codex alimentarius commission

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

WORLD HEALTH ORGANIZATION

JOINT OFFICE: Viale delle Terme di Caracalla 00100 ROME Tel: 39 06 57051 www.codexalimentarius.net Email: codex@fao.org Facsimile: 39 06 5705 4593

Agenda Item 1 **CX/FFP 02/20**

JOINT FAO/WHO FOOD STANDARDS PROGRAMME

CODEX COMMITTEE ON FISH AND FISHERY PRODUCTS
Twenty-fifth Session
Ålesund, Norway, 3 - 7 June 2002

PROPOSED DRAFT STANDARD FOR SCALLOPS

At the 24th Session of the Committee on Fish and Fishery Products, the Delegation of Canada presented a discussion paper on the need to develop a standard for scallops. The Delegation outlined the importance of trade in scallop meat and major issues that could be taken into account while deciding whether developing one or two standards for the above products: accumulation of marine biotoxins, use of sodium tripolyphosphate as a food additive, accumulation of moisture and use of bovine fibrinogen to bind pieces of scallop meat.

The Committee discussed this question and agreed to initiate the elaboration of a standard for scallops as new work, subject to approval by the Commission. All interested Member Governments were invited to participate in the drafting of the above standard led by Canada (ALINORM 01/18, paras. 141-144).

The 49th (Extraordinary) Session of the Executive Committee approved this proposal as new work (ALINORM 03/3, para. 21, Appendix III). The Proposed Draft Standard for Scallops prepared by Canada in cooperation with other countries is presented as **Annex 1**, and a summary of the issues considered is presented as **Annex 2**. The Proposed Draft is hereby circulated for comments at Step 3 and consideration by the 25th Session of the Committee.

Governments and international organizations wishing to provide comments should do so in writing, preferably by email, to the Secretary, Codex Alimentarius Commission, Joint FAO/WHO Food Standards Programme, FAO, Viale delle Terme di Caracalla 00100 Rome, Italy, Fax: +39 (06) 5705 4593, E-mail: codex@fao.org with a copy to the Codex Contact Point for Norway, Norwegian Food Control Authority, P.O. Box 8187 Dep. 0034 Oslo, Norway, Fax: +47.23.21.70.01, E-mail: ccffp@snt.no, **no later than 15 May 2002**.

ANNEX 1

PROPOSED DRAFT STANDARD FOR
QUICK FROZEN SCALLOP ADDUCTOR MUSCLE MEAT
(At Step 3 of the Procedure)

1. SCOPE

This standard applies to quick frozen raw scallop adductor muscle meat[1] in which the shell, viscera and roe have been removed and which are intended for direct human consumption or for further processing. **[**This standard does not cover scallop meat bound by fibrinogen or other binders. **]**

[Live scallops and scallop meat in which the shell, viscera and roe are attached shall also meet the requirements that apply to [live and quick frozen bivalve molluscs] in the Proposed Draft Standard for Live, Quick Frozen and Canned Bivalve Mollusc (*under elaboration*).**]**

2. DESCRIPTION

2.1 Product definition

Quick frozen scallop meat is prepared by completely removing the adductor muscle from the shell and completely detaching the viscera and/or roe from the adductor muscle of live scallops belonging to the Pectinidae family.

2.2 Process definition

The product after any suitable preparation shall be subjected to a freezing process and shall comply with the conditions laid down hereafter. The freezing process shall be carried out in appropriate equipment in such a way that the range of temperature of maximum crystallization is passed quickly. The quick freezing process shall not be regarded as complete unless and until the product temperature has reached -18°C or colder at the thermal centre after thermal stabilization. The product shall be kept deep frozen so as to maintain the quality during transportation, storage and distribution.

The recognized practice of repacking quick frozen products under controlled conditions which will maintain quality of the product, followed by the reapplication of the quick freezing process as defined, is permitted.

These products shall be processed and packaged so as to minimize dehydration and oxidation.

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, and;

2.3.3 the scallop meat may be packed by count per unit weight or, as "pieces"or terms to that effect if the scallop meat pack exhibits the presence of broken pieces that is > **[**5%**]** of the sample weight.

3. ESSENTIAL COMPOSITION AND QUALITY FACTORS

3.1 Scallop Meat

The product shall be prepared from sound and wholesome scallops of the family described in Section 2.1.1 which are of a quality suitable to be sold fresh for human consumption.

3.2 Glazing

If glazed, the water used for glazing or preparing glazing solutions shall be of potable quality. Potable water is fresh-water fit for human consumption. Standards for potability shall not be less than those

[1] Hereafter referred to as scallop meat

contained in the latest edition of the WHO "International Guidelines for Drinking Water Quality." Sea water used for glazing must meet the same microbiological standards as potable water and is free from objectionable substances.

3.3 Final Product

3.3.1 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.

3.3.2 A lot of scallop meat shall not have a moisture content **[**greater than 81.0%**]**or **[**if the moisture content is greater than 81.0%, the label must indicate that water was added or a statement to this effect**]**.

4. FOOD ADDITIVES

[No food additives are permitted in these products**]**.

5. HYGIENE AND HANDLING

5.1 The final product shall be free from any foreign material that poses a threat to human health.

5.2 **[**For scallops that have been determined to accumulate marine biotoxins in the adductor muscle meat at levels that poses a threat to human health**]**, their meat must comply with the biotoxin provisions set out in Section 5 and as sampled and analyzed by methods given in Section 7 of the "Proposed Draft Standard for Live, Quick Frozen and Canned Bivalve Molluscs (*under elaboration*)"

5.3 It is recommended that the products 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 1-1969, Rev. 3, 1997) and other relevant Codex texts such as:

(i) the Revised Code of Practice for Fish and Fishery Products (*under elaboration*);

(ii) the Recommended International Code of Practice for the Processing and Handling of Quick Frozen Foods (CAC/RCP 8-1976).

