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Code on Quality and Safety Control of Fishery Products for Export

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Contents

Foreword	4
1. Scope	5
2. Normative Reference	5
3. Terms and Definitions	6
4. General Principles	6
5. Raw Materials and Ingredients.....	6
5.1 Farmed fish and fishery products	6
5.2 Fishing for raw materials	10
5.3 Imported raw materials of fishery products	11
5.4 Auxiliary materials and ingredients	12
5.5 Other special requirements.....	12
6 Processing Enterprises	12
6.1 Enterprise site environment	13
6.2 Workshops.....	13
6.3 Workshop Facilities and Equipments	14
6.4 Equipments and utensils.....	15
7 Personnel.....	15
7.1 Personal hygiene and health.....	15
7.2 Training	16
8 Production and processing	16
8.1 Contamination prevention.....	16
8.2 Cleaning and disinfection.....	17
8.3 The maintenance of premises, facilities, equipments and utensils	17
8.4 Insect and rodent control.....	17
8.5 Control of water, ice and steam.....	17
8.6 Poisonous and hazardous substances control	18
8.7 Temperature and time control	18
8.8 Handling of fishery products.....	19
8.9 Metallic foreign material control	19
8.10 Waste management.....	20
9. Packing, storage and transportation	20
9.1 Packing.....	20
9.2 Storage	20
9.3 Transportation	21
10 Inspection and quality control.....	21
11 Product traceability and recalls	21
12 Code of hygienic practice for processing of major exports of fishery products.....	22
Appendix A	23
(Normative appendix)	23
Traceability Regulation of Fishery Products for Export	23
Appendix B	27
(Normative).....	27

General Requirements for Fish Farms Rearing Fish to Be Processed as Fishery Products for Export.....	27
Appendix C	29
(Normative appendix)	29
Requirements for Exports of Freshwater Aquatic Products in Terms of Fishing Areas and Purchasing Places of Raw Materials	29
Appendix D	30
(Normative appendix)	30
Hygiene Requirements for Fishing Vessels.....	30
Appendix E	32
(Normative appendix)	32
Code of Hygienic Practice for Processing of Major Exports of Fishery Products	32

Foreword

Appendices A, B, C, D, and E to this standard are all normative.

This standard was proposed by the General Administration of Quality Supervision, Inspection and Quarantine (AQSIQ), and it is under the jurisdiction of AQSIQ.

This standard was drafted by the Import and Export Food Safety Bureau of AQSIQ and Zhejiang Entry-Exit Inspection and Quarantine Bureau.

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Code on Quality and Safety Control of Fishery Products for Export

1. Scope

This standard specifies the general principles of quality and safety control of fishery products for export and requirements on raw materials and ingredients, processing enterprises and plants, employees and production management, processing controls, packaging, storage and transportation, product traceability and recall, and the code of hygienic practice for processing of major exports of fishery products.

This standard is applicable to quality and safety control of fishery products for export, exclusive of eel and any derivative products.

2. Normative Reference

The following normative documents contain provisions which, through references in this text, constitute provisions of this national standard. For dated references, subsequent amendments to (excluding those corrections), or revisions of, any of these publications do not apply. However, parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. For undated references, the latest edition of the normative document referred to applies.

GB2760 Standards for Use of Food Additives

GB5749 Standards for Drinking-water Quality

GB7718 General Rules for the Labeling of Prepackaged Foods

GB11607 Water Quality Standard for Fisheries

GB13078 (Full) Feed Hygiene Standards

GB/T 19838 Hazard Analysis and Critical Control Points (HACCP) System and Guidelines for Its Application to Fish & Fishery Product

NY5071 Fishery Drug Use Guideline for Pollution-Free Food

NY5072 Fishery feed Safety Limits for Pollution-Free Food

SN/T 1347 Hygiene Regulations on Registered Enterprises Processing Fishery Products

CAC/RCP23-1979(Rev.2-1993) Code of Hygienic Practice for Low-Acid and Acidified Low-Acid Canned Foods

CAC/RCP38 Recommended International Code of Practice for Control of the Use of Veterinary Drugs

Methods of Quarantine Supervision on Feed for Exported Edible Animal Products

(Act No.5, 1999)

The OIE International Aquatic Animal Health Code (3rd Edition)

3. Terms and Definitions

For the purposes of this standard, the following terms and definitions apply.

3.1 Fishery products

It means any freshwater or seawater aquatic animal (exclusive of live aquatic animals and reproductive materials, aquatic mammals and amphibian life) and food prepared from the above categories, which is intended for human consumption.

4. General Principles

4.1 Raw materials and ingredients for processing fishery products to be exported should meet hygiene and health requirements;

4.2 The HACCP system and quality management system should be established and implemented in accordance with GB/T 19838 and SN/T 1347 by enterprises processing fishery products for export.

4.3 For fishery products to be exported, product traceability and recall programs should be proposed and implemented in accordance with Appendix A. The food safety should be ensured along the whole food supply chain starting from fishing, processing, and distribution.

4.4 Fishery products for export should meet the standards of the importing country, international or (and) domestic standards for related products.

5. Raw Materials and Ingredients

5.1 Farmed fish and fishery products

5.1.1 Basic requirements

Farmed fish and fishery products for export should be cultivated in the sites which meet the standards, as stipulated in Appendix B. The farmed fish and fishery products should be slaughtered or treated under hygienic conditions, thus preventing contamination by soil, mucus or feces. If processing steps cannot be carried out immediately after slaughtering, the above fishery products should be kept chilled. The catching and transportation of farmed fish and fishery products should meet relevant requirements.

5.1.2. Farming site environment

The farming site environment should comply with the following requirements:

- The layout, design and construction of plant sites should be beneficial to fish farming.
- As different species require different farming conditions, the temperature, currents, salinity, depth and other natural conditions in the environment should be taken into consideration. Closed-loop system should be adapted to the natural environment required by farmed species.
- Farming sites should be located in an area with the fewest risks for chemical, physical and biological pollutions and controllable pollution sources. The concentration of chemicals and other substances in the soil used to build fishing ponds shall not cause excessive concentration of pollutants in the water.
- If necessary, farming sites should be equipped with adequate sewage treatment facilities, allowing sufficient time for used water to undergo sedimentation and organic sedimentation prior to discharges into public waters.
- Water intake and drainage systems should be separate, and have filtration facilities in order to prevent entry of any unwanted mixed breeds.
- Use of fertilizer, lime or other chemicals and biological substances shall comply with good farming practices.
- All operations on the fish farming sites shall follow the principle that the consumption of farming products will cause no harm to human health.

5.1.3 Water quality

The water quality in the farming site environment should comply with the following requirements:

- Water quality should meet the requirements of GB 11607;
- Water quality should be regularly monitored to ensure that the quality of fishery products is safe for human consumption;
- Farming sites should not be located in waters at risks of contamination;
- The design and construction of the farming sites should be reasonably carried out, in order to ensure the control and prevention of water pollution risks.

5.1.4 Seed sources for fish farming

Fish seeds to be raised in the farming sites should meet the requirements of the OIE International Aquatic Animal Health Code to avoid potential risks. The fish seed farms should comply with the relevant requirements of national authorities.

5.1.5 Fish farming

5.1.5.1 Feed

Fish feed used in the process of farming should meet the requirements of GB 13078, NY 5072 and Methods of Quarantine Supervision on Feed for Edible Animal Products for Export.

Potential hazards: chemical pollution, toxic and microbial contamination.

Potential defects: deterioration of feeds and fungal growth.

Technical guidance:

- Feeds and fresh raw materials should be purchased, stored and used prior to the expiration date;
- Dried fish feeds should be stored in a cool, dry place to prevent damage, mildew and pollution, while wet feeds should be refrigerated as recommended by the manufacturer;
- Feed ingredients should not contain dangerous pesticides, chemical pollutants, microbial toxins or other adulterated materials;
- For industrially produced compound feed, feed ingredients should be identified and the component content should be in line with label instructions. The hygiene conditions should meet relevant standards;
- Fresh or frozen fish to be used as feeds should be fresh and good;
- Raw meat and relevant products should be properly steamed or handled to eliminate potential risks to human health;
- Storage and transport conditions should be consistent with label instructions;
- Feeds with drug additives added should be clearly labeled on the packaging, stored separately in order to avoid distribution mistakes;
- Whoever uses the feeds with drug additives added should follow the manufacturer's suggestions;
- Traceability of all feed ingredients should be properly recorded for the sake of practical operation.

5.1.5.2 Veterinary drugs

Potential hazards: veterinary drug residues

Potential defects: unlikely

Technical guidance:

- All veterinary drugs in the fishing farms should comply with relevant national standards (e.g. NY 5071) and international regulations (e.g. CAC / RCP 38);
- A monitoring system should be established to identify which batches of farmed fish have received drug treatment, in order to implement the drug withdrawal period;
- Veterinary drugs or feeds with drug additives added should be used following the suggestions given by the manufacturer. Be aware of the drug withdrawal period;
- Veterinary drugs should be registered with competent national authorities;
- Veterinary drugs should be prescribed or sold in accordance with national regulations;
- Storage and transport conditions should follow the special requirements written on the label;
- Use of veterinary drugs to control diseases should be reasonably based on the diagnosis;
- Any veterinary drug use in the process of breeding should be properly recorded;
- For fishery products whose drug residue test results exceed the maximum residue limit (MRL), fishing should be postponed until these products meet the regulations of MRL. Drug residue control system should be modified in accordance with good farming practices;
- Fishery products which fail to meet drug residue requirements regulated by relevant

authorities cannot be used for human consumption.

5.1.5.3 Farming

Potential hazards: pathogenic bacteria and chemical contamination.

Potential defects: abnormal color, odor and mechanical damage.

Technical guidance:

- The post-larvae and seed sources should be controlled to ensure healthy farming;
- Stocking density should be determined by various factors such as types and breeding habits of the fish, seed size, farming techniques, the capacity of the farming site, expected survival conditions and fishing sizes.;
- If necessary, sick individuals should be isolated and destroyed immediately in a sanitary manner to prevent the spread of disease, and conduct disease investigation;
- Good water quality should be maintained and the amount of fishing feed shall not exceed the capacity of the farming system;
- Management plans should be developed for the farming sites, including health programs, monitoring and corrective actions, explicit start date and end date of the rearing period of fish farming, rational use of agricultural chemicals, farming operations and verification procedures for the recording system;
- The design and production of equipment such as cages, nets and others should follow the principle of minimizing mechanical damage to the fish during the breeding process;
- All facilities and equipment shall be easy to clean and disinfect, which should be regularly and properly carried out.

5.1.5.4 Fishing

Potential hazards: unlikely

Potential Defects: mechanical damage

Technical guidance:

- Reasonable fishing techniques shall be implemented to minimize mechanical damage to the fish;
- Fishery products shall not be exposed to extreme heat or cold, or sudden changes in temperature and salinity;
- Once captured, the product shall be immediately rinsed under appropriate pressure with clean seawater or fresh water to remove excess dirt and weeds;
- If necessary, fishery products should be purified to reduce viscera mass and potential pollution for subsequent processing;
- Fishing should be quick, thus preventing fishery products from being exposed to high temperatures;
- - All facilities and equipment shall be easy to clean and disinfect, which should be regularly and properly carried out.

5.1.5.5 Storage and Transportation

Potential hazards: pathogens, biotoxins and chemical contamination (such as oil, detergents and disinfectants).

Potential defects: death, physical and biological changes caused by mechanical damage, odor and the stress response

Technical guidance:

- If fresh products need storage and transportation, healthy and complete individuals should be chosen. During storage and transport, containers should be checked regularly to avoid unnecessary irritation and mechanical damage. Products found with injury, illness or dead should be immediately removed.
- Design and operation of the vessel and the transportation system should meet the hygienic requirements to prevent contamination of water and equipment; containers used for storage and transport should be made of non-toxic, harmless and anti-corrosion materials, and the surface should be smooth and easy to clean and disinfect; for temperature-sensitive species, containers used for storage and transport should be installed with a temperature control system.
- During the storage and transport process of fresh products, oxygen in the containers should be maintained through continuous flows of water or change of the water if needed; if sea water is used, it should be properly filtered to avoid the concentration of algae likely to produce toxins in seawater.
- Fishery products should not be put together with products easily to cause contamination for transport. Aquatic species, which easily become aggressive and active in circumstances of stimulation, should be packed in a separate container, or suitably protected to prevent any damage.
- To reduce the stimulation to aquatic products, the temperature should be set properly according to the type, transport and packaging conditions, reducing its metabolism on the premises of preventing harm to their physical body. Before transport, fresh products should be fasting for 24 hours, and should not be fed during the storage and transport process.
- Transport records should be maintained to ensure that all the products can be traced.

5.2 Fishing for raw materials

5.2.1 Raw materials- freshwater fishing

5.2.1.1 Requirements for fishing areas and purchasing places of raw materials to be processed as exports of freshwater aquatic products

Fishing areas and purchasing places of raw materials to be processed as exports of freshwater aquatic products should meet the requirements as stipulated in Appendix C.

