SRI LANKA STANDARD 1213 : 2001

UDC 639.2 : 639.5 : 664.95

CODE OF PRACTICE FOR
CRABS

SRI LANKA STANDARDS INSTITUTION

- Blank Page -

CODE OF PRACTICE
FOR CRABS

SLS 1213 : 2001

Gr. 18

SRI LANKA STANDARDS INSTITUTION
No. 17, Victoria Place,
Elvitigala Mawatha,
Colombo – 08.
SRI LANKA.

- Blank Page -

CONTENTS

- Blank Page -

SRI LANKA STANDARD
CODE OF PRACTICE FOR CRABS

FOREWORD

This standard was finalized by the sectoral committee on Agriculture and Food products and was authorized for adoption and publication as a Sri Lanka Standard by the council of the Sri Lanka Standards Institution on 2001-05-22.

This standard is an adoption of Codex Alimentarius Commission/Recommended International Code of Practice for Crabs CAC/RCP – 28-1983. The text of CAC/RCP– 28-1983 was considered suitable for adoption as a Sri Lanka Standard without major changes.

The code of practice has been written for the use of those engaged in the crab industry. It contains technological and essential hygiene requirements for the preparation of high quality crab products and is based on long established and widely recognized good commercial practices.

Methods of handling and processing crab vary considerably depending on the species, the nature of the product and to some extent on the specific (traditional) custom in the country. It is not possible to consider each individual process in detail in a code of this type.

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

1 SCOPE

This code of practice applies generally to commercial crabs of the **Cancer** species, king crab related species (**Lithodes** and **Paralithodes**), swimming crabs (**Portunidae**), Geryon species and snow crab species (**Chionoectes**). It may also apply to other species which are similar in physical structure to the above mentioned. It contains the technological guidelines and the essential requirements of hygiene for harvesting, processing and handling of crabs at sea and on shore. No attempt has been made to identify regional practices. The technology of canning crab meat is not covered in this code.

2 REFERENCES

SLS 614 Specification for potable water
Part 1 : Physical and chemical requirements
Part 2 : Bacteriological requirements
SLS 902 Code of practice for canning of fish
SLS 910 Limits for pesticide residues in food
SLS 975 Code of hygienic practice for frozen fish

3 DEFINITIONS

For the purpose of this code of practice the following definitions shall apply :

3.1 autolysis : Breakdown or deterioration of the crab meat or viscera by means of indigenous enzymes.

3.2 back shell : Carapace of the crab.

3.3 batch systems : Processing methods where crabs are processed as bulk.

3.4 black light : Invisible light within ultraviolet range which falls on fluorescent materials and causes them to omit visible light.

3.5 brine : Solution of food grade salt (sodium chloride) in potable water or clean sea water.

3.6 butchering : Process of removing the back shell, viscera and gills; in some areas it may also include the removal of walking legs and claws. Butchering may take place either before or after cooling.

3.7 chilling : Process of cooling crabs to a temperature approaching that of melting ice.

3.8 chilled sea water : Clean sea water reduced in temperature by the addition of ice prepared from potable water or clean sea water.

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

3.10 cleaning : Removal of objectionable matter from surfaces.

3.11 cocktail claw : Crab claw product where the shell is partially removed to expose the meat portion of the claw.

3.12 contamination : Direct or indirect transmission of objectionable matters to the product.

3.13 cooking : Boiling of crabs in potable water or clean sea water or brine or heating in steam for a period of time sufficient for the thermal centre to reach a temperature adequate to coagulate the protein.

3.14 crab : Commercially important species of the Decapoda order in the Brachyura and Anomura sections.

3.15 debacking : Process of removing the back shell.

disinfection : Reduction without adversely affecting the food, by means of hygienically satisfactory chemical agents and/or physical methods, of the number of micro-organisms to a level that will not lead to harmful contamination of food.

3.16 enzymatic activity : Catalytic action of enzymes on biochemical reactions.

3.17 leg tips : Third leg segments counting from the carapace.

3.18 merus : Thigh or the first large leg segment from the carapace.

3.19 pasterurization : Subjecting crab meat to heat at times and temperatures which destroy a high proportion of micro-organisms without noticeable changes in appearance, texture and flavour of the product.

3.20 picking : The removal of meat from the crab shell by machine or by hand.

3.21 plant or establishment : Building or buildings or parts there of , used for, or in connection with, the manufacture or holding of food for human consumption.

3.22 potable water : Fresh water fit for human consumption. Standards of potability should not be lower than those contained in the SLS 614 Part 1 and part 2.

3.23 pounding : Holding of live crabs in water tanks or floating crates for extended periods of time .

3.24 refrigerated sea water : Clean sea water reduced in temperature by a suitable refrigeration system. Its salt content is normally about 3 percent.

3.25 sections : Cleaned, eviscerated and degilled crab parts usually consisting of one half of the crab body and the attached walking legs and claw.

3.26 shaking : Industrial practice of manual meat extraction used for king, snow and Dungeness crabs. The cooked sections are processed by hitting or shaking the meat out of the shell.

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

3.28 thermal processing : Heat treatment commonly used in canning to render the product commercially sterile.

3.29 viscera : Contents of the gut cavity of crabs.

3.30 waste : Crab parts which remain after the meat removal operation is completed.

4 RAW MATERIAL REQUIREMENTS

4.1 General considerations

4.1.1 Live crabs are extremely delicate animals and should be handled at all times with great care.

The natural environmental condition of crabs is quickly changed when they are brought to the surface from the sea bottom. Healthy crabs can gradually adapt themselves to these changes but the crabs vitality is considerably weakened, and care in handling at this point is extremely important if heavy losses are to be avoided. Crabs should not be exposed to direct sunlight or to the drying effect of winds, but should be carefully packed in crates or circulated sea water and kept cool (2-10 ^{o}C). Any careless treatment will result in a high mortality rate and deterioration in the raw material.

4.1.2 Where harvesting operations permit, crabs should be kept vigorously alive until the time of processing.

Crabs deteriorate more rapidly after death than most fish and quality can best be maintained by keeping them alive until processing . If this is not possible, they should be butchered and the sections carefully separated and cleaned before freezing or cooling down to the temperature of melting ice, which should be done as rapidly as possible.
These precautions will retard the growth of micro-organisms and reduce enzymatic deterioration.

4.1.3 Where live crabs are harvested any dead, mutilated or unwholesome crabs should be removed from the catch immediately.

Such animals if not removed will cause deterioration of the rest of the catch. Weak crabs should be processed immediately.

5 HANDLING OF CRABS 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 crabs, 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 crab fishing vessel many other factors, apart from the vessel's performance as a harvesting unit, should be considered. Contamination of crabs with bilge water, sewage, smoke, fuel, oil, grease or other objectionable substances must be avoided.

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

Vessels on which crabs are processed should meet the requirements of shore establishments in design, layout, construction and equipment, and processing should be carried out under similar hygienic conditions.

5.2 Crab vessel construction and sanitary design

5.2.1 Deck pound or pen stanchions and dividing boards and holding tanks should be constructed of suitable, smooth-surfaced corrosion-resistant material. They should be adequate in number and height to prevent crushing of the crab due to excess weight or to the vessel's motion, and to hold the estimated catch.

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 non-toxic paint or other non-toxic surface coating that is smooth and readily cleanable. Steel work should be coated with anti-corrosion non-toxic paint. Whenever possible, suitable corrosion-resistant materials should be used. On vessels which hold live crabs, only small deck pounds are required as the crabs should be sorted and conveyed with care to the tank, well or bag as soon as possible after being brought on board.

5.2.2 Vessel holds or tanks for storage of iced crab sections 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 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.

5.2.3 Hold or tank linings should be completely water-tight. The insulation layer should be protected bya lining made of corrosion-resistant metal sheets or any other equally suitable material having water-tight joints.

It is important to prevent water from carrying dirt and offal to parts of the vessel where effective cleaning is virtually impossible.

The melt water seeping through the vessel hold lining will also reduce the efficiency of the insulation and this will, in turn, lead to an increase in the temperature of the crabs or crab sections. The insulation should be covered with corrosion resistant metal sheets or any other 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.

5.2.4 Wooden holds or wooden holding tanks should be lined with a suitable material.

The linings of wooden holds or tanks should be similar to those 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.

5.2.5 There should be no sharp corners or projections in the hold or tank as these will make cleaning difficult and may damage the crabs.