5.4 The products should comply with any microbiological criteria established in accordance with the Principle for the Establishment and Application of Microbiological Criteria in Foods (CAC/CL 21-1997).

5.5 The product shall not contain any other substance in amounts which may present a hazard to health in accordance with standards established by the Codex Alimentarius Commission.

6. LABELLING

In addition to the provisions of the Codex General Standard for the Labelling of Prepackaged Foods (CODEX STAN 1-1985, (Rev. 1, 1991)) the following specific provisions apply:

6.1 Name of the Food

6.1.1 The name of the product as declared on the label shall be the common or usual name of the species of scallops according to the law, custom and practice in the country in which the product is to be distributed in a manner not to mislead the consumer.

6.1.2 There shall appear on the label, reference to the form of presentation described in Section 2.3.3, in close proximity to the name of the product in such descriptive terms that will adequately and fully describe the nature of the presentation to avoid misleading or confusing the consumer.

6.2 Net Contents (Glazed Products)

Where the food has been glazed the declaration of net contents shall be exclusive of the glaze.

6.3 Storage Instructions

The label should include terms to indicate that the product shall be stored at a temperature of -18℃ or colder for describing the product processed in accordance with subsection 2.2.2 of this standard.

6.4 Labelling of Non-Retail Containers

Information specified above shall be given either on the container or in accompanying documents, except the name of the food, lot identification, and the name and address as well as storage instructions shall always appear on the container.

However, lot identification and the name and address may be replaced by an identification mark, provided that such a mark is clearly identifiable with the accompanying documents.

7. SAMPLING, EXAMINATION AND ANALYSIS

7.1 Sampling

(1) Sampling of lots for examination of the product shall be in accordance with the FAO/WHO Codex Alimentarius Sampling Plan for Prepackaged Foods (AQL 6.5) CAC/RM 42-1969. The sample unit is the primary container, or for individually quick frozen products or bulk packaged, is at least a 1 kg portion of the sample unit.

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.

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 7.7 and Annexes, and in accordance with the Guidelines for the Sensory Evaluation of Fish and Shellfish in Laboratories (CAC/GL 31-1999).

7.3 Determination of Count and Pieces

When declared on the label, the count of the scallop meat shall be determined by counting the numbers of scallop meat in the container or representative sample thereof and dividing the count of scallop meat by the actual de-glazed weight to determine the count per unit weight.

A scallop meat shall be considered a scallop piece when the weight of that scallop meat is less than 50% of the average weight of 10 unbroken scallop meats contained in the pack. The percentage of scallop pieces in the sample unit can be determined by using the following equation:

$$\%\,\text{Scallop Pieces} = \frac{\text{G weight of scallop pieces in a sample unit x 100}}{\text{weight of sample unit}}$$

7.4 Determination of Net Weight of Products Covered by Glaze

Remove surface glaze from the scallop meat under running water until no ice can be felt by the finger tips on the surface of the scallop meat but it is evident that the ice crystals remain within the product (i.e. the interior of the product remains frozen). Block frozen product should be gently separated to individual scallop meat or scallop pieces and ice within the block should be removed until the surface of the product is free of ice (from slippery to rough). Place the scallop meat on a sieve of appropriate size and drain for 1 to 1½ minutes. Weigh the product in a tared pan.

7.5 Determination of Moisture

Deglaze the scallop meat using procedures elaborated in Section 7.4 and obtain a total of approximately 100 g of scallop meat from the five sample units. Comminute the 100 g sample until a homogenous blend is attained. Collect the homogenized sample into a clean, sealable plastic cup or glass bottle. Store the sample in a refrigerator or freezer until required. Ensure that the prepared sample is still homogeneous prior to weighing. If liquid separates from the sample, reblend before use.

Accurately weigh a moisture dish of appropriate size. Add approximately 10 g of the comminuted sample and reweigh. Place the container in a vacuum oven at 100°C and less than 100 mm Hg for approximately 5 hours. Remove dish from the oven, cover, cool in desiccator, and weigh. Redry 1 hr and repeat process until constant weight has been achieved, i.e., change in weight between successive dryings at 1 hour intervals is < 5 mg. The moisture content can be determined by using the following equation:

$$\% \text{ Moisture} = \frac{(\text{weight of sample} - \text{weight of dried sample})}{\text{weight of sample}} \times 100$$

7.6 Procedures for Thawing

The sample unit is thawed by enclosing it in a film type bag and immersing in water at room temperature (not greater than 35°C). The complete thawing of the product is determined by gently squeezing the bag occasionally so as not to damage the texture of the scallop meat until no hard core or ice crystals are left.

7.7 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 temperature used. The exact times and conditions of cooking for the product should be determined prior to 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 into 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.

8. DEFINITION OF DEFECTIVES

The sample unit shall be considered as defective when it exhibits any of the properties defined below.

8.1 Deep Dehydration

Greater than 10% of the weight of the scallop meat or greater than 10% of the surface area of the block exhibits excessive loss of moisture clearly shown as white or yellow abnormality on the surface which masks the colour of the flesh and penetrates below the surface, and cannot be easily removed by scraping with a knife or a sharp instrument without unduly affecting the appearance of the product.

8.2 Foreign matter

The presence in the sample unit of any matter which has not been derived from scallops, 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.