5.2.1.2 Requirements for purchasing raw materials obtained by freshwater fishing

Raw materials to be processed as exports of freshwater aquatic products should come from the fish producing areas or purchasing places which meet the requirements as stipulated in Appendix C. Processing enterprises should establish a checking system of raw materials and a management system of raw material producing areas and the purchasing place, to identify safe fishing areas and qualified suppliers with stable supply of raw materials, and ensure the safety and hygiene of fishing personnel, vessels and transportation vessels. Before the purchase of raw materials, quality and safety of raw freshwater fishery products should be carefully monitored to ensure that

their microorganisms, chemical contaminants and natural toxins and other safety indicators meet the standards of the importing country. If excessive drug residues and other abnormal substance are found during the tests, purchase from the area should be immediately stopped. For requirements of storage and transportation of raw materials, refer to Section 5.1.5.5.

5.2.2 Raw materials-marine fishing

5.2.2.1 Basic requirements

Raw materials through marine fishing to be processed and exported should come from unpolluted waters. They should be immediately chilled with ice or placed in cold storage after catching. Clarifications should be made if additives are used for preservation. Enterprises should purchase raw materials from vessels which comply with the requirements in Appendix D, and determine the batch number of raw materials with proper identification in accordance with the requirements in Appendix A.

5.2.2.2 Requirements for fishing vessels

Catching vessels, processing vessels or transportation vessels shall comply with the hygiene requirements and obtain approval from the national competent authorities; live aquatic products should be transported under conditions suitable for survival; iced-fresh fishery products should be chilled immediately after catching, and the temperature should be maintained between 0 and 4 degree °C; the ice or water used for keeping fish fresh should be clean and hygienic; fishing and pre-handling, chilling, freezing and other operations on the vessels should comply with national hygiene requirements.

5.2.2.3 Requirements for purchasing raw materials obtained via marine fishing

Before the purchase of raw materials, additives, heavy metals, pathogenic bacteria and other toxic substances contained in the raw materials should be carefully monitored. The raw materials can only be purchased after they pass the tests. If excessive harmful substances are found during the tests, purchase from the area should be immediately stopped. For requirements of personnel hygiene, storage and transportation of raw materials, refer to Appendix D.

5.3 Imported raw materials of fishery products

5.3.1 Countries or regions providing the imported raw material should comply with national laws, regulations and requirements of the national inspection and quarantine agencies. Upon the entry of the imported raw materials, they should have a health certificate, a certificate of origin and other relevant documents issued by the competent national authorities of the exporting country. Imported raw materials can only be used for processing fishery products after they are verified as qualified by the inspection and quarantine authorities.

5.3.2 Imported raw materials for processing fishery products should be stored in repository designated by the inspection and quarantine authorities. Processing enterprises should implement the safety and health monitoring project on imported

raw materials. Only qualified raw materials can be used for processing while for those which fail to meet the standards, the whole batch of products should be sealed and stored. The destroy, return or safe disposal of the raw materials shall be carried out according to the relevant regulations.

5.3.3 Processing enterprises should establish files and folders for receiving raw materials of fishery products and verification management. Information such as name, batch number, fishing waters, country of origin, date of harvest, the raw material depot, storage temperature, and the hygiene status of the raw materials should be recorded. When the finished products are ready for export, they should be verified before distribution and selling.

5.4 Auxiliary materials and ingredients

5.4.1 Domestic auxiliary materials and ingredients

Domestic auxiliary materials and ingredients should come from manufacturers approved by the national authorities. Each batch of auxiliary materials and ingredients should have the factory inspection certificate. Upon reception of the materials, enterprises should carefully check the external packaging to verify the packaging is complete; labeling is clear with the specification of the components and shelf life meeting the requirements.

5.4.2 Imported auxiliary materials and ingredients

Imported auxiliary materials and ingredients should have the inspection certificate issued by the national authorities of importing countries. Also, they can only be used after passing the inspection of China's inspection and quarantine agencies. Upon reception of the materials, enterprises should carefully check and verify relevant certificates and if necessary, conduct sample testing on quality and safety indicators.

5.5 Other special requirements

5.5.1 Shellfish obtained farming or fishing shall come from farming or fishing waters approved by the authorities. The purchasing enterprises should regularly conduct sample testing on the poisoning toxins of the shellfish to ensure the safety of raw materials.

5.5.2 For puffer fishes and other fishery products which may accumulate Tetrodotoxin themselves, their handling and reception should be carried out by personnel trained and qualified in species verification.

5.5.3 Raw materials for processing semi-finished fishery products should come from enterprises which meet the requirements of SN/ T 1347 requirements and have registered with inspection and quarantine agencies.

6 Processing Enterprises

6.1 Enterprise site environment

6.1.1 Enterprises site environment should be far away from the contamination sources and areas which may pose hygienic risks; The surrounding areas should be kept clean and hygienic. The plant site should have convenient transportation and sufficient water supply. Other products harmful to food hygiene should not be distributed, processed or stored in the plant site;

6.1.2 The main roads of site should be paved suitable for vehicles, such as concretes or bitumen, etc. The surface of road should be even and easy to clean without standing water;

6.1.3 The layout and design of the food establishment site should be reasonably carried out. The establishments should have hygiene compliant storage facilities built compatibly with the production capacity for storing raw materials, ingredients, chemicals and packaging and other waste water treatment, waste collection and garbage temporary storage facilities; The drainage system should be able to work freely;

6.1.4 There shall be no blind spots of poor hygiene within the factory sites. Waste and garbage shall be stored and transported using lid containers made of watertight and corrosion-resistant materials. Waste and garbage should be promptly cleaned and disposed out of the factory.

6.1.5 The waste water, waste materials, smoking and dust generated during the processing should be treated and discharged according to relevant national regulations;

6.1.6 The toilets of the plant site should be equipped with flushing, hand washing, ventilation, pest and rodent proof facilities, easy to clean and be kept dry and clean;

6.1.7 The establishments should not feed and raise any animals irrelative to the production; the site should establish effective mouse-proof facilities, free from the breeding areas of mosquitoes and flies.

6.1.8 The processing area should be separated from living area which should not bring any negative impacts on processing area.

6.2 Workshops

6.2.1 The workshops should be suitably designed to avoid cross contamination, which complies with the corresponding processing flow of fishery products and their hygienic processing requirements; The coverage area and height of workshops should be commensurate with the processing capacity and the setting of the equipment;

6.2.2 The floor of the workshops should be anti-corrosive, anti-slippery, wearing resistant and have adequate slope. The floor should facilitate the water to discharge and avoid the standing water, and should be easy to clean and disinfect with cleanness easily maintained, and coved at the junctions with walls;

6.2.3 The walls, roofs or ceilings inside the workshops should be made from non-poisonous, light colored, waterproof, mould resistant, not loose and easy to clean

materials; the roofs or ceilings and the fixtures above the workshops should prevent the formation of dust and condensation and loose miscellaneous matters falling off;

6.2.4 The doors and windows of the workshops should be made from strong materials which are light colored, smooth, easy to clean and disinfect, waterproof and anti-corrosive; the fabrication should be rigorous;

6.3 Workshop Facilities and Equipment

6.3.1 The ventilation equipment should be installed in workshops, the design and installation of which should facilitate the maintenance and be kept clean. It is essential to have good ventilation to remove excess steam, smoke or odor and avoid cross-contamination caused by the smoke. Air inlets should be away from contamination sources and air outlets; The workshop exit, discharge outlets connected externally and ventilation areas should be installed with the facilities which are dustproof, pest proof and rodent preventative;

6.3.2 The designated areas should be set up which fits for cleaning and disinfection of utensils and equipment, which should not jeopardize the operations of processing and products;

6.3.3 Ice production and storage facilities should meet the hygienic requirements.

6.3.4 The drainage system should have settings which stop the solid wastes from entry. The pitch bottom of drainage should be arc shaped and facilitates the cleaning; and the drainage pipe should be equipped with seal water unit to resist the spoilage of foreign odor and rodent-proof grids; Production water directly discharging onto the floors should be avoided; Any pipes and drainage should be ensured with the free flow and non-standing water; and the waste water from the production should not be discharged from low clean area to high clean area;

6.3.5 Separate areas should be sufficiently provided for storing disinfectant, detergent, packaging and trash to avoid cross contamination;

6.3.6 Adequate lighting, either natural or lights, should be provided to all work surfaces and shall not change the color of fishery products to be processed. Lighting facilities shall be equipped with protective cover.

6.3.7 All plumbing and waste lines should be capable of coping with peak demand.

6.3.8 Facilities should include adequate means of hygienically washing and disinfecting hands, which should be separate from processing areas.

6.3.9 In the workshop entrance, toilets and other proper locations of the workshops, adequate means of hygienically washing and drying hands and footwear with suitable water temperature shall be provided. Concentration of disinfectant and time of disinfection should be able to achieve effective results. Faucets for washing hands should be able to operate in non-manual modes. The drainage of handwashing facilities should be directly connected into the underground water pipes.

6.3.10 Areas with different requirements for cleanliness and hygiene should be provided with separate and designated changing rooms, with an area size suitable to the number of workers in the workshops. Its facilities and layout shall not cause potential contamination to products.

6.3.11 There should be toilets connected with the processing workshops and installed with self-closing doors. Doors and windows should not directly face the workshops. Toilets should have sufficient ventilation to remove excess steam, smoke and objectionable odours, as well as anti-fly/insect devices.

6.4 Equipment and utensils

6.4.1 Equipment and utensils should be made from materials which are strong, non-poisonous, non-absorbent, corrosion resistant, non-rusty and easy to clean and disinfect, and having no chemical reactions with fishery products, detergents and disinfectants; bamboo and wooden utensils are not allowed to be used;

6.4.2 Equipment and utensils should not have obvious cove, bulging, gap and splitting. The equipment inside the workshop should be durable, easy to dismantle and clean, and their installation should comply with the requirements in terms of specification and hygiene with certain distance kept from floors, roofs and walls, which should be easy to maintain, clean and disinfect and hygiene control;

6.4.3 The designated containers should be distinguished with obvious marking and make sure the waste containers should not be mixed with edible products containers. The waste containers should be waterproof, corrosion resistant and leakage-proof; If waste is transferred by pipes, then the installation and maintenance of the pipes should prevent the products from being contaminated;

6.4.4 For facilities and equipment which may come in direct contact with fish and fishery products, their design and manufacture should ensure that they can be drained adequately.

7 Personnel

7.1 Personal hygiene and health

7.1.1 Only those who pass both the health check and training on food hygiene and safety can be allowed to engage in production and processing of fishery products. All persons should attend health checks once a year and do a temporary health checks when necessary. No person who is known to be suffering from, or who is a carrier of, any communicable disease affecting food hygiene, should be engaged in preparation and handling.

7.1.2 All persons engaged in processing and management of aquatic products production should maintain a high degree of personal cleanliness and should not bring stuff irrelevant with production into the processing facility. During working, wearing make-up, jewelry or watches should not be permitted. Whoever enters the facility should have hands washed and disinfected and wear appropriate protective clothing, headcoverings and footwear, and sometimes masks when necessary. Likewise, change the clothing, headcoverings and footwear when leaving the processing sites. Special

laundry room should be established in the factory sites. A centralized management system should be established for the working uniforms, which will be washed, disinfected, and distributed in a unified manner. If gloves are used in the production operations, they should be kept in good condition, cleaned and disinfected. Before wearing gloves, people should have their hands thoroughly cleaned and disinfected.

7.1.3 People working in washing-cleaning area and other areas, areas of handling raw materials and cooked products, should wear different uniforms and headcovering of different colors or logos, for the sake of differentiation. People from different processing areas should not freely enter others' working places.

7.1.4 Chewing or eating, smoking, spitting, sneezing or coughing over unprotected food should not be permitted in changing rooms, toilets and processing areas.

7.1.5 Other persons who enter the processing facilities including visitors shall comply with the requirements of the present document.

7.2 Training

All personnel should be aware of their role and responsibility in protecting fishery products from contamination and deterioration. All handlers should have the necessary knowledge and skill to enable them to handle fishery products hygienically. Each processing enterprise should ensure that relevant individuals have received adequate and periodic training in the design and proper application of an HACCP system and process control so that they understand the principles involved in HACCP. Those who handle strong cleaning chemicals or other potentially hazardous chemicals should be instructed in safe handling techniques.

8 Production and processing

8.1 Contamination prevention

8.1.1 Production and processing should be conducted in accordance with the sequence of the production process and product characteristics. Areas for raw materials pre-handling, processing and product packaging have different sanitary requirements, which should be separate from each other in terms of layout. Products of each processing area should be stored separately to prevent cross contamination.

8.1.2 During the production process, measures should be taken to prevent raw materials and products from contamination by sewage and wastes. Running water should be used for cleaning products, tools and instruments. Product containers should not be in directly contact with the floor.

8.1.3 The maintenance of equipment shall not pose contamination to raw materials, auxiliary ingredients, semi-finished and finished products. The areas should be cleaned and disinfected after the maintenance.

8.1.4 All the operations should ensure that they can effectively prevent products from spoilage or contamination by harmful microorganisms, toxic and hazardous goods.

8.1.5 Faulty products generated during processing should be isolated and stored separately with clear logos, and properly treated under the supervision of quality management personnel.

8.1.6 Waste generated during processing shall be promptly shipped out from the processing workshops and stored in special containers or temporary facilities, and timely shipped out of the factory area for treatment. Once the treatment is finished, the transportation vehicles and appliances should be cleaned and disinfected.

8.2 Cleaning and disinfection

8.2.1 Enterprises should make the cleaning and disinfection plan according to the characteristics of process, and designate specified personnel to fulfil effectively, the cleaning agent and disinfectants used should comply with the relevant requirements.