Contamination with dirt and offal 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, wires, chains and conduits, that are passing through the vessel hold should be so constructed as to allow free drainage, ease of cleaning and not to cause any physical damage, to the crabs.

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 holds.

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 durable non-toxic paint or other equally suitable surface coating that is smooth, readily cleanable and repairable. Wherever possible, the shelving and the partitioning boards should be interchangeable in size.

5.2.7 Shelving boards should be designed to allow adequate drainage.

Crab sections are iced and should be held in containers so that melt water does not contaminate them and should be placed on shelving boards.

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 There should always be ample drainage space between the lowest shelves or the "false bottom" and the floor of the 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 connexions to these sumps should be fitted with coarse screen filters.

Proper drainage facilities can prevent a build-up of large quantities of melt water, dirt and offal. If drainage is inadequate, the bottom layers of the crabs in the hold may be contaminated by this dirty liquid, especially during the periods of severe motion of the vessel .

5.2.9 Tanks and wells used for holding live crabs should be so placed and constructed as to ensure survival of the crabs and to protect them from damage.

A tank for storing crabs should have forced circulation of clean sea water by pumping from the bottom to the top of the tank. Care should be taken in design so that there are no "dead spots" in the tank. This can be accomplished by the use for a plenum chamber with grating in the bottom of the tank or by an adequate sea water distribution pipe system. The tank should not be too large and when full of crabs, the rate of change of water should be at least four times per hour. The tanks should be divided into compartments for the purpose of segregating the catch and can also be provided with baskets of impervious corrosion-resistant materials for ease of unloading. Baskets one metre cube have been found to be satisfactory but experimentation on packing density is necessary for each fishery.

Where wet wells are used, the holes in the hull of the boat should be large enough to provide effective exchange of water. It should be remembered that the motion of the boat is an essential factor to successful circulation unless auxiliary aids are used, such as pumps. If the water stagnates, the crabs will die.

5.2.10 Tanks and wells used for holding live crabs should be refrigerated or kept cold.

Refrigerated sea water has been shown to reduce mortality in holding tanks. Cold water crabs require holding temperatures in the range of 0 to 5 ^{o}C (32-41 ^{o}F). Warm water crabs maybe held at higher temperatures (up to 17 ^{o}C or 62.5 ^{o}F), but it has been shown that colder temperatures (4-10 ^{o}C, 39-50 ^{o}F) reduce metabolic rates and cannibalism.

5.2.11 Properly designed facilities should be provided for hauling traps, pots and nets to prevent damage during catching.

This will enable undersize crabs to be returned to the sea where required, and minimize damage to the commercial part of the catch. Crabs are fragile and legs and other appendages are easily broken. This causes loss of blood and the risk of infection with consequent weakening of the crab. The market value of damaged crabs may also be reduced. An inclined chute should be used to facilitate the transfer of the crabs from deck to the hold and will reduce mortality in this operation.

5.3 Hygiene facilities

5.3.1 Areas of the deck where crabs are unloaded and handled, or the hold where crab sections are stowed should 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 possibility of contamination of surfaces with which crabs come into contact.

5.3.2 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.

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 or 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-syphonage from the kitchen sink or toilets.

5.3.3 Ice should be made from potable water 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 crabs with water-borne micro-organisms 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.

When vessels are taking ice to sea, only fresh clean ice should be taken on board at the beginning of each voyage. Ice storage on board should be in an insulated hold and all unused ice should be discarded at the end of the trip.

5.3.4 The vessel's toilet facilities and all plumbing and waste disposal lines should be so constructed as not to contaminate the catch.

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 should not go through the holds where crabs are being handled or stored.

5.3.5 Where bait is carried, it should be held in such a manner that it will not contaminate the catch.

On vessels which carry bait, a separate area or special container should be set aside for bait storage 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.

5.3.6 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 crabs. 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 them should be handled only by personnel trained in their use.

5.3.7 The fishing vessel should be equiped 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 in 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 (eg. dipping in 50 ppm chlorine solution) and when not used should be stored in a dry state. Brushes could spread dirt and micro-organisms. Micro-organisms may prolifierate 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.

5.4 Equipment and utensils

5.4.1 All containers used for ice stowing of crabs should be of uniform and suitable size, easy to handle when loaded, and should be constructed of suitable corrosion-resistant material.

Such containers, 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 crab sections on board the vessel or on shore, as they are difficult to clean and disinfect.

5.4.2 All equipment used in freezing and frozen storage of crab sections aboard the vessel should meet the requirements of the "code of hygienic practice for frozen fish".

Most of the recommendations made in that code would apply equally to freezing and frozen storage of crab sections.

5.4.3 Cookers should be designed to provide constant and adequate supply of heat so that all crabs could be given the same time/temperature exposure during the cooking operation.

Cooking, or any other heat treatment of crab, is a very critical process as far as the yield and quality of the final product are concerned.

The cooker should be constructed to provide a good control of time/temperature exposure of the crab sections at the maximum processing load. As an aid in this respect, each cooker should be equipped with a suitable thermometer to show a water temperature and simple timing device to indicate time of cooking to the operator. It is poor practice to keep crabs in hot water or brine for a long time before boiling commences.

5.4.4 Cookers should be made of suitable corrosion-resistant material and be built in such a way that they can be drained and easily dismantled for cleaning.

All parts of the cooker that come into contact with the crab sections should be made of suitable corrosion-resistant material. The cooker, of a conventional or continual type, should be designed to permit easy and frequent drainage and dismantling for washing and sanitizing.

5.4.5 Suitable equipment for cooling of cooked crab sections should be provided.

Crab sections should be cooled rapidly and thoroughly either by immersion in a tank containing clean sea water or by exposure to an effective air cooling system.

The cooling tank should be of suitable corrosion-resistant material and should be designed to provide a constant change of water with good circulation. It should be located close to the cooker but in such a way that the chance of contamination with micro-organisms derived from the raw crab is reduced to a minimum.

5.5 Hygienic operating requirements

5.5.1 All tubs, tanks, barrels and other equipment used in handling, butchering, washing and conveying operations should be thoroughly cleaned, disinfected and rinsed after each cycle of use.

Any dirt or offal allowed to dry and accumulate on surfaces with which crabs come into contact will be very difficult to remove later and will thus contaminate the subsequent loads of crabs.

5.5.2 During fishing trips the vessel's hold bilge sump should be drained regularly. The sump should be accessible at all times.

Bilge water containing dirt and offal, if not regularly pumped out, will provide a medium for the multiplication of micro-organisms and insects and give rise to offensive odours and infestation in the hold.

5.5.3 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 hygiene 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.

5.5.4 Sea water which has been used for cooling engines, condensers or similar equipment should not be used for washing crabs, deck, hold or any other equipment which might come into contact with crabs.

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, therefore, will considerably accelerate spoilage of crabs by raising the temperature and might impart objectionable taste, odour or undesirable discolouration.

5.5.5 Only potable water or clean sea water should be used for cooking of crabs or crab sections.

Crabs that are cooked at sea may be eaten without further heat treatment and the presence of any micro-organisms of public health significance on this product may therefore endanger health of the consumer.

5.5.6 All equipment used in the cooking and cooling of crabs should be frequently hosed down, brushed to remove all visible dirt, cleaned with a suitable cleaning agent, disinfected and rinsed thoroughly.

During the cooking of crab, impurities such as sand, clay, miscellaneous sea-bottom detritus, parts of crab and coagulated proteinaceous material accumulate. These may discolour the cooked crab and introduce undesirable odours and flavours. Foam which is formed in dirty cooking water may harbour and protect the spores of thermophilic micro-organisms and this may cause trouble during subsequent processing.

It is important, therefore, that a thorough cleaning of the cooker, cooling tank and other associated equipment should be carried out frequently and at least once daily.

5.5.7 Personnel engaged in cooking, cooling and handling of cooked crab should take all the necessary precautions not to contaminate the cooked product with micro-organisms which might cause spoilage or constitute a public health hazard.

Crabs or crab sections when removed from the cooker are practically free from living micro-organisms. Recontamination commences during cooling and increases progressively during further handling. As crabs cooked at sea are frequently eaten without additional heat treatment, contamination of the product with micro-organisms of public health significance is dangerous and contamination with spoilage organisms will reduce the potential shelf-life of the product. Workers who are engaged in cooking, cooling or handling of crab at sea should maintain the same high degree of personal cleanliness as workers in processing plants. It is undesirable for the same workers to handle the raw as well as the cooked product; if this is unavoidable, stringent precautions should be taken to prevent contamination of the cooked product by micro-organisms from raw material.

