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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

WORLD HEALTH ORGANIZATION

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Agenda Item 13 **CX/FFP 03/14**

JOINT FAO/WHO FOOD STANDARDS PROGRAMME
CODEX COMMITTEE ON FISH AND FISHERY PRODUCTS

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DISCUSSION PAPER ON FISH CONTENT IN FISH STICKS

(Prepared by the United Kingdom in collaboration with Canada, and the USA*)

Background

1. At its last meeting in June 2002, the UK and other participants of the WG presented a discussion paper CX/FFP 02/13 to the Codex Committee on Fish and Fishery Products (CCFFP) on the definition of a fish ingredient and a suggested method of analysis. This was in response to a request by the Committee on Food Labelling (CCFL) to finalise the Draft Amendment to the Standard for Quick Frozen Fish Sticks and Fish Portions – Breaded or in Batter (Codex Stan 166-1989) to declare "fish content" in place of "fish core content". The twenty-sixth session requested other member countries to contribute to the discussion and detail of the method of analysis.

2. The US and Canada have responded, and their contribution is given in Annex A and B. These highlight some of the technical arguments against using a chemical analysis based on a "nitrogen factor" to determine fish content.

3. This paper includes a UK case study in checking QUID (quantitative ingredient declarations) and "added water" based on the use of nitrogen factors. It restricts the discussion to the question posed by the CCFL, which concerns the technical aspects of fish content declaration. (CX/FFP 02/13 gives the rationale for this). The paper sets out comments from the UK, USA and Canada and suggests an approach agreed by these three countries for discussion by the CCFFP.

A Case Study of Using Chemical Analysis to Check Fish Content

The UK Food Standards Agency has been working with trade bodies and enforcement laboratories over a number of years to arrive at established nitrogen factors for the measurement of meat and fish content in meat and fish products. These studies have been based on sound protocols, published and accepted by both industry and enforcement [1-7].

4. Studies have been taking place to arrive at an accepted nitrogen factor for cod. Unfortunately these have been delayed because of problems of supply of cod fillets and cod blocks. However the study will use 400 cod blocks produced in the UK, and 120 samples of imported cod blocks.

5. In December 2002 the UK Food Standards Agency completed a survey of coated scampi (*Nephrops norvegicus*), as well as frozen ice glazed scampi and scallops. The objective of the study was to check the scampi content against the label declaration and also the scampi and scallop content of the frozen "core" without ice glaze. Although the study did not look at coated fish sticks, the methods of analysis used were the same as described in CX/FFP 02/13.

6. Annex C gives a report of the survey. The nitrogen factor for scampi had been established after a robust study to look at scampi composition variation with season and catching grounds and after processing (cleaning, removal of shell. Full details of the study can be found on the Agency's website as Food Surveillance Information Sheet 30/02:

   http://www.food.gov.uk/science/surveillance/fsis-2002/waterinrawscallops

7. The survey revealed high levels of added water to the cores of ice-glazed scallops and scampi, as well as some problems of excessive water in the core of coated scampi products. These problems would only have been revealed by using a chemical analysis approach as outlined previously by the UK.

Discussion

8. All methods of analysis have a certain uncertainty. It is estimated that using the ISO methods for moisture, fat and nitrogen there is a combined analytical uncertainty at the 95% confidence level of around 3% fish content. This is equivalent to the uncertainty of the AOAC Method 996.15 (Determination of Fish Core). A greater uncertainty exists in the use of the nitrogen factor, which takes account of natural variation in composition of fish, as well as their processing. Experience has shown that nitrogen values of fish taken out of the sea are remarkably robust and often have remained very similar over a thirty year period or more i.e. the time between when different studies have been carried out in the UK.

9. Allowances for processing take into account the hygienic handling of fish to transform it into a fish ingredient. The reduction of 7-8% in the UK interim factors was based on historical data rather than an independent study and is being investigated at present. The contribution by nitrogen from the coating is normally an insignificant part of the overall fish nitrogen. Recent evidence shows that many manufacturers are using starch rather than wheat flour in a substantial proportion of their batter, which has zero nitrogen contribution. This was taken into account in the breaded scampi survey.

10. More importantly, the nitrogen factor, QUID and GMP (good manufacturing practice) approach outlined by the UK for fish content declaration in fish products has been helpful to fish product manufacturers. They have used nitrogen factors to monitor their own supplies of fish blocks, since the UK is now almost totally an importer of frozen fish blocks. This approach, therefore, whilst recognising the uncertainties of the determination can reveal serious abuses of adding water to fish or not declaring fish content correctly.

Recommendations from Canada and the United States

12. Given the on-going work in the CCFL, Canada has recommended that the CCFFP discontinue work on elaborating any requirement that specifically deal with the declaration of the amount of fish ingredient as it relates to the "*Codex Standard for Quick Frozen Fish Sticks (Fish Fingers), Fish Portions, Fish Fillets - Breaded or Battered.*" This recognises that the Proposed Draft Amendment to the General Standard for the Labelling of Pre-packaged Foods, (Quantitative Ingredient Declaration Labelling) will provide the necessary "over arching" guidance on the QUID issue and supports a consistent policy across commodities. (See Canada's paper at Annex B.)

13. The UK noted that although the CCFL will certainly be able to provide very general guidance on QUID, they will not be able to provide the technical detail that would be necessary to resolve the many questions surrounding the definition and determination of the "fish ingredient". Experience in the

European Union has shown that each sector raises its own questions on QUID which often require specific solutions.

14. After considering all the technical aspects, the USA has recommended that if the CCFL and the CCFFP wish to proceed with percentage labelling for quick frozen fish sticks: (a) the labelling should address "content" rather than "core" as a matter of principle; (b) AOAC Method 996.15 should be retained as a method for determining content; but that (c) chemical analysis could also be utilized in those countries that prefer it for domestic use and for the products they export. (See U.S. paper at Annex A)

Recommendations

15. Taking into account the concerns of the USA and Canada, the UK would recommend to the CCFFP, the following:

Recommendation #1

16. The CCFFP should request advice and direction from the CCFL regarding whether the draft amendment to Codex Stan 166-1989 on percentage of fish ingredient labelling for breaded or battered fish sticks, portions and fillets should be held in abeyance until completion of the Proposed Draft Amendment to the General Standard for Labelling of Prepackaged Foods (Quantitative Ingredient Declaration Labelling) in order to assure that percentage labelling for these fish products is consistent with overarching policy on quantitative ingredient labelling generally.

17. It is recognised that in 2000, the CCFL initiated new work on what is now The Proposed Draft Amendment to the General Standard for the Labelling of Prepackaged Foods, (Quantitative Ingredient Declaration Labelling) (Alinorm 03/22A, Appendix VII). It is currently at Step 3 of the Procedure. The revised standard will apply to foods that include breaded or battered fish sticks, portions and fillets.

Recommendation # 2

18. Recommendation #1 notwithstanding, the CCFFP is still in a position to respond to the two requests made by the CCFL in 2000. The first of these involves how to define "fish content" in the draft amendment to Codex Stan 166-1989. We suggest that the amendment read as follows:

6.1.3 The proportion of fish content should be declared on the label.

Recommendation # 3

19. The second request from the CCFL goes to the question of methodology to measure "content." We recommend responding to the CCFL as follows:

"In the majority of cases, especially where processors have a degree of confidence over their raw materials, the CCFFP recommends that AOAC Method 996.15 be used as the routine method to check fish content. In cases where there is some doubt over the composition of the fish core, the chemical analysis outlined in CX FFP 02/13 could be used, i.e., as a reference method."

20. We further recommend amending section 7.4 of Codex Stan 166-1989 to correspond to this response, as follows:

7.4 ESTIMATION OF FISH CONTENT

According to AOAC Method 996.15. **In cases where there is some remaining doubt over the composition of the fish core then the method of analysis as outlined in CX FFP 02/13 could be used, i.e., as a reference method.**

References

1. Nitrogen Factors for Pork: A Reassessment, *The Analyst*, July, 1991, No. 7, pp. 761-766

2. Nitrogen Factors for Beef: A Reassessment, *The Analyst*, September, 1993, Vol. 118, pp. 1217-1225

3. Nitrogen Factors for Sheepmeat, Part 1 Mutton *The Analyst*, June, 1995, Vol. 120, pp. 1823-1824

4. Nitrogen Factors for Sheepmeat, Part 2 Lamb Meat, *The Analyst*, July, 1996, Vol. 121, pp. 889-896

5. Nitrogen Factor for *Nephrops norvegicus* (Scampi) *The Analyst*, 2000, Vol 125, 347-351

6. Nitrogen Factors for Chicken Meat, *The Analyst*, 2000, June, Vol. 125, pp. 1359-1366

7. Nitrogen Factors for Turkey Meat, *The Analyst*, 2002, April, Vol. 127, pp. 859-869

ANNEX A

United States Discussion Paper

Draft Amendment to the Standard for Quick Frozen Fish Sticks (Fish Fingers), Fish Portions and Fish Fillets, Breaded or in Batter

(Standard 166-1989)

An analysis and a compromise proposal on: (1) How to define fish "content;" and (2) Whether the AOAC Method now referenced in the Standard should be replaced with a nitrogen determination plus carbohydrate analysis

[NOTE: This paper does not address the issue of whether percentage labeling should be addressed for foods generally before it is considered for a limited number of products, such as those covered in Codex Standard 166-1989 (i.e., whether the draft amendment to the Standard should be considered alone or in the context of percentage labeling generally.) The issues addressed here primarily involve practicality and certainty of outcome if nitrogen plus carbohydrate analysis were to be used to measure "content" on an international basis.]

BACKGROUND:

The Standard: The Codex Committee on Fish and Fishery Products (CCFFP) developed, and the Commission adopted in 1989, a Standard for Quick Frozen Fish Sticks (Fish Fingers), Fish Portions and Fish Fillets, Breaded or in Batter. A revision to the Standard was also developed by the CCFP and adopted by the Commission in 1995. Among other things, the revised standard contains:

- Labeling provisions relating to the name of the product and storage instructions, but not to the percentage of fish in a stick, portion, or fillet.
- A reference to AOAC method 996.15 as the means by which fish "core" is "estimated." Fish "core" is not defined in the standard but the AOAC method essentially involves scraping away the breading and weighing the remaining product.
- Criteria for lot acceptance that includes: "the average percent of fish flesh of all sample units is not less than 50% of the frozen weight."

The proposed amendment to the Standard: "The proportion of fish core shall be declared on the label."

- This language was proposed for inclusion during the development of the revised Standard by the CCFFP in 1994. It was referred to the Committee on Labeling (CCL) because it was a matter on which general guidance was required.
- In 1996, the CCL decided that labeling should include this declaration in order to provide clear information to consumers and agreed to circulate the draft amendment at Step 3 of the Accelerated Procedure.
- In 1998, the CCL forwarded the draft amendment to the Commission at Step 8.
- In 1998, the CCFFP was advised that EC had amended its labeling legislation to require percentage of fish excluding water and additives, i.e., fish "content." Based on concern that the new EC standard did not correspond to fish "core," the United Kingdom proposed to develop a discussion paper on "content" methodology to measure only actual fish "content" rather than the entire fish "core."
- In 1999, the Commission returned the amendment to Step 6 and referred it to both the CCL and the CCFFP for further consideration.
- In 2000, the CCL "agreed in principle" that fish "content" should be declared on the label and asked the CCFFP to consider a definition of "fish content" and the method for its determination.
- In 2000, the United Kingdom presented a discussion paper to the CCFFP on how "fish content" could be calculated by determining nitrogen content, based on the Kjeldahl method.

- In 2002, the United Kingdom presented a second discussion paper that included a proposed definition of "fish content."

ISSUES:

1. Can a measurement of nitrogen content based on the Kjeldahl method plus determination of carbohydrates measure the actual fish content of a frozen coated fish product with greater certainty than AOAC Method 996.15 that is referenced in the Codex Standard for these products? The AOAC method was designed to weigh the entire core of a product once the breading is scraped away.
2. What are the practical and technical considerations that affect the use of a method involving measurement of nitrogen content plus carbohydrates?
3. Taking into account issues 1 and 2, is it possible to define "fish content" in a way that would honor the concept of providing information to consumers about the actual content of the fish in the product while acknowledging that current methodologies cannot determine actual fish content with certainty?

SUMMARY, CONCLUSIONS, AND RECOMMENDATION:

4. If Codex Standard 166-1989 were to be amended to contain a labeling provision that provided the percentage of fish in these products, we could support the concept that labeling should state the percent of actual fish to the extent that it is practicable to do so, and that the consumer should not be misled.

5. We are not aware of any data on the extent to which water and additives are added to these products so as to deceive the consumer, so we cannot determine how much of a problem this is. We can identify several factors, however, that have the potential to limit the scope of the problem. These include: (a) the ability of frozen coated fish processors to identify in most cases when they have purchased a fish block that has been made from fish that have been excessively treated with a solution of sodium tripolyphosphate (STP) in order to add water; (b) the difficulty of adding water to a fish block without using STP; (c) the likelihood that 2-3 percent of any water gained from using STP when making fish blocks would be offset by the loss of water that occurs when fish are compressed into blocks; and (d) the risk of quality defects occurring in the finished product as a result of adding excessive water.

6. Nonetheless, as the U.K. has pointed out, it is true that AOAC Method 996.15 currently referenced in Standard 166-1989 weighs the core remaining after the breading has been removed and is therefore unable to distinguish added water and additives from non-added water and actual fish protein (see U.K. 2002 discussion paper, paragraph 13).

7. On the other hand, attempting to determine fish content minus added water and additives by measuring nitrogen content and carbohydrates also can result in considerable uncertainty. The extent to which a determination of nitrogen content could clearly reveal added water and additives against the background of normal moisture variability that seafood products demonstrate appears to be limited. Nitrogen determination analyses would likely also generate "false positives" that could cause products to be considered improperly labeled even though the fish contained no added water or additives. The nitrogen method also poses significant practical challenges and expenses to regulators and industry alike that are not a problem with AOAC Method 996.15. We tentatively conclude that this method is unlikely to measure fish content more reliably than the existing AOAC method -- and possibly less so.

8. While measuring "fish content" is, in principle, a more desirable goal than measuring "fish core," there is not yet an ideal method for determining fish content that would eliminate the uncertainties in the results to everyone's satisfaction and, at the same time, be practical to perform. We are concerned that representing the outcome to consumers as "actual" fish content could be deceptive.

9. Should the CCFFP choose to adopt a definition of "fish content," we therefore recommend that the definition honor the ideal that labeling of fish core should distinguish actual fish from added water and additives but still take into account the practical realities, as follows:

"Fish content is the actual amount of fish in the product that can be measured practically and at reasonable cost."

This definition could be added to the draft amendment to the standard now at Step 6, so that the amendment would read:

"**6.1.3 The proportion of fish content shall be declared on the label. Fish content is the actual amount of fish in the product that can be measured practically and at reasonable cost."**

10. AOAC Method 996.15 meets that definition as well as any other method and should continue to be referenced in the standard. AOAC Method 996.15 should remain acceptable for all products in international commerce. However, Codex Standard 166-1989 could also cite nitrogen and carbohydrate measurement or other measurement techniques as provided for in national legislation as equally acceptable in international trade for countries that choose to use them for the products they export.

DISCUSSION

a. AOAC Method 996.15

11. Standard 166-1989 references A.O.A.C Method 996.15 for measuring the fish in a frozen coated fish product. That method essentially involves scraping away the breading and weighing the remainder. The method was developed for this Standard by the governments and industries of the United States and Canada at substantial cost.

12. Relatively speaking, it is not a difficult or expensive test to conduct. Nonetheless, in order to compensate for possibilities such as fish being inadvertently scraped off along with the breading during the conduct of the test and moisture migration from the fish into the coating, the CCFFP in 1998 added "adjustment factors" of 2 percent for raw breaded and batter-dipped products and 4 percent for pre-cooked products. By deciding to adopt a method with a 2-4 percent range of "adjustment" in the amount of fish that consumers actually receive, the CCFFP acknowledged that some variability is inherent in this kind of measurement and effectively decided that consumers could occasionally receive 2-4 percent less fish than called for in Standard 166-1989 (50%).

13. The E.U., through the United Kingdom (U.K.), is now essentially arguing that, because water and additives may be added to the product, the uncertainty regarding the percentage of actual fish in the product is actually greater than 2-4 percent and, as a consequence, the amount of fish in a portion could occasionally be below 46-48% by weight. This additional uncertainty – along with the potential for less fish in a portion -- should be unacceptable and thus rejected by Codex through a revision to the current pending labeling amendment to Standard 166-1989.

14. In principle, we agree with the U.K. in that consumer information should always be as accurate and certain as possible and consumer fraud should be discouraged. Moreover, the U.K. is correct that AOAC Method 996.15 cannot detect added water or additives.

b. Nitrogen and carbohydrate content – Cost and Practicality

15. The U.K. is offering a determination of nitrogen and carbohydrate content as a way of eliminating, or at least minimizing, that additional uncertainty as well as the potential for less actual fish in the portions than is claimed on the label. The issues before us are whether it in fact does so and whether it is sufficiently practical to adopt as a replacement for A.O.A.C Method 996.15 in Standard 166-1889. The U.K. has provided the CCFFP with two excellent discussion papers on this subject that form the basis for the analysis in this paper.

16. While the addition of water and/or additives definitely can occur in these products, we have no insight into the frequency with which consumers are being exposed to this practice in a way that results in deception. We can say, however, that if water is being added in significant quantity and sold as fish, it is occurring with the acquiescence of the processors of frozen coated fish products because an incoming fish block that has been substantially treated with STP feels slippery relative to other blocks and can be recognized. (We have been advised that where treatment with STP has been minimal, detection can be more difficult.) Moreover, treatment with a chemical such as STP is the only way known to us to add water that will not be squeezed out during the process that compresses fish into the fish blocks from which individual pieces are cut. Treating with STP causes added water to "bind" to the fish, in contrast to "unbound" water that could be added without benefit of STP. Added "unbound" water will be squeezed out.

17. There are legitimate uses for STP that can benefit consumers when the application of STP does not result in excessive moisture gain. In countries where STP use is legal, honest companies will either drop suppliers that sell blocks made from fish that have been excessively treated or they will accept those blocks

and alter their labeling to indicate the presence of STP. They will also alter the amount of breading per fish stick or other product in order to limit breading to no more than 50 percent. Presumably, in countries where STP use is illegal, honest processors will reject the blocks. Consequently, to the extent that the problem exists, it is largely the result of dishonest processors knowingly accepting STP-treated blocks when they should not, or accepting such blocks and failing to appropriately label and adjust breading. This problem would appear to be limited primarily to dishonest processors of frozen coated fish products.

18. Another factor that might limit the scope of the problem is the extent to which the water loss that normally occurs when fillets or minced fish are compressed into fish blocks offsets any water gain that has occurred through treating with STP. We are not aware of studies on how much natural water from the fish is routinely lost when pressure is applied to create a fish block, but we have received from industry sources a rough estimate of 2-3 percent.

19. Because we have no insight into the extent to which labeling fraud is occurring in international trade in these products as a result of added water and additives and because the extent of the problem may be self-limiting in some respects, we cannot confirm that a consumer fraud emergency exists that warrants drastic action. For that reason, we suggest that if the AOAC Method 996.15 were to be deleted from Standard 166-1989 and replaced with another, the replacement method should be roughly equivalent to it in terms of cost and overall practicality.

20. As described in the U.K. discussion papers, determinations of nitrogen content plus carbohydrates would be conducted by regulatory authorities in order to check on the validity of labeling claims made by processors. Doing so on an international scale would appear to involve the following:

- 21. **Ability to perform Kjeldahl method:** Some regulatory laboratories and their personnel would have to be equipped and trained to perform Kjeldahal analyses. For the products included in Standard 166-1989, this ability would be necessary at least in the producing countries. Importing countries that wish to verify the labeling claims made for their imports would also want this capability. In addition, as the 2002 U.K. discussion paper points out (see paragraph 30), the same capability would be necessary in countries that produce products encompassed in other Codex standards, e.g., the Codex Standard for Quick Frozen Blocks of Fish Fillet, Minced Fish Flesh and Mixtures of Fillets and Minced Fish Flesh (Codex Standard 165-1989).

- 22. **Ability to measure carbohydrates:** The Kjeldahl analysis cannot distinguish between nitrogen in the fish and any nitrogen that might be in the breading or in additives. Distinguishing one from the other is essential in order to avoid a result that suggests there is more actual fish in the product than there really is. In order to subtract out any nitrogen that might be in the breading, separate analyses would be needed. One possibility would be to perform existing AOAC Method 996.15 as a first step, since this method involves scraping the breading off the fish core. However, the 2002 U.K. discussion paper at Annex A calls for an analysis of the percentage of carbohydrates in the product as a way of calculating the percentage of "non-meat nitrogen" in the product. The percentage of "non-meat nitrogen" (as essentially measured by the percentage of carbohydrates in the product) would then be subtracted from the percentage of total nitrogen in the product. As a practical matter, therefore, regulatory laboratories performing the overall determination would have to be equipped and trained to analyze for carbohydrates. As described in the U.K. paper, this analysis would include analyses for the percentages of water, fat, proteins and ash in the product.

- 23. **Cost comparison -- Kjeldahl plus carbohydrates vs. existing method:** In order to measure the core of a fish stick or other product, AOAC Method 996.15 involves scraping the breading off of the product. In order to measure nitrogen content plus carbohydrates, four separate chemical analyses would be needed. We estimate that in order to test a "lot" of products, the Kjeldahl method plus carbohydrate analysis would cost approximately ten times (10x) more than AOAC Method 996.15.

- 24. **Development of nitrogen (N) factors:** After subtracting the percentage of "non-meat nitrogen" (essentially the carbohydrates) from the percentage of total nitrogen, the result would be divided by a nitrogen (N) factor that had been developed for the species being processed. If we understand the N factor correctly, it is the percentage of nitrogen that a particular species should possess after processing in accordance with GMPs designed to keep water uptake during processing

to a minimum. A finding of a nitrogen percentage that is below the N factor would at least suggest the possible presence of added water or additives.

25. The U.K. discussion papers do not include a formula for calculating N factors; presumably a formula for international use would have to be agreed upon by the CCFFP and thus would have to be taken up by the committee as future work. However, we note that the "interim" N factors listed in Table 2 of the U.K. discussion papers are consistently 8 percent below the mean nitrogen percentages for each species.

- 26. **N factors – first step: determining the mean and range of nitrogen content in individual species:** Table 1 in both U.K. discussion papers provides both the mean nitrogen content and the range of nitrogen content for eight species of fish as taken from the sea. For seven of the eight species it also indicates the number of samples that were taken to develop the mean and the range.

27. As the U.K. discussion papers point out, most of these means and ranges are "based on data from U.K. fisheries, so similar figures would need to be developed to account for different fishery stocks and species of fish from other geographic locations worldwide" (see paragraph 24, 2002 U.K. discussion paper). Consequently, sampling and analyses would have to be performed on a country-by-country basis or on a regional basis, or through a combination of country-by-country and region, as appropriate. Some form of international sampling strategy (e.g., country-by-country or regional or combination of the two) would have to be worked out and generally agreed upon. It is worth considering what this enterprise might involve.

28. In addition to the country-by-country vs. regional consideration, the major factors that we have identified are: (1) an accurate identification of all of the significant species used in international trade in these products; (2) an accurate identification of all of the locations from which these species are harvested, as well as times of year, since, as the U.K. points out, "nitrogen levels vary…within species due to different fishing grounds, fish size, time of year, sex or spawning cycles" (see paragraph 15, 2002 U.K. discussion paper); (3) the number of samples that would have to be taken per species in each country's or region's sampling plan in order to provide an internationally acceptable level of certainty; and (4) the cost per sample.

29. Presumably an inventory of all the species, harvesting locations, and times of year could be developed by countries surveying the industries involved. Arriving at an international understanding on the number of samples that should be taken per species would require considerable discussion and analysis, given the complexity of the subject. It would be essential to inventory all the variables and then analyze their impact on sampling regimes. In addition to location, fish size, time of year, sex, and spawning cycles, as pointed out by the U.K., other possibilities include: (a) depth of capture, since some species are known to exhibit significantly different moisture levels when captured at different depths in the water column; and (b) stress factors, since a fish population that experiences a change in the environment, such as lack of food, loss of habitat, or disease, will generally lose flesh protein content. An understanding of all of the variables would be essential to the development of statistically significant sampling schemes in order to reduce the uncertainty of the outcome to some internationally acceptable level.

30. Our admittedly "back-of-the-envelope" calculation of the number of samples needed per species in order to be 99 percent sure that the calculation of the mean nitrogen percentage is within one-half percent of the actual mean is just under 1,000. This figure assumes that there are no significant variables that would affect the sampling scheme and cause the number of samples to increase in order to achieve this level of certainty. It appears, however, that the variables mentioned in the previous paragraph do have the potential to affect the sampling scheme significantly. Each variable could require its own sampling scheme and its own number of samples. Moreover, these sampling schemes would likely have to be repeated for each geographic location and possibly for other variables as well.

31. One anticipated consequence of this kind of sampling on an international scale would be that each species would have more than one mean nitrogen percentage reported for it depending on geographic location and the other variables. A regulator attempting to compare the nitrogen percentage found to be in a sample of frozen coated fish product against the mean nitrogen percentage for a particular species (as adjusted into the final "N factor" as described below) would

have to know which mean nitrogen percentage to apply to that particular sample. It could be necessary to link geographic location, season of year, depth of catch, etc. to the fish in each box.

32. Once the species had been inventoried and the number of samples per species had been determined on the basis of harvest locations, times of year, and all other agreed-upon variables, the total number of samples needed for an international database could be estimated. A total cost could then be estimated by multiplying the total number of samples by the cost per sample. The cost-per-sample would include: (1) cost of catching and holding on the fishing vessel; (2) cost of transport to a laboratory; and (3) cost of the analysis. The activities on board the fishing vessels might have to be controlled to ensure that no water uptake occurred while the fish were on board the vessel, since the purpose of the analysis would be to determine the percentage of nitrogen in the fish at the moment of catch.

33. It is important to recognize that we are not describing a one-time enterprise. The U.K. points out that N factors should be revisited and updated periodically (see 2002 U.K. discussion paper, paragraph 23). We agree. For example, factors such as "El Nino" weather patterns could have a significant effect on nitrogen values. Also, this enterprise would have to be repeated for the species used in products covered by other Codex Standards that would need to be amended for consistency with Codex Standard 166-1989.

- 34. **N factors – second step: determining the final N factor for each species:** As mentioned previously, in order to account for unavoidable water uptake during processing, the interim N factors calculated by the U.K. are 8 percent below the mean nitrogen percentages for each species. The threshold question, therefore, is whether 8 percent below the mean should be considered a universal value. Examination would likely be necessary into whether different species uptake water differently during processing, or whether individual species uptake water variably during processing depending upon location of harvest, time of year of harvest and related factors, or whether different processing conditions in different countries should legitimately result in N factors that differ from one country to another.

35. Answering these questions could be a significant undertaking. The U.S. government worked with its scallop industry several years ago to develop data to help determine what the minimum water uptake would be for scallops if processed under GMP; this work involved the acquisition of considerable data over time. In this case, as the U.K. has pointed out, "The very nature of the wet processing of fish is such that changes can take place at virtually all stages of a process which alter the chemical composition of the fish" (U.K 2000 discussion paper, paragraph 12), so the data that would have to be collected might be substantial. We cannot predict the collective international cost of developing the data necessary to calculate N factors. We can, however, envision debate over what would be meant by the concept of "minimum uptake." Would it mean, for example, "minimum" when using the world's most advanced technologies and practices or "minimum" when using the practices and technologies available in a particular country? If the latter, it is entirely plausible that more water uptake would be allowable in "Country A" then in "Country B," depending on conditions and practices, as suggested previously

36. **N factors – third step: developing GMPs:** In order to ensure that processors keep water uptake to the minimum in accordance with GMPs, it might be necessary to write GMPs. For this reason, the U.K. has proposed that the CCFFP amend the Code of Practice for Fishery Products to include such GMPs, or at least a reference to them (2000 discussion paper, paragraph 25).

37. It is possible that each country that processes products subject to Standard 166-1989 would also need to write its own GMPs in order to require adherence to them by the processors in that country and to establish a specified percentage below the mean nitrogen percentage for a species as being the maximum allowable water uptake for labeling purposes. While, as the U.K. points out, such GMPs would be meritorious in their own right, many countries, including the United States, have outstanding safety-related agendas and finite public health resources to implement them. The emerging need to develop and implement food security measures based on a risk of deliberate contamination only compounds this situation. We recommend that the CCFFP carefully consider whether the development of non-safety GMPs for fish sticks should become a pre-condition for trade in these products. At best, the time frames for development and issuance of national GMPs, including the issuance of mandatory

national N factors for labeling purposes, would have to be protracted in order to account for more urgent matters and finite resources.

- 38. **Linking chemical tests to in-factory inspections:** In this regard, it is also worth noting that when a chemical test indicated the possibility of added water or additives, it would trigger an in-factory inspection by the regulatory authority. As described below, a chemical test alone could not determine whether packages were mislabeled (see U.K. 2002 discussion paper, paragraph 22). While inspections are generally meritorious in their own right, we can predict that in many countries an inspection generated by a labeling concern would compete with inspections that are oriented toward safety. The resources needed to verify label declarations on packages of fish sticks and related products – whether to develop N factors, GMPs, or to conduct inspections – must be considered in the context of overall public health priorities and resources.

- 39. **Effect on industry costs:** The effect on industry practices and costs as a result of verification by regulators of labeling claims through nitrogen determinations cannot be easily predicted. The 2002 U.K. discussion paper, Annex A, recommends that processors measure content by weighing the core – essentially the same concept as currently incorporated in Standard 166-1989 – although the U.K. does not recommend the use of AOAC Method 996.15. Since longstanding industry practice has been to measure and cut incoming fish blocks by weight, we assume that the U.K. recommendation would not, itself, generate notable costs to industry. Nonetheless, a processor would find itself in the dilemma of using a test that is less than fully predictive of what a regulator might find for the same fish through determination involving nitrogen and carbohydrates. As described below, nitrogen and carbohydrate determinations have their own uncertainties and are capable of generating false positives. All of this would be true even though a processor might have examined its incoming fish blocks and determined that they contained no significant water added. Processors that begin conducting their own nitrogen and carbohydrate analyses in order to predict the behavior of the regulator would incur additional expenses due to a loss of fish because these tests would be intrusive and involve the expenditure of product. As an additional matter, analyses by regulators that generated false positives could also result in expenses through loss of fish.

c. Nitrogen and Carbohydrate Content – Uncertainties

40. At some point the regulator must decide whether the labeling on a box of frozen coated fish product is accurate or not, i.e., whether the fish content is at least 50 percent of the product by weight. As described below, we have identified several principal uncertainties that could affect whether the regulator could make the right decision, or whether it is even possible to for the regulator to know whether the right decision has been made.

- 41. **Distinguishing the breading or batter from the fish:** As described previously, an early stage in the analysis includes distinguishing the breading or batter from the fish. AOAC Method 996-15 involves scraping the breading or batter from the fish. If this method is used, it is worth remembering that a 2-4 percent "adjustment" has been allowed for in the result. This percentage range may be thought of as an uncertainty baseline, to which all additional uncertainties would be added.

42. As described previously, the U.K. does not recommend AOAC Method 996-15 to distinguish fish from breading or batter; instead, it recommends measuring the carbohydrates in the product in order to determine "non-meat nitrogen" (see 2002 U.K. discussion paper, Annex A). As part of the determination, non-meat nitrogen would be subtracted from total nitrogen. Although we do not fully understand all the steps in the carbohydrate analysis as described in the U.K. discussion paper, we still perceive issues with it that could add significantly to the uncertainties inherent the overall fish content analysis.

43. It is reasonable to assume that most of the breading or batter in the product consists of carbohydrates, so subtracting out carbohydrates to account for the breading is a reasonable start. However, breading and batter can contain some protein that must somehow be distinguished from the fish protein. It appears to us that the U.K. has attempted to do this by assuming that breading or batter typically contains about 2 percent protein. Thus, according the formula as we think we understand it, if one knows the percent of the carbohydrates in the product, and multiplies that number by 2 percent, one

then knows the percent of "non-meat" nitrogen in the product that should be subtracted from the total nitrogen.

44. One problem with this approach is that the specific fish stick, fillet, or portion might contain somewhere around 2 percent protein in the breading or batter, but it probably would not contain exactly 2 percent protein. This is the same problem we have with the nitrogen factor: if calculated correctly it might represent an average fish of a particular species, but is unlikely to be accurate for the specific fish stick, fillet, or portion being analyzed, given the wide range of moisture contents in fish due to a substantial number of variables. As stated previously, the more little uncertainties there are, the greater the total uncertainty when all uncertainties are added together, and the less likelihood that label declarations could provide consumers with the actual fish content even though the label would claim to do so.

45. Actually, we perceive a greater problem with the assumption that there is always 2 percent protein in the breading. The percent of protein in the breading can easily be manipulated by the addition of chemicals containing nitrogen so that the percentage can be much higher than 2 percent. We do not see how the overall analysis could distinguish this nitrogen from fish nitrogen. If the two cannot be distinguished, the calculation of fish content could be manipulated without detection, possibly to a much greater extent than it could through the addition of water. The reliance on nitrogen analysis could provide an incentive for cheating that does not exist with AOAC Method 996-15.

46. The formula for determining carbohydrates in Annex A raises an additional question. While it appears that the U.K. uses an assumption that the breading contains 2 percent protein, it also appears to require that carbohydrates be measured by calculating and adding up the percent water, fat, protein, and ash. We do not understand how the analysis could add the protein percentage to the water, fat, and ash, since the protein percentage is the very number that the whole process is attempting to figure out.

- 47. **The N factor:** If the N factor were to be calculated in the same way as the U.K. now calculates its interim nitrogen factor (i.e., a nitrogen percentage that is 8 percent below the mean nitrogen percentage of a species), a fixed number would serve as an approximation for two highly variable numbers, neither of which would be known: (1) for any particular frozen coated fish product, the actual percentage(s) of nitrogen in the original fish at the time of catch; and (2) the actual amount of water uptake that the fish experienced during processing into a stick, fillet, or portion. We are not aware of any practical alternative to establishing a single number that approximates these unknown realities but it is unlikely that this approximation would be accurate for any particular piece of fish. While the difference between the approximation and the reality might or might not be minor, it will always represent another uncertainty to be added to the others.

- 48. **The N factor relative to the range:** A comparison of U.K. Tables 1 and 2 shows that an N factor of 8 percent below the mean produces a percentage that is **above** the lowest natural nitrogen percentage recorded for any species in question. For example, in Table 2, Whiting has an N factor of 2.68 percent while the reported range of nitrogen percentages for Whiting at the time of catch is 2.35-3.35 percent (Table 1). Because an analysis of a stick, portion, or fillet that yields a percentage below the N factor would trigger a presumption that the product is mislabeled, legitimate nitrogen values at the low end of the range will always trigger that presumption, i.e., automatically generate a false positive. The difference between the N value and the lowest legitimate percentage in the range for any given species varies from 3 – 22 percent. For Whiting the difference is 12 percent.

  49. The only way we can imagine to eliminate these false positives would be to reduce the N value so that it is below the lowest legitimate nitrogen value in the range. Using the U.K. reduction of 8 percent, the N value would become 8 percent below the lowest percentage in the range, rather than 8 percent below the mean. For example, for Whiting, the N factor would become 8 percent below 2.35 percent, or 2.162. The problem with this approach is that it allows processors with fish with naturally high nitrogen percentages to add enough water to reduce the nitrogen level significantly (by as much as 35 percent for Whiting, as calculated by the difference between the high end of the range (3.35 percent) and the new N factor of 2.162) without going below the N factor. Recall that products that are not below the N factor would not raise a concern about added water.

- 50 **Linking chemical tests to in-factory inspections:** As the above discussion demonstrates, a nitrogen test alone cannot conclusively determine whether a product has been mislabeled as a result of

added water. Findings below the N factor could be the result of natural moisture levels at the low end of the range. Conversely, even with water added, the moisture level could still be within the normal range of variability for that species. Presumably for this reason, the U.K. discussion paper states that a chemical analysis should be followed by an in-factor inspection "if there is reasonable doubt that the declaration is correct." The question that this strategy raises for us is what, exactly, would the inspector be looking for? The inspector could check to determine whether processors were following GMPs, but it is not clear how the inspector could determine whether processors were using fish blocks containing fish that had been excessively treated with STP. As stated earlier, a processor would likely know of the excessive treatment through organoleptic analysis of the incoming fish blocks and would be disguising that knowledge from the public and undoubtedly from the inspector. Short of a criminal investigation that reached back to the manufacturer of the fish blocks, it is not certain how the inspector would detect the fact that the processor was excessively treated blocks. Assuming that the inspector did not detect the use of blocks containing excessively treated fish but did otherwise find the processor in compliance with GMPs, it is not clear how the regulator could conclude that the product was mislabeled. Of course, importing countries could not conduct these inspections and would rely only on analytical results for regulatory purposes.

ANNEX B

Discussion Paper on Fish Content in Fish Sticks

(Prepared by Canada)

Background

1994

At the 21st Session of the **Codex Committee on Fish and Fishery Products** (CCFFP)[1], while discussing the revision to the *Codex Standard for Quick Frozen Fish Sticks (Fish Fingers), Fish Portions, Fish Fillets - Breaded or Battered*" (CODEX-STAN 166-1989), the Committee considered a proposal to require the declaration of the amount of fish core present on the label of the product. The Committee noted that this was a matter where general guidance was required and decided to refer the matter to the **Codex Committee on Food Labelling** (CCFL).

1995 - 1997

During the 24th Session of the **CCFL**[2] (1996) and 25th Session of the **CCFL** [3] (1997), the Committee agreed that the labelling should include the declaration of the proportion of fish core in order to provide clear information to the consumer. The proposed draft amendment to the labelling section of the *Codex Standard for Quick Frozen Fish Sticks (Fish Fingers), Fish Portions, Fish Fillets - Breaded or Battered* was advanced in the Step Procedure.

1998

At the 26th Session of the **CCFL**[4], several delegations expressed the view that mandatory declaration of the proportion of the fish core would allow consumers to make an informed choice. It was also suggested that the term "fish core" included other ingredients such as water and additives and therefore, the designation of the "fish content" was more appropriate. Other delegations stated that the labelling should be voluntary, as the composition of the product was already defined in the Standard, and it was difficult to maintain an exact percentage of fish core, and to ensure enforcement of such a requirement. The Committee agreed to retain the mandatory provisions as proposed and advanced the Draft Amendment to Step 8 of the Procedure.

At the 23rd Session of the **CCFFP**[5], the Delegation of the United Kingdom informed the Committee that the EC had amended its Directive on the declaration of quantitative ingredients and noted that the percentage of fish which has to be declared in the EC no longer corresponds to "fish core" as described in the "*Codex Standard for Quick Frozen Fish Sticks (Fish Fingers), Fish Portions, Fish Fillets - