOOR

Window sills and frames should be made of smooth, waterproof material and, if of wood, should be kept well-painted. Internal window sills should be sloped to prevent storage of miscellaneous materials or accumulation of dust and should be constructed to facilitate cleaning.

Windows should be filled with whole panes and those which open should be screened. The screens should be constucted so as to be easily removable for cleaning and should be made from suitable corrosion-resistant material.

6.1.2.6 ALL DOORS THROUGH WHICH FISH OR THEIR PRODUCTS ARE MOVED SHOULD BE SUFFICIENTLY WIDE, WELL CONSTURCTED OF A SUITABLE MATERIAL AND SHOULD BE OF A SELF-CLOSING TYPE

Doors through which fish or their products are moved should be either of a corrosion-resistant metal, or sheathed with a corrosion-resistant metal or made from other suitable material with adequate impact resistance and, unless provided with an effective air screen, should be of self-closing type.

Both the doors and the frames of the doorways should have a smooth and readily cleanable surface.

Doors through which the product is not moved, such as those providing staff access, should be appropriately surfaced, at least on the processing area side, to allow for ease of cleaning.

6.1.2.7 CEILINGS SHOULD BE DESIGNED AND CONSTRUCTED TO PREVENT ACCUMULATION OF DIRT AND CONDENSATION AND SHOULD BE EASY TO CLEAN

Ceilings should be at least 3 metres in height, free from cracks and open joints and should be of a smooth, waterproof, light coloured finish.

In buildings where beams, trusses, pipes or other structural elements are exposed, the fitting of a suspended ceiling just below is desirable.

Where the roof beams and trusses cannot be covered, the underside of the roof may constitute a satisfactory ceiling providing all joints are sealed and the supporting structures are of a smooth, well-painted and light coloured surface, easily cleanable and constructed to protect the fish products from falling debris, dust or condensate.

6.1.2.8 PREMISES SHOULD BE WELL VENTILATED TO PREVENT EXCESSIVE HEAT, CONDENSATION AND CONTAMINATION WITH OBNOXIOUS ODOURS, DUST, VAPOUR OR SMOKE

Special attention should be given to the venting of areas and equipment producing excessive heat, steam, obnoxious fumes, vapours or contaminating aerosols. The air-flow in the premises should be from the more hygienic areas to the less hygienic areas. Good ventilation is important to prevent condensation and growth of moulds in overhead structures. Ventilation openings should be screened and, if required, equipped with proper air filters. Windows which open for ventilation purposes should be screened. The screens should be made easily removable for cleaning, and should be made from suitable corrosion-resistant material.

6.1.2.9 A MINIMUM ILLUMINATION OF 220 LUX IN GENERAL WORKING AREAS AND NOT LESS THAN 540 LUX AT POINTS REQUIRING CLOSE EXAMINATION OF THE PRODUCT SHOULD BE PROVIDED AND SHOULD NOT ALTER COLOURS

Light bulbs and fixtures suspended over the working areas where fish is handled in any step of preparation, should be of the safety type or otherwise protected to prevent food contamination in case of breakage.

6.1.3 *Sanitary Facilities*

6.1.3.1 AREAS WHERE FISH ARE RECEIVED OR STORED SHOULD BE SO SEPARATED FROM AREAS IN WHICH FINAL PRODUCT PREPARATION OR PACKAGING IS CONDUCTED AS TO PREVENT CONTAMINATION OF THE FINISHED PRODUCT

Separate rooms or well defined areas of adequate size should be provided for receiving and storing raw materials and for operations like heading and gutting fish, washing, filleting, steaking or other processing and packaging.

Manufacture or handling of edible products should be entirely separate and distinct from the areas used for inedible materials.

The food handling areas should be completely divorced from any part of the premises used as living quarters.

Receiving and storage areas should be clean and readily capable of being maintained in a clean condition and should provide protection for the raw fish from deterioration and contamination.

6.1.3.2. A SEPARATE REFUSE ROOM OR OTHER EQUALLY ADEQUATE OFFAL STORAGE FACILITIES SHOULD BE PROVIDED ON THE PREMISES

If offal or other refuse is to be collected and held before removal, adequate precautions should be taken to protect it against rodents, birds, insects and exposure to warm temperatures.

A separate refuse room for storing waste in water-tight containers or offal bins should be provided. The walls, floor and ceiling of such a storage room, and the area under the elevated bins should be constructed of impervious material which can be readily cleaned. Where waste material is held in containers outside the establishment, the containers should be lidded. A separate enclosure should be provided for their storage with easy access for vehicles loading and unloading. Stands for the containers should be of solid, hard and impervious material which can be easily cleaned and properly drained.

If containers are used in large numbers, a mechanical washing plant might be advisable to provide for routine washing. Containers should be capable of withstanding repeated exposure to normal cleaning processes.

6.1.3.3. ANY BY-PRODUCT PLANT SHOULD BE ENTIRELY SEPARATE FROM THE PLANT WHICH IS PROCESSING FRESH FISH FOR HUMAN CONSUMPTION

The layout and construction of a plant processing fish for human consumption should be such as to ensure that the areas in which fish for human consumption are held, processed and stored are used for that purpose only.

Any processing of by-products or non-fish products not intended for human consumption should be conducted in separate buildings or in areas which are physically separated in such a way that there is no possibility for contamination of fish or fish products.

6.1.3.4 AN AMPLE SUPPLY OF COLD AND HOT POTABLE WATER CONFORMING TO SLS 614 AND/OR CLEAN SEA WATER UNDER ADEQUATE PRESSURE SHOULD BE AVAILABLE AT NUMEROUS POINTS THROUGHOUT THE PREMISES AT ALL TIMES DURING THE WORKING HOURS

All water available for use in those parts of establishments where fish is received, held, processed, packaged and stored should be potable water or clean sea water and should be suppiled at a pressure of no less than 1.4 kg/cm^2. If sea water is used, it must be clean sea water.

An adequate supply of hot water of potable quality at a minimum temperature of 82 ^{o}C should be available at all times during the plant operation.

The cold water supply used for cleaning purposes should be fitted with an in-line chlorination system allowing the residual chlorine content of the water to be varied at will in order to reduce multiplication of microorganisms and prevent the build-up of fish odours.

Water used for washing or conveying raw materials should not be recirculated unless it is restored to a level of potable quality.

6.1.3.5 WHEN INPLANT CHLORINATION OF WATER IS USED THE RESIDUAL CONTENT OF FREE CHLORINE SHOULD BE MAINTAINED AT NO MORE THAN THE MINIMUM EFFECTIVE LEVEL FOR THE USE INTENDED

Chlorination systems should not be relied upon to solve all sanitation problems. The indiscriminate use of chlorine cannot compensate for unsanitary conditions in a processing plant.

6.1.3.6 ICE SHOULD BE MADE FROM POTABLE WATER OR CLEAN SEA WATER AND SHOULD BE MANUFACTURED, HANDLED AND STORED SO AS TO PROTECT IT FROM CONTAMINATION

Ice used in the operation of the fresh fish processing establishment should be made from potable water or clean sea water.

A special room or other suitable storage facilities, should be provided to protect the ice from contamination and excessive meltage. Dust, flaskes of paint, bits of wood or sawdust, straw and rust, are the most frequent impurities transferable by ice into the final product. Care should be taken to ensure that ice used to chill fish or fishery products does not contaminate them.

6.1.3.7 WHERE A NON-POTABLE AUXILIARY WATER SUPPLY IS USED, THE WATER SHOULD BE STORED IN SEPARATE TANKS AND CARRIED IN SEPARATE LINES, IDENTIFIED BY CONTRASTING COLOURS AND LABELLED AND WITH NO CROSS-CONNECTIONS OR BACK-SIPHONAGE WITH THE LINES CARRYING POTABE WATER

Non- potable water may be used for such purposes as producing steam, cooling heat exchangers and fire protection.

It is very important that the systems of storage and distribution of potable and non-potable water are entirely separate and there is no possibility for cross-connection or for inadvertent usage of non-potable water in the fish processing areas. Only quality water should be used for the supply of hot water.

The same requirement for the separation of systems would apply to clean sea water when it is used in the processing of fish.