5.5.8 When cleaning and hosing operations are carried out while the vessel is in port, potable water or clean sea water should be used.

Harbour water is usually heavily polluted and should never be used or deaning purposes. This is also true for sea water in the close vicinity towns, villages, industrial plants, fish-processing establishments and factory ships.

5.5.9 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.

Blood, guts, slime and other residue left on the deck will support multiplication of micro-organisms which may contaminate future catches. If allowed to dry, dirt and offal are very difficult to remove.

Thorough cleaning should always precede disinfection especially when chlorine is used as the disinfecting agent. Any organic matter which is not removed form the surfaces that are to be disinfected will rapidly combine with and neutralize the micro-organism killing ability of chlorine or any other disinfectant.

5.5.10 At the end of each trip, any unused ice should be discarded.

Despite all precautions, unused ice in the hold will become contaminated and will contaminate the new catch.

5.5.11 Immediately after the catch is landed, the hold and bilge sump should also be emptied completely. All surfaces in the hold, pound boards and sump should be thoroughly cleaned with a suitalble cleaning agent, disinfected and rinsed.

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

5.5.12 Cleaning and disinfection procedures should be effective.

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.

Cleaning agents and disinfectants used should not be allowed to come into contact with fishery products or ingredients. Any residue of cleaning agents used for the equipment or utensils should be removed by thorough rinsing with potable fresh water or clean sea water before the equipment or utensils are used again.

In choosing and applying different cleaning agents and disinfectants, one should be fully aware of their properties and limitations. Many agents are effective only when prepared and used in strict accordance with the manufacturer's recommendations. Care should be exercised not to use agents that will taint the product.

Temperature of the solution , its acidity or alkalinity, concentration of the active ingredient, presence of other chemicals, kind of surface to be treated or type of soil (dirt) and mode of application are some of the factors that will determine the usefulness of the agent. Different agents should not be combined without it having been established that they are compatible since one agent may neutralize the activity of another.

5.5.13 Empty vessel holds or crab storage tanks should be ventilated.

Strong odours associated with mildew, stagnant humid air and decomposing organic matter will develop in the absence of ventilation. All the containers, pails, boxes and tubs, after washing and disinfection should be stacked in such a way as to permit sufficient aeration.

5.5.14 Efective 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 crabs. 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.

5.5.15 Dogs, cats and other animals should be excluded from areas of the vessel where crabs are 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 comes into contact with crabs should be exposed to contamination with animal hair or excreta.

5.6 Handling the catch on board

5.6.1 Holding live crabs

5.6.1.1 Live storage is strongly recommended for production of high quality products.

Crabs can be held alive either on board vessels or at shore side establishments, in tanks, wet wells or floating cages, They can also be held for short periods in clean moist bags or boxes. When live crabs are being held in storage with ice, care should be taken that the ice does not come into contact with the crabs since melt water and extreme cold are lethal to most species. Live storage is not practicable in all fisheries and therefore other methods of storage involving part – processing on board should be considered,
eg. butchering and chill storage of sections. These storage methods should also be used in fisheries where the crabs are weakened or mutilated during catching.

Live storage tanks and wells should have either an adequate water circulation system or an effective sea water exchange system. In order to reduce mortality, the best holding temperatures for deepwater crabs are in the range of 0-5 ^{o}C (32-41 ^{o}F). Warm water crabs maybe held at higher temperatures up to 17 ^{o}C (or 62.6 ^{o} F), but it has been shown that colder temperatures 4-10 ^{o}C (39.2-50 ^{o}F) reduce metabolic rates and cannibalism.

5.6.1.2 Storage times and stocking density should be controlled.

Holding tanks are regarded as a better method of stroage for long-term handling than well storage. Storage times exceeding 7 days are not recommended.

In either method, crabs should not be tightly packed and it is recommended that in a well, horizontal divisions should be no more than 70 cm apart. On the other hand, very loose packing in wells or tanks will permit the crabs to damage each other. Violent agitation should be prevented.

Crabs in bags or boxes should be tightly packed to prevent movement and damage. Maximum weight must be determined for each fishery.

Bags cannot be recommended for storage over 24 h, but, where used, they should be moist, thoroughly clean and of open weave construction. Slime or mud in the weave of the bag will cause rapid suffocation of the crabs. Bags should not be stored at high humidity and should be kept dry to keep the crabs inactive. The use of clean hessian or jute bags is preferred. Boxes should be clean and not overloaded. Crabs can also be held for short periods if kept cool and moist in clean, moist bags or in boxes covered with clean wet sacking.

5.6.2 Handling and processing of crabs at sea

5.6.2.1 If crabs cannot be landed alive, processing at sea is recommended.

Whole crabs which are weak will die rapidly and enzymatic deterioration will take place even with proper refrigeration. These crabs should be cooked whole as soon as possible.

5.6.2.2 For most species freezing of uncooked crabs or crab sections is not recommended.

Enzymatic reactions in uncooked crab will still occur during frozen storage. This produces poor flavour and texture in the finished product, and since the crab meat has a tendency to adhere to the shell, poor yields and a reduction of meat picking efficiency result.

5.6.2.3 Butchered sections should be cooked and chilled or frozen immediately.

Butchered sections will undergo autolysis and microbiological decomposition very rapidly during iced or refrigerated storage and storage times exceeding 3-5 days are not recommended. Good quality can be maintained by immediate cooking and chilling or freezing. This can be accomplished on board in properly designed vessels.

5.6.2.4 Whole cooked crabs or sections should be chilled rapidly in melting ice or in chilled or refrigerated sea water and should be stowed so that the temperature of the product does not rise.

Temperature is the most important single factor influencing the keeping quality of fresh crab sections.

The effects of increasing temperature are cumulative; that is , some potential keeping time is lost each time the temperature of the crabs rises. The extent of this loss depends both on the degree of rise and the length of time the crabs remain at the higher temperature. It is, therefore, important to chill the catch quickly to the temperature of melting ice and maintain it in a chilled condition until it reaches the porcessor or the market.

Ice is necessary, not only to cool the crabs ,but to maintain them in a cool condition. There should be enough ice to cope with any heat leaking into the holding room. If, at the end of a voyage, the crabs are no longer surrounded by ice, then insufficient ice has been used. It is difficult to lay down precise quantities required, but icing should be heaviest against ship sides and bulkheads. In warm waters it will be necessary to use more ice than in colder climates, and this will also depend on whether the hold is insulated. The correct quantities of ice require to be worked out for individual vessels by trial and error.

5.6.2.5 Crab sections in ice should be stowed in shallow layers.

In bulk stowing, the sections should be well mixed with finely divided ice or layers which are not excessive in depth. Adequately shelved holds, or pens, or proper containers, should be used for this purpose. Chilling of sections in bulk by top icing only should be avoided.

5.6.2.6 Finely divided ice should always be used.

This gives close contact with the crabs, reduces damage by crushing and gives rapid cooling.

5.6.2.7 Where boxes are used for stowing crabs or crab sections, they should be properly iced and not overfilled.

It is sometimes an advantage to pack crabs or sections with ice into boxes at sea. The crabs, if adequately iced, can remain undisturbed in the boxes until they reach the processor or the market. Unloading the catch can be simpler and, if required, more ice can be added to the boxes on landing without disturbing the crabs.

Each day's catch can also be separated more easily. Since boxes are stacked one on top of another in the hold, overfilling will result in damage to the crabs. For efficient cooling, each box should contain a layer of ice on the bottom, then crabs 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.

5.6.2.8 Where appropriate a stowage plan 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. Crabs from different days' catches should never be mixed together when stowed.

5.6.2.9 If rapid chilling is required, this should be carried out in refrigerated sea water or brine.

In certain geographical regions, the use of refrigerated sea water or brine has been practised extensively and with excellent results. It is the most rapid method for chilling crabs.

5.6.2.10 Freezing and frozen storage on board vessels should be carried out in accordance with the recommendations contained in the "code of hygienic practice for frozen fish".

The hygienic requirements on board vessels should be just as high as those in shore processing plants. Although the "Code of Hygienic Practice for Frozen Fish" does not deal specifically with the freezing of crabs, most of the recommendations made would apply.

5.7 Unloading and transport of the catch.

5.7.1 Suitable landing areas should be provided.

Landing directly on to beaches or uncontrolled areas can lead to contamination. Provision of a wharf, quay or pier is most desirable.

5.7.2 Landing areas should be kept clean.

Refuelling and handling of fuel, lubricants and other material which might contaminate the catch should be done in areas separate from those where the catch is unloaded. It should be the specific responsibility of an individual to keep the unloading areas clean.

5.7.3 Unloading facilities should either be provided on the wharf or incorporated on the vessel.

These should enable the catch to be transferred to the wharf smoothly and without causing damage.

5.7.4 Containers used for unloading should be constructed of suitable corrosion resistant material. They should be clean to avoid contamination and strong enough to prevent physical damage to the crabs during transit. Wicker baskets and wooden boxes should not be used.

Live crabs will grip any available part of a container and legs will often protrude. Care should be taken not to damage the crabs during unloading, or removal from the container. If crab sections are iced in boxes, the boxes should be large enough to hold sufficient ice.

5.7.5 Only live, healthy crabs should be selected for transport.

Because of the delicate nature of crabs, care should be taken to avoid the transport of weak and mutilated crabs.

5.7.6 Crabs after unloading should be transferred without delay into transport vehicles.

Landings will either be direct to a processing plant or some transport by truck, rail or air will be necessary.

5.7.7 Surface transport vehicles should be insulated or preferably refrigerated to keep crabs cool.

Live crabs in bags, boxes or cages will survive best if carried at about 5 ^{0}C (41 ^{0}F). Crab sections iced at sea should be carried as close to melting ice temperature as maybe practicable and re-iced as necessary. Cooked crabs and sections, frozen at sea, should not be allowed to thaw out in transit. The temperature should be maintained as close to the freezer store temperature as possible and should not exceed - 18 ^{0}C (0 ^{0}F).

5.7.8 Air transport facilities for live crab and schedules should be designed and arranged to protect the crabs against contamination and high temperatures.

Although air transport is expensive, the extra cost can be justified when dealing with high priced products; as there may be difficulties in surface transportation due to distance or terrain. However, because of weight restrictions, ice and refrigeration may not be practicable for air transport. Schedules should therefore allow for the most rapid transit possible with the shortest possible exposure to high temperatures. In some fisheries transportation of live crabs in light weight polystyrene boxes has been found economically feasible and successful. However, such boxes should not be re-used.

5.7.9 Live crabs should be held under conditions which will prevent losses due to mortality.

In order to market live crabs in an orderly fashion, and to maximize profits, it is often necessary to hold the animals alive for extended periods. Some crab species may be held alive in tanks or floating crates until sold. In the case of tanks for holding crabs installed ashore a system providing for oxygenation of the water in the tank should be provided. Long term "pounding" of crabs (several weeks) is not a general practice because of high mortalities.

6 HANDLING OF CRABS ON SHORE PLANT FACILITIES AND OPERATING REQUIREMENTS

6.1 Plant construction and layout

6.1.1 General considerations

6.1.1.1 Crab processing plants should be specially designed for the purpose.

Crab meat spoils even more rapidly than fish, because of the high non-protein nitrogen content. It is therefore essential that the processing is carried out rapidly in a plant designed to handle crabs and that no build – up of part- processed products occurs.

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 buildings should be sufficient in size without crowding of equipment or personnel, well constructed and kept in good repair. They should be designed and constructed to protect against the entrance and harbouring of insects, birds or other vermin, and to permit ready and adequate cleaning.

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

Where new premises are constructed, or when existing buildings are modified, 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.

Prior to the construction of a new plant or modification of the existing one, a proper flow pattern of operation should be considered (see Appendix 1, "Flow Diagram for Handling Crabs"). Only a well-organized work flow could assure the maximum efficiency of the operation and the better quality product.

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 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.

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 be no 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 overflowing 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 (4 in.) and, if required, run to a catch basin for removal of the 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 approved by the local authorities 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, various 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 the wall surface or neatly boxed in.

6.1.2.5 Window sills should be kept to a minimum size, be sloped towards the processing area at 45 ^{o}C, and be at least 1 m from the floor.

Window sills and frames should be made of a 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 constructed 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 crabs or their products are moved, should be sufficiently wide, well constructed of a suitable material, and should be of a self-closing type.

Doors, through which crabs or crab products are moved, should be either sheeted with or made of a corrosion-resistant metal or other suitable material with adequate impact resistance and, unless provided with an effective air screen, should be of a 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 preferably a minimum of 3 m from the floor in height, free from cracks and open joints and should be of a smooth, waterproof, light coloured finish, which does not permit the growth of mould.

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 crab 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 ones. 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 (20 ft candles) in general working areas and not less than 540 lux (50 ft candles) 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 crabs are handled at any stage of preparation should be of the safety type, or otherwise protected to prevent food contamination in case of breakage.

It is highly desirable to have the light fixtures either recessed flush with the ceiling, or with the upper surface of the light fixtures fitting flush with the ceiling, in order to prevent the accumulation of dust on them.

6.1.3 Hygiene facilities

6.1.3.1 Areas where crabs are received or stored should be so separated from areas in which product preparations or packaging are conducted as to prevent contamination of the finished product.

Well defined areas of adequate size, preferably separate rooms, should be provided for receiving and storing raw materials and for operations like butchering, washing, cooking, picking or other processing and packaging.

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

Receiving and storage areas should be clean and readily capable of being maintained in a clean condition and should provide protection for the crabs 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 watertight 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. If waste material is held in containers outside the establishment, the containers should be lidded. A separate enclosure should be provide 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 crab for human consumption.

The layout and construction of a plant processing crab for human consumption should be such as to ensure that the area in which crabs for human consumption are held, processed and stored, are used for these purposes 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 of contamination of crabs or crab products.

6.1.3.4 An ample supply of cold and hot potable water and /or clean sea water, under adequate pressure, should be available at numerous points throughout the premises at all times during working hours.

All water available for use in those parts of establishments where crabs are receive, held, processed, packaged and stored, should be potable water or clean sea water and should be supplied at a pressure of not less than 1.4 kg/cm^2 (20 1b/in^2). If sea water is used, it must be clean sea water.

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

6.1.3.5 When in-plant chlorination of water is issued, the residual content of free chlorine should be maintained at not more than the minimum effective level for the use intended.

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 micro-organisms and prevent the build-up of fish odours.

Chlorination systems should not be relied onto solve all hygiene problems. The indiscriminate use of chlorine cannot compensate for non-hygienic conditions in a processing plant.

Ice used in the operation of the crab processing establishment should be made from water of potable quality.

A special room, or other suitable storage facilities, should be provided to protect the ice from contamination and excessive meltage. Dust, flakes of paint, bits of wood or sawdust, straw and rust, are the most frequent impurities transferable by ice into the final product.

Care must be taken to ensure that ice used to chill crabs or crab products does not contaminate them.

6.1.3.6 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-syphonage with the lines carrying potable 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 crab processing areas. Only potable water should be used for the supply of hot water.

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

6.1.3.7 All plumbing and waste disposal lines, including the sewer system, should be large enough to carry peak loads and should be properly constructed.

All lines should be watertight and have adequate deep deal 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 be located outside 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 manner of waste disposal should be approved by the official agency having jurisdiction.

6.1.3.8 Proper facilities for washing and disinfection of equipment should be provided.

Facilities should be present in every crab processing establishment for cleaning and disinfection of trays, removable cutting 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.

6.1.3.9 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.

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

Hand washing facilities of a type not requiring operation by hand, with an adequate supply of potable water or clean sea water, with liquid or powdered soap and with suitable hygienic means of drying the hands, should be provided adjacent to the toilets and in such a position that the employee must pass them when returning to the processing room Where paper towels are used, a sufficient number of dispensers and receptacles for used towels should be provided.

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

The following formula could be used as a guideline 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

6.1.3.10 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 handwashing facilities available in toilet rooms, a number of wash basins with an adequate supply of potable water or clean sea water and liquid or powdered soap should be provided whenever the process demands. They should be located at all employee entrances in full view of the processing floor and should be of a type not requiring operation by hand or should be fed by a continuous flow of potable water or clean sea water. Single-use paper 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.

6.1.3.11 Staff amenities consisting of lunch rooms, 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 or some alternative facilities for each employee without causing undue congestion. Clothing and footwear not worn during working hours must not be kept in any processing area.

6.1.3.12 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.

6.1.3.13 If poisonous or harmful materials, including cleaning agents, disinfectants, sanitizers and pesticides are stored, they should be kept in a separate room designed or marked specifically for this purpose.

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 crab should be of smooth, impervious, non-toxic material which is corrosion-resistant. Such equipment and utensils should be designed and constructed to prevent hygienic hazards and permit easy and thorough cleaning. In general, the use of wood for this purpose is not recommended.

Contamination of crabs 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, crab juices or other ingredients used and capable of withstanding repeated cleaning and disinfection. Machines and equipment should be so designed that they can be easily dismantled to facilitate thorough cleaning and disinfection.

Containers used for holding crabs 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 to permit easy access and thorough cleaning and disinfection.

Washing tanks should be designed to provide a constant change of water with good circulation, and to have provisions for drainage and 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 crabs and products intended for human consumption.

6.2.2 Adequate facilities should be available at the processing plant to maintain crabs in chilled condition.

Where crabs cannot be processed on arrival, or when the final product cannot be distributed soon after packing, adequate facilities are required to keep the crabs or their products cool, Chill rooms should not be used to cool the crabs but only to maintain them chilled after they have been cooled by ice or other means.

It is poor practice, therefore, to load the chill rooms with large quantities of fresh crabs 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 could be kept 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 ^{o}C (32 ^{o}F).

6.2.3 Surfaces on which crabs are processed shall be made of suitable corrosion resistant material, other than wood, and all joints on such surfaces should be smooth and watertight.

It is important that all surfaces be of a non-absorbent and crevice- free material so that they will not become saturated with juices containing micro-organisms which would give rise to off-odours and be a source of contamination. Corrodible materials are objectionable because the product of corrosion may contaminate the product.

6.2.4 Cracking blocks and mallets should be constructed of non-absorbent and crevice free material.

Cracking blocks and mallets should be constructed of a non-absorbent and crevice-free material so that they will not become saturated with juices containing micro-organisms which would give rise to off-odours and be a source of contamination. Corrodible materials are objectionable because the products of corrosion may contaminate the product. Hard rubber and certain forms of plastic have been found suitable. These blocks and mallets should be constructed in an approved manner, free of cracks and crevices and be suitably maintained. Wooden blocks or mallets should not be used.

6.2.5 Tables should be so constructed that they, and the areas beneath, can be readily cleaned.

Tables should be so constructed that there will be no inaccessible points which may be omitted in establishment clean-up. Stands for workers along the processing lines should be constructed of metal, should be well maintained and should be movable or so constructed that the stands and the floor beneath can be properly cleaned.

6.2.6 Equipment used for the cooking of crabs should be large enough to handle the maximum production load and should be designed to provide constant and adequate supply of heat so that all crabs are given the same time/temperature treatment.

As has already been stated, the cooking or any other heat treatment of crabs is a very critical process as far as the yield and quality are concerned. To ensure the adequacy and uniformity of treatment, the equipment used should be designed to operate at the estimated maximum processing load. To protect the quality of the product, the equipment should be constructed from suitable corrosion-resistant material and should be so designed that it could be readily drained, washed and disinfected.

6.2.7 Heating equipment used in the pasteurization of crabs should be provided with automatic temperature controlling and recording devices.

It is essential that time and temperature are strictly controlled during the pasteurization process. Automatic time/temperature controlling and recording devices are helpful but it is important to calibrate them properly. Accurate heating records should be kept for each lot of pasteurized crab. It should be possible to identify each lot in relation to time and temperature records.

6.2.8 Refrigeration and freezing equipment should be properly designed and constructed and should be of adequate capacity.

The freezing equipment should be designed and operated in accordance with the requirements stated in the "Code of Practice for Frozen Fish" so that freezing of crabs or crab meat is accomplished rapidly.

6.2.9 All freezer and cold storage facilities should be adequate for the intended production and should be fitted with automatic temperature controlling and recording devices.

Frozen crabs and crab products should be stored at a uniformly low temperature if a considerably quality loss is to be avoided. Freezer stores should be able to operate at
-30 ^{o}C (-22 ^{o}F) or lower as crab meat deteriorates more rapidly than fish.

Thermometers, or other temperature recording devices, should be capable of being read easily within a two-degree accuracy. More detailed requirements for the construction and operation of a freezer store are given in the "Code of Practice for Frozen Fish".

6.2.10 Transport vehicles should be designed to protect crabs from warming up during transport and should be of such material and construction as to permit easy and thorough cleaning.

Vehicles used for transporting crabs and crab products should be designed to provide some means of refrigeration and constructed to ensure constant protection against contamination by dust, 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 vehicle 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 crabs but helps to keep them at the temperature at which they were put into the vehicle.

Vehicles used for transporting frozen crab should be able to maintain the product as close to the freezer store temperature as possible and should not exceed -18 ^{o}C (0 ^{o}F).

For the purpose of cleaning the transporting vehicle should have the wall, floor and roof linings made of suitable corrosion-resistant material with smooth and non-absorbent surface. Floors should be adequately drained.

6.3 Hygienic operating requirements

6.3.1 All wharves, quays, markets and similar areas where crabs are unloaded or displayed for sale should be kept clean and disinfected.

Crabs, 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 crabs will be contaminated with filth and micro-organisms of public health significance.

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 into contact with crabs or crab products 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 into contact with crabs should be rinsed thoroughly with cool potable water or cool 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. The use of sponges and towels to wipe table or container surfaces which come into contact with crabs should not be allowed.

6.3.3 All machines used should be thoroughly cleaned, disinfected and rinsed at suitable intervals and at the end of operations and before resumption of production following extended work stoppages, and at other times when necessary.

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

6.3.4 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 practice to start with a wet line rather than with a dry surface.

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

6.3.5 Only potable or clean sea water should be used for washing, rendering insensible or killing, cooking, cooling and conveying of crabs and should not be recirculated.

It has been stated before that cooked crabs can be eaten without any further heat treatment and the presence of micro-organisms of public health significance on this product could endanger the health of the consumer.

Contamination from raw, fresh or frozen crabs could also be spread by an unwary consumer to kitchen utensils and other foods under preparation.

6.3.6 Removal of solid, semi-solid or liquid wastes from crab unloading, holding and processing areas should be on a continuous 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 form the operation of a processing 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 or offer harbourage or breeding places for rodents, insects or other vermin.

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

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

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

6.3.7 Effective measures should be taken to protect against the entrance into the premises, especially storage areas, and the harbourage on the premises of insects, rodents, birds or other vermin.

An effective and continuos 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 under the direct supervision of personnel with a thorough understanding of the hazards involved, including the possibility of harmful residues being retained by the crabs or their products, and 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 ultraviolet insect killers with the attached collecting trays, is recommended. Insect traps and light sources which may attract insects should not be located directly over the processing areas and should be away form windows and doors. Ultraviolet insect killers should be left on overnight with all doors and windows shut.

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.

6.3.8 Dogs, cats and other animals should be excluded from areas where crabs are received, handled, processed or stored.

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

6.3.9 All persons working in a crab processing plant should maintain a high degree of personal cleanliness while on duty and should take all necessary precautions to prevent the contamination of the crabs, their products, or ingredients, with any foreign substance.

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

Gloves used in the handling of crabs should be maintained in a sound, clean and hygienic 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 other cleansing agent 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 crabs such as eating, smoking chewing of tobacco and other materials and spitting should be prohibited in any part of the crab handling areas.

6.3.10 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 crabs or their products.

Plant management should require that any person afflicted with infected wounds, sores, or any illness, notably diarrhoea, should immediately report to management. Management should not allow any person down 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 plant in a capacity in which there is a likelihood of such a person contaminating crabs or crab products with disease-causing micro-organisms.

Minor cuts and abrasions on the hands should immediately be 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.

6.3.11 Market containers and all returnable 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 in hot water at a suitable temperature 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 done immediately and the containers' surfaces are not allowed to dry.

6.4 Operating practices and production requirements

6.4.1 General considerations

6.4.1.1 Only good quality crabs should be accepted for processing.

Dead or decomposed crabs should be rejected. The entire batch should be rejected if it contains harmful or extraneous substances which will not be removed to acceptable levels by normal procedures of sorting or preparation.

6.4.1.2 Live crabs should be handled and processed with care and a minimum of delay.

Crabs should be kept alive until they are shipped to the market or processed.

Crabs will live for varying lengths of time depending on conditions under which they are held. These factors vary with the season and temperature, salinity, oxygen content and load, if held in sea water.

For short-term storage, crabs are held in ordinary crates or in land-based tank units supplied with running sea water.

A system of tanks through which cool clean sea water is pumped and aerated is recommended, either in a building or in the open, but covered to protect crabs from the sun.

6.4.1.3 Plants should regulate the volume of live crabs they receive and/or hold so that their supplies do not become too large to be processed while the crabs are in prime condition.

Live crabs should always be processed as soon as possible after capture. The length of time that crabs can be satisfactorily held at the plant before processing will depend on the length of time already elapsed since capture, and on the care with which they were handled on board the fishing vessels and during transport to the plant.

Plants should limit the amount of live crabs they accept to the amount that they can process while they are still in good condition.

Where the volume of live crabs available for processing is subject to large fluctuations, the feasibility of butchering, cooking and freezing and storing the surplus for packing during slack periods might be considered.

6.4.2 Preparatory operations

6.4.2.1 Preparatory operations for preservation such as : sorting, butchering, cooking, cooling, picking and washing should be done in a clean and hygienic manner and should be carried out carefully to avoid spoiling the quality of the product and/or wasting material.

Preparatory operations leading to the finished product should be so aimed as to permit expeditious handling of consecutive units in production under conditions which would prevent contamination, deterioration or spoilage by the development of spoilage bacteria or micro- organisms of public health significance.

Butchering, washing and picking should be done very thoroughly so that no viscera, blood clots or shell pieces are left to spoil the appearance or the flavour of the final product.

6.4.2.2 Crabs should be examined before processing starts.

In plants which process live crabs any dead crabs should be discarded. Where sections are processed, any defective or deteriorated parts should be removed.

6.4.2.3 Particular care should be taken to ensure that shell fragments are removed from crab meat.

Fragments of shell left in shellfish meat are very objectionable to consumers and in some circumstances they may be dangerous. Crab shall fluoresces (glows) under ultraviolet light and this property can be used to find fragments mixed with fresh crab meat. Crab meat in early stages of decomposition may also fluoresce under ultraviolet light. If the ultraviolet light is used it should be in compliance with the requirements of the official authorities having jurisdiction.

6.4.2.4 Butchering

6.4.2.4.1 Butchering of live crabs should be carried out as smoothly as possible and care should be taken to avoid mutilation of the crab sections.

King crab, snow crab, and *geryon* species are commonly butchered prior to processing for picked meats. The crabs can be butchered by hand or by machine. Loss of legs and mutilated sections will result in substantial yield losses and reductions in processing efficiency.

6.4.2.4.2 All viscera and gill material should be removed before cooking.

After butchering, any remaining viscera and gills can be removed by brushing and washing. Proper cleaning at this stage eliminates the risk of foreign material being included in the finished product.

6.4.2.5 Rendering insensible or killing whole crabs

6.4.2.5.1 Crabs which are to be processed whole for fresh and frozen products should be rendered insensible or killed just prior to cooking.

Some crab species will throw off their legs and claws if placed directly in boiling water or steam. To prevent leg loss the crabs should be rendered insensible prior to cooking. This may be accomplished by the following method ;

- cooling the crabs for one or two hours at 0 ^{o}C or lower ;

- immersion of the crabs in potable water or clean sea water until the crabs are rendered insensible. For speed of processing this is usually accomplished in water which is approximately 10-15 ^{o}C warmer than the natural environment of the species ;

- piercing of the two nerve centres by means of a stainless steel skewer or rod. The rod is inserted through one of the eyes and through the vent; and

- stunning the crabs by passing an electric current through seawater in which the crabs are immersed. Expert advice should be obtained before attempting this procedure as severe shock to the operative is very likely unless correct procedures and equipment are employed.

6.4.2.5.2 Crabs that are rendered insensible or killed should be cooked immediately.

Spoilage in dead crabs takes place very rapidly. Any delay prior to cooking may reduce the meat quality.

6.4.2.6 Cooking

6.4.2.6.1 Cooking should be done in water or by steaming the crabs or crab sections.

In most cases the cooking of crabs in boiling water is preferred to steaming. Steaming has a tendency to dry the meat, resulting in the flesh adhering to the shell. Because of the inconsistencies in batch cooking, continuous conveyorized cooking is recommended. Cook water should be discarded periodically to prevent build – up of blood protein and other foreign materials.

Processors should not cook more crabs than can be handled continuously by the processing staff. Cooked crabs and crab parts should not be held for long periods unless properly refrigerated.

6.4.2.6.2 Cooking should be controlled as to be adequate for the purpose for which the product is intended.

Cooking coagulates the protein in crab tissues which results in shrinkage of the meat and separation of the meat from the shell material. Adequate uniform cooking is essential. Too much cooking causes excessive meat shrinkage, moisture loss and lower yields, and too little cooking makes it difficult to remove the meat from the shell. It is difficult to specify cooking times generally due to differences in size, structure and physiology of the crabs. In general, a minimum meat temperature of 180 to 200 ^{o}F should be achieved. The following represents some general practices presently used in the industry for various crab species :

Blue crab (whole crabs) :

(a) steam retorted for 10 min after reaching 121 ^{o}C retort temperature; and

(b) boiling or steaming for a minimum of 15 min at 100 ^{o}C

King crab section :

(a) one – stage cook ; 22-25 min in seawater at 100 ^{o}C

(b) two – stage cook ; 10 min at 71-75 ^{o}C followed by meat removal and a second cook for about 10 min at 100 ^{o}C in brine ; and

(c) " green cook or partial cook" for canning where sections are blanched for 10 - 15 min at 100 ^{o}C

Snow crab and *Geryon* sections :

(a) one – stage cook; 7 –15 min at 100 ^{o}C depending on the size of the crab ; and

(b) two-stage cook; 4 –5 min in water 71 - 82 ^{o}C followed by meat removal and a second cook of 3 –5 min in steam (100 ^{o}C)

Cancer species :

(a) butchered sections ; 10 –15 min in water or steam at 100 ^{o}C ; and

(b) whole crabs ; inactivation followed by boiling or steaming 100 ^{o}C for 15 –25 min depending on size.

6.4.2.7 Cooling

6.4.2.7.1 Cooling of cooked crabs or crab sections should be done quickly without contamination of the product.

Freshly cooked crabs are practically free of spoilage micro- organisms but during a large part of the cooling period they are within the temperature range in which any that are present will multiply rapidly and may cause spoilage.

Cooling times should, therefore, be kept as short as possible and every effort should be made to avoid contamination of the products during this period.

Where crabs have to be held after cooling they should be held in specially designated, clean, dust-free areas where there is a good circulation of air and from which vermin and other possible sources of contamination can be excluded.

Cooling should be done in air, potable water or clean sea water. Cooling water should be used only once.

Where crabs are cooked on a continuous basis, cooling is also best done on a continuous basis. A chamber of adequate length, through which an open link conveyor passes and which is equipped with spray nozzles so that the crabs are sprayed from all sides, may be used for the purpose. Air cooling may also be used.

The reason for cooling the crabs is to end cooking uniformly throughout the batch and to avoid holding at temperatures which would encourage the growth and multiplication of bacteria. Cooked crabs should be removed simultaneously from the cooker and cooled as rapidly as possible after cooking. Cooling should be completed within two hours.

6.4.2.7.2 In batch systems the inactivation tank, cooker and cooling tank should be located adjacent to each other with an overhead hoist or gantry provided to transfer baskets from one to the other.

This enables crabs packed in a basket for rendering inactive or for killing to be cooked and cooled in the same container.

6.4.2.7.3 After cooling, the crabs should be taken from the container and all adhering coagulated protein removed.

Spraying during cooling maybe sufficient but it may be necessary to wash by hand. Spraying and brushing can be combined. Either potable water or clean sea water should be used.

Care must be exercised to avoid contamination when brushes are used.

6.4.2.7.4 After washing, the crabs should be adequately drained in an area set aside for the purpose.

In some species the body cavity contains a considerable amount of water. While adequate drainage is desirable, the crabs should not be allowed to drain unnecessarily.

6.4.2.8 Holding

6.4.2.8.1 Where cooked crabs are held before distribution, freezing or further processing (E. G. Picking),they should be chilled.

There should be no unnecessary delay between time crabs enter the production line and when the preservation process is finished. Where the final product is to be marketed as fresh whole crab or after further processing the cooked crabs in the shell or the shucked meat should be chilled to a temperature approaching that of melting ice and either passed into the distribution chain or processed within 18 hours.

6.4.2.9 Meat extraction

6.4.2.9.1 If crabs have not been butchered before cooking meat extraction should take place in an area of the factory and in such a manner as to prevent contamination from uncooked raw material.

White meat (muscle) and especially so called brown meat (hepatopancreas and gonads), where this is utilized are easily contaminated during the butchering process. Contamination from uncooked crabs is possible if butchering takes place in the same area as cooking or if the same staff are involved in both operation.