8.2.2 Cleaning and disinfection must be done thoroughly on the equipment, utensils, containers, and areas etc, before and after the work every day and checked before the work.

8.2.3 Cleaning and disinfection procedures should be done on the food-contact surfaces in sufficient frequency during processing.

8.3 The maintenance of premises, facilities, equipment and utensils

8.3.1 Preventative maintenance plan should be established and effectively implemented for premises, facilities, equipment and utensils in order to maintain good working conditions;

8.3.2 Maintenance and calibration should be conducted regularly for instruments and equipment.

8.4 Insect and rodent control

8.4.1 Enterprises should make plans for controlling insects and rodents, put the trap tool at place necessary and number them one by one.

8.4.2 Avoid rodents entering the workshop by the effective physical method. Trapping and killing insect facilities should not be set above the processing area in workshop.

8.4.3 Check and clean all the insect and rodent trap facilities according to the plan.

8.5 Control of water, ice and steam

8.5.1 Water supply facilities should be able to ensure that the water flow and pressure

in all parts of the enterprise meet the requirements. Water pipelines should be made from non-toxic, harmless and corrosion-resistant materials, with devices to prevent backflow installed. Water pipelines should not be connected to those not for processing. Pipelines for water used for processing and other uses should be labeled for differentiation.

8.5.2 Water used for processing can be treated by adding water purification facilities based on the local water quality characteristics and product requirements; storage facilities should be made from non-toxic and harmless materials, which shall be built in uncontaminated areas with regular cleaning and disinfection.

8.5.3 Water supply capacity should be adapted to the production capacity to ensure adequate supply of water for processing. Water (ice) used for processing shall comply with the requirements of GB 5749 or other relevant national standards. If using self-produced water for processing, it should be effectively treated and monitored in terms of hygiene. Enterprises should be equipped with water supply network diagram.

8.5.4 The residual of chlorine of processing water(ice) should be tested(when applicable) before processing, and microbes should be also regularly test for processing water (ice), to ensure the sanitation of the processing water(ice). Testing on processing water should be made at least twice a year by the hygienic authorities each year.

8.5.5 The make, smash, transportation and storage of the ice during processing should be under the sanitary condition.

8.5.6 The operation which uses steam should ensure the sufficient pressure and steam supply.

8.6 Poisonous and hazardous substances control

8.6.1 Enterprises should establish and execute the plan of storage and management for cleaning agents, disinfectants, pesticides and other chemical reagents, to ensure the use in the factory, workshop and laboratory effectively controlled.

8.6.2 Enterprises should establish a separate warehouse and designate specified personnel to be in charge of the lock and storage. All poisonous and hazardous substances should be packed with special container and labelled clearly.

8.6.3 When necessary, it should be operated by specially trained personnel according to regulations, and avoid polluting the foods, food-contact surface and packing material.

8.7 Temperature and time control

8.7.1 Temperature and time control should be strictly in accordance with the processing specification and hygienic requirements during pretreatment, cooking, frying, cooling, processing and storage process.

8.7.2 The process or place which has temperature requirements should be installed

temperature display device. Processing workshop temperature should not be higher than 21 °C (except for heating process). Instant cold storage facilities should be controlled below -28 °C. Frozen products packaging room should be controlled below 10 °C.

8.7.3 Adequate supply of ice and cooling water should be provided, and fresh aquatic products should be chilled and maintained between 0 °C and 4 °C quickly. Aquatic products should be stored in a thin layer with ice covered. The chilling time, temperature and effects should be regularly monitored and controlled.

8.7.4 It should control the internal temperature of products and exposure time during process (except for heating process). If the internal temperature of the product is above 21 °C during process, then cumulative exposure time should not exceed 2 hours; if the internal temperature of the products is between 10 °C -21 °C, then cumulative exposure time should not exceed 6 hours; if the internal temperature of the products is up and down at 21 °C during process, then the cumulative exposure time above 21 °C should not exceed 2 hours, cumulative exposure time above 10 °C should not exceed 4 hours.

8.7.5 Pasteurization equipment should pass the heat distribution test, to ensure the uniformity of heating sterilization; when necessary, sterilization time and temperature should be confirmed through heat penetration test; sterilization F value shall comply with the relevant provisions; pasteurized canned products, the double seam structure should be consistent with the canned edge sealing requirements.

8.7.6 For histamine-producing species group, the temperature and time from raw materials to finished product should be controlled according to the characteristics of the product; when necessary, the histamine level should be tested.

8.8 Handling of fishery products

8.8.1 Fish and shellfish should be handled and conveyed with care particularly during transfer and sorting in order to avoid physical damage such as puncture and mutilation.

8.8.2 Where fish and shellfish are held or transported live, care should be taken to maintain factors that can influence fish health (e.g. pH, oxygen, temperature and nitrogenous wastes).

8.8.3 Fish and shellfish should not be trampled or stood upon.

8.8.4 Where boxes are used for storage of fish and shellfish, they should not be overfilled or stacked too deep to avoid deformation.

8.8.5 While fish and shellfish are on deck, exposure to the adverse effects of the elements should be kept to a minimum in order to prevent unnecessary dehydration.

8.9 Metallic foreign material control

Metal detectors should be set for products which may cause metal fragments hazards during the process from fishing to processing.

8.10 Waste management

8.10.1 Wastes and other unnecessary materials should be removed and disposed regularly.

8.10.2 Storage facilities of waste and other unnecessary materials should be well maintained.

9. Packing, storage and transportation

9.1 Packing

9.1.1 Packaging container and packaging materials shall comply with relevant standards of hygiene, with no toxic and hazardous substances, and should not change the sensory characteristics of aquatic products

9.1.2 Packaging container and packaging materials shall have sufficient strength and not to be broken during transportation and carrying.

9.1.3 Packing material shall not be used repeatedly, except that the package is made by easy-to-clean, corrosion-resistant material and has been cleaned and disinfected before use.

9.1.4 The internal and external packing material shall be stored separately. Warehouse shall be kept sanitary and dry to prevent the entry of insects and rodents.

9.1.5 Packaging should be labeled with relevant information and comply with relevant requirements of the importing countries and regions.

9.2 Storage

9.2.1 Storage should be kept clean and tidy with no items to be potential health hazards. The goods which may cause cross contamination or mixed odour should not be stored in the same storage. Mold, insect and rodent-proof facilities should be set up and disinfected regularly.

9.2.2 The goods should keep a distance no less than 30cm against the storage wall and a distance no less than 10cm against the ground, and maintain a certain distance from the ceiling. Store the same goods in separate stacks with clear identification.

9.2.3 Pre-cold (cooling storage) and cold storage should be equipped with automatic temperature recording devices, and have a periodic calibration. The temperature in cooling storage shall be controlled between 0 °C and 4 °C; The temperature in cold storage shall be controlled below -18 °C; The temperature and moisture in storage for dried products etc. shall be based on the product characteristics.

9.3 Transportation

9.3.1 The transportation vehicle shall comply with relevant safety and health requirements. Clean and disinfect the transportation vehicle when necessary to keep it clean. It is not allowed to mix-load with the products that may cause cross contamination.

9.3.2 The transportation vehicle shall be equipped with refrigeration, thermal insulation and temperature records facilities etc. A suitable temperature should be maintained during transport. The transportation temperature for chilled products shall be maintained close to 0 °C, for the frozen products it shall be below -18 °C (except for the brined frozen fish used for making canned fish, which can be kept at a temperature below -9 °C during the transport) .

10 Inspection and quality control

10.1 The enterprise shall own an independent quality control department and qualified staff appropriate to its processing capacity.

10.2 The enterprise shall have protocols, standards, facilities and equipment needed for the work of sample testing. The enterprise shall have the capability to independently run basic tests such as water quality test and microbial test. Records of tests and inspections shall be kept.

10.3 If the enterprise needs to entrust tests for its products, the independent laboratory shall be qualified. And a contract should be signed between the laboratory and the enterprise.

10.4 All products shall pass all required inspections or tests to be eligible for export.

11 Product traceability and recalls

11.1 Business managers should establish effective procedures for full traceability and recall of all the fishery products from transportation to distribution. Each enterprise shall formulate traceability plans for fishery products in accordance with its own product features and Appendix A.

11.2 Relevant processing, production and sales records shall be kept longer than the shelf life of the product.

11.3 Production batch number should be clearly identified on the packaging of fishery products used for final consumption or further processing to ensure effective recalls.

11.4 When there are potential hazards to public health, for products produced under the same condition, recall them and start early warning and risk management.

11.5 Recalled products should be destroyed under the supervision of inspection and quarantine agencies, and cannot be used for human consumption. Alternatively, reprocess the products in a way with safety guaranteed.

12 Code of hygienic practice for processing of major exports of fishery products

Code of hygienic practice for processing of major exports of fishery products can be found in (but not limited to) Appendix E. When necessary, similar standards can be formulated for other species of fishery products.

Appendix A

(Normative appendix)

Traceability Regulation of Fishery Products for Export

A.1 Scope

This regulation is applicable to the traceability of fishery products (except for live aquatic animals) processed by registered enterprises for export.

A.2 Traceability requirements

A.2.1 Determination of product batch/lot number

A.2.1.1 Batches of raw materials: raw materials purchased at the same time, caught in the same fishing area (sea, waters or ponds, etc.) or batches of the same species imported at the same time can be regarded as one batch of raw materials, more specifically:

- a) Marine fishing: fishery products acquired from one ship can be regarded one batch;
- b) Breeding: products from the same registered fish breeding farm or pond (cage) can be regarded one batch;
- c) Freshwater fishing: products caught in the same waters can be regarded as one batch;
- d) Imported (Inward) raw materials: the same species of products issued with the same health certificate after import inspection can be regarded as one batch.

A.2.1.2 Production batch: in terms of production, the products produced on the same day in the same plant or the same production line using the same raw material is one batch.

A.2.1.3 Batches of products for inspection: fishery products of the same species using the same inspection form or certificate of inspection for goods can be regarded as one batch.

A.2.1.4 Principle of co-batch: products with different batch codes but of the same variety, once passing the inspection, can be co-batched.

A.2.1.5 For the same processing enterprise, product identification code of the same species should be unique.

A.2.2 Determination of product identification code

A.2.2.1 Determination of identification code for batches of raw materials

Each batch of raw materials should have an identification code, expressed as “numbers and letters”, like AAAB.

- a) AAA refers to raw material acquisition serial number; one year is one cycle to be numbered. Processing enterprises of the enterprise can choose to determine the digits of the serial number based on the amount of acquisition, which usually

contains at least 3 digits.

b) B indicates the nature of the raw material, which can be divided into the following categories:

- “H” represents marine fishing;
- “Y” represents breeding;
- “D” represents freshwater fishing;
- “J” represents imported raw materials to be processed.

For instance, the third batch of raw materials obtained through marine finishing can be expressed as 003H.

A.2.2.2 Determination of identification code for batch production

a) Put the production date (in the format of year-month-day) before the raw material batch identification code. For instance, code 030725003H refers to the third batch of raw materials obtained through marine finishing on July 25 of 2003.

b) In the processing operation, if there are different batches of raw materials which are co-batched, this can be expressed as the code number of larger quantities of raw materials followed by the production date. The batch number for the rest of the raw materials can be specified on the records of production and processing.

A.2.2.3 Determination of identification code for batches of products undergoing inspection

The identification code is based on the serial number of the batch of products the enterprise has declared for inspection by inspection and quarantine agencies within a one-year period, which is usually 3 digits. For example, code 101 indicates that the products are the 101th batch the enterprise has declared for inspection in a certain year.

A.2.3 Identification Code Management

A.2.3.1 Identification Code Records Management

a) Raw material batch identification code: when recording a purchase of raw materials, it is necessary to determine the batch identification code and record the identification code, species, quantity, purchasing sources. For the catch obtained through marine fishing, the fishing areas, fishing vessel name and registration number should be recorded; for fish farming, information about the farm or pond as well as the registration number should be provided; for imported raw materials, the inspection declaration number for imported goods and the health certificate number issued by the exporting country should be specified; for freshwater wild fish, relevant information of the purchasing waters should be provided.

b) Production batch identification code:

It is necessary to determine and include the production batch identification code in the production and processing records. Raw material batch identification code should be provided, as well. In cases of co-batched products, the identification codes of other batches of raw materials shall be simultaneously recorded.

c) Identification code for product batch declaring inspection:

Once the processing enterprise has determined the identification code for product batch declaring inspection, it shall submit a checklist to the inspection and quarantine

agencies. The checklist shall include the inspection batch code, codes for individual batches of products, and the corresponding quantity.

d) All production and inspection records of the enterprise shall specify corresponding product identification codes in accordance with the requirements of SN / T 1347.

A.2.3.2 Identification code management

a) Identification code logos on the external packaging

Directly print the inspection batch code, production batch code and the enterprise's hygiene registration number on the external packaging, for example,

Hygiene Registration No.	3300/00001
Inspection Batch Code	<i>101</i>
Production Batch Code	<i>030725003H</i>

Except for the information in italics which will be printed after the packaging of the product is completed, all the remaining information shall be printed simultaneously with the printing of external packaging.

b) Processing identification code logos

Batch identification code logos should be placed at the beginning, end and appropriate steps in each batch processing. Identification codes should be clear and hardly lost to prevent the mixture of different batches of products.

c) Management of batch identification code logos during storage

Raw materials or products of different batches should be separately stacked with each stack having its own identification code logo (including the quantity). When different batches of raw materials or products need to be stored in the same stack, clear signs should be provided for differentiation, and measures should be taken to ensure no cross-contamination.