6.1.3.8 ALL PLUMBING AND WASTE DISPOSAL LINES, INCLUDING SEWER SYSTEM, SHOULD BE LARGE ENOUGE TO CARRY PEAK LOADS AND SHOULD BE PROPERLY CONSTRUCTED

All lines should be watertight and have adequate deep seal traps and vents. Disposal of waste should be effected in such a manner as not to permit contamination of potable water or clean sea water supplies.

Sumps or solid matter traps of the drainage system should preferably be located out-side the processing area and so designed as to allow them to be emptied and thoroughly cleaned at the end of each working day.

The plumbing and the manner of waste disposal should be approved by the official agency having jurisdiction.

6.1.3.9 PROPER FACILITIES FOR WASHING AND DISINFECTION OF EQUIPMENT SHOULD BE PROVIDED

Facilities should be present in every fresh fish processing establishment for cleaning and disinfection of trays, removable cutting or filleting boards, containers and other similar equipment and working implements. Such facilities should be located in a separate room or in designated areas in the work rooms where there is an adequate supply of hot and cold potable water or clean sea water, under good pressure, and where there is proper drainage.

Any containers and equipment used for offal or contaminated materials should not be washed in the same area.

6.1.3.10 ADEQUATE AND CONVENIENTLY LOCATED TOILET FACILITIES SHOULD BE PROVIDED

Toilet rooms should have walls and ceilings of a smooth washable, light coloured surface and floors constructed of impervious and readily cleanable material. Toilet facilities should be well lit, ventilated and kept in a hygienic condition at all times. Adequate supply of toilet paper should be available in each toilet cubicle.

The doors leading to the facilities should be of a self-closing type and should not open directly into the fish processing areas.

The hand washing facilities in the toilet rooms should be of a type not requiring operation by hand and should have an adequate supply of hot and cold potable water or clean sea water and liquid or powdered soap should be provided. Suitable hygienic means of drying the hands such as single use towels should be available. Where paper towels are used, a sufficient number of dispensers and receptacles for used towels should be provided.

Notices should be posted requiring personnel to wash their hands after using the toilets.

The following formula could be used in assessing the adequacy of toilet facilities in relation to the number of employees:

1	to 9	employees	- 1 toilet
10	to 24	employees	- 2 toilet
25	to 49	employees	- 3 toilet
50	to 100	employees	- 5 toilet
for every 30		employees over 100	- 1 toilet

6.1.3.11 FACILITIES SHOULD BE AVAILABLE IN THE PROCESSING AREAS FOR EMPLOYEES TO WASH AND DRY THEIR HANDS AND FOR DISINFECTION OF PROTECTIVE HAND COVERINGS

In addition to hand washing facilities available in toilet rooms, a number of washbasins with an adequate supply of hot and cold potable water or clean sea water and liquid or powdered soap should be provided wherever the process demands. They should be located in full view of the processing floor and should be of a type not requiring operation by hand or be fed by a continuous flow of potable water or clean sea water. Single use towels are recommended, otherwise the method of drying hands should meet the requirements of the official agency having jurisdiction. The facilities should be kept in a hygienic condition at all times.

6.1.3.12 STAFF AMENITIES CONSISTING OF LUNCHROOMS, CHANGING-ROOMS OR ROOMS CONTAINING SHOWER OR WASHING FACILITIES SHOULD BE PROVIDED

Where workers of both sexes are employed, separate facilities should be present for each except that the lunchrooms, may be shared. As a general guide, the lunchrooms should provide seating accommodation for all employees and the changing-rooms should provide enough space for lockers for each employee without causing undue congestion. Clothing and footwear not worn during working hours must not be kept in any processing area.

6.1.3.13 STORAGE FACILITIES SHOULD BE AVAILABLE FOR THE PROPER DRY STORAGE OF PACKAGING MATERIALS

Separate facilities for the storage of cartons, wrappings or other packaging materials should be provided in order to protect them against moisture, dust or other contamination.

6.1.3.14 IF POISONOUS OR HARMFUL MATERIALS, INCLUDING CLEANING COMPOUNDS, DISINFECTANTS, SANITIZERS AND PESTICIDES ARE STORED, THEY SHOULD BE KEPT IN A SEPARATE ROOM DESIGNED AND MARKED SPECIFICALLY FOR THIS PRUPOSE

All such materials must be prominently and distinctly labelled so that they can be easily identified. The room should be kept locked and the materials contained in it should be handled only by personnel trained in their use.

6.2 Equipment and Utensils

6.2.1 ALL WORK SURFACES AND ALL CONTAINERS, TRAYS, TANKS OR OTHER EQUIPMENT USED FOR PROCESSING FISH SHOULD BE OF SMOOTH, IMPERVIOUS, NON-TOXIC MATERIAL WHICH IS CORROSION RESISTANT AND SHOULD BE DESIGNED AND CONSTRUCTED TO PREVENT HYGIENIC HAZARDS AND PREMIT EASY AND THOROUGH CLEANING. IN GENERAL THE USE OF WOOD FOR THIS PURPOSE IS NOT RECOMMENDED

Contamination of fish during processing can be caused by contact with unsatisfactory surfaces. All food contact surfaces should be smooth, free from pits, crevices and loose scale, substances harmful to man, unaffected by salt, fish juices or other ingredients used, and capable of withstanding repeated cleaning and disinfection. Wood could be used for cutting surfaces only when no other suitable material is available. Machines and equipment should be so designed that they can be easily dismantled to facilitate thorough cleaning and disinfection.

Containers used for holding fish should preferably be constructed of plastic or corrosion-resistant metal, and if of wood, they should be treated to prevent the entry of moisture and coated with a durable, non-toxic paint or other surface coating that is smooth and readily washable. Wicker baskets should not be used.

Stationary equipment should be installed in such a manner as will permit easy access and thorough cleaning and disinfection.

Fish washing tanks should be designed to provide a constant change of water with good circulation, and to have provisions for drainage and to be easily cleaned.

Equipment and utensils used for inedible or contaminated materials should be identified as such and should not be used for handling of fish and products intended for human consumption.

6.2.2 MARKET CONTAINERS FOR REPEATED USE SHOULD BE MADE OF SUITABLE CORROSION-RESISTANT MATERIAL AND SHOULD BE CONSTRUCTED SO THAT THEY CAN BE EASILY CLEANED

The type of container used in fish markets varies from area to area, but whatever shape or dimension, they should not have crevices, lips or sills which render them difficult to clean. Containers of wood and wicker cannot be cleaned satisfactorily and their use should be discouraged. A number of plastic and light alloy containers are now available for the handling and storage of fish.

6.2.3 CONTAINERS SHOULD BE LARGE ENOUGH TO HOLD ADEQUATE QUANTITIES OF ICE AS WELL AS THE CORRECT WEIGHT OF FISH. THEY SHOULD BE STRONG ENOUGH TO WITHSTAND FAIRLY ROUGH HANDLING AND BE SUITABLE FOR STACKING WHEN FILLED, WITHOUT DAMAGE TO FISH IN BOXES BELOW. DRAINAGE SHOULD ALSO BE ARRANGED TO AVOID CONTAMINATION OF FISH IN STACKED BOXES.

As the fish should always be well iced, it is necessary that the containers be large enough to hold adequate quantities of ice for the standard amount of fish being sold. It should be possible to stack containers close together to reduce the amount of heat absorbed from the surrounding atmosphere. Good drainage arrangements prevent fish lying in melt-water containing microorganisms and the digestive enzymes derived from the stomach and intestines of the fish.

6.2.4 RETURNABLE BOXES SHOULD BE OF SUITABLE CORROSION-RESISTANT MATERIAL

Returnable boxes should be clean to avoid contamination, and strong, enough to with-stand physical damage to the fish during transit. The boxes should also be large enough to hold sufficient ice in order to maintain the fish in a chilled condition while being transported. Boxes of plastic or light-alloy material are recommended, as raw wood cannot be cleaned properly.

New developments in some areas include the use of plastic non-returnable liners and returnable outer boxes in alloy material. Some have built-in melt-water collecting compartments so that they can be transported along with other goods, which might otherwise be contaminated by the melt-water.

