codex alimentarius commission

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

WORLD HEALTH ORGANIZATION

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ALINORM 99/18

JOINT FAO/WHO FOOD STANDARDS PROGRAMME

CODEX ALIMENTARIUS COMMISSION
Twenty-third Session
Rome, 28 June - 3 July 1999

REPORT OF THE TWENTY-THIRD SESSION OF THE CODEX COMMITTEE ON FISH AND FISHERY PRODUCTS
Bergen, Norway, 8-12 June 1998

Note: This document incorporates Circular Letter CL 1998/23-FFP

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CX 5/15 **CL 1998/23-FFP**
July 1998

TO: - Codex Contact Points
- Interested International Organizations
- Participants at the 23rd Session of the Codex Committee on Fish and Fishery Products

FROM: - Secretary, Codex Alimentarius Commission, Joint FAO/WHO Food Standards Programme, FAO, 00100 Rome, Italy

SUBJECT: **Distribution of the Report of the 23rd Session of the Codex Committee on Fish and Fishery Products (ALINORM 99/18)**

A. MATTERS FOR ADOPTION BY THE 23rd SESSION OF THE CODEX ALIMENTARIUS COMMISSION

Draft Guidelines at Step 8 of the Procedure

1. Draft Guidelines for the Sensory Evaluation of Fish and Shellfish in Laboratories (para. 34, Appendix II)

Governments wishing to propose amendments or comments on the above documents should do so in writing in conformity with the Guide to the Consideration of Standards at Step 8 (see Procedural Manual of the Codex Alimentarius Commission) to the Secretary, Joint FAO/WHO Food Standards Programme, FAO, via delle Terme di Caracalla, 00100 Rome, Italy **before 30 March 1999**.

Proposed Draft Standard at Step 5 of the Accelerated Procedure

2. Proposed Draft Amendment to the Standard for Canned Sardines and Sardine-Type Products (Inclusion of an additional species) (para. 22, Appendix III)

Governments wishing to submit comments on the implications which the Proposed Draft Amendment may have for their economic interests should do so in writing in conformity with the Accelerated Procedure for the Elaboration of Codex Standards to the Secretary, Joint FAO/WHO Food Standards Programme, **before 30 March 1999**.

B. REQUEST FOR COMMENTS AND INFORMATION

Draft Standards at Step 6 of the Procedure

3. Draft Standard for Dried Salted Anchovies (para. 76, Appendix IV)

4. Draft Standard for Crackers from Marine and Freshwater Fish, Crustacean and Molluscan Shellfish (para. 85, Appendix V)

Draft Standard at Step 3 of the Procedure

5. Proposed Draft Standard for Salted Atlantic Herring and Salted Sprats (para. 93, Appendix VII)

Governments wishing to submit comments on points 3, 4, and 5 should do so in writing to the Secretary, Joint FAO/WHO Food Standards Programme, FAO, via delle Terme di Caracalla, 00100 Rome, Italy, **before 1 June 1999.**

Proposed Draft Code of Practice at Step 3 of the Procedure

6. Proposed Draft Code of Practice for Fish and Fishery Products (para. 65, Appendix VI)

Governments are invited to provide comments and proposals on the questions identified for further consideration in paragraphs 40 to 63 of the present report and on the sections which remain to be developed.

Governments wishing to submit comments should do so in writing to the Secretary, Joint FAO/WHO Food Standards Programme, FAO, via delle Terme di Caracalla, 00100 Rome, Italy, **before 15 December 1998.**

SUMMARY AND CONCLUSIONS

The summary and conclusions of the 23rd Session of the Codex Committee on Fish and Fishery Products are as follows:

Matters for adoption by the Commission:

The Committee:

- agreed to advance to Step 8 the Draft Guidelines for the Sensory Evaluation of Fish and Shellfish in Laboratories (para. 34, Appendix II)

- agreed to advance to Step 5 of the Accelerated Procedure the Proposed Draft Amendment to the Standard for Canned Sardines and Sardine-Type Products (inclusion of an additional species: *Clupea bentincki*) (para. 22, Appendix III)

Other matters of interest to the Commission:

The Committee:

- agreed to return to Step 6 the Draft Standard for Dried Salted Anchovies (para. 76, Appendix IV) and the Draft Standard for Crackers from Marine and Freshwater Fish, Crustacean and Molluscan Shellfish (para. 85, Appendix V);

- agreed to return to Step 3 the Proposed Draft Standard for Salted Herring and Salted Sprats (para. 93, Appendix VII)

- agreed to return to Step 3 the Proposed Draft Code of Practice for Fish and Fishery Products, which would incorporate all current codes of practice and the new codes under development (frozen surimi and aquaculture) (para. 65, Appendix VI)

- decided to proceed with the drafting of a model certificate for fish and fishery products (para. 101)

- decided to proceed with the elaboration of standards for molluscan shellfish and smoked fish (paras. 94-96)

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INTRODUCTION

1. The Codex Committee on Fish and Fishery Products held its Twenty-third Session in Bergen, Norway, from 8 to 12 June 1998, by courtesy of the Government of Norway. The Session was chaired by Dr John A. Race, Norwegian Food Control Authority. The Session was attended by 129 delegates and observers representing 38 member countries and 1 international organization. The complete list of participants is attached as Appendix 1 to this report.

OPENING OF THE SESSION (Agenda Item 1)

2. The session was opened by Mr. Peter Gullestad, Director-General of Fisheries, who welcomed the participants, especially those participating for the first time, on behalf of the Norwegian Minister of Fisheries, and noted that the increased number of delegates and observers present showed that there was great interest in the work of the Committee. He emphasized the importance of the Codex Alimentarius Commission's work in view of its relevance for international trade in food in general, and because of its great significance in relation to the World Trade Organization and the Agreement on the Application of Sanitary and Phytosanitary Measures, as well as the Agreement on Technical Barriers to Trade. Mr. Gullestad stressed the fact that all Codex documents should be based on sound scientific analysis and evidence, involving a thorough review of all relevant information. He pointed out the importance of reaching decisions by consensus on controversial issues and wished the participants all success in their activities.

ADOPTION OF THE AGENDA (Agenda Item 2)[1]

3. The Committee adopted the Provisional Agenda as proposed. It was noted that the documents for Agenda Items 13, 14 and 15 were distributed as Conference Room Documents due to their late availability and the Committee agreed to have only an initial discussion on these matters. The Chairman informed the Committee that Agenda Items 7, 8 and 9 would be discussed under Agenda Item 6 - Proposed Draft Code of Practice for Fish and Fishery Products.

MATTERS ARISING FROM THE CODEX ALIMENTARIUS COMMISSION AND OTHER COMMITTEES (Agenda Item 3)[2]

4. With reference to the request of the Commission concerning the elaboration of standards for tropical fish and freshwater fish, the Committee expressed its willingness to consider any specific proposal which would be made in this respect, and recalled that standards were of a general nature and applied to all fish species covered by their scope. The Committee noted that specific remarks concerning the application of the Code of Practice for Fish and Fishery Products in tropical conditions would be considered under Agenda Item 6.

Committee on Food Hygiene

5. The Committee noted that the matter of the residual levels of chlorine in shrimps and prawns had been referred back by the Committee on Food Hygiene, which had recommended that a paper be prepared on this question. The Committee was informed that the use of chlorinated water was common practice in a number of countries, while it was prohibited by EC legislation, and recognized that this matter required further discussion as significant differences in approach existed among member countries. The Committee welcomed the offer of

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1 CX/FFP 98/1

2 CX/FFP 98/2, CX/FFP 98/2-Add. 1 (comments from the United States) and Add. 2 (comments from South Africa), CRD 6, CRD 6-Add.1 and 2 (additional information on methods of analysis)

FAO and WHO to prepare a discussion paper on the use of chlorinated water and agreed that a Circular Letter would ask member countries to provide information on their experience in this area, in order to facilitate the preparation of the document.

Committee on Food Labelling

6. In addition to the matters presented in the document, the Committee was informed that the last Session of the Committee in Food Labelling (May 1998) had advanced to Step 8 the Draft Amendment to the Labelling Provisions of the Standard for Fish Fingers (Fish Sticks) Fish Portions and Fish Fillets - Breaded or in Batter, whereby the declaration of the proportion of fish core was requested. Some delegations expressed their concern about this decision and it was noted that they had an opportunity to submit their comments to the Commission at Step 8. The Committee noted that the EC legislation did not any longer refer to fish core but to fish contents, as water and additives should be excluded from the declaration (see also para. 102).

Committee on Methods of Analysis and Sampling

Determination of Salt Content in Salted Fish of the *Gadidae* Family

7. With reference to the proposal of the Committee on Methods of Analysis and Sampling to consider the general method for the determination of salt content, the Delegations of Germany and Norway confirmed that they had developed a specific method for products with a high salt content as the general method was not appropriate in such cases, and the Committee agreed to retain the current method. As it was recalled that the relevant data should be submitted to the CCMAS to allow for the endorsement of the method, the Delegation of Germany indicated that performance characteristic data would be forwarded in due time.

Thawing Procedures - Standard for Quick Frozen Blocks of Fish Fillets, Minced Fish Flesh and Mixtures of Fillets and Minced Fish Flesh

8. Following its discussions at the last session, the Committee considered several documents including comments and proposals relating to methods of analysis, which were introduced by Dr. Jane Fox-Dobson of the United States.

9. The Committee agreed to correct the section on Thawing Procedures - Water Immersion Method in the standard to indicate that the frozen fish blocks were "sealed in plastic bags" and to correct the temperature to 21°C ± 1.5°C (70°F ± 3°F), as these had been initially included in the text.

Proportion of Fish Flesh in Fish Sticks

10. The Committee was informed by the Delegation of the United States that, as a result of a collaborative study carried out with collaborators from the USA and Canada, a modification had been adopted to AOAC Official Method 971.13 for the determination of fish flesh content in frozen coated fish products, currently referred to in the standard. The modified method was adopted as AOAC Official Method 996.15[3]. The Committee therefore agreed that the new reference should be included in the standard.

11. The Delegation of the United States indicated that it also appeared from the study that the mean determined percent fish flesh (DPFF) for the modified AOAC method was less than the mean actual percent fish flesh (APFF) for the on-line method for 29 out of 36 products tested, which corresponded to 4 different percentages of fish flesh, 3 raw materials, 4 forms of processing and 4 styles of products, with a total of 6336 test samples. On the basis of the report, the Delegation proposed to add the following fish flesh adjustments to the

[3] Journal of AOAC International (Volume 80, No.6, 1235-1271)

determined percent fish flesh (DPFF) according to the product styles: raw breaded 2%; precooked 4%; batter-dipped 2%. This would account for the influence of analytical methods and processing factors: preservatives (phosphates); tempering of fish blocks; viscosity and temperatures of batters; time and temperatures associated with cooking, freezing, and storage.

12. The Delegation of France expressed the view that it may be premature to include this amendment to the method as no study had been carried out so far in other countries on the need for adjustment factors. The Committee however noted that this proposal would be forwarded to the CCMAS for endorsement and that member countries would have the opportunity to provide their comments to CCMAS.

13. The Committee agreed to include in the standard a reference to AOAC Method 996.15 with an adjustment factor of 2% for raw breaded and batter-dipped products; 4% for precooked products, subject to endorsement by the CCMAS.

Weight Determination for Quick Frozen Shrimps and Prawns

14. The Committee recalled that its last session had discussed this question and encouraged member countries to perform comparative studies on the methods for net weight determination for all products covered by the standards. The Delegation of the United States presented the results of a pre-collaborative study comparing the precision and accuracy of the official AOAC Method with other selected methods for determining the net weight of IQF-glazed shrimp and block-glazed shrimp.

15. Test samples were subjected to water with or without sodium tripolyphosphate (STP). During deglazing (IQF-glazed shrimp only) and/or thawing, test samples were allocated to assess the effects of STP presence, sieve mesh sizes and sieve diameters. The effects of using sieve weights (dry and wet) in combination with paper towels usage and tared pan weight when calculating the determined net weights were also assessed. The Modified AOAC^{pb} Method 967.13 and the Air Thaw Method seemed to be the best methods (for accuracy and precision) to determine the net weight of IQF- and block-glazed shrimps and, as a result of this study, these methods and the official AOAC Methods 963.18 and AOAC Method 967.13 would be tested in a collaborative study.

16. The Committee expressed its appreciation to Dr. Fox-Dobson and the Delegation of the United States for this comprehensive work and discussed a proposal to include Modified AOAC^{pb} Method 967.13 on an interim basis for the determination of net weight (in the thawed state) in the standard for Quick-Frozen Shrimps and Prawns. It was pointed out that there was currently no method for this determination and that it would be useful to include it even on an interim basis.

17. Some delegations however pointed out that they needed more time to consider the information provided by the United States and it was agreed that the detailed study would be circulated for the information and comments of member countries, to allow further consideration of this matter at the next session.

Proportion of Fish Fillet and Minced Fish

18. The Delegation of South Africa presented the data which had been collected in that country on the application of the WEFTA method to certain species of hakes from the Southern Hemisphere, and highlighted the differences in the results with firm flesh species. As the amounts of minced flesh recovered for soft textured hakes, and the excess mince was generally higher when storage time was longer. The Delegation consequently proposed that a 5% allowance be made for soft fleshed species such as hake.

19. The Committee noted that the CCMAS was scheduled to consider the endorsement of this method in the light of data to be submitted by the United Kingdom, and agreed that the results and proposals provided by South Africa would also be forwarded to the CCMAS for review at its next session (December 1998).

INCLUSION OF ADDITIONAL SPECIES IN FISH STANDARDS (Agenda Item 4)[4]

20. The Committee recalled that during its 22nd session, it was agreed that a Working Group consisting of Germany (lead country), Finland and France should carry out sensory tests with products processed from new species for inclusion into the relevant Codex Standards. It was proposed to include *Allothunus fallai, Auxis rochei* and *Auxis thazard* into the Standard for Canned Tuna and Bonito and *Clupea bentincki* into the Standard for Canned Sardines and Sardine-type Products, following the Accelerated Procedure as agreed by the Commission[5].

Clupea bentincki

21. The Delegation of Germany introduced the document on behalf of the working group and informed the Committee that results on complete independent sensory evaluation of samples of *Clupea bentincki* were obtained from three laboratories of the above mentioned countries. It was pointed out that the quality of canned *Clupea bentincki* was equivalent to other sardine and sardine-type products. The conclusion from the three participating laboratories was that *Clupea bentincki* should be included into the Codex Standard for Canned Sardines and Sardine-type products as a new sardine-type species. Several delegations supported this proposal.

22. The Committee expressed its appreciation to the countries which had carried out the tests and agreed to accept the conclusion of the working group for the inclusion of *Clupea bentincki* into the Standard for Canned Sardine and Sardine-type Products. The Committee agreed to forward this Proposed Draft Amendment to Step 5 of the Accelerated Procedure, for final adoption by the 23rd Session of the Commission (see Appendix III).

Other species

23. As regards *Allothunnus fallai, Auxis rochei* and *Auxis thazard* the Committee was informed that canned samples were obtained from France (*Thunnus albacares)*, Spain (*Thunnus albacares* and *Thunnus alalunga)*, Philippines (*Katsuwonus pelamis)* and Thailand (*Auxis thazard)*. Thailand communicated that samples of *Auxis rochei* were difficult to send because of deficiency of raw fish, as this migratory species was not always present in the waters of that country. The Delegation of the United States stated that the species, which its national industry proposed to include into the standard, were not generally available, and it was difficult to process products consisting of a single species.

24. The Committee was informed that the working group had decided to wait until all samples of new species had arrived before a sensory trial was made. The Committee recognized the difficulties in obtaining samples of some tuna species and decided to keep this question under review for the three species considered. The countries which had performed the tests indicated their willingness to proceed with this work if adequate samples of the species under consideration became available.

25. As regards the proposal of Chile, the Committee decided to discuss it under Agenda Item 16 (Other Business) as the document presented proposed a new approach to the subject - a proposal to elaborate a separate standard for Chilean langostino.

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4 CX/FFP 98/3, CRD 1 (comments from Chile), CRD10 (EC)

5 ALINORM 97/18, paras. 23-28

DRAFT GUIDELINES FOR THE SENSORY EVALUATION OF FISH AND SHELLFISH (Agenda Item 5)[6]

26. The Chairman recalled that the 22nd Session of the CAC adopted the Draft Guidelines at Step 5 and agreed that the sensory evaluation of cephalopods should be considered in view in their importance in international trade, and that the Proposed Draft Section for Training was circulated for comments at Step 3. In order to facilitate deliberation, it was proposed to establish an *ad hoc* Working Group.

27. The Working Group was asked to consider the comments received in writing and made during the general discussion, which reflected the following concerns related to the title, the scope and other parts of the document, in particular: a) the guidelines should be usable by industry as well as food inspectors, b) the title should reflect that sensory analysis was intended to detect defects, c) in general the document was too prescriptive, especially descriptions of training procedures and procedures for harmonization, and e) the training section and the rest of the Guidelines should be advanced to the same Step of the Procedure.

28. The Committee agreed to specify in the scope that the guidelines were intended for use by industry as well as regulatory authorities and that emphasis was on laboratory facilities although in practice evaluation was carried out at other locations in the field. It was recognized that industry analysis emphasized grading while regulatory analysis focused on fitness for consumption; it should be made explicit that the document applied to any fish standard referring to decomposition; the details provided in some sections should be removed and the description of facilities should be more conceptual. Some delegations expressed their concern that the training section might be too prescriptive in a document which would be used as a reference in international trade, as training programmes and methods differed among member countries.

29. The Chairman of the Working Group, Dr. George Hoskin (USA), informed the Committee that the group had reached consensus on the main issues identified in the general discussion and introduced a revised document, incorporating the section on training. The Committee considered the revised text section by section and agreed to the following amendments.

30. The title of the document was changed to “Draft Guidelines for the Sensory Evaluation of Fish and Shelfish in Laboratories” in order to reflect its contents more accurately. Inspection Laboratories were renamed as “Laboratories for Sensory Evaluation”. The document was shortened since unnecessary specifics were taken out but the main parts of the text were kept unchanged as much as possible. In Section 3.3 Cooking, it was agreed to insert the wording of the Standard for Quick Frozen Fish Fillets.

31. The Committee agreed that the Table of Attributes was a good basis for assessment but should not be exhaustive as the essential requirement was that analysts should be properly trained. The proposal from Spain on cephalopods was included into the table, and a reference to “sour” was added in that section. The presence of «ink» was questioned and the Committee agreed that it could be taken out since there was no definiton of “ink”.

32. The Committee agreed that the sections on training should include the screening of assessors as to several essential attributes, and that emphasis should be put on regular recalibration of analysts, to ensure that the performance and consistency of analytic decisions was maintained. Following a question concerning the use of the existing ISO standard on sensory evaluation in relation to the current text, the Committee noted that the Guidelines were more specific in their scope and purpose but could be used in addition to the existing ISO document, which concerned sensory evaluation in general.

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6 CL 1997/22-FFP; CX/FFP 98/4-A (comments from Costa Rica, Cuba, Spain); CX/FFP 98/4-B (Czech Republic, Denmark, India, New Zealand, Norway, United States); CX/FFP 98/4-C (Italy, Japan); CX/FFP 98/4-D-CRD 12 (Australia, Egypt, Poland); CRD 2 (Thailand); CRD 10 (EC); CRD 14 (Mexico).

33 The Committee agreed that some further reorganization within the sections would be helpful, and in particular moving Table 1 (Attributes) into Annex 1, including the sections on a training course in Annex III and combining all literature references into a single section at the end of the document. The Committee expressed its appreciation to Dr. Hoskin and to the members of the Working Group for their excellent work, and recognizing that the document was significantly improved, agreed that part one on Sensory Evaluation and part two on the Training of Assessors could be merged into a final document.

Status of the Draft Guidelines for the Sensory Evaluation of Fish and Shelfish in Laboratories

34. The Committee agreed to advance part one of the document on Sensory Evaluation to the Commission for adoption at Step 8 and part two on the Training of Assessors to Step 5 with a recommendation to the Commission to omit Steps 6 and 7 and to adopt it at Step 8 of the Procedure (see Appendix II).

PROPOSED DRAFT CODE OF PRACTICE FOR FISH AND FISHERY PRODUCTS (Agenda Item 6)[7]

35. The Committee recalled that its last session had agreed that the combined Code for Fresh Fish, Frozen Fish and Minced Fish would be used as a template for the revision of the other codes, and that the countries responsible for individual codes would meet between sessions to coordinate the revision and ensure a common approach. Two Working Groups had been held since the last session, in 1996 in Ottawa, Canada, and in 1997 in Bergen, Norway for this purpose.

36. The Delegation of the United Kingdom presented the revised text, which had been drafted as a result of the decision of the second Working Group to combine all codes into a single document, as it had been recognized that many common elements existed in the codes and that duplication should be avoided. The combined Code included the codes under consideration at the last session : Fresh Fish, Frozen Fish, Minced Fish, Canned Fish, Surimi, Smoked Fish, Salted Fish and it had also been decided in principle to include the codes which had not yet been specifically discussed: Cephalopods, Crustaceans, as well as the Molluscan Shellfish and Aquaculture Codes. In this respect, some delegations suggested that there might be a need for two codes, one for pre-harvest operations and one for processing, and the Committee noted that this might be considered in the future. The Delegation of the United Kingdom pointed out that the purpose of the revision was to make the codes more understandable and easily applicable, as they were intended to facilitate compliance with the relevant Codex standards. The revised text included pre-requisite programmes which were required for the implementation of HACCP principles and of a similar system for quality aspects. The Delegation of Norway asked for a clarification of the status of the Codes of Practice in relation to the WTO SPS Agreement. The Secretariat recalled that the SPS Agreement applied only to measures related to food safety and referred to the letter from the Chairman of the SPS Committee, which clarified that the Agreement did not establish distinctions between Codex standards, guidelines and other texts in this respect.

37. The Committe had a general exchange of views and agreed to the overall approach taken to the revision of the code, and especially the following principles: the incorporation of all current codes into a single text; the use of the code as a stand-alone document without referring to other codes (such as the General Principles of Food Hygiene for general requirements); the use of a system similar to HACCP for non-safety provisions, with the application of Defect Action Points (DAPs). The Committee considered the proposed draft code section by section and made the following amendments.

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7 CX/FFP 98/5, CX/FFP 98/5-Add.1 (comments from Poland, Spain), CRD 7 (USA),CRD 9 (Thailand), CRD 10 (EC), CRD13 (South Africa, New Zealand),
CX/FFP 98/8, CRD 16 (comments of New Zealand on Aquaculture)

Introduction - How to use this code

38. The Committee agreed to delete the reference to "HACCP-based principles" throughout the text and to replace it with "a similar approach" to HACCP as the reference to HACCP principles when the HACCP system as such was not applied could be misleading.

Section 1. Scope

39. The exception relating to processing of fish sticks or portions was deleted as it was intended that such products would also be covered by the code.

Section 2. Definitions

40. A reference to a definition for aquaculture was inserted in the general definition, as the relevant code was integrated into the general text. The Committee agreed to use the general Codex definiton of «contaminant» rather than the definition specific to food hygiene, as other types of contamination should be covered.

41. The Committee agreed to refer to "approximately 0°C" in the definition of "chilled sea water", in view of the practical difficulties to reach this temperature, and also clarified the definition of "chilling". The definition of "Disinfection" was amended for consistency with the General Principles of Food Hygiene. The Committee agreed to a definition of "fish" which did not include shellfish. The definition of "Processing facility" was clarified by a reference to "processing vessels". The Committee agreed that "Validation" should be defined as it was required in the application of the HACCP system.

42. In the section on Fresh, Frozen and Minced Fish, it was agreed that candling applied to «fish or part of fish» according to the size of the fish. In the section on Salted Fish, it was agreed that maturation should be added to the list in square brackets, for further definition. The Committee agreed to put in square brackets the current limit of 2% fat for fatty fish, as it did not seem to correspond to current practice. In the section on Smoked Fish, it was agreed that liquid smoke was also used and its definition should be included in the future. The Committee noted that the definitions relating to Canned Fish should be checked for consistency with the Code of Practice on Low-Acid Canned Foods.

Section 3. Pre-Requisite Programme

43. The Delegation of New Zealand pointed out that some aspects were missing, such as waste disposal and transportation, and that reference should be made to the General Principles of Food Hygiene. The Committee recognized that as a rule the Principles should be followed closely. The Delegation of the United Kingdom indicated that this section had been drafted when the code incorporated only fresh, frozen and minced fish and that further consideration should be given to other relevant aspects of the programme, since the code was intended to apply to all fish and fishery products.

44. The Delegation of Norway expressed the view that the implementation of the programme should be adequately documented; it was noted that this question should be further considered. The Committee agreeed that section 3 would be redrafted along the lines proposed.

Section 4. Principles and Development of HACCP-based Systems

45. The Delegation of the United States proposed to amend the current text to make it clear that the HACCP system and principles as such applied only to safety, while other systems using a similar approach may be used for other aspects. Other delegations supported this position, stressing the importance of safety concerns, and the need to establish a difference with requirements applying to non-safety criteria. In reply to a question,

the Secretariat recalled that the first principle of HACCP was to conduct a hazard analysis, which could not apply when the objective was not safety-related. The Committee agreed to refer to the application of HACCP and to «a similar approach involving many of its principles» for a broader application in the Preamble.

Section 4.3 Application

46. The Committee had an exchange of views on the opportunity of requiring the application of a similar approach to HACCP to aspects other than safety, as some delegations felt that this would ensure compliance with quality requirements. The Committee recognized that recommendations could be made in this sense but that definite requirements should apply only to food safety. It was therefore agreed to indicate that «..each facility should implement a food safety management system based on HACCPprinciples, and should at least consider a similar approach to defects, both of which are described in this Code», and other amendments were made to the text in the same perspective.

47. The Committee agreed to retain the flow diagram, as required in the HACCP Guidelines, while noting that it was not mandatory in the legislation of some countries. The Delegation of Thailand pointed out that the inclusion of the DAPs in the same diagram as HACCP may give the impression that they were also required; as it was not practical to split the diagram, a footnote was included to clarify that «a similar approach can also be applied to DAPs». The mention «if required» was added to point 12 on record-keeping for the DAPs.

48. The Delegations of South Africa and Marocco pointed out that the examples might create confusion as the industry sometimes used them as they were; the need to establish specific flow diagrams adapted to the process should be emphasized.

49. In the section on Nematodes, it was proposed to change the temperature from 55°C to 60°C, as required in EC legislation and this figure was put in square brackets, as well as the requirement for freezing at -20°C for 24 hours in the fish core. The Observer from the EC informed the Committee that, according to a report of the Scientific Committee for Foods on nematodes, the presence of Anisakis was not rare but may be misdiagnosed and create allergic reactions. The Committe noted that a combination of salt and acetic acid could also kill nematodes. The Delegation of China pointed out that the intended use of the fish (i.e. cooked or raw) should also be made clear to the consumer. In Table 2, The Committee agreed with the proposal of Japan to list ciguatoxin with chemical hazards and that physical hazards included the presence of metal fragments.

50. As regards the general approach to the revision of section 4, the Committee agreed to:

- include a more detailed description of HACCP and how to apply it;
- select a process and use this to show how an example could be worked through for both a CCP and a DAP;
- revise Table 2 giving examples of major hazards for the various product types.

The Committee also agreed that the titles of specific sections (5 to 13) would not refer to «Application of HACCP to Processing of...» but to «Processing of..» as the application of HACCP was addressed in Section 4.

Section 5. Processing of Fresh, Frozen and Minced Fish

51. The Delegation of the United States pointed out that many elements covered by this section and other similar sections in the Code did not actually relate to HACCP but rather to Good Manufacturing Practice and would be more relevant in section 3, and stressed the need to separate clearly quality from safety aspects.

52. The Delegation of Israel proposed that heavy metals should be considered in the list of hazards. In Section 5.2, the Delegations of South Africa and Thailand expressed their concern with the requirements for a temperature as close as possible to 0°C, in view of the difficulties to achieve this in tropical conditions. In section 5.3.5, the Committee agreed to indicate that raw materials should be segregated «as appropriate» as different species could be processed together in the production of minced fish.

53. The Committee noted that there were differences in the identification of hazards across the sections, and the degree of precision and detail as to corrective action. The Committee had an exchange of views on the best approach to be followed to list hazards, as some delegations felt that the sections should not be too prescriptive while other delegations stressed that the CCPs should be identified clearly. In order to harmonize presentation, it was decided that the control boxes would be deleted and the flow diagrams would include the relevant reference to hazards. The Committee also recognized that some parts of Section 5 should be transferred to Section 3, as they related to the pre-requisite programme. In relation to section 5 and subsequent sections, the Committee generally agreed to delete the various CCP and DAP boxes; to revise the text parts of the sections and include only GMP requirements in section 3; for the remaining text, to identify those parts relating to safety and those relating to non-safety aspects.

Section 6. Molluscan Shellfish

54. The Delegation of New Zealand pointed out that there were too many CCPs and that they did not always actually correspond to hazards, or did not identify them clearly. The Committee noted that following its decision to delete the CCP boxes, the examples should be reviewed and the various hazards would be identified in the flow diagram.

Section 7. Crustaceans and Section 8. Cephalopods

55. The Delegation of Brazil agreed to undertake the drafting of a section on lobsters and the Delegation of Mexico agreed to continue its work on a section on shrimps and prawns, for inclusion on the general section on Crustaceans. The Delegation of New Zealand agreed to undertake the drafting of a section on Cephalopods, in the light of the decisions of the Committee concerning other sections.

Section 9. Salted Fish

56. In reply to a question on section 9.4.4., the Committee recalled that the general requirement for salted fish was set out in the first indent, whereby maturing time depended on fish, temperature and the amount of salt absorbed, while curing at a temperature of 0 to 50°C applied only to *Clupeidae* and *Scombridae* in order to control the presence of histamine.

Section 10. Smoked Fish

57. The Delegation of Denmark indicated that the corresponding standard would focus on the cold-smoked products as they were the object of significant trade, and the Committee noted that in addition to salmonids, smoked hakes were also concerned. The Representative of WHO however pointed out that there was significant trade in some species of hot-smoked fish exported from South-East Asia and these should also be taken into consideration. The Delegation of Norway pointed out that other hot-smoked products such as mackerel, sprat and herring were found on the market. The Committee confirmed that in any case the code should apply to smoked fish in general, whether hot-smoked or cold-smoked. The Delegation of New Zealand noted that there were inconsistencies between CCPs in the flow diagram and in the control boxes and suggested that this should be revised.

Section 11. Canned Fish

58. The Committee noted that in this section the reference to "canned fish" also included canned shellfish. The Delegation of Japan pointed out the specific hazard related to cooling with water when the cans were not well sealed. The Delegation of France indicated that in the flow diagram this hazard had been taken into account in the CCP on "heat processing", but that it would be identified separately if required as "cooling".

Section 12. Frozen Surimi

59. The Committee noted that the detailed CCP boxes would be deleted and that the flow diagram would have to identify the hazards and CCPs.

Section 13. Aquaculture

60. The Committee confirmed that the definition of aquaculture should cover fish, crustaceans and molluscan shellfish, and agreed that the general FAO definition used in the Introduction was too broad and should be revised as it did not correspond exactly to the scope of the text. The Representative of WHO recalled that the code applied to intensive aquaculture, which was understood as high density farming, with regular stocking from hatcheries, the use of formulated feed and medication, and that the extensive farming systems prevailing in many developing countries was not covered.

61. The Committee recalled that the section on veterinary drugs had been drafted by the Committee on Residues of Veterinary Drugs in Foods. The Delegation of Norway indicated that its national legislation did not allow any detectable residue in fish. The Delegations of Norway and Japan considered that the withdrawal period should be long enough to ensure zero residue levels and that pre-slaughter control was an additional way to ensure compliance. The Observer from the EC pointed out that EC legislation requested a strict control on the use of veterinary drugs, with prescription under veterinary supervision and specific MRLs but no pre-slaughter control.

62. The Delegation of Thailand pointed out that even in the case of intensive aquaculture, record-keeping would not be practical for small farms, and it was noted that the introduction provided for the adaptation of the requirements to local conditions. The Committee noted the proposal of the Delegation of Germany concerning a reference to animal welfare in this section, and that Guidelines had been prepared by the Council of Europe in this area.

Optional Requirements

63. The Committee agreed that the reference to "critical bone" should be deleted, and that the use of merit points for surimi should be clarified.

General Conclusion

64. The Committee expressed its appreciation for the extensive work carried out by the Working Group, the lead countries, FAO and WHO, and recalled that these would proceed with the revision of the code, with the participation of all interested countries, as follows:

United Kingdom /Canada	Frozen, Fresh and Minced Fish
France	Canned Fish
Netherlands	Molluscan Shellfish
Japan/USA	Frozen Surimi
Norway	Salted Fish
Denmark	Smoked Fish
Mexico	Shrimps and Prawns
Brazil	Lobsters and Crabs
New Zealand	Cephalopods
Germany/USA	Frozen Coated Products
FAO/WHO	Aquaculture

Status of the Proposed Draft Code of Practice for Fish and Fishery Products

65. The Committee agreed that the proposed draft, as amended during the present session, would be returned to Step 3 for further comments, especially on the aspects which had been highlighted in the above discussion (see Appendix VI). The comments would be forwarded to the countries responsible for each specific section, who would continue their revision work in the meantime. It was agreed that another meeting of the Working Group would be necessary to coordinate the revision, under the leadership of the United Kingdom, Canada and France, and to prepare a revised draft for circulation well ahead of the next session. The revised draft in Appendix VI should be read in conjunction with the present report, bearing in mind that many sections still need to be extensively reviewed.

PROPOSED DRAFT CODE OF PRACTICE FOR SHRIMPS AND PRAWNS (Agenda Item 7)
PROPOSED DRAFT CODE OF PRACTICE FOR MOLLUSCAN SHELLFISH (Agenda Item 8)
PROPOSED DRAFT CODE OF PRACTICE FOR THE PRODUCTS OF AQUACULTURE (Agenda Item 9)

66. The Committee noted that these Items had been covered by the discussion under Agenda Item 6.

DRAFT STANDARD FOR DRIED SALTED ANCHOVIES (Agenda Item 10)[8]

67. The Committee recalled that the draft standard had initially been developed by the Codex Coordinating Committee for Asia, and forwarded to the CCFFP for finalization after its adoption at Step 5 by the Executive Committee in 1996. The Committee reviewed the standard section by section and made the following amendments.

Section 2.2 Process Definition

68. The Delegation of Spain proposed that the fish should be eviscerated before processing and the Committee had an exchange of view on the necessity for such a requirement. Some delegations pointed out that gutting was not necessary as the fish was very small and was boiled in brine before drying, so that no health hazard existed. From the technological point of view, gutting was not practical as it would destroy fish with a soft texture. Other delegations pointed out that the sizing section referred to fish up to 6.5 cm; for fish of that size, and at a temperature where salt migration would be slow, there was a significant risk that botulism would develop. It was noted that in general, fish covered by the standard were much smaller than 6.5 cm and producing countries had not experienced health problems with this product. It was agreed that this issue would be subject to further discussion.

Section 2.3 Handling Practice

69. The Delegation of Thailand expressed the view that it was not practical to keep the temperature of fresh fish below 1.5°C and the Committee agreed to refer to "an adequate temperature to prevent spoilage and bacterial growth" prior to processing.

Section 3. Essential Composition and Quality Factors

70. The Committee agreed with the proposal of the Delegation of Thailand to move sections 3.3 to 3.5 (Grading) to an Annex on optional composition criteria. The Committee noted that the Labelling section referred to sizing and grading and amended this provision to make it optional, while noting the concern of the Delegation of Canada that the main body of the standard should not be linked to the Annex. The Chairman recalled that the Annex had been introduced in the revision process of some current standards to take care of

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[8] CL 1996/FFP-ASIA, CX/FFP 98/9 (comments from Spain), CRD 3 (Thailand), CRD 8 (Czech Republic, Indonesia, Denmark)

existing material, but that when elaborating new standards, careful consideration should be given to the opportunity of including provisions which were not essential. Some delegations supported size declaration with the actual size rather than with "big" or "medium", and the Committee agreed that further consideration should be given to these sections.

Section 4. Hygiene

71. The Delegation of France recalled that certain *Engraulidae* species were included in the Standard for Canned Sardines, where the level of histamine was limited in view of safety concerns, and pointed out that a similar approach should be taken for dried anchovies as defined in the current text. This was supported by other delegations and the Committee agreed to insert the provisions on histamine which were included in the Standard for Sardines and Sardine-Type Products.

Section 5. Packing

72. The Delegation of Thailand questioned the need for transparent packaging material and the Committee agreed that this should be further considered.

Section 6. Labelling

73. The reference to "English" names was deleted and replaced with "common" names, in conformity with the General Standard for the Labelling of Prepackaged Foods. The Committee agreed to require the declaration of grading and size according to the provisions in the Annex when these criteria were applied.

74. The Delegation of France supported the declaration of the scientific name and the country of origin in order to prevent confusion and provide clear information to the consumer, as the product was not very well known, and covered a large number of different species. The Committee had an exchange of views on the need for such requirements, and recalled that the standard for sardines provided for the indication of the country or the species, not both of them, and that the General Standard required the declaration of origin only when its absence would mislead the consumer. The Committee could not come to a conclusion at this stage and left the section as currently drafted (including the declaration of the scientific name and no reference to the origin).

General aspects

75. The Committee recognized that, as noted by the Delegation of Germany, several sections which were usually found in fish standards were missing in this text, such as the definition of defectives, the reference to odour and flavour and sensory evaluation. The Committee noted that the Committee on Methods of Analysis and Sampling had recommended that for the determination of acid insoluble ash (method stated in the standard), the CCFFP consider a more generally applicable method such as AOAC 938.08. The Chairman noted that, in view of the above discussions, several sections required further consideration before the current text could be finally converted into a world-wide standard.

Status of the Draft Standard for Dried Salted Anchovies

76. The Committee agreed to return the Draft Standard, as amended at the current session, to Step 6 for further comments and consideration by the next session (see Appendix III)

DRAFT STANDARD FOR CRACKERS FROM MARINE AND FRESHWATER FISH, CRUSTACEAN AND MOLLUSCAN SHELLFISH (Agenda Item 11)[9]

77. The Committee recalled that the draft standard had initially been developed by the Codex Coordinating Committee for Asia, and forwarded to the CCFFP for finalization after its adoption at Step 5 by the Executive Committee in 1996. The Committee reviewed the standard section by section and made the following amendments.

3.2 Other Ingredients and 3.3 Optional Ingredients

78. In section 3.2, the Committee agreed that "suitable starches" would cover all starches in general, the specific examples on tapioca and sago were therefore deleted. In section 3.3, a reference to "suitable spices" was added to "sugar" and the additives were moved to the section on Additives. The Secretariat recalled that additives should be specified and that the level of use should be indicated.

3.4 Final Product and Table 1

79. The Committee agreed to move section 3.4.2 to the Hygiene section. As it was noted that the aspects included in the section were covered by general hygiene requirements, the section was put in square brackets.

80. The Committee had an exchange of views on the reference to crude protein in Table 1, as some delegations felt that it would be preferable to include a percentage of fish flesh; however, there would be no method to determine this percentage. It was also noted that the Table did not provide criteria for crackers which were made from mixture of fish and shellfish.

81. The Committee noted that the purpose of Codex standards was to establish minimum requirements and that grades were not usually defined in standards. In reply to a question, the Delegation of Indonesia confirmed that grading of crackers in three grades corresponding to protein levels was current practice in trade, according to the quantity of fish or shrimp in the product. The Committee agreed that this question required further consideration.

82. The Delegation of Canada pointed out that the characteristics of the final product should be defined more precisely and that a section on Defectives would also be required as in other standards.

Section 5. Packing
Section 6. Labelling

83. The Delegation of Thailand questioned the need for transparent packaging material and the Committee agreed that this should be further considered. The reference to "English" names was deleted and replaced with "common" names, in conformity with the General Standard for the Labelling of Prepackaged Foods.

General aspects

84. Some delegations noted that several sections which were usually found in fish standards were missing in this text, such as the definition of defectives, or the reference to odour and flavour. The Committee recognized that, as appeared from the above discussions, further work was needed to clarify several sections before the current text could be finally converted into a world-wide standard.

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[9] CL 1996/FFP,ASIA, CX/FFP 98/10 (comments from Spain), CRD 4 (Thailand), CRD8 (Czech Republic, Indonesia, Denmark)

Status of the Draft Standard for Crackers from Marine and Freshwater Fish, Crustacean and Molluscan Shellfish

85. The Committee agreed to return the Draft Standard, as amended at the current session, to Step 6 for further comments and consideration by the next session (see Appendix IV)

PROPOSED DRAFT STANDARD FOR SALTED ATLANTIC HERRING (Agenda Item 12)[10]

86. The Committee recalled that, following a proposal made at the last session, and following its approval as new work by the Executive Committee, the proposed draft standard had been developed by a group of countries led by Germany and Norway. The Delegation of Germany introduced the document and stressed the major aspects of the standard: the need to address safety aspects related to nematodes; the exclusion from the scope of marinated and substitution products; the intention to cover both semi-final products and those ready for consumption. The Committee reviewed the text section by section and made the following amendments.

87. The Committee agreed with the proposal of the Delegation of Denmark to include sprats (*Sprattus sprattus*) in the standard; the title, scope and relevant sections were modified accordingly, with a reference to "fish" instead of "herring" in several sections.

Section 2.1

88. Some delegations expressed their concern about the hygiene of the product, as salting might be carried out on fish which had not been eviscerated in certain cases. Other delegations indicated that as producer countries of this traditional product, they were not aware of health hazards. The Delegation of the Netherlands stated that only a small portion of the intestines remained in their special product (maatjes). The Committee did not come to a conclusion on this question.

Section 2.3

89. The Committee noted that the EC legislation did not allow any visible parasites in herring, whether dead or alive, and the Committee had a detailed discussion on the requirements concerning nematodes. Some delegations stressed that only live nematodes represented a hazard to health, and that they were visible only in fillets and not in whole fish. The Committee agreed that section 2.2.3 on Nematodes would refer to "visible" larvae and would be moved to the Hygiene section.

Section 6. Labelling

90. Some delegations questioned the purpose of section 6.1.2, which required additional labelling without clarifying what this labelling should describe, and the Committee noted that this provision had been taken from other standards, but could be reconsidered in the future.

Section 7. Sampling

91. The Committee recalled that the current sampling plan referred to containers (barrels) of salted fish and agreed to the suggestion of the Delegation of Canada to refer to the Codex Sampling Plan (CAC/RM 42-1969) for smaller containers.

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[10] CX/FFP 98/11; CX/FFP 98/11-Add.1 (comments from South Africa, Turkey, Poland, France, Spain), CRD 10 (EC), CRD 15 (Denmark)

Section 8. Defectives and Annex I

92. Following its earlier discussion on nematodes, the Committee agreed to add the same section on Parasites as in the Standard for Quick-Frozen Fish Fillets. The Delegation of Iceland reserved its position on the whole issue of nematodes as it required further consideration. The Delegation of Germany indicated that it was willing to develop a method to determine the viability of nematodes.

Status of the Proposed Draft Standard for Salted Atlantic Herring and Salted Sprats

93. The Committee agreed to return the Draft Standard, as amended at the current session, to Step 3 for further comments and consideration by the next session (see Appendix VII).

PROPOSED DRAFT STANDARD FOR SMOKED FISH (Agenda Item 13)[11]

94. The Chairman recalled that the Committee had agreed at its 22nd Session to develop a standard for cold-smoked fish, the inclusion of other products to be considered at a later stage and that Denmark had agreed to prepare a draft standard in collaboration with France and Norway. The Delegation of Denmark briefly introduced the draft, inviting delegations to present their views, especially as to whether they agreed with the scope. The Delegation of South Africa proposed that the scope should be extended to cover cold smoked hake as well. Since this document was distributed for information only at the current session it was agreed that member countries should provide their comments directly to Denmark in order to prepare the document in good time for consideration at the next session.

PROPOSED DRAFT STANDARD FOR MOLLUSCAN SHELFISH (Agenda Item 14)[12]

95. The Chairman recalled that the last session of the Committee had agreed to develop a standard for molluscan shelfish, to be focused on bivalve moluscs. The Delegation of the Netherlands informed the Committee that the draft was targeted to cover all types of bivalve molluscs since they were high risk products and traded worldwide, and invited delegates to provide their comments on the scope of the draft, while confirming that it would proceed with this work.

96. The Delegation of Indonesia suggested to broaden the scope of the drafts on smoked fish and molluscan shellfish indicating that they should cover also tropical products. It was confirmed that both standards were intended to be of general application, and countries were invited to provide comments at this stage directly to the Netherlands in order to prepare a draft in good time and to circulate it for government comments prior to the next session of the Committee.

MODEL CERTIFICATE FOR FISH AND FISHERY PRODUCTS (Agenda Item 15)[13]

97. The Committee recalled that it had agreed at the 22nd Session to proceed with the development of a model certificate for fish and fishery products, recognizing that a generic certificate would not address all issues related to import/export control[14]. The Delegations of Canada and Norway introduced the discussion paper, highlighting problems in this area.

98. The Committee noted that the important elements to be considered included the identification of the processing establishment by name or by code, the name of the exporter, the destination of the lot. It was also necessary to consider the title of the certificate, its scope, and the type of attestations used to indicate compliance

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11 CRD 17

12 CRD 18

13 CRD 5 (Discussion Paper prepared by Canada and Norway); CRD 10 (comments from the European Community)

14 ALINORM 97/18, paras. 6-8

with the exporting or importing country's requirements or other international requirements. All these issues required clarification before the model certificate could be finalized. The Committee agreed that reference should be made to "Sanitary Certificate" as the term "Health" did not reflect the nature of the certificate or correspond to current practice.

99. Some delegations stressed the great diversity of certificates required by importing countries, and the specific problems associated with transit requirements. The Committee recognized the importance of such work to facilitate international trade in view of the difficulties faced by exporting countries. It was noted that the use of references to competent authorities and to production conditions of the lot were important elements of official certificates.

100. Some countries pointed out linguistic problems in relation with certificates and were of the opinion that the number of languages should be limited. The Delegation of the United States expressed the view that the identity of processors was commercial confidential information which could not be disclosed by brokers; for the purposes of traceability it should be made available only for official purposes. The Observer from the EC informed the Committee that the establishment of origin was an essential information as the EC system was based on a list of establishments.

101. The Committee was informed that the Committee on Food Import and Export Inspection and Certification Systems was working on Guidelines and Criteria for Official Certificate Formats and Rules Relating to the Production and Issuance of Certificates. In the light of the on-going work in the CCFICS it was suggested that the CCFFP continue its work on the title and scope of the model certificate and keep the CCFICS informed of its progress. The Committee agreed that work on a model certificate should proceed and
delegations were invited to send their comments on the issues discussed to Norway (Directorate of Fisheries in Bergen), with a view to the preparation of a draft model certificate by Canada and Norway for further consideration.

OTHER BUSINESS, FUTURE WORK AND DATE AND PLACE OF NEXT SESSION (Agenda Item 16)

Proposal from Chile on Squat Lobster

102. The Committee considered CRD 1, a partial translation of the information provided by Chile on the taxonomy and trade importance of the species *Pleuroncodes monodon* and *Cervimundia johni*. The Delegation of Chile pointed out that these species had been exported for a long time, and that the Codex standard did not presently cover Galatheidae; it would therefore be necessary to develop a standard for such products. Some delegations felt that the trade in these products was not important enough to justify the development of a separate standard. It was also proposed to consider the opportunity of including both species in the Standard for Quick-Frozen Lobsters with specific labelling requirements. The Committee however could not come to a conclusion on how to address the proposal from Chile on the species of "squat lobster" at this stage and agreed that the information provided by Chile would be circulated and translated in order to allow more time for comments and due consideration of this question at the next session.

Fish Core in Fish Sticks

103. The Delegation of the United Kingdom indicated that the EC had amended its Directive on the declaration of quantitative ingredients since the Committee had asked the Committee on Food Labelling to consider the declaration of fish core. The percentage of fish (excluding water and additives) which had to be declared in the EC did not any longer correspond to "fish core" as described in the Standard for Fish Sticks. The Delegation proposed to prepare a paper for consideration by the next session on this question.

Future Work

104. The Committee agreed to consider the above proposals and discussion documents at its next session. The Delegation of the Russian Federation proposed to prepare a discussion paper with a view to developing a standard for granular sturgeon caviar.

105. The Delegation of Canada proposed to prepare a paper concerning the development of a standard for scallops, and pointed out the specificity of this product, while agreeing to discuss the matter with the Delegation of the Netherlands which was preparing a standard for bivalve molluscs (see also paras. 95-96).

106. The Committee noted that its future work would include all the matters discussed at the current session, with the exception of the Sensory Evaluation Guidelines which had been finalized, and agreed that any proposal for new standards would have to be considered in the light of its considerable workload.

Date and Place of the Next Session

107. The Committee noted that its next session would be held in Norway in the first half of 2000, the exact arrangements to be determined between the Host Government and Codex Secretariats.

SUMMARY STATUS OF WORK

Subject Matter	Step	Action by	Document Reference in ALINORM 99/18
Draft Guidelines for the Sensory Evaluation of Fish and Shellfish in Laboratories	8	Governments 23rd CAC	para. 34 Appendix II
Inclusion of additional species (Proposed Draft Amendment to the Canned Sardines Standard)	5[1]	Governments 23rd CAC	para. 22 Appendix III
Draft Standard for Dried Salted Anchovies	6	Governments 24th CCFFP	para. 76 Appendix IV
Draft Standard for Fish Crackers	6	Governments 24th CCFFP	para. 85 Appendix V
Proposed Draft Code of Practice for Fish and Fishery Products	3	Governments 24th CCFFP	para. 65 Appendix VI
Proposed Draft Standard for Salted Atlantic Herring and Salted Sprats	3	Governments 24th CCFFP	para. 93 Appendix VII
Model Certificate for Fish and Fishery Products	3	Norway/Canada Governments 23rd CCFFP	para. 101
Proposed Draft Standard for Smoked Fish	3	Denmark Governments 24th CCFFP	para. 94
Proposed Draft Standard for Molluscan Shellfish	3	Netherlands Governments 24th CCFFP	paras. 95-96

[1] Accelerated Procedure

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DRAFT GUIDELINES FOR THE SENSORY EVALUATION OF FISH AND SHELLFISH IN LABORATORIES

(At Step 8 of the Procedure)

CONTENTS

I. SCOPE AND PURPOSE OF THE GUIDELINES

The guidelines are intended to be used by analysts who need to apply sensory methods when using criteria based on sensory attributes of the products. Though the guidelines have been written with the Codex requirements in mind they include some provisions for products not covered by these standards but where sensory evaluation is used in the testing of fishery products for conformity requirements.[1] These guidelines are to be used for sensory examination of samples in a laboratory to determine defects by procedures, including cooking, which are not normally done by analysts in the field. Technical information is provided on the laboratory facilities used for such analyses and training of analysts.

The objective of guidelines is to ensure uniformity of application of standards by making recommendations for inspection purposes concerning the facilities required in sensory testing and the procedures for carrying out sensory tests.

For the purpose of this document the use of fish means finfish, crustaceans, and molluscs.

II. FACILITIES FOR SENSORY EVALUATION

2.1 General Observations

Sensory evaluation should be carried out by adequately trained personnel (see Section IV). They evaluate a specialized range of products, and use one sensory methodology.

2.2 Laboratories for Sensory Evaluation

2.2.1 Location and Layout

Figure 1 illustrates a plan of a laboratory that would be suitable for use for examining fishery products. The plan illustrates the principle that the preparation area should be separate from the evaluation area.

Office accommodation, storage rooms, staff facilities, and possibly other test facilities should be provided elsewhere in the premises. The evaluation area must not be used for chemical and microbiological analyses however, some types of analyses could be done in the preparation area.

2.2.2 Preparation Area

This area is to used for the handling and storage of fishery products, and for the preparation of samples for sensory evaluation. it should be constructed so as to comply with the requirements of good manufacture practices for the design and construction of fishery establishments. The rooms should be designed to ensure cooking odours do not interfere with sensor analysis.

2.2.3 Evaluation Area

There should be no preparation of products in this area other than final trimming of samples prior to cooking.

The area, ventilation, procedures and sample sequence should be organized to minimize disturbing sensory stimuli. Also influence and disturbances from fellow evaluators and other personnel should be minimized. The colour of evaluation area should be neutral.

The benches should be illuminated by daylight or artificial daylight. Any specific conditions in standards should be met.

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[1] Additional criteria may be included if new recommendations are made by the Committee

Figure 1. Illustrative Plan of a Laboratory for Sensory Evaluation of fishery Products

2.2.4 Equipment

The exact type and amount of equipment required will depend to some extent on the nature of products to be inspected and the number and intensities of the examinations.

III. PROCEDURES FOR SENSORY EVALUATION

3.1 Collecting and Transporting Samples

In most circumstances where fishery products are subjected to sensory evaluation a decision is made about a batch of fish, for example, acceptance or rejection of a consignment of imported products, classification of batches of fish on a market into freshness grades. The decision is made on the basis of an examination of a sample drawn from the batch according to guidelines which will usually specify how sample is to be taken for the intended regulatory or commercial purpose of the examination.

When collecting a sample for inspection the inspector should ensure that the procedures used for taking the sample, and the subsequent handling of the sample, do not materially affect its sensory properties.

The inspector should check that the sample is properly packed and where necessary, under temperature control before dispatching it to the inspection laboratory. If the sample is not under the supervision of officials during transport the inspector should ensure that sample can not be tampered with during the journey.

On receipt at the inspection laboratory, samples, if not evaluated immediately, should be stored under appropriate conditions. However fresh and chilled products should be examined on the day they are received. Products in either chill or frozen storage should be appropriately wrapped to prevent drying out or desiccation.

3.2 Preparation of Samples for Examination

Table 1 presents attributes useful in evaluating some species and products. Procedures for preparation of samples should be appropriate for the product types. Some procedures relative to fresh or frozen finfish are described in the following paragraphs.

The fish, if entire, should be gutted and the guts retained. The head should be removed, and the fillet from one side to taken off. The portions should be assembled on tray for analysis.

QF Products can be laid out on the examination bench in the evaluation area, but it is often more convenience for presentation and for clearing up after if sample units are presented on trays.

Frozen products should be first examined in the frozen state. The complete sample unit or portions of the unit should then be thawed. Whether the can, or should be subdivided, depends on the nature of the products. Packs of IQF shrimps or fillets can be opened and subsamples taken. Portions could be sawn off large fish or off blocks, but this might be difficult in the case of thick material unless a bandsaw is available.

Frozen material should be thawed out as quickly as possible, but without raising the temperature of all or part of the product so that it might spoil. The simplest procedure is to spread out the sample units on the benches and tables in the preparation area and leave them to thaw at ambient temperature. They should be covered to prevent drying and contamination. The progress of thawing should be monitored and when it is judged that thawing is complete the products should be evaluated, or transferred to a refrigerator. Products should be covered with plastics film before storing in the refrigerator, Storage should be limited in order to maintain sample integrity. If possible sample units should be thawed out on trays so that the amount and nature of the thaw drip can be assessed.

Thawing can be accelerated by immersion of the material in water. This is acceptable if product is protected from the contact with water by suitable wrappings, or if contact with water does not materially affect the sensory properties of the product. Care must be taken to prevent further spoilage or bacterial growth. Small sample units such as IQF fillets or small packs of shrimps or shellfish meats could be thawed in a microwave cooker on the defrost setting, but care must be taken not to use too high power settings otherwise parts of the material will be overheated.

Large frozen fish or large blocks of frozen products will take many hours to thaw out at ambient temperature, longer than a normal working day, and they can not be properly monitored throughout the whole process of thawing. One solution is to lay the products out of thawing at the end of a working day when they will just be completely, or almost completely, thawed by the following morning. Alternatively the material can be put out to thaw as early as possible in the day and transferred to a chill room at the end of the day to complete the process at low temperature. It is helpful to break apart blocks of product when they are partially thawed to accelerate thawing if this can be done without damaging the material.

3.3 Cooking

In cases where a final decision on odour or gelatinous state cannot be made in the thawed uncooked state, a small portion of the disputed material (approximately 200g) is sectioned from the sample unit and the odour and flavour or gelatinous condition confirmed by cooking without delay by one of the following cooking methods. The following procedures are based on heating the product to an internal temperature of 65 - 70□C. The product must not be overcooked. Cooking times vary according to the size of the product and the temperatures used. The exact times and conditions of cooking for the products should be determined by prior experimentation.

Baking Procedure: Wrap the product in aluminum foil and place it evenly on a flat cookie sheet or shallow flat pan.

Steaming Procedure: Wrap the product in aluminum foil and place it on a wire rack suspended over boiling water in a covered container.

Boil-in-Bag Procedure: Place the product in a boilable film-type pouch and seal. Immerse the pouch in boiling water and cook.

Microwave Procedure: Enclose the product in a container suitable for microwave cooking. If plastic bags are used, check to ensure that no odour is imparted from the plastic bags. Cook according to equipment instructions.[2]

3.4 Procedures for the Assessment of Products

Standards and specifications for fishery products will specify the features of the product that are able to be evaluated, and the criteria for accepting or rejecting products or for allocating them to grades. Table 1 presented in Annex I lists sensory attributes and criteria which may apply to standards and quality grading schemes. In order to apply quality criteria consistently in inspection of products it is necessary to conduct the sensory assessments in a consistent and systematic manner. Samples should be assessed relative to the characteristics of the species concerned.

Assessors must pay particular attention to those features of the product which are referred to in any standards and which determinate conformance to the standard, but in addition they should assess record other relevant attributes of the samples, as appropriate.

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[2] General Standard for Quick Frozen Fish Fillets, Annex A “Sensory and Physical Examination”

3.4.1 Assessment of Raw Products

Fresh fish will be normally assessed by appearance and odour. Fish change in appearance in a number of ways during spoilage in ice and it is not usually difficult to accurately grade iced fish by appearance alone. Characteristics to look for are listed in Table 1 of Annex I.

3.4.2 Assessment of Frozen Products

Frozen fish should be examined in the frozen state. The assessor should note the nature and state of any wrappings and glazes and the product should be examined for any discolourations and for the extent and depth of any dehydration. The assessor should if there are any signs that product might have been thawed and refrozen. Signs of slumping or distortion of blocks, the collection of frozen drip in pockets in the wrappings, (not to be confused with water that might have been present on the fish at the time of freezing), and the partial loss of glaze.

Thawed samples should be presented and examined as for the corresponding unfrozen product where appropriate. It is not easy to evaluate the freshness of thawed whole fish by appearance because the freezing and thawing processes alter characteristics like the eyes, skin and colour of gills and blood. The gills have a leathery or slightly rancid odour even after short periods of frozen storage which have no significance for the quality of the product

3.4.3 Assessment of Cooked Samples

Cooked samples should be held in a closed container, allowed to cool to a comfortable tasting temperature, and kept warm unless they are assessed immediately. products which have already been cooked, for example cooked shrimps, should be warmed up slightly.

The assessor should note the appearance of the product and record any unusual features. The odour should be smelled and its character and strength recorded, particularly any unusual odours like chemical taints. Assessors should be encouraged to taste cooked samples as some compounds can only be detected by mouth (e.g. low levels of decomposition or fuel contamination).

The flavor of a sample in the mouth should confirm the assessment based on odour, but can give additional information. For example most additives such as salt, sorbates, polyphosphates, are not detectable by odour, but are detectable by taste. Sensory analysis alone should not be used to determine the presence by odour, but are detectable by taste. Sensory analysis alone should not be used to determine the presence of additives and any suspicion that non permitted additives have been used, or that excess amounts of permitted additives are present, should be confirmed by chemical analysis where appropriate.

IV. TRAINING OF ASSESSORS

4.1 Objective Sensory Training

4.1.1 Considerations for Objective Sensory Training

In the sections below examples are provided of test materials which have been used for screening and training analysts.

Objective sensory testing measures the intrinsic sensory attributes of a sample through the analytic sensory perceptions of human assessors. In order to conduct objective sensory analyses of fish and fish products, assessors must be selected for their ability to perform the sensory tasks required, must be trained in the application of the required test methods, and must be monitored for their ongoing ability to perform the sensory tasks. Thus, sensory training includes:

(a) The selection of assessors for basic sensory acuity and for the ability to describe perceptions analytically i.e. without the effect of personal bias. Allergies to seafood's or to some food additives could eliminate an analyst candidate.

(b) The development of the assessor's analytical capability by familiarization with test procedures, improvement of ability to recognize and identify sensory attributes in complex food systems, and improvement of sensitivity and memory so that he/she can provide precise, consistent, and standardized sensory measurements which can be reproduced.

(c) The monitoring of the assessor by the frequent periodic assessment of the sensory decisions made - the performance and consistency of the analytic decisions.

4.1.2 Selection of Candidate Assessors

A candidate for assessor training should demonstrate that he/she:

1. is not anosmic (unable to perceive odours) - so that odours of decomposition and other defects will be perceived and described in a consistent manner;

2. is not ageusic (unable to perceive basic tastes) - so that tastes associated with decomposition and other defects will be perceived and described in a consistent manner;

3. has normal colour vision and is able to detect anomalies in the appearance of fish and fish products in a consistent manner,

4. is able to rely on sensory perceptions and to report them appropriately;

5. is able to learn terminology for new or unfamiliar perceptions (odours, tastes) and to report them subsequently; and

6. is able to define sensory stimuli and relate them to an underlying cause in the product.

The first five points can be measured in testing, the last ability is developed during specific product training.

In conducting the tests, it is useful to allow for repetition of the tests for basic taste and for odour perception. This is necessary to ensure that the candidate is being tested for basic ability and not responding to an unfamiliar testing situation. New code numbers and presentation sequences are used in each test method.

4.1.2.1 Screening for Perception of Basic Tastes

The diversity of flavors, especially of defects from decomposition, which the inspector will be required to perceive and describe make it essential that some indication of the general ability to perceive basic tastes be established. One area of particular importance in selection and training is the ability to discriminate bitter and sour tastes/flavors as this is a common area of confusion in inexperienced assessors. These tastes/flavors are critical in the examination of fish and fish products as they are evident in the early stages of decomposition.

A matching standards test using concentrations which should be perceived by a normal taster has been described by several standard sources. the concentrations used have been shown in testing to be perceptible.

Table 1 A selection of published test solutions used for screening and training analysts

Basic Tastes	Standard Compounds Used (in water)	DFO Screening Tests (1986-96)	Meilgaard et al. (slight to very strong) (1991)	Jellinek (1985)	ASTM (1981)	Vaisey Genser and Moskowitz (1977)
bitter	caffeine	0.06%	0.05 to 0.2%	0.02 & 0.03%	0.035, 0.07 & 0.14%	0.150%
sour	citric acid	0.06%	0.05 to 0.20%	0.02, 0.03 & 0.04%	0.035, 0.07 & 0.14%	0.01%
salt	sodium chloride	0.02%	0.2 to 0.7%	0.08 & 0.15%	0.1, 0.2% 0.4%	0.1%
sweet	sucrose	2.0%	2.0 to	0.40 & 0.60%	1.0, 2.0 & 4.0%	1.0%
umami*	monosodium glutamate	0.08%				

* This has been identified by some analysts as being a fifth basic taste, however this remains controversial. This **may** be used as part of the selection procedure, but should definitely be used as part of the training sessions to illustrate the contribution to the flavors of fish contributed by the ribonucleotides.

4.1.2.2 Screening for Perception of Odours

In this case, several types of tests are available which will accomplish the selection procedure.

Because people are able to perceive a very large number of separated odour qualities, the samples used should be chosen to be both representative of common odours with which the candidate would likely have had experience, and also be representative of odour qualities which occur as defects in fish and fish products. Two examples two test methods which would be appropriate for use are presented in Annex II.

4.1.2.3 Screening of Normal Colour Perception

Colour blindness is measured by the use of one of several standard ophthalmologic tests including the Ishihara Colour Blindness Test and the Farnsworth-Munsell 100-Hue Test. These tests may be purchased through medical and complete instructions as to their use. They must be administered under the exact conditions specified in the instructions.

4.1.2.4 Screening Test for the Assessment of Texture

There can be cases when fish is rejected for texture. These are tests which are essentially done by touch on raw product. Characteristics which may be assessed include:

(a) firmness: in fresh fish and shellfish (shrimp); and
(b) springiness: in fresh fish.

One such test is the procedure designed by Tilgner (1977) and reported in Jellinek (1985). This test used a series of samples which increase slightly in firmness and uses pressure with the forefinger of the dominant hand to assess firmness and allow the candidate to rank the samples from least to most firm. This allows the assessment of the concept of firmness and the concept of increasing intensity in a sensory attribute. The samples used in the test described are permanent samples cast from polyvinyl chloride although a series of samples can also be generated from appropriate food samples.

4.1.3 Training of Assessors

The following is a model training syllabus. The length of the basic sensory science training which is included in the course can vary from the 10 hours (1.5 days) shown below to full length courses of university level training. It is suggested that hands-on exercises accompany each section to demonstrate the concept under discussion (e.g. prepare basic taste solutions and have the students taste them during the lecture on taste). A Suggested Syllabus for a Training Course for Assessors in the Sensory Assessment of Fish and Fishery Products is presented in Annex III.

4.1.4 Monitoring of Assessors

The validation of the effectiveness of sensory training and of the consistency of sensory assessments is achieved through ongoing monitoring of the sensory decisions made by the assessor. This may be accomplished in a variety of ways, either singly or in combination.

(a) The first is the use of check samples which are samples of known quality which are distributed to inspectors for examination in their day-to-day testing facility. The results are sent back to the central coordinator of the samples for analysis. The advantage of this method is that samples are being assessed under the actual laboratory conditions. Samples used for this are prepared using the procedures described in Section 4.2, Preparation and Handling of Samples. Also commercial product of known quality and which is available in sufficient quantity may be used.

(b) Another procedure which is used to validate the performance of an inspector is through actual accreditation testing and calibration procedures. These are conducted in a central location laboratory which is large enough to accommodate all of the inspectors participating in the test. Preparation and Handling of Samples. Also commercial product of known quality and which is available in sufficient quantity may be used. This procedure must be repeated at regular intervals to ensure that no change has occurred in the inspectors' ability to evaluate products and the inspector must reach a pre-defined level of performance on both «pass/accept» samples and «fail/reject» samples.

(c) A supplementary method of evaluation of an inspector's performance is the accumulation over time of the on-going inspection results vs. any other known information on samples, e.g. reinspection results, consumer complaints, chemical analyses, etc.

4.1.5 Reference Documents

Reference documents are presented in Appendix II.

4.2 Preparation and Handling of Samples

4.2.1 Type of Samples

Samples used for the purpose of training individuals in sensory techniques concerning fishery products are the single most important factor to be considered. It is imperative that proper samples be provided in reference to sensory training.

There are two types of samples to be considered in the training of sensory analysts or inspectors.

1. Controlled spoilage samples: These samples should display or represent a full range of quality, as well as the normal range of product characteristics related to odour, flavor, appearance, and texture.

It is essential that samples of excellent quality be provide a reference point during the preparation of such packs.

Quality defects should be natural occurring, if possible, to exhibit sensory characteristics which are typical to the product to be used. If the samples are spoiled or contaminated artificially, they may not exhibit typical sensory properties for both the acceptable or unacceptable units to be used for training.

It is important for the individual preparing the samples to have knowledge of the normal commercial process of the product to be spoiled from harvesting to freezing and be aware of processing methods and conditions under which spoilage usually occurs. Understanding the general pathways of decomposition would be useful in the preparation of controlled spoilage samples.

When possible, controlled spoilage, samples should be prepared where the product is harvested and processed to allow for the species, flora, etc. to duplicate normal spoilage conditions that allows for typical odours of decomposition as well as other characteristics that mimic commercial samples.

2. Commercial samples: Whenever possible, the use of commercial samples should be incorporated into the sensory training of individuals. Many times, quality defects (odour, flavor, appearance, texture, etc.), as well as taints (musty/moldy odours, flavors, rancidity, petroleum distillates, etc.) can be best shown with commercially produced samples that have these defects. These commercially manufactured samples allow one to assess sensory personnel during training by providing «real life» samples. They can also be used to measure an individual's retention abilities as it relates to making correct decisions in sensory science.

Many times, quality defects and taints are not found in all intensities in controlled spoilage samples but can be shown in slight, medium, and strong intensity from commercially produced samples.

4.2.2 Preparation of Sample Packs

Sample preparation should be started in plenty of time to allow one to obtain the majority of defects as well as allowing product to go through a curing process if necessary.

If possible, the spoilage run should be conducted with fish «in the round» to allow for natural spoilage to occur. This allows for typical spoilage odours to form.

(1) Baseline

It is essential that excellent quality material of all species and product forms of known history, without commercial abuse, be obtained to provide a constant reference to the workshop participants. Whenever possible, both fresh and frozen product forms should be included in the preparation of controlled spoilage samples. The lot should be uniform at the start of the run.

Proper record keeping is essential in the preparation of spoilage samples. Samples of each code taken should be consistent within a set, each succeeding set representing a longer period of time that the product has been held under ambient or iced conditions. Temperature monitoring is essential to prevent fluctuations during each spoilage run.

Spoilage must be accomplished under appropriate conditions of temperature and environmental contamination if authentic spoilage effects are to be obtained. Variations in spoilage rates between individual units can be minimized if the starting material is of uniform size and contact between individual units maintained during spoilage.

Fish tend to spoil at different rates so one should examine product at regular intervals and group the product together that have similar characteristics prior to processing. Expert evaluation of the samples is constantly needed at this stage.

The number of increments needed will depend on the purpose of the training and the species to be examined but a minimum of 5 increments and as many as 8 may be needed. At least 50% of the pack should be of acceptable product.

(2) Spoilage

Generally, both high and low temperature decomposition spoilage should be included, but knowledge of the species and the standard processing method and at what point of the process is spoilage most likely to occur should determine the general spoilage method. It is important to avoid «shortcuts» for the sake of convenience. If pre-chilling spoilage is the issue, the use of frozen fish must be avoided. Careful temperature control is necessity.

(3) Packaging and Storage

The species and type of product from a spoilage run should be taken into account to determine the amount of shelf life one can expect.

Canned products should be allowed to cure in the can for at least 30 days prior to use. They should be stored in a cool and dry location with a temperature range of 14°C - 18°C, otherwise one can expect a much shorter storage life. Maximum shelf life of canned seafood products for training purposes is approximately 2 years. After this amount of time, characteristics develop that may affect one's judgement or render the samples of little value for training purposes.

Unless freezer storage damage is intended to be demonstrated, raw and pre-cooked frozen products should be properly glazed to prevent dehydration and freezer burn. Depending on the length of storage, the samples may require periodic reglazing to ensure the quality. If possible, product should be vacuum packed to ensure quality and is essential in the storage of some fish species as well as pre-cooked samples.

Both raw, precooked and canned controlled spoilage samples should be evaluated by a qualified individual prior to use in a workshop. The samples should have both chemical analysis and sensory results to determine the quality of the increment and the homogeneity of the increment.

4.2.3 Characteristics of Samples

4.2.3.1 Sensory Attributes

A. Must show normal odours, flavor, appearance, texture, etc. characteristics of the species to be used for samples.

B. If product forms normally show characteristics attributed to harvest location, feed odours, etc. include with the controlled spoilage samples if possible.

C. Samples which exhibit odours of spoilage or contamination defects must not be too intense to the point of overpowering the participant's senses and affecting judgement of other samples during a training session.

D. Samples showing slight to moderate odours of spoilage or contamination provide more of a challenge and better represent «real world» conditions.

E. Each increment or code must show consistent or similar characteristics to have value when used for training.

4.2.3.2 Chemical Attributes

Inclusion of chemical attributes of authentic pack samples can be useful in training (see model syllabus).

A. Chemical indicators of decomposition (CID) are selected that are essentially absent in the fresh product.

B. A CID is selected that will monitor the decomposition pathway of interest in the particular products to be used for training. Methods are used which are capable of differentiating between the CID levels found in passable, slightly abused-passable and the first definite stage of decomposition. When possible it is preferable to use two CID's.

C. The CID should be retained in the processed forms (washed/cooked/canned/stored) of the fishery product to be examined.

D. The changes in a CID should track the changes in sensory quality in the fishery product.

E. A sufficient number of subsamples should be analyzed for each increment of prepared sample to measure the degree of variation within sample increments. This is especially important for those increments representing the transition from a passable product to the first definite stage of decomposition.

Annex I

Table 1. Examples of Attributes of Fishery Products Used in Sensory Evaluation[3]

Vertebrate fish, iced

Presentation	Feature	Criteria and description
Raw whole, gutted or ungutted	outer surface, skin	colour: bright, dull, bleached slime: colourless, discoloured damage: none, punctures, abrasions
	eyes	shape: convex, flat, concave brightness: clear, cloudy colour: normal, discoloured
	belly cavity	guts (in intact fish): intact, digested cleanliness (in gutted fish): completely gutted and cleaned, incompletely gutted, not washed belly walls: bright, clean, discoloured, digested parasites: absent, present blood: bright, red, brown
	texture, appearance of gills	skin: smooth, gritty, flesh, firm, soft colour: bright red or pink, beached, discoloured mucus: clear, opaque, discoloured
	odour of gills	fresh, characteristic, neutral, slightly sour, slightly stale, definite spoilage, putrid
Raw fillets	appearance	translucent, glossy, natural colour, opaque, dull, blood-stained, discoloured
	texture	firm, elastic, soft, plastic
	odour	marine, fresh, neutral, sour, stale, spoiled, putrid
Cooked fillets	odour	spoilage: marine, fresh, neutral, musty, sour, spoiled taints: absent, disinfectant, fuel oil, chemicals, sulphides
	flavour	spoilage: sweet, creamy, fresh oil, neutral, sour, oxidised, putrid, musty, fermented, rancid, bitter, taints: absent, disinfectant, fuel oil, very bitter, alkaline, polyphosphates, chemicals
	texture	succulent, firm, soft, pasty, gelatinous, dry

Vertebrate fish, frozen

Frozen	appearance	freezer burn: absent, slight, superficial, extensive, deep colour: normal, yellow to bronze discolouration in fatty fish

[3] References to be included for the clarification of sensory properties, as established by ISO

Thawed fillets, raw	texture	firm, elastic, flexible, very firm, hard, stiff drip: slight, moderate, abundant odour spoilage and taints: as for chilled fish cold storage: absence of cold storage odours, sharp, cardboardy, rancid
Thawed fillets	odour and flavour	spoilage and taints: as per chilled fish cold storage: absence of cold storage odours, sharp, cardboardy, rancid
	texture	firm, succulent, though, fibrous, dry

Crustacean shellfish, chilled

Raw	appearance, shell on	bright colours, slight blackening on the head, blackening on head and body
	appearance, peeled meats	translucent, overall white or light grey, slight black discolouration, extensive black discolouration, very translucent, slimy, yellowish discolouration on butt end of tail meat taken from head-on products
	odour	fresh, marine, musty, ammoniacal, sour, spoiled, putrid
Cooked meats	appearance	white, opaque, blacks spots, extensive back discolouration, slightly translucent
	odour	fresh, boiled milk, musty, ammoniacal, rancid, sour, spoiled
	flavour	sweet, creamy, neutral, musty, sour, bitter, spoiled
	texture	firm, elastic, soft, mushy

Crustacean shellfish, frozen

Criteria specific to the grading of frozen shellfish, and their descriptions, are essentially the same as those applied to the grading of frozen vertebrate fish.

Cephalopods, fresh or refrigerated

	colour	skin: bright, dull, bleached meat: pearly white, lime coloured, pinkish or light yellow
	adherence	adherent to the meat, easily separating from the meat
	texture	meat: very firm, firm, slightly soft tentacles: resistant to tearing off, can be torn off easily
	odour	fresh, seaweed, slight or no odour, sour

Annex II

EXAMPLES OF TEST METHODS WHICH WOULD BE APPROPRIATE FOR USE

1. A list of samples as used in Canada can include vials containing:

(a) canned salmon (fish)
(b) canned sardines (fish/smoke)
(c) yeast (growth of yeasts)
(d) coffee (common product - to illustrate the method)
(e) orange & pineapple (fruity odours)
(f) cucumber & asparagus (vegetable odours)
(g) vinegar, cinnamon, pepper & cloves (pungent odours which can be differentiated)
(h) vanilla (sweet odour)
(i) prepared mustard (strong vinegar component, illustrates ability to perceive in mixtures)
(j) acetone, rubbing alcohol (contaminants, solvents)
(k) petroleum product (fuel oils)
(l) old vegetable oil (rancid oil)

In this test, the candidate is asked to identify the samples only by the odour as all visual information is masked. The sample are then identified and discussed with the candidate and the number of correct identifications recorded. During this step the candidate is given the opportunity re-examine any of the samples. the test is repeated after a time period such as 2 or 4 hours (during which other selection tests or interviews may be given), and number of correct responses recorded. The improvement in test scores which should occur (unless all were correct on the first round) gives an indication of the ability of the candidate to learn new terms to describe sensory perceptions.

2. The University of Pennsylvania Smell Identification Test, a standardized test for assessment of odour perception, is available from Sensonics, Incorporated, 155 Haddon Avenue, Haddonfield, New Jersey, 08033 USA.

Annex III

SUGGESTED SYLLABUS FOR A TRAINING COURSE FOR ASSESSORS IN THE SENSORY ASSESSMENT OF FISH AND FISH PRODUCTS

I. LECTURES

Part I: Theoretical Principals and Laboratory Practices of Sensory Assessment (10 Hours)

A. Basic Sensory Testing Principles:

1. Affective or subjective testing (test types, information gained, data collection, respondent type and numbers, decision-making possible from this information).

2. Analytical or objective testing (test types, information gained, data collection, respondent type and numbers, decision-making possible from this information).

   i. Discriminative testing: types of information that is gained and that is not.
   ii. Descriptive testing: qualitative and quantitative.

3. The role of the fish and seafood assessor or product expert in sensory testing.

B. Action of the Senses and the Perception of Sensory Properties of Fishery Products:

1. The physiology of the senses - sight, smell, taste, touch and hearing;
2. The perception of sensory properties - appearance/colour, odour, flavor, texture; and
3. Sensory interactions.

C. Sample Evaluation techniques:

1. Odour evaluation techniques.
2. Flavor evaluation techniques.
3. Texture evaluation (firmness and springiness).
4. Special techniques for seafood samples.

D. Basic Psychophysics of Sensory Assessment:

1. Thresholds; detection and recognition.
2. Intensity; the logarithmic nature of character strength perception.
3. Saturation; explanation of the phenomenon.

E. Factors Influencing Sensory Judgments:

1. Physiological effects; blending; masking, carry-over, enhancement and suppression.
2. Psychological effects; expectation, stimulus, halo, order, proximity, stimulus, logical, suggestion, contrast and convergence, and central tendency.

3. Control of physiological and psychological effects.

F. Basic Date Collection and Analysis:

1. Discriminative methods: triangle (3-alternative forced choice or balanced design), duo-trio, two-out-of-five, paired comparison):

   i. Ballot information and design types
   ii. Analysis of data

2. Descriptive methods: Flavor Profile, Texture Profile, Spectrum, QDA:

   i. Scales; category, line, magnitude estimation
   ii. Ballot information and design types
   iii. Analysis of data

3. Sensory methods for quality control - general discussion.

G. Terminology and the use of reference standards. the analyst should «understand the role of sensory descriptors as an aid to developing long term sensory memory and as a means of communicating results». (see Appendix 1):

1. Terminology development (including internationally recognised sources for known terms).
2. The importance of definitions
3. The use of reference Standards
4. Overview of terms relevant to seafood quality, with specific attention to those associated with low levels of decomposition.

H. Sample Handling and Preparation:

1. Presentation and coding.
2. Randomization of samples; purpose and occasion for use.
3. Homogeneity of samples and serving temperature.
4. Sample size and quantity.

Part II: Deterioration of Fish and Fish Products (3 Hours)

A. Composition of Fish and Shellfish:

1. Major components: protein, fat, carbohydrate, water.
2. Minor components; non-protein nitrogenous compounds, minerals, vitamins.

B. Pathways of Quality Deterioration:

1. Breakdown of protein, fat, non-protein nitrogenous compounds, and, for some species, carbohydrates.
2. Microbial spoilage.
3. Terminology associated with each type of spoilage pathway.

C. Chemical Indicators of Fish Quality and the Correlation of these with Sensory Data.

Part III: Contamination and Taint (1 Hour)

A. Types:

1. Naturally-occurring (muddy-earthy off-flavors).
2. Man-made (petroleum, pulp and paper effluent, other processing effluents).

B. Mechanism of flavor and odour changes.

C. Testing methods for contamination and/or taint (special considerations).

II. PRACTICAL EXERCISES

Part I: Presentation of Seafood Related Terminology, Clear Definitions, and References Which Demonstrate the Terms (2 hours)

Part II: Spoilage and Decomposition (18 hours)

This portion of the course provides hands-on experience. It is suggested that only one species at a time be evaluated.

This section may include whole fish, fillets, canned fish and/or smoked fish and other specialty products. Whenever possible, trainees should evaluate flavor as well as odour, e.g. especially in products such as canned fish packed in oil as the packing medium can mask odours.

The following sequence of three session formats are suggested for each species and will require approximately 4 hours in total. It is suggested that the effectiveness of the training be evaluated by testing the trainee's ability to assess sample quality correctly before moving on to another species:

(a) Demonstration session: Group demonstrations of samples of know quality by an experienced product expert. The labeled samples should represent a full range of quality, in order from highest to lowest quality, with discussion of sensory results, descriptors, as well as any data from chemical indicators of quality which are appropriate for that species.

(b) Discussion session: Random presentation of blind-coded samples for individual evaluation an group discussion or the results.

(c) Testing session: individual evaluation of blind-coded test samples and comparison of results with product expert.

The collection and analysis of data with detailed discussions of the samples will provide feed-back to the trainees.

Part III: Deterioration in Frozen Stored Fish and Shellfish (4 hours)

A. Demonstration of varying degrees of defects in appearance, odour, flavor, and texture caused by frozen storage of seafood products.

B. Include both low-fat and high-fat fish and seafood samples.

C. Have available terminology, definitions, and references for the oxidation process and for textural changes.

Part IV: Deterioration in Canned Fish and Shellfish (4 hours)

A. As for section II, and also to include information on pre- and post- processing deterioration.

Part V: Other Defects (2 hours)

A. Detection of taints using spiked samples (assess by odour only).

B. Demonstration of visual defects.

Appendix 1

DEFINITIONS OF SOME OF THE TERMS USED IN SENSORY ANALYSIS OF SEAFOOD

Appearance All the visible characteristics of a substance/sample;

Analyst/ Assessor Any person taking part in a sensory test;

Bilgy The aromatic associated with anaerobic bacterial growth, which is illustrated by the rank odour of bilge water. The term «bilgy» can be used to describe fish of any quality which has been contaminated by bilge water on board a vessel. Bilge water is usually a combination of salt water fuel, and waste water;

Bitter One of the four basic tastes, primarily perceived at the back of the tongue, common to caffeine and quinine. There is generally a delay in perception (2-4 seconds);

Briny The aroma associated with the smell of clean seaweed and ocean air;

Chalky In reference to texture, a product which is composed of small particles which imparts a drying sensation in the mouth. In reference to appearance, a product which has a dry, opaque, chalk like appearance;

Cucumber The aroma associated fresh cucumber, similar aromas can be associated with certain species of very fresh raw fish;

Decompose To break down into component parts;

Decomposed Fish that has an offensive or objectionable odour, flavor, colour, texture, or substance associated with spoilage;

Distinct Capable of being readily perceived;

Feedy «Feedy» is used to describe the condition of fish that have been feeding heavily. After death, the gastric enzymes first attack the internal organs, then the belly wall, then the muscle tissue. If the enzymes have penetrated into the flesh, they are capable of causing quality changes dimethyl (DMS), and may be attributed to certain zooplankton as it passes through the food chain. The odour of «feed» fish has been described as similar to certain sulfur containing cooked vegetables, such as broccoli, cauliflower, turnip, or cabbage;

Fecal Aroma associated with feces;

Firm A substance which exhibits moderate resistance when force is applied in the mouth or by touch;

Fish Means any of the cold-blooded aquatic vertebrate animals commonly known as such. This includes Pisces, Elasmobranchs and Cyclostomes. Aquatic mammals, invertebrate animals and amphibians are not include;

Fishy Aroma associated with aged fish, as demonstrated by trimethylamine (TMA)or cod liver oil. May or may not indicate decomposition, depending on species;

Flavor An attribute of foods resulting from the stimulation of taste, smell, sight, pressure, and often warmth, cold or mild pain;

Freshness Concept relating to time, process, or characteristics of seafood as defined by a buyer, processor, user, or regulatory agency;

Fruity Aroma associated with slightly fermented fruit. Term is used to describe odours resulting from high temperature decomposition. Example = canned pineapple;

Gamey The aroma and/or flavor associated with the heavy, gamey characteristics of some species such as mackerel. Similar to the relationship of fresh duck meat as compared to fresh chicken meat;

Glossy A shiny appearance resulting from the tendency of a surface to reflect light at 45 degree angle;

Grainy A product in which the assessor is able to perceive moderately hard, distinct particles. Sometimes found in canned seafood products;

Intensity The perceived magnitude of a sensation;

Iridescent An array of rainbow like colours, similar to an opal or an oil sheen on water;

Intensity The perceived magnitude of a sensation;

Iridescent An array of rainbow like colours, similar to an opal or an oil sheen on water;

Masking The phenomenon where one sensation obscures one or several other sensations present;

Mealy Describes a product that imparts a starch-like sensation in the mouth;

Metallic Aroma and/or taste associated with ferrous sulfate or tin cans;

Moist The perception of moisture being released from a product. The perception can be from water or oil;

Moldy Aroma associated with moldy cheese or bread;

Mouth coating The perception of a film in the mouth;

Mouth filling The sensation of a fullness dispersing throughout the mouth. A umami sensation, as stimulated by MSG;

Mushy Soft, thick, pulpy consistency. In seafood little or no muscle structure discernible when force is applied by touch or by mouth;

Musty The aroma associated with a moldy, dank cellar. Product can also have a musty flavor;

Odour Sensation due to stimulation of the olfactory receptors in the nasal cavity by volatile material. Same as aroma;

Off odour/ Atypical characteristics often associated with deterioration or transformation of a flavor product;

Opaque Describes product which does not allow the passage of light. In raw muscle tissue of fishery products, this is usually due to the proteins loosing their light reflecting properties due to falling pH;

Pasty A product which sticks together like paste in the mouth when mixed with saliva. Forms a cohesive mass which may adhere to the soft tissue surfaces of the mouth or fingers;

Persistent Existing without significant change; not fleeting;
Pungent An irritating, sharp, or piercing sensation;

Putrid Aroma associated with decayed meat;

Quality A degree of excellence. A collection of characteristics of a product that confers its ability to satisfy stated or implied needs;

Rancid Odour or flavor associated with rancid oil. Gives a mouth-coating sensation and/or a tingling perceived on the back of the tongue. Sometimes described as «sharp» or «painty»;

Reference Either a sample designated as the one to which others are compared, or another type of material used to illustrate a characteristic or attribute;

Rotting vegetable Aroma associated with decayed vegetables, in particular the sulfur containing vegetables, such as cooked broccoli**,** cabbage, or cauliflower;

Rubbery A resilient material which may be deformed under pressure, but returns to its original form once the pressure is released;

Salty The taste on the tongue associated with salt or sodium;

Sensory Relating to the use of the sense organs;

Slimy A fluid substance which is viscous, slick, elastic, gummy, or jelly-like;

Sour An odour and/or taste sensation, generally due to the presence of organic acids;

Stale Odour associated with wet cardboard or frozen storage. Product can have a stale flavor as well;

STP Sodium tripolyphosphate. Can produce a soapy, alkaline feel and taste in the mouth;

Sweet The taste on the tongue associated with sugar;

Taste One of the senses, the receptors for which are located in the mouth and activated by compounds in solution.Taste is limited to sweet, salty, sour, bitter and sometimes umami;

Terminology Terms used to describe the sensory attributes of a product;

Translucent Describes an object which allows some light to pass, but through which clear images can not be distinguished;

Transparent Describes a clear object, which allows light to pass and through which distinct images appear;

Umami Taste produced by substances such as monosodium glutamate (MSG) in solution. A meaty, savory, or mouth filling sensation;

Watermelon Aroma characteristic of fresh cut watermelon rind. Similar odours are sometimes found in certain species of very fresh raw fish;

Yeasty/ fermented Aroma associated with yeast and fermented products such as bread or beer.

Appendix 2

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APPENDIX III

PROPOSED DRAFT AMENDMENT TO THE STANDARD FOR CANNED SARDINES AND SARDINE-TYPE PRODUCTS

(At Step 5 of the Accelerated Procedure)

2. Description

2.1 Product Definition

2.1.1 Canned sardines or sardine type products are prepared from fresh or frozen fish of the following species:

Clupea bentincki[4]

[4] To be added to the current list

DRAFT STANDARD FOR DRIED SALTED ANCHOVIES

(At Step 6 of the Procedure)

1. SCOPE

This standard shall apply to all commercial species of fish belonging to the family *Engraulidae* that have been either washed in salt water and dried or washed, boiled in salt water and dried.

2. DESCRIPTION

2.1 PRODUCT DEFINITION

The product shall be prepared from fresh fish of the family *Engraulidae* obtained from the raw material described in Section 3.1.

2.2 PROCESS DEFINITION

The product shall be prepared by either washing fresh fish in salt water and drying or washing followed by boiling in salt water and drying. The drying process shall mean sundrying or artificial drying.

2.3 HANDLING PRACTICE

Fresh anchovies that are not processed immediately after harvesting shall be handled under such conditions as will maintain the quality during transportation and storage up to and including the time of processing. It is recommended that the fish shall be properly chilled or iced to bring its temperature down to 0°C (32°F) as quickly as possible as specified in the "Recommended International Code of Practice for Fresh Fish" (CAC/RCP 9-1976) and kept at an adequate temperature to prevent spoilage and bacterial growth prior to processing.

3. ESSENTIAL COMPOSITION AND QUALITY FACTORS

3.1 RAW MATERIAL

3.1.1 Fish

The product shall be prepared from clean, sound fish which have characteristic fresh appearance, colour and odour.

3.1.2 Salt

Salt shall mean sodium chloride of suitable quality as specified in sub-section 5.4.2 of the "Recommended International Code of Practice for Salted Fish" (CAC/CRP 26-1979).

3.2 FINAL PRODUCT

3.2.1 The product shall be free from any microbiological spoilage, any visible fungal growth, any odour or colour indicative of spoilage, any insect infestation and any foreign matter.

3.2.2 The product shall comply with the requirements prescribed in Table 1.

Table 1: Requirements for Dried Salted Anchovies

Characteristics	Requirement
Sodium chloride, percent by weight, max (d.b.)	15
Water activity (a_w), max	0.75
Acid insoluble ash, percent by weight, max. (d.b.)	1.5

3.3 BREAKAGE

3.3.1 Breakage shall mean fish (excluding fins and scales) which is not intact. The percentage of breakage is determined by the number of broken fish over the total number of fish in the test sample.

3.3.2 The percent breakage defined in section 3.3.1 shall not exceed the limits specified in section 3.5.

3.4 DECOMPOSITION

The products shall not contain more than 10 mg/100g of histamine based on the average of the sample unit tested.

3.5 SIZE CLASSIFICATION

According to Annex A

4. HYGIENE

4.1 It is recommended that the product covered by the provisions of this standard be prepared and handled in accordance with the appropriate sections of the Recommended International Code of Practice - General Principles of Food Hygiene (CAC/RCP 1-1985, Rev 2-1997), and the Recommended International Code of Practice for Fresh Fish (CAC/RCP 9 - 1976).

4.2 To the extent possible in good manufacturing practice, the product shall be free from objectionable matter.

4.3 When tested by appropriate methods of sampling and examination, the product:

(a) shall be free from microorganisms or in amounts which may represent a hazard to health;

(b) shall be free from parasites which may represent a hazard to health; and

(c) shall not contain any other substance originating from microorganisms in amounts which may represent a hazard to health.

(d) no sample unit shall contain histamine that exceeds 20 mg/100g

5. PACKING

5.1 The product shall be packed in a suitable packaging material which is moisture proof, gas impermeable and of transparent characteristics.

6. LABELLING

In addition to the provisions of the Codex General Standard for the Labelling of Prepackaged Foods (CODEX STAN 1-1985), the following specific provisions apply:

6.1 THE NAME OF THE FOOD

The name of the product shall be "Dried Salted Anchovies".

6.2 GRADE AND SIZE OF PRODUCT

The grade and size of the product shall be declared.

6.3 SCIENTIFIC AND COMMON NAMES

The scientific and common names of the fish shall be declared.

6.4 ADDITIONAL REQUIREMENTS

The package shall bear clear directions for keeping the product from the time they are purchased from the retailer to the time of their use and directions for cooking.

7. SAMPLING AND ANALYSIS

7.1 SAMPLING

According to the Codex Sampling Plan for Prepackaged Foods.

7.2 DETERMINATION OF SODIUM CHLORIDE

According to AOAC 937.09 (volumetric method).

7.3 DETERMINATION OF WATER ACTIVITY

According to AOAC 978.18.

7.4 DETERMINATION OF ACID INSOLUBLE ASH

According to method set out in Annex B.

ANNEX A

1. SIZING

Size shall be determined by the length of the product (whole fish).

Size Designation	Length
Small	less than 3.5 cm
Medium	3.5 - 6.5 cm
Big	greater than 6.5 cm

2. GRADING

Each size of dried salted anchovies shall be classified into two grades as defined below:

Characteristics	Grade	
	A	B
Breakage	Less than 5%	Less than 15%
Colour (comparison of colour must be among the same species of fish)	Whitish or bluish or yellowish (characteristic of species)	Off colour
Odour	No foul or rancid smell	No foul or rancid smell

ANNEX B

DETERMINATION OF ACID INSOLUBLE ASH

1. PREPARATION OF SAMPLE

1.1 Use sample from A1.1

2. REAGENT

2.1 Dilute hydrochloric acid, 1:1

3. PROCEDURE

3.1 Weigh accurately about 2 g of the dried sample (from A1.1) in a tared porcelain, silica or platinum dish. Ignite with a burner for about 1 hour. Complete the ignition by putting sample in a muffle furnace at 600 ± 20°C until grey ash results.

3.2 Cool and add 25 ml of dilute hydrochloric acid, cover with a watch-glass and heat on a water bath for 10 min.

3.3 Cool and filter through Whatman filter paper No. 42 or its equivalent.

3.4 Wash the residue with hot water until the washings are free from chlorides as tested with silver nitrate solution and return the filter paper and residue to the dish. Keep it in an electric air oven maintained at 135 ± 2°C for about 3 hours.

3.5 Ignite it in a muffle furnace at 600 ± 20°C for 1 hour. Cool in a desiccator and weigh. Ignite the dish again for 30 min, cool and weigh. Repeat this procedure until the difference between two successive weightings is less than 1 mg. Record the lowest weight.

3.6 CALCULATION

$$\text{Acid insoluble ash, per cent by weight} = \frac{(W_2 - W)}{(W_1 - W)} \times 100$$

where,

W is the weight in grammes, of the empty dish

W_1 is the weight in grammes, of the dish with the dried sample taken from the test

W_2 is the lowest weight in grammes, of the dish with the acid insoluble ash.

DRAFT STANDARD FOR CRACKERS FROM MARINE AND FRESHWATER FISH, CRUSTACEAN AND MOLLUSCAN SHELLFISH

(At Step 6 of the Procedure)

1. SCOPE

This standard shall apply to crackers prepared from marine and freshwater fish, crustacean and molluscan shellfish. It does not include ready-to-eat fried as well as artificially flavoured fish, crustacean and molluscan shellfish crackers.

2. DESCRIPTION

2.1 PRODUCT DEFINITION

The product is a traditional snack food made from fresh fish or frozen minced flesh of either marine (including both the red meat and white meat species) or freshwater fish, crustacean (including prawns and shrimps) and molluscan shellfish (including squids, cuttlefish, oysters, clams, mussels and cockles) as described in section 3.1 and other ingredients as described in section 3.2.

2.2 PROCESS DEFINITION

The product shall be prepared by mixing all the ingredients, forming, cooking, cooling, slicing and drying. The product prepared from frozen fish or frozen minced flesh may contain phosphate as food conditioner.

2.3 HANDLING PRACTICE

Fresh marine and freshwater fish, crustacean and molluscan shellfish shall be preserved immediately after harvesting by chilling or icing to bring its temperature down to 0°C (32°F) as quickly as possible as specified in the Recommended International Code of Practice for Fresh Fish (CAC/RCP 9-1976) and kept at an adequate temperature to prevent spoilage and bacterial growth prior to processing.

3. ESSENTIAL COMPOSITION AND QUALITY FACTORS

3.1 RAW MATERIAL

Fresh marine and freshwater fish, crustacean and molluscan shellfish shall mean freshly caught, chilled or frozen marine and freshwater fish, crustacean and molluscan shellfish. Frozen minced flesh shall mean freshly caught, chilled or frozen marine and freshwater fish, crustacean and molluscan shellfish which has been appropriately processed. The marine and freshwater fish, crustacean and molluscan shellfish shall have a characteristic fresh appearance, colour and odour.

3.2 OTHER INGREDIENTS

Suitable starches and/or flour, salt and potable water.

3.3 OPTIONAL INGREDIENTS

The product may contain sugar as well as suitable spices.

3.4 FINAL PRODUCT

3.4.1 The product shall display a uniform size, shape, colour, thickness and texture.

3.4.2 The product shall comply with the requirements prescribed in Table 1.

Table 1 : Requirements for Crackers From Marine and Freshwater Fish, Crustacean and Molluscan Shellfish

Characteristics	Grade	Fish	Crustacean and Molluscan Shellfish
Crude protein (N x 6.25), percent w/w min.	I	12	8
	II	8	5
	III	5	2
Moisture content, percent w/w	I, II, III	8 to 14	8 to 14

4. FOOD ADDITIVES[5]

Additives		Maximum Level in the Final Product
Food conditioner		
	Polyphosphate	Limited by GMP
Flavour enhancer		
621	Monosodium glutamate	Limited by GMP

5. HYGIENE

5.1 It is recommended that the product covered by the provisions of this standard be prepared and handled in accordance with the appropriate sections of the Recommended International Code of Practice - General Principles of Food Hygiene (CAC/RCP 1-1985, Rev 2-1985), and the Recommended International Code of Practice for Fresh Fish (CAC/RCP 9 - 1976).

5.2 To the extent possible in good manufacturing practice, the product shall be free from objectionable matter.

5.3 When tested by appropriate methods of sampling and examination, the product:

(a) shall be free from microorganisms or in amounts which may represent a hazard to health;

(b) shall be free from parasites which may represent a hazard to health; and

(c) shall not contain any other substance originating from microorganisms in amounts which may represent a hazard to health.

5.4 The product shall be free from any microbiological spoilage, any visible fungal growth, adulterants, foreign matter and other signs of spoilage.

6. PACKING

6.1 The product shall be packed in a suitable packaging material which is moisture proof, gas impermeable and of transparent characteristics.

7. LABELLING

In addition to the provisions of the Codex General Standard for the Labelling of Prepackaged Foods (CODEX STAN 1-1985), the following specific provisions apply:

7.1 THE NAME OF THE FOOD

The name of the product from marine and freshwater fish shall be "Fish Crackers" and those from crustacean and molluscan shellfish shall depict the common name of the species, like "Prawn Crackers" or "Squid Crackers".

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5 Subject to endorsement by the Codex Committee on Food Additives and Contaminants.

7.2 SCIENTIFIC AND COMMON NAMES

The scientific and common names of marine fish, freshwater fish, crustacean and molluscan shellfish shall be declared.

7.3 GRADES

When declared by grade, the package shall declare the grade as prescribed in Table 1.

7.4 ADDITIONAL REQUIREMENTS

The package shall bear clear directions for keeping the product from the time it is purchased from the retailer to the time of its use and directions for cooking.

8. SAMPLING AND ANALYSIS

8.1 SAMPLING

According to the Codex Sampling Plan for Prepackaged Foods.

8.2 DETERMINATION OF CRUDE PROTEIN

According to AOAC 920.87 or 960.52.

8.3 DETERMINATION OF MOISTURE

According to AOAC 950.46B (air drying).

PROPOSED DRAFT CODE OF PRACTICE FOR FISH AND FISHERY PRODUCTS

(At Step 3 of the Procedure)

TABLE OF CONTENTS

INTRODUCTION

This Code of Practice for Fish and Fishery Products has been developed by the Codex Committee on Fish and Fishery Products from the merging of current individual codes of practice plus sections on aquaculture and frozen surimi. These codes were primarily of a technological nature offering general advice on the production, storage and handling of fish and fishery products on board fishing vessels and on shore. It also deals with the distribution and retail display of fish and fishery products.

This combined Code of practice has been further modified to incorporate the Hazard Analysis Critical Control Point (HACCP) approach described in Codex document "HACCP system and guidelines for its application", and the General Principles for Food Hygiene, (Codex Alimentarius Supplement toVolume 1B - Food Hygiene). A pre-requisite programme is described in the Code covering technological guidelines and the essential requirements of hygiene in the production of fish and fishery products which are safe for human consumption and otherwise meets the requirements of the appropriate Codex product standards. The Code also contains guidance on the use of HACCP which is recommended to ensure the hygienic production of fish and fishery products to meet health and safety requirements. Within this Code a similar systematic approach has been applied to essential quality, composition and labelling provisions of the appropriate Codex product standards.

The Codex Committee on Fish and Fishery Products recommended at its Twentieth Session that defects of a commercial nature, i.e. workmanship defects, which had been removed from Codex fish product standards, be transferred to the appropriate Codex Code of practice for optional use between buyers and sellers during commercial transactions. The Committee further recommended that this detail should be described in a section on End Product Specifications which now appear as Appendices II - IX of this document. A similar approach to HACCP has been incorporated into the Code as guidelines for the control of defects.

This Code will assist all those who are engaged in the handling and production of fish and/or fishery products, or are concerned with their storage, distribution, export, import and sale in attaining safe and wholesome products which can be sold on national or international markets and meet the requirements of the Codex Standards.

HOW TO USE THIS CODE

The aim of this Code is to provide a user-friendly document as background information and guidance for the elaboration of fish and shellfish process management systems which would incorporate GMP as well as the application of HACCP in countries where these, as yet, have not been developed. In addition, it could be used for training of fishermen and employees of the fish processing industry.

The practical application of this *international* Code, with regard to *national* fisheries, would therefore require some modifications and amendments, taking into account local conditions and specific consumer requirements. This Code, therefore, is not intended to replace the advice or guidance of trained and experienced technologists regarding the complex technological and hygienic problems which might be unique to a specific geographical area or specific fishery and, in fact, is intended to be used as a supplement in such instances.

Before HACCP or a similar approach to HACCP can properly be applied to a process it is important that a solid foundation of good manufacturing practice exists. This is covered in *Section 3 - Pre-requisite Programme* and such groundwork should be regarded as the minimum requirements for a processing facility prior to the application of hazard and defect analyses. Only when this base has been satisfactorily achieved should the application of the principles outlined in *Section 4* be considered. *Section 5* deals with the major steps in the chain from handling of the raw fish through to cold storage and gives guidance and examples on the sort of hazards and defects to expect at the various points of this chain. This Section is used as the basis for all the other fish processing operations (Sections 6-13) which give additional guidance specific to the appropriate product sector. It must be stressed, however, that hazards and defects, and their subsequent control or action points, are product and line specific and therefore a full critical analysis based on *Section* 4 must be completed for each individual operation.

PROPOSED DRAFT CODE OF PRACTICE FOR FISH AND FISHERY PRODUCTS

SECTION 1 SCOPE

This Code of practice applies to the growing, harvesting, handling and production of fresh and processed fish and fishery products from marine and freshwater sources which are intended for human consumption.

SECTION 2 DEFINITIONS

For the purpose of this Code:

2.1 GENERAL DEFINITIONS

Aquaculture	To be developed
Chilled Sea Water	is clean sea water in which the temperature is maintained at approximately 0°C (32°F) or slightly colder by the addition of ice;
Chilling	is the process of cooling and is only completed when the fish is at a temperature approaching that of melting ice;
Clean Sea Water	means sea water or brackish water which is free from microbiological contamination, harmful substances and/or toxic marine plankton in such quantities as may affect the health quality of fishery products. For the purpose of this Code clean sea water also includes water sources from fresh water lakes;
Cleaning	means the removal of soil, food residues, dirt, grease or other objectionable matter from surfaces;
Contaminant	means any substance not intentionally added to food, which is present in such food as a result of the production (including operations carried out in crop husbandry, animal husbandry and veterinary medicine), manufacture, processing, preparation, treatment, packing,packaging, transport or holding of such food or as a result of environmental contamination.
Contamination	compromise fish safety or suitability;
Control Measure	means any action and activity that can be used to prevent or eliminate a food safety hazard or reduce it to an acceptable level. For the purposes of this Code a control measure is also applied to a defect.
Corrective Action	means any action to be taken when the results of monitoring at the CCP indicate a loss of control. For the purposes of this Code this also applies to a DAP.
Critical Control Point (CCP)	a step at which control can be applied and is essential to prevent or eliminate a food safety hazard or reduce it to an acceptable level.
Critical Limit	is a criterion which separates acceptability from unacceptability. For the purpose of this Code this also applies to a DAP;
Decision Tree	a sequence of questions applied to each process step with an identified hazard to identify which process steps are CCPs. For the purpose of this Code this also applies to a DAP;
Decomposition	is a persistent and distinct objectionable odour or flavour including texture breakdown caused by the deterioration of fish;
Defect	means a condition found in a product which fails to meet essential quality, composition and/or labelling provisions of the appropriate Codex product standards;
Defect Action Point (DAP)	a point, step or procedure at which control can be applied and a defect can be prevented, eliminated or reduced to acceptable level, or a fraud risk eliminated;

Disinfection	The reduction, by means of chemical agents and/or physical methods, of the number of microorganisms in the environment, to a level that does not compromise food safety or suitability
Dressed	means that portion of fish remaining after heading and gutting;
Fish	means any of the cold-blooded aquatic vertebrates commonly known as such.This includes Pisces, Elasmobranchs and Cyclostomes. Aquatic mammals and amphibians are not included;
Hazard	a biological, chemical or physical agent in, or condition of, food with the potential to cause an adverse health effect;
Hazard Analysis Critical Control Point (HACCP)	a system which identifies, evaluates, and controls hazards which are significant for food safety;
Marine Biotoxins	means poisonous substances accumulated by fish and shellfish feeding on toxin producing algae, or in (sea)water containing toxins produced by such organisms;
Monitor	the act of conducting a planned sequence of observations or measurements of control parameters to assess whether a CCP is under control. For the purpose of this Code this also applies to a DAP;
Potable Water	is fresh water fit for human consumption. Standards of potability should not be lower than those contained in the latest edition of the "International Standards for Drinking Water", World Health Organisation;
Pre-Requisite Programme	is a programme that is required prior to the application of the HACCP system to ensure that a fish processing facility is operating according to the Codex Principles of Food Hygiene, the appropriate Code of Practice and appropriate food safety legislation;
Processing Facility	means any premises where fishery products are prepared, processed, chilled, frozen, packaged or stored. For the purposes of this Code, premises also includes processing vessels;
Raw Material	are fresh and frozen fish and/or parts of fish which may be utilised to produce fish and fishery products products intended for human consumption;
Refrigerated Sea Water	is clean sea water cooled by a suitable refrigeration system;
Shelf-Life	the period during which the product maintains its microbiological safety and sensory qualities at a specific storage temperature. It is based on identified hazards for the product, heat or other preservation treatments, packaging method and other hurdles or inhibiting factors that may be used;
Shellfish	means those species of molluscs and crustaceans including cephalopods that are usually used for food;
Step	is a point, procedure, operation or stage in the food chain including raw materials, from primary production to final consumption;
Validation	Obtaining evidence that the elements of the HACCP plan are effective
Verification	the application of methods, procedures, tests and other evaluations, in addition to monitoring to determine compliance with the HACCP plan. For the purposes of this Code this also applies to a DAP;
Whole Fish	are fish as captured, ungutted.

2.2 FRESH, FROZEN AND MINCED FISH

Candling	is passing fish or parts of fish over a translucent table illuminated from below to detect parasites and other defects

Dehydration is the loss of moisture from frozen products through evaporation. This may occur if the products are not properly glazed, packaged or stored. Deep dehydration adversely affects the appearance and surface texture of the product and is commonly known as "freezer burn";

Fillet is a slice of fish of irregular size and shape removed from the carcase by cuts made parallel to the backbone;

Freezer is equipment designed for freezing fish and other food products, by quickly lowering the temperature so that after thermal stabilisation the temperature in the thermal centre of the product is the same as the storage temperature;

Freezing Process is a process which is carried out in appropriate equipment in such a way that the range of temperature of maximum crystallisation is passed quickly. The quick freezing process shall not be regarded as complete unless and until the product temperature has reached -18°C (0°F) or lower at the thermal centre after thermal stabilisation;

Fresh Fish are fish or preparations thereof which, in their final form, have received no preserving treatment other than chilling;

Frozen Fish are fish which have been subjected to a freezing process sufficient to reduce the temperature of the whole product to a level low enough to preserve the inherent quality of the fish and which have been maintained at this low temperature during transportation, storage and distribution up to and including the time of final sale. For the purpose of this Code the terms "frozen", "deep frozen", "quick frozen", unless otherwise stated, shall be regarded as synonymous;

Glazing a protective layer of ice formed at the surface of a frozen product by spraying it with, or dipping it into, clean sea water, potable water, or potable water with approved additives;

Minced Fish is comminuted flesh produced by separation from skin and bones;

Modified Atmosphere Packaging (MAP) means packaging in which the atmosphere surrounding the fish is different from the normal composition of air;

Separation is a mechanical process for producing minced fish whereby the skin and bone is substantially removed from the flesh;

Separator is a mechanical device used for separation;

Steak is a section of fish, removed by cutting approximately at right angle to the backbone.

2.3 MOLLUSCAN SHELLFISH

Accepted / Acceptable / Approved means accepted by the official agency having jurisdiction;

Conditioning means placing live molluscan shellfish in tanks, floats or natural sites to remove sand, mud or slime and improve product acceptability;

Distribution Centre means any approved on-shore or off-shore installation or establishment for the reception, conditioning, washing, cleaning, grading and packaging of live molluscan shellfish fit for human consumption;

Growing Areas means all brackish and marine areas approved for the production or harvesting of molluscan shellfish either by natural growth or by aquaculture, destined for human consumption;

Heat Shocking means the process of subjecting molluscan shellfish in the shell to any form of heat treatment, such as steam, hot water, or dry heat for a short period of time, to facilitate rapid removal of meat from the shell. Such treatment should not be considered as any part of a cooking process;

Purification (depuration) means the removal of microorganisms from molluscan shellfish by the process of holding live molluscan shellfish for a period of time under approved, controlled conditions in natural or artificial sea water suitable for the process, which may be treated or untreated, in tanks, floats or rafts;

Relaying means the removal of molluscan shellfish from a polluted growing area to an acceptable growing or holding area under the supervision of the agency having jurisdiction and holding them there for the time necessary for the reduction of pollutants to an acceptable level.

2.4 CRUSTACEANS

[TO BE COMPLETED]

2.5 CEPHALOPODS

[TO BE COMPLETED]

2.6 SALTED FISH

Brine solution of salt in water;

Brine Injection is the process for directly injecting brine into the fish flesh;

Brining means the process of placing fish in brine for a period of sufficient length for the fish tissue to absorb a significant quantity of salt;

Dry-Salting is the process of mixing fish with suitable salt and stacking the fish in such a manner that the resulting brine drains away;

Fatty Fish refers to those fish that contain more than [2% fat] or oil in the flesh;

Gibbing the process of removing the gills, long gut and stomach from a fish such as herring, by inserting a knife at the gills; the milt or roe and some of the pyloric caeca are left in the fish;

Heavy Salted Fish the salt content of the fish muscle is above 20 g/100 g water phase;

Medium Salted Fish the salt content of the fish muscle is above 10 g/100 g water phase and is lower or equal to 20 g salt/100 g water phase;

Light Salted Fish the salt content of the fish muscle is above 4 g/100 g water phase and is lower or equal to 10 g salt/100 g water phase;

Nobbing removing gut from fatty fish, such as herring by partially severing the head and pulling the gills away together with attached gut;

Pickle brine which may contain vinegar and spices;

Salt is a crystalline product consisting predominantly of sodium chloride. It is obtained from the sea, from underground rock salt deposits or from natural brine

Salt Cured Fish means fish that is preserved with salt;

Salt-Matured Fish means salted fish that has an appearance, consistency and flavour characteristic of the final product;

Salted Fish /Salted Fillet fish /fillets which have been treated by either brining, dry-salting, pickle curing or a combination of these;

Split Fish fish that have been cut open from throat or nape to the tail, with gills, guts and roe removed. Whole or part of backbone may be left in or removed;

Wet Salting (Pickling) is the process whereby fish is mixed with suitable salt and stored in watertight containers under the resultant brine (pickle) which forms by solution of salt in the water extracted from the fish tissue. Brine may be added to the container. The fish is subsequently removed from the container and stacked so that the brine drains away;

[**Maturation**] To be developped

2.7 SMOKED FISH

Cold Smoking	means smoking at a temperature of the smoked product lower than the temperature where the fish flesh shows sign of heat denaturation;
Hot Smoking	means smoking at a temperature of the smoked product until the fish flesh is denatured throughout;
Mechanical Smoking	means a smoking process where the smoke is generated outside the smoking chamber and by artificial ventilation forced to flow around the fish;
Smoke	means the aerosol of particles and droplets in the combustion gases from the combustion of wood. The smoke might be submit to separation of tar before it enters the smoking chamber;
Traditional Smoking Kiln	means an enclosed space such as a chamber or chimney where smoke is generated beneath the fish and allowed to flow around the fish by draught to a chimney;
Wood	means wood including sawdust, shavings and chips, and woody plants in their natural or dried state. Painted, impregnated or otherwise treated wood or woody plants must not be used for the generation of smoke.
Liquid smoke	To be developed

2.8 CANNED FISH

Biological Stability	means that no micro-organism can grow in the food under no-refrigerated conditions usually provided for processing, retail and storage.
Bleeders	are small vents through which steam and other gases escape throughout the entire heat process. Bleeding provides a circulation of steam within the retort and ensures the elimination of any air that enters the retort with the steam;
Canned Product	means fish or shellfish packed in containers which have been hermetically sealed and have been subjected to a sufficient heat treatment, alone or in combination with other appropriate treatments, to obtain the biological stability of canned fish or shellfish;
Come-Up Time	is the time required to bring a loaded retort up to the specified processing temperature;
Heat Process of Sterilisation	is the process with sufficient heat to ensure the biological stability. It is described as a function of time and temperature;
Hermetically Sealed Container	means a container sealed in order to protect its content against the penetration of micro-organisms during and after heat processing**;**
Retort	is a pressure vessel designed for heat processing product packed in hermetically sealed containers;
Saturated Steam	is pure steam in equilibrium with water at the same temperature. Under these conditions, the temperature of the steam is entirely dependent on its pressure;
Sterilisation Duration	is the duration between the time the temperature of sterilisation is reached and the time the cooling begins;
Sterilisation Schedule	is the whole set of the time-temperature pairs selected by the canner for a certain product in a container of a given size, to ensure at least the biological stability;
Temperature of Sterilisation	is the temperature which is maintained during the heat treatment, such as it is specified in the chosen sterilisation schedule;
Venting	is the process of flushing completely the air out of retorts at the beginning of a heat process. It is done by allowing large volumes of steam to flow through the retort to drive and carry the air out through open vents at the top of the retort.

2.9 FROZEN SURIMI

De-Watering means removal of excessive wash water from the minced fish flesh;

Frozen Surimi means the fish protein product for further processing, which has been processed by heading, gutting, cleaning fresh fish, and mechanically separating the edible muscle from the skin and bone. The minced fish muscle is then washed, refined, de-watered, mixed with cryoprotective food ingredients and frozen;

Gel Forming Ability means the ability of surimi to form an elastic gel when fish meat is comminuted with the addition of salt and then formed and heated. This elasticity is a function possessed by myosin as the primary component of myofibrillar protein;

Myofibrillar Protein is a generic term of skeletal muscle proteins such as myosin and actin;

Refining means a process of removing from washed meat by used of a strainer small bones, sinews, scales and bloody flesh of such sizes as may not be mixed in a final product, thereby concentrating myofibrillar protein;

Surimi-Based Products means a variety of products produced from surimi with addition of ingredients and flavor such as "surimi gel" and shellfish analogs;

Water-Soluble Components means any water-soluble proteins, organic substances and inorganic salts contained in fish meat;

Washing means a process of washing away blood and water soluble components from minced fish with cold water by the use of a rotary filter, thus increasing the level of myofibrillar proteins thereof;

Washed meat means fish meat that is washed and then drained of water.

2.10 AQUACULTURE

Aquaculture Establishment is any premises for the production of live finfish or crustaceans (fish) intended for human consumption, including the supporting inner infrastructure and surroundings under the control of the same management;

Chemicals includes any substance either natural or synthetic which can affect the live fish, its pathogens, the water, equipment used for production or the land within the aquaculture establishment; such substances include pesticides, therapeutic chemicals, disinfectants, anaesthetics, hormones, dyes, detergents, antifoulants, and fertilizers;

Colouring means obtaining specifically coloured fish flesh by incorporating into the fish food a natural or artificial substance or additive approved for this purpose by the agency having jurisdiction

Conditioning means transferring harvested fish which are fit for human consumption into other ponds, tanks or cages of the same aquaculture establishment , in order to clean the gut, recover from stress or acclimatize to different conditions before transport of the live product;

Corrosion-resistant Material means impervious material which is free from pits, crevices, and scale, is non-toxic and unaffected by water (or seawater), ice, slime or any other corrosive substance with which it is likely to come into contact. Its surfaces must be smooth and it must be capable of withstanding exposure to repeated cleaning, including the use of detergents and disinfectants;

Diseased Fish means a fish on or in which pathological changes or other abnormalities are apparent;

Establishment see aquaculture establishment;

Equipment means utensils such as nets, conveyers, sorting tables or machines, buckets, dip nets, pumps, transportation tanks, vehicles, etc., used during fishing out, sorting, loading and transportation of fish to market;

Feed Additives means chemicals other than nutrients for fish, which are approved for addition to fish feed;

Fish Feed means fodder intended for fish in aquaculture establishments, in any form and of any composition;

Fishing Out	means collecting or harvesting of fish out of rearing units for their transfer to another rearing unit;
Good Aquaculture (or Good Fish Farming) Practices	are defined as those practices of the aquaculture sector that are necessary to produce quality food products conforming to food laws and regulations;
Growing Area	means freshwater, estuarine, brackish and marine areas used for aquaculture establishments, including surroundings under the control of the same management;
Harvesting	means those operations which start with taking the fish from the water and end with the transport of live or fresh fish for human consumption to the market;
Manager	in relation to an establishment includes any person for the time being responsible for the management of the establishment;
Official Agency Having Jurisdiction	means the official authority or authorities charged by the government with the control of food hygiene (sometimes referred to as the competant authority) as well as/or with sanitation in aquaculture;
Pesticide	means any substance intended for preventing, destroying, attracting, repelling or controlling any pest including unwanted species of plants or animals during the production, storage, transport, distribution and processing of food, agricultural commodities, or animal feeds or which may be administered to animals for the control of ectoparasites. The term normally excludes fertilizers, plant and animal nutrients, food additives, and veterinary drugs;
Pesticide Residue	means any specified substance in food, agricultural commodities, or animal feed resulting from the use of a pesticide. The term includes any derivatives of a pesticide, such as conversion products, metabolites, reaction products, and impurities;
Pollutants	means substances originating from human activities and not from natural causes, which can contaminate the fish or impair the quality of the water in which they are grown;
Purification	see entry in molluscan shellfish section;
Rearing Environment	is the water space in which fish are confined for the purpose of aquaculture by any construction material;
Rearing Unit	**in an aquaculture establishment** means an adequate aqueous confinement space for a certain biomass; this term includes a pond, storage pond, tank, raceway, or cage;
Residues	means any foreign substances including their metabolites, which remain in fish prior to harvesting as a result of either application or accidental exposure. Examples of such substances are antibiotics, anthelminthics, chemotherapeutics, disinfectants, fish food additives, growth promoters, hormones, hormone-like substances, heavy metals, pesticides, tranquilizers and radioactive materials. Maximum residue limits (MRLs) are specified for many substances by the Codex Alimentarius or national regulations;
Tolerance	refers to residue levels of a chemical that are permitted by the official agency having jurisdiction in food for human consumption;
Unit	see "rearing unit";
Veterinary Drug	means any substance applied or administered to any food-producing animal, such as meat or milk-producing animals, poultry, fish or bees, whether used for therapeutic, prophylactic or diagnostic purposes or for modification of physiological functions or behaviour;
Wastewater	refers to liquic waste discharged from homes, commercial premises and similar sources to individual disposal systems or to municipal sewers, and consists mainly of excreta and used water;
Withdrawal Time	is the period of time between the administration of a veterinary drug to fish, or exposure of fish to a chemical, and harvesting of the fish to ensure that the concentration of the drug or chemical in the edible flesh of the fish complies with the maximum permitted concentration of the drug or chemical in fish for human consumption.

SECTION 3 PRE-REQUISITE PROGRAMME

Prior to the application of HACCP to any segment of the fish processing chain, that segment must be supported by a pre-requisite programme based on good hygienic practice or as required by the competent authority. The establishment of pre-requisite programmes will allow the HACCP team to focus on the HACCP application for the product and process selected, without undue consideration and repetition of hazards from the surrounding environment. The pre-requisite programme would be generic to all processes within an individual establishment and will require monitoring and evaluation to ensure its continued effectiveness. A summary of the pre-requisite programme elements is given in Table 1.

Table 1 SUMMARY OF PRE-REQUISITE PROGRAMME ELEMENTS

	SECTION	HAZARD/ DEFECT	EXAMPLE OF MONITORING PROCEDURE	EXAMPLE OF CORRECTIVE ACTION
3.1 - 3.2	Vessel and Plant design and construction	Contamination or loss of essential quality	Vessel and Plant inspection	Modification or maintenance to the vessel or plant
3.3	Design and construction of equipment and utensils	Contamination or loss of essential quality	Equipment and utensils inspection	Modification or maintenance to the equipment and utensils
3.4	Hygiene control programme			
	- Cleaning & disinfection	Contamination	Vessel and Plant/equipment/ inspection	Redesign or repeat programme
		Contamination		Repair or replace
	- Water & ice	Contamination	Water treatment and ice making equipment inspection, chlorine levels	Modify programme
	- Pest control		Plant/equip. inspection, bait/trap inspection	
3.5	Personal hygiene and health	Contamination	Supervision	Re-training
3.6	Traceability and recall procedures	Inability to retrieve unacceptable product	Inventory checks/ reconciliation of recall procedures	Modify procedures
3.7	Training	Not operating system correctly	Supervision	Re-train / modify procedures

3.1 FISHING VESSEL HYGIENIC DESIGN AND CONSTRUCTION

There are many different types of fishing vessel used throughout the world which have evolved in particular regions to take account of the prevailing economics, environment and types of fish caught or harvested. This Section attempts to highlight the basic requirements for cleanability, minimising damage, contamination and decomposition to which all vessels should have regard to the extent possible in order to ensure hygienic, high quality handling of fresh fish intended for further processing and freezing.

The hygienic design and construction of a fishing vessel and vessels used to harvest farmed fish should take into consideration the following recommendations:

3.1.1 For Ease of Cleaning and Disinfection

- all surfaces with which fish might come in contact should be of corrosion resistant material which is smooth and easily cleanable;
- vessels should be designed and constructed to reduce sharp corners and projections to avoid dirt traps;
- construction should facilitate ample drainage;
- a good supply of clean sea water or potable water at adequate pressure.

3.1.2 To Minimise Contamination

- bilge, water, smoke, fuel oil, grease or other objectionable substances should not contaminate the fish;
- all surfaces in fish handling areas should be non-toxic, and smooth and impervious to minimise build-up of contamination with fish slime, blood, scales and guts;
- drainage should not be permitted to contaminate fish;
- adequate hand washing and toilet facilities should be available;
- all plumbing and waste lines should be capable of coping with peak demand;
- the intake for clean sea water should be located to avoid contamination;
- prevent the entry of birds, insects, or other pests, animals and vermin, where appropriate;
- non-potable water lines should be clearly identified and separated from potable water to avoid contamination.
- separate facilities should be provided to segregate:
  - poisonous or harmful substances;
  - dry storage of materials, packaging etc.;
  - offal and waste materials.

3.1.3 To Minimise Damage to the Fish

- in fish handling areas, surfaces should have a minimum of sharp corners and projections;
- in boxing and shelving fish storage areas, the design should preclude excessive pressure being exerted on the fish;
- in refrigerated sea water storage areas, the density of the fish should be controlled to prevent damage;
- chutes and conveyors should be designed to prevent physical damage caused by long drops or crushing;
- prevent unnecessary exposure to the elements.

3.1.4 To Minimise Decomposition

- design should permit quick and efficient handling of fish;
- suitable facilities should be provided for storage of ice, where appropriate;
- refrigerated and/or chilled sea water systems should provide adequate cooling capacity.

3.1.5 To Minimise Damage during Harvesting of Farmed Fish

Farmed fish are usually harvested using seines or nets and may be transported live to processing plants.

- seines, nets and traps should be carefully selected to ensure minimum damage during harvesting;
- harvesting areas should be designed and constructed for easy, fast and hygienically acceptable operations;

- all equipment for harvesting, catching, sorting, grading, conveying and transporting of live fish should be designed for rapid and efficient handling of live fish without causing mechanical damage and should be suitable for easy and thorough cleaning as well as disinfection, when appropriate;
- conveying equipment for live and slaughtered fish should be constructed of suitable corrosion-resistant material which does not transmit toxic substances; should be easy to clean and should not cause mechanical injuries to fish;
- where fish are transported live, care should be taken to avoid overcrowding and to minimise bruising.

3.2 PLANT HYGIENIC DESIGN AND CONSTRUCTION

Fish are highly perishable foods and should be handled carefully and chilled without undue delay. The fish processing plant, therefore, should be designed for the rapid processing and storage of fish and fishery products. The plant shall have a product flow-through pattern which minimises risk of cross-contamination and further reduction in fish quality, and allows the separation of finished product from raw materials.

The hygienic design and construction of a fish plant should take into consideration the following recommendations:

3.2.1 For Ease of Cleaning and Disinfection

- the surfaces of walls, partitions and floors should be made of impervious, non-toxic materials;
- walls and partitions should have a smooth surface up to a height appropriate to the operation;
- floors should be constructed to allow adequate drainage;
- ceilings and overhead fixtures should be constructed and finished to minimise the build-up of dirt and condensation, and the shedding of particles;
- windows should be constructed to minimise the build-up of dirt and, where necessary, be fitted with removable and cleanable insect-proof screens. Where necessary, windows should be fixed;
- doors should have smooth, non-absorbent surfaces.
- joints between floors and walls should be constructed for ease of cleaning.

3.2.2 To Minimise Contamination

- all surfaces in fish handling areas should be non-toxic, and smooth and impervious to minimise the build-up of contamination with fish slime, blood, scales and guts;
- ventilation should be sufficient to remove excess steam, smoke and objectionable odours;
- prevent the entry of birds, insects, or other pests, animals and vermin;
- drainage should be suitably sized;
- ceiling lights should be covered or otherwise suitably protected to prevent contamination by glass or other material;
- working surfaces that come into direct contact with fish should be in sound condition, durable and easy to maintain. They should be made of smooth, non-absorbent and non-toxic materials, and inert to fish, detergents and disinfectants under normal operating conditions;
- adequate facilities should be provided for washing and disinfecting equipment;
- all plumbing and waste lines should be capable of coping with peak demands;
- plant layout should be designed to minimise cross-contamination;
- adequate hand washing and toilet facilities should be available;
- an ample supply of cold and hot potable water and/or clean sea water under adequate pressure should be provided;
- non-potable water lines should be clearly identified and separated from potable water to avoid contamination;

- a suitable water treatment system should be installed, where appropriate;
- separate facilities should be provided to segregate:
  - poisonous or harmful substances;
  - dry storage of materials, packaging etc.;
  - offal and waste materials.

3.2.3 To Minimise Decomposition

- the plant should be designed for the quick and efficient processing of fish;
- suitable and adequate facilities should be provided for storage and/or production of ice;
- all refrigeration and cold storage systems should provide adequate cooling and freezing capacities.

3.2.4 To Provide Adequate Lighting

- on all work surfaces.

3.3 HYGIENIC DESIGN AND CONSTRUCTION OF EQUIPMENT AND UTENSILS

Equipment, containers and utensils coming into contact with fish should be designed and constructed to ensure that they can be adequately cleaned, disinfected and maintained to avoid contamination. Equipment should be durable and movable and/or capable of being disassembled to allow for maintenance, cleaning, disinfection and monitoring.

The hygienic design and construction equipment and utensils should take into consideration the following recommendations:

3.3.1 For Ease of Cleaning and Disinfection

- all surfaces which come into contact with fish should be of corrosive resistant material which is smooth and easy to clean;
- equipment and utensils should be designed and constructed to reduce sharp corners and projections to avoid dirt traps;
- construction of equipment should provide for ample drainage and ease of dismantling;
- a suitable and adequate supply of cleaning utensils and cleaning agents should be provided.

3.3.2 To Minimise Contamination

- all surfaces of equipment in fish processing areas should be non-toxic, and smooth and impervious to minimise the build-up of contamination with fish slime, blood, scales and guts;
- adequate drainage should be provided in storage containers and equipment;
- drainage should not be permitted to contaminate fish.

3.3.3 To Minimise Damage

- surfaces should have a minimum of sharp corners and projections;
- chutes and conveyors should be designed to prevent physical damage caused by long drops or crushing;
- fish storage equipment should be fit for the purpose and not lead to crushing of the fish.

3.4 HYGIENE CONTROL PROGRAMME

The potential effects of harvesting and handling of farmed products, on-board vessel handling or in-plant production activities on the safety and suitability of fish should be considered at all times. In particular this includes all points where contamination may exist and taking specific measures to ensure the production of a safe and wholesome product. The type of control and supervision needed will depend on the size of the operation and the nature of its activities.

3.4.1 A Permanent Cleaning and Disinfection Schedule

A permanent cleaning and disinfection schedule should be drawn up to ensure that all parts of the vessel, plant and equipment therein are cleaned appropriately and regularly.

A typical cleaning and disinfecting process may involve as many as six separate steps:

Pre-cleaning	Preparation of area and equipment for cleaning. Involves steps such as removal of all fish or fish products from area, protection of sensitive components and packaging materials from water, removal by hand or squeegee of fish scraps, etc.
Pre-rinse	A rinsing with water to remove remaining large pieces of loose soil.
Cleaning	Treatment of surfaces with an appropriate detergent to remove soil.
Rinse	A rinsing with water to remove all soil and detergent.
Disinfection	Application of chemicals and/or heat to destroy most microorganisms on surface.
Post-rinse	A final rinse with water to remove disinfectant.

Fish handlers or cleaning personnel as appropriate should be well trained in the use of special cleaning tools, methods of dismantling equipment for cleaning and should be knowledgeable in the significance of contamination and the hazards involved.

3.4.2 Designation of Personnel for Cleaning

It is recommended that in each processing plant or vessel an individual is designated to be responsible for the cleanliness of the plant or vessel.

Schedules should be implemented to:

- prevent the build up of waste and debris;
- protect the fish from contamination;
- dispose of any rejected material in a hygienic manner;
- monitor personal hygiene and health standards;
- monitor the pest control programme;
- monitor cleaning and disinfecting programmes;
- monitor the quality of water and ice supplies.

3.4.3 Maintenance of Premises, Equipment and Utensils

- Buildings, materials, utensils and all equipment in the establishment - including drainage systems - should be maintained in a good state and order;
- Procedures for the maintenance, repair and adjustment of apparatus should be established. These procedures should specify notably, for each equipment, the methods used, the persons in charge of their application and their frequency.

3.4.4 Pest Control Systems

- Good hygienic practices should be employed to avoid creating an environment conducive to pests. Pest control programmes could include preventing access, eliminating harbourage and infestations, and establishing monitoring detection and eradication systems.

3.5 PERSONAL HYGIENE AND HEALTH

Personal hygiene and facilities should be such to ensure that an appropriate degree of personal hygiene can be maintained to avoid contaminating fish

3.5.1 Facilities and Equipment Should Include :

- appropriate number and hygienic design of toilets;

- adequate means of hygienically washing and drying hands;
- adequate changing facilities for personnel should be suitably located and designated.

3.5.2 Personnel Hygiene

- no person who is known to be suffering from, or who is a carrier of any communicable disease or has an infected wound or open lesion should be engaged in the preparation, handling or transporting of fish or fishery products;
- all persons working in a fish plant should maintain a high degree of personal cleanliness and should take all necessary precautions to prevent the contamination of the fish or their products or ingredients.

3.6 TRACEABILITY AND RECALL PROCEDURES

Experience has demonstrated that a system for recall of product is a necessary component of a pre-requisite programme because no process is fail-safe. Traceability, which includes lot identification, is essential to an effective recall procedure.

- managers should ensure effective procedures are in place to effect the complete traceability and rapid recall of any lot of fishery product from the market.
- Appropriate records of processing, production and distribution should be kept and retained for a period that exceeds the shelf-life of the product.
- each container of fish or fishery product should be marked to identify the producer/processor and lot.
- where there is an immediate health hazard, products produced under similar conditions, and likely to present a similar hazard to public health, may be withdrawn. The need for public warnings should be considered.
- recalled products should be held under supervision until they are destroyed, used for purposes other than human consumption, or reprocessed in a manner to ensure their safety.

3.7 TRAINING

Fish hygiene training is fundamentally important. All personnel should be aware of their role and responsibility in protecting fish from contamination and deterioration. Fish handlers should have the necessary knowledge and skill to enable them to handle fish hygienically. Those who handle strong cleaning chemicals or other potentially hazardous chemicals should be instructed in safe handling techniques.

Each fish processing facility should ensure that individuals have received adequate and appropriate training in the design and proper application of a HACCP system and process controls. Training of personnel in the use of HACCP is fundamental to the successful implementation and delivery of the programme in fish processing establishments. The practical application of such systems will be enhanced when the individual responsible for HACCP has successfully completed a course given by or certified by a competent authority. Managers should also arrange for adequate and periodic training of every employee in the establishment so that they understand the principles involved in HACCP.

SECTION 4 PRINCIPLES AND DEVELOPMENT OF HAZARD ANALYSIS CRITICAL CONTROL POINT (HACCP) BASED SYSTEMS

The Hazard Analysis Critical Control Point (HACCP) is a science-based system which identifies specific hazards and measures for their control to ensure the safety of food. HACCP is a management system (see figure 1) which identifies specific hazards and control measures rather than relying on end-product testing.

This section explains the principles of HACCP as it applies to the handling and processing of fish. It also explains how a similar approach involving many of the principles can apply to the broader application covering the essential quality, composition and labelling provisions of Codex standards which in this case are referred to as **Defect Action Point Analysis**.

4.1 HACCP PRINCIPLES

The HACCP system consists of seven principles which have to be followed in any consideration of HACCP (Supplement to Codex Alimentarius Volume 1B - Food Hygiene, Annex to RCP/CAC 1-1969, Rev.3 (1997), page 19).

HACCP is an important management tool which can be used by operators for ensuring safe, efficient processing. Its proper use can greatly reduce the need for end-product testing but it must also be recognised that personnel training is essential in order that HACCP will be effective.

4.2 IMPLEMENTATION

This Code can only provide guidance on how to use HACCP principles with pointers given as to the type of hazards or defects which may occur. It is important that HACCP principles be applied to each process and are considered on a specific basis to reflect the risks of the operation.

In following HACCP principles, users are requested to establish the potential hazards associated with each product type at each step or procedure in the process from point of harvest, during unloading, transport or during processing, as appropriate to the process defined. Since the Code is intended to cover not only those hazards associated with safety but to include other aspects of production including the essential product quality, composition and labelling provisions as described in product standards developed by the Codex Alimentarius Commission, both critical control points (CCP) and defect action points (DAP) are included in the Code.

4.3 APPLICATION

Each fish processing facility should ensure that the provisions of the appropriate Codex standards are met. To accomplish this, each facility should implement a food safety management system based on HACCP principles and should at least consider a similar approach to defects, both of which are described in this code. Prior to the application of HACCP to any segment of the handling and processing chain of fish, that segment must be supported by a pre-requisite programme based on good hygienic practice (see Section 3). It should be noted that parts of the pre-requisite programme may be classified as a CCP or DAP within a particular process.

The food management system developed should indicate responsibility, authority and the interrelationships of all personnel who manage, perform and verify work affecting the performance of such systems. The design of this programme should identify critical control points in the operation where the plant or product will be inspected, the specification or standard to be met, the monitoring frequency and sampling plan used at the control point, the monitoring system used to record the results of these inspections and any corrective action when required. A record for each critical control point that demonstrates that the monitoring procedures and corrective actions are being followed should be provided. The records should be maintained as verification and evidence of the plant's quality assurance programme. Similar records and procedures may be applied to DAPs. A method to identify, describe, and locate the records associated with HACCP programmes should be established as part of the HACCP programme.

The implementation of HACCP principles is better identified in the Logic Sequence for implementation of HACCP (Figure 1).

4.3.1 Flow Diagram

When applying HACCP, it is necessary to construct a flow diagram describing each step of the process. The flow diagrams presented in Sections 5-12 are examples of typical process-lines appropriate to different products. CCPs and DAPs are identified at some steps, ***for illustrative purposes only***, with references to the appropriate sections of the Code.

For Hazard and Defect Analysis it is necessary to carefully examine both the product and the process and produce a flow diagram(s) (see individual sections for flow diagrams). Any flow diagram should be as simple as possible provided that each step in the process, including process delays, from the selection of raw materials through to the processing, distribution, sale and customer handling should be clearly outlined in sequence with sufficient technical data to avoid ambiguity.

In addition to the flow diagram it is important to identify potential hazards and defects in the operation from the point of view of construction and equipment contained in the plant of hygienic operation, including hazards associated with the use of ice and water. This is covered by the pre-requisite programme and is used to denote hazards which are common to almost any point in the process. If a process is too complex to be easily represented by a single flow chart then it can be sub-divided into constituent parts, provided the relationship between each of the parts is clearly defined.

Examples of the type of information needed to identify hazards and defects are as follows:

- all raw materials/ingredients and packaging used (microbiological, chemical, physical data);
- sequence of process steps (including raw material addition);
- process controls; time/temperature history of all raw materials, intermediate and final products, including potential for delay;
- product recycle/rework loops;
- high/low risk area segregation;
- equipment design features;
- personnel routes;
- routes of potential cross-contamination;
- efficiency of cleaning and disinfection procedures.

It should be stressed that in individual plants a complete and precise flow chart has to be drawn up for each process in order to implement properly the HACCP principles. An indication of the principle HAZARD (CCP) or DEFECT (DAP) with corresponding CONTROL MEASURE should be given at each step where appropriate.

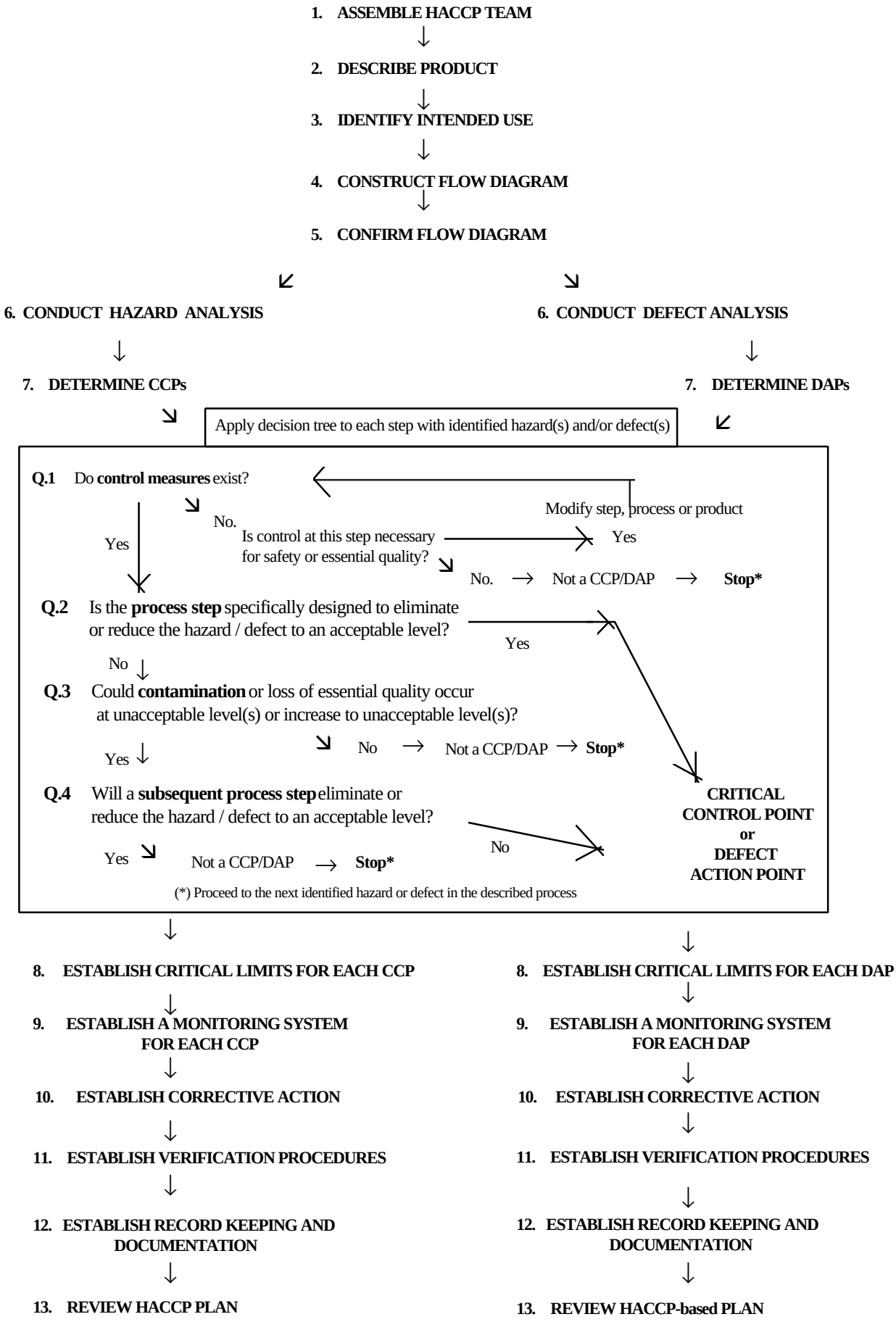


Figure 1 Summary of how to develop a HACCP and Defect Analysis system for a fish plant

4.3.2 Identification of Hazards and Defects

Risks to consumer health from seafoods captured in unpolluted marine environments are low, provided these products are handled in line with principles of Good Manufacturing Practice. However, as with all foods, there are some health risks associated with the consumption of certain products, which may be increased when the catch is mishandled after harvest. Fish from some marine environments, such as tropical reef fish, can pose a consumer risk from natural marine toxins, such as ciguatera. The risk of adverse health effects from certain hazards might be increased under certain circumstances in products from aquaculture when compared with fish from the marine environment. The risks of foodborne disease associated with products from aquaculture are related to inland and coastal ecosystems, where the potential of environmental contamination is greater when compared to capture fisheries. In some parts of the world, where fish are consumed either raw or partially cooked, there is an increased risk of foodborne parasitic or bacterial disease. In order to perform a hazard analysis as part of the process of developing a HACCP plan, fish processors must have information on potential hazards associated with raw material and products for further processing. Table 2 summarises possible biological and chemical food safety hazards associated with fresh fish.

Biological Hazards

Parasites

The parasites known to cause disease in humans and transmitted by fish or crustaceans are broadly classified as helminths or parasitic worms. These are commonly referred to as Nematodes, Cestodes and Trematodes. Fish can be parasitised by protozoans, but there are no records of fish protozoan disease being transmitted to man. Parasites have complex life cycles, involving one or more intermediate hosts and are generally passed to man through the consumption of raw, minimally processed or inadequately cooked products that contain the parasite infectious stage, causing foodborne disease. Freezing at -20°C or below for 7 days or -35°C for about 20 hours of fish intended for raw consumption will kill parasites. Processes such as brining or pickling may reduce the parasite hazard but will not eliminate it. Candling, trimming belly flaps and physically removing the parasite cysts will also reduce the hazards but will not guarantee elimination.

Nematodes

Many species of nematodes are known to occur world-wide and some species of marine fish act as secondary hosts. Among the nematodes of most concern are *Anisakis* spp., *Capillaria* spp., *Gnathostoma* spp., and *Pseudoteranova* spp., which can be found in the liver, belly cavity and flesh of marine fish. An example of a nematode causing disease in man is *Anisakis simplex;* its occurrence is rare as the infective stage of the parasite is killed by heating ([60°C] for 1 minute) and by freezing ([-20°C] for 24 hours) in the fish core.

Table 2: Possible Safety Hazards in Freshly-Caught Fish

Biological		*Chemical*	
Parasites:	Parasites of public health significance: Trematodes, Nematodes, Cestodes	**Agro-chemicals:**	Disinfectants, pesticides, herbicides, algicides, fungicides, anti-oxidants (added in feeds)
Pathogenic bacteria:	*Salmonella, Shigella, E. coli 0157, Vibrio cholerae, Vibrio parahaemolyticus, Vibrio vulnificus, Listeria monocytogenes, Clostridium botulinum*	**Veterinary drug residues:**	Antibiotics, growth promoters (hormones), other feed additives from animal manures.
Biological toxins:	Scombrotoxin Ciguatoxin	**Heavy metals:**	Metals leached from marine sediments and soil, from industrial wastes, from sewage or animal manures

Cestodes

Cestodes are tapeworms and the species of most concern associated with the consumption of fish is *Diphyllobotrium latum*. This parasite occurs world-wide and marine fish are intermediate hosts. Similar to other parasitic infections, the foodborne disease occurs through the consumption of raw or under-processed fish. Similar freezing and cooking temperatures as applied to nematodes will inactivate the infective stages of this parasite.

Trematodes

Fish-borne trematode (flatworm) infections are a major public health problem that occur endemically in about 20 countries around the world, particularly in Southeast Asia. The most important species with respect to the numbers of people infected belong to the genera *Clonorchis* and *Ophisthorchis* (liver flukes), *Paragonimus* (lung flukes), and to a lesser extent *Heterophyes* and *Echinochasmus* (intestinal flukes). The most important definitive host of these trematodes is man or other mammals. Freshwater fish are the second intermediate host in the life cycles of *Clonorchis* and *Ophistorchis*, and freshwater crustaceans in the case of *Paragonimius*. Foodborne infections take place through the consumption of raw, undercooked or otherwise under-processed products containing the infective stages of these parasites. Freezing fish at -20°C for 7 days or at -35°C for 24 hours will kill the infective stages of these parasites.

Bacteria

The level of contamination of fish at the time of capture will depend on the environment and the bacteriological quality of the water in which fish are harvested. Many factors will influence the microflora of finfish, the more important being water temperature, salt content, proximity of harvesting areas to human habitations, quantity and origin of food consumed by fish, and method of harvesting. The edible muscle tissue of finfish is normally sterile at the time of capture and bacteria are usually present on the skin, gills and in the intestinal tract.

There are two broad groups of bacteria of public health importance that may contaminate products at the time of capture - those that are normally present in the aquatic environment, referred to as the indigenous microflora, and those introduced through environmental contamination by domestic and /or industrial wastes. Examples of indigenous bacteria which may pose a health hazard are *Aeromonas hydrophyla*, *Clostridium botulinum*, *Vibrio parahaemolyticus*, *V. cholerae*, *V. vulnificus*, and *Listeria monocytogens*. Non-indigenous bacteria of public health significance include members of the Enterobacteriaceae, such as *Salmonella* spp., *Shigella* spp., and *Escherichia coli*. Other species that cause foodborne illness and which have been isolated occasionally from fish are *Edwardsiella tarda*, *Pleisomonas shigeloides* and *Yersinia enterocolitica*.

Indigenous pathogenic bacteria, when present on fresh fish, are usually found in fairly low numbers, and where products are adequately cooked prior to consumption, food safety hazards are insignificant. During

storage, indigenous spoilage bacteria will outgrow indigenous pathogenic bacteria, thus fish will spoil before becoming toxic and will be rejected by consumers. Hazards from these pathogens can be controlled by heating seafoods sufficiently to kill the bacteria, holding fish at chilled temperatures and avoiding post-process cross-contamination.

Vibrio species are common in coastal and estuarine environments and populations can depend on water depth and tidal levels. They are particularly prevalent in warm tropical waters and can be found in temperate zones during summer months. *Vibrio* species are also natural contaminants of brackish water tropical environments and will be present on farmed fish from these zones. Hazards from *Vibrio* spp. associated with finfish can be controlled by thorough cooking and preventing cross-contamination of cooked products. Health risks can also be reduced by rapidly chilling products after harvest, thus reducing the possibility of proliferation of these organisms.

Scombrotoxin

Scombroid intoxication, sometimes referred to as histamine poisoning, results from eating fish that have been incorrectly chilled after harvesting. Scombrotoxin is attributed to *Enterobacteriaceae* which produce high levels of histamine in the fish muscle when products are not immediately chilled after catching. The main susceptible fish are the scombroids such as tuna, mackerel, and bonito, although it can be found in other species. The intoxication is rarely fatal and symptoms are usually mild. Rapid refrigeration after catching and a high standard of handling during processing should prevent the development of the toxin. The toxin is not inactivated by normal cooking temperatures or by canning. In addition, fish may contain toxic levels of histamine without exhibiting any of the usual sensory parameters characteristic of spoilage.

Viral Contamination

Molluscan shellfish harvested from inshore waters that are contaminated by human or animal faeces may harbour viruses that are pathogenic to man. Enteric viruses that have been implicated in seafood-associated illness are the hepatitis A virus, caliciviruses, astroviruses and the Norwalk virus. The latter three are often referred to as small round structured viruses. All of the seafood-borne viruses causing illness are transmitted by the faecal-oral cycle and most viral gastroenteritis outbreaks have been associated with eating contaminated shellfish, particularly raw oysters.

Viruses are species specific and will not grow or multiply in foods or anywhere outside the host cell. There is no reliable marker for indicating presence of the virus in shellfish harvesting waters. Seafood-borne viruses are difficult to detect, requiring relatively sophisticated molecular methods to identify the virus.

Viral gasteroenteritis can be prevented by controlling sewage contamination of shellfish farming areas and pre-harvest monitoring of shellfish and growing waters. Depuration or relaying are alternative strategies but longer periods are required for shellfish to purge themselves clean of viral contamination than for bacteria. Thermal processing (85-90°C for 1.5 min.) will destroy viruses in shellfish.

Chemical hazards

Fish may be harvested from coastal zones and inland habitats that are exposed to varying amounts of environmental contaminants. Of greatest concern are fish harvested from coastal and estuarine areas rather than fish harvested from the open seas. Agro-chemicals and heavy metals may accumulate in products that can cause public health problems. Antibiotic residues can occur in aquaculture products when correct withdrawal times are not followed or when the sale and use of these compounds are not controlled. Fresh fish can also be contaminated with chemicals such as diesel oil, when incorrectly handled on-board.

Biotoxins

There are a number of important biotoxins to consider. Around 400 poisonous fish species exist and, by definition, the substances responsible for the toxicity of these species are biotoxins. The poison is usually limited to some organs, or is restricted to some periods during the year.

For some fish, the toxins are present in the blood; these are ichtyohaemotoxin. The involved species are eels from the Adriatic, the moray eels, the lampreys. In other species, the toxins are spread all over the tissues (flesh, viscera, skin); these are ichtyosarcotoxins. It concerns tetrodotoxic species responsible for several poisonings, often lethal.

Biotoxins are often heat-stable and the only possible control measure is to check the identity of the used species.

Ciguatoxin

The other important toxin to consider is ciguatoxin which can be found in a wide variety of mainly carnivorous fish inhabiting shallow waters in or near tropical and subtropical coral reefs. The source of this toxin is dinoflagellates and over 400 species of tropical fish have been implicated in intoxication. The toxin is known to be heat stable. There is still much to be learnt about this toxin and the only control measure that can reasonably be taken is to avoid marketing fish that have a known consistent record of toxicity.

Phycotoxins

These toxins concern especially the bivalve shellfish; the toxicity is due to the ingestion by the shellfish of phytoplanktonic species which are able to synthesise toxic substances. The shellfish concentrates the toxin to a level such as it becomes potentially toxic. The principal toxins are the PSP (Paralytic Shellfish Poison) produced by dinoflagellates genus *Alexandrium*, the DSP (Diarrheic Shellfish Poison) produced by other dinoflagellates genus *Dinophysis*, or domoic acid produced by a diatom *Nitzschia pungens*.

All these toxins are known to keep in general their toxicity through processing, even in canned fish products, so the knowledge of the species identity and/or origin of fish or shellfish intended for processing is important.

Physical Hazards

These can include such things as metal or glass fragments, shell, bones, etc.

Defects

Potential defects are outlined in the end-product specifications described in Appendices II - ix and in the appropriate Sections 5-13.

4.3.3 End Product Specifications

4.3.3.1 Essential Final Product Requirements

Codex Standards' end product specifications describe the essential final product specifications for fish and fishery products. These specifications are divided into two categories:

- essential health and hygiene requirements;
- essential final product quality requirements.

These essential requirements are provisions describing the minimal health, hygiene and other factors which must be met in order to comply with Codex standards.

4.3.3.2 Optional Final Product Requirements

End product specifications outlined in Appendices II - IX, describe optional requirements which are intended to assist buyers and sellers in describing those provisions which are often used in commercial transactions or in designing specifications for final products. These requirements are intended for voluntary application by commercial partners and not for application by governments.

SECTION 5 PROCESSING OF FRESH, FROZEN AND MINCED FISH

Once a processing facility has established a pre-requisite programme (Section 3) the principles of HACCP can then be applied to each individual process within that facility. This section describes the technological guidelines and provides examples of the application of HACCP principles to the processing of fresh, frozen and minced fish. This includes examples of points in the process where potential hazards and/or defects may be found and suggested control measures.

5.1 HANDLING OF FRESH FISH PRIOR TO PROCESSING

Fish handlers should inspect all fish on catching or receipt. Only sound suitable fish should be retained. No fish should be accepted if it is known to contain parasites, undesirable microorganisms, pesticides, veterinary drugs or toxic, decomposed or extraneous substances which would not be reduced to an acceptable level by normal sorting and / or processing. The three most important factors to consider when handling fresh fish for processing are:

(i) time and temperature control;

(ii) handle with care, and do not damage the fish; and

(iii) maintain a 'clean as you go' policy.

5.1.1 General Considerations

- poor handling practices can lead to an accelerated rate of decomposition of fresh fish;
- the fabric of the plant, equipment, utensils and other physical facilities should be kept clean and in good repair;
- accumulation of solid, semi-solid or liquid wastes should be minimised to prevent contamination of fish;
- all fish should be inspected and sorted to remove defective fish;
- the fish should be stored in shallow layers and surrounded by sufficient quantities of finely divided ice;
- fish should not be stored in refrigerated sea water systems to a density which impairs its working efficiency;
- where boxes are used for storage of fish they should not be overfilled.

5.1.2 On Board Fishing and/or Harvesting Vessels

- the fishing gear and its usage should minimise damage and deterioration to the fish;
- the fish should be handled carefully, quickly and efficiently once on board;
- fish unsuitable for human consumption should be removed from the catch;
- bleeding, gutting and grading where appropriate for the species should be conducted without delay;
- fish should not be trampled or stood upon and should not be stacked too deeply;
- all fish on deck should be protected from the adverse effects of the elements;
- chilling of fish should commence as soon as possible (see Secton 5.2);
- fish should be washed with clean sea water or potable water;
- care should be taken that fish are not damaged or contaminated during sorting, gutting, weighing and during transfer;

- fish intended for human consumption should be stored in an area exclusively for that purpose;
- a storage plan of the catch should be kept on any vessel fishing for more than a day in length;
- fish of different species should be stored separately, unless this would unduly delay chilling.

5.1.3 On Shore

- fresh fish should be kept chilled, handled, distributed and processed with care and minimum delay;
- no fish should be sold which is unfit for human consumption;
- fish not suitable for human consumption should be stored separately.

5.1.4 Sensory Evaluation of Fresh Fish

The best way of assessing the freshness/spoilage of fish is by sensory evaluation techniques. It is recommended that sensory evaluation charts be used to verify the acceptability of fresh fish and to eliminate fish showing an unacceptable level of decomposition (see [draft] Codex Guidelines on Sensory Evaluation). As an example fresh white fish species are considered unacceptable when showing the following characteristics:

Skin / Slime: dull, gritty colours with yellow brown dotting slime.

Eyes: concave, opaque, sunken discoloured.

Gills: grey - brown or bleached, slime opaque yellow, thick or clotting.

Odour: flesh odour amines, ammonia, milky lactic, sulphide, faecal, putrid, rancid.

5.2 TEMPERATURE CONTROL

Temperature is the single most important factor affecting the rate of fish deterioration and multiplication of microorganisms. Fish, fillets and other similar products which are to be chilled should be held at a temperature as close as possible to 0ºC.

5.2.1 Minimise the Deterioration of Fish

To minimise the deterioration of fish, temperature control can be achieved by:

- sufficient and adequate icing, or chilled or refrigerated sea water system;
- proper operation of refrigeration plant;
- monitoring and controlling the temperature;
- quick and efficient handling of fish.

5.2.2 Quality of Ice

The quality of ice is determined by the following factors:

- use of potable water or clean sea water in its manufacture;
- prevention of contamination from other sources;
- use of finely divided ice to maximise cooling capacity and minimise damage to fish.

5.3 PROCESSING OPERATIONS - FRESH, FROZEN AND MINCED FISH

In order to maintain the quality of fish it is important to adopt quick, careful and efficient handling procedures (See Figures 2a and 2b).

5.3.1 General

- frozen fish intended for sale in a chilled state should be defrosted in accordance with the procedures defined in Section 5.3.3 and inspected for suitability;
- fish should not be processed beyond the plant rated capacity for an extended period;

- the plant should be designed and equipped to ensure that efficient chilling processing and dispatch of the fish is with the minimum of delay;
- in the event that fish cannot be processed or frozen immediately, it should be well iced in clean containers and stored in specially designated and appropriate areas within the plant.

5.3.1.1 Raw Material Reception

- For raw materials, these specifications could include the following characteristics :
  - organoleptic characteristics such as appearance, odour, texture, etc;
  - chemical indicators of decomposition and/or contamination, for example, TVBN, histamine, heavy metals, pesticide residues, nitrates etc;
  - microbiological criteria, in particular for intermediate raw materials, to prevent the processing of raw material containing microbial toxins such as staphylotoxin.
  - foreign matter,
  - physical characteristics such as size of fish or shellfish,
  - species homogeneity, etc.

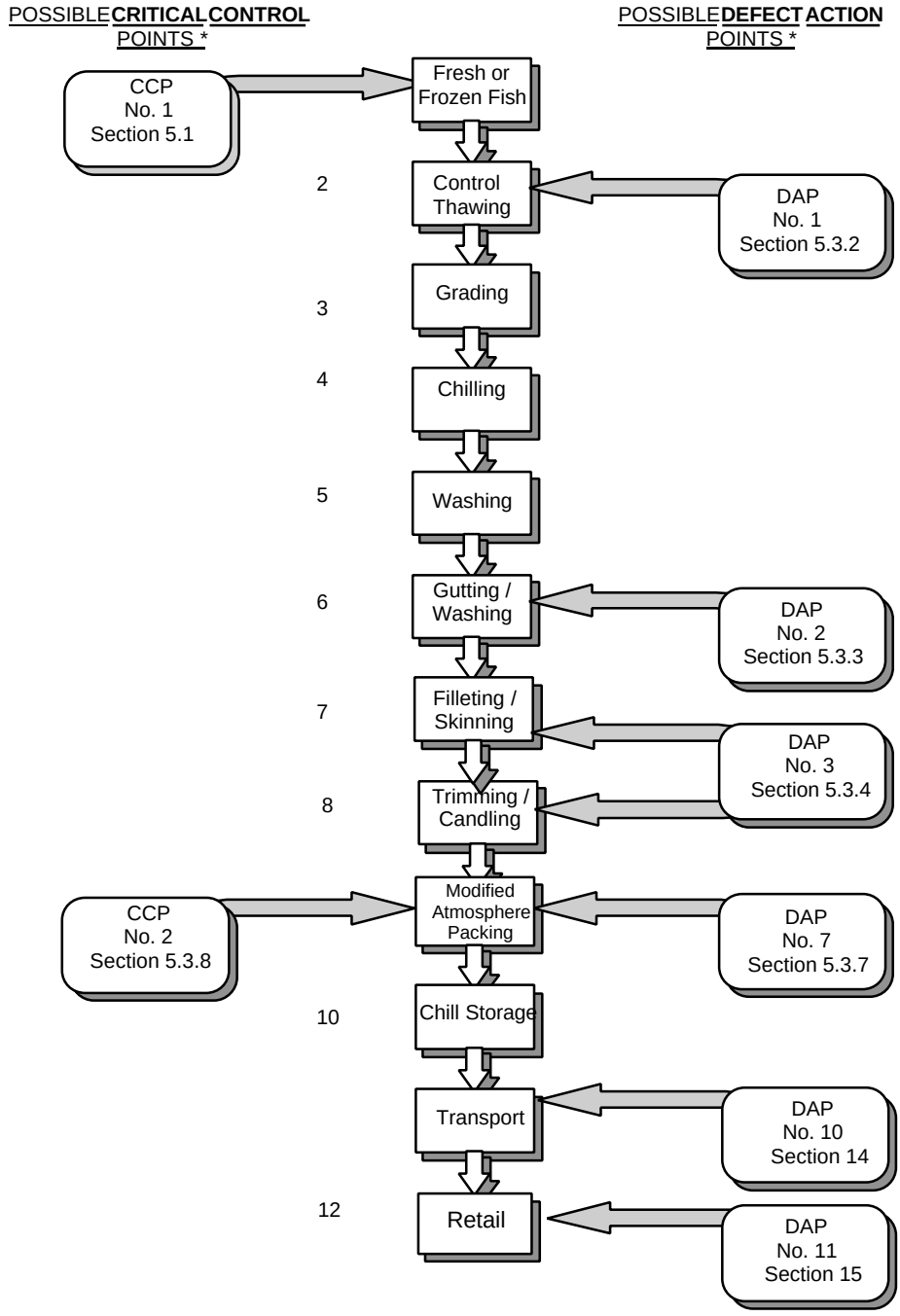
5.3.2 Control Thawing for Further Processing

- The thawing method (in particular, in terms of time and temperature of thawing) should be clearly defined. The thawing schedule (time and temperature parameters) should be carefully checked. Selection of the thawing method should take into account in particular the thickness of the products to thaw.
- Thawing time and temperature should be selected so as to avoid conditions favourable for development of microorganisms or decomposition.
- During thawing, according to the method used, products should not be exposed to excessively high temperatures :
- Particular attention should be paid to controlling condensation and drip from the fish and shellfish. An effective drainage should be made.
- After thawing, fish or shellfish should be immediately processed or refrigerated and kept at the adequate temperature (temperature of melting ice).

5.3.3 Gutting and Washing

- fish requiring gutting on arrival at the plant should be gutted efficiently and with care to avoid contamination;
- gutting must be complete to remove pieces of intestinal tract and internal organs;
- immediately after gutting, fish should be washed with clean sea water or potable water. After washing the fish should be drained and properly iced;
- separate and adequate storage facilities should be provided for the fish roe, milt and livers if these are saved for later utilisation.

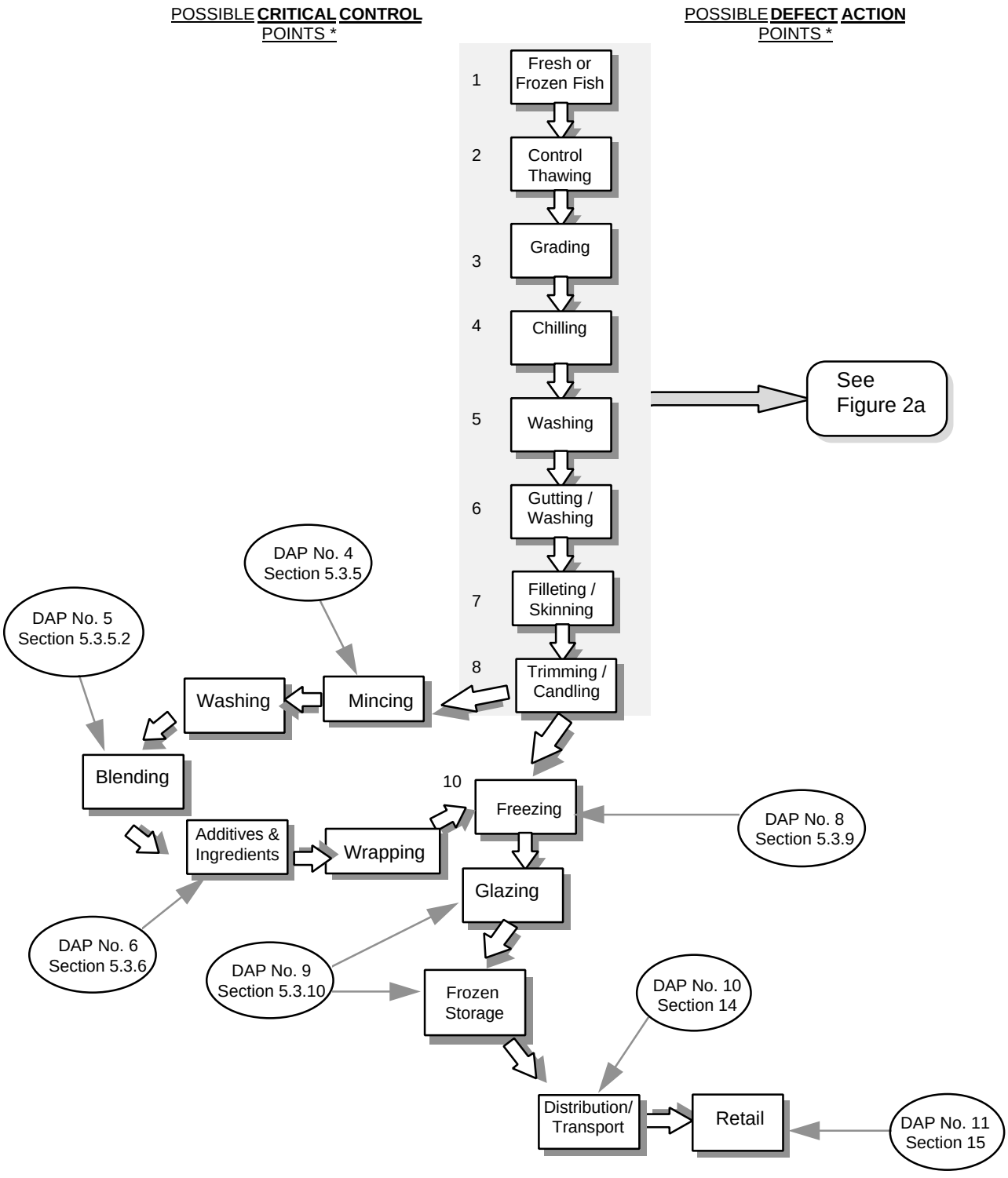
This flow chart is for illustrative purposes only. For in-factory HACCP implementation a complete and comprehensive flow chart has to be drawn up for each process.



* Note: the CCP/DAP number and the section references refer to the text of the Code where the appropriate processing step is discussed.

Figure 2a Example of a flow chart of a fresh fish processing line, including modified atmosphere packaging

This flow chart is for illustrative purposes only. For in-factory HACCP implementation a complete and comprehensive flow chart has to be drawn up for each process.



* Note: the CCP/DAP number and the section references refer to the text of the Code where the appropriate processing step is discussed.

Figure 2b Example of a flow chart of a frozen fish fillet processing line, including mincing operation

5.3.4 Filleting, Skinning, Trimming and Candling

- the design of the filleting line should be continuous and sequential to permit the uniform flow without stoppages or slow-downs and removal of waste;
- fish should be thoroughly washed before filleting or cutting especially fish that have been scaled;
- any damaged, contaminated or otherwise unacceptable fish should be discarded before filleting;
- piling of large quantities of fillets or steaks in one container should be avoided;
- it is advisable to make the candling of skinless fillets of certain species a routine practice;
- immediately after filleting, fish should be washed in running potable water or clean sea water, to remove all impurities, blood spot and slivers from the fish. Adhering skin and ragged edges must be cut away;
- care should be taken to avoid contamination or damaging the fillets.

5.3.5 Minced Fish Using Mechanical Separation Process

- raw materials of different species and types should be segregated and processed in separate batches;
- special care should be taken to ensure that the raw material is maintained as close as possible to the temperature of melting ice throughout the processing;
- fish used as raw material should be gutted with care, thoroughly washed, headed, and scaled before mincing;
- the separator should be fed continuously but not excessively;
- fish should be fed to the separator in a size that it is able to handle;
- candling is recommended for fish suspected of high infestation with parasites;
- split fish or fillets should be fed to the separator so that the cut surface contacts the perforated surface;
- the perforation sizes of the separator surface as well as the pressure on the raw material should be adjusted to the characteristics desired in the final product;
- the separated residual material should be carefully removed on a continuous or near-continuous basis to the next processing stage.

5.3.5.1 Washing of Minced Fish

- if necessary the mince should be washed, washing should be adequate for the type of product desired;
- stirring during washing should be carried out with care, but it should be kept as gentle as possible in order to avoid excessive disintegration of the minced flesh which will reduce the yield due to the formation of fines;
- the mince should be “de-watered” to the appropriate moisture content;
- if necessary and depending on eventual end-use, the de-watered mince should be either strained or emulsified;
- special attention should be taken to ensure mince being strained is kept cool;
- the resulting waste water should be disposed of in a suitable manner.

5.3.5.2 Blending of Minced Fish

- blending should be carried out under controlled conditions;
- if fish or other foodstuffs are to be added they should be blended in the proper proportions;
- the minced fish product should be packaged and frozen immediately after preparation; if it is not frozen or used immediately after preparation it should be chilled.

5.3.6 Application of Additives and Ingredients

- if food ingredients or additives are used, they should be added in proper proportions;
- if food additives are to be used, the advice of a food technologist should be sought and the approval of the official agency having jurisdiction should be obtained;
- additives should comply with the requirements of the Codex General Standard for food Additives.

5.3.7 Wrapping and Packing

- packaging material should be clean, sound, durable, sufficient for its intended use and of food grade material;
- the packaging operation should be conducted to minimise the risk of contamination and decomposition;
- products should meet appropriate standards for labelling and weights.

5.3.8 Modified Atmosphere Packing

The extent to which the shelf-life of the product can be extended by MAP will depend on the species, fat content, initial bacterial load, gas mixture, type of packaging material and, especially important, the temperature of storage (see Appendix I).

Modified atmosphere packaging should be strictly controlled by:-

- monitoring the gas to product ratio;
- types and ratio of gas mixtures used;
- type of film used;
- temperature control of product during storage;
- type and integrity of the seal.

5.3.9 Freezing Operations

The fish product should be frozen as quickly as possible since unnecessary delays before freezing will cause temperature of the fish products to rise, increasing the rate of quality deterioration and reducing shelf-life due to the action of micro-organisms and undesirable chemical reactions.

- plant production shall be geared to the capacity of freezers;
- frequent checks should be made to ensure correct operation of freezing;
- accurate records of all freezing operations should be kept;

5.3.10 Glazing and Cold Storage

The freezer store should be designed taking into account the size of intended production, the type of fish product, the intended time of storage and the optimal temperature requirements. The store should be equipped with indicating thermometer. Fitting of recording thermometers is strongly recommended.

- frozen product not packaged or wrapped should be glazed, wrapped or packaged to protect quality during storage and distribution;
- frozen products should be immediately transferred to the freezer store;
- temperature should be monitored and recorded.

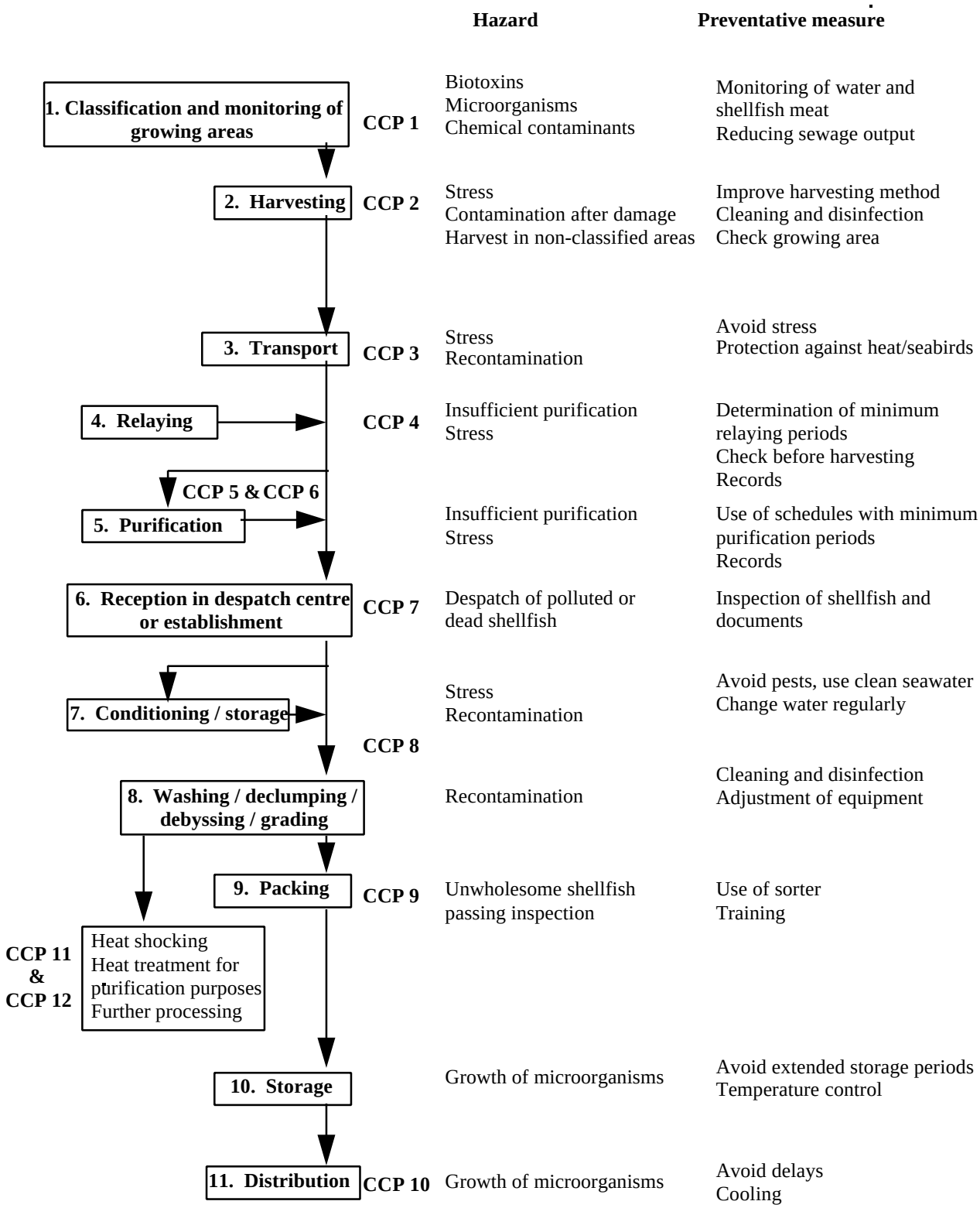


Figure 3. Example of a simplified flow diagram for the production of live molluscanshellfish

6.1 IDENTIFICATION OF HAZARDS

Molluscan shellfish species like oysters, mussels, manilla and hard shell clams can survive for extended periods out of water and can be traded for human consumption as live animals. Other species like cockles can be traded live if carefully handled, but are normally processed. Species not adapted to drying conditions soon die out of water and are best handled as chilled products or processed.

When spawning it becomes undesirable and in many instances impracticable to trade them as live animals. Stress can induce spawning.

The main hazards known from the production of molluscan shellfish are from sewage contamination of their growing waters, especially when the molluscan shellfish are intended to be eaten raw. Since molluscs are filter feeders they can concentrate pollution until a much higher concentration than the surrounding sea water. The pollution in the growing area is therefore critical for the end product specification and determines the process requirements for further processing. Gastro-enteritis and other serious diseases such as hepatitis can occur as result from sewage contamination like enteric bacterial and/or viral pathogens (Norwalk like viruses, viruses causing hepatitis) or from natural occurring bacterial pathogens (Vibrio spp.)Biotoxins coming from certain toxic algae can cause various forms of serious poisoning like diarrhetic shellfish poisoning (DSP), paralytic shellfish poisoning (PSP), neurotoxic shellfish poisoning (NSP) or amnesic shellfish poisoning (ASP).

To control the hazards coming from the growing area identification and monitoring is very important for molluscan shellfish safety. The identification, classification and monitoring of growing waters is a responsibility for competent authorities. E.coli/faecal coliforms are used as an indicator for the possibility of bacterial and viral pathogens although it is known that for especially viruses and for natural occurring bacterial pathogens the indicator is not working effectively. If the biotoxins are found in the shellfish flesh in an hazardous amounts the production area must be closed until toxicological investigation has made clear that the shellfish meat is free from hazardous amount of biotoxins. Chemical toxins should not be present in amounts so that the calculated dietary intake exceeds the permissible daily intake, or so that the taste of the molluscs may be impaired

Molluscan shellfish from waters subject to relatively low levels of sewage contamination can be made safe by relaying in a suitable growing area or a purification process to reduce the level of bacteria and of viruses if the process is continued long enough, or by a heat treatment to destroy the pathogens. Purification is a short term process commonly used to reduce low levels of bacterial contamination, but much longer term relaying is required if there is a greater risk of viral contamination.

Especially when the molluscan shellfish need to undergo relaying, purification and /or are meant to be eaten raw (temperature) stress and excessive shocks of the molluscan shellfish are a hazard and must be avoided. This is very important because these molluscan shellfish should be able to function again during purification, relaying or conditioning.

When molluscan shellfish are meant to be processed avoiding stress and excessive shocks is less important.

Mussels, oyster, manila and hard shell clams are considered suitable for purification, cockles can be purified provided they are carefully handled and there is only a short delay between harvesting and purification, but scallops may not be suitable for purification.

Recontamination has to be avoided. Therefore hygienic handling and the use of clean sea water and a good working cleaning and disinfection program is important when handling and/or processing of molluscan shellfish. When out of the water live molluscan shellfish should be kept cool to slow their metabolism and prevent them form drying out. Storage temperature as low as 0°C can cause thermal shock. Blue mussels are an exception and can be kept directly iced. Dead molluscan shellfish held as fresh fishery products, such as scallops are best well iced or otherwise chilled.

6.2 GROWING AREA REQUIREMENTS

As already stated, identification of hazards, sewage contamination of the growing waters is critical for the end product specification and determines the process requirements for further processing. To control the hazards

coming from the growing area identification and monitoring is very important for molluscan shellfish safety. The identification, classification and monitoring of growing waters is a responsibility for competent authorities.

There are 5 different types of important hazards coming from the shellfish growing environment:

- enteric bacterial pathogens;
- enteric viral pathogens (Norwalk like viruses, viruses causing hepatitis);
- natural occurring bacterial pathogens (Vibrio species);
- biotoxins (DSP, PSP, NSP, ASP);
- chemical contaminants.

E.coli/faecal coliforms are used as an indicator for the possibility of the first 3 types of hazards, although it is known that for especially viruses and for natural occurring bacterial pathogens the indicator is not working effectively. The contamination with E.coli/faecal coliforms in sea water or molluscan shellfish is used in defining a growing area. The present monitoring programs of the US and the EU are examples of good monitoring programs. Both monitoring programs are presented in [to be defined].

Biotoxins in molluscan shellfish are caused by plankton containing toxins. If the biotoxins are found in the shellfish flesh in an amount higher than the limit in the end product specification the production area must be closed until toxicological investigation has made clear that the shellfish meat is free from hazardous amount of biotoxins.

Chemical toxins should not be present in amounts so that the calculated dietary intake exceeds the permissible daily intake, or so that the taste of the molluscs may be impaired.

Deep water stocks of wild scallops of the type trawled commercially are not considered prone to sewage contamination but can be subject to algal toxins and chemical/toxic substance contamination.

Growing areas should be clearly defined by the competent authority as suitable for harvesting for either:

a. direct human consumption;
b. relaying in acceptable water or purification in an approved purification centre or other forms of treatment e.g. heat treatment, radiation;
c. non-suitable for growing or harvesting molluscan shellfish.

Growing areas providing molluscan shellfish for direct human consumption meet the following requirements at time of harvest:

a. the area is not subject to contamination that may present an actual or potential hazard to human health;
b. The molluscan shellfish harvested meet the end product specification in the Codex Standard and the requirements outlined in Appendix III.

Production areas providing molluscan shellfish for indirect human consumption should be defined in relation to the further procedure of the lot.

In determining the public health suitability of molluscan shellfish growing areas the official agency having jurisdiction should take the following actions:

- Classification/reclassification of growing areas by frequent monitoring of E.coli/faecal coliforms.
- Closure/Reopening of growing waters by frequent monitoring of algae in sea water and biotoxins in shellfish.
- Control of chemical contaminants

6.2.1 Classification of growing areas

Surveys of the growing area, shoreline and land catchment should be conducted to determine sources of both domestic and industrial pollution which may affect the quality of the growing area water and molluscan shellfish. Sources may include municipal sewage outputs, industrial outputs, mine wastes, geophysical

contaminants, domestic animal holding pens, pastoral farming activities, nuclear power plants, refineries or other sources. The need to reschedule hygiene surveys will be determined by population shifts and changes in agricultural and industrial activities in the coastal area. Resurveys should be conducted at an acceptable frequency

When pollution sources have been identified and evaluated, sampling stations for water, molluscan shellfish and/or sediments should be established and studies conducted to determine the effects of the pollutants on water and molluscan shellfish quality. The data should be evaluated by the official agency having jurisdiction and growing areas should be classified according to official standards and criteria.

When interpreting growing area data, the official agency having jurisdiction should take into account variations which may affect the level of pollution during the most unfavourable hydrographic and climatic conditions as influenced by rainfall, tides, winds, methods of sewage treatment, population variations and other local factors, since shellfish respond rapidly to an increase in the number of bacteria or viruses in their environment by accumulating these agents. The agency should also consider that shellfish have the ability to accumulate toxic chemicals in their tissue in concentrations greater than the levels found in the surrounding water. FAO, WHO, or other international or national food standards may be used as a guide to acceptable levels.

Classified growing areas should be routinely monitored for changes in water quality and/or molluscan shellfish quality, and sub-standard areas patrolled to prevent harvesting for purposes other than that established by the official agency. Tests for suitable indicator bacteria such as faecal coliforms or *Escherichia coli* should be used to determine the degree of faecal contamination. The effectiveness of indicator bacteria used should be kept under constant review for their reliability as measures for the degree of faecal contamination If faecal contamination exceeds a certain threshold-level, to be set by the official agency, only relaying in a suitable area for a time approved by the competent authority is allowed.

When routine monitoring programs or resurvays show that the growing area no longer meets the classification criteria, the area should be reclassified or closed for harvesting immediately. by the official agency having jurisdiction.

The official agency having jurisdiction should immediately announce these decisions to the affected producers and purification and distribution centres.

6.2.2 Marine biotoxin control

All growing areas should be routinely monitored for the presence of marine biotoxins such as paralytic shellfish poison. The risk of blooms of toxic algae may show seasonal variability and areas may also be affected by toxic algae earlier unknown in the surrounding sea or coastal waters. These risks should be recognised when drawing up monitoring schedules.

The official agency having jurisdiction should close immediately and effectively patrol affected areas when acceptable levels are exceeded in edible portions of shellfish meats. These areas should not be opened before toxicological investigation has made clear that the shellfish meat is free from hazardous amounts of biotoxins.

The official agency having jurisdiction should immediately announce these decisions to the affected producers and purification and distribution centres.

6.2.3 Chemical contaminants

Growing areas should be monitored on regular basis on chemical contaminants

6.3 HYGIENIC HARVESTING, TRANSPORTATION AND STORAGE TECHNIQUES OF LIVE MOLLUSCAN SHELLFISH

Especially when the molluscan shellfish need to undergo relaying, purification and /or are meant to be eaten raw (temperature) stress and excessive shocks of the molluscan shellfish are a hazard and must be avoided. This is very important because these molluscan shellfish should be able to function again during purification, relaying or conditioning. The shellfish need to stay alive until they are cooked or eaten raw by the consumer. When molluscan shellfish are meant to be processed avoiding stress and excessive shocks is less important but still advisable

6.3.1 Hygiene requirements for vessels/conveyances harvesting or transporting live molluscan shellfish from growing area to relaying area, purification tank, raft or float or distribution centre or establishment

- Equipment and product containers should not constitute a hazard to health. Containers which are re-used should be of such material and construction as will facilitate thorough cleaning, and should be so cleaned and maintained as not to constitute a source of contamination to the product.
- Dredges and other harvesting equipment, decks, holds and containers which come into contact with molluscan shellfish should be capable of being well drained and easily cleaned. These equipment and containers should be corrosion resistant.
- Dredges and other harvesting equipment, decks, holds and containers which are contaminated from use in a polluted area should be cleaned and if applicable disinfected (sanitised) before being used for shellfish from an unpolluted area.
- Holds in which molluscan shellfish are held or containers should be so constructed that the molluscan shellfish are held above the floor level and drained so that the molluscan shellfish is not in contact with wash-down or bilge water, or shell fluid. Where necessary a bilge pumping system must be provided.

6.3.2 Protection of product from contamination

- Suitable precautions should be taken to protect molluscan shellfish and those parts of the harvesting boat, harvesting equipment, containers and other equipment likely to come into contact with molluscan shellfish from being contaminated by polluted water, droppings from sea birds, footwear which may have been in contact with faecal matter or by other polluted material.
- No animals should be permitted to live on any harvesting boats.
- Fuel, lubricating oils, chemicals used for the control of pests and other noxious chemicals should not be stored near molluscan shellfish or containers and equipment likely to come into contact with molluscan shellfish.
- Wash-down pumps should draw water only from non-contaminated sea water and should not be connected directly or indirectly to the bilge or the toilet facilities.
- Effective measures should be taken to protect against the entrance of rodents and other vermin into harvesting boats.

6.3.3 Harvesting, transporting and storage of live molluscan shellfish

Appropriate handling procedures depend on different species, growing area and season

- Molluscan shellfish should be harvested from and stored in an growing area or relaying area acceptable to the official agency having jurisdiction.

- Excessive shocks during harvesting should be avoided using appropriate harvesting techniques and by carefully handling the molluscan shellfish.
- On removal from water or during handling and transportation, molluscan shellfish should not be subjected to extremes of heat or cold or sudden variations in temperature. This is particularly important for those molluscan shellfish which are to be subjected to purification. Temperature control is critical in handling live molluscan shellfish. The temperature should be advised to each species separately. Special equipment, such as insulated containers and refrigeration equipment, should be used if prevailing temperatures and the time involved so require. Molluscan shellfish should not be exposed to full sun or surfaces heated by the sun or come into direct contact with ice and other freezing surfaces, nor should it be held in closed containers with solid carbon dioxide. In most cases storage above 10 ^{o} C (50^{o} F) or below 2^{o} C(35^{o} F) should be avoided.
- Molluscan shellfish should be freed from excessive mud and weed soon after being harvested by washing it with clean sea water or approved fresh water under suitable pressure. Wash water should not be allowed to flow over shellfish already cleaned. The water should not be re-circulated.
- Molluscan shellfish held on boats should not come into contact with accumulated wash-down water, bilge water of shell fluid.
- During handling and transportation, molluscan shellfish should be held under hygienic conditions and should not come into contact with substances which may render the meats unfit for human consumption. Shell washings should be drained from the molluscan shellfish containers.
- At all times shellfish should be handled and transported carefully to avoid damage to the shells and under conditions which will prevent death of the shellfish. Containers should not be dropped or subjected to excessive weights where there is a danger of damage occurring to the shells in the course of normal handling. The use of shallow rigid boxes, trays or baskets will minimise damage. The handling of molluscan shellfish in large bulk containers should be avoided.
- The interval between harvesting and immersion in water for relaying, storage, conditioning or purification should be kept as short as possible. This also applies to the interval between final harvesting and handling in a distribution centre.
- If molluscan shellfish is to be re-immersed after harvest it should be re-immersed in clean sea water.

6.4 RELAYING

For relaying areas must requirements for growing areas do also apply.

Relaying is intended to reduce the level of contaminants that may be present in shellfish which have been harvested from contaminated areas to such levels that the shellfish will be acceptable for human consumption without further processing. Shellfish harvested for relaying should only be harvested from areas that are so designated/classified by the official agency .

For natural functioning and therefore relaying to occur it is essential that the molluscs have not been over-stressed or damaged during harvesting or handling prior to purification and are not in a seasonally weak or spawning condition.

Some species such as the soft shell clam Mya arenaria can not be relayed.

- When biologically feasible molluscan shellfish may be relayed from contaminated growing areas to areas approved for harvesting . Relaying operations should be strictly supervised by the official agency having jurisdiction to prevent contaminated molluscan shellfish from being diverted directly to the consumer market or form cross contamination of other molluscan shellfish. Boundaries of relaying areas should be clearly identified by buoys, poles or other fixed means.
- Holding time and minimum temperature in the accepted area prior to harvest will be determined by the official agency having jurisdiction according to the degree of contamination before relaying, the temperature of the water, the shellfish species involved and local geographic or hydrographic conditions.

- Molluscan shellfish should be laid out at a density which will permit them to open and undergo natural purification**.**
- For harvesting of molluscan shellfish from relaying areas, see the recommendations Section 6.3.2.
- After relaying the molluscan shellfish should meet the end product specifications in Appendix III

6.5 PURIFICATION OF MOLLUSCAN SHELLFISH IN TANKS, FLOATS AND RAFTS

Purification is intended to reduce the number of pathogenic bacteria that may be present in shellfish which have been harvested from moderately polluted areas to such levels that the shellfish will be acceptable for human consumption without further processing. Purification alone is not suitable for cleansing molluscs from more heavily contaminated areas or areas subject to contamination by hydro-carbons, heavy metals, pesticides or by biotoxins. Shellfish harvested for purification should only be harvested from areas that that so designated/classified by the official agency .

The required conditions vary according to the species of mollusc and the design of the purification system.

For natural functioning and therefore purification to occur it is essential that the molluscs have not been over-stressed or damaged during harvesting or handling prior to purification and are not in a seasonally weak or spawning condition.

Mussels, oysters, manila and hard shell clams are considered suitable for purification, cockles can be purified provided they are carefully handled and there is only a short delay between harvesting and purification, but scallops may not be suitable for purification.

Purification centres, rafts, tanks and floats must be approved by the competent authority.

- Molluscan shellfish subjected to the purification process should not contain metallic ions, pesticides, industrial wastes or marine biotoxins in such quantities that it presents a health hazard to the consumer. A low rate of removal of these substances makes purification impracticable.
- The process and the equipment, tanks, float, rafts used for purification should be acceptable to the official agency having jurisdiction.
- Sea water for the tanks, or sea water where floats or rafts are used in purification should be clean and of a salinity to permit the shellfish to function normally. When sea water has a microbiological quality not acceptable to the official agency having jurisdiction, a method of disinfecting (sanitising) the water, which should be approved by the official agency having jurisdiction, should be employed. Water used in purification tanks should be changed continuously or at suitable intervals or if recirculated be treated properly. The flow of water per hour should be sufficient to the amount of shellfish treated and should be depend on the degree of contamination of the shellfish.
- Dead or damaged shellfish should be removed before the purification process, when practicable. Surfaces of shells should be free from mud and soft commensal organisms. If necessary the molluscan shellfish should be washed with clean sea water or potable water before the purification process.
- Molluscan shellfish should be laid out at a density which will permit them to open and undergo natural purification.
- There should be no toxic substances, for example chlorine, in the water at levels that will prevent the shellfish from functioning properly.

- The oxygen content of the water should be maintained at an adequate level by aeration, or by intermittent or continuous replacement.
- The length of the period of purification should be adapted to the water temperature, the degree of contamination before purification and the shellfish species. Microbiological investigation of process water and of shellfish meat should be used to assess purification parameters. It should be taken into account that viruses and Vibrio spp. are more persistent during purification than the indicator bacteria mostly used for microbiological monitoring (*E. coli* and faecal coliforms).
- During the process of purification, the water temperature should not be allowed to fall below the minimum at which shellfish remain physiologically active; high water temperatures which adversely affect the pumping rate and the purification process should be avoided; tanks should be protected from the direct rays of the sun when necessary.
- Equipment in contact with water, i.e. tanks, pumps, pipes or piping, and other equipment should be constructed of non-porous, non-toxic materials. Copper, zinc, lead and their alloys should preferably not be used in tanks, pumps or piping systems used in purification processing.
- To avoid recontamination of molluscan shellfish undergoing purification, unpurified molluscan shellfish should not be placed in the same tank as molluscan shellfish which are already undergoing purification.
- Molluscan shellfish undergoing purification should remain immersed in approved, clean sea water until it satisfies the sanitary requirements of the official agency having jurisdiction.
- On removal from the purification system, molluscan shellfish should be washed with running potable water or clean sea water, and handled in the same manner as living molluscan shellfish taken directly from a non-polluted area. Dead, with broken shells or otherwise unwholesome shellfish should be removed.
- Before removing the shellfish form the tanks drain the water from the system to avoid resuspension and reingestion. The tanks should be cleaned after each use and disinfected at suitable intervals.
- After purification the molluscan shellfish should meet the end product specification in Appendix III

6.6 DISPATCH OF MOLLUSCAN SHELLFISH IN A DISTRIBUTION CENTRE

6.6.1 Reception

- Molluscan shellfish dispatched by a distribution centre must leave the distribution centre alive. Therefore stress and excessive shocks of the molluscan shellfish must be avoided.
- Distribution centres should only accept molluscan shellfish which meet the end product specification in appendix I from approved growing areas or after relaying in an approved relaying area or after purification in an approved purification centre, raft, float or tank .

6.6.2 Conditioning and storage of molluscan shellfish in sea water tanks, basins etc.

Conditioning means storage of molluscan shellfish in sea water tanks, basins, floats, rafts or natural sites which the intention to remove mud, sand and slime.

- The process of storing molluscan shellfish in sea water tanks, basins, floats, natural sites or rafts can be used if it is acceptable to the official agency having jurisdiction.
- Only clean sea water should be used in the tanks, floats, natural sites or rafts and should be of an adequate salinity to permit the shellfish to function normally. Optimum salinity will vary with shellfish species and with the harvesting area. Water condition has to be satisfactory adequate for the process.
- Equipment in contact with water, i.e. tanks, pumps, pipes or piping, and other equipment should be constructed of non-porous, non-toxic materials. Copper, zinc, lead and their alloys should preferably not be used in tanks, pumps or piping systems
- Before conditioning or storage molluscan shellfish should be washed to remove mud and soft commensal organisms and dead or damaged shellfish should be removed when practicable.

- During storage molluscan shellfish should be laid out at a density and under such conditions that will permit them to open and function normally.
- The oxygen content in the sea water should be maintained at an adequate level at all times.
- The temperature of the water in storage tanks should not be allowed to rise to such levels as to cause weakness of the molluscan shellfish. If ambient temperatures are excessively high, tanks should be placed in a well-ventilated building or away from the direct rays of the sun. The length of the period of conditioning should be adapted to the water temperature.
- Shellfish should be stored in clean sea water only for such time as they remain sound and active.
- Tanks should be drained, cleaned and disinfected at suitable intervals.
- Recirculating wet storage systems must contain approved water treatment systems**.**

6.6.3 Washing, declumping, debyssing and grading

- All steps in the process, including packaging, should be performed without unnecessary delay and under conditions which will prevent the possibility of contamination, deterioration and the growth of pathogenic and spoilage microorganisms.
- Damage to shells and stress will shorten the shelf life of shellfish and increase the risk of contamination and deterioration. So shellfish have to be handled carefully:
  - The number of handlings with shellfish should be minimised;
  - Excessive shocks should be avoided.
- The different process steps should be supervised by technically competent personnel.
- The outsides of the shells should be washed free of mud, and all soft adhering organisms should be removed. Hard adhering organisms should also be removed when possible, care being taken not to chip lips of shells by vigorous washing. Washing should be carried out using pressurised clean sea water or potable water.
- Molluscan shellfish having formed clumps, should be declumped and debyssed as appropriate. The equipment used should be designed and adjusted to minimise the risk of damage to the shells.

6.6.4 Packing

- Before packing shellfish should undergo visual inspection. Shellfish which are dead, with broken shells, with adhering soil or otherwise unwholesome should not be passed for human consumption.
- The packaging material should be appropriate for the product to be packed and for the expected conditions of storage and should not transmit to the product harmful or other objectionable substances or odours and tastes. The packaging material should be sound and should provide appropriate protection from damage and contamination.
- The packaging material should avoid contamination and should be drained.
- Labels should be clearly printed and must comply with the labelling laws of the country where the product is marketed. The packaging material may be used to bear an indication as to how the shellfish should be kept from the time they were bought at the retailer. It is recommended to mention the date of packaging or a shelf life date.
- All packaging material should be stored in a clean and sanitary manner. Product containers should not have been used for any purpose which may lead to contamination of the product. Packaging material should be inspected immediately before use to ensure that they are in a satisfactory condition and where necessary disposed of or cleaned and/or disinfected; when washed they should be well drained before filling. Only packaging material required for immediate use should be kept in the packing or filling area.
- Packing should be done under conditions that preclude the introduction of contamination into the product.

6.6.5 Storage

- The end product should be stored under such conditions as will preclude the contamination with and/or proliferation of microorganisms. If prevailing temperatures are high it is recommended to cool the shellfish before distribution. The packaging material of the end product should not have direct contact with the floor but should be placed on a clean, raised surface.
- Periodic inspection of the end product should take place to ensure that only food which is fit for human consumption is dispatched and that end product specifications should be complied with when they exist.
- Storage periods should be kept as short as possible.
- Reimmersion in or spraying with water of live bivalve molluscs must not take place after they have been packed and have left the distribution centre except in the case of retail sale at the distribution centre.

6.6.6 Distribution

- The product should be dispatched in the sequence of the lot numbers.
- Molluscan shellfish intended for human consumption should only leave the distribution centre in closed packaging.
- The means of transport should provide sufficient protection of the shellfish against extremes of hot and cold, contamination with dirt or dust and damage to the shells from shocks. The shellfish should not be transported with other products which might contaminate them.
- During distribution the product should be maintained at a temperature which does **not** adversely affect their quality and viability.

6.7 HEAT TREATMENT/HEAT SHOCKING OF MOLLUSCAN SHELLFISH IN ESTABLISHMENT

In this section only heat treatment/ heat shocking of molluscan shellfish is covered which is specific for this code of hygienic practice.

Most requirements for reception of molluscan shellfish, conditioning, storage, washing/ declumping/ debyssing/ grading, packaging, storage and distribution would also apply for molluscan shellfish intended for heat treatment or heat shocking.

Stress and excessive shocks of the molluscan shellfish to be heat treated are somewhat less critical than molluscan shellfish which are intended to be distributed..

6.7.1 Heat treatment for purification purposes

In stead of relaying/ purification it is possible in certain circumstances to eliminate microbiological contamination with a heat treatment. This can be either a sterilisation or pasteurisation process.

The time/ temperature control is very important (F >= 15). The heat treatment is very critical and must be approved by the competent authority.

The establishments must carry out frequent own checks to ensure that the heat treatment is satisfying.
Also very import is documentation of the lots of molluscan shellfish. Polluted shellfish should not come in contact/ be mixed with molluscan shellfish which meet the end product specification.

After the heat treatment the molluscan shellfish must meet the end product specification in Appendix III.

- The molluscan shellfish must come from approved growing areas.

- Each establishment which purifies molluscan shellfish with a heat treatment must develop a heat treatment process schedule, acceptable to the official agency, which addresses such critical factors as the species and size of shellfish, time of exposure to heat, internal shellfish temperature, type of heat process used, water/steam to shellfish ratios, nature of heat equipment, measurement devices and their calibration, post heating chilling operations, cleaning and sanitising of heat process equipment.
- The heat treatment process must be approved by the competent authority.
- All molluscan shellfish should be washed with pressurised potable water or clean sea water and culled for damaged and dead molluscan shellfish prior to heat treatment.
- Polluted shellfish should not come in contact with molluscan shellfish which meet the end product specification.
- After the heat treatment the molluscan shellfish must meet the end product specification in Appendix III.

6.7.2 Heat shocking of molluscan shellfish followed by packing

Heat shocking is a method to remove shells from the molluscan shellfish.

- The molluscan shellfish must come from approved growing areas and/or after relaying in an approved relaying area or purification in an approved purification centre, raft, float or tank. Each establishment which heat shucks shellfish should develop a heat shuck process schedule, acceptable to the official agency, which addresses such critical factors as the species and size of shellfish, time of exposure to heat, internal shellfish temperature, type of heat process used, water/steam to shellfish ratios, nature of heat equipment, measurement devices and their calibration, post heating chilling operations, cleaning and sanitising of heat process equipment.
- All molluscan shellfish should be washed with pressurised potable water or clean sea water and culled for damaged and dead molluscan shellfish prior to heat treatment.
- Before heat shocking the molluscan shellfish should be inspected if the shellfish are alive and not badly damaged
- The heat shocking process should not result in an increase in microbiological levels in the shellfish.
- Heat shocked shellfish should be cooled to 7°C or less within two hours of being heat treated (this time includes the shucking process) and should be further cooled to 4°C or less within 4 hours of heat treatment This temperature should be maintained during transport, storage and distribution.
- The heat shocked shellfish should be packed as soon as possible. Before packing the shellfish should be examined for objectionable matter such as shell pieces
- After heat shocking the shellfish must meet the end product specification in Appendix III.

6.8 DOCUMENTATION

- The transport of live bivalve molluscs from a growing area to a distribution centre, purification centre, relaying area or establishment must be accompanied by documentation for the identification of lots of live bivalve molluscs.
- Permanent, legible and dated records of relaying and purification should be kept concerning each lot. These records should be retained for a period of minimal two years.
- Purification centres, tanks, floats and rafts and distribution centres and establishments should only accept lots of live molluscan shellfish with documentation issued by or accepted by the official agency having jurisdiction. This document should contain the following information
    - the gatherer's identity and signature;
    - the date of harvesting;
    - the location of the growing area.

- Complete records of harvest area and date of harvest and length of time of relaying or purification of each lot should be maintained by the distribution centre or establishment for a period designated by the official agency having jurisdiction.

6.9 LOT IDENTIFICATION AND RECALL PROCEDURES

- Each product leaving the distribution centre or establishment should have an easy identifiable lot number. This lot number must include an identification code number of the distribution centre or establishment the country of origin and day and month of packing in order to facilitate the traceback of the product. The distribution centres should establish a record-keeping system based on these lot numbers so that individual lots of shellfish can be traced from the growing area to the end user.
- If a recall must be carried out its success depends on whether the management of the distribution centre has taken certain preparatory steps in advance.
- Some important aspects are:
  - The affected product must be easy identifiable by lot numbers;
  - Destination and customers of the affected product must be identifiable;
  - Competencies and responsibilities of management and personnel must be clear;
  - Names and telephone numbers of affected personnel, organisations and customers must be present.

SECTION 7 PROCESSING OF CRUSTACEANS [TO BE COMPLETED]

SECTION 8 PROCESSING OF CEPHALOPODS [TO BE COMPLETED]

SECTION 9 PROCESSING OF SALTED FISH

Salted fish and fish products should be sound and wholesome, well prepared and packaged so that they will be protected from contamination and remain attractive and safe to eat. In order to maintain the quality of fish it is important to adopt quick, careful and efficient handling procedures.

9.1 GENERAL

Refer also to Section 5 for general handling prior to processing

- fresh fish intended for processing salted fish should be checked for nematodes;
- frozen fish should not be salted before it is thoroughly thawed and inspected for suitability;

9.2 PREPARING BEFORE SALTING

9.2.1 Splitting, Washing and Rinsing

- the design of the splitting line should be continuous and sequential to permit the uniform flow without stops or slow-downs. The waste should be removed continuous from the line;
- any damaged, contaminated or otherwise unacceptable fish should be discarded before splitting;
- fish should be split by a cut made parallel to the backbone straight down from the nape to the tail and in such a way as to prevent uneven and ragged edges or a loss in recovery. If the backbone is to be removed, the fish should be split so deeply that the remains of the backbone (the tail-bone) lie free. It is important to cut the bone rather than to break it from the flesh;
- splitting of fish should be carried out expertly so that blood in nape and blood clots are removed;
- immediately after splitting, fish should be washed for in plenty of running potable water or clean sea water, to remove all blood from the fish;
- all impurities, blood and slivers should be removed;
- if the black membrane has to be removed than it should be done after the splitting step.

This flow chart is for illustrative purposes only. For in-factory HACCP implementation a complete and comprehensive flow chart has to be drawn up for each process.

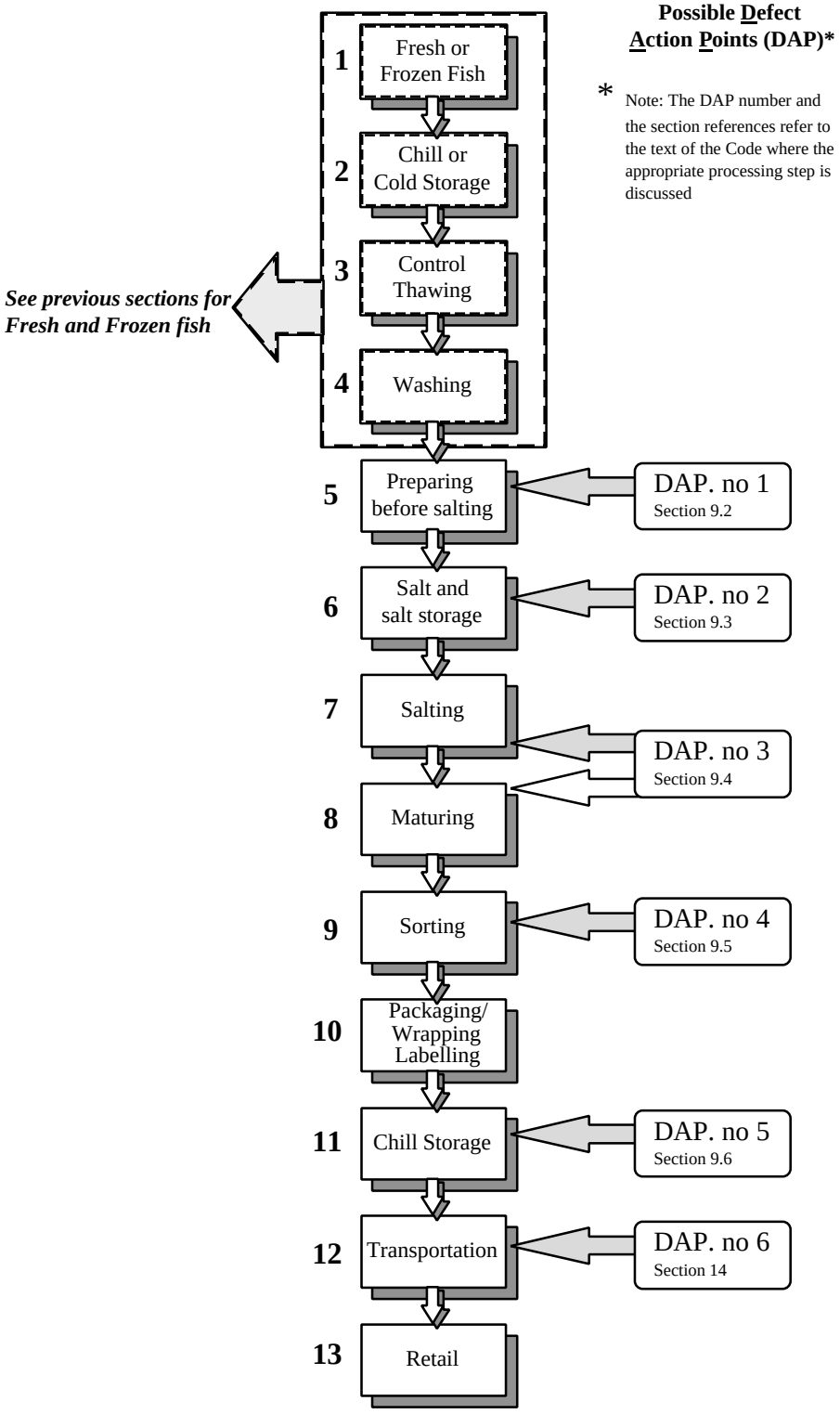


Figure 4 Example of a flow chart of a salted fish processing line

9.2.2 Filleting, Skinning And Trimming

Refer to Section 5.3.4

9.2.3 Nobbing (Herring) (To be developed)

9.2.4 Gibbing (Herring) (To be developed)

9.3 SALT HANDLING AND SALT REQUIREMENTS

9.3.1 Handling

- Salt for salting of fish should be transported an stored dry and hygienically covered in salt bins, storerooms, containers or in plastic sacks;
- In order to minimise infections of salted fish the re-use of salt should be avoided.

9.3.2 Salt Requirements

- The quality of salt used in salting of fish should possess an appropriate composition for the product.
- The composition of salt differs according to the origin. Mine salt is usually almost pure sodium chloride but solar salt of marine origin contains several other salts like calcium sulphate, magnesium sulphate and chloride as impurities.
- A relatively pure salt is needed for the dry-salting of fatty fish but for some products the presence of small quantities of calcium salts will give the product a somewhat superior appearance. Too much calcium may reduce the rate of salt penetration to an extent that spoilage may occur.
- Magnesium salts if present at too high a concentration will give rise to unpleasant bitter flavours and may cause spoilage during the salting operation.
- Salt produced from marine sources may contain halophilic bacteria which continue to live in the salt and dry salted fish.
- Salt used to salted fish should be clean, free from foreign matter and foreign crystals, show no visible sign of contamination with dirt, oil, bilge or other extraneous materials. Salt used for heavy salted fish should meet the following requirements:
    - levels of calcium salts between 0.15% and 0.35% have been found satisfactorily;
    - levels of magnesium salts if present, not more than 0.15%;
    - content of copper not more than 0.1 mg/kg ;
    - content of iron not more than 10 mg/kg;
    - small crystals for dry-salting of fatty fish and large crystals for lean fish;
    - free from micro-organisms which adversely affect the quality of final products;

9.4 SALTING AND MATURING

Salted fish should be mature, sound and wholesome. The fish should be free of remains of the guts, liver and other entrails;

Salting of fish either by brining, pickling (wet salting) or dry salting should be carried out with full understanding of their effects on the quality of the final product and should be done under strict hygienic condition.

Two particular conditions that can adversely affect the quality of dry salted fish are the occurrence of "*pink*", a discoloration caused by red halophilic bacteria; and "*dun*"**,** a development of the mould Sporendonema epizoum. Both defects can be combated by maintaining a temperature lower than 10^{o}C (50^{o}F). Salt produced from marine sources may contain halophilic bacteria which continue to live in the salt and salted fish. In order to minimise infections of salted fish, previously used and/or contaminated salt should be removed from the plant.

9.4.1 Brining

- only fresh stabilised brine should be used for the salting operations;
- the ratio of brine to fish and the concentration of the brine should be adjusted to desired product;

9.4.2 Pickling (Wet Salting)

- fish for pickling should be carefully salted and properly packed into the curing container;
- amount of salt, time and temperature should be carefully controlled to obtain the desired product;
- during the pickling operation all fish should be well immersed in the resulting pickle;
- fish should be allowed to settle in containers and than added salt or pickle before the container is closed;
- when salting the fish, the salt concentration of the pickle should be checked periodically with a salinometer according to specifications;
- after salting in container the fish could be stacked. This should not be done before the proper salt/water balance is obtained. In case of stacking, adequate amounts of salt should be added and evenly distributed over the whole surface of the fish;
- cured fatty fish should be kept in brine or pickle;
- fatty fish should always be covered with pickle during curing;
- salted fish should be stored or maintained for a sufficient period under controlled temperatures, to ensure proper curing and to prevent deterioration of the product;
- when salting fish of Scombridae and Clupeidae families, regular checks should be made of histamine content.

9.4.3 Dry Salting

- fish for dry salting should be properly arranged to ensure uniform conditions and proper drainage;
- fish piles should never be placed directly on the floor;
- amount of salt, time and temperature should be carefully controlled to obtain the desired product;
- fish should be restacked periodically with the top of the pile going to the bottom of the new pile, and with the addition of fresh salt to ensure that sufficient salt will be present to complete the cure;
- if the fish is restacked on pallets, the pallet should be clean;
- under certain conditions dry salting of small fatty fish, such as anchovy and small herring, may be used. For large fish, pickling or brining should be used in preference;
- fish should not be exposed to freezing temperatures or to high temperatures;

9.4.4 Maturing

- maturing time depends on the fish (species, size and quality), temperature and the amount of salt absorbed by the fish tissues;
- wet salted split fish of the Gadidae family is regarded as mature after 10 to 12 days in the brine, and for dry salted split fish after 20 to 28 days, with temperature between 5° to 8°C;
- fatty fish as herring may be kept for up to three weeks in a temperature range of 5^{o} C to 10^{o} C. If the containers are to be held at lower temperatures, the maturing period will increase;
- the first part of curing period for fish of the Clupeidae and Scombridae families should be done at temperatures between 0°C and 5°C to prevent development of histamine;

9.5 SORTING, PACKAGING, WRAPPING AND LABELLING

Refer also to Section 5.3.7

9.5.1 Sorting

- salted fish should be sorted into species, sizes and trade quality categories for the relevant market;
- loose salt should be removed from the fish before sorting and new salt should be added before packaging.

9.5.2 Packaging

Refer to Section 5.3.8

- barrels in which fatty fish are to be marketed should be clean, whole and hygienic.

9.5.3 Labelling

Refer to Section [ ]

9.6 CHILL STORAGE

- salted mature fish should be stored in chill storage. The storage should be well ventilated and the products protected from dust, rodents and other contamination;
- the temperature in the chill storage should be between 1^{o}C to 5^{o}C ;
- temperature and storage time should be monitored and recorded at regular intervals ;
- the products should be handled carefully and not be over-stacked.

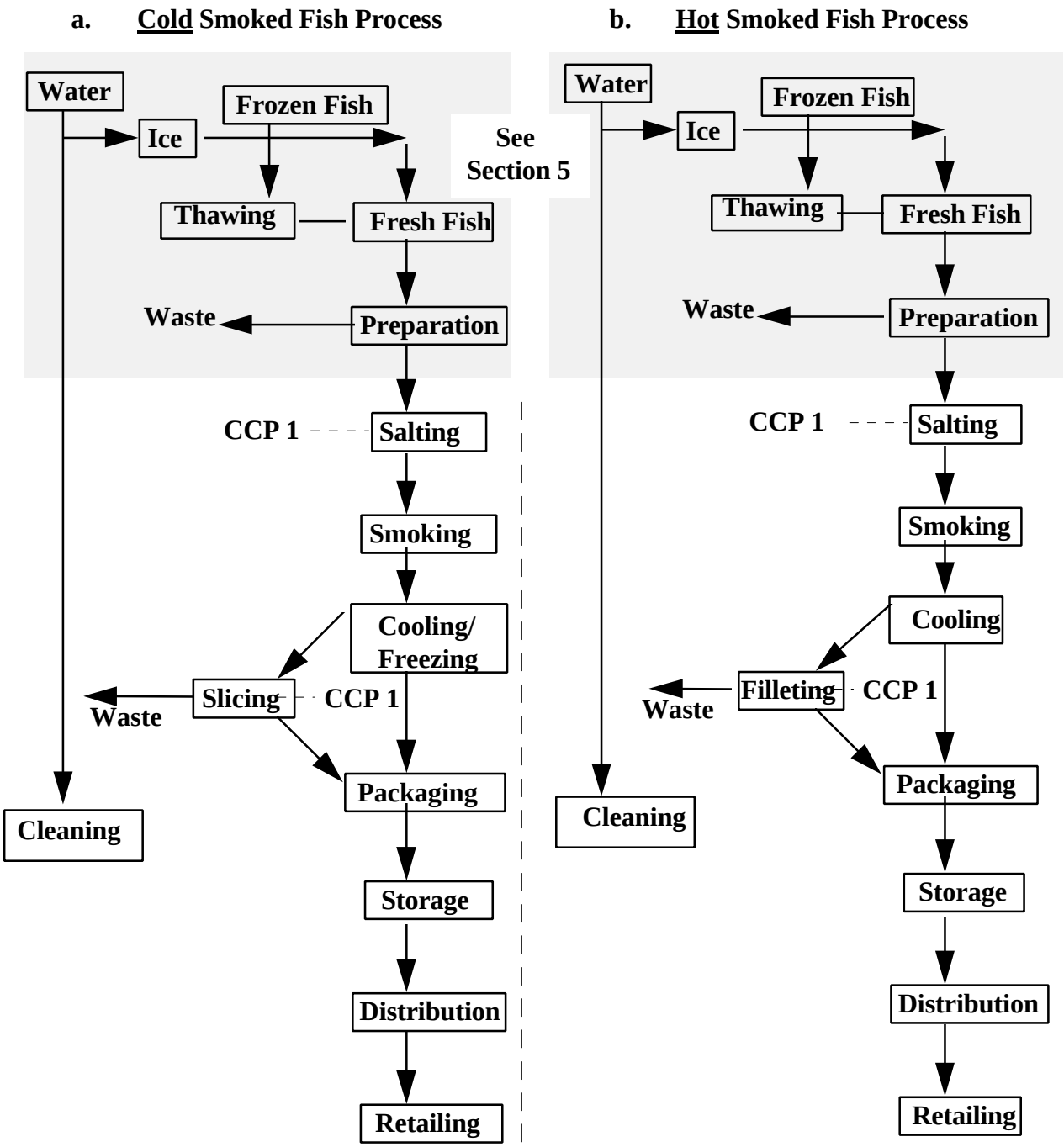


Figure 5 Flow diagram of smoked fish processes

10.1 IDENTIFICATION OF HAZARDS AND DEFECTS

For smoked products in particular a health risk might appear if the technology moves in the direction of a reduction of the traditional barriers to out growth of pathogens or changes of packaging methods such as the history of the safety of the product is not valid any more.

- In addition to what is stated in Section 4.3.2 under bacteriological hazards it should be stressed that one cannot rely on that the indigenous spoilage bacteria will outgrow the pathogens in smoked fish.
- The inhibiting elements of the smoke are not mapped very well but the smoking process seem although somewhat undefined to extend the storage life for fish compared to that of fresh fish.
- However food poisoning from smoked fish such as histamine food poisoning or botulism is known.
- Myxosporidiae and other organisms are in some cases causing proteolysis and therefore considered as defects when apparent.
- Lack of vacuum or wrong proportion of packaging gases should also be considered defects.

10.2 PROCESSING OPERATIONS

In order to maintain the quality of the product it is important to adopt quick, careful and efficient handling procedures. In order to minimise cross contamination auxiliary operations such as fuelling the smoke generator should be kept separate.

In addition to the possible hazards related to the raw materials as described under box CCP no 1 the following CCP's could be relevant for hot smoked respectively cold smoked fish.

10.2.1 The Hot Smoking Process

The process will follow the general line as described by the flow diagram in Figure 5a, however the processing parameters are numerous.

Depending on the fish in question the temperature obtained in the fish will vary from about 60^{o} C for e.g. hot smoked eels to about 80^{o} C as recommended by some countries and even higher resulting in crust formation from the burned surface e.g. smoked bonga.

The fish flesh will appear cooked.

The smoking time will vary as well depending on the size of the fish and the conditions for the marketing of the products but will usually be 1-2 hours.

Usually the fish is dried for a period before smoking in order to prepare the skin for the reception of the smoke. The drying can be carried out in the smoking equipment or in special driers or under more primitive conditions out doors maybe under shelter maybe in the sun.

The fish could be lightly salted or not be salted at all before smoking, sometimes a sprinkle of salt is given when packed in boxes after smoking.

The equipment for the hot smoking process has developed from the most simple chimney/barrel to specially designed cabinets with inbuilt devises for the control of the smoking process but it is characteristic that the very primitive equipment persists.

Usually the fish is gutted or gilled but can be round for smaller species or be as fillets or steaks for greater fish.

10.3 PACKAGING AND DISTRIBUTION

Much hot smoked fish are traded locally and the need for packaging the products and keeping them under refrigeration has been limited. However when the market for hot smoked products expands and they eventually enter into international trade the need for packaging and temperature control during storage and transport increases.

The products are usually fragile and need to be protected from physical impact. As the fish is often fatty the smoked products also need to be protected against the influence of oxygen even though the smoke is having antioxidant properties.

In order to minimise the risk the salt content of the smoked fish should be increased to more than 3 %WPS and to be even more sure the products should be kept under 5^{o} C.

10.3.1 The Cold Smoking Process

The process will follow the general line as described by the flow diagram in Figure 5b. The products originates in countries belonging to the temperate geographical zone and when following the parameter that the temperature should be $<30^{o}$ C the resulting product does not appear cooked. However the temperature could most probably be increased for tropical fish living in waters of that temperature.

The characteristic feature for cold smoked fish will be that the flesh does not appear cooked. Most cold smoked fish are smoked as fillets. The fish could be exposed to smoke for an extended period of 24 hours or more in a smoking cabinet, however the time is shortened considerably in the modern cold smoking process to approach the times known from the hot smoking process.

The fish is dried until the surface will receive the smoke. Traditionally the fish has only been salted slightly if at all and the keeping properties has been poor. Today the fish is usually lightly salted by dry salting for 24 hours or by pickle injection of brine and then maturing for 24 hours to reach a salt%> 3 WPS.

10.3.2 Packaging and Distribution

The traditional products were traded to the local consumers who carried out the final preparation of the cold smoked products such as the slicing. It is extremely perishable and need to be handled fast.

Today pre-sliced products are the dominant presentations on the market.

The smoked filets are prefrozen to about -5C in order to run better in the slicers and the sliced product is vacuum packed.

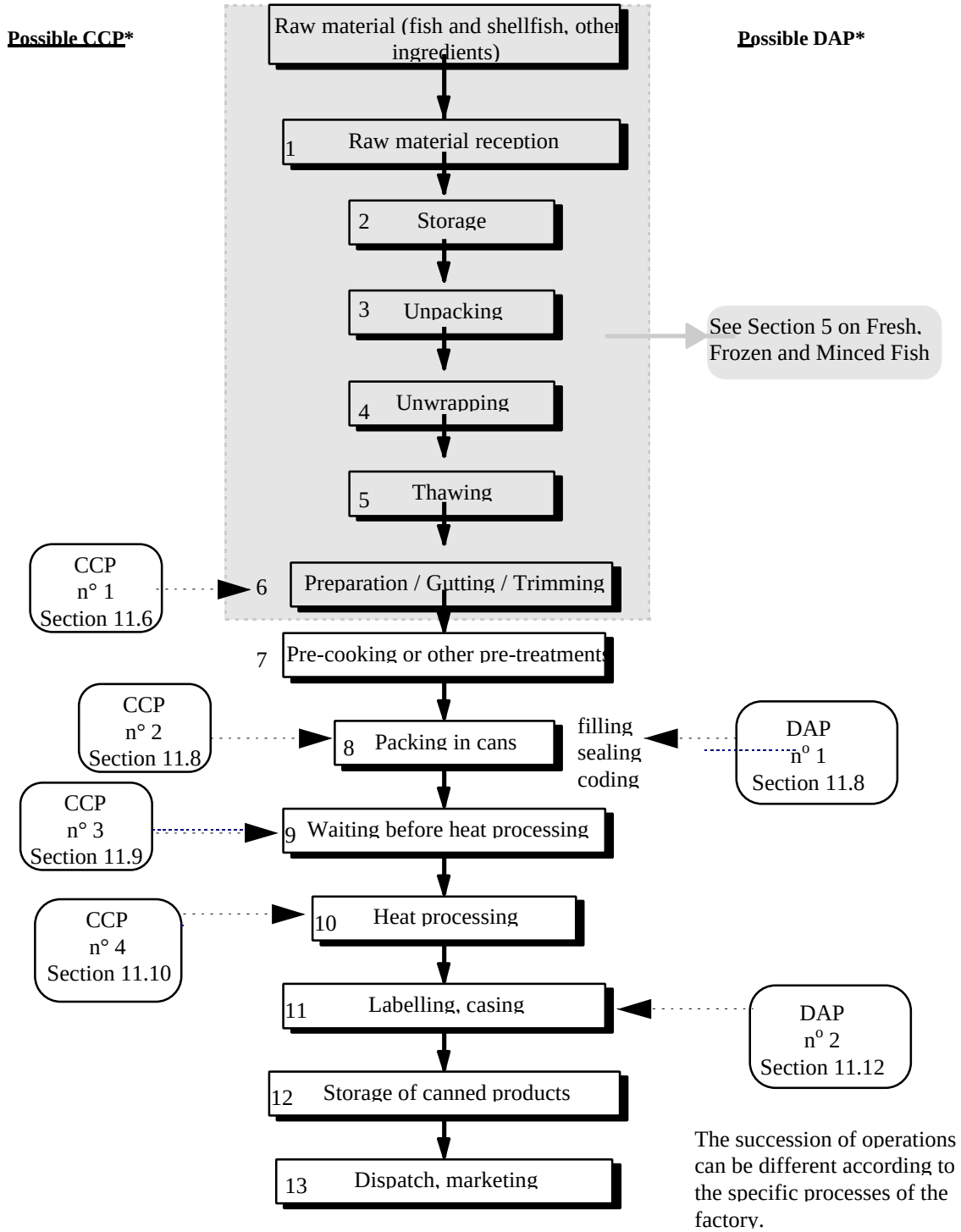
Often the products are frozen again as an intermediate part of the process in order to establish a buffer storage for being able to meet the demands of the peak seasons, and then thawed before the presentation to the final consumer.

Regardless of whether the prepacked product is fresh or thawed it should be kept > 5 C during storage, transport and presentation and the salt% should be >3% WPS.

SECTION 11 PROCESSING OF CANNED FISH

This Section applies to the application of HACCP to the production of heat processed sterilised canned fish and shellfish products which have been packed in hermetically sealed rigid or semi-rigid containerscontaining at least 50% of fish or shellfish and intended for human consumption. Aseptic filling is not covered by this Code, reference should be made to the Code of Hygienic Practice for Aseptically Processed and Packaged Low Acid Foods (CAC/RCP 40-1993).

This flow chart is for illustrative purpose only. For in-factory implementation of HACCP principles, a complete and comprehensive flow chart has to be drawn up for each product.



* Note : The CCP and DAP numbers and the sections references refer to the Sections of the Code where the appropriate processing step is discussed.

Figure 6 Example of a flow chart for the processing of canned fish and shellfish

11.1 GENERAL - ADDITION TO PRE-REQUISITE PROGRAMME

- conveyor systems used to transport empty containers to filling machines should be designed and constructed to prevent contamination and damage of those containers;
- an adequate number of efficient sealing machines should be available to avoid undue delay in processing;
- retorts should have a suitable supply of energy, vapour, water and/or air so as to maintain in it sufficient pressure during the heat treatment of sterilisation ; their dimensions should be adapted to the production to avoid undue delays;
- Every retort should be equipped with an indicating thermometer, a pressure gauge, and a time and temperature recorder;
- The thermometers should be tested regularly to ensure that they are accurate. Calibration records should be maintained;
- Time-temperature recorders should be used;
- Canneries using steam retorts should consider installing automatic retort controls.

11.2 IDENTIFICATION OF HAZARDS AND DEFECTS

Refer also to Section 4.3.2

11.2.1 Hazards

A - <u>Naturally occurring marine toxins</u>

Biotoxins such as tetrodotoxines or ciguatoxines are known to be generally heat-stable, so the 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, so it important to know the origin of molluscan shellfish intended for processing.

<u>B - Microbiological toxins</u>

Histamine
Histamine is heat-stable, and so its toxicity remain practically intact in cans. Good practices for the conservation and handling from capture to heat processing are essential to prevent the histamine production. The Codex Commission adopted in its standards for some fish species maximum levels tolerated for histamine.

Clostridium botulinum
The botulism risk appears only after an inadequate heat processing. The toxin is heat-sensitive, on the other hand, the destruction of *Clostridium botulinum* spores, in particular from proteolytic strains, requires high sterilisation values. The heat processing effectiveness depends on the contamination level at the time of the treatment. Therefore, it is advisable to limit proliferation and the contamination risks during processing.

Staphylococcus aureus
Toxins from *Staphylococcus aureus* can be present in a highly contaminated raw material or can be produced by bacterial proliferation during processing. These toxins are heat-resistant, so they have to be taken into account in the hazard analysis.

Hazards linked to the containers
Care should be taken to avoid contamination of the product from components of the containers.

11.2.2 Defects

Potential defects are outlined in the end-product specifications described in Appendix VIII and in Codex standards concerning canned fish and shellfish products.

11.3 PROCESSING OPERATIONS

Once a processing facility has established a pre-requisite programme (Section 3), HACCP principles can be applied in this establishment to each process and to each product. This section describes the technological guidelines for processing canned fish and shellfish and gives some recommendations in order to control hazards and defects at the different processing steps. It provides examples of the application of HACCP principles : identification of potential hazards or defects, suggestion of control measures etc.

11.3.1 Requirements Concerning Raw Materials, Containers and Packaging Materials

General

Fish and shellfish intended for canning should be produced in accordance with the appropriate Sections of this code.

11.3.2 Specifications for containers and packaging materials

- Containers and packaging materials should be suitable for the type of product, the conditions provided for storage, the filling, sealing and packaging equipment and the transportation conditions.

The containers in which fish and shellfish products are canned should be made from suitable material and constructed so that they can be easily closed and sealed to prevent the entry of any contaminating substance

Containers for canned fish and shellfish should meet the following requirements:

(a) they should protect the contents from contamination by micro-organisms or any other substance;
(b) their inner surfaces should not react with the contents in any way that would adversely affect the product or the containers ;
(c) their outer surfaces should be resistant to corrosion under any likely conditions of storage ;
(d) 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) they should be of convenient size and shape to suit the nature of the product ;
(f) they should be easy to open and to empty.

11.3.3 Inspection on receipt

- When necessary, some characteristics of containers or materials from which containers are made should be checked. It concerns in particular their resistance to mechanical, chemical and thermal stress encountered during the product life. This can be carried out by visual examinations and/or physical testing.

11.3.4 Storage of raw material, containers and packaging materials

- Raw materials should be stored, as quickly as possible after reception, in suitable premises. Raw materials should be stored so that any recontamination of final products, in-process products or containers should be prevented. Raw materials and ingredients stored within the cannery should be kept in conditions designed to prevent their spoilage, to protect them from contamination by microorganisms, insects, rodents, foreign matter and chemical substances and to minimise possible damage.
- All materials for containers or packages should be stored in satisfactory clean and hygienic conditions.
- Containers (empty cans) and covers should be stored in dry premises, kept away from dirt and sudden temperature variations, in order to avoid humidity condensations on metal and corroding phenomenon which can result from them.
- N.B. : during transportation of empty cans, any shock should be avoided. In fact, shocks can deform the cans (can body or flange), that can compromise tightness (shocks on the seam, deformed flange) or be prejudicial to appearance.
- During loading, stowing and unloading of empty containers, containers shouldn't be stepped on. These precautions become more imperative when cans are put in bags or on pallets.

11.4 UNWRAPPING, UNPACKING

- During unwrapping and unpacking operations, precautions should be taken in order to limit product contamination and foreign matters introduction into the product. To avoid microbial proliferation, there should be no waiting periods during these operations.

11.5 THAWING

- See Section 5.3.2

11.6 FISH AND SHELLFISH PREPARATORY PROCESSES

11.6.1 Fish preparation (see Sections 5.3.1 - 5.3.4)

- The operations of gutting, heading, skinning, boning or portioning should be done in a clean and hygienic manner and should be carried out carefully to prevent any contamination, deterioration, spoilage or the development of infectious or toxigenic micro-organisms.
- When operated, gutting should be done very thoroughly so that no viscera are left to spoil the appearance or the flavour of the final product.
- When skinning of fish is operated by soaking in soda solution, a particular care should be taken to carry out an appropriate neutralisation.
- Raw fish should be thoroughly washed in cool potable water or clean sea water immediately after they have been subjected to any dressing operation such as gutting, heading, scaling, skinning or portioning.

11.6.2 Preparation of molluscs and crustaceans

- The preparation of bivalve molluscs should be conducted in accordance with the recommendations of the « Recommended Code of Practice for Molluscan Shellfish.
- Particular care should be taken to ensure that shell fragments are removed from shellfish meat. Inspection methods and appropriate techniques for the removal of shell fragments from the meat, should be used.

11.7 PRE-COOKING AND OTHER PRE-TREATMENTS

11.7.1 Pre-cooking

11.7.1.1 General considerations

- There are several reasons for pre-cooking fish or shellfish prior to canning:

  - to lower the water content of the flesh in order to avoid water exudation during heat processing;

  - to give a particular flavour or texture to the product;

  - in some cases, to prepare the products for later treatments.

- Methods used to pre-cook fish or shellfish for canning should be designed to bring about the desired effect with a minimum delay and a minimum amount of handling; the choice of method is usually strongly influenced by the nature of the treated material.
- Means should be found to reduce the amount of handling subsequent to pre-cooking, wherever practical.

11.7.1.2 Pre-cooking schedule

- The pre-cooking method, in particular, in terms of time and temperature, should be clearly defined. The pre-cooking schedule should be checked.
- Fish pre-cooked 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.

11.7.1.3 Control of quality of pre-cooking oils and other fluids

- Only good quality vegetable oils should be used in pre-cooking fish or shellfish for canning.

- Cooking oils should be changed frequently in order to avoid the formation of polar compounds. Water used for pre-cooking should also 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.

11.7.1.4 Cooling

- Expect for products which are packed when still hot, cooling of pre-cooked 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.
- Where water is used to cool crustacea for immediate shucking, it should be potable water or clean sea water. The same water should not be used for cooling more than one batch.

11.7.2 Smoking

- When a smoking step is realised, the smoking operations should be conducted in accordance with the recommendations of Section 10.

11.7.3 Use of Brine and Other Dips

- Where fish or shellfish are dipped or soaked in brine or in solutions of other conditioning or flavouring agents or additives in preparation for canning, solution strength and time of immersion should both be carefully controlled to bring about the optimum effect.
- Dip solutions should be replaced 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 will be permitted in canned fish and shellfish by the related Codex Standards and in the countries where the product will be marketed.

11.8 PACKING IN CANS (FILLING, SEALING AND CODING)

11.8.1 Filling

- Containers and covers should be inspected immediately 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 faulty containers, because they can jam a filling or sealing machine, or cause trouble during heat processing (bad sterilisation, leaks).
- Empty containers should not be left on the packing tables or in conveyor systems during clean-up of premises to avoid contamination or splashes.
- To prevent microbial proliferation, containers should be filled with hot fish and shellfish (> 63°C, for example for fish soups) or should be filled quickly (the shortest possible waiting period) after the end of the pre-treatments.
- 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 in order to comply with the filling rate and the headspace specified in the adopted sterilisation schedule. A regular filling is important not only for economical reasons, but also because the heat penetration and the container integrity can be affected by excessive filling changes.
- Shallow metal containers with relatively large flexible covers need little or no headspace but other containers may require sufficient empty space to allow for the expansion of the contents during the heat process.

- The necessary amount of headspace will depend partly on the nature of the contents. The filling should also take into account the heat processing method.
- Furthermore, containers should be filled such as the end-product meets the regulatory provisions or the accepted standards concerning weight of contents.
- Where canned fish and shellfish is packed by hand, there should be a steady supply of fish, shellfish and eventually other ingredients. Build-up of fish and shellfish, as well as filled containers at the packing table should be avoided.
- The operation, maintenance, regular inspection and adjustment of filling machines should received particular care. The machine manufacturers' instructions should be carefully followed.
- The quality and the amount of other ingredients should be carefully controlled to bring about the optimum 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

  - and to verify product quality and workmanship just before they are closed.
- Manual filled products such as mackerels or sardines should be carefully checked by the operators. For automatic filled products, a sampling plan should be implemented.

11.8.2 Sealing

Sealing the container is one of the most essential processes in canning.

- The operation, maintenance, regular inspection and adjustment of sealing machines should received particular care. The sealing machines should be adapted and adjusted for each type of container and each closing method which are used. Seams and other closures should be well formed with dimensions within the accepted tolerances for the particular container.
- This operation should be conducted by qualified personnel specially trained.
- Whatever the type of sealing equipment, the manufacturer's or equipment supplier's instructions should be followed meticulously.
- If vacuum is used during packing, it should sufficient to prevent the containers from bulging under any condition (high temperature or low atmospheric pressure) likely to be encountered during the transport, storage or marketing of the product. This is 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.
- 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.
- To find the best methods to create vacuum, competent technologists should be consulted.
- Regular inspections should be made during production to detect potential external defects on containers. At intervals sufficiently close to each other in order to guarantee a closure in accordance with specifications, 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 which are used. A sampling plan should be used for the checks.
- In particular, 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.
- All appropriate observations should be recorded.

11.8.3 Coding

- Each container of canned fish and shellfish should bear indelible code markings from which all important details concerning its manufacture (type of product, cannery where the canned fish or shellfish was produced, production date, etc.) can be discovered.
- Coding equipment must be carefully adjusted so that the containers are not damaged and the code remains legible.

11.9 HANDLING OF CONTAINERS AFTER CLOSURE - WAITING BEFORE HEAT PROCESSING

- Containers after closure should always be handled carefully in such a way as to prevent every damage capable to determine defects and microbiological recontamination. Conception, working and maintenance of handling devices for containers and loading devices for the baskets aimed at retorting should be well adjusted to the kind of containers and material which are used. These devices should prevent any excessive fall of the containers.
- If necessary, filled and sealed metal containers should be thoroughly washed before heat processing to remove grease, dirt and fish or shellfish marks on their outside walls.
- To avoid microbial proliferation, there should be a waiting period as shortest as possible.
- If the filled and sealed containers must be held for a long time before heat processing, refrigeration or heat holding (> 63°C) for fish soups, for example, are necessary.

11.10 HEAT PROCESSING AND COOLING

Heat processing is one of the most essential operations in canning. Canners can refer to the Recommended International Code of Hygienic Practice for Low-Acid and Acidified Low-Acid Canned Foods (CAC/RCP 23-1979, Rev. 2 1993) in order to obtain detailed advice on heat processing. In this Section, only essential elements are pointed out.

11.10.1 Sterilisation Schedule

- To determine the sterilisation schedule, at first, the heat process required to obtain the biological stability should be established taking into account some factors (microbial flora, dimensions and nature of the container, product formulation, etc.).
- Then, heat penetration tests should be carried out by competent canning technologist to take into account the sterilisation equipment at disposal and the product quality which is desired. This heat penetration in the product must be established in the most unfavourable conditions likely to occur during processing.
- A sterilisation schedule is established for a certain product in a container of a given size.
- Standard heat processing procedures and experimentally established sterilisation schedules should be checked and validated by an expert to confirm that the values are appropriate for each product and retort.
- If any changes in operations (initial temperature of filling, product composition, size of containers, fullness of the retort, etc.) are made, competent technologists should be consulted as to the need for re-evaluation of the process.

11.10.2 Heat Processing Operation

- Retorts should be operated only by qualified and properly trained personnel. Therefore it is necessary that retort operators control the principles involved and follow closely the processing instructions, and use meticulous care in timing, determining temperatures and pressures, and in making records.
- It is essential to comply with the initial temperature described in the schedule process to avoid underprocessing. If the filled containers were held at refrigerated temperatures because of a too long waiting period before heat processing, the sterilisation schedule should take into account these temperatures.

- If production rates are low, the product should be heat processed in partly filled retorts. Therefore, a separate heat process should be established for partly filled retorts.
- Every cannery should develop a system which will prevent non heat-processed canned fish and shellfish from being accidentally taken past the retorts into the storage area.
- It is essential to flush all the air out of steam retorts in order to attain the controlled processing temperature. This is done by venting.
- In order that the heat processing is efficient, steam must flow freely throughout the load. Air pockets should not remain in the retort.
- It is therefore important that the flow of steam throughout each retort should be studied by an expert and that some elements are modified if necessary (such as steam distribution, venting and loading arrangements) to reduce the time required to exhaust all air and ensure an even distribution of heat.
- These studies should be repeated for each size of container and whenever the retort equipment or loading arrangements are changed.
- The timing of the heat processing should not be commenced 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.
- Canned fish and shellfish in different size containers should not be processed together in the same retort load.
- 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;
- Retort temperatures should always be determined from the indicating thermometer, never from the temperature recorder.

11.10.3 Monitoring of Heat Processing Operation

- During the application of heat processing, it is important to ensure at each production that the sterilisation schedule and factors such as container filling, minimal internal depression at closing, retort loading, initial product temperature, etc. are in compliance with the working procedures.
- Permanent records of the time, temperature and other pertinent details should be kept concerning each retort load.
- Inspections should be made periodically to ensure that retorts are equipped and operated in a manner that will provide thorough and efficient heat processing, 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 canning technologist;
- Nevertheless, retorts with automatic controls need to have an operator in attendance. Monitoring records must be maintained;
- the temperature diagrams should be kept as part of the monitoring procedures so that in the event of any claims the records can be consulted.

11.10.4 Retort Equipment

- An accurate clearly visible clock should be installed in the retorting room.

11.10.5 Cooling

- In order to avoid an organoleptic spoilage of the canned fish and shellfish, the internal temperature of containers should be lowered as quickly as possible. After heat processing, canned fish and shellfish should, wherever practical, be water cooled under pressure. In case of recycling, only potable chlorinated water should be used for this purpose.
- Unless otherwise specified, an overpressure should be applied during cooling to prevent deformations which could result in a loss of tightness.

- 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 due 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. They should not be labelled, cased or handled unnecessarily until they are quite cool.
- Rapid cooling of canned fish and shellfish avoids the formation of struvite crystals (quality defect).

11.11 HANDLING AFTER HEAT PROCESSING

- Heat processed canned fish and shellfish should not be touched by hand 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.
- Canned fish and shellfish should be inspected for faults and for quality assessment soon after it is produced and before labelling.
- Representative samples from each code lot should be examined to ensure that the containers are sound and the product meets the standards for weight of contents, vacuum, workmanship and wholesomeness. Texture, colour, odour, flavour and condition of the packing medium should be assessed.
- This examination should be made as soon as practical after the canned fish and shellfish have been produced, so that if there are any faults due to failings on the part of cannery workers or canningequipment, these failings can be corrected without delay.
- Stability tests could be conducted as part of the verification.

11.11.1 Labelling, Casing and Storage of Finished Products

- The materials used for labelling and casing canned fish and shellfish should not be conducive to corrosion of the container. Cases should have an adequate size in order that the containers fit them and are not damaged by any move inside. Cases and boxes should be the correct size and strong enough to protect the canned fish and shellfish during distribution.
- Code marks appearing on containers of canned fish and shellfish should also be shown on the cases in which they are packed.
- The labelling should be in compliance with the Codex General Standard for the labelling of prepacked foods an in compliance with the labelling provisions of the Codex standards for canned fish and shellfish.
- Storage of canned fish and shellfish should be made in order not to damage the containers. In particular, the fork-lift trucks used for the storage should be used in a proper manner.
- Canned fish and shellfish should be so stored that they will be kept dry and not exposed to extremes of temperature.

11.12 TRANSPORTATION OF FINISHED PRODUCTS

- Transportation of canned fish and shellfish should be made in order not to damage the containers. In particular, the fork-lift trucks used during the loading and unloading should be used in a proper manner.
- Cases and boxes should be completely dry. In fact, moisture has effects on the mechanical characteristics of boxes and the protection of containers against damages during transportation couldn't be sufficient.
- Metal containers should be kept dry during transportation in order to avoid corroding and/or rust.

SECTION 12 PROCESSING OF FROZEN SURIMI

Frozen surimi is in brief terms raw material for food that is myofibriller protein isolated from fish meat protein by washing, most of which is not intended for direct human consumption but further heat treated and consumed in the form of surimi-based products. It should be kept in mind that frozen surimi was originally developed as raw material for surimi-gel that is produced by taking advantage of gel forming ability possessed by myofibrillar protein. Therefore, certain properties specifically required for surimi-based products should be taken into consideration, and it should be fully understood that it is in this point that code of practice for frozen surimi is different from the codes of practice for all the other fish and fishery products.

However, since most of the practical information pertaining to the technology and hygiene of the production of frozen surimi has been based upon experiences gained in Japan and the United States of America, this Section is not intended to be strictly applied in all countries producing frozen surimi without any modification irrespective of the conditions of the respective countries. The establishment of a code of any country will, in accordance with this Section, probably require the consideration of various conditions and consumers' tastes in the country concerned. In order words, a "national" code of practice of any country could be developed from the information contained in this Section supplemented by taking into due consideration the species of fish and the various conditions of the country in question.

Moreover, this Section has been prepared on the basis of Alaska pollock(*Theragra chalcogramma*) that constitutes the great majority of frozen surimi production in the world, and will require periodic revision, since the increase of surimi made from other fish species as well as further technological development can be foreseen.

This Section dose not specifically deal with non-frozen surimi being produced in certain countries because of its small production output, but may be applicable to such surimi as its production process is almost identical to that of frozen surimi. Further, this Section is applicable to frozen surimi that is produced at sea by factory ship.

12.1 IDENTIFICATION OF HAZARDS AND DEFECTS

12.1.1 Hazards

Bacteriological hazards

Raw material fish has always been regarded as reservoir of pathogenic bacteria. However these bacteria are killed or reduced to acceptable level when surimi is cooked(heated) for preparing surimi-based products, hence pathogenic bacteria needs not identified as a hazard. Contamination with *Staphylococcus aureus*, which produces heat-stable toxins, should be fully been controlled by pre-requisite programme for personnel hygiene.

Parasites

The frozen surimi is refined and frozen in its manufacturing process, and in addition, in the process to be finished into its end product, i.e.; fish meat paste, material is heated. For this reason, substantially incidence of health hazards by parasites for frozen surimi and fish meat paste is substantially lower than for raw fish and fillet and it is at the negligible levels. Typical parasites that may be found in the raw material fish of frozen surimi include anisakis and pseudoterranova.

Anisakis and Pseudoterranova

The anisakis is, in many cases, parasitic in encystation formed on the surface membrane of the liver of walleye pollock, while the pseudoterranova, in many cases, inhabit in the muscle of Pacific cod and Atka mackerel in forming itself the shape of a swirl. Most of these parasites are deactivated in the process of meat separation from the fish by a separator or refining by a refiner. Therefore, frozen (storage) process and further more, heating during the production process of fish meat paste enable the prevention of occurrence of health hazards.

Scombrotoxin

Scombrotoxin forming fish species may be used for production of frozen surimi. Scombrotoxin is attributed to *Enterobacteriaceae* when high levels of histamine are produced in the fish muscle. The main fish susceptible

are the scombroids such as tuna, mackerel, bonito etc. although it can be found in other species. The intoxication is rarely fatal, but generally symptoms are usually mild. Rapid refrigeration after catching and a high standard of handling during processing should prevent the development of the toxin.

Ciguatoxin
The other important possible toxin is ciguatoxin which can be found in wide variety of mainly carnivorous fish inhabiting shallow waters in or near tropical and sub-tropical coral reefs. The levels of study and analysis still inadequate for this toxin and the only control measure that can reasonable be taken is to avoid marketing fish that have a consistent record of detection of toxicity. Specific attention should be paid when south-coral fish are used as raw materials.

Foreign matter
Metal fragments as foreign matter may enter the production process of frozen surimi. The usage of a metal detection device is effective for removing the product contaminated with such metal fragment. Surimi processing consists of numerous mechanical steps. Therefore there is a great chance of any broken metals (i.e., bolts, washer, nuts, etc.) to be left in the meat. This safety hazard must be evaluated all the time.

12.1.2 Defects

Potential defects are outlined in the end-product specifications described in Appendix IX of this Code of Practice.

Parasites
The presence of parasites in the fish may often cause quality problems, which requires caution. Typical parasites that may live in the raw material fish of frozen surimi and those that may cause quality problems to frozen surimi include myxosporida.

Myxosporida
The myxosporida is found in such fish as Hake and Pacific whiting, but it is necessary to note that, even if the level of parasite infection of the material fish is low, gel functionality of the fish meat paste product may sometimes deteriorated by the existence of protease. Since, in many cases, the myxosporida can not be identified by appearance, it is desirable that the material fish with smaller infection possibility judging from the past experiences be selected or an enzyme inhibitor be used as a food additive.

Decomposition

Decomposed fish
Decomposed fish should be identified as a defect when receiving raw material, because decomposed fish is not suitable to surimi processing, because it will cause negative effect to gel forming ability. Therefore, decomposed fish should not be received.

Proliferation of spoilage bacteria
If temperature goes up higher than approximately 10 degree C when “Washing and De-Watering” process, spoilage bacteria may proliferate, as the result, the product will be decomposed, falling short of its quality standards. Therefore, the washing water should be thoroughly controlled lower temperature. And also “Mixing with Food Additives” process should be kept lower temperature, because if temperature goes up higher than approximately 10 degree C, spoilage bacteria may proliferate, as the result, decomposition the product will be brought about.

Residual water-soluble protein
If washing cycle is insufficient, residual water-soluble protein will remain in the surimi, deteriorates the gel forming ability, and also give negative effects on the quality during the long-term frozen storage. Therefore, washing cycle should be adequately treated.

Foreign matter inclusion(exclusion of metal fragment)
Frozen surimi should not be included foreign matter, such as small bones and black membrane, because surimi-based products producer always need to make taintless products. It is important to make a high quality

frozen surimi, such as low ratio of inclusion of foreign matter, and then to satisfy producer's requirement. Therefore, refining should be adequately treated.

Misuse or erroneous quantity of food additives(non-usage standards which have no food safety hazard)
If you use food additives, such as polyphosphate, with the amount lower than the specified concentrations, the surimi will lose its quality during the storage. Sugar must also be added properly to avoid denaturation of protein. For additives, enzyme inhibitors, such as bovine plasma and egg white, should be used when you process hake and Pacific Whiting surimi, in order to maintain gel forming ability of frozen surimi. Therefore, food additives should be adequately used without misusing or erroneous.

Denaturation of surimi protein
If temperature goes up higher than approximately 10 degree C when "Mixing with Food Additives" process, and held in these condition for certain period of time, since surimi protein will be denatured. Therefore, "Mixing with Food Additives" process should be thoroughly controlled at lower temperature.

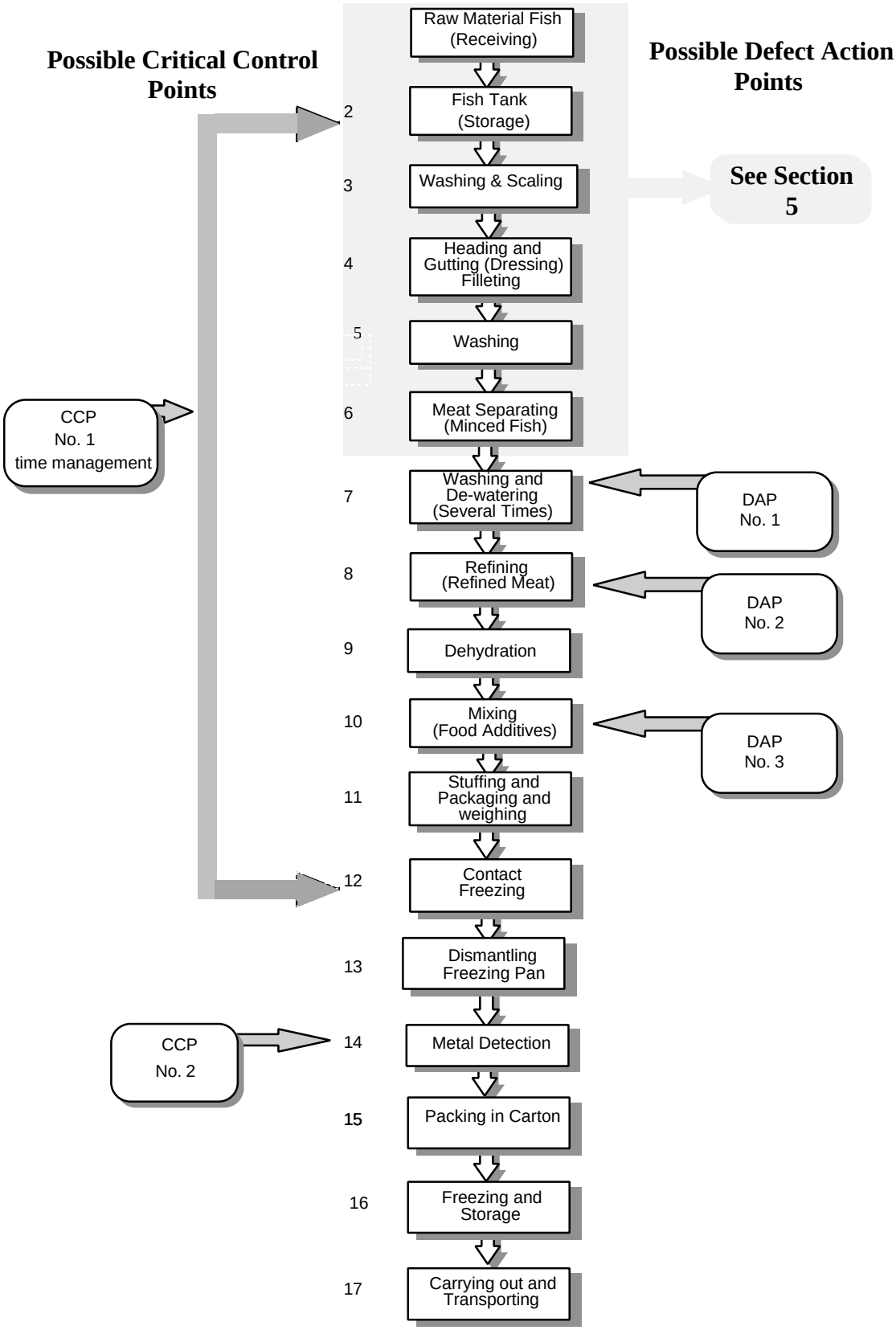
12.2 HANDLING OF FRESH FISH PRIOR TO PROCESSING

Refer To Section 5.1

12.3 TEMPERATURE CONTROL

Refer To Section 5.2

Though Frozen Surimi has been manufactured using various methods, this flow chart shows the most typical procedure up to now. For in-factory HACCP implementation, it is requested that each factory prepares the flow chart of its own.



* Note: See the appropriate production process step for each numbered CCP and DAP.

Figure 7 Example of a flow chart of a frozen surimi production process

12.4 PROCESSING OPERATIONS

In order to maintain the quality of products it is important to adopt quick, careful and efficient handling procedure.

12.4.1 General

Refer To Section 5.3.1

12.4.2 Handling of Raw Material

- if frozen fish, [including minced fish with added cryoprotectants,] is used as raw material the incoming material should be stored in a freezer with sufficient capacity to keep the temperature of the product at -18 degree C(0 degree F) or lower so as to maintain products awaiting processing in good condition;
- in receiving the raw material fish, appearance of the fishes, quality of flesh, freshness, storage temperature (at 10 degree C or less), pH of the fish(6.5-7.5), etc. should be determined(the measurement of the temperature of fish is not required for live fish), as a DAP;
- however, especially for scombrotoxin forming fish species, the incoming fish temperature should be kept at 4 degree C or less, as a CCP;
- in case of stored raw material fish, the lot should be identified by date of fishery or time of processing, the target standards of the period of storage should as follows: as to round, within 14 days after fishery, in case of storage at 4 degree C; and as to dress, within 24 hours after the processing of dress, in case of storage at 4 degree C.

12.4.3 Control Thawing

Refer To Section 5.3.2

12.4.4 Gutting, Filleting and Washing

Refer To Section 5.3.3 and 5.3.4

12.4.5 Meat Separation Process

Refer To Section 5.3.5

12.4.6 Washing and De-Watering Process

- minced fish should be spread uniformly in the water, rendered to elute its water soluble components including elasticity-preventive components;
- a sufficient amount of potable water should be employed for the purpose of washing. The water temperature of washing is preferably 5-10 degree C. But in the case of warm water species, a slightly higher temperature is acceptable (not to exceed [15 degree C]);
- pH of water used for washing should be in the vicinity of neutrality;
- nature of water used for washing soaking should preferably have a total hardness of 100 ppm or below in terms of converted $CaCO_3$;
- de-watering aids (less than 0.3% salt) should be added in the final stage of washing so as to enhance the dehydration efficiency;
- temperature of the washed meat soaked in the rotating sieve should be at 10 degree C or less for cold water species such as Alaska Pollock (*Theragra chalcogramma*). Some warm water species may be processed at slightly higher temperatures(not to exceed [15 degree C]);
- the resulting waste water should be disposed of in a suitable manner.

12.4.7 Refining Process

- extraneous substances such as small bones, scales, bloody flesh and sinews should be removed from washed meat with a refiner, etc. before final de-watering;

- adjustment of equipment should appropriately be performed and care should be paid to avoid elevation of temperature of refined meat;
- refined meat should not remain adhered on sieve plate for long periods of time, and, if adhered, it should be removed periodically.

12.4.8 Final De-Watering Process

- recommended temperature of refined meat before dehydration process should be 10 degree C or less for cold water species, such as Alaska Pollock (*Theragra chalcogramma*). Warm water species may be processed at slightly higher temperatures (not to exceed 15 degree C). However, better quality will be achieved at a lower temperature.

12.4.9 Addition of Adjuvant Ingredients and Mixing Process

- adjuvant ingredients (cryoprotectants, protease inhibitors, antioxidants, etc.) should be employed in appropriate amount and mixed homogeneously;
- Cryoprotectants, most commonly sugars and polyhydric alcohols, are used to prevent frozen surimi from undergoing freeze denaturation. Food grade enzyme inhibitors are used for surimi made from specific fish such as Pacific whiting. They inhibit heat stable proteolytic enzymes that would otherwise degrade the product during heating;
- it is preferable to keep the temperature of the surimi after the addition of adjuvant ingredients at 10 degree C or less for cold water species, such as Alaska Pollock (*Theragra chalcogramma*). Warm water species may be processed at slightly higher temperatures (not to exceed 15 °C).

12.4.10 Stuffing, Weighing, Packaging and Metal Detection Process

- product should be filled in unused plastic bags which have been kept under proper storage conditions, weighed and packed in appropriate shape;
- stuffing and packaging material should be clean, sound, durable and sufficient for its intended use;
- the stuffing and packaging operation should be conducted to minimize the risk of contamination and decomposition;
- the packed product should contain minimum voids;
- in order to detect metals in the mixed product, it should be passed through a metal detector either after weighing or the dismantling of freezing pan, as a CCP;
- the product should be labelled in compliance with general standard.

12.4.11 Freezing Operations

See Also Section 5.3.9

- care should be taken especially in case of surimi to freeze it as quickly as possible for retaining the adequate quality;
- to avoid histamine accumulation in fish flesh in case of scombroid toxin forming fish species, time from thawing to contact freezing(in case frozen raw fish are used), from fish tank to contact freezing(in case fresh fish are used) must be controlled as a CCP to conform to the critical limits.

12.4.12 Cold Storage

See Also Section 5.3.10

- in order to minimise decomposition, frozen surimi should be stored at -20°C or colder, but quality will be better retained at -25°C or colder.

SECTION 13 AQUACULTURE PRODUCTION

13.1 INTRODUCTION

This Section of the Code applies to industrialised and commercial aquaculture operations, producing finfish and crustaceans, hereafter referred to as "fish" that are internationally traded, and that are intended for direct human consumption. It does not cover extensive fish farming systems that prevail in many developing countries or integrated livestock and fish culture systems.

For the purposes of this Code aquaculture is defined as "the farming of aquatic organisms including fish, molluscs, crustaceans and aquatic plants. Farming implies some sort of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, etc. Farming also implies individual or corporate ownership of the stock being cultivated. For statistical purposes, aquatic organisms which are harvested by an individual or corporate body which has owned them throughout their rearing period contribute to aquaculture while aquatic organisms which are exploitable by the public as a common property resource, with or without appropriate licences, are the harvest of fisheries." (FAO Technical Guideline for Responsible Fisheries No. 5, Rome, FAO. 1997. 40p)

Once a fish farm has established a pre-requisite programme (Section 3), the principles of HACCP can then be applied to each individual production process. This model HACCP plan has been produced as guidance to fish farmers who wish to, or are required to, prepare HACCP plans for the production of fish in aquaculture systems. It is meant to serve only as a model and an establishment must prepare a plan for the specific conditions prevailing in a production unit, and for a particular product.

13.2 IDENTIFICATION OF HAZARDS

Consumption of fish and fishery products is associated with a variety of human health hazards, and broadly the same hazards are present in aquaculture products as in corresponding varieties caught in the wild (Section 4.3.2) The risk of harm from a particular hazard might be increased under some circumstances in aquaculture products compared with fish caught in the wild, for instance the presence of residues of veterinary drugs. High stocking densities compared with the natural situation might increase the risk of cross-infection of pathogens within a population of fish. On the other hand, farmed fish can also present a lower risk of harm. In systems where the fish receive artificial feeds, the risks associated with transmission of hazards through the food consumed by the fish is very much reduced. For example infection with nematode parasites is absent from, or very much reduced in, farmed salmon compared with salmon caught in the wild.

13.3 PRODUCT DESCRIPTION

The products within the scope of this model HACCP plan are raw vertebrate fish and raw crustacean shellfish. They are produced by a controlled growing system which might include the full production cycle from the egg, or just the later, 'growing-on', stages. The products usually receive very little processing after harvesting and before dispatch from the fish farm. Typically this will include no more than slaughtering, sorting, packing, icing, and perhaps gutting, bleeding or beheading. Any further processing or handling than this should be subject to an HACCP plan for the particular operations, as described in Section 5.

13.4 INTENDED CONSUMERS AND USE

The purpose of this step in the procedure is to identify if the product will be used in a way which increases the risk of harm to the consumer, or if the product will be particularly used by consumers who are especially susceptible to a hazard.

Mostly the products will be cooked before consumption, but sometimes they might be consumed raw or after treatments which might not kill or inactivate biological agents or toxins. As far as preparation for consumption is concerned, aquaculture products are generally not treated differently from the equivalent products harvested from the wild. Nevertheless, the assessment team drawing up the HACCP plan must determine if a particular product is likely to be consumed without a prior process that would inactivate biological agents, and bear this in mind when developing the HACCP plan.

The intended consumer is the general public, which could include vulnerable groups like the elderly, the very young, and people with low resistance to infection, but generally aquaculture products are not targeted towards particular sections of the public and are distributed along with fish products harvested from the wild.

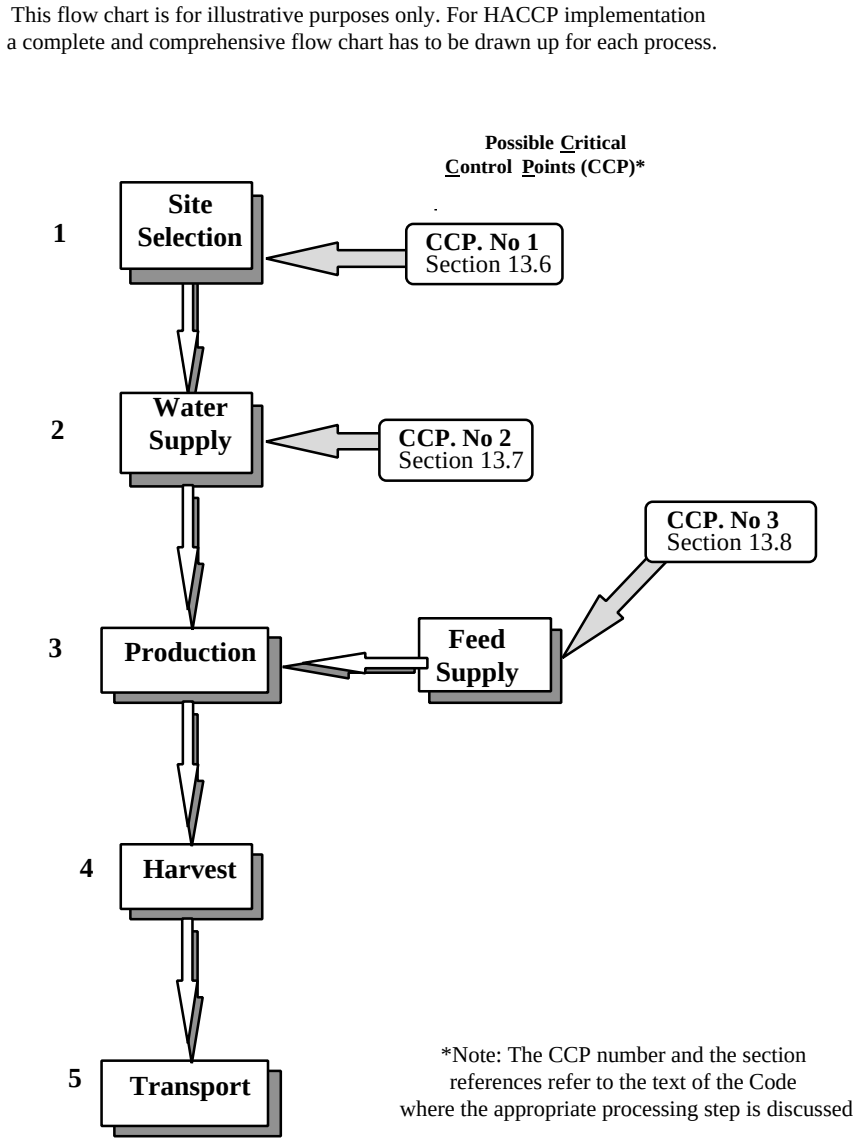


Figure 8 Example of a flow chart for aquaculture production

Cultural practices differ among the varieties of fish and crustacea grown in aquaculture systems, and among production systems, and a particular production unit might not have all the steps shown in this diagram. Growing practices do not of themselves generate hazards to human health and are not elaborated in the diagram.

13.5 DEVELOPMENT OF THE HACCP PLAN

When the flow diagram has been drawn up, each step in the process is examined to decide if it is a Critical Control Points (CCP), according to the process summarised in Figure 1 in Section 4. The investigation team considers what hazards could be introduced, or produced, at that step, and whether or not any hazard could be controlled at that step to eliminate or reduce the risk. For a step to be a CCP there must exist a preventive measure that reduces or eliminates the risk from that hazard. More than one preventive measure may be applied at a CCP to control more than one hazard. Each preventive measure is associated with critical limits which act as bounds to the extent of that measure within which the hazard

is effectively controlled. It is central to the idea of a CCP that the property that controls the hazard can be measured, monitored, and controlled under the circumstances that exist at the potential CCP. If these conditions can be satisfied then a protocol for sampling and measuring the property is specified in the monitoring step in the HACCP plan. If the result of the monitoring action shows that the criterion for control has gone outside the control limits then the system should be altered to bring the process under control. The HACCP plan will specify the action to be taken for this, and might require that farmed fish exposed to the hazard at that step since the last monitoring point be isolated for more detailed examination and possible treatment to reduce the risk. Keeping accurate and adequate records of all monitoring procedures and of actions taken following monitoring is an essential part of the HACCP system.

There are three Critical Control Points (CCPs) associated with the proposed model in Figure 8, which are steps where control is necessary to prevent or eliminate a food safety hazard or to reduce it to an acceptable level. The CCPs are the site or location of the fish pond, the water supply, and the feed supply. The nature of CCPs will depend on the aquaculture system and it is essential to consider the unique conditions that exist within each fish farm when developing a HACCP plan.

13.6 SITE SELECTION

The siting, design and construction of fish farms should follow principles of good aquacultural practice. Hazards may exist with the location of the fish pond and site selection, relating to chemical contamination of the environment and soil/water interaction that will influence water quality (CCP No 1). Soil properties are directly related to the nutrients in the pond water and such factors as acidity or alkalinity, will be related to soil quality. Acidic soils may cause low pH and leaching of metals that may accumulate in fish. Fish farms can be subject to pesticide and chemical run-off from adjacent agricultural land or industrial sources, and this can lead to unacceptable levels of chemical contaminants in cultured products. Control measures involve activities that can be used to prevent or eliminate a food safety hazard or to reduce it to an acceptable level. Such measures relate to the selection of a site for locating a fish pond and will include a soil survey in order to establish the soil suitability for aquaculture. Fish ponds should be located in areas where the risk of contamination with hazardous chemical effluents is minimal and where sources of pollution can be controlled.

Monitoring procedures include a sequence of observations or measurements to assess that a CCP is under control. With respect to the location of the fish pond this will initially involve soil analysis in the immediate area, and will also involve regular inspection of the locality for likely sources of pollution. Corrective actions have to be taken if the results of monitoring the CCP indicate a loss of control. If soil analysis shows that the site is not suitable to locate a fish farm, then an alternative must be found. Batches of fish may have to be isolated or pond water treated if unacceptable pollution of fish ponds occurs.

Before building an aquaculture establishment a survey of the soil should be conducted in order to determine the concentration and extent of any parameters which are of importance for the safety of end products. The decision on which parameters should be measured as well as what should be the type of the survey will depend on the local situation concerning the potential contaminants and the availability of previous data. Soil for the construction of earthen ponds should not contain such concentrations of chemicals which may lead to the presence of unacceptable levels of contamination in fish.

13.7 WATER QUALITY

The hazards presented by the water in which fish is raised, or by the water supply to the installation, vary greatly with the cultural system. Some broad classes of systems can be identified based on the hazards and risks.

Raising fish in cages in a marine environment poses the fewest hazards and lowest risks. The marine environment is generally not polluted except in estuaries of rivers receiving industrial or human or animal wastes. Siting of the installation is important for reducing or eliminating these hazards. Water-borne parasites generally are not a hazard in this marine environment. The artificial feeding required for caged fish considerably reduces, or eliminates, risks from hazards transmitted through natural feed.

Cage systems in freshwater might be at risk of water-borne parasitic infections or bacterial contamination. The risk is reduced the more the unit is free from sources of human or animal sewage, and siting is again an important factor in reducing risk.

Land-based installations usually have scope for controlling the quality of the water used in the system. One of the objectives of controlling the quality of the water supply is to protect the health of the stock, and adventitiously the same controls will reduce or eliminate human health risks. Any process of water treatment should be subjected to an HACCP analysis for control of human health hazards.

Fish should not be cultured in water where the presence of harmful substances would lead to an contamination of products with an unacceptable level of such substances. Establishments should be sited at a safe distance from potential sources of water contamination in order to ensure protection of products from contamination. Attention to good hygienic design and construction, appropriate location, and the provision of adequate facilities, is necessary to enable hazards to be effectively controlled.

The hygienic design of aquaculture systems where fish are raised in cages or pens or in any other form of enclosure in open water, or in ponds or raceways should take into consideration the following recommendations:

13.7.1 Land-based Establishments

- the water in which fish are raised should be suitable for the production of products which are safe for human consumption;
- the establishment should not be sited where there is a risk of contamination of the water in which fish are reared;
- the immediate vicinity of establishments should be free of potential sources of water contamination;

Locations close to industry or mining, especially if they lie within the same watershed, as well as small locations for stillwater establishments within large fields for plant crops may be exposed to risks from unexpected chemical contamination. Locations close to densely populated areas or downstream from concentrations of animal husbandry or close to hospitals may be exposed to unexpected contamination which can render the fish unfit for consumption.

- roadways and railroads in the vicinity of the site should have adequate drainage which should not be directly connected with the water used in the growing area including any water used during harvesting and processing operations.

13.7.2. Water-based Establishments

- aquaculture systems where fish are raised in cages or pens or in any other form of enclosure in open waters should be sited in water of a quality acceptable for the production of fish for human consumption;
- cages, pens or any other form of enclosures should be sited away from routes of water-borne traffic, and preferably upstream of any water-borne traffic;
- cages, pens or any other form of enclosures should be sited away from, and preferably upstream of, any natural or man-made discharges of contamination.

13.8 FEED SUPPLY AND FEEDING

Feeding regimes vary widely in aquaculture from no supplementary feeding at all to full feeding with compounded feeds. Depending on species, age, rearing systems and conditions, the nutritional requirements of fish for good growth and health can be met either by natural food which should be made available by proper technology in the rearing unit, or by a mixture of natural and added (supplemental) feed, or by a complete diet. Feeds which completely satisfy the known nutritional requirements of fish

are produced either industrially or at the establishment by mixing of ingredients and other components in accordance with the formulation. Most supplemental feeds consist of a single ingredient, providing mainly energy, and are often of local origin.

In order to ensure fish feeds of a quality that will not result in farmed products which will pose a hazard to consumers, the following are recommended:

- fish feeds should be stored to prevent spoilage, protect against contamination and minimise damage; stocks should be rotated and used prior to the expiry of their shelf life;
- industrially produced complete feeds and industrially produced feed ingredients should be properly labelled; their composition must fit the declaration on the label and they should be hygienically acceptable;
- moist feed or feed ingredients should be fresh and of adequate chemical and microbiological quality;

Fresh or frozen fish, fish silage, offal from fish or animal slaughter and rejects from animal slaughterhouses should reach the establishment in an adequate state of freshness. Decomposing moist feed can cause stress and diseases in fish and endanger its quality. Rejects from animal slaughterhouses must be sterilised by an approved procedure prior to acceptance.

- feed which is compounded industrially or at the establishment should contain only such additives, growth promoting substances, fish flesh colouring agents, anti-oxidising agents, caking agents or veterinary drugs which are permitted for fish by the official agency having jurisdiction.

13.8.1 Registration and Distribution of Veterinary Drugs

- all veterinary therapeutic products and medicinal premixes for inclusion in fish feeds should comply with the OIE Code of Practice for the Registration of Veterinary Drugs;
- products should be registered with the appropriate national authority;
- products should only be distributed through veterinarians (or appropriately authorised/trained persons), registered wholesalers, pharmacists or other retail outlets permitted by national laws and regulations;
- storage and transport conditions should conform to the specifications on the label.

13.8.2 Handling and Administration of Veterinary Drugs

- control of diseases with drugs should be carried out only on the basis of an accurate diagnosis by a veterinarian or a qualified fish disease specialist;
- laboratory examination may be required for proper drug selection and for ensuring an appropriate route for application;
- in determining treatments veterinarians/authorised persons should be guided by the principles of maximum effectiveness combined with minimum risk;
- veterinary drugs must be used in compliance with regulations of the official agency having jurisdiction;
- veterinary drugs should be used according to manufacturers instructions and note should be taken of all warning statements and contra- indications for use, in particular any incompatibility with other medicinal products;
- drugs used for treatment as well as prophylaxis must not be given to fish during a certain period of time before slaughtering. Such time must be at least as long as the withdrawal period established by the authority for the species and the drug in question.

Uncontrolled and unlimited use of medicinal products may lead to the accumulation of undesirable residues in the fish treated and in the environment, and that the continuous use of antibacterial, antiprotozoan or anthelminthic products may favour the development of resistance. It is the responsibility of the veterinarian or other authorised persons to draw up programmes of preventive

medicine for the fish farmer and to stress the importance of sound management and good husbandry in order to reduce the likelihood of fish diseases. Every effort should be made to use only those drugs known to be effective in treating the specific disease.

In disease circumstances where no authorised product exists or certain indications or target species are not provided for in the product literature, the veterinarian/authorised person can on his/her own responsibility or with advice from the manufacturer, have recourse to other licensed products for off-label use. Administration of products in this manner, however, may have unpredictable side effects and may give rise to unacceptable residue levels. Veterinarians should therefore only embark on such uses after the most careful consideration of the needs of the disease or physiological need situation and provided the following criteria are met: (1) a medical diagnosis is made by an attending veterinarian within the context of a valid veterinary-client-patient relationship; (2) a determination is made that no marketed drugs is currently labelled to treat the condition diagnosed or the recommended dosage on the labelling has been found to be clinically ineffective in the fish to be treated; and (3) procedures are instituted to assure the identity of the treated fish is carefully maintained. Under these circumstances, a significantly extended withdrawal time should be assigned for drug withdrawal prior to marketing the fish. The veterinarian is responsible for providing written instructions on the use of withdrawal times for all medicines used off-label. Off-label use by persons other than veterinarians must not be permitted except when such use is conducted or permitted under the supervision or prescription of the veterinarian.

The veterinarian/authorised person should assess the need for diseased fish to be segregated from healthy stock or fish and treated individually. Close observation of fish during medication in water and following medication in feed is required, to monitor adverse reactions. Beyond his/her responsibility for advice on measures that will reduce the incidence of disease and for controlling it when it arises, the veterinarian is also responsible for taking the welfare of fish stock fully into account.

13.8.3 Withdrawal Period - Control Related to the Protection of Public Health

Good practice in the use of veterinary drugs (GPVD), as defined by the Codex Alimentarius Commission, is the official recommended or authorised usage including withdrawal periods, approved by national authorities, of veterinary drugs under practical conditions. The maximum residue limit for veterinary drugs (MRLVD) is based on the type and amount of residue considered to be without toxicological hazard for human health while taking into account other relevant public health risks.

Drugs applied to fish tend to remain in their tissues for a longer time compared to other animals; as fish are poikilothermic metabolism is primarily dependent on water temperature. In addition to water temperature, the length of time for elimination of drug and of drug metabolites depends on other factors, such as drug properties, route of application, fish species and its physiological condition, salinity of water. These variable factors make it difficult to set withdrawal periods.

The best way of controlling drug residues in fish is preslaughter control. If the average drug concentration in tested fish is above the MRL, slaughter of the batch has to be postponed. The official agency having jurisdiction should have access to laboratory services to ensure that drug residues in slaughtered fish are within the acceptable range.

Appropriate methods should be used for sampling, analytical procedures and examination to determine compliance with Codex recommendations. At harvesting, veterinary drug residues in fish must not be above the maximum permissible levels set up by the official agency having jurisdiction. A post slaughter control should reject all fish that do not comply with the requirements set for veterinary drug residues by the Codex Alimentarius.

To avoid the presence of unacceptable residues in fish or by-products of fish origin it is essential that the fish farmer adheres to the withdrawal period established for each product and dose regime, or, to a suitably lengthy withdrawal period where none is specified. Full instructions should be given as to how this period is to be calculated including the use of on site residue detection methods where applicable and on the disposition of any fish harvested during treatment or before the end of the withdrawal period.

Fish must not be slaughtered before the end of the withdrawal period, and if sold live before the end of that period the buyer must be informed.

13.8.4 Information on Veterinary Drugs

Product information considered essential by the national authority to ensure the safe and effective use of veterinary medicinal products must be made available in the form of labelling and nationally approved data sheets or leaflets produced by the manufacturer or supplier of the medicinal product. Information on dosage schedules should be complemented by instructions on dose- related recommended withdrawal periods, contra-indications and any other constraints on the use of the product including any precautions regarded as necessary.

13.8.5 Preparation of Medicines and Occupational Risks

Incorporation of medicines into feed on the fish farm and handling and administration of medicated feeds, may give rise to potentially hazardous effects in the human operator. The preparation of medicines and medicated feeds should be undertaken by suitably trained personnel, using appropriate techniques and equipment, and according to manufacturer instructions.

13.9 PRODUCTION FACILITIES

Production facilities are all the infrastructures, buildings, and equipment used in the growing of the aquaculture product. The facilities can range from the very simple to quite elaborate structures and constructions. Hazards associated with facilities are reduced or eliminated by selection of the site and adherence to the pre-requisite programme described in Section 3 of this Code and following the Codex recommended International Codex of Practice - General Principle of Food Hygiene.

13.10 HARVESTING AND HANDLING

The actual harvesting of the fish, that is, removal from the water, is unlikely to pose a hazard and food safety hazards are predominately associated with post-harvest handling of the product. The guidelines described in Section 5 of this Code should apply to post-harvest handling of farmed products.

13.11 TRAINING

- fish production should be supervised by suitably trained and experienced personnel

Supervision of all phases, steps and operations in the production process should ensure the adherence to good production practices during the whole technological procedure on the establishment, including maintenance of adequate conditions for living and growth of fish, protection of fish health, proper and careful handling of live fish, proper handling and application of fish feed and of other inputs, as well as the observation of regulations and instructions for the use of veterinary drugs, pesticides and other chemicals.

The goal of the supervision should be to secure good performance in production under conditions which will prevent the possibility of contamination of fish and assure high quality of end products.

13.12 RECORDS

The results of all monitoring actions, and of any corrective actions taken after monitoring must be recorded. Each CCP should have one or more standard forms for recording the results of inspections and tests, and of any action taken.

One purpose of record keeping is traceability, that is, the ability to document the history of any material that has caused a health problem. All production batches must be identified and be allocated batch codes. The history of the batch must be fully documented.

Also, the establishment will need to examine records as part of its reviews of the HACCP system. Records must be held long enough for both these purposes and storage for at least a year would be reasonable for aquaculture products. Regulatory authorities might specify minimum holding times for records, which could be longer than one year.

13.13 DOCUMENTATION

The preparation of the HACCP plan, and any amendments to it, must be fully documented. This documentation is distinct from the keeping of records of monitoring activities. The various papers must be

collected together systematically so that they can be inspected easily by a regulatory authority. The documentation should include the following:

- names and qualifications of members of the HACCP team that produced the plan
- description of the product, its intended use, and the hazards and risks associated with its use
- the flow diagram for the process showing the CCPs, and justification for classifying these steps in the process as CCPs
- the hazards associated with each CCP, and the preventive measures
- critical limits for each CCP
- sources of information on hazards, preventive measures, and critical limits, including relevant legislation and the requirements of regulatory authorities
- the HACCP plan worksheet
- monitoring procedures, including protocols for inspection, sampling and testing, and procedures for quality assurance of testing procedures
- corrective actions to be taken if the monitoring indicates loss of control, including the names or job titles of persons responsible for initiating the action
- copies of forms used in monitoring, and procedures for storing the records
- procedures for review of the HACCP plan and system.

13.14 REVIEW AND VERIFICATION

The HACCP plan is the written document derived from the systematic application of the principles of HACCP, and describes the procedures to be adopted to ensure the safety of the product; the HACCP system is the result of the implementation of the plan. The system must be periodically reviewed to determine if it complies with, and is operating according to, the HACCP plan, and the plan itself must be verified, and perhaps modified, at intervals. The operations of review and verification are distinct from those of monitoring. The HACCP plan will describe procedures for review and verification.

Reviews of parts of the system might take place at perhaps daily, weekly, monthly, or at other intervals, depending on circumstances. The review will consist essentially of examination by senior members of the management, particularly those involved in quality assurance and production, of records, or summaries of records, of monitoring and corrective actions to confirm that the process is under control. They will take into account reports of any problems concerning products dispatched from the establishment, and the outcome of any testing of final products. Generally, an HACCP plan does not call for chemical or microbiological examination of products during production, but relies on control of the process. Testing of end products gives no immediate control of the production process, but it has a role in review and verification of the HACCP plan and system. Some procedures might be changed in the light of these reviews and any changes must be fully documented.

The HACCP plan should be reviewed, perhaps verified, whenever there is a change in the process or when a new product introduced.

Verification is a more thorough review of the HACCP plan to confirm the decisions on which the plan was based, and might be undertaken annually. Verification essentially involves going through all the steps of preparing an HACCP plan using the existing plan as a basis, but taking into account the conclusions of periodic reviews of the existing plan and any new knowledge concerning hazards and risks of the products and their control. The management of the establishment might want to bring in outside experts to help in this verification.

SECTION 14 TRANSPORTATION

It is particularly important throughout the transportation of fish and fishery products that care is taken to minimise any rise in temperature of the fish and that the chill or frozen temperature, as appropriate, is maintained under controlled conditions.

14.1 VEHICLES SHOULD BE DESIGNED AND CONSTRUCTED :

- such that walls, floors and roofs, where appropriate, are made of a suitable corrosion-resistant material with smooth non-absorbent surfaces. Floors should be adequately drained;
- to maintain chilled fish during transport to a temperature as close as possible to 0°C;
- to ensure the temperature of frozen fish and fishery products is maintained at -18°C or colder;
- to provide the fish with protection against contamination from dust, exposure to higher temperatures and the drying effects of the sun or wind;
- to permit the free flow of chilled air around the load when fitted with mechanical refrigeration means.

14.2 TO MINIMISE DAMAGE AND THE RATE OF DECOMPOSITION OF FISH AND FISHERY PRODUCTS DURING TRANSPORTATION:

- pre-cool containers before loading;
- avoid unnecessary exposure to elevated temperatures during loading and unloading of fish products and fishery products;
- ensure the free passage of chilled air to all parts of the load;
- monitor temperatures during transportation.

SECTION 15 RETAIL

Fish should be presented to the consumer in the best possible condition. It is important throughout the whole retail system that adequate temperature control is maintained and that stock is rotated in a proper manner.

15.1 TO MINIMISE THE RATE OF DECOMPOSITION OF FISH DURING RETAIL :

- ensure adequate temperature control and monitoring in all storage and retail display areas;
- do not store product above the designated 'load line' in any display cabinet;
- frozen fish should be offered for sale from refrigerated cabinets designed for the purpose;
- ensure proper stock rotation;
- display cabinets should be defrosted as required;
- for wet counters the temperature of the fish should be maintained as close as possible to that of melting ice. For other display cabinets and chilled storage areas the air temperature should be no greater than +5°C;
- utensils used to handle raw seafood should be kept separate or adequately cleaned before being used for ready to eat seafood;
- unpackaged raw fish should be kept physically separated from ready to eat products;
- proper and adequate labelling should inform consumers of storage requirements and durability.

Appendix I

MODIFIED ATMOSPHERE PACKING

GOOD PROCESS CONTROLS ARE ESSENTIAL WHEN PACKING FILLETS AND SIMILAR PRODUCTS IN A MODIFIED ATMOSPHERE

Modified atmosphere packing (MAP), in which the composition of the atmosphere surrounding the fillet is different from the normal composition of air, can be an effective technique for delaying microbial spoilage and oxidative rancidity in fish.

For white fish gas mixtures containing 35-45% CO_2, 25-35% O_2 and 25-35% N_2 are recommended. Gas mixtures containing up to 60% CO_2 in combination solely with N_2 are recommended for oily fish. The inclusion of CO_2 is necessary for inhibiting common aerobic spoilage bacteria such as *Pseudomonas* species and *Acinetobacter/Moraxella* species. However, for retail packs of fillets or similar products, too high a proportion of CO_2 in the gas mixture can induce pack collapse, excessive drip and may cause bleaching. Other gases, N_2 and O_2, are included as diluents to prevent these effects. O_2 is preferentially excluded from oily fish in MA packs so as to inhibit oxidative rancidity. A gas/product ratio of 3:1 is commonly recommended. Any reductions in this ratio can result in an impaired shelf-life extension.

The extent to which the shelf-life of the product can be extended by MAP will depend on the species, fat content, initial bacterial load, gas mixture, type of packaging material and, especially important, the temperature of storage. Determination of the shelf-life of a particular product should be by a suitably qualified person such as a food technologist or microbiologist. Since fish can be contaminated with *Clostridium botulinum* type E great care has to be exercised when determining the shelf-life. Although it is generally accepted that *Clostridium botulinum* does not grow at temperatures below +3°C other factors, e.g. salt content or pH etc., can also have an inhibitory effect. Thus when determining the shelf-life of MAP fresh fish it is advisable to do challenge tests on the product which accurately reflect the product conditions and storage and distribution environment. It is very important to note that the inclusion of O_2 does not preclude the growth of *Clostridium botulinum* type E and temperature control throughout the shelf-life of the product is very important. In many circumstances it is considered undesirable to use ice to cool these packs and therefore mechanical refrigeration methods are preferred.

Seal integrity of MA packs is a critical control point since it determines whether a MA pack is susceptible to external microbial contamination and air dilution of the gas mixture. Essential checks on heat sealing should include proper alignment of the sealing heads or jaws, dwell time, temperature, pressure and machine speed. Great care should be taken to ensure that the seal area is not contaminated with product, product drip or moisture since seal integrity may be reduced. In addition, the quality of the film used is important, particularly with regard to gas permeability, and only film with a clearly defined specification from reputable manufacturers should be used.

Maintenance of the correct gas mixture injected into MA packs is essential to ensure product quality, appearance and shelf-life extension. For these reasons routine gas analysis of MA packs should be included as part of the process control. Analysis of the gases within MA packs can indicate faults with seal integrity, MA materials, MAP machinery or gas mixing prior to flushing. The use of continuous gas analysers is recommended. Immediate gas analysis following packing is necessary as CO_2 absorption takes place rapidly.

Appendix II

OPTIONAL FINAL PRODUCT REQUIREMENTS[1] - FRESH, FROZEN AND MINCED FISH

These end product specifications describe the optional defects for quick frozen fish. The descriptions of optional defects will assist buyers and sellers in describing those defect provisions which are often used in commercial transactions or in designing specifications for final products.

The following definitions are recommendations for use by purchasers or sellers of quick frozen fish in designing specifications for final product. These specifications are optional and are in addition to the essential requirements prescribed in the appropriate Codex Product Standards and may be appropriately applied for purchases or sales of fresh fish.

1.1 Quick Frozen Finfish, Uneviscerated and Eviscerated

Defect	Recommended Defect Description
a) Body Deformation	Deformation of the back (hump-back) or of the head if present (hooked snout) as a result of the extension of cartilaginous material in these areas as the fish approaches spawning condition.
b) Damage to protective coating	Voids in the ice glaze or tears in the covering membrane.
c) Surface defects:	
Discoloration from bruises	Readily discernible localised discoloration caused by diffusion of blood into the flesh.
Cuts, wounds and other skin breaks	Readily discernible damage to the skin
Discoloured skin	Readily discernible deviation from the normal characteristic colour of the species concerned.
d) Gutting and Cleaning Defects	Improper washing
	Belly burn or loose belly bones.
Gill and body cavity cuts	Misplaced cuts made during gutting.
	Incomplete removal of the viscera.
Remains of viscera	Inadequate removal of slime, blood and bits of viscera from the surface of the fish and from the body cavity.
	Readily discernible enzymatic damage to the tissues in the area of the belly cavity, or loose belly bones in the abdominal cavity which have become detached from the flesh.

1.2 Quick Frozen Fish Fillets[2]

	Defect	Recommended Defect Description
a)	Moderate Dehydration	A loss of moisture from the surface of the sample unit which is colour masking, but does not penetrate the surface and can be easily removed by scraping. Over 10% of the total surface area; or

Pack Size	Defect Area

[1] Optional final product specifications for Quick-frozen Finfish, Uneviscerated and Eviscerated were developed from the Codex Standard for Quick-frozen Gutted Pacific Salmon (Codex Stan 36 1981).

[2] In skinless Flat Fish, small pieces of white skin should not be regarded as defects, provided that the skin does not exceed more than 10% of the surface area of the fillets in the sample unit.

		a) <200 g units = 25 cm^2 b) 201-500 g units = 50 cm^2 c) 501- 5000 g units =150 cm^2 d) 5001-8000 g units =300 cm^2 e) 8000 g units =500 cm^2
b)	Ragged or Torn Fillets	Longitudinal edges markedly and excessively irregular. Each instance.
c)	Small Pieces (not applicable to fillets cut from blocks)	A fillet piece weighing less than 25 g.
d)	Skin and black membrane(does not include sub-cutaneous layer). In flat fish white skin is not regarded as defect.	Skinless fillets Each piece greater than 3 cm^2
e)	Black Membrane or Belly Lining (does not include white membrane)	Skin-on fillets Each piece greater than 3 cm^2
f)	Scales: Attached to skin	Skin-on fillets - scaled Each area of scale greater than 3 cm^2
	Readily noticeable loose scales	Skinless fillets More than 5, or in the case of hake fillets, more than 10 loose scales
g)	Blood Clots (spots)	Any mass or lump of clotted blood greater than 5 mm in diameter.
h)	Bruises Discoloration	Diffused blood causing distinct reddish, brownish or other off-coloration. Any aggregate area of discoloration or bruising exceeding 3 cm^2.
i)	Fins or part of fins	Two or more bones connected by membrane, including internal or external bones, or both in a cluster. Any instance where a bone in the fin exceeds 40 mm in length.
j)	Bones	Any bone greater than or equal to 10 mm in length or with a diameter greater than or equal to 1 mm; any bone greater than or equal to 5 mm in length is not to be considered if the diameter is not greater than or equal to 2 mm. The foot of a bone (where it has been attached to the vertebra) shall be disregarded if its width is less than or equal to 2 mm or if it can be easily stripped off by a finger nail
k)	Packaging Material	Each instance.
l)	Viscera	Each instance of the internal organs.

1.3 Quick Frozen Blocks of Fish Fillet, Minced Fish Flesh and Mixtures of Fillets and Minces Fish Flesh

	Defect	Recommended Defect Description
a)	Block Irregularity (applies only to blocks intended for cutting into cores for fish slices or fish portions)	Deviations from declared dimensions (e.g. length, width and thickness of a block), non-uniformity of shape, poor angles, ragged edges, ice pockets, air pockets or other damage which would result in product loss. Deviation from declared (nominal) dimensions: Length, width and thickness (i) Over 5 mm in any dimension. (ii) Edges (formed by two surfaces)

		A gap greater than 10 mm between the actual and true edge. (iii) Angles (formed by three edges) A gap greater than 10 mm between the actual and true corner.
b)	Ice pockets	Each pocket with a surface area greater than 10 cm^2.
c)	Air pockets (including troughs)	Each pocket with a surface area greater than 2 cm^2 and with a depth greater than 3 mm
d)	Moderate Dehydration	A loss of moisture from the surface of the sample unit which is colour masking, but does not penetrate the surface and can be easily removed by scraping. Over 10% of total surface area, or

Pack Size	Defect Area
a) <200g units	>25cm^2
b) 201-500g units	>50cm^2
c) 501-5000g units	>150 cm^2
d) 5001-8000g units	>300 cm^2
e) >8000g units	>500 cm^2

e)	Skin and Black Membrane Skin (does not include sub-cutaneous layer). In flat fish white skin is not regarded as a defect.	Skinless fillet block Each piece greater than 3 cm^2
f)	Black Membrane or Belly Lining (does not include white membrane)	Skin-on fillet blocks Each instance greater than 3 cm^2
g)	Scales (Attached to skin)	Skin-on fillet blocks (scaled) Each area of scale greater than 3 cm^2
	Scales (Readily noticeable loose scales)	Skinless fillet blocks More than 5, in the case of hake fillets, more than 10 loose scales.
h)	Blood Clots (spots)	Any mass or lump of clotted blood.
i)	Bruises and Discoloration	Diffused blood causing distinct reddish brownish or other off coloration which appears as significantly intense discoloration due to melanin deposits, bile stains, liver stains or other causes. . Any aggregate area of discoloration or bruising exceeding 3 cm^2.
	Minced part of mixed blocks:	Objectionable discoloration, spots or particles derived from skin, black membrane, blood clots, blood spots, spinal cord or viscera. (i) Distinctly discoloured, spotted or otherwise heavily deviating from the colour of the species. (ii) Objectionable deviation from the colour of the fillet.
j)	Fins or Parts of Fins	Two or more bones connected by membrane, including internal or external bones, or both, in a cluster. Any instance where a bone in the fin exceeds 40 mm in length.

k)	Bones	Any bone greater than or equal to 10 mm in length or with a diameter greater than or equal to 1 mm; any bone less than or equal to 5 mm in length is not to be considered if the diameter is not greater than 2 mm. The foot of a bone (where it has been attached to the vertebra) shall be disregarded if its width is less than 2 mm or if it can be easily stripped off by a finger nail.
l)	Viscera	Each instance.
m)	Packaging Material	Each instance.

Appendix III
OPTIONAL FINAL PRODUCT REQUIREMENTS - MOLLUSCAN SHELLFISH
[TO BE COMPLETED]

Appendix IV
OPTIONAL FINAL PRODUCT REQUIREMENTS --CRUSTACEANS
[TO BE COMPLETED]

Appendix V
OPTIONAL FINAL PRODUCT REQUIREMENTS - CEPHALOPODS
[TO BE COMPLETED]

Appendix VI
OPTIONAL FINAL PRODUCT REQUIREMENTS - SALTED FISH
[TO BE COMPLETED]

Appendix VII
OPTIONAL FINAL PRODUCT REQUIREMENTS - SMOKED FISH
[TO BE COMPLETED]

Appendix VIII

OPTIONAL FINAL PRODUCT REQUIREMENTS - CANNED FISH

The following definitions are recommendations for use by purchasers or sellers of canned fish in designing specifications for final product. These specifications are optional and are in addition to the essential requirements prescribed in the appropriate Codex Product Standards.

1. Canned finfish

Defects	Recommended Defect Description
a) Drained or Washed Drained Weight	The drained weight of fish (liquid pack), or the washed drained weight of fish (sauce packs) shall be not less than the following % (m/m) of water capacity of the can when packed in : (i) edible oil 70% (ii) own juice ; brine or water ; marinade ; aspic 60% (iii) sauces, also with other packing media added 50%
Exuded water (oil packs only)	Water content (expressed as % of declared net contents of can). (i) fish packed in oil > 8% (ii) fish packed in oil with own juice > 12%
Separation of sauces	Sauce separated into solid and liquid (except oil)
b) Appearance	The product in a can shall comprise fish of an appearance and colour characteristic of the genus processed and packed in the manner indicated.
Dressed Fish and Cutlets in Various Packing Media	Cutting, Trimming and Evisceration (i) Parts of tail (except for small fish) and/or head (ii) Hard scutes (jack mackerel) (iii) More than one fish with feed except for small fish and cutlets in the belly uncut. Excessive amount of viscera (one or more fish not eviscerated). Non characteristic pieces (i) Each additional small piece (ii) Over 10% of flake or further disintegrated fish flesh, skin, bone or fin fragments.
Fillets, Bits, and Flakes in Various Packing Media	Cutting and Trimming Parts of head, tail, viscera or scutes each instance. Skin (fillets labelled skinless) - Each instance greater than 3 cm^2 Black Membrane - Each instance greater than 5 cm^2 Non characteristic pieces (fillets and pieces only) Flake or further disintegrated fish flesh clearly separated from fillets or pieces of fillets (expressed as % of drained fish solids material)
Discoloration, packing media	The packing medium not of normal colour and consistency for the type of pack.
Fill of Container	A can not well filled with fish and packing media not in accordance with the type of pack.

2. Canned sardines and sardine-type products

Defects	Recommended Defect Description
a) Appearance	The fish in the container : (i) are not reasonably uniform in size ; (ii) are not of an appearance or colour characteristic of the species processed or packed in the manner indicated ; (iii) are not neatly cut to remove the head ; (iv) have excessive ventral breaks (unsightly rupture of the ventral area), or breaks and cracks in the flesh. (v) More than 40% of fish in a can having ventral breaks of half the length or more of the abdominal cavity (vi) The packing medium is not of normal colour and consistency for the type. (vii) The can is not well filled with fish.
b) Exuded water (oil packs only)	Water content expressed as % of net contents of can

3. Canned tuna and bonito

No optional defects have been developed for this product.

4. Canned salmon

Defect	Recommended Defect Description
a) Appearance	(i) The can is not well filled with fish.
(i) Cross fill (ii) Ragged appearance	(ii) In the case of regular packs, the sections of fish are not arranged so that the cut surfaces are approximately parallel to the opened end and the skin side is not parallel to the walls of the can. Regular packs are not reasonably free from cross packs and pieces or sections of vertebrae across the top of the can.
	(iii) The oil and liquid released during processing are not normal and characteristic of the species packed.
b) Bones	Hard bone
c) Colour of Flesh	Fish having the appearance and colour of the following : (i) Mixed colours in a single can (ii) Abnormal pale colour for the species (iii) Belly burn
d) Bruising and Blood Spots	Presence of bruising or blood spots expressed as a % of the net content of the can.

5. Canned crab meat

Defect	Recommended Defect Description
Appearance	On opening the cans are not well filled and are not well arranged where appropriate for the style of presentation.

6. Canned shrimps or prawns

No optional defects have been developed for this product.

Appendix IX

OPTIONAL FINAL PRODUCT REQUIREMENTS - FROZEN SURIMI

These end product specifications describe the optional defects for frozen surimi. The descriptions of optional defects will assist buyers and sellers in describing those defect provisions which are often used in commercial transactions or in designing specifications for final products.

Frozen surimi is myofibrillar protein concentrate prepared from fish meat without retaining the original shape of fish, so that it is difficult to determine its quality from its appearance. Moreover, it is generally not consumed directly, but further processed. This means that the quality of frozen surimi is measured by both the compositional properties and the functional properties for surimi-based products. Therefore, it is strongly recommended to inspect such functional properties, as the following quality attributes, that are different from those for other fishery products.

It is most important to evaluate the following primary test attributes: moisture content, pH and objectionable matter of raw surimi and gel strength, deformability, and color of cooked surimi gel. Other secondary attributes may be measured as desired.

1. Primary Quality Attribute

1.1 Raw Surimi Tests

Preparation of test sample:

Put 2-10 kg of frozen surimi in a polyethylene bag, seal the bag, and temper the surimi at room temperature (20°C) or below so that the temperature of the surimi rises to approximately -5°C. Do not soften the surface of the test sample.

1.1.1 Moisture

Sample for moisture content should be taken from the interior of a surimi block to insure no freezer burn (surface dehydration) of the sample has occurred. Put the test sample in a polyethylene bag or polyethylene bottle, seal the bag or bottle and let the test sample thaw so that the temperature of the sealed article rises to room temperature. Then measure the moisture using any of the following methods:

In case of using a drying oven method (see AOAC Method);

In case of using an infrared lamp moisture tester, take out 5 g of the test sample precisely weighed with a sample tray, and dry it immediately [Details of the method to be provided]; or

In case of using a microwave drying moisture tester (see AOAC Method). [Details of an alternate method to be provided].

Calculate the moisture according to the following formula to the first decimal place.

In using any of the measurement methods, test two or more pieces of the test sample, and indicate the average value obtained thereby.

When measuring a fatty test sample with a microwave drying moisture tester, cover the top of the sample tray with glass fiber paper to prevent fat from splashing, as being dried.

$$\text{Moisture (\%)} = \frac{\text{Pre-dry weight (g) - After-dry weight (g)}}{\text{Pre-dry weight}}$$

1.1.2 pH

Add 90 or 190 *ml* as needed to disperse the sample of distilled water to 10 g of the test sample as need to disperse. Homogenize it, and then measure pH of the suspension with a glass electrode pH meter to second decimal place. Indicate the value obtained thereby.

1.1.3 Objectionable Matter

The term "objectionable matter" as used in this item shall mean skin, small bone and any objectionable matter other than fish meat.

Spread 10 g of the test sample to the thickness of 1 mm or less, and count the number of visible objectionable matter in it. Indicate the value obtained thereby, provided an objectionable matter of 2 mm or larger shall be counted as one and an objectionable matter smaller than 2 mm shall be counted as one half, respectively, and any unnoticeable matter smaller than 1 mm shall be disregarded.

The inspection method for distinguishing scales visibly unnoticeable is specified in Section 2.1.1 of this Appendix.

1.2 Cooked Surimi Gel Tests

1.2.1 Gel Strength and Deformability

Two methods are presented here. The test to use should be decided upon between buyer and seller.

1.2.1.1 Puncture Test

Preparation of test sample:

Put 2-10 kg of frozen surimi in a polyethylene bag, seal the bag, and temper the surimi at room temperature (20°C) or below so that the temperature of the surimi rises to approximately -5°C. Do not soften the surface of the test sample.

Preparation of surimi gel for testing: Surimi gel not containing added starch

A. Comminution

Sample volume necessary for surimi paste preparation depends on the capacity of mixing instrument used. Use of 1.5 kg or more is necessary to represent the property of 10 kg of block. Regarding that enough amount of surimi is necessary for consistency of testing, equipment of large capacity which can mix surimi of 1.5 kg or more must be installed in laboratory. When you use larger size of the equipment, you also need to put in adequate amount of surimi in accordance with equipment to secure enough texture of surimi paste. Crush 1.5 kg or more of the test sample with a silent cutter, then add 3% of salt to it, and further grind and mash it for 10 minutes or more into homogenized meat paste. Remember to keep the temperature of the material to be tested, at 10°C or less.

Desirable timing for adding salt is at -1.5°C.

Desirable temperature of the test material is 5-8°C.

B. Stuffing

Stuff a polyvinylidene chloride tube of 48 mm width (30mm in diameter), when flatten, with approximately 150 g (resulting in approximately 20 cm in length) of the meat paste by the use of a stuffer with a 18 mm diameter stuffing tube, and tie the both ends of the tube.

C. Heating

Heat the test material in hot water of 84-90°C for 30 minutes.

At the time the test material is being put in, the temperature drop should not exceed 3°C.

D. Cooling

Immediately after finishing the heating treatment, put the test material in cold water and fully cool it, and then leave it at the room temperature for 3 hours or longer.

Test Method

Perform between 24 and 48 hours after cooking the following measurements of the prepared inspection sample of surimi gel of which temperature should equilibrate to the room temperature and record the temperature of the sample at the time of measurement.

Measure the gel strength and deformability of the inspection sample of surimi gel with a squeeze stress tester (rheometer). Use a spherical (plunger), of which diameter shall be 5 mm and speed shall be 60 mm/minute.

Remove film off the inspection sample of surimi gel, cut it into 25 mm long test specimen, and place test specimen on the sample deck of the tester so that the center of the test specimen will come just under the plunger. Apply load to the plunger, and measure the penetration force in g and the deformation in mm at breakage.

Record the obtained value of the penetration and deformation in g by integral number. Record the obtained value of the deformation in mm to the first decimal place.

Prepare six or more test specimens from the same inspection sample of Surimi gel, and test each of them. Record the average values obtained thereby.

1.2.1.2 Torsion Test

Preparation of the surimi gel test specimen

A. Comminution

Temper frozen surimi at room temperature (near 25 degree C) for 1 hr., or in a refrigerated tempering room to approximately -5°C. Cut the tempered surimi blocks into slices or chunks and load into bowl of a silent cutter or cutter/mixer equipped for vacuum use. First reduce the frozen surimi to a powder by comminution at low speed without vacuum. Add sodium chloride (2% on total batch weight basis) and ice/water (sufficient to obtain 78% final moisture content on total batch weight basis). Secure the lid and begin chopping again at low speed with no vacuum, gradually (if possible) increasing to high speed (about 2000 rpm). At the point that the mixture becomes a single mass, turn on the vacuum pump and allow approximately 70-80% of a full vacuum (approximately 20- 25 inch Hg or 500-650 mm Hg) to be obtained. During comminution insure that paste is scraped from the walls and balls of paste are forced down into the blades of a cutter/mixer. Discontinue chopping when a temperature of 5-8°C is obtained. A minimum 6 minute chopping time is recommended.

B. Stuffing

Transfer the paste to the sausage stuffer with a minimum of air incorporation. Maintain paste temperature below 10°C at all times. Stuff into polycarbonate or stainless steel tubes 1.9 cm (i.d.) of an appropriate length, typically about 20 cm. Tubes should be sprayed with lecithin release agent prior to filling. Stuff the paste uniformly and without air pockets into tubes. Cap or seal both ends and place in ice bath until ready to heat process (within one hour).

C. Heating

Heat process by immersing filled tubes in a water bath previously equilibrated to the proper temperature. Time-temperature relationships for thermal processing are: low temperature setting ability: 0-4°C for 12-18 hours, followed by 90°C for 15 min; median temperature setting ability: 25°C for 3 hours, followed immediately by 90°C for 15 min; high temperature setting ability: 40°C for 30 minutes, followed immediately by 90°C for 15 min; evaluation of protease activity: 60°C for 30 minutes, followed immediately by 90°C for 15 min; rapid cooking effect: 90°C for 15 minutes. It is recommended that water baths be heated to about 5°C higher than the intended treatment temperature, to account for the heat loss experienced upon loading, and the temperature be adjusted approximately within 2 minutes, possibly requiring ice addition.

Only cold water species will demonstrate good setting ability at lower temperatures. The heat process used to prepare the sample should be specified; if not, it is assumed that only the rapid cooking effect is being assessed. Relative proteolytic activity is assessed by comparing tests conducted on gels prepared at 60/90°C with those processed only at 90°C.

Ohmic heating can be used as a means of heating method. Heat is uniformly generated through electrical resistance. Paste placed in a chlorinated PVC tube is heated between two electrodes. Internal temperature of 90 can be reached within 1 min. Heating rate (fast and slow) can be controlled linearly. This method provides another advantage: Pacific whiting surimi or others with proteolytic enzymes can be successfully gelled (without enzyme inhibitors) under ohmic heating because fast heating can inactivate the enzyme.

D. Cooling

After heat processing, quickly transfer tubes to an ice water bath and equilibrate to 0°C. Remove gels from tubes with a plunger and seal in plastic bags. Keep samples refrigerated until tested (within 48 hours).

Test Method

Perform within 24 hours the following measurements of the prepared inspection sample of surimi gel, whose temperature should be equilibrated to the room temperature (20-25°C).

Measurement of Stress and Strain:

The gel-forming ability of surimi is evidenced by the fundamental rheological properties of the test product when strained to failure (breakage). Allow refrigerated samples to reach room temperature (near 25°C) before testing. Cut test specimens to length of about 30 mm. Attach specimens to mounting discs at each flat end with cyanoacrylate glue, being careful to place samples in center of mounting discs. Mill center of test specimens to a capstan shape, the milled portion being 1 cm. in diameter. Mount the milled test specimen in the torsion rheometer. Rotate top of sample to the point of sample failure (breakage) and record torque and rotational distance at this point. Calculate and report stress and strain at sample failure as: Stress = t = 1581 x (torque units); Strain = ln $[1+(g^2/2) + g(1+g^2/4)^{0.5}]$, where g = 0.150 x (rotational distance, mm) - 0.00847 x (torque units). In practice these equations are normally programmed onto a computer linked to the torsion rheometer for data acquisition and analysis, thus yielding directly the stress and strain measurements.

1.2.2 Color

Cut the inspection sample of Surimi gel into flat and smooth slices 15 mm or more thickness, and immediately measure with a color-difference meter the cross section of the slice pieces in the values of L*(lightness) ,a* (red-green) and b* (yellow-blue) to the first decimal place. Test three or more slice pieces, and indicate the averages of the values obtained thereby.

2. Secondary Quality Attributes

2.1 Raw Surimi Tests

Preparation of test sample:
Put 2-10 kg of frozen surimi in a polyethylene bag, seal the bag, and defrost the surimi at room temperature (20°C) or below so that the temperature of the surimi rises to approximately -5°C. Do not soften the surface of the test sample.

2.1.1 Objectionable Matter(Scales)

After the measurement according to Appendix.1.1.3 add 100 *ml* of water to the same test sample, homogenize it, further add 100 *ml* of 0.2M-NaOH solution to it, and dissolve it with a stirrer. Filter the dissolved solution with filter paper (No.2), wash the residue with water, and then dry it at 105 for two hours. Count the number of scales obtained thereby, and indicate that number in (brackets) appearing subsequent to the number of the objectionable matter according to Section.1.1.3 of this Appendix.

After having dissolved, leave the dissolved solution still to insure precipitation, and scoop up as much skim as possible before filtration.

2.1.2 Crude Protein Content

AOAC Kjeldahl Method

2.1.3 Sugar Content

Precisely weigh 10 g of the test sample, put it in a 50 ml beaker, add to it 10 ml of 2% trichloroacetic acid (TCA) solution, and fully stir the material. Leave it still for approximately 10 minutes, stir it again, and leave it still for 10 minutes. Filter it with filter paper(No.2), drop some part of the filtered liquid on a refractometer (for Brix 0-10% use), and read the graduation on the refractometer. Apply it to the following formula and calculate a value to the first decimal place. Indicate the value obtained thereby.

Calibrate in advance the refractometer at a specified temperature with distilled water.

Sugar(%)=2.04 x Brix(%) - 2.98

2.1.4 Crude Fat Content

Put in a mortar, a precisely weighed 5-10 g of the test sample with approximately same quantity of anhydrous sodium sulphate and a small amount of refined sea sand. Mash the material uniformly into dry powder, and put it in a cylindrical filter paper. Do not fail to take out and put in the cylindrical filter paper the powder remaining in the mortar by the use of a small amount of ethyl ether and absorbent cotton. Extract and determine the fat according to Soxhlet method, and calculate a value according to the following formula to the first decimal place. Indicate the value obtained thereby.

Fill the ends of the cylindrical filter paper with a slight amount of absorbent cotton so that the material to be tested will not fall out.
Dry the extraction receptacle in advance at 100 - 106°C, and weigh it.
Extraction speed shall be 20 times per hour.

Crude Fat (%) = (W1 - W0)/S x 100

S : Quantity of test sample taken(g)
W0 : Weight of receptacle(g)
W1 : Weight of receptacle after fat has been extracted (g)

2.1.5 Color and Whiteness

Color: Temper frozen surimi completely to room temperature (near 25°C). Fill into a 50 ml glass beaker (4 cm diameter, 5.5 cm height) and measure color values of L*, a*, and b* (CIE Lab system) to the first decimal point. Complete contact between the test specimen and the colorimeter measurement port, as well as filling of the beaker with no voids, is recommended for consistent results. Measure three or more samples and record the average value.

Whiteness: Whiteness can be calculated as: whiteness = L* - 3b* or whiteness = $100 - [(100 - L^*)^2 + a^{*2} + b^{*2}]^{0.5}$.

2.1.6 Pressure Induced Drip

Defrost 50 g of the test sample and put it in a circular cylinder of 35 mm inner diameter and 120-150 mm long made of stainless steel or synthetic resin and having 21 holes of 1.5 mm diameter distant 3 mm from each other opened in the bottom. Immediately apply 1 kg of load with a pressurizing cylindrical rod of 34 mm diameter, of which weight shall be included in the load. Leave as it is for 20 minutes, and then measure the weight of the dripped liquid. Calculate its percentage to the weight of the test sample to the first decimal place. Indicate the value obtained thereby.

2.2 Cooked Surimi Tests

2.2.1 Preparation of test sample

2.2.1.1 Water-added Surimi gel:

A. *Comminution*

Sample volume necessary for surimi paste preparation depends on the capacity of mixing instrument used. Use of 1.5 kg or more is necessary to represent the property of 10 kg of block. Regarding that enough amount of surimi is necessary for consistency of testing, equipment of large capacity which can mix surimi of 1.5 kg or more must be installed in laboratory. When you use larger size of the equipment, you also need to put in adequate amount of surimi in accordance with equipment to secure enough texture of surimi paste. Crush 1.5 kg or more of the test sample with a silent cutter, then add to it 3% of salt and 20% of 3% cooled salt water, and further grind and mash it for 10 minutes or more into homogenized meat paste. However, if using the remaining water-unadded, starch-unadded test material under Section 1.2.1.1.A of this Appendix, add 20% of 3% cooled salt water only, and further grind and mash it for 5 minutes into homogenized meat paste, while keeping the temperature at 10°C or less for cold water species, such as Alaska Pollocks (*Theragra chalcogramma*) . Warm water species may be processed at a slightly higher temperature (not to exceed [15°C]). However, better quality will be achieved at a lower temperature.

B. Casing

Same as Section1 2.1.1.B of this Appendix

C. Heating

Same as Section 1.2.1.1.C of this Appendix

D. Cooling

Same as Section 1.2.1.1.D of this Appendix

2.2.1.2 Starch-added Surimi gel

A. Comminution

Add 5% of potato starch to the meat paste prepared according to the method under Section 1.2.1.1.A of this Appendix, and mix (homogenize) within 5 minutes. Remember to keep the temperature of the test material at 10°C or below all the while. Desirable temperature of the test material is 7-8°C.

B. Stuffing

Same as Section 1.2.1.1.B of this Appendix

C. Heating

Same as Section 1.2.1.1.C of this Appendix. However, if performing treatment to secure Suwari (setting), same as Section 2.2.1.3.C of this Appendix Suwari- treated surimi gel.

D. Cooling

Same as Section 1.2.1.1.D of this Appendix.

2.2.1.3 Suwari (setting)-treated Surimi gel

A. Comminution

Same as Section 1.2.1.1.A of this Appendix.

B. Casing

Same as Section 1.2.1.1.B of this Appendix.

C. Heating

After treatment to secure Suwari(setting) in warm water of 30 (28-32)°C for 60 minutes, perform the same heating as Section 1.2.1.1.C of this Appendix.

D. Cooling

Same as Section 1.2.1.1.D of this Appendix.

2.2.2 Test method

Perform between 24 and 48 hours after cooking the following measurements of the prepared inspection sample of surimi gel which temperature should equilibrate to the room temperature and record the temperature of the sample at the time of measurement.

2.2.2.1 Whiteness

Whiteness, as an index for the general appearance of a surimi gel, can be calculated as: Whiteness = L* - 3b*. or: Whiteness = $100 - [(100 - L^*)^2 + a^{*2} + b^{*2}]^{0.5}$.

2.2.2.2 Expressible Moisture

Place a slice of surimi gel (2 cm daimeter X 0.3 cm thick and about 1 g in weight) between two filter papers and press them by an oil pressure equipment under a fixed pressure (10 kg/cm^2) for 20 sec.

Calculate the expressible water according to the following formula to the first decimal.

Test three or more pieces of the test sample, and indicate the average value obtained thereby.

$$\text{Expressible water (\%)} = \frac{\text{Pre-pressed weight (g)-after-pressed weight (g)}}{\text{Pre-pressed weight (g)}}$$

Water holding capacity is also used as an index of surimi gel as well as the expressible water.
Water holding capacity (%) is calculated as follows.

$$\text{Water holding capacity (\%)} = \frac{\text{Expressible water content (g)}}{\text{Total moisture content of pre-pressed sample(g)}}$$

2.2.2.3 Folding test:

The folding test is conducted by folding a 5-millimeter thick slice of gel slowly in half and in half again while examining it for signs of structural failure (cracks). Make sure the sample is folded completely in half. Keep the folded state for five seconds, and then evaluate the change in the shape by 5 - stage merit marks. The minimum amount of folding required to produce a crack in the gel determines the score for this test. Test three or more slice pieces of the same inspection sample, and indicate the average mark obtained. In case of folding by hand, apply constant power throughout the folding surface.

Merit Mark	Property
5	No crack occurs even if folded in four.
4	No crack occurs if folded in two but a crack(s) occur(s) if folded in four.
3	No crack occurs if folded in two but splits if folded in four.
2	Cracks if folded in two.
1	Splits into two if folded in two.

2.2.2.4 Sensory (Biting) Test

Bite a 5 mm thick slice piece of the gel sample, and evaluate its resilience upon touch to teeth and cohesiveness upon bite by 10-stage merit marks. Test three or more slice pieces of the same inspection sample by a panel consisting of three or more experts, and indicate the average mark obtained thereby. Merit marks 2, 3, 4, 5 and 6 corresponds to the folding merit marks 1, 2, 3, 4 and 5 under (2), respectively.

Merit Mark	"Ashi (footing) Strength"
10	Extremely strong
9	Very strong
8	Strong
7	Slightly strong
6	Fair
5	Slightly weak
4	Weak
3	Very weak
2	Extremely weak
1	Incapable to form gel

PROPOSED DRAFT STANDARD FOR SALTED ATLANTIC HERRING AND SALTED SPRATS

(At Step 3 of the Procedure)

1. SCOPE

The standard applies to salted Atlantic herring (*Clupea harengus*) and sprats (*Sprattus sprattus*)[1].

2. DESCRIPTION

2.1 Product definition

The product is prepared from fresh or frozen fish. The fish is salted as whole fish or as beheaded or nobbed or beheaded and gutted or gibbed or filleted (skin-on or skin-off) fish. Spices, sugar and other optional ingedients may be added. The product is either intended for direct human consumption or for further processing.

Fish products produced by use of added natural or artificial enzymic preparations, acids and/or artificial enzymes are not covered by this standard.

2.2 Process definition

The fish after any suitable preparation shall be subjected to a salting process and shall comply with the conditions laid down hereafter.

2.2.1 Salting

Salting is the process of mixing fish with the appropriate amount of food grade salt, sugar spices and all optional ingredients and/or of adding the appropriate amount of salt-solution of the appropriate concentration. Salting is performed in watertight containers (barrels etc.).

2.2.2 Types of salted fish

2.2.2.1 Lightly salted fish

The salt content in the fish muscle is above 4 g/100 g water phase and below or equal to 10 g salt/100 g.

2.2.2.2 Medium salted fish

The salt content in the fish muscle is above 10 g salt/100 g water phase and below or equal to 20 g salt/100 g.

2.2.2.3 Heavily salted fish

The salt content of the fish muscle is above 20 g salt /100 g water phase.

2.2.4 Storage temperatures

The products shall be kept refrigerated or frozen at a temperature which ensures that the development of biotoxins is under control.

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[1] For the purpose of the standard, fish includes herring and sprats

2.3 Presentation

Any presentation of the product shall be permitted provided that it:

2.3.1 meets all requirements of this standard, and

2.3.2 is adequately described on the label to avoid confusing or misleading the consumer.

3. ESSENTIAL COMPOSITION AND QUALITY FACTORS

3.1 Fish

Salted Atlantic herring and salted sprats shall be prepared from sound and wholesome fish which are of a quality fit to be sold fresh for human consumption after appropriate preparation.

3.2 Salt and other ingredients

Salt and all other ingredients used shall be of food grade quality and conform to all applicable Codex standards.

3.3 Final Product

Products shall meet the requirements of this standard when lots examined in accordance with Section 9 comply with the provisions set out in Section 8. Products shall be examined by the methods given in Section 7.

4. FOOD ADDITIVES

Only the use of the following additives is permitted.

Additive	**Maximum level in the final product**
[Sodium nitrate]	***To be defined***
[sodium benzoate[	
[sodium sorbate]	
[lactic acid]	
[citric acid]	
[ascorbic acid]	
[tartric acid]	
[glucoco-delta-lacton]	

5. HYGIENE AND HANDLING

5.1 The final product shall be free from foreign material that poses a threat to human health

5.2 When tested by appropriate methods of sampling and examination prescribed by the Codex Alimentarius Commission (CAC), the product:

(i) shall be free from microorganisms or substances originating from microorganisms in amounts which may present a hazard to health in accordance with standards established by the CAC.

(ii) shall not contain other substances in amounts which may present a hazard to health in accordance with standards established by the CAC

(iii) no sample unit shall contain histamine that exceeds 20 mg per 100g fish muscle.

(iv) shall not contain visible larvae of nematodes. If living nematodes are present the lot has to be treated according to the methods laid down in Annex II. Viability of nematodes shall be examined according to Annex

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5.3 It is recommended that the products covered by the provisions of this standard be prepared in accordance with the following codes:

(i) the appropriate sections of the Recommended International Code of Practice - General Principles of Food Hygiene (CAC/RCP 1-1985, Rev.3, 1997);

(ii) the Recommended International Code of Practice for Salted Fish (CAC/RCP 26-1979);

(iii) the Recommended International Code of Practice for Fresh Fish (CAC/RCP 9-1976);

(iv) the Recommended International Code of Practice for Frozen Fish (CAC/RCP 16-1978)

6. LABELLING

In addition to the provisions of the Codex General Standard for the Labelling of Prepackaged Foods (CODEX STAN 1-1985) the following specific provisions apply:

6.1 Name of the Food

6.1.1 The name of the product shall be ...-herring or ...- sprats in accordance with the law and custom of the country in which the product is sold, in a manner not to mislead the consumer.

6.1.2 In addition the label shall include other descriptive terms that will avoid misleading or confusing the consumer.

7. SAMPLING, EXAMINATION AND ANALYSIS

7.1 Sampling plan for containers (barrels)

(i) Sampling of lots for examination of the product for quality shall be in accordance with the sampling plan defined below. The sample unit is the entire container.

Lot Size (Number of containers)	Sample Size (Number of containers to be tested) (n)	Acceptance Number (c)
<15	2	0
16-50	3	0
51-150	5	1
151-500	8	1
501-3200	13	2
3201-35 000	20	3
>35 000	32	5

If the number of defective containers in the sample is less than or equal to c, accept the lot: otherwise, reject the lot.

(ii) Sampling of lots for examination of net weight shall be carried out in accordance with an appropriate sampling plan meeting the criteria established by the CAC.

(iii) For products in smaller containers the Codex Sampling Plan for Prepackaged Foods (CAC/RM 42-1969) should be applied.

7.2 Sensory and Physical Examination

Samples taken for sensory and physical examination shall be assessed by persons trained in such examination and in accordance with procedures elaborated in Section 7.3 through 7.8 and Annexes and in accordance with the Guidelines for the Sensory Evaluation of Fish and Shellfish in Laboratories (under development).

7.3 Determination of salt content: see Annex III

7.4 Determination of water content: see Annex IV

To be elaborated

7.5 Determination of the viability of nematodes: see Annex II

To be elaborated

7.6 Determination of histamine: AOAC 977.13 (15th Edition, 1990)

7.6 Determination of net weight

The net weight (excluding packaging material) of each sample unit in the sample lot shall be determined.

Specific method to be elaborated

7.8 Determination of drained weight

To be elaborated

8. DEFINITION OF DEFECTIVES

8.1 The sample unit shall be considered as defective when it exhibits any of the properties defined below.

8.1.1. Foreign matter

The presence in the sample unit of any matter which has not been derived from fish, does not pose a threat to human health, and is readily recognized without magnification or is present at a level determined by any method including magnification that indicates non-compliance with good manufacturing and sanitation practices.

8.1.2 Parasites

The presence of two or more parasites per kg of sample unit detected by a method described in the Codex General Standard for Quick Frozen Fish Fillets (Section 7.4) with a capsule diameter greater than 3 mm or a parasite encapsulated and greater than 10 mm.

8.1.3 Odour and flavour/taste

Fish affected by persistent and distinct objectionable odours or flavours indicative of decomposition (such as sour, putrid, fishy, rancid, etc.) or contamination by foreign substances (such as fuel oil, cleaning compounds, etc.).

8.1.3 Living larvae of Nematodes

The presence in the sample unit of a living nematode.

9. LOT ACCEPTANCE

A lot shall be considered as meeting the requirements of this standard when:

(i) the total number of defectives as classified according to Section 8 does not exceed the acceptance number (c) of the sampling plan in Section 7; and

(ii) the average net weight of all sample units is not less than the declared weight, provided no individual container is less than 95% of the declared weight; and

(iii) does not exceed the acceptance number (c) of the sampling plan in Section 7;

(iv) the Food Additives, Hygiene and Handling and Labelling requirements of Sections 4, 5.1, 5.2 and 6 are met.

Annex I

Treatment procedures sufficient to kill living nematodes

- e.g. freezing to - 20° C for not less than 24 h in all parts of the product
- the adequate combination of salt content and storage time (To be elaborated)
- or by other processes with the equivalent effect (To be elaborated)

Annex II

Determination of the viability of nematodes: to be elaborated.

Annex III

Determination of the salt content in Salted Atlantic Herring and Salted Sprats (method from salted cod standard).

Annex IV

Determination of water: to be elaborated.