Exactly the same contamination hazards exist during butchering after cooking as during picking-thus great care to prevent contamination from human sources must also be taken.

Various machines for the automatic butchering of crabs or devices to assist the operative, where full mechanical butchering is impossible, are available and should be used if feasible. Such equipment not only helps in what is a laborious operation in some species but speeds up the process and reduces the possibilities for contamination. Both machines and devices must be so designed that cleaning is facilitated.

6.4.2.9.2 The extraction of crab meat by hand should be done quickly and carefully.

Picking or shaking operations should be carefully controlled to provide an attractive product and to prevent bacterial spoilage or contamination from foreign materials.

In species such as *Cancer pagurus* where the brown meat is utilized the edible parts should be scooped from the back shell with a spoon or spatula and any adhering meat removed from the body core.

The flow of product should be kept constant to prevent build-up of meat or sections at various processing points. This is particularly important for such operations as the mincing of brown meat. It is recommended that all types of meat are picked, packaged and either chilled or frozen within two hours.

6.4.2.9.3 Continuous mechanical processing of white crab meat should be used if possible.

Because of the possibilities of contamination and spoilage, continuous mechanical processing is preferable to hand picking or shaking of white meat by batch processing.

Due to the diverse nature of different crab species different machines have been developed to accomplish this task. In general terms crabs which have a more flexible leathery shell can be processed by machinery which squeezes the meat from the limbs or body sections by rollers. Other machinery has been developed which removes the meat from certain species by vacuum. If a species will process in such ways it is preferable to methods which disrupt the meat to a greater extent.

Species such as cancer pagurus which have a hard brittle shell and or a highly developed endophragmal system cannot be processed by this type of machinery and other machinery must be used, for instance continuous centrifugation in conjunction with sugar/sodium chloride brine flotation after initial comminution. Such a technique does not give as high a quality product as hand picking or the other methods referred to since it is more fragmented but it is far superior to that obtained from a recovery operation using a meat/bone separator or static brine flotation.

Since development work on mechanical crab picking equipment is still taking place, enquires on the status of the various devices available should be made before capital investment programmes are finalized.

Whatever continuous mechanical equipment is employed product flow through the entire process (cooking, unless held in chill as in 5.4.2.8.1, though to preservation) should be continuous avoiding the accumulation of raw materials or meat. All machinery should be cleaned and disinfected regularly during the processing operation. Care should be taken to continuously adjust the equipment to give maximum yield whilst maintaining the quality of the product. Brines should be changed frequently to prevent bacterial build- up in flotation methods.

6.4.2.9.4 Waste materials should not be allowed to accumulate in the processing area.

Back shells, viscera (if not utilized as brown meat) and other shell wastes, should be removed continuously from the processing area.

6.4.2.9.5 Picking tables, conveyors, equipment and utensils should be periodically cleaned and disinfected.

Complete washing and disinfection of all equipment in the picking area is recommended after every four hours of operation. Hand utensils, bowls and mincers, the latter used in the processing of brown meat, should be washed and disinfected at two hourly intervals during the work period. It is good practice to wash containers into which meat is picked each time they are emptied but at least every two hours.

6.4.2.9.6 Picked crab meat should not be allowed to accumulate on the processing line.

Picked crab meat is especially vulnerable to contamination.

Fresh picked crab meat should be cooled to an internal temperature of 4.5 ^{o}C (40 ^{o}F) or less within two hours after picking.

6.4.2.9.7 Waste shell and by-products from the picking operation which are to be further processed for meat recovery should be handled rapidly and efficiently.

Claws, leg tips and shell waste containing recoverable meat should be continuously separated from other waste material during the picking operation. All of these materials should be kept chilled and free from contamination.

6.4.2.9.8 Meat recovery operations from waste materials should be carried out continuously.

Since waste materials are subject to rapid spoilage, stockpiling is not recommended. A continuous system of recovery using meat bone separation or brine flotation is common industry practice.

6.4.3 Packaging

6.4.3.1 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 harmful substances or odours and tastes, and should protect the product against damage deterioration and contamination.

Packaging may be in plastic, metal or cardboard containers for frozen or chilled products, whilst packaging in metal containers is generally done for the purpose of heat processing. Care should be taken that empty containers be removed from the packing room and conveyors to the filling machine before the plant is washed down in order to avoid splatter with dirty water or debris.

6.4.3.2 There should be no build-up of raw material or part-processed products at any stage of the processing line.

Since any delay in processing will have an adverse effect on quality, there should be no large backlog of raw material or filled containers in the plant. The packers should package the crab meat in the order in which it comes to them.

6.4.3.3 Picked crab meat should be handled carefully to prevent physical damage to the product.

All handling of the meats should be reduced to a minimum and all methods of conveying and packaging should be designed to prevent unnecessary breakage of lump meat or merus meat.

6.4.3.4 Crab products should be inspected for quality and workmanship at the time packing.

This inspection should take place just before final packing and closing of containers. Each packer's output should be inspected regularly so that faults can be corrected and a high standard of workmanship achieved.

6.4.3.5 All crab products should be indelibly marked with a lot identification.

This is good commercial practice as it enables the manufacturer to withdraw defective products if necessary.

6.4.4 Preservation

6.4.4.1 Thermal processing should be carried out in accordance with recommendations contained in the "Code of Practice for Canning of Fish" .

The guidelines contained in the Code of Practice for Canning of Fish sub-section **4.3** as well as Appendix **A**, Factors Affecting Quality, apply to crab meat.

6.4.4.2 Pasteurization should be carried out properly in order to be effective.

Pasteurization is common practice in the blue crab industry where it is used for extending the shelf life of blue crab meat for several months at refrigerated temperatures. Pasteurization may be used for other species; however, scientific data on incidence and types of pathogenic organisms indigenous to the species should be enumerated and testing should be carried out on finished products to ensure the safety of the product.

Pasterurization means further treatment of cooked crab meat by heat at times and temperatures which will reduce appreciably the total number of micro-organisms present and destroy a high proportion of objectionable micro-organisms. As it involves application of heat, further reduction in weight and undesirable changes in texture, appearance and taste might easily occur unless the technique is well researched to suit the local conditions and strictly controlled.

6.4.4.2.1 Pasteurization should be carried out in hermetically sealed containers.

The guidelines contained in the Code of Practice for Canning of Fish regarding sealing of cans apply to pasteurizing crab meat. Plastic bags or snap-lid containers are not recommended.

6.4.4.2.2 Crab meat should be pasteurized immediately after picking and packing.

To prevent any possible deterioration of the product the crab meat should be pasteurized immediately. It is preferable that the meat be at a temperature of approximately 18 ^{o}C (64.4 ^{o}F) when the cans are hermetically sealed to provide a slight vacuum after chilling.

6.4.4.2.3 The crab meat should be exposed to a minimum internal temperature of 85 ^{o}C (185 ^{o}F) for one minute during the pasteurizing process.

The object of the heat pasteurization of crab meat is to reduce the microbiological load to a point where little or no microbiological multiplication occurs during the later refrigerated storage period. Crab meat should be exposed to a minimum processing temperature of 85 ^{o}C (185 ^{o}F) for at least 1 min. at the geometric centre of the container.

The water bath should be preheated to a temperature of 90 ^{o}C (194 ^{o}F) before the loaded basket is lowered into it. Special concern should be given to proper water circulation within the bath and around each individual can being pasteurized. Hot water bath temperature must remain constant until processing is completed.

Proper pasteurization procedures for blue crab usually require a cooking time of 110 to 115 min. when 401 flat cans are used.

Once proper times and temperatures are established, they must be adhered to closely and pasteurization processes should be standardized by accurate thermocouple measuring equipment. It is recommended that new equipment be standardized after installation and re-standardized on an annual basis or when difficulties are experienced.

6.4.4.2.4 The pasteurized cans of meat should be immediately chilled after processing.

Cooling is best accomplished in an ice water bath. The size of the cooling bath should exceed the size of the pasteurizing water bath to allow for an excess of ice, which is needed if the water is to be kept below 8 ^{o}C (46.4 ^{o}F) and a maximum cooling rate is to be realized. No water agitation is required since adequate convection currents are created by differences between bath and product temperatures.

The product should be removed from the ice bath when the temperature has been reduced to approximately 3.3 ^{o}C (38 ^{o}F) with subsequent transfer to refrigerated storage held constantly at 0-2 ^{o}C (32-35.6 ^{o}F).