6.2.5 NON-RETURNABLE BOXES SHOULD BE STRONGLY CONSTRUCTED AND DURABLE ENOUGH FOR ANY NORMAL HANDLING OPERATION DURING DISTRIBUTION. THEY SHOULD BE LARGE ENOUGH TO HOLD AN ADEQUATE AMOUNT OF ICE AS WELL AS THE REQUIRED WEIGHT OF FISH. PROVISION SHOULD BE MADE FOR THE DRAINAGE OF MELT-WATER. WHERE WOOD IS USED IT SHOULD BE CLEAN AND NEW

Non- returnable boxes, in a variety of materials, are used in various fisheries. Many are of poor construction and are easily broken during distribution, thus damaging the contents, or allowing outside contamination to take place. In some cases boxes are too small to hold adequate quantities of ice. Overfilling a box will result in the crushing and bruising of fish when the boxes are stacked for transport. In many areas, non-returnable boxes are now available constructed of specially treated fibre-board. Others are made from expanded plastic material which acts as an insulant as well as container but the fish must of course be chilled before packing, or the insulation would maintain them at a higher temperature.

6.2.6 FILLETING BOARDS AND OTHER SURFACES ON WHICH FISH ARE CUT SHOULD BE MADE OF IMPERVIOUS MATERIALS WHICH MEET THE PHYSICAL REQUIREMENTS FOR CUTTING SURFACES

Considerable microbial contamination of fillets and steaks is caused by contact with the filleting and cutting boards. Wooden cutting surfaces are porous and quickly become water logged and are practically impossible to clean thoroughly. They are not recommended as suitable for this type of work.

If in the absence of other materials, wood has to be used, a single board of a well finished and smooth surface is recommended. Once the surface becomes badly worn then the board should be reconditioned or discarded.

The use of plywood or other boards of laminated structure should be discouraged.

6.2.7 THE FILLETING LINE SHOULD BE DESIGNED AS A CONTINOUS PROCESSING UNIT WITH ALL OPERATIONS ARRANGED SEQUENTIALLY IN SUCH A WAY THAT THE FISH COULD MOVE UNIFORMLY FAST THROUGH THE LINE WITHOUT ANY STOPPAGES OR SLOW-DOWNS

A properly designed filleting line means saving in the cost of processing and will result in a better quality of the final product. When the fish or fillets are moved through the line by a conveyor, the conveyor should be provided with scrapers and spray-washers at least at its two terminal pulleys. If the fish are flumed, no recirculation of the fluming water should be allowed unless it is restored to a level of potable quality. Offal chutes should be located as close as possible to the filleter's stations but in such a way that there is no possiblility for a splash-back. Each filleter's station should have a line of potable water or clean sea water with a tap to regulate the flow of water over the surface of the filleting board.

The filleting line should be easy to dismantle for cleaning purposes and should be constructed from a corrosion-resistant material such as stainless steel or marine grade aluminium. There should be an easy access to every part of the line.

6.2.8 THE USE OF MACHINES FOR GUTTING, WASHING, FILLETING, SKINNING, STEAKING AND SIMILAR OPERATIONS, WHICH ARE PROPERLY DESIGNED, IS TO BE ENCOURAGED

Where large quantities of fish are processed properly designed machines will simplify the production of fillets and similar products in quantity, with consistently low microbial counts. This is mainly because well designed machines have impervious and corrosion-resistant working surfaces, are easy to dismantle, clean, disinfect and are capable of handling the fish with a minimum of delay.

It is essential that the installation of new machinery should be well researched, economically justified and the units should be rigorously tested before being put into commercial use, otherwise costly failures may arise.

6.2.9 CANDLING TABLES SHOULD BE EASY TO CLEAN AND THEY SHOULD NOT RAISE THE TEMPERATURE OF THE FILLETS

Since heat from the light may produce rapid growth and activity of microorganisms on candling surfaces, these should be thoroughly cleaned and treated with disinfectant at frequent intervals. The frame and the body of a candling table should be made of a suitable corrosion-resistant material. A heavy sheet of opaque glass or translucent plastic should be used for the candling surface.

Preferably white, fluorescent light tubes should be employed as a source of a strong and shadow-free light. The encasement, where the lights are located, should be made of waterproof material and should be well ventilated to reduce the heat. A constant flow of cold potable water or clean sea water across the candling surface is highly desirable to keep the surface constantly wet, clean and cold.

Electrical wiring of a candling table should be done by a competent electrician.

To increase the efficiency of candling operation, any extraneous or overhead source of light should be reduced to a minimum.

6.2.10 EQUIPMENT USED FOR DIPPING OR SPRAYING FILLETS SHOULD BE MADE OF IMPERVIOUS CORROSION-RESISTANT MATERIAL AND SHOULD BE EASY TO CLEAN. DIP TANKS SHOULD BE EMPTIED, THOROUGHLY CLEANED AND DISINFECTED BETWEEN EACH CYCLE OF USE

Where it is desired and permissible to use such dips as anti-oxidants or polyphosphate, the dangers of contamination must be fully appreciated. Microbial numbers will increase rapidly during use, and this requires that the tanks be frequently and thoroughly cleaned and refilled with new solutions. The use of sprays instead of dips has been found by many operators as a more efficient method for treatment of fillets or fish steaks. It eliminates an additional contamination with microorganisms, provides a continously uniform solution strength and lends itself to a better temperature control No recirculation of the solution should be permitted, except if the solution is filtered, pasteurized and cooled.

6.2.11 FRESH FISH TRANSPORT VEHICLES SHOULD BE DESIGNED TO ALLOW ADEQUATE ICING OF FISH, TO PROTECT FISH FROM WARMING UP DURING TRANSPORT, AND SHOULD BE OF SUCH MATERIAL AND CONSTURCTION AS TO PERMIT EASY AND THOROUGH CLEANING

Vehicles used for transporting fresh fish should be designed and constructed to ensure constant protection to the fish against contamination by dust, exposure to higher temperatures and the drying effect of sun or wind. Even where ice is very cheap and journey times or distances are relatively short, the use of an insulated vehicle provides an additional insurance against inadequate icing or unforeseen delays. The walls, roof and the floor of the vehichle should be insulated. The thickness of insulation employed will depend on the outside temperatures normally encountered. It should be remembered that insulation cannot help to cool the fish but helps to keep it at the temperature at which it was put into the vehicle.

For the purpose of cleaning, the vehicles transporting fish should have the walls, floors, and roofs made of a suitable, corrosion-resistant material with smooth and non-absorbent surface. Floors should be adequately drained.

6.3 Hygienic Operating Requirements

6.3.1 GENERAL SANITATION IN AN ESTABLISHMENT WHERE FRESH FISH IS PROCESSED FOR HUMAN CONSUMPTION SHOULD BE OF THE HIGHEST STANDARD PRESENT IN ANY FOOD PROCESSING INDUSTRY

Fish, because of its highly perishable nature, requires strict adherence to specific hygienic requirements which should become a part of a daily operational routine of the plant.

All operations should be carried out in a manner and conditions suitable for the handling of food for human consumption.

6.3.2 THE BUILDING, EQUIPMENT, UTENSILS AND OTHER PHYSICAL FACILITIES OF THE PLANT SHOULD BE KEPT CLEAN, IN GOOD REPAIR AND SHOULD BE MAINTAINED IN AN ORDERLY AND HYGIENIC CONDITION

All surfaces which come in contact with fish should be hosed down with cold or hot potable water or clean sea water as frequently as necessary to ensure cleanliness. It is important that the cleaning method used will remove all residues and the disinfecting method will reduce the microbial population of the surface being cleaned.

The use of cold or hot potable water or clean sea water alone is generally not sufficient to accomplish the required result. It is desirable, if not essential, that aids such as suitable cleaning and disinfecting agents together with manual or mechanical scrubbing, wherever appropriate, be used to assist in achieving the desired objective. After the application of cleaning and disinfecting agents the surfaces which come in contact with fish should be rinsed thoroughly with cold potable water or clean sea water before use.

Cleaning agents and disinfectants used should be appropriate for the purpose and should be so used as to present no hazard to public health and should meet the requirements of the official agency having jurisdiction.

6.3.3 FILLETING AND CUTTING BOARDS SHOULD BE FREQUENTLY AND THOROUGHLY SCRUBBED AND TREATED WITH DISINFECTANT. WHEREVER PRACTICABLE THE BOARDS SHOULD BE CONTINOUSLY FLUSHED WITH RUNNING POTABLE OR CLEAN SEA WATER DURING USE. THE FULSHING WATER SHOULD CONTAIN 4 ppm OF RESIDUAL CHLORINE

It is recognized that the amount of microbial contamination on fillets and similar products is related to the amount of microbial contamination of the working surfaces. Clean surfaces become contaminated as soon as they are used, and consequently each fish that is filleted, after the first one, increases the surface contamination. Filleting and cutting surfaces should therefore be cleaned during meal breaks and before resumption of production following other work stoppages. If they are not thoroughly scrubbed and disinfected, at least at the end of each working day, there may be serious day-to-day carry-over of microbial contamination.

It has been proved that this contamination of both fillets and boards can be considerably reduced by continous flushing with cold potable water or clean sea water. A further reduction in contamination has been observed when using chlorinated water for flushing.

6.3.4 IF BARRELS OR OTHER CONTAINERS ARE USED ON THE FILLETING LINE FOR THE COLLECTION AND DISPOSAL OF OFFAL, THEY SHOULD BE LOCATED BELOW THE LEVEL AT WHICH THE FISH ARE PROCESSED AND IN SUCH A WAY THAT THERE IS NO SPLASH-BACK ON THE PROCESSING LINE

If individual offal containers are used close to a processing line instead of the flumes or chutes connected to a common line, they should be located in such a way that there is no possibility of splash-back. Placement of the filleting boards or the fillet containers on the rims of the offal barrels should not be practiced.

If the containers are not being used then they should be lidded. In general, much could be gained in efficiency and cleanliness of an operation if flumes or other equally effective methods are employed for the disposal of the fish offal.

6.3.5 ALL MACHINES USED FOR GUTTING, WASHING, FILLETING, SKINNING, STEAKING OR SIMILAR OPERATIONS SHOULD BE THOROUGHLY CLEANED, DISINFECTED AND RINSED DURING REST OR MEAL BREAKS AND BEFORE RESUMPTION OF PRODUCTION FOLLOWING OTHER WORK STOPPAGES

The use of machinery reduces the risk of contamination from human sources. If, however, these machines are not properly maintained and cleaned at least once every day, they can become a serious source of contamination.

6.3.6 ALL MACHINERY AND EQUIPMENT SHOULD BE INSPECTED BEFORE PROCESSING BEGINS TO ENSURE THAT IT HAS BEEN PROPERLY CLEANED, DISINFECTED, RINSED AND REASSEMBLED

Dirty (soiled) surfaces and residues of the cleaning and disinfecting agents which have not been removed by rinsing will contaminate the product. It is better to start with a wet line rather than a dry surface.

Machanized or automated equipment should be regularly checked to prevent breakdowns.

6.3.7 ALL TRAPPED OR ACCUMULATED PRODUCT IN MACHINERY AND EQUIPMENT SHOULD BE REMOVED PERIODICALLY THROUGHOUT THE WORKING DAY

Fish or pieces of fish trapped in equipment spoil rapidly and can contaminate the rest of the product. Fish fillets or similar products which drop on the floor should be discarded.

6.3.8 ALL HANDLING AND PROCESSING OPERATIONS INVOLVED IN THE PREPARATION AND DISTRIBUTION OF FILLETS AND SIMILAR PRODUCTS SHOULD BE CARRIED OUT UNDER HYGIENIC CONDITIONS

Fillets and similar products are particularly vulnerable to contamination, as their preparation usually involves much handling. When the flesh is exposed, any contamination with microorganisms will rapidly reduce potential keeping time. All plant, equipment and fish workers should therefore comply with the hygienic operating requirements.

6.3.9 **MARKET CONTAINTERS AND ALL RETURNABLE FISH BOXES SHOULD BE THOROUGHLY CLEANED AND TREATED WITH DISINFECTANT IMMEDIATELY AFTER EACH USE**

The use of properly designed washing machines is recommended wherever practicable. Good washing by hand can be achieved by scrubbing with stiff brushes and by using high pressure water jets, with detergent added to the water. A preliminary rinse in potable cold water or clean sea water, followed by a wash with hot water at a minimum temperature of 43 °C has been recommended for efficient cleaning. An ample supply of potable water or clean sea water at adequate pressure is the first requirement and cleaning will be much easier if slime and blood are not allowed to dry on to the container surfaces.

6.3.10 **ONLY NEW AND CLEAN BOXES, CARTONS AND WRAPPING MATERIAL SHOULD BE USED FOR THE TRANSPORT AND DISTRIBUTION OF FILLETS AND SIMILAR PRODUCTS, WHERE RETURNABLE BOXES ARE USED THEY SHOULD BE OF CORROSION-RESISTANT MATERIAL AND THOROGUHLY CLEANED AND DISINFECTED AFTER EACH USE**

The practice of using returnable boxes for the transport and distribution of fillets and similar products should be discouraged, unless the box is constructed of light inner non-returnable container protected by a stronger returnable outer case.

All too often, returnable boxes lie around processing plant yards in an unwashed, filthy condition, where blood and slime are allowed to dry on to the box surfaces. They are then found to be extremely difficult to clean properly and may only receive a quick hose down with cold water.

As the importance of protecting fillets and other similar products from all sources of contamination cannot be over-emphasized, new and clean non-returnable containers should always be used.

6.3.11 **ALL WHARVES, QUAYS, MARKETS AND SIMILAR AREAS WHERE FISH ARE UNLOADED OR DISPLAYED FOR SALE, SHOULD BE KEPT CLEAN AND DISINFECTED**

Fish, as a food for human consumption, should be treated as such, in clean surroundings. Any dirty surfaces in the vicinity of the unloading area involves the risk that fish will be contaminated with filth and microorganisms of public health significance.

6.3.12 **REMOVAL OF SOLID, SEMI-SOLID OR LIQUID WASTES FROM FISH UNLOADING, HOLDING AND PROCESSING AREAS SHOULD BE ON A CONTINOUS OR NEAR CONTINUOUS BASIS USING WATER AND/OR APPROPRIATE EQUIPMENT SO THAT THESE AREAS ARE KEPT CLEAN AND THERE IS NO DANGER OF CONTAMINATING THE PRODUCT**

All waste materials resulting from the operation of a fish plant should be disposed of as soon as possible in a way that they cannot be used for human food and in a manner that they cannot contaminate food and water supplies and offer harbourage or breeding places for rodents, insects or other vermin.

Containers, flumes, conveyors, bins or storage bays used for removal; collection or storage of fish offal and other waste should be cleaned frequently with potable water or clean sea water containing an appropriate amount of free chlorine.

All waste material from containers and vehicles should be removed in such a way as not to cause any contamination and not to create a nuisance.

Arrangements for the disposal of trade refuse and inedible waste should be approved by the appropriate official agency having jurisdiction.

6.3.13 EFFECTIVE MEASURES SHOULD BE TAKEN TO PROTECT AGAINST THE ENTRANCE INTO THE PREMISES AND THE HARBOURAGE ON THE PREMISSES OF INSECTS, RODENTS, BIRDS OR OTHER VERMIN

An effective and continuous programme for the control of insects, rodents, birds or other vermin within the establishment should be maintained. The plant and surrounding area should be regularly examined for evidence of infestation. Where control measures are necessary, treatment should be undertaken under the direct supervision of personnel with a thorough understanding of the hazards involved, including the possibility of harmful residues being retained by the fish, or their products. The chemical, biological or physical agents used should meet the requirements of the official agency having jurisdiction.

The use of insecticides, during the plant operation, without any provision for collection of dead insects, should be discouraged. Instead, the use of adhesive insect traps or very efficient "black light insecticutor" lamps with the attached collecting trays, is recommended. Insect traps should not be located directly over the processing areas, and should be away from windows and doors.

All rodenticides, fumigants, insecticides or other harmful substances should be of an approved type and should be stored in separate locked rooms or cabinets and handled only by properly trained personnel.

6.3.14 DOGS, CATS AND OTHER ANIMALS SHOULD BE EXCLUDED FROM AREAS WHERE FISH IS RECEIVED, HANDLED, PROCESSED OR STORED

Dogs, cats and other animals are potential carriers of diseases and should not be allowed to enter or to live in rooms or areas where fish or their products are handled, prepared, processed or stored.

6.3.15 ALL PERSONS WORKING IN A FRESH FISH PLANT SHOULD MAINTAIN A HIGH DEGREE OF PERSONAL CLEANLINESS WHILE ON DUTY AND SHOULD TAKE ALL NECESSARY PRECAUTIONS TO PREVENT THE CONTAMINATION OF THE FISH OR THEIR PRODUCTS OR INGREDIENTS WITH ANY FOREIGN SUBSTANCE

All employees should wear, appropriate to the nature of their work, clean protective clothing including a head covering and footwear all of which articles are either washable or disposable. The use of waterproof aprons, where appropriate, is recommended.

Gloves used in the handling of fish should be maintained in a sound, clean and sanitary condition and should be made of an impermeable material except where their usage would be incompatible with the work involved. Hands should be washed thoroughly with soap or another cleansing agent and warm water before commencing work, on every occasion after visiting a toilet, before resuming work and whenever necessary. The wearing of gloves does not exempt the operator from having thoroughly washed hands.

Any behaviour which can potentially contaminate the fish such as eating, smoking, chewing of tobacco or other materials and spitting should be prohibited in any part of the fish handling areas.

6.3.16 NO PERSON WHO IS KNOWN TO BE SUFFERING FROM, OR WHO IS A CARRIER OF ANY COMMUNICABLE DISEASE OR HAS AN INFECTED WOUND OR OPEN LESION SHOULD BE ENGAGED IN THE PREPARATION, HANDLING OR TRANSPORTING OF FISH OR FISH PRODUCTS

Plant management should require that any person afflicted with infected wounds, sores, or any illness, notably diarrhoea, should immediately report to management. Mangement should not allow any person known to be affected with a disease capable of being transmitted through food, or known to be a carrier of such disease, or while afflicted with infected wounds, sores or diarrhoea to work in any area of a fish plant in a capacity in which there is a likelihood of such a person contaminating fish or fish products with disease-causing microorganisms.

Minor cuts and abrasions on the hands should be immediately treated and covered with a waterproof dressing of contrasting colour and of a nature that it cannot be accidently detached; but if infection should occur subsequently, the worker should not be allowed to handle the fish. Adequate first-aid facilities should be provided.

6.3.17 CONVEYANCES USED FOR TRANSPORTING FISH SHOULD BE CLEANED AND DISINFECTED IMMEDIATELY AFTER EACH USE AND SHOULD BE SO MAINTAINED AS NOT TO CONSTITUTE A SOURCE OF CONTAMINATION FOR THE PRODUCT

The cleaning of vehicles, together with receptacles and equipment thereon, should be planned to a regular routine. Hosing, scrubbing and cleaning with potable water or clean sea water to which a suitable detergent and/or disinfectant has been added is usually, necessary.

6.4 Operating Practices and Production Requirements

6.4.1 *General Considerations*

6.4.1.1 FRESH FISH SHOULD BE HANDLED, PROCESSED AND DISTRIBUTED WITH CARE AND A MINIMUM DELAY

Poor handling of fish on shore can ruin the best efforts of the fisherman. As has already been explained, even well iced fish loses quality in a relatively short time. If unnecessary delays occur after the fish are landed, their quality and the keeping time can be reduced considerably. Everyone concerned should therefore exercise the greatest care and at the same time endeavour not to delay any stage in the handling, processing and distribution chain.

Fresh fish is often handled a number of times after it is landed, and the effects of bruising, contamination or exposure to unduly high temperatures will become apparent by the time the final product reaches the consumer. Fresh fish have a very short time in which to remain in a marketable condition.

The precise steps which follow unloading of the fish from the vessel vary from one fishery to another. In some areas the catch may be unloaded and transported directly to a large processing factory, in others it may be laid out in containers in a market and sold by auction. Sales may also be made through intermediates before the fish reaches the processor.

Whatever the system, it is essential to ensure that the fish reaches the consumer in an acceptable condition.

6.4.1.2 FRESH FISH SHOULD ALWAYS BE TREATED IN A HYGIENIC MANNER

Evisceration, filleting and other operations in the handling of fish should be clean and hygienic. Precautions should be taken to protect the fish from contamination by animals, insects, birds, chemical or microbiological contaminants or other objectionable substances during processing, handling and storage.

Preparatory operations leading to the finished product and the packaging operations should be so timed as to permit expeditious handling of consecutive batches in production within the time and temperature range that will prevent deterioration, spoilage or the development of microorganisms of public health significance.

It is considered good practice to develop a schedule of permitted times in which each operation will be allocated a portion of a total time permitted for each fish to remain on the premises of the fresh fish processing plant.

6.4.1.3 ADEQUATE FACILITIES SHOULD BE AVAILABLE, AT THE PROCESSING PLANT, TO MAINTAIN FISH IN A CHILLED CONDITION

Where supplies of fish cannot be processed on arrival at the factory, or when the final product cannot be distributed soon after packing, adequate facilities are required to keep the fish or their products cool. It must be noted, however, that where chill rooms are installed, these are not designed to cool the fish but only to maintain them in this condition after they have been cooled by ice or other means.

It is poor practice, therefore, to load the chill room with large quantities of fresh fish that were not prechilled effectively to the temperature of the melting ice.

The chill room should be equipped with the recording thermometer and an automatic temperature control, and should be so designed that in a clean hygienic condition at all times. The chill room should also be equipped with an automatic alarm system to alert the proper personnel when the temperature drops below 0°C.

6.4.1.4 NO FISH SHOULD BE OFFERED FOR SALE OR USED FOR FURTHER PROCESSING WHICH HAS UNDERGONE DETERIORATION OR ANY PROCESS OF DECOMPOSITION OR WHICH HAS BEEN CONTAMINATED WITH FOREIGN MATTER TO AN EXTENT WHICH HAS MADE IT UNFIT FOR HUMAN CONSUMPTION

The fresh fish should be rejected if it is known to contain harmful, decomposed or extraneous substances which will not be removed to an acceptable level by normal procedures of sorting or preparation. Fish in a diseased condition should be discarded or the diseased portion removed. Only clean, sound fish should be used for further processing and distribution.

6.4.2 *Handling of whole and Gutted Fish*

6.4.2.1 FISH SHOULD NOT BE DISPLAYED OR LEFT LYING ABOUT MARKETS OR AUCTION HALLS ANY LONGER THAN NECESSARY TO MEET INSPECTION REQUIREMENTS AND SALE

The auction system of selling fish offers some economic advantages, but where the auction required the laying out of unchilled fish, the practice is technologically undesirable. The fish should always be mixed with suitable quantities of ice. In areas where only one auction takes place in a day, the sale may be delayed for a number of reasons, increasing the rate of spoilage. This undesirable situation can be avoided in fisheries holding several auctions of various catches in one day.

In certain areas fish are sold by sample, and this method avoids the exposure of the catch on the market without ice, as the fish can remain on board until transport is available to take it immediately to the processor or merchant. It is difficult, where large quantities of fish are being weighed into market containers, to ensure adequate icing. Here again fish boxed and iced at sea, and unloaded and distributed in the same containers, have a distinct advantage.

6.4.2.2. FINELY DIVIDED ICE SHOULD BE WELL DISPERSED AMONG THE FISH WHEN FILLING MARKET CONTAINERS

Top and bottom icing should be used with more ice dispersed through smaller fish. Bottom icing will retard conduction of heat from the market floor and top icing prevents drying, cools and protects the fish. Even where proper icing is not practicable a layer of finely divided top ice is better than no ice at all.

6.4.2.3 FISH OFFERED FOR SALE ON THE MARKET SHOULD BE GRADED AND SORTED SO THAT ALL FISH IN A CONTAINER ARE OF SIMILAR SPECIES, SIZE AND QUALITY

Care in grading, weighing and sorting ensures that all fish in a container are uniform in species, size and quality. This will result in the use of better quality fish to the best advantage and can help to retain the confidence of the buyer.