8.3 Odour/Flavour

Scallop meat affected by persistent and distinct objectionable odours or flavours indicative of decomposition and/or rancidity.

[8.4 Parasites

(To be elaborated)**]**

9. LOT ACCEPTANCE

A lot shall be considered as meeting the requirements of this standard when:

the total number of defectives as classified according to Section 8 does not exceed the acceptance number (c) of the appropriate sampling plan in the Sampling Plans for Prepackaged Foods (AQL 6.5) CAC/RM 42-1969;

where appropriate, the total number of sample units not meeting the count designation or presentation as defined in section 2.3.3 does not exceed the acceptance number (c) of the appropriate sampling plan in the Sampling Plans for Prepackaged Foods (AQL 6.5) CAC/RM 42-1969;

the moisture content of the scallop meat requirement of Section 3.3.2 is met;

the average net weight of all sample units is not less than the declared weight, provided there is no unreasonable shortage in any individual container; and

(v) the Food Additives, Hygiene and Handling and Labelling requirements of Sections 4, 5.1, 5.2, 5.4, 5.5 and 6 are met.

“ANNEX A”

SENSORY AND PHYSICAL EXAMINATION

1. Complete net weight determination, according to defined procedures in Section 7.4.
2. Examine the frozen scallop meat in the sample unit or the surface of the block for the presence of dehydration. Determine the percentage of scallop meat or surface area affected.
3. Thaw using the procedure described in Section 7.6 and individually examine each scallop meat in the sample unit for the presence of foreign matter and presentation defects. Determine the weight of scallop meat affected by presentation defects.
4. Examine product for count declarations in accordance with procedures in Section 7.3.
5. Assess the scallop meat for odour and **[**parasites**]** as required.
6. In cases where a final decision regarding the odour cannot be made in the thawed state, a small portion of the sample unit (100g to 200g) is prepared without delay for cooking and the odour/flavour confirmed by using one of the cooking methods defined in Section 7.7.

ANNEX 2

PROPOSED DRAFT STANDARD FOR QUICK FROZEN SCALLOP ADDUCTOR MUSCLE MEAT - SUMMARY OF THE DRAFTING COUNTRIES COMMENTS

Introduction:

At the 24th Session of the Codex Committee on Fish and Fishery Products (CCFFP), Ålesund, Norway, June 5 - 9, 2000, the Committee agreed to elaborate on a standard for scallops as new work, subject to approval by the Commission. The drafting of this standard will be led by Canada, with participation from France, Ireland, Japan and Thailand (Alinorm 01/18, para 141 - 144). Other interested Member Governments were invited to participate in the drafting of the standard. The United States expressed interest in participating in the drafting of the standard and the Netherlands, as the lead country on the development of the bivalve molluscs standard, was included for information purposes.

The 49th (Extraordinary) Session of the Executive Committee of the Codex Alimentarius Commission, (September 2001) approved the development of a standard for scallop as new work (Alinorm 03/3, Appendix III).

Due to time constraints, it was not possible for the Drafting Group to meet and discuss the proposed draft standard in detail. Alternatively, Canada circulated by electronic correspondence to the Head of delegation of the Drafting Countries with a copy to Dr. B. R.Knudtsen, the proposed draft standard along with a document that identified the key issues for their consideration and sought their views. Comments were received and this report will summarize the general views.

SECTION 1 - SCOPE

4. **Protein Bound Scallops**: Drafting Countries generally supported the provisional statement that this standard does not apply to scallop meat bound by fibrinogen or other binders and the text has been placed in square brackets. The rationale is that protein bound scallops are products of further processing and that this specialty product differs from the common scallop meat form as defined in the scope (i.e. for direct consumption or further processing).

Inclusion of 'Scallop Meat with Viscera and/or Roe Attached' into the Most Appropriate Codex Standard: Scallop meat with viscera and/or roe attached are commonly marketed in some countries and these products are generally known to have a greater potential for containing biotoxin than scallop meat alone and therefore poses an increased health and safety risk. Since scallop meat with viscera and/or roe attached share a similar risk with bivalve molluscs, including the former product in the "Proposed Draft Standard for Live, Quick Frozen and Canned Bivalve Molluscs" document would seem to be a legitimate approach. However, scallop meat with viscera and/or roe attached are often processed in a similar fashion as scallop meat alone, that is, with the use of sodium tripolyphosphate, moisture retention and labelling. The dilemma becomes, which of the two proposed draft standards (bivalve molluscs or scallop meat) would be the most appropriate and practical to address scallop meat with viscera and/or roe attached. This matter was identified in para 142 of the report of the 24th Session of the CCFFP (Alinorm 01/18).

In considering this matter, Drafting Countries were prompted to examine the purpose of the scallop standard and the bivalve molluscs standard and compare which standard would be best to address the health and safety issues (i.e. related to marine biotoxin). Two options generated discussion and were as follows:

Option 1 - Bivalve Molluscs Standard Would Reference the Scallop Standard (i.e. Scallop Meat Without Viscera and/or Roe Attached as a Standalone Document

The scope of the "Proposed Draft Standard for Live, Quick Frozen and Canned Bivalve Molluscs" document could be modified slightly by appending the following clause: "**Quick frozen scallop adductor muscle meat**

with viscera and/or roe attached shall also meet the requirements laid down in the "Proposed Draft Standard for Quick Frozen Scallop Adductor Muscle Meat (under elaboration)."

Advantages

- **Bivalve molluscs that share the health and safety concern of marine biotoxin are contained in one standard** (the "Proposed Draft Standard for Live, Quick Frozen and Canned Bivalve Molluscs" document).
- The biotoxin and labelling provisions regarding traceability is being elaborated in the "Proposed Draft Standard for Live, Quick Frozen and Canned Bivalve Molluscs" document. The proposal wording in the option #1 paragraph above clearly indicates that scallop adductor muscle meat with viscera and/or roe attached, will also need to meet other relevant issues, such food additives, moisture content and labelling.

Disadvantage

- Users will need to cross-reference between the "Proposed Draft Standard for Quick Frozen Scallop Adductor Muscle Meat" and the "Proposed Draft Standard for Live, Quick Frozen and Canned Bivalve Molluscs."

Option 2 - Scallop Meat With Viscera and/or Roe Attached is Included in Scallop Standard

Amend the title and scope of the "Proposed Draft Standard for Quick Frozen Scallop Adductor Muscle Meat" document to include scallop meat with viscera and/or roe attached. This would mean that the title of the "Proposed Draft Standard for Quick Frozen Scallop Adductor Muscle Meat" document would become "*Proposed Draft Standard for Quick Frozen Scallop Adductor Muscle Meat With or Without Viscera and/or Roe Attached*" (or wording to that effect) and the format of the standard would incorporate biotoxin, appropriate labelling and methods of analysis provisions from the "Proposed Draft Standard for Live, Quick Frozen and Canned Bivalve Molluscs" document. In addition, the scope of the "Proposed Draft Standard for Live, Quick Frozen and Canned Bivalve Molluscs" will need to be clarified that it will continue to only cover whole live scallops in a shell.

Advantages

- Users will not be required to cross-reference between the "Proposed Draft Standard for Quick Frozen Scallop Adductor Muscle Meat" and the "Proposed Draft Standard for Live, Quick Frozen and Canned Bivalve Molluscs."
- Emphasizes uniqueness of scallop products compared to other bivalve molluscs. (i.e. Scallops adductor mucsle meat is the main edible portion and is marketed in different forms such as with or without roe and with or without viscera).

Disadvantages

- **Bivalve molluscs** (especially live whole scallops and scallop adductor muscle meat with viscera and/or roe attached) **that share the health and safety concern of marine biotoxin are separated between two standards**.
- There will be duplication between the "Proposed Draft Standard for Quick Frozen Scallop Adductor Muscle Meat" and the "Proposed Draft Standard for Live, Quick Frozen and Canned Bivalve Molluscs" and if revisions on shared elements (i.e. biotoxin limits, etc.) are required in the future, these changes will need to be made to both Codex Standards.

From the response of the Drafting Countries, there was no clear agreement on how scallop meat with viscera and/or roe attached should be dealt with and the proposed draft standard as presented will allow for further discussion.

SECTION 2 - DESCRIPTION

Definition for the term "Scallop Pieces": Drafting Countries did not see an issue with provisionally stipulating in the "Presentation" section, a tolerance for scallop pieces in a package and the text has been placed in square brackets. Most consumers generally prefer scallop meat which are not broken over scallop pieces. Because of the overall uniform shape and size of the intact scallop meat, consumers are usually willing to pay a higher price. Where the count/size of the scallop meat is declared on the label, an "excessive" proportion of pieces relative to the whole scallop meat, could result in the consumer being misled. In addition, a methodology for the determination of scallop pieces was elaborated in the "Sensory and Physical Examination" section.

SECTION 3 - ESSENTIAL COMPOSITION AND QUALITY FACTORS

Moisture Content: The "Proposed Draft Standard for Quick Frozen Scallop Adductor Muscle Meat" document has included a provisional maximum moisture content (i.e. placed in square brackets) and a suggested compliance action. From the response of the Drafting Countries, there were differences in opinion regarding the appropriate upper limit moisture level in scallops since the scallop meat musculature is conducive for moisture uptake and retention when exposed to ice melt or fresh water contact during chilled storage. Natural moisture content of scallop meat (differences among varieties, influence from biological, seasonality and other environmental factors) and its holding and processing practices have been studied by several countries. The United States provided a discussion paper on this topic (see Appendix I). Mixed views remain on the issue of moisture content for scallops and the proposed draft standard as presented will allow for further discussion.

SECTION 4 - FOOD ADDITIVES

Sodium tripolyphosphate (STP): Similar to the moisture content provision, Drafting Countries had varied views on including a provisional restriction (i.e. placed in square brackets) on the use of food additives in quick frozen scallop meat. Among the comments received, some supported for the use and labelling of STP in scallops. Although the potential for misleading consumers exists when this additive is applied to help increase the moisture content in scallops, it was also suggested that overall quality (colour, appearance) is improved with the addition of STP. It was recommended that the technical desirability and functions of STP on the characteristics of the finished product should be evaluated. The proposed draft standard as presented will allow for further discussion on this topic.

SECTION 5 - HYGIENE & HANDLING

Marine Biotoxin in Adductor Muscle Meat: Drafting Countries did not see an issue with provisionally stipulating a requirement to address the issue of marine biotoxin for those scallops that have been determined to accumulate marine biotoxin in the adductor muscle meat and the text has been placed in square brackets. There was general recognition that the potential health hazard of marine biotoxins in scallop adductor muscle meat could be present in relatively few scallops and this matter should be addressed in the Scallop standard. It was stressed that the proposed wording will require discussion and clarification since scientific data regarding marine biotoxin accumulation in scallop adductor muscle meat was limited and in light of the fact that biotoxins in the adductor muscle meat is generally not a concern in the majority of scallops.

SECTION 6 - LABELLING

Name of the Food: Drafting Countries shared the view that rather than limiting the application of the scallop standard to specific species, the standard should be sufficiently broad to cover all scallops of current and

future commercial importance. These species are found in the Pectinidae family. No conclusion was reached on the labelling requirement governing the common name that this product can be declared. The proposed draft standard as presented will allow for further discussion on this topic.

SECTION 8 - DEFINITION OF DEFECTIVES

Parasites: Drafting Countries did not see an issue with provisionally stipulating that a definition and limit for parasites in scallop meat is needed in the future and the text has been placed in square brackets. Parasite infestations in bivalve molluscs have been well documented. In general, the parasites are known to affect the respiratory system, organs and the connective tissue of organs (i.e. Perkinsis spp.). Sulcascaris sulcata, a nematode, has been known to parasitize the adductor muscle of calico scallops. Scientific information is limited on the significance of scallop parasites to public health. Never the less, the presence of cysts or mature parasites in scallops can be aesthetically offensive and therefore should be addressed as a defective in this standard.

APPENDIX I

Discussion Paper on Establishing an Acceptable Upper Level Moisture Content for Scallops

(PREPARED AND SUBMITTED BY THE UNITED STATES)

The purpose of this document is to describe a process for establishing an acceptable upper level moisture content for scallops. It does not attempt to describe the only possible way of doing so or whether Codex should do so. The document is based on U.S. experience; consequently, data from other sources might be necessary in order to establish a single upper level for all scallops, or to establish different upper levels for various types of scallops.

Scallops are filter feeding molluscs. There are more than 350 species of scallops found worldwide, but only about a dozen are harvested commercially. Three types of scallops dominate the U.S. market: sea scallops, bay scallops and calico scallops (Ref. 1, pages 149-150). The harvesting and processing practices for each differ in ways that can affect moisture content.

Fresh sea scallops (*Placopecten magellanicus*) sold in the U.S. are harvested principally from off-shore banks in the Atlantic Ocean. Because scallops do not live long out of water, and harvest vessels typically stay out between 10 and 15 days, sea scallops are shucked by hand on the boat. The adductor muscle, the only part generally consumed in the U.S., is separated from the rest of the scallop and the shucked meats are stored in linen bags packed in ice. During the warmer months, ice-water slurries may be used on deck to chill the scallop meats before bagging. Frozen sea scallops also are imported from many foreign countries.

Fresh bay scallops (*Argopecten irradians*) are harvested from inshore waters along the Atlantic coast from Cape Cod to North Carolina. They are landed alive and are shucked onshore by hand and packed in plastic containers. Bay scallops are also imported frozen into the United States.

Calico scallops (*Argopecten gibbus*) are a semitropical species harvested from the U.S. southern Atlantic coast and from the Gulf of Mexico. These scallops are also landed alive and shucked onshore, with the aid of steam to open the shells.

Shucked scallop meats of all commercially harvested species readily lose natural moisture and can also absorb water, particularly fresh water (i.e., no salt) from the environment. The adductor muscle of a scallop is made up of parallel strands of fibers that can absorb water through capillary action. Over time shucked scallop meat will lose natural and added moisture, through a process known as drip loss, until it is only a fraction of its original weight. Significant amounts of water-soluble nutrients can be lost as well. Drip loss is enhanced by freeze/thaw cycles because of damage to the muscle cell structure (Ref. 2, pages 100-104).

Fresh sea scallops, because they must be held in ice on board the fishing vessel to avoid spoilage, have ample opportunity to absorb water before they reach shore. Ice melt occurs around the bagged scallops in the hold during the time that the boats are out, and the scallop meats absorb this water. In the warmer months, when ice-seawater slush combinations are used on deck to prevent thermal abuse of the shucked product before bagging, absorption can occur even before the scallop meats are stored in the hold.

A study conducted in 1993 by the Canadian Department of Fisheries and Oceans and the Fisheries Council of Canada showed that water absorption increased with the number of days the scallop meats were held in ice (Ref. 3). Sea scallops harvested by commercial fishing vessels in the George's Bank area were shucked and the meats held in ice under normal vessel handling conditions. On-board storage time ranged from zero days (live control samples) up to 10 days of storage. Periodically, samples of stored scallop meats were analyzed for total moisture content. The results showed a continuous increase in the moisture content of the scallop meats in the ice hold. After 10 days of storage, the moisture content of the scallop meats had increased by 2 percent, on average. Due to the common fiber structure of the adductor muscles, increases would also be

expected to occur for all other types of scallops when exposed to moisture, especially in the form of fresh water.

All types of scallops are subject to drip loss after shucking. Consequently, it became a common practice in the U.S. industry to soak scallop meats in water to replace the natural moisture lost after shucking. Subsequently, the industry began using solutions of water and phosphate compounds, rather than water alone, to process scallop meats. These compound solutions were found to aid the scallops in retaining their natural moisture. However, it was soon discovered that these compounds not only enhanced the ability of the scallop meats to retain their natural moisture, but to also increase their capability for taking up and retaining added water. Without this aid for retention, the water added through soaking would also be subject to drip loss. Phosphates also help to maintain the original white or creamy color of the scallop meat, which tends to darken over time. The phosphate compound most commonly used for this treatment is sodium tripolyphosphate (STP), which is a "Generally Recognized as Safe (GRAS)" substance in the United States. (It is listed in Title 21 Code of Federal Regulations Section 182.1810 (21 CFR Part 182.1810), as a multiple purpose GRAS substance with no limitations on use when used in accordance with good manufacturing practices (GMP)).

The U.S. scallop industry claims that it developed the use of STP in scallop processing in response to consumer demand for fresh scallops. Before STP use, the only way to extend shelf life was to freeze the scallops. Processing scallop meats with STP eliminated this need for freezing by extending shelf life and reducing or preventing excessive drip loss and improving the overall quality of the scallops. According to the industry, this use of STP permitted nationwide distribution of fresh product (Ref. 4, pages 3-4).

On the other hand, it is well recognized that there is also a significant potential for the misuse of STP. Soaking scallops in water or phosphate solutions for lengths of time beyond what is needed to prevent drip loss can substantially increase their apparent size and weight. It is generally not possible for a consumer to visually distinguish a scallop that has gained excessive moisture through soaking from an untreated one or one that has been treated solely to prevent drip loss. When the soak has been excessive, the consumer pays for the added water at full price. Consequently, a fundamental question is whether it is possible to determine on behalf of the consumer when soaking has been excessive.

To help answer this question, in March 1993, the American Scallop Association (ASA), a U.S. industry trade association, and the International Food Additives Council (IFAC), jointly submitted to the U.S. Food and Drug Administration (FDA) the final report of a collaborative study conducted by researchers at VIMS, the University of Florida and Virginia Polytechnic Institute and State University (Ref. 5). The primary purposes of the study were to obtain data on: (1) the effect of certain processing practices on the retention and addition of moisture in scallops; (2) the effect of these processing practices on nutritional composition; and (3) the effect of these processing practices on consumer preference.

In order to obtain as uniform a sample as possible, the scallops used for the study were harvested from the same geographic area (off Cape Cod), within as short a time as possible. The scallops were harvested midway through the fishing trip so that the shucked meats would be in the ice-hold for about seven days (the mid-point of a typical commercial run for U.S. scallop boats, according to the report). Scallops of uniform size were chosen, and were all treated in the same manner from shucking to off-loading from the harvest vessel.

Moisture and protein contents were determined at harvest and again at off-loading from the boat. At harvest, moisture levels ranged from 76.7-77.4 percent with a mean of 77.1 percent. Protein levels ranged from 17.9-18.8 percent with a mean of 18.6 percent. At off-loading, moisture levels ranged from 77.9-79.6 percent with a mean of 78.6 percent. Protein levels ranged from 16.4-17.1 percent with a mean of 16.7 percent.

Onshore, the scallops were divided into six subsamples. The six subsamples were subjected to four different processing methods, with one method further subdivided into three different soaking times, as follows:

1) **"FW Wash:"** washed for twenty minutes with fresh water;

7. **"STP Processed:"** soaked in a 2.5 percent STP and 1.0 percent sodium chloride aqueous (i.e., water) solution, for five hours, thirteen hours, and twenty-four hours, respectively;

3) **"STP Wash:"** washed for twenty minutes in a 4.0 percent STP and 1.0 percent sodium chloride aqueous solution;

4) **"STP Dip:"** washed for twenty minutes with fresh water and then dipped for one minute in a 10.0 percent STP and 1.0 percent sodium chloride aqueous solution.

After being treated according to one of the four methods described above, the moisture content of each scallop sample was again determined. The results for the moisture contents of scallop meats before and after processing are summarized in Table 1 below:

Table 1: MEAN MOISTURE CONTENTS OF SCALLOP MEATS BEFORE AND AFTER PROCESSING

	Mean Moisture Contents (%)
At Harvest	77.1
At Off-loading	78.6
"STP Processed"	
5 hours	81.6
13 hours	82.4
24 hours	83.9
"FW Wash"	82.5
"STP Wash"	79.7
"STP Dip"	81.3

In their report, the researchers explained their results on moisture absorption in scallop meats as follows. For the three "STP Processed" samples, moisture absorption was a function of soaking time, i.e., the amount of moisture absorbed increased as the soaking time went from 5 hours up to 24 hours.

The results for the "FW Wash" versus the "STP Wash" samples led the authors to conclude that given the same contact time (which, for each of the two "Wash" processes, was 20 minutes), scallop meats will absorb more moisture if they are washed with fresh water than if they are washed with a 4 percent aqueous STP solution.

The fact that more moisture was absorbed by the "FW Wash" sample than the "STP Dip" sample, even though the "STP Dip" treatment included a 20 minute fresh water wash prior to dipping, was attributed to water migration out of the washed scallop into the dip solution. All of these conclusions are consistent with the physics of solutions containing dissolved solids (Ref. 6).

The effect of processing on drip loss from scallop meats during iced storage was also evaluated. Scallop meats processed using each of the four methods described above were packed in plastic containers and stored in ice for a total of 15 days. On days 4, 6, 8, 11 and 15, the containers were opened and the amount of drip loss was determined.

Drip loss generally increased as a function of storage time for all of the processed scallops. The "FW Wash" scallops showed significantly greater drip loss than any of the STP processed scallops. By day 15, these scallops had lost a total of 4.5 percent of their initial weight through drip loss.

Of the three methods of processing using STP, the "STP Dip" method resulted in the lowest amount of drip loss during iced storage. Essentially no loss occurred until day 11, and after 15 days the amount of drip loss was less than 1 percent of the initial weight of the scallops. The "STP Wash" method resulted in the highest amount of drip loss during iced storage of the three STP processing methods evaluated. By day 15, these scallops had lost nearly 3 percent of their initial weight.

The study also addressed moisture loss of scallops due to cooking and to freezing/thawing. Results of these experiments are summarized in Table 2 below:

Table 2: MEAN MOISTURE LOSS FROM SCALLOP MEATS AFTER COOKING AND AFTER FREEZING/THAWING

	* Mean Cooked Weight Loss (%)	Mean Freeze/Thaw Weight Loss (%)
Untreated	16.7	
"STP Processed"		
5 Hours	14.1	7.5
13 Hours	14.6	6.7
24 Hours	15.1	5.9
"FW Wash"	19.0	15.0
"STP Wash"	13.1	3.4
"STP Dip"	12.4	0.9

*All scallop samples were broiled to an internal temperature of 70_ C.

Both untreated scallops and scallops treated according to the four processing methods described above were broiled to an internal temperature of 70_ C and the percent weight loss determined. The “FW Wash” scallops lost the most weight during cooking (mean weight loss of 19.0 percent). The untreated scallops had a mean weight loss of 16.7 percent. All of the scallops treated with STP (“STP Processed,” “STP Wash,” and “STP Dip”) showed a lower percent weight loss during cooking than either the untreated scallops or the “FW Wash” scallops. The researchers attributed this result to the enhanced moisture binding capabilities of the scallop meat protein that results from STP treatment. The “STP Dip” scallops had the lowest mean weight loss (12.4 percent).

Similar results were obtained when processed scallops were frozen and then thawed. “FW Wash” scallops showed an average weight loss during freezing/thawing of 15.03 percent. “STP Wash” scallops averaged only 3.45 percent loss, and the “STP Dip” scallop meats showed a minimal average weight loss of less than 1 percent.

As expected, percent nutrient levels in scallop meats were found to be principally a function of moisture content. As scallop meats absorbed water during onboard storage or during processing, nutrient levels were reduced on a per weight basis. Also, drip loss resulted in loss of water-soluble nutrients (e.g. riboflavin, niacin and vitamin B_{12}), as did cooking. Treating scallop meats with STP reduced moisture loss and loss of water soluble nutrients. Of the processing methods evaluated in this study, the “STP Dip” was the most effective in retaining water-soluble nutrients.

Consumer evaluations of cooked scallops were also conducted as part of this study. Consumer panels were asked to rate various attributes (texture, moistness, aroma, flavor etc.) of scallops which had been processed by "FW Wash," "STP Wash," STP Dip" and "STP Processed." Untreated scallops were not included in the evaluations. Overall, more consumers preferred the scallops that had been treated with STP over the "FW Wash" scallops in the various tests. However, the differences in ratings for the "FW Wash" versus the STP treated scallops, while generally statistically significant, were not large.

As discussed previously, the researchers who conducted the 1993 VIMS study, which focused on the effects of STP treatment on moisture content and other sea scallop meat parameters, deliberately tried to obtain as uniform (in terms of size, moisture content, etc.) a sample of scallop meats as possible. All of the scallops used in the study were harvested from a single location over a short time period and were treated in the same manner from shucking to off-loading. The data from this study do not permit a full assessment of the range of moisture contents in sea scallops at harvest or at off-loading from fishing vessels.

To resolve this problem, in November 1996, FDA received a report describing the results of a study conducted by VIMS with support from the Virginia Sea Grant Marine Advisory program (Ref. 7). According to the report, the goal of the study was to assess the natural and ex-vessel (before processing) moisture content of sea scallop meats harvested from most of the commercially fished areas in the Atlantic Ocean over an extended period of time. As the ASA had pointed out in 1993, the moisture content of scallop adductor muscle meat is affected by various biological and environmental factors. Therefore, in order to get a true picture of the range of moisture levels in sea scallop meats, the researchers collected samples over a period of three years at numerous commercial fishing areas from Virginia to George's Bank.

Scallop meat samples were taken from freshly shucked scallops at the time of harvesting. At a minimum, samples were taken daily, and the frequency was increased when different locations were fished in a single day. Samples were also taken at off-loading from the boat, before processing, from bags marked with harvest location and date of bagging and storage.

Moisture content of scallop meats at harvest (immediately after shucking) ranged from 73.7 to 78.9 percent. A total of 136 samples were analyzed. Each sample was a composite of seven scallop meats. At off-loading from the harvest vessel, the values ranged from 74.2 percent to 82.5 percent. A total of 91 composite samples were analyzed. The broader range in moistures at off-loading, compared to the moisture values at harvest, was attributed to the added variables that influence moisture uptake during on-board processing and storage, such as whether ice-seawater slush's were used on deck, and the length of time the scallop meats were stored in the ice hold.

The results at off-loading were statistically analyzed to determine what the upper limit for moisture content would have to be in order for all the samples collected in this study to be in compliance with a hypothetical upper limit for scallop meat moisture. The study report states that to achieve a 95 percent probability of compliance, the upper limit would have to be 81.6 percent. For the probability of compliance to be greater than 95 percent, the upper limit for moisture content would have to be 82.0 percent.

Another study, performed by the North Carolina State University Seafood Laboratory, assessed moisture levels in bay, calico and sea scallops. FDA received the report of this study in November 1993 (Ref. 8).

The study included a random survey of scallop meat moisture levels after shucking, after processing, and in retail establishments. Live bay scallops (shellstock) were obtained from North Carolina dealers and processors. Live calico scallops (shellstock) were obtained from shipments coming from the west coast of Florida. Commercially shucked and processed bay and calico scallop meats were obtained from North Carolina processors. Samples of bay, calico and sea scallops were also purchased at retail markets across North Carolina.

Live bay and calico scallops were shucked at the North Carolina State University Seafood Laboratory and the moisture levels determined. The moisture levels in the bay scallop meats after shucking ranged from 77.5-82.5 percent; for calico scallops the moisture levels ranged from 76.1- 79.2 percent. The moisture levels in the

commercially processed bay scallop meats ranged from 81.8-84.3 percent; for commercially processed calico scallops, the moisture levels ranged from 77.7- 81.2 percent. For samples obtained at retail, the mean moisture contents were as follows: bay scallop meats - 82.6 percent; calico scallop meats - 78.6 percent; sea scallop meats- 86.3 percent.

This study is significant because it provides data on moisture levels in bay and calico scallops, as well as sea scallops. Interpretation of the data is difficult, however, because unlike the two VIMS studies, this was not a controlled study. It is not known how the commercially processed scallop meats and the scallop meats obtained at retail were handled or processed.

Based on data reflecting the range of moisture levels in scallop meats at off-loading from the 1993 and 1996 VIMS studies, a maximum moisture content for scallops – at least for those labeled as "sea scallops" -- could be 82 percent. As previously indicated, the 1993 VIMS study produced moisture contents at off-loading reaching to almost 80 percent. However, the broader 1996 VIMS study on the range of scallop moisture levels at off-loading from the fishing vessel suggested that essentially all sea scallops at off-loading would be in compliance with an upper limit for moisture content of 82 percent.

An upper limit of 82 percent also would appear to allow for a treatment with STP that achieves results beneficial to consumers without adding excessive moisture to the product. The 1993 VIMS study demonstrated that treatment of sea scallop meats with STP can effectively minimize drip loss, as well as minimize the resulting loss of water soluble nutrients, during iced storage and cooking, and after freezing/thawing. Moreover, the 1993 study indicated that benefits can be obtained through techniques that have limited if any impact on moisture content (e.g., STP Wash). In any event, because the 1993 and 1996 studies show that moisture content at off-loading can be as low as 74.2 percent and is under 80 percent more often than not, an upper limit of 82 percent can accommodate more than one technique. Data from the 1993 VIMS study on scallop meat moisture content after processing showed that sea scallops processed using the "STP Dip," "STP Wash" and "STP Processed (5 hours)" methods all resulted in mean moisture content increases of 3 percent or less, compared to the mean moisture content at off-loading. Each of these processing methods provided improved moisture retention (drip loss reduction) during iced storage and cooking, and after freezing/thawing compared to sea scallops processed without STP ("FW Wash").

The data that provided the basis for this discussion paper only involve three types of scallops and, of these, they are not as extensive for bay and calico scallops as it is for sea scallops. Consequently, more study might be needed on the appropriateness of 82 percent as the upper limit for moisture in scallops other than "sea scallops."

FDA is aware that other countries have issued regulations designed to control added moisture in scallops. In France, for example, no more than 5 percent added water is permitted in scallop meats as a result of processing. In order to accomplish this, the regulation sets an upper limit of 4.99 for the value obtained by dividing the percent moisture by the percent protein in the scallop meat.

Canada, in 1995, established an upper limit of 81 percent moisture for scallop meats, based on the results of the study conducted by the Department of Fisheries and Oceans and the Fisheries Council of Canada (Ref. 3). In January 1997, the level was changed from 81 percent to 81.0 percent (Ref. 9).

Based on the results of the Canadian study and the 1996 VIMS Study, the agency tentatively concludes that differences in commercial practices in the U.S., Canadian and European scallop industries make different regulatory limits appropriate. The European scallop harvesters do not shuck the scallops at sea and store the meats in ice until off-loading as is done in the U.S. and in Canada. The authors of the Canadian study noted in their report that a significant portion of the samples that they analyzed had values for percent moisture/percent protein that exceeded the French regulatory limit of 4.99.

While the Canadian harvesting practices are similar to those of the U.S. in that they shuck the sea scallops at sea and store them in ice, the lengths of the fishing voyages are considerably shorter for the Canadian scallop fleet. Canadian vessels rarely stay out for more than ten days, while the average voyage for U.S. scallop

harvesters is 12-15 days. U.S. vessels harvest scallops farther south in the Atlantic, where in the warmer months, ice/seawater slurries are used to cool the scallops after shucking until they can be stored in the ice hold. These differences in harvesting practices result in higher moisture contents for domestically harvested sea scallops compared to Canadian product (Ref. 7).

REFERENCES

The following references are available.

1. The New Fresh Seafood Buyer's Guide, Ian Dore, An Osprey Book, published 1991.

2. Seafood Scams and Frauds, Ian Dore, Urner Barry Publications, published 1992.

3. A Study of the Seasonal Variations of the Moisture Content of Sea Scallop Meats Harvested by Canadian Vessels in the Georges Bank Area, Mills, R.E. et al., Draft Abstract, 1993.

4. American Scallop Association Letter dtd 5/14/92.

5. An Evaluation of Atlantic Sea Scallops (Placopecten magellanicus), DuPaul, W.D. et al.,Virginia Marine Resource Report #93-2, March 1993).

6. Cell Physiology, Giese, A.C., Third Edition, 1968.

7. Natural and Ex-Vessel Moisture Content of Sea Scallops (Placopecten magellanicus), DuPaul, W.D. et al., Virginia Marine Resource Report #96-5, November 1996).

8 . Moisture Content of North Carolina Bay, Calico, and Sea Scallop Meats at Harvest, Processing and Retail, Green, D.P. et al., 1993.

9. Bulletin No. 27, Fish Products Inspection Manual, Canadian Department of Fisheries and Oceans, Dated 1/31/97.