A.2.4 Processing requirements for different batches of products

Different batches of products should be separately processed or the corresponding production line should be separate. Once processing of a certain batch is completed, the production line should be thoroughly cleaned and disinfected before processing another batch of products.

A.2.5 Documentation requirements

Enterprises processing exports of fishery products should develop a practical and suitable product identification code scheme in accordance with the present regulations.

A.3 Retroactive implementation of the exports of fishery products

A.3.1 If any faulty product is found, retroactive measure should be taken through the product identification code to each processing step from the finished material back to raw materials. The steps are as follows:

Export health certificate - inspection declaration form - inspection batch checklist - records of production and processing - the raw material reception records - raw

materials purchasing sources, e.g. raw materials obtained from marine fishing can be traced back to the fishing vessel, reared fish can be traced back to the fish farm or pond, freshwater fishing raw materials can be traced to the fishing waters while for imported raw materials, information can be retrieved to the imported batch.

A.3.2 Enterprises should develop a recording system for the flow and whereabouts of products with each batch of raw materials as a unit. This can benefit the retroactive handling from raw materials to products, identify the whereabouts of faulty products, and timely recall the defective products.

A.3.3 If a certain batch of product is found faulty, records of the product can be referred to through traceability and analyzed to find out the reasons so as to take effective corrective measures.

Appendix B

(Normative)

General Requirements for Fish Farms Rearing Fish to Be Processed as Fishery Products for Export

B.1 Fish farms should establish quality management system and good agricultural practices (GAP) to ensure that the fish they rear are safe and hygienic as raw materials for fishery products to be exported. The fish farm quality management system documentation shall include, but not limited to, the following items:

- Roles and responsibilities of aquaculture technicians, quality control inspectors and other personnel;
- Fish seed, feeds, water and medication management system;
- Veterinary prescription system;
- Environment and hygiene management system;
- Fish breeding log management system;
- Inventory of veterinary drugs and feed (including drug name, ingredients, approval number, drug withdrawal periods, etc.);
- Important diseases and major events reporting system.

B.2 Fish farms should reach a certain size: the water area of earthen ponds should be no smaller than 3.33×10^4 square meters; that of concrete ponds should be no smaller than 6.67×10^3 square meters; the size of ponds built in mud flat areas shall be no smaller than 2.00×10^5 square meters while that of cages used for fish farming shall be larger than 3.33×10^3 square meters. Breeding areas must be numbered in a standard manner.

B.3 Fish farms should be sited where there is adequate supply of water with no risk of contamination in which fish are reared. Refer to Section 5.1.3 for the fish growing water quality standards.

B.4 For the requirements concerning the surroundings of the fish farm as well as its inlets and discharge canals, refer to Section 5.1.2.

B.5 The farm should have separate storage for veterinary drugs and feeds, which should be kept clean and dry, well-ventilated.

B.6 The farm should have appropriate stocking density and accordingly sufficient supply of facilities which can pump oxygen to the fish.

B.7 For requirements of feeds used in aquaculture production, refer to Section 5.1.5.1.

B.8 Use of veterinary drugs should comply with national regulations. Drugs or other toxic and harmful substances, which are forbidden by the exporting country and importing countries or regions, shall not be used or stored. Active ingredients in the used veterinary drugs should be specified. Records should be maintained for the use of in aquaculture production and veterinary drugs should be used strictly in

accordance with the withdrawal periods. Refer to Section 5.1.5.2 for more details.

B.9 Veterinary prescription system should be established for the farm, which shall be equipped with trained and qualified aquaculture technicians and quality control inspectors. Veterinary drugs should only be prescribed by the technicians while the quality control inspectors are responsible for storing and distributing the drugs. Aquaculture technicians and quality control inspectors should meet the following requirements:

- Comply with relevant laws, regulations on inspection and quarantine, be honest and trustworthy, and earnestly perform their duties;
- have expertise in fish farming and epidemic prevention;
- have engaged in aquaculture production for more than two years;
- Understand and be familiar with relevant requirements of the exporting country, importing countries or regions on prohibited and restricted drugs or other toxic and harmful substances. Withdraw the drugs in accordance with the withdrawal periods.

B.10 Comply with the relevant requirements of other laws and regulations.

Appendix C

(Normative appendix)

Requirements for Exports of Freshwater Aquatic Products in Terms of Fishing Areas and Purchasing Places of Raw Materials

- C.1 The surrounding areas of fishing areas and the purchasing places should have good sanitation with no pollution.
- C.2 Sound management systems should be established for the raw material producing areas and the purchasing places as well as the process of acquisition, which must meet traceability requirements.
- C.3 Water quality should meet the requirements of GB 11607;
- C.4 Raw materials in the producing areas should pass the quality inspection by quarantine agencies;
- C.5 Raw material producing areas should be within the waters identified as safe and fishable by inspection and quarantine authorities.
- C.6 The person-in-charge and authorized signatory of raw material producing areas and the purchasing places should have sufficient management skills and abide by national laws and regulations.

Appendix D

(Normative appendix)

Hygiene Requirements for Fishing Vessels

D.1 Hygiene Requirements for Facilities

D.1.1 The area stored the aquatic products shall be separated from the machine room and dormitory to guarantee no pollution to aquatic products. The process facilities shall not be rusty or moldy, whose design shall guarantee that the melting ice water does not contaminate the aquatic products.

D.1.2 The container or storage tank which contains the aquatic products shall be made with non-toxic, harmless and anti-corrosion materials, the surface shall be smooth and easy to be cleaned and disinfected. Bamboo utensils shall not be used for storing the aquatic products.

D.1.3 If using the sea water to cool the aquatic products, the equipment and facilities should meet the following requirements:

- Seawater should be clean and hygienic;
- The sea water in cabin shall be injected and drained in accordance with the actual needs of the aquatic products, and the temperature of sea water should be kept consistent and stable;
- Automatic temperature recording devices shall be equipped with temperature sensors installed where the temperature is the highest in the cabin;
- Cooling system shall guarantee to cool the mixture of aquatic products and sea water below 3 °C within 6 hours and below 0 °C after 16 hours.

D.1.4 The fishing vessel shall meet the following conditions if it shall freeze the aquatic products at sea:

- The freezing facilities can enable the products center temperature to reaching -18 °C or below;
- The temperature in cold storage shall be -18 °C or below;
- Automatic temperature recording devices shall be installed in a position of the cold storage, which is easy to observe.

D.1.5 If using ice to cool the aquatic products, the equipment and facilities should meet the following requirements:

- Ice should be clean and hygienic, which shall be stored separately to avoid contamination.
- Ice should keep the products center temperature between 4 and 10 °C. Aquatic products shall not be kept over 36 hours;

D.1.6 Living facilities should be kept clean. Toilets shall be equipped with automatic hand-washing device, disposable paper towels or other drying facilities.

D.1.7 All packaging materials used aboard should meet relevant requirements and be

stored away from the place where fishery products are processed.

D.2 Hygiene Requirements for processing

D.2.1 The processing operation should be clean and hygienic. It is necessary to prevent the processing area and facilities of the catch from contamination of chemicals, fuel or sewage.

D.2.2 When cleaning, processing and storing the catch, care must be taken to avoid should prevent abrasions or damage to the fish meat. Chilling treatment should be carried out immediately after the handling of the fishery products. In the case of no chilling facilities, storage of the catch on board must not exceed 8 hours.

D.2.3 Water or ice used for washing and chilling the fishery products shall be potable water or clean, unpolluted sea water.

D.2.4 Processing areas, facilities, cabins, storage tanks and containers should be cleaned and disinfected before and after use each time.

D.2.5 Waste discharge should not pollute the water intake of the fishing vessel or the fish and fishery products caught and harvested.

D.2.6 Measures should be taken regularly to get rid of insects, rodents and other pests. All chemicals such as cleaning agents, disinfectants and pesticides should have their components, safe use and storage method specified on the labeling. These products should be stored separately with records of their inventory information and use well maintained.

D.2.7 Records about the operation of the fishing vessels and temperature shall be maintained and saved for inspection by competent authorities.

Appendix E

(Normative appendix)

Code of Hygienic Practice for Processing of Major Exports of Fishery Products

E.1. Processing of raw, fresh or frozen fish

E.1.1 Pre-handling

E.1.1.1 Raw, fresh or frozen fish reception

Potential hazards: pathogenic bacteria, parasites, biotoxins, mackerel toxins, chemicals (including veterinary drug residues) and physical hazards

Potential defects: spoilage, live parasites, physical hazards

Technical guidance:

Use of appropriate sensory evaluation is recommended for assessing the acceptability of raw fish material, so as to remove fish whose quality does not meet the standards. Fish handlers and relevant management personnel should receive training on variety testing to ensure that the fish obtained is of homogeneous species containing no biotoxins such as mackerel toxins. Knowledge of fishing waters is also required. Fish in need of gutting shall be cleaned immediately upon arrival in the processing plants to avoid contamination. If fish contains harmful, spoilage or foreign substances, which still cannot be eliminated or reduced to the acceptable standard through normal process, should be rejected.

Acceptance criteria for raw materials should include the following items:

- Organoleptic properties, such as appearance, smell, quality, and size, etc.
- Chemical indicators of spoilage and (or) pollution, such as total volatile basic nitrogen (TVBN), histamine, heavy metals, pesticide residues, nitrates, etc.
- Microbiological indicators, especially for semi-finished raw materials, measures should be taken to prevent microbial contamination in the process of handling raw materials.

E.1.1.2 Chilled storage

Potential hazards: pathogens, biotoxins and mackerel toxins

Potential defects: spoilage and mechanical damage

Technical guidance:

- Fish should be chilled as quickly as possible between 0 ° C and 4 ° C. If ice is used for chilling fish, one bed of ice should be placed under one layer of fish. If cold sea water is used alternatively, the fish should be fully soaked in the water;
- Cold storage should be equipped with a calibrated thermometer and it is recommended to use an automatic temperature recorder;
- Storage management of chilled fish should follow the principle that whichever is put

in storage earlier should be distributed out earlier;

- Fish storage should avoid excessive squeezing and damage to the fish.

E.1.1.3 Frozen storage

Potential hazards: pathogens, toxins and live parasites

Potential defects: deterioration and decrease of nutritional quality

Technical guidance:

- The temperature of frozen storage facilities should be maintained below -18 ° C with little fluctuation;
- The frozen storage should be equipped with a calibrated thermometer and it is recommended to use an automatic temperature recorder;
- A cold storage management system should be established, so that the frozen goods can follow the principles that whichever is put in storage earlier should be distributed out earlier;
- Frozen products should be glazed and packaged before storage so as to avoid dehydration;

E.1.1.4 Thawing

Potential hazards: pathogens, biotoxins and scombrototoxin

Potential defects: spoilage

Technical guidance:

- Thawing should be carried out in a dedicated site; a series of thawing techniques should be developed to control the temperature and time of thawing; high-risk species, such as fish which can produce histamine, should be treated as critical control points, thereby determining the critical limits.
- Thawing sites should be installed with automatic thermometer or temperature recorder.
- Effective measures should be taken to prevent raw materials from contamination in the thawing process. More specifically, it is necessary to prevent melting water from changing raw materials into pollutants, or to prevent raw materials from being chewed by rodents and other insects.
- Running water should be used for thawing, and the water quality should meet the requirements of GB 5749.
- The method used during the thawing process should not expose the products to excessive temperatures.

E.1.1.5 Washing and gutting

Potential hazards: pathogens, biotoxins and mackerel toxins

Potential defects: presence of viscera, bruising, off-flavours

Technical guidance:

- Gut the fish thoroughly;
- Clean the whole fish before gutting. During the gutting process, relevant equipment or tools should be cleaned and disinfected;
- During the gutting process, time and temperature should be controlled. High-risk

species, such as those which can produce histamine, should be treated as critical control points, thereby determining the critical limits;

- Gutted fish should be cleaned and drained immediately. Use ice or chill the fish in a clean container before being placed in a suitable area for storage;
- If internal organs, such as roe, spleen and liver, etc, have other uses, should be stored separately.

E.1.1.6 Slicing, peeling, trimming and candling

Potential hazards: live parasites, pathogens, biotoxins, scombrototoxin and bones

Potential defects: parasites, presence of bones, objectionable matter (such as skin, scales, etc.), spoilage

Technical guidance:

- The process of slicing, peeling, trimming and candling should be coherent and reasonable to reduce time delay;
- Fish which has gone through the process of slicing, peeling, trimming should be promptly cleaned with potable water, and disinfected by equipment or tools;
- For boneless fillets, processing personnel should adopt proper inspection techniques to remove the bones which fail meet the requirements;
- For the fish which may contain parasites, candling should be conducted to get rid of parasites;
- During the process, the candling equipment should be regularly cleaned in order to remove residues of fish and further prevent the reproduction of microbes on the contact surface;
- During the gutting process of slicing, peeling and trimming, time and temperature should be controlled. High-risk species, such as those which can produce histamine, should be treated as critical control points, thereby determining the critical limits;
- Processed fillets should be immediately chilled and cooled with ice and properly stored to avoid dehydration.

E.1.2 Modified atmosphere packaging or vacuum packaging

E.1.2.1 weighing

Potential hazards: unlikely

Potential defects: incorrect net weight

Technical guidance: It is necessary to calibrate scales regularly to ensure accuracy.

E.1.2.2 Modified atmosphere packaging or vacuum packaging

Potential hazards: pathogens, biotoxins and physical hazards, such as metal

Potential defects: spoilage

Technical guidance:

The shelf life of the product using vacuum packaging or modified atmosphere packaging depends on the species, the fat content as well as the initial number of microorganisms of the product, gas mixture, types of packaging materials, and in particular, the temperature of the storage.

a) Modified atmosphere packaging should be strictly controlled as follows:

- The gas-product ratio should be monitored;
- Types and ratios of gas mixture used;
- Type of film used;
- Type and integrity of the seal;
- Temperature control of product storage;
- b) Appropriate vacuum degree and packaging;
- c) Remove any fish meat from the seam area;
- d) Use harmless or pollution-free packaging materials;
- e) Qualified personnel should regularly check the package of the finished product to verify whether the sealing is effective and the packaging machinery is running correctly. Make sure that the vacuum volume is enough and the product is fully sealed.
- f) Once sealed, modified atmosphere or vacuum-packed products should be placed in chilled storage as soon as possible.

E.1.2.3 Labeling

Potential hazards: unlikely

Potential defects: incorrect labeling

Technical guidance:

- All declared information should be verified to ensure it comply with the regulations of GB 7718.
- Unqualified labels should be evaluated to find out the reasons for incorrect labelling, modify accordingly and re-label the products;

E.1.2.4 Metal detection

Potential hazards: metallic foreign materials

Potential defects: unlikely

Technical guidance:

- During the detection process, if the product fails to go through metal detection, formal investigation should be started to find out the cause;
- Metal detectors should be regularly calibrated for use.

E.1.3 Processing of frozen fish

E.1.3.1 freezing process

Potential hazards: live parasites.

Potential defects: deterioration and odors.

Technical guidance:

- Fishery products should be frozen immediately after pre-handling, so as to avoid the rise of product temperature, the microbial growth, quality deterioration and further shortened shelf life.
- The freezing capacity of the equipment and product characteristics should be taken into consideration during the freezing process. The freezing time, temperature and production capacity should be determined in order to ensure that the range of

temperature of maximum crystallization is passed through as quickly as possible.

- Products entering the freezing process shall be as identical as possible in terms of thickness, shape and temperature;
- Frozen products should be moved to the cold storage facility as soon as possible;
- The core temperature of frozen products should be monitored regularly to verify that the freezing process is completed;
- In order to kill parasites harmful to human health, the freezing temperature and time should meet relevant requirements;
- The original records during the whole freezing process should be kept.

E.1.3.2 Glazing

Potential hazards: pathogenic bacteria

Potential defects: dehydration, incorrect net weight

Technical guidance:

- If additives have been added to the water used for the glazing, their use should comply with relevant national regulations;
- The amount of glazing should be consistent with the product labeling;
- If dipping is chosen as the glazing method, the glazing solution should be regularly changed.

E.1.4 Packaging, labels and ingredients

E.1.4.1 Reception-packaging, labels and of ingredients

Potential hazards: pathogenic bacteria, chemical and physical hazards

Potential defects: incorrect labelling

Technical guidance:

- Ingredients, packaging materials and labels should comply with relevant national regulation;
- Labels which will have direct contact with fish should be made with non-absorbent materials, and the ink or dye used on the label shall be approved by the competent authority.

E.1.4.2 Storage- packaging, labeling and ingredients

Potential hazards: pathogenic bacteria, chemical and physical hazards

Potential defects: quality decrease of packaging materials or ingredients

Technical guidance:

- Ingredients and packaging materials should be stored at an environment with proper temperature and humidity;
- Systematic inventory management system should be developed, so that the packaging materials can follow the principle that whichever is put in storage earlier should be distributed out earlier, in order to avoid the expiry of materials;
- Ingredients and packaging materials should be properly protected and stored separately to avoid cross-contamination;
- Defective ingredients and packaging materials should not be used.

E.2 Processing of frozen surimi

E.2.1 Potential hazards and defects of frozen surimi production

E.2.1.1 Hazards

Frozen surimi is an intermediate food ingredient that will be further processed into surimi-based products such as kamaboko and crab analogues. Many of the potential food safety hazards will be controlled during subsequent processing. For example, pathogenic bacteria such as *Listeria monocytogenes* and toxin formers such as *C. botulinum* (that becomes a hazard owing to MAP of the end product) should be controlled during the cooking or pasteurizing steps of final processing. Possible *Staphylococcus aureus* contamination that produces heat-stable enterotoxins should be adequately controlled by the prerequisite programme.

Parasites will not be a hazard as the final product will be cooked or pasteurized. If scombrototoxin-forming fish such as tuna or mackerel or tropical reef fish that may accumulate ciguatera toxin are utilized for surimi, appropriate controls for these hazards should be developed. Likewise, owing to the highly mechanized nature of surimi processing, appropriate controls should be instituted to ensure that metal fragments (e.g. bearings, bolts, washers and nuts) are excluded or eliminated from the end product.

E.2.1.2 Defects

Frozen surimi should not contain fish bones, fish scales, black belly lining and other hazardous substances. Certain quality attributes of frozen surimi are important for the successful manufacture of surimi-based products such as kamaboko and crab analogues that meet consumer expectations of quality. Some of these important factors are colour, moisture content, pH or gel strength. Gel elasticity is an important indicator of the quality of surimi products. Myofibrillar protein is one major component for fish meat to form into an elastic gel, and the higher content of this protein product, the better elasticity the surimi product has. Influencing factors include parasites or enzymes produced by microorganisms, water-soluble substance, and protein denaturation caused by temperature rise, etc.

E.2.2 Fish preparation

E.2.2.1 Raw fresh and frozen fish reception

Potential hazards: uncertainty of raw material.

Potential defects: spoilage and protein denaturation.

Technical guidance:

- Harvested fish intended for frozen surimi processing should preferably be kept at 4 °C or below, but processing as fast as possible after harvest will better retain adequate quality of frozen surimi:

- Round: within 14 days after harvest when stored at 4 °C or below;
- Dressd: within 24 hours after dressing when stored at 4 °C or below.

Date, time of harvesting, origin and harvester or vendor of products received should be properly recorded and identified.

- Consideration should be given to the age and condition of fish used for surimi processing as the factors will affect the final gel strength capability. Fish that is used

for frozen surimi processing should have a flesh for adequate gel strength capability. For example, an aggregate flesh for Alaska pollock (*Theragra chalcogramma*) should have a pH of 7.0 ± 0.5 .

E.2.2.2 Chilled storage

Potential hazards: unlikely

Potential defects: protein denaturation

Technical guidance:

Chilled storage at the processing facility should be minimized, with prompt processing in order to minimize protein denaturation and loss of gel strength capability. Raw fish should preferably be stored at 4 °C or below, and the dates of harvesting and the time of receipt of the fish should identify the lot of fish used for processing.

E.2.2.3 Washing and scaling

Potential hazards: unlikely

Potential defects: protein denaturation and change of colour, objectionable matter

Technical guidance:

- The epidermis (slime layer), scales and loose pigment should be removed before heading and gutting, as these materials can negatively affect the gel strength capability and colour of the end product.

E.2.2.4 Washing

Potential hazards: unlikely

Potential defects: impurities, extraneous materials

Technical guidance:

- Headed and gutted fish should be re-washed. This will lessen the level of impurities and extraneous material that can negatively affect the gel strength capability and colour of the end product.

E.2.3 Meat separation

Potential hazards: metal fragments

Potential defects: impurities

Technical guidance:

- If fish flesh is minced using a mechanical separation process, metal detection equipment that is capable of sensing product that has become contaminated with metal fragments likely to cause human injury should be used.
- Procedures should be established to ensure that chemical contamination of the product is not likely.
- Separated minced meat should be immediately spread into water and transferred to the washing and dewatering step to prevent blood from congealing and causing loss of gel strength capability.

E.2.4 Washing and dewatering

Potential hazards: pathogenic microbial growth

Potential defects: decomposition, protein denaturation, residual water-soluble protein

Technical guidance:

- Temperature of the water and minced fish flesh in the rotating sieve or wash water should be adequately controlled to prevent the growth of pathogenic microbes.
- Wash water should be 10 °C or below for adequate separation of water-soluble proteins. Wash water for Pacific whiting should be lower than 5 °C because this species will usually have a high protease activity. Some warmwater species may be processed at temperatures up to 15 °C.
- Product should be processed promptly to minimize possible pathogenic microbial growth.
- Minced fish should be spread uniformly in the water to assure dilution of the water-soluble components and effect proper separation from the myofibrillar protein.
- Consideration should be given to the specific design of the washing and dewatering step in regard to the desired yield, quality and fish species.
- A sufficient amount of potable water should be available for washing.
- The pH of wash water should be near 7.0. Wash water should preferably have a total hardness of 100 mg/kg or below in terms of converted CaCO₃.
- Salt or other dewatering aids can be added (less than 0.3 percent salt) in the final stage of washing to enhance dehydration efficiency.
- Food additives should be added in accordance with national regulations and manufacturer instructions, if used in this process.
- Wastewater should be disposed of in a suitable manner.

E.2.5 Refining

Potential hazards: pathogenic microbial growth, metal fragments

Potential defects: objectionable matter, protein denaturation

Technical guidance:

- Temperature of the minced fish flesh in the refining process should be adequately controlled to prevent the growth of pathogenic bacteria.
- For preventing protein denaturation, temperature of minced fish flesh should not exceed 10 °C in the refining process.
- Product should be processed promptly to minimize possible pathogenic microbial growth.
- Metal detection equipment capable of sensing product that has become contaminated with metal fragments of the size likely to cause human injury should be used in the process to eliminate the hazard.
- Objectionable matter, such as small bones, black membranes, scales, bloody flesh and connective tissue, should be removed from washed flesh with appropriate refining equipment before final dewatering.
- Refined product should not be allowed to accumulate on sieve screens for long periods of time.

E.2.6 Final dewatering

Potential hazards: pathogenic bacteria

Potential defects: protein denaturation

Technical guidance:

- Temperature of the refined fish flesh in the final dewatering process should be adequately controlled to prevent the growth of pathogenic bacteria.
- Temperature of refined fish flesh should not exceed 10 °C for coldwater fish species, such as Alaska pollock. For Pacific whiting, the temperature should not exceed 5 °C because this species will usually have a high protease activity. Some warmwater species may be processed at temperatures up to 15 °C.
- Product should be processed promptly to minimize possible pathogenic microbial growth.
- The moisture level of refined product should be controlled to specified levels with appropriate dewatering equipment (e.g. centrifuge, hydraulic press, screw press).
- Consideration should be given to variations in moisture levels caused by the age, condition or mode of capture of the raw fish. In some cases, dehydration should be performed before refining.

E.2.7 Mixing and addition of adjuvant ingredients

Potential hazards: pathogenic microbial growth, metal fragments

Potential defects: improper use of food additives, protein denaturation

Technical guidance:

- Temperature of the product in the mixing process should be adequately controlled to avoid the growth of pathogenic bacteria.
- Temperature of dehydrated fish flesh during mixing should not exceed 10 °C for coldwater fish species such as Alaska pollock. For Pacific whiting, the temperature should not exceed 5 °C because this species usually will have a high protease activity. Some warmwater species may be processed at temperatures up to 15 °C.
- Product should be processed promptly to minimize possible pathogenic microbial growth.
- Metal detection equipment that is capable of sensing product that has become contaminated with metal fragments of the size likely to cause human injury should be used in the process to eliminate the hazard.
- Food additives should comply with the requirements of GB 2760.
- Food additives should be mixed homogeneously.
- Cryoprotectants should be used in frozen surimi. Sugars and/or polyhydric alcohols are commonly used to prevent protein denaturation in the frozen state.
- Food-grade enzyme inhibitors (e.g. egg white, beef protein plasma) should be used for species that exhibit high levels of proteolytic enzyme activity, such as Pacific whiting, that reduce the gel-forming ability of surimi during kamaboko or crab analogue processing. The use of protein plasma should be appropriately labelled.

E.2.8 packaging and weighing

Potential hazards: pathogenic microbial growth

Potential defects: foreign matter (packaging), incorrect net weight, poor packaging, protein denaturation

Technical guidance:

- Temperature of the product should be adequately controlled during packaging to avoid the growth of pathogenic bacteria.
- Product should be packaged promptly to minimize possible pathogenic microbial growth.
- The packaging operation should have procedures established that make possible cross-contamination unlikely.
- Product should be inserted into clean plastic bags or packaged into clean containers that have been properly stored.
- Packaged products should not contain voids.
- The product should meet appropriate standards for net weight.

E.2.9 Freezing operation

Potential hazards: unlikely

Potential defects: protein denaturation, decomposition

Technical guidance:

- After packaging and weighing, the product should be promptly frozen to maintain the quality of the product.
- Procedures should be established that specify maximum time limits from packaging to freezing.

E.2.10 Metal detection

Potential hazards: metal fragments

Potential defects: unlikely

Technical guidance:

- Metal detection equipment that is capable of sensing product that has become contaminated with metal fragments of the size likely to cause human injury should be used in the process to eliminate the hazard.

E.2.11 Boxing and labeling

Potential hazards: unlikely

Potential defects: incorrect label, damage to packaging

Technical guidance:

- Boxing should be clean, durable and suitable for the intended use.
- The boxing operation should be conducted to avoid the damage of packaging materials.
- Product in damaged boxing should be re-boxed so that it is properly protected.

E. 2.12 Frozen storage

Potential hazards: unlikely

Potential defects: decomposition, protein denaturation

Technical guidance:

Refer to Section 9.2 .Frozen surimi should be stored at -20 °C or colder to prevent protein denaturation from taking place. Quality and shelf-life will be maintained more adequately if the product is stored at -25 °C or colder.

E.2.13 Raw material reception – packaging and ingredients

Refer to Section E.1.4.1.

E.2.14 Raw material storage – packaging and ingredients

Refer to Section E.1.4.2.

E.3 Processing of quick-frozen coated fish products

E.3.1 Special requirements for processing

- Conveyor systems used to transport uncoated and coated fish should be designed and constructed to prevent damaging and contamination of the products.
- Shims sawn for formed fish production and held for tempering should be kept at temperatures that will prevent deterioration of the essential quality of the product.
- If the whole process is run continuously, an adequate number of processing lines should be available to avoid interruptions and batch-wise processing.
- If the process has to be interrupted, intermediate products have to be stored under deep-frozen conditions until being further processed.
- Prefrying baths, freezing cabinets used for re-freezing should be equipped with permanent temperature and belt speed control device.
- The proportion of sawdust should be minimized by using appropriate sawing equipment.
- Sawdust should be kept well separated from fish cores used for coated products, should be temperature controlled, not stay too long at ambient temperature and should be stored preferably in frozen state prior to further processing into suitable products.

E.3.2 Hazards and defects

E.3.2.1 Hazards

The production and storage of batter for application to fish portions, fillets, etc. may involve either rehydration of a commercial batter mix or preparation from raw ingredients. During the preparation of this batter and its use, the potential hazard for the possible growth and toxin production of *Staphylococcus aureus* and *Bacillus cereus* must be controlled.

E.3.2.2 Defects

Quick-frozen coated fish products mainly include fish sticks (fish fingers), fish portions and fish fillets. Potential defects are mainly irregular shape, abnormal flavour, incorrect labelling about the composition, and poor coloration.

E.3.3 Processing operations

E.3.3.1 Reception

E.3.3.1.1 Fish

Potential hazards: chemical and biochemical contamination, histamine

Potential defects: tainting, block irregularities, water and air pockets, packaging

material, foreign matter, parasites, dehydration, decomposition

Technical guidance:

- Temperatures of all incoming lots should be recorded.
- Packaging material of frozen products should be examined for dirt, tearing and evidence of thawing;
- Cleanliness and suitability of the transport vehicle to carry frozen fish products should be examined.
- Use of temperature recording devices with the shipment is recommended.
- Representative samples should be taken for further examination for possible hazards and defects.

E.3.3.1.2 Other ingredients

Potential hazards: chemical, biochemical and microbiological contamination

Potential defects: mould, colour deviations, filth, sand

Technical guidance:

- Breeding and batter should be inspected for broken packaging material, signs of rodent and insect infestations and other damage such as dirt on packaging materials and wetness.
- Cleanliness and suitability of the transport vehicle to carry food products should be examined.
- Representative samples of the ingredients should be taken and examined to ensure that the product is not contaminated and meets specifications for use in the end product.
- Ingredients should be shipped on transportation vehicles that are suitable for handling food products and ingredients. Vehicles that have previously hauled potentially unsafe or hazardous material should not be used for hauling food products or ingredients.

E.3.3.1.3 Packaging materials

Potential hazards: foreign matter

Potential defects: tainting of products

Technical guidance:

- Packaging material used should be clean, sound, durable, and sufficient for its intended use and of food-grade material.
- For pre-fried products, it should be impermeable for fat and oil.
- Cleanliness and suitability of the transport vehicle to carry food packaging material should be examined.
- Preprinted labelling and packaging material should be examined for accuracy.

E.3.3.2 Storage of raw material, other ingredients and packaging materials

E.3.3.2.1 Fish (frozen storage)

Refer to Section E.1.1.3.

E.3.3.2.2 Fish (chilled storage)

For storage of non-frozen fish, refer to Section E.1.1.2.

E.3.3.2.3 Other ingredients and packaging materials

Potential hazards: biological, physical and chemical contamination

Potential defects: loss of quality and characteristics of ingredients, odor

Technical guidance:

- All other ingredients and packaging material should be stored in a dry and clean place under hygienic conditions.
- All other ingredients and packaging material should be stored appropriately in terms of temperature and humidity.
- A systematic stock rotation plan should be developed and maintained to avoid out-of-date materials.
- Ingredients should be protected from insects, rodents and other pests.
- Defective ingredients and packaging material should not be used.

E.3.3.3 Frozen fish block/fillet tempering

Potential hazards: unlikely

Potential defects: incorrect dimension owing to sawing of oversoftened fish flesh (applies to fish sticks).

Technical guidance:

- Depending on the use of the fish, the tempering of frozen fish blocks/fillets should be carried out in a manner that will allow the temperature of the fish to rise without thawing.
- Tempering block/fillets of frozen fish in chilled storage is a slow process that usually requires at least 12 hours or more.
- Oversoftening of the outer layers is undesirable (poor performance during sawing) and should be avoided. It can be avoided if facilities used for tempering are maintained at a temperature of 0–4 °C and if fish blocks/fillets are stacked in layers.
- Microwave tempering is an alternative method but should also be controlled to prevent softening of outer layers.

E.3.3.4 Unwrapping, unpacking

Potential hazards: microbiological contamination

Potential defects: unclean materials

Technical guidance:

- During unwrapping and unpacking of fish blocks, care should be taken not to contaminate the fish.
- Special attention has to be given to cardboard and/or plastic material partly or fully embedded in the blocks.
- All packaging material should be disposed of properly and promptly.
- Protect wrapped, unwrapped and unpacked fish blocks when cleaning and sanitizing processing lines during breaks and between shifts if the production process is interrupted.

E.3.3.5 Production of fish core

E.3.3.5.1 Sawing

Potential hazards: foreign material (metal or plastic parts of saws)

Potential defects: irregularly shaped pieces or portions

Technical guidance:

- Sawing instruments should be kept in clean and hygienic conditions.
- Saw-blades must be inspected regularly in order to avoid tearing of the product and breakage.
- Sawdust must not collect on the saw-table and must be collected in special containers if used for further processing.
- Sawn shims used to form irregularly shaped fish cores by mechanical pressure should be kept in clean, hygienic conditions until further manufacturing.

E.3.3.5.2. Application of additives and ingredients

Potential hazards: foreign material, microbiological contamination

Potential defects: incorrect addition of additives

Technical guidance:

- The temperature of the product in the mixing process should be adequately controlled to avoid the growth of pathogenic bacteria.

E.3.3.5.3 Forming

Potential hazards: foreign material (metal or plastic from machine) and/or microbiological contamination (fish mixture only)

Potential defects: poorly formed fish cores, cores subjected to too much pressure (mushy, rancid)

Technical guidance:

- Forming of fish cores should adopt highly mechanized methods of producing fish cores for battering and breading.
- Forming machines should be kept in hygienic conditions.
- Formed fish cores should be examined closely for proper shape, weight and texture.

E.3.3.6 Separation of pieces

Potential hazards: unlikely

Potential defects: adhering pieces or portions

Technical guidance:

- The fish flesh cores cut from the blocks or fish fillets or other irregular-shaped quick frozen fish material must be well separated from one another and should not adhere to one another.
- Fish cores that are touching one another going through the wetcoating step should be removed and placed back on the conveyor in order to obtain a uniform batter coat and a uniform breading pick-up.
- Cored fish should be monitored for foreign material and other hazards and defects before coating.
- Remove from production any broken, misshapen or out-of specification pieces.

E.3.3.7 Coating

E.3.3.7.1 Wet coating

Potential hazards: microbiological contamination

Potential defects: insufficient cover or excessive cover of coating

Technical guidance:

- Fish pieces must be well coated from all sides.
- Surplus liquid, which should be reused, must be re-transported under clean and hygienic conditions.
- Surplus liquid on fish pieces should be removed by clean air.
- Viscosity and temperature of hydrated batter mixes should be monitored and controlled within certain parameters to effect the proper amount of breading pick-up.
- To avoid microbiological contamination of the hydrated batter, appropriate means should be adopted to ensure that significant growth does not take place, such as temperature control, dumping liquid contents and regular or scheduled clean-ups and/or sanitation during the manufacturing shift.

E.3.3.7.2 Dry coating

Potential hazards: microbiological contamination

Potential defects: insufficient coating or excessive coating

Technical guidance:

- Dry coating must cover the whole product and should stick well on the wet coating.
- Surplus coating is removed by blowing away with clean air and/or by vibration of conveyors and must be removed in a clean and hygienic way if further use is intended.
- Flow of breading from the application hopper should be free, even and continuous.
- The proportion of breading and fish core should be in accordance with relevant regulations.

E.3.3.8 Pre-frying

Potential hazards: unlikely

Potential defects: overoxidized oil, insufficient frying, loosely adhering coating, burnt pieces and portions

Technical guidance:

- Frying oil should have a temperature between approximately 160 °C and 195 °C.
- Coated fish pieces should remain in frying oil for sufficient time depending on the frying temperature in order to achieve a satisfying colour, flavour and structure to adhere firmly to the fish core, but core should be kept frozen throughout the whole time.
- Frying oil shall not be expired or deteriorated;
- Remains from coating that concentrate at the bottom of the frying bath have to be removed regularly
- Excessive oil should be removed from coated products after prefrying by a suitable device.

E.3.3.9 Re-freezing - final freezing

Potential hazards: foreign material

Potential defects: insufficient freezing leads to sticking of units to one another or to walls of freezing equipment and facilitates mechanical removal of breading/batter

Technical guidance:

- Re-freezing to -18 °C or lower of the whole product should take place immediately after pre-frying.
- Products should be allowed to stay sufficient time in freezer cabinet to ensure core temperature of products of -18 °C or lower.
- Cryogenic freezers should have sufficient compressed gas flow to affect proper freezing of the product.
- Processors that utilize blast freezers may package the product in the consumer containers before freezing.

E.3.3.10 Packaging and labeling

Potential hazards: pathogenic bacteria

Potential defects: improperly sealed containers, wrong or misleading labelling

Technical guidance:

- Products should be packaged in hygienic conditions as soon as possible once frozen;
- During the entire packaging process, the product should keep frozen;
- Weighing equipment must be regularly calibrated, and the finished products should pass the tests by metal detectors or other suitable devices;
- When products are packaged for selling and shipping, the packaging shall be marked with the correct batch code to facilitate traceability and recall.

E.3.3.11 Freezing and transportation of finished products

Potential hazards: unlikely

Potential defects: quality changes, deep freezer burn, odour in the cold storage and cardboard caused by temperature fluctuations.

Technical guidance:

Refer to Section 9.

E.4 Shrimp processing

E.4.1 Handling raw shrimp upon receipt

Potential hazards: pathogenic bacteria, antioxidants, sulfites, pesticides and fuel

Potential defects: mixture of shrimp varieties, blackening, deterioration and spoilage

Technical guidance:

- Raw shrimps should be frozen or chilled properly, and have supply proof to ensure the product traceability;
- Sampling tests can be selectively conducted according to different sources and characteristics of raw shrimps.

E.4.2 Freezing of blocks of frozen raw shrimps

Potential hazards: unlikely

Potential defects: protein denaturation and dehydration

Technical guidance:

- The external packaging shall not be broken; otherwise, the product should be

re-packaged so as to prevent contamination and dehydration;

- Frozen storage temperature should be appropriate and measures should be taken to avoid temperature fluctuation;
- Frozen storage facilities should be equipped with the automatic temperature recorder.

E.4.3 Thawing of frozen whole raw shrimps

Potential hazards: pathogenic bacteria and packaging pollution

Potential defects: spoilage

Technical guidance:

- Internal and external packaging should be removed before thawing the frozen whole shrimps, with particular attention to the fragments on the surface of frozen blocks, so as to avoid contamination;
- The design of thawing facilities should meet the requirements. Water used for thawing should be running water and not appropriate for re-use;
- The temperature of clean seawater or potable water used for thawing should not be higher than 20 ° C (68 ° F), and the product temperature after thawing should be below 4 ° C, in order to maintain its quality;
- It is necessary to spray cooling water on the product after thawing;
- Prior to subsequent processing, thawed shrimp shall be placed with ice or refrigerated promptly to maintain its quality.

E.4.4 Cold storage

Potential hazards: pathogenic bacteria

Potential defects: spoilage

Technical guidance:

- Upon the receipt, fresh raw materials should be put in cold storage below 4 ° C;
- Cold storage should be equipped with temperature monitoring facilities and storage temperature should be well recorded;
- To maintain the quality, products should be put in cold storage for too long.

E.4.5 Sorting and grading

Potential hazards: pathogenic bacteria

Potential defects: spoilage

Technical guidance:

- Depending on the requirements, categorize shrimps into different quality classes;
- Grading shrimps can be done manually or by machine. As the shrimp may get stuck in the machine, the machine should be checked and cleaned regularly;
- Graded shrimp should be promptly placed with ice or put into cold storage;
- Shrimps should be selected and graded as soon as possible to avoid the growth of microorganism and product spoilage.

E.4.6 Use of additives and ingredients

Potential hazards: chemical and microbiological contamination, sulfites.

Potential defects: spoilage and improper use of additives.

Technical guidance:

- Additives or ingredients maybe used during shrimp processing. For example, use of sodium sulfite can reduce the shrimp blackening and salt can enhance the flavour;
- The use of additives should comply with the requirements of GB 2760.

E.4.7 Peeling

Potential hazards: microorganism

Potential defects: spoilage, shrimp shell and foreign substances

Technical guidance:

- In the peeling process, it is necessary to remove shrimp shell promptly, regularly clean the processing surface to avoid contamination;
- Peeled shrimp should be promptly placed with ice to keep fresh.

E.4.8 Deveining

Potential hazards: bacteria and metallic foreign materials

Potential defects: intestinal tract, spoilage and foreign substances

Technical guidance: A black threadlike intestinal tract runs along the back of the shrimp. Run the tip of a sharp knife along the shrimp's back to lift out and remove the black vein, thus avoiding microbial growth.

E.4.9 Cleaning

Potential hazards: pathogenic bacteria

Potential defects: spoilage and foreign substances

Technical guidance:

- Peeled and deveined shrimp should be cleaned immediately to remove shrimp shell and residues of intestinal tract;
- Shrimp should be drained and chilled before subsequent processing.

E.4.10 Steaming and boiling

Potential hazards: bacteria remains

Potential defects: excessive cooking

Technical guidance:

- The critical control points(CCP) for the steaming and boiling process should be established based on the requirements of the final product, to determine the value of critical limits(CL),such as the steaming and boiling time and temperature;
- Critical control points should be monitored by qualified personnel according to the requirements of the HACCP plan, to make sure whether the CCP deviates from the value of CL;
- Timely verification should be conducted in accordance with the HACCP;
- It is necessary to make and keep records of the critical control points;
- It is necessary to prevent cooked shrimp from cross-contamination.

E.4.11 Peeling of cooked shrimp

Potential hazards: pathogenic bacteria

Potential defects: shrimp shell

Technical guidance:

Refer to Section E.4.7.

E.4.12 Chilling

Potential hazards: pathogenic bacteria

Potential defects: unlikely

Technical guidance:

- Cooked shrimp should be chilled as quickly as possible to prevent the growth of microorganisms;
- The chilling process should meet the time and temperature requirements and be operated by trained personnel;
- Only potable water or clean water can be used for chilling, which should not be reused;
- After chilling and draining, the shrimp should be frozen as soon as possible to avoid contamination.

E.4.13 Freezing

Potential hazards: pathogenic bacteria.

Potential defects: unlikely.

Technical guidance:

- Individually quick frozen (IQF) machine should be fully pre-cooled prior to freezing the shrimp. The operating temperature and speed requirements should comply with the freezing requirements so that there is no clumping, i.e. pieces frozen together.
- Freezer cleaning and maintenance should be carried out by qualified personnel.

E.4.14 Glazing

Potential hazards: pathogenic bacteria

Potential defects: variation in size of ice picked up by products, spots and labeling inconsistency.

Technical guidance:

- For blocks of frozen shrimp meats, simply immerse the frozen shrimps in cold drinking water;
- For individual frozen shrimps, once coated with ice, they should be re-frozen before packing; otherwise, the shrimps should be packaged and placed in cold storage as soon as possible, to avoid clumping.

E.4.15 Weighing, packaging and labeling

Potential hazards: sulfites

Potential defects: labeling inconsistency and spoilage

Technical guidance:

- All wrapping and packaging materials, including glues and inks, should be food grade with no harm to health;
- When being packaged, products should be weighed and calibrated reasonably;

- Where products are glazed, checks should be carried out to ensure the correct compositional standards to comply with regulations and packaging declarations;
- Ingredient lists on packaging and labelling should comply with the requirements of GB 7718, and declare presence of ingredients and any additives used in the product;
- Products shall be kept frozen during the transport for packaging, to ensure that their temperature does not go up before being put into cold storage;
- If sulfite is used for processing, it has to be accurately specified.

E.4.16 Metal detection

Potential hazards: metallic foreign material

Potential defects: unlikely

Technical guidance:

- In the process of final packaging, products should pass the metal detection by high-sensitivity instruments, whose sensitivity should be regularly checked.
- Large-size products should go through metal detection prior to packaging while for small-size products, metal detection should be carried out after packaging, to avoid potential contamination before packaging.

E.4.17 Freezing of finished products

Potential hazards: unlikely

Potential defects: quality changes, deep freezer burn, odour in the cold storage and cardboard caused by temperature fluctuations.

Technical guidance:

Refer to Section 9.

E.5 Processing of cephalopods

E.5.1 Reception of cephalopods

Potential hazards: microbiological contamination, chemical contamination, parasites.

Potential defects: damaged products, foreign matter

Technical guidance:

- The processing facility should have in place a programme for inspecting cephalopods on catching or arrival at the factory. Only sound product should be accepted for processing. Personnel inspecting product should be trained and experienced with the relevant species in order to recognize any defects and potential hazards.
- Product specifications could include:
 - organoleptic characteristics, such as appearance, odour and texture, that can also be used as indicators of fitness of consumption;
 - chemical indicators of decomposition and/or contamination, e.g. TVBN, heavy metals (cadmium);
 - microbiological criteria;
 - parasites, e.g. Anisakis, foreign matter;
 - the presence of lacerations, breakages and discoloration of the skin, or a yellowish tinge spreading from the liver and digestive organs inside the mantle, which are

indicative of product deterioration.

E.5.2 Storage of cephalopods

E.5.2.1 Chilled storage

Potential hazards: microbiological contamination

Potential defects: decomposition, physical damage

Technical guidance:

Refer to Section E.1.1.2.

E.5.2.2 Frozen storage

Potential hazards: heavy metals, e.g. cadmium migration from the gut

Potential defects: freezer burn

Technical guidance: Refer to Section E.1.1.3.

- Consideration needs to be given to the fact that when there are high cadmium levels in the gut contents, there may be migration of this heavy metal into the flesh.
- Products should be properly protected from dehydration by sufficient packaging or glaze.

E.5.3 Thawing

Potential hazards: bacteria.

Potential defects: spoilage, discoloration.

Potential hazards: microbiological contamination

Potential defects: decomposition, discoloration

Technical guidance:

Refer to Section E.1.1.4.

E.5.4 Splitting, gutting and washing

Potential hazards: microbiological contamination

Potential defects: presence of gut contents, parasites, shells, ink discolouration, beaks, spoilage

Technical guidance:

- Gutting should remove all intestinal material and the cephalopod shell and beaks if present.
- Any by-product of this process that is intended for human consumption, e.g. tentacles, mantle, should be handled in a timely and hygienic manner.
- Cephalopods should be washed in clean seawater or potable water immediately after gutting to remove any remaining material from the tube cavity and to reduce the level of microorganisms present on the product.
- An adequate supply of clean seawater or potable water should be available for the washing of whole cephalopods and cephalopod products.

E.5.5 Skinning, trimming

Potential hazards: microbiological contamination

Potential defects: presence of objectionable matter, bite damage, skin damage, spoilage

Technical guidance:

- The method of skinning should not contaminate the product nor should it allow the growth of micro-organisms, e.g. enzymatic skinning or hot water techniques should have defined time/temperature parameters to prevent the growth of microorganisms.
- Care should be taken to prevent waste material from cross-contaminating the product.
- An adequate supply of clean seawater or potable water should be available for the washing of product during and after skinning.

E.5.6 Use of additives

Potential hazards: physical contamination, non-approved additives, non-fish allergens

Potential defects: physical contamination, improper use of additives.

Technical guidance:

- Mixing and application of appropriate additives should be carried out by trained operators.
- The use of additives should comply with the requirements of GB 2760.

E.5.7 Grading/packaging/labelling

- Grading and packing operations should be carried out as soon as possible in order to prevent corruption cephalopods;

- If using the sulfite process, should be accurate identification.

Potential hazards: chemical or physical contamination from packaging

Potential defects: incorrect labelling, incorrect weight, dehydration

Technical guidance:

- Packaging material should be manufactured from food-grade materials.
- Grading and packaging operations should be carried out with minimal delay to prevent deterioration of the cephalopod.
- Where sulphites have been used in the process, care should be taken to ensure that they are properly labelled.

E.5.8 Freezing

Potential hazards: parasites.

Potential defects: freezer burn, decomposition, loss of quality owing to slow freezing.

Technical guidance: refer to Section E.1.3.1.

E.5.9 Packaging, labels and ingredients

Refer to Section E.1.4.

E.6 Processing of canned fish, shellfish, cephalopods and other aquatic invertebrates

E.6.1 Special requirements

Enterprises producing canned fish, shellfish, cephalopods and other aquatic invertebrates for export should comply with the relevant hygienic requirements for registration. For processing requirements, refer to CAC/RCP23-1979 (Rev. 2-1993).

E.6.2 Definitions of hazards and defects

E.6.2.1 Hazards

E.6.2.1.1 Biological hazards

a) Naturally occurring marine toxins

Biotoxins such as tetrodotoxins or ciguatoxins are known to be generally heat stable, hence, knowledge of the identity of the species and/or the origin of fish intended for processing is important. Phycotoxins such as DSP, PSP or ASP are also heat stable, hence, it is important to know the origin and the status of the area of origin of molluscan shellfish or other affected species intended for processing.

b) Scombrototoxin

For example, Histamine is heat stable, and so its toxicity remains practically intact in containers. Good practices for the conservation and handling from capture to heat processing are essential to preventing histamine production. Hence, it is important to comply with relevant standards on maximum levels of histamine.

c) Microbiological toxins

- *Clostridium botulinum*: The botulism risk usually appears after inadequate heat processing and inadequate container integrity. The toxin is heat sensitive. On the other hand, the destruction of *C. botulinum* spores, in particular from proteolytic strains, requires high sterilization values.
- *Staphylococcus aureus*: Toxins from *Staphylococcus aureus* can be present in a highly contaminated raw material or can be produced by bacterial proliferation during processing. After canning, there is also the potential risk of post-process contamination with *Staphylococcus aureus* if the warm wet containers are handled in an unsanitary manner. These toxins are heat resistant, so they have to be taken into account in the hazard analysis.

E.6.2.1.2 Chemical hazards

Care should be taken to avoid contamination of the product from components of the containers (e.g. lead) and chemical products (lubricants, sanitizers, detergents).

E.6.2.1.3 Physical hazards

Containers prior to filling may contain materials such as metal or glass fragments.

E.6.2.2 Defects

Defects include spoilage, deterioration and others which hinder food safety and hygiene and do not comply with national regulations and/or commercial specifications.

E.6.3 Processing operations

E.6.3.1 Reception of Raw material, containers, covers and packaging material and other ingredients

E.6.3.1.1 fish and shellfish

Potential hazards: chemical and biological contamination (paralytic shellfish poisoning, diarrhetic shellfish poisoning, neurotoxic shellfish poisoning, scombrototoxin, heavy metals, etc.).

Potential defects: species substitution, spoilage, parasites.

Technical guidance:

Refer to Section E.1.1.1 and other relevant parts; when live shellfish (crustaceans) are received for canning processing, an inspection should be carried out in order to discard dead or badly damaged animals.

E.6.3.1.2 Containers, covers and packaging materials

Potential hazards: bacteria.

Potential defects: product spoilage.

Technical guidance:

- a) Polymer materials, the paint, coatings and sealants used for making containers should meet hygienic requirements and contain no toxic substance. They should be kept clean and hygienic during the store and transportation.
- b) Toxicological tests should be carried out on polymer materials, the paint, coatings and sealants used for making containers. Corresponding certificates issued by the relevant official bodies should be provided;
- c) Containers and covers for canned fish and shellfish should meet the following requirements:
 - They should protect the contents from contamination by microorganisms or any other substance;
 - Their inner surfaces should not react with the contents in any way that would adversely affect the product or the containers;
 - Their outer surfaces should be resistant to corrosion under any likely conditions of storage;
 - They should be sufficiently durable to withstand the mechanical and thermal stresses encountered during the canning process and to resist physical damage during distribution.

E.6.3.1.3 other ingredients

Refer to Section E.1.4.

E.6.3.2 Storage of raw material, containers, covers and packaging materials

E.6.3.2.1 Fish and shellfish

Refer to Section E.1.1.2 and E.1.1.3.

E.6.3.2.2 Containers and packaging

Potential hazards: unlikely

Potential defects: foreign matter

Technical guidance:

Refer to Section E.1.4.2 and also:

- All materials for containers or packages should be stored in satisfactorily clean and

hygienic conditions.

- During storage, empty containers and covers should be protected from dirt, moisture and temperature fluctuations in order to avoid condensation on containers and, in the case of tin cans, the development of corrosion.
- During loading, stowing, transportation and unloading of empty containers, any shock should be avoided. Containers should not be stepped on. These precautions become more imperative when containers are put in bags or on pallets. Shocks can deform the containers (can body or flange) – this may compromise tightness (shocks on the seam, deformed flange) or be prejudicial to appearance.

E.6.3.2.3 other ingredients

Refer to Section E.1.4.2.

E.6.3.3 Unwrapping, unpacking

Potential hazards: unlikely

Potential defects: foreign matter

Technical guidance:

- During unwrapping and unpacking operations, precautions should be taken in order to limit product contamination and foreign matter introduction into the product. To avoid microbial proliferation, waiting periods before further processing should be minimized.

E.6.3.4 Thawing

Refer to Section E.1.1.4.

E.6.3.5 Fish and shellfish preparatory processes

E.6.3.5.1 Fish preparation (gutting, trimming, etc.)

Potential hazards: microbiological contamination, biochemical development (histamine)

Potential defects: objectionable matter (viscera, skin, scales, etc. in certain products), off-flavors, presence of bones, parasites, etc.

Technical guidance:

Refer to Section E.1.1.5 and E.1.1.6.

E.6.3.5.2 Preparation of molluscs and crustaceans

Potential hazards: microbiological contamination, hard shell fragments

Potential defects: objectionable matters

Technical guidance:

- When live shellfish are used, an inspection should be carried out in order to discard dead or badly damaged animals.
- Particular care should be taken to ensure that shell fragments are removed from shellfish meat.

E.6.4 Precooking and other treatment

E.6.4.1 Precooking

Potential hazards: chemical contamination (polar components of oxidized oils), microbiological or biochemical (scombrotoxin) growth

Potential defects: water release in the final product (for products canned in oil), abnormal flavours

Technical guidance:

a) General considerations.

- The choice of method used to precook fish or shellfish for canning should be based on the nature of the treated material, which should be designed to bring about the desired effect with a minimum delay and a minimum amount of handling;.
- For products canned in oil, such as sardines or tunas, precooking should be sufficient in order to avoid excessive release of water during heat processing.
- If eviscerated fish are used, then the fish should be arranged in the belly-down position for precooking to allow for the drainage of fish oils and juices, which may accumulate and affect product quality during the heating process.
- Care should be taken to prevent temperature abuse of scombrotoxic species before precooking.

b) Precooking schedule

- The precooking method, particularly in terms of time and temperature, should be clearly defined. The precooking schedule should be checked.
- Fish precooked together in batches should be very similar in size. It also follows that they should all be at the same temperature when they enter the cooker.

c) Control of quality of precooking oils and other fluids

- Only good-quality vegetable oils should be used in precooking fish or shellfish for canning.
- Cooking oils should be changed frequently in order to avoid the formation of polar compounds;
- Water used for precooking should be changed frequently in order to avoid contaminants.
- Care must be taken that the oil or the other fluids used, such as vapour or water, do not impart an undesirable flavour to the product.

d) Cooling

- Except for products that are packed when still hot, cooling of precooked fish or shellfish should be done as quickly as possible to bring the product temperatures in a range limiting proliferation or toxin production, and under conditions where contamination of the product can be avoided.

e) Use of brine and solutions of other flavouring agents

- Where fish or shellfish are dipped or soaked in brine or in solutions of other flavouring agents or additives in preparation for canning, solution strength and time of immersion should both be carefully controlled to bring about the optimal effect.
- Dip solutions should be changed frequently and dip tanks and other dipping apparatus should be thoroughly cleaned at frequent intervals.
- Care should be taken to ascertain whether or not the ingredients or additives used in

dips would be permitted in canned fish and shellfish by national standards of the exporting country and the countries where the product will be marketed.

E.6.4.2 Packing in containers

E.6.4.2.1 Filling

Potential hazards: bacteria

Potential defects: incorrect weight, foreign matter

Technical guidance:

- A representative number of containers and covers should be inspected before delivery to the filling machines or packing tables to ensure that they are clean, undamaged and without visible flaws.
- If necessary, empty containers should be cleaned. It is also a wise precaution to have all containers turned upside down to make certain that they do not contain any foreign material before they are used.
- Care should also be taken to remove defective containers, because they can jam a filling or sealing machine, or cause trouble during heat processing (inadequate sterilization, leaks).
- Empty containers should not be left on the packing tables or in conveyor systems during cleanup of premises to avoid contamination or splashes.
- Where appropriate, to prevent microbial proliferation, containers should be filled with hot fish and shellfish (for example, $> 63^{\circ}\text{C}$ for fish soups) or should be filled quickly (the shortest possible waiting period) after the end of the pretreatments.
- If the fish and shellfish must be held for a long time before packing into containers, they should be chilled.
- Containers of canned fish and shellfish should be filled as directed in the scheduled process.
- Mechanical or manual filling of containers should be checked regularly in order to comply with the filling rate and the headspace specified in the adopted sterilization schedule.
- A regular filling is important not only for economic reasons, but also because heat penetration and container integrity can be affected by excessive filling changes.
- The necessary amount of headspace will depend partly on the nature of the contents, size and type of the container. The filling should also take into account the heat processing method. Headspace should be allowed as specified by the container manufacturer.
- Containers should be filled such that the end product meets the regulatory provisions or the accepted standards concerning weight of contents.
- Where canned fish and shellfish are packed by hand, there should be a steady supply of fish, shellfish and, eventually, other ingredients. Buildup of fish and shellfish, as well as filled containers at the packing table, should be avoided.
- The operation, maintenance, regular inspection, calibration and adjustment of filling machines should receive particular care. The instructions provided by the machine manufacturer should be carefully followed.
- The quality and the amount of other ingredients such as oil, sauce, vinegar, etc.

should be carefully controlled to bring about the optimal desired effect.

- If fish has been brine-frozen or stored in refrigerated brine, the amount of salt absorbed should be taken into consideration when salt is added to the product for flavouring.
- Filled containers should be inspected to ensure that they have been properly filled and will meet accepted standards for weight of contents; also, the product quality and workmanship needs to be verified before they are sealed.
- Manual filled products such as small pelagic fish should be carefully checked by the operators to verify that container flanges or closure surface have no product residues, which could impede the formation of a hermetic seal. For automatic-filled products, a sampling plan should be implemented.

E.6.4.2.2 Sealing

Potential hazards: subsequent contamination owing to a bad seam

Potential defects: unlikely

Technical guidance:

- The operation, maintenance, regular inspection and adjustment of sealing machines should receive particular care. The sealing machines should be adapted and adjusted for each type of container and each closing method used. Whatever the type of sealing equipment, the instructions provided by the manufacturer or equipment supplier should be followed meticulously.
- Seams and other closures should be well formed with dimensions within the accepted tolerances for the particular container.
- Qualified personnel should conduct this operation.
- Vacuum packaging should be used in order to prevent the containers from bulging under any condition (high temperature or low atmospheric pressure) likely to be encountered during the distribution of the product. This is particularly useful for deep containers or glass containers. It is difficult and hardly necessary to create a vacuum in shallow containers that have relatively large flexible covers.
- An excessive vacuum may cause the container to panel, particularly if the headspace is large, and may also cause contaminants to be sucked into the container if there is a slight imperfection in the seam.
- Regular inspections should be made during production to detect potential external defects on containers.
- In order to guarantee a closure in accordance with specifications, at sufficiently close intervals, the operator, the supervisor of the closure or any other competent person should examine the seams or the closure system for the other types of containers that are used.
- At each start of the production line and at each change in container dimensions, after a jamming, a new adjustment or a restarting after a prolonged stop of the sealing machine, a check should be carried out.
- A sampling plan should be used for the checks and all appropriate observations should be recorded.

E.6.4.2.3 Coding

Potential hazards: subsequent contamination owing to damaged containers

Potential defects: loss of traceability owing to an incorrect coding

Technical guidance:

- During the on-site production, efforts should be made to ensure that each container of canned fish and shellfish should bear indelible code markings from which all-important details concerning its manufacture (the hygiene registration number of the producing enterprise type of product, the production date or expiry date, batch number, etc.) can be determined.
- Coding equipment must be carefully adjusted so that the containers are not damaged and the code remains legible.
- Coding may sometimes be carried out after the cooling step.

E.6.4.3 Handling of containers after closure (staging before heat processing)

Potential hazards: bacteria

Potential defects: unlikely

Technical guidance:

- After closure, containers should always be handled carefully in such a way as to prevent any damage capable of causing defects and microbiological recontamination.
- If the filled and sealed containers must be held for a long time before heat processing, the product should be held at temperature conditions that minimize microbial growth.
- If necessary, filled and sealed metal containers should be thoroughly washed before heat processing to remove grease, dirt and fish or shellfish stains on their outside walls.
- Every cannery should develop a system that will prevent nonheat-processed canned fish and shellfish from being accidentally taken past the retorts into the storage area.

E.6.4.4 Heat sterilization

Potential hazards: survival of spores of *C. botulinum*

Potential defects: survival of micro-organisms responsible for spoilage

Technical guidance:

a) Sterilization process specification

- To establish a plan for the sterilization process, the following basic factors and data should be taken into account: microbial flora in the canned products and their heat resistance; product types, technical conditions and formula for production, container size and shape, pH value of the product and product formulation, solids content, the storage temperature, the maximum loading weight for the can(including liquids) and the filling method; the display of cans in the retort, the lowest temperature and air evacuation method, the form and characteristics of the sterilization system, the temperature and time of sterilization, back pressure and cooling method, etc.
- Heat distribution in retorts should be regularly checked and validated by the competent authority. Only those retorts which meet the standards within the validity period of the test can be used for processing canned products.

- Before any changes in operations are made, competent technologists should be consulted as to the need for re-evaluation of the process.

b) Heat sterilization processing operation

- Only qualified and properly trained personnel should operate retorts to ensure standard processing operations. It is necessary to maintain true and accurate records.
- It is essential to comply with the initial temperature described in the schedule process. If the filled containers have been held at refrigerated temperatures before heat processing, the sterilization schedule should take into account these temperatures.
- In order that the heat processing is effective and processing time is controlled, air must be evacuated from the retort through a venting procedure that is deemed efficient by a competent technologist.,
- Retort installation and loading equipment and procedures should be determined based on container size and type.
- The timing of the heat processing should not commence until the specified heat processing temperature has been reached, and the conditions to maintain uniform temperature throughout the retort achieved, in particular, until the minimum safe venting time has elapsed.
- For other types of retorts (water, steam/air, flame, etc.), refer to CAC/RCP 23-1979(Rev. 2-1993).
- If canned fish and shellfish in different size containers are processed together in the same retort load, care must be taken to ensure that the process schedule used is sufficient to provide commercial sterility for all container sizes processed.
- When processing fish and shellfish in glass containers, care must be taken to ensure that the initial temperature of the water in the retort is slightly lower than that of the product being loaded. The air pressure should be applied before the water temperature is raised.

c) Monitoring of heat sterilization processing operation

- During the application of heat processing, it is important to ensure that the sterilization process and factors such as container filling, minimal internal depression at closing, retort loading and initial product temperature are in accordance with the sterilization schedule.
- Retort temperatures should always be determined from the indicating thermometer, never from the temperature recorder.
- Permanent records of the time, temperature and other pertinent details should be kept concerning each retort load.
- The thermometers should be tested regularly to ensure that they are accurate. Calibration records should be maintained; the recording thermometer readings should never exceed the indicating thermometer reading.
- Inspections should be made periodically to ensure that retorts are equipped and operated in a manner that will provide thorough and efficient heat processing, and that each retort is properly equipped, filled and used, so that the whole load is brought up to processing temperature quickly and can be maintained at that temperature throughout the whole of the processing period.
- The inspections should be made under the guidance of a competent technologist.

E.6.4.5 Cooling

Potential hazards: recontamination owing to a bad seam and contaminated water

Potential defects: formation of struvite crystals, buckled containers, scorch

Technical guidance:

- After heat processing, canned fish and shellfish should, wherever practical, be water cooled under pressure to prevent deformations, which could result in a loss of tightness. Where water is recycled, potable water should always be chlorinated (or other appropriate treatments used) for this purpose. The residual chlorine level in cooling water and the contact time during cooling should be checked in order to minimize the risk of post-processing contamination. The efficiency of the treatment other than chlorination should be monitored and verified.
- In order to avoid organoleptic defects in the canned fish and shellfish, such as scorch or overcooking, the internal temperature of containers should be lowered as quickly as possible.
- For glass containers, the temperature of the coolant in the retort should be, at the beginning, lowered slowly in order to reduce the risks of breaking owing to thermal shock.
- Where canned fish and shellfish products are not cooled in water after heat processing, they should be stacked in such a way that they will cool rapidly in air.
- Heat-processed canned fish and shellfish should not be touched by hand or articles of clothing unnecessarily before they are cooled and thoroughly dry.
- They should never be handled roughly or in such a way that their surfaces, and in particular their seams, are exposed to contamination.
- Rapid cooling of canned fish and shellfish avoids the formation of struvite crystals.
- Every cannery should develop a system to prevent unprocessed containers being mixed with processed containers.

E.6.4.6 Monitoring after heat sterilization and cooling

- Canned fish and shellfish should be inspected for faults and for quality assessment soon after they are produced and before labelling. If there are any faults owing to failings on the part of cannery workers or canning equipment, these failings can be corrected without delay. Segregating and properly disposing of all defective units or lots that are unfit for human consumption should be ensured.
- Representative samples from each code lot should be examined to ensure that the containers do not exhibit external defects and the product meets the standards for weight of contents, vacuum, workmanship and wholesomeness. Texture, colour, odour, flavor and condition of the packing medium should be assessed.

E.6.4.7 Labelling, casing and storage of finished products

Potential hazards: subsequent recontamination owing to container damage or exposure to extreme conditions

Potential defects: incorrect labelling

Technical guidance:

Refer to Section 9.

E.6.4.8 Transportation of finished products

Potential hazards: subsequent recontamination owing to container damage or exposure to extreme conditions

Potential defects: unlikely

Technical guidance:

Refer to Section 9.3. Cases and boxes should be completely dry. In fact, moisture has negative effects on the mechanical characteristics of boxes and the protection of containers against damage during transportation may not be sufficient. Metal containers should be kept dry during transportation in order to avoid corrosion and/or rust.