6.4.2.4 WALKING ON OR KICKING FISH AND WALKING OVER BOXES IN THE MARKET SHOULD BE DISCOURAGED

Rough careless handling or exposure to contamination may reduce the quality of fish through physical damage or increased spoilage.

6.4.2.5 INSPECTION PROCEDURES SHOULD NOT INVOLVE DELAYING THE SALE OF THE CATCH

Inspection should be carried out quickly and to good technological standards. It should not result in a temperature rise of the fish.

6.4.2.6 BOXES SHOULD NOT BE EMPTIED OUT ON THE MARKET FLOOR FOR EXAMINATION

This involves the risk of contamination from unclean surfaces. If fish are graded and sorted properly, then only one of the top fish in a box or batch need be inspected.

6.4.2.7 FISH SHOULD BE REMOVED FROM THE MARKET IMMEDIATELY AFTER THE SALE

Distributors and processors should arrange to remove their fish immediately following the sale, and where necessary ice should be added quickly.

Some observations have shown that even in temperature climates the temperature of un-iced fish, exposed while lying on market floors or similar places, may rise to as high as 16 ^{o}C at the top of containers. It has already been explained that fish will spoil very rapidly at these temperatures.

6.4.2.8 THE FISH SHOULD AT ALL TIMES BE KEPT CHILLED AND MOVED THROUGH THE PROCESSING CHAIN QUICKLY

Distributors and processors should realize that the fish they receive is usually at least one day, and often several days, old. It should therefore be handled as a highly perishable food and when it cannot be dealt with immediately, it should be packed in ice, in clean containers. Where possible these iced containers should be stored in a chill room.

In some cases refrigerated sea water or brine or chilled sea water storage may be satisfactory, provided that the fish are not cooled below - 1 ^{o}C. Fish should not be stored in this way for more than a day or so.

6.4.2.9 SOME WHOLE FISH MAY REQUIRE CUTTING ON ARRIVAL AT THE PROCESSING PLANT. THIS OPERATION SHOULD BE CARRIED OUT EFFICIENTLY AND WITH CARE

Whether mechanical or manual methods are used, gutting must be complete in order to remove all pieces of guts, liver, blood along the backbone and any loose discoloured belly membrane. During the gutting the knife should not cut through the intestines releasing their contents or go beyond the vent exposing the sterile muscles to microbial and enzymatic action. Some species of fish destined for filleting need not be gutting.

6.4.2.10 IMMEDIATELY AFTER GUTTING AND BEFORE PACKING, ALL FISH SHOULD BE THOROUGHLY WASHED USING COOL POTABLE WATER OR COOL CLEAN SEA WATER. THE FISH SHOULD NOT BE EXPOSED TO ANY WARMING EFFECTS OF THE WATER FOR LONG PERIODS. AFTER WASHING, THE FISH SHOULD BE DRAINED PROPERLY

Proper washing will remove all traces of slime, blood and gut particles which may contaminate the flesh. Leaving fish in washing water for long periods will accelerate spoilage due to temperature rise. Containers used for washing fish should be provided with a continuous flow of cold potable water or cold clean sea water to keep the temperature down and, in sufficient amounts, to prevent the accumulation of contaminating materials. If the fish are not drained, but packed while very wet, excessive ice meltage will take place in the box.

6.4.2.11 FISH SHOULD BE THOROUGHLY PRECHILLED BEFORE BEING PACKED FOR SHIPMENT

If there should be any delay in packing, the fish should be prechilled by an immersion in ice and water mixture or chilled sea water. Prechilling of the fish will reduce the meltage of ice used in the shipping containers.

6.4.2.12 ADEQUATE QUANTITIES OF FINELY DIVIDED ICE SHOULD BE USED IN PACKING FISH FOR TRANSPORT. THE ICE SHOULD BE WELL DISPERSED AMONGST THE FISH AND SHOULD ALSO SURROUND IT IN SUFFICIENT AMOUNT TO KEEP IT OUT OF CONTACT WITH THE CONTAINER SURFACES DURING THE JOURNEY

The amount of ice required when packing will depend on the length of journey and the ambient temperatures involved. The ice should always be more than enough to last the journey. A suggested minimum is one part of ice to three parts of fish. If the ice is well mixed through the load and surrounding it, then deterioration of fish quality due to rise of temperature and the resulting growth of microorganisms will be minimized.

6.4.2.13 FOR TRANSPORT TO THE VARIOUS OUTLETS, BOXES OF ICED FISH SHOULD BE LOADED IN INSULATED VANS AND SHOULD BE STACKED CLOSE TOGETHER, TO PRESENT AS LITTLE SURFACE AS POSSIBLE FOR HEAT ABSORPTION. A LAYER OF ICE BELOW AND ON TOP OF THE STACK OF BOXES FOR ADDITIONAL COOLING IS OF FURTHER BENEFIT. IF POSSIBLE THE VEHICLE CONTAINER SHOULD BE PRE-COOLED BEFORE LOADING STARTS

Heat flows from regions of higher temperature to those of lower temperature and will thus enter the boxes of fish through surfaces which are exposed to warmer surroundings. If flows that the rate at which heat flows into a load of stacked boxes may be reduced by minimizing the total box surface area exposed. This can be done by stacking boxes compactly and by placing a layer of finely divided ice around the stack wherever practicable.

Insulation will, of course, reduce the amount of heat leak into the vehicle container, particularly during warm, sunny weather. This in turn will reduce excessive ice meltage. In warm climates, ice packed with the fish in large transport containers may be quickly depleted, if the containers themselves are not initially cooled. The difficulty here is that the time taken to load the container often nullifies the effect of any pre-cooling operation.

In many areas where container transport is not available, and short distances are involved, open vehicles are used. Fish boxes stacked on these should be surrounded with ice and covered by ice blankets (insulated blankets), canvas or tarpaulin.

6.4.2.14 WHERE FISH IS TRANSPORTED IN VEHICLES HAVING MECHANICALLY REFRIGERATED CONTAINERS, COLD AIR SHOULD BE CIRCULATED COMPLETELY ROUND THE LOAD. THE TEMPERATURE SHOULD BE MAINTAINED SLIGHTLY ABOVE THE MELTING POINT OF ICE, SO THAT SOME ICE MELT-WATER IS ALWAYS COOLING THE FISH, AND TO AVOID PARTIAL FREEZING OF THE OUTER LAYERS OF FISH

The prime function of the cold air is to absorb heat entering through the walls of the container. If the free passage of cold air is obstructed by boxes, there is a risk that part of the load will be higher in temperature. Temperatures slightly above the melting point of ice are fairly easy to control automatically, therefore damage through partial freezing can be avoided. It should be borne in mind that refrigerated containers are not meant to cool the loads. Their purpose is to maintain the load in a cool condition after it has been chilled with ice.

6.4.3 *Handling of fillets and similar products*

6.4.3.1 FISH WHICH CANNOT BE PROCESSED IMMEDIATELY ON ARRIVAL AT THE FACTORY SHOULD BE WELL ICED IN CLEAN CONTAINERS AND STORED IN SPECIALLY DESIGNATED AREAS WITHIN THE PLANT, WHERE THEY WILL BE PROTECTED FROM HEAT AND WEATHER CONDITIONS, AND WILL NOT BE CONTAMINATED BY DUST, INSECTS OR VERMIN. WHERE POSSIBLE THE ICED FISH SHOULD BE STORED IN A CHILL ROOM, THE TEMPERATURE OF WHICH IS JUST ABOVE THAT OF MELTING ICE

In order to produce good quality fillets or similar products, the quality of the fresh fish must be maintained by protecting it from heat, contamination from other sources, and physical damage.

It must be stressed again that placing quantities of fish in a chill room does not remove the need for adequate icing. Chill rooms are designed to maintain a chill temperature and to keep already cool fish from warming up. The refrigeration machinery used in chill room operation is not adequate to lower the temperature of a mass of fish in a short time. The initial cooling must be done by the addition of ice.

It is poor practice therefore, to load the chill room with large quantities of fresh fish that were not pre-chilled effectively to the temperature of melting ice.

The chill room should be equipped with a recording thermometer and an automatic temperature control and should be so designed that it can be kept in a clean hygienic condition at all times. The chill room should also be equipped with an automatic alarm system to alert proper personnel when the temperature drops below 0°C.

6.4.3.2 ALL FISH SHOULD BE CAREFULLY SORTED BEFORE THEY ARE FILLETED OR PROCESSED IN A SIMILAR MANNER. ANY DAMAGED, CONTAMINATED OR OTHERWISE UNACCEPTABLE FISH SHOULD BE DISCARDED

As has already been stated, the quality and keeping time of fillets and similar products is largely dependent on the quality of the fish from which they are produced.

Fish which are damaged will produce poor, unacceptable fillets, and if contaminated in any way can spread this contamination to working surfaces and other fillets. Fillets of some species of fish will darken appreciably with the exposure to air and, therefore, it would be better to freeze them without delay rather than to market them as fresh fish.

6.4.3.3 ALL FISH SHOULD BE THOROUGHLY WASHED BEFORE BEING PLACED ON THE FILLETING AND CUTTING TABLES. SOME SPECIES MAY REQUIRE SCALING AND SHOULD BE WASHED AFTER THIS OPERATION

Spoilage microorganisms come mainly from the surfaces of the fish being processed. Experience has shown that most of the surface microorganisms can be removed by proper washing.

The removal of scales from certain species is sometimes required, particularly if they are to be marketed as unskinned fillets. Fish should be well washed after scaling, otherwise loose scales adhering to the surfaces may find their way on to the fillets, thus detracting from their appearance.

In handling of unskinned fillets, it is advisable not to stack them in a skin-to-flesh manner, as this practice will contaminate the almost sterile flesh surfaces of the fillets with microorganisms from the skins. This will occur even when the fish are thoroughly washed prior to filleting.

6.4.3.4 ALL FILLETERS SHOULD BE TRAINED AND REQUIRED TO USE FILLETING TECHNIQUES IN WHICH CONTACT BETWEEN THE CUT SURFACES OF THE FILLET AND THE FILLETING BOARD IS MINIMIZED.

The more skilled the filleter, the quicker the fish are filleted, with less risk of contamination from cutting surfaces.

The surfaces of a freshly cut fillet is practically free from micro-organisms except those that have been introduced by the blade of a filleting knife. The fillet, therefore should be lifted by the same knife away from the carcass without touching the surfaces of the filleting board which usually is contaminated with microorganisms derived from the skin or intestinal content of the fish.

Cutting through the belly cavity during the filleting of ungutted fish should be avoided.

6.4.3.5 WITH NON-MECHANIZED FILLETING LINES THE SUPPLY OF RAW FISH TO THE LINE SHOULD BE REGULATED SO THAT EACH FISH COULD BE PROCESSED WITH THE MINIMUM OF DELAY

It is a frequent occurrence that the filleting lines are being oversupplied resulting in accumulation of raw fish in front of the filleters. In such an event, usually the top layer or the fish most easily accessible to the filleters will be the first one to go through the processing line, while the fish at the bottom and away from the filleter's easy reach, could remain for hours pressed against the revolving surface of the conveyor or left in the pools of stagnant water containing fish slime, blood and digestive juices.

6.4.3.6 AFTER CUTTING, THE FILLETS OR SIMILAR PRODUCTS SHOULD BE PLACED DIRECTLY ON CLEAN CONVEYORS OR INTO CLEAN CONTAINERS. PILING LARGE QUANTITIES IN ONE CONTAINER SHOULD BE AVOIDED

Wherever possible during processing, unskinned fillets should be transferred individually by conveyor so that contact between skin and other fillets can be largely avoided, thus reducing the risk of microbial contamination.

Containers in which fresh fillets or steaks are kept immediately after being filleted or cut, should be of a size that will require longer than 15 minutes to fill them.

When the containers are full, they should be transferred to the next stage of processing without any delay. Leaving the full containers, as occasionally happens, stacked on the floor or pallet boards close to the filleting line and below the processing level of the line, might result in a serious contamination caused by the splash of dirty water from the processing line.

6.4.3.7 IT IS ADVISABLE TO MAKE THE CANDLING OF FILLETS OF CERTAIN SPECIES OF FISH A ROUTINE PRACTICE

If the fish is known to be highly parasitized, it pays to fillet and a candle a few which are picked at random in order to decide whether to proceed with the processing.

Although most types of parasites found in fish are harmless to humans, nevertheless the presence of parasites in fish or fish products highly objectionable to the majority of the consuming public.

Proper and careful candling will not only remove the undesirable parasites but will also detect and remove the blood spots, pieces of skin, on the skinless fillets, and any other defects which otherwise might reduce the overall quality of the product.

6.4.3.8 IF THE FISH ARE TO BE DIPPED OR SPRAYED WITH FOOD ADDITIVES, THE ADVICE OF AN EXPERIENCED FOOD TECHNOLOGIST OR AN OFFICIAL AGENCY HAVING JURISDICTION SHOULD BE SOUGHT

Undoubtedly, any additive or additional treatment of fish during the processing, increases its cost and, therefore, should be measured against the benefits gained. An additive permitted in one country might not be allowed in another.

6.4.3.9 IN ORDER TO PRESERVE THE QUALITY AND KEEPING TIME OF FILLETS AND STEAKS, THEY SHOULD BE MAINTAINED AS COOL AS POSSIBLE THROUGHOUT THE WHOLE OF THE PROCESSING OPERATIONS. ALL THE WORK SHOULD BE CARRIED OUT WITH CARE, AS QUICKLY AS POSSIBLE, THERE BEING NO UNNECESSARY DELAY BETWEEN THE TIME THE FISH ARE CUT AND THE TIME THE FILLETS OR SIMILAR PRODUCTS ARE AGAIN IN A COOL CONDITION

It is inevitable that the fillet or similar product temperature will rise between the time that the gutted fish are taken out of chilled storage and the time the finished products can again be placed in chilled conditions. While cold potable water or cold clean sea water, used for washing, and cold dip solutions will assist in keeping fillet and steak temperatures down, even these slight warming effects can be reduced by quick and efficient operations.

6.4.3.10 FILLETS AND SIMILAR PRODUCTS SHOULD BE PROPERLY CHILLED BEFORE BEING PACKED FOR SHIPMENT

If there should be any delay in packing, pre-cooling the product will conserve ice used to pack the box. Individual or thin layers of fillets will cool more rapidly than those in bulk quantities. In some cases fillets or similar products may be chilled by brief immersion in an ice and water mixture. Satisfactory chilling by short exposure to a temperature of about $-5^{\circ}C$ has also been reported. Great care must be taken in this case, however, to avoid damage by partial freezing.

6.4.3.11 FILLETS AND SIMILAR PRODUCTS WHICH HAVE NOT BEEN COOLED BEFORE PACKING SHOULD BE PACKED SO THAT NO PART OF ANY FILLET IS MORE THAN 40 MM FROM ICE OR OTHER SUITABLE COOLING MEDIUM

Fish flesh is a poor conductor of heat and the rate at which fillets can be cooled decreases considerably if the depth of the layer in which they are packed is increased. It is known that the centre of a 75 mm layer of fillets, initially at 4.4 $^{\circ}C$ and iced top and bottom, will cool to $1.7^{\circ}C$ in 1 1/2 hours. Under similar conditions a time of 8 hours is required for the centre of a 150 mm layer to reach the same temperature.

6.4.3.12 FILLETS AND SIMILAR PRODUCTS SHOULD BE PACKED FOR TRANSPORT SO THAT THERE IS NO DIRECT CONTACT WITH ICE OR MELT-WATER. WET-STRENGTH PAPER OR PLASTIC FILMS SHOULD BE USED TO WRAP THE PRODUCTS AND SEPARATE THEM FROM ICE USED IN PACKING

Immediately after weighing, packaging should be carried out quickly and efficiently. Prolonged contact with ice or melt-water may result in the leaching away of flavour and nutrient constituents, a softening of the texture and spoilage of surface appearance.

Technical and commercial developments have resulted in a wide variety of materials and styles of packing being used for the distribution of fillets. These range from bulk shipments of unwrapped fillets to various types and sizes of package, including hermetically sealed self-serive packs with a specified shelf life. Ice packed in the same container with the fillets, but not in direct contact with them, is still the most common method of maintaining a chilled condition during transport. Dry ice or pre-chilled eutectic solutions, in plastic or metal containers, are used in master containers having good insulating properties. Carefully controlled mechanical refrigeration is also used. Transport facilities should be similar to those already recommended for whole and gutted fish.