Crates used to hold cans in refrigerated storage must allow free passage of air currents in order to complete the cooling cycle.

6.4.4.2.5 The pasteurized product is perishable and should be labelled accordingly.

Unless such a product is kept refrigerated at a minimum temperature of below
3.3 ^{o}C (38 ^{o}F) there is a possibility that the spores of *Clostridium botulinum* may grow and produce toxins.

6.4.4.3 Freezing should be carried out in accordance with recommendations contained in the " Code of Hygienic Practice for Frozen Fish".

The considerations outlined in the Code of Practice for Frozen Fish generally apply to the freezing of crabs. This code contains some specific recommendations.

6.4.4.3.1 Freezing should be commenced within one hour after packing.

Spoilage of crab meat in containers can take place quickly at usual plant temperature. This can result in deterioration of the finished product and shorten the storage life.

Therefore, crab meat should be frozen as soon as possible after packaging, but at the most within one hour, in order to inactivate spoilage micro-organisms.

6.4.4.3.2 Methods of rapid freezing should be used to protect the quality of crab products.

Rapid freezing is essential for maintaining the quality of crab meat or crab products. Immersion freezing in brine can be recommended for whole crabs and crab sections provided that extreme care is taken to avoid excess salt penetration. However, blast freezing is the method of choice for whole crabs, sections, legs and claws. Plate freezing is recommended for crab meat products. Blast freezing may be used for sections, legs and claws. Shelf freezing in still air is not recommended. Glazing for protection against dehydration is commonly used for blocks of crab meat, crab sections and claws.

6.4.4.3.3 The storage temperatures of frozen crab meat and crab products should be maintained as low as possible.

Crab meat and crab products are generally vulnerable to rapid loss of quality in frozen storage. During storage crab products should be held below -30 ^{o}C (-22 ^{o}F). Storage of crab meat beyond six months is not recommended for many species.

6.4.4.3.4 Freezing and storage of uncooked whole crabs or crab parts is not recommended.

During freezing and storage enzymatic activity results in losses of flavour and texture and the meat becomes difficult to remove from the shell.

6.4.4.4 Fresh crab meat and crab parts.

6.4.4.4.1 Packaged crab meat and crab parts such as legs and claws to be sold in the fresh cooked form should be handled and stored in a manner to inhibit deterioration of the product.

Crab meat and crab parts intended for sale in the fresh state should be immediately chilled and maintained at melting ice temperatures.

Scientific data on the storage potential at chill temperatures of many species of crab are not available but, based on the available data, at chill temperature a total storage period of not more than five days up to the point of consumption should be allowed in developing marketing programmes.

6.5 Hygiene Control Programme

6.5.1 It is desirable that each crab processing plant in its own interest designate 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 cleanin 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 crab processing plant in its own interest should have access to laboratory control to establish hygienic quality of the products processed.

The extent and type of such control will vary with the crab product as well as the needs of management. Such control should reject all crabs 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) Crabs or crab products should, to the extent possible in good manufacturing practice, be free from objectionable matter ;

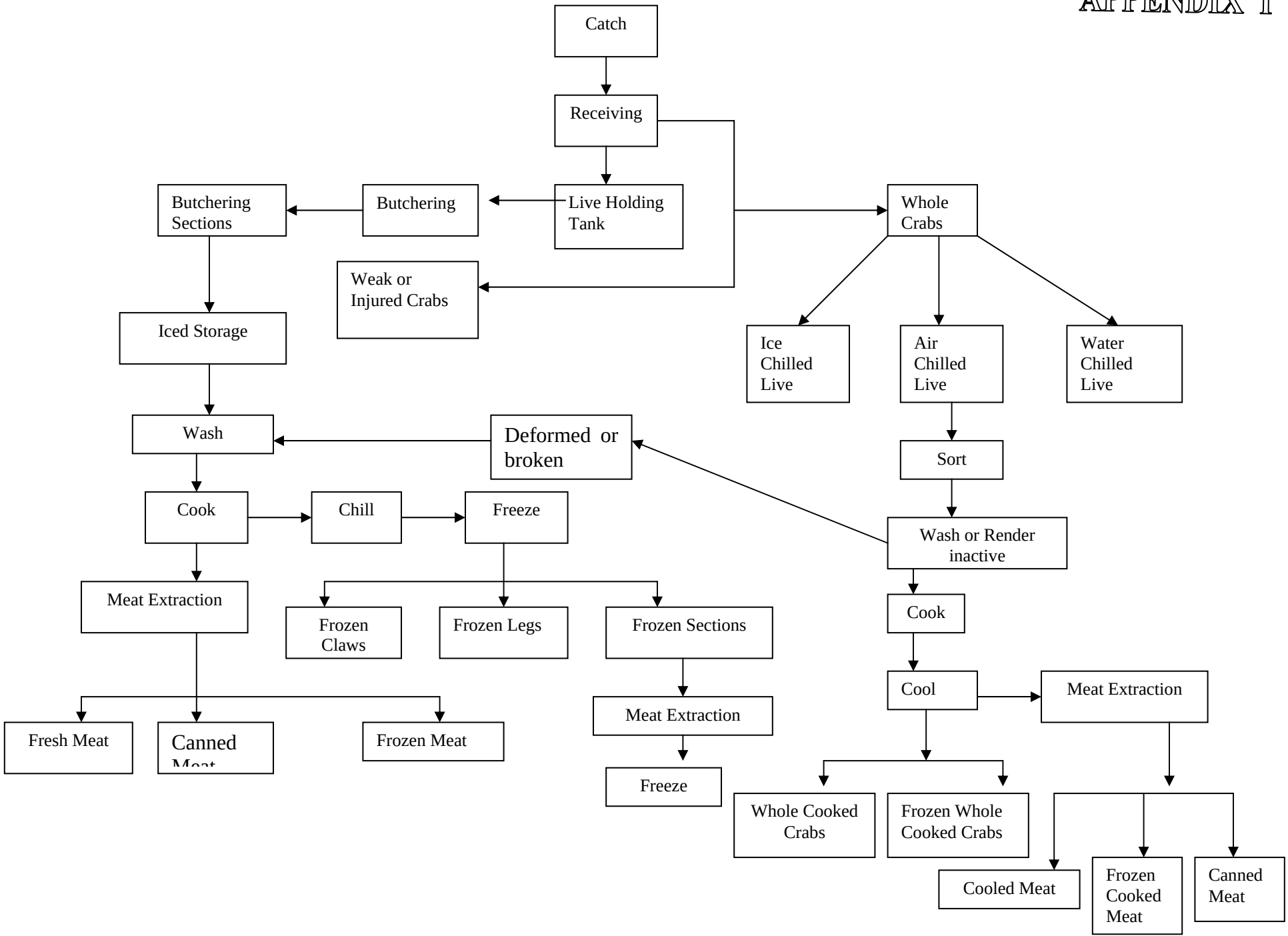
b) Crabs or crab products should be free from micro- organisms harmful to man, and should not contain any toxic substances originating from micro-organisms in amounts which may represent a hazard to health ;

c) Crabs or crab products should be free from chemical contaminatnts in amounts which may represent a hazard to health ; and

d) Crabs or crab products should comply with requirements specified in Specification Limits for Pesticide residues in food and food additives specified in food regulations under the Food Act or should comply with the requirements on pesticide residues and food additives of the country in which the fish will be sold.

FLOW CHART FOR HANDLING CRABS

APPENDIX I



SRI LANKA STANDARDS INSTITUTION

The Sri Lanka Standards Institution (SLSI) is the National Standards Organization of Sri Lanka established under the Sri Lanka Standards Institution Act No. 6 of 1984 which repealed and replaced the Bureau of Ceylon Standards Act No. 38 of 1964. The Institution functions under the Ministry of Science & Technology.

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.

The development and formulation of National Standards is carried out by Technical Experts and representatives of other interest groups, assisted by the permanent officers of the Institution. These Technical Committees are appointed under the purview of the Sectoral Committees which in turn are appointed by the Council. The Sectoral Committees give the final Technical approval for the Draft National Standards prior to the approval by the Council of the SLSI.

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.

In the International field the Institution represents Sri Lanka in the International Organization for Standardization (ISO), and participates in such fields of standardization as are of special interest to Sri Lanka.

Printed at the Sri Lanka Standards Institution, 17, Victoria Place, Elvitigala Mawatha, Colombo 08.

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.*

Printed at SLSI (Printing Unit)