Whatever the method employed it is most important that fillets and similar products are protected from contamination, in some circumstances from dehydration, and are always kept as near as possible to the temperature of melting ice until they reach the consumer.

6.4.3.13 PACKAGING MATERIALS SHOULD BE SUFFICIENTLY STRONG AND DURABLE TO WITHSTAND STRESSES DURING PROCESSING, HANDLING, STORAGE AND DISTRIBUTION

The package should be able to withstand stresses during assembly, filling, machine closing, storage and transport. Wet-strength and impermeability to moisture are necessary as products may be wet when packed. Low temperature flexibility of the packaging material will prevent it from rupturing or tearing during storage or transportation. Laminated materials should not separate when damp.

6.4.3.14 PACKAGING MATERIALS SHOULD BE CLEAN AND STORED IN A HYGIENIC MANNER. PACKAGING SHOULD BE CARRIED OUT UNDER CONDITIONS THAT PREVENT CONTAMINATION OF THE PRODUCT

Packaging materials should not transfer to the product any objectionable or toxic substances or odours and tastes, and should protect the product against damage,deterioration and contamination.

6.4.3.15 IF POSSIBLE THE PREPACKAGING SHOULD ALSO BE DONE BY THE FRESH FISH PROCESSING PLANT RATHER THAN BY A DISTRIBUTOR OR RETAILER

Fish which has been prepacked into the final consumer packages, has the advantages that it can be handled by a non-specialized staff, and can be easily examined by the buyer for species, additives, quantity, price and methods of preparation. If properly packed, it can be carried and held with other foods without the danger of contaminating them with the fish juices or the fishy odour.

Only the best quality fish should be prepacked and the packing materials should be such as to protect the contents from dehydration, inside condensation and accumulation of unsightly fish juices. The final package should be sturdy and attractive.

6.4.3.16 BOXES FOR FILLETS AND SIMILAR PRODUCTS SHOULD BE HANDLED VERY CAREFULLY DURING TRANSPORT AND DISTRIBUTION. THEY SHOULD NEVER BE UP-ENDED

In some areas, boxes may be handled and stacked many times during distribution. Handling practices are often very rough, due to shortage of time at transfer points, and use of outdated methods for handling large quantities of boxes. It should be borne in mind that these boxes contain food for human consumption and modern handling techniques require to be introduced to avoid damage which may result in contamination of the packed product. Boxes should never be up-ended as this can result in fillet distortion and creasing and may cause loss of weight through excessive pressure on fillets at the bottom . It may also contaminate the fillets with ice melt-water.

6.5 Sanitary control programme

6.5.1 IT IS DESIRABLE THAT EACH FISH PROCESSING PLANT IN ITS OWN INTEREST DESIGNATES A SINGLE INDIVIDUAL WHOSE DUTIES ARE PREFERABLY DIVORCED FROM PRODUCTION, TO BE HELD RESPONSIBLE FOR THE CLEANLINESS OF THE ESTABLISHMENT

Such a person or his staff should be a permanent part of the organization or employed by the organization and should be well trained in the use of special cleaning tools, methods of dismantling equipment for cleaning and in the significance of contamination and the hazards involved. A permanent cleaning and disinfection schedule should be drawn up to ensure that all parts of the establishment are cleaned appropriately and that critical areas, equipment and material are designated for cleaning and/or disinfection daily or more frequently if required.

6.6 Laboratory control

6.6.1 IN ADDITION TO ANY CONTROL BY THE OFFICIAL AGENCY HAVING JURISDICTION, IT IS DESIRABLE THAT EACH FISH PROCESSING PLANT IN ITS OWN INTEREST SHOULD HAVE ACCESS TO LABORATORY CONTROL TO ESTABLISH HYGIENIC QUALITY OF THE PRODUCT PROCESSED

The extent and type of such control will vary with the food product as well as the needs of management. Such control should reject all foods that are unfit for human consumption.

Analytical procedures used should follow recognized standard methods in order that the results may be readily interpreted.

7. END PRODUCT SPECIFICATIONS

7.1 Appropriate methods should be used for sampling and examination to determine compliance with the following specifications :

a) Fishery products should be, to the extent possible in good manufacturing practic, free from objectionable matter and parasites;

b) Fishery products should be free from microorganisms in amounts harmful to man, free from parasites harmful to man and should not contain any toxic substances originating from microorganisms in amounts which may represent a hazard to health;

c) Fishery products should be free from chemical contaminants in amounts which may represent a hazard to health;

d) Fishery products should comply with any requirements set forth by the Codex Alimentarius Commission on pesticide residues and food additives as contained in permitted lists of Codex commodity standards, or should comply with the requirements on pesticide residues and food additives of the country in which the fish will be sold; and

e) Specifications a), b), c) and d) should to the extent possible also apply to fresh fish.

APPENDIX A
GENERAL PRINCIPLES OF FISH SPOILAGE

Soon after fish are dead, they begin to spoil, hence fresh caught fish pass through various stages of decay until they become putrid and unfit for human consumption.

Spoilage occurs for two main reasons : firstly, the controlled biochemical processes (digestive enzymes) which occur in all living tissues to assist the digestion of food, continue after death in an uncontrolled manner. These digestive enzymes then begin to attack the surrounding flesh, causing it to become soft.

Secondly, microorganisms are present on the gills, in the surface slime and in the intestines of live, healthy fish, but not in the flesh, which is sterile. Soon after death, microorganisms on the skin, surface slime and intestines multiply rapidly and can soon be detected in the flesh near the skin and belly walls. The spread into the flesh can be much more rapid if the fish have been damaged in any way. The microorganisms continue to multiply inside the flesh, and at the same itme begin to break down the tissues into a series of compounds with strong odours and tastes, and thus the fish become spoilt. In some species fat oxidation will also quickly occur and alter the flavour. The rate of chemical change and of microbial activity depends on temperature. In general, the closer the temperature is to that of melting ice, 0°C, the slower the rate of chemical and microbiological spoilage. For this reason, ice in one form or another is used throughout the world to prolong the storage life of fish.

Since microorganisms from both intestines and surfaces with which the fish come in contact, play a major part in fish spoilage, high standards of cleanliness at all stages of handling, processing, storage and distribution are essential. This means that strict attention must be given to the efficient cleaning of the fish, the regular cleaning of all surfaces with which the fish come in contact, the provision of an uncontaminated water supply and the hygiene of workers. These factors are all important in order to provide the consumer with good quality wholesome food.

Chemical composition of fish flesh varies from species to species and even within species according to season, maturity, fishing ground, feed, etc. The rate of spoilage can therefore vary, and the spoilage pattern can be influenced by these factors.

SLS CERTIFICATION MARK

The Sri Lanka Standards Institution is the owner of the registered certification mark shown below. Beneath the mark, the number of the Sri Lanka Standard relevant to the product is indicated. This mark may be used only by those who have obtained permits under the SLS certification marks scheme. The presence of this mark on or in relation to a product conveys the assurance that they have been produced to comply with the requirements of the relevant Sri Lanka Standard under a well designed system of quality control inspection and testing operated by the manufacturer and supervised by the SLSI *which includes surveillance inspection of the factory, testing of both factory and market samples.*

Further particulars of the terms and conditions of the permit may be obtained from the Sri *Lanka Standards Institution, 17, Victoria Place, Elvitigala Mawatha, Colombo 08.*

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SRI LANKA STANDARDS INSTITUTION

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The principal objects of the Institution as set out in the Act are to prepare standards and promote their adoption, to provide facilities for examination and testing of products, to operate a Certification Marks Scheme, to certify the quality of products meant for local consumption or exports and to promote standardization and quality control by educational, consultancy and research activity.

The Institution is financed by Government grants, and by the income from the sale of its publications and other services offered for Industry and Business Sector. Financial and administrative control is vested in a Council appointed in accordance with the provisions of the Act.

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All members of the Technical and Sectoral Committees render their services in an honorary capacity. In this process the Institution endeavours to ensure adequate representation of all view points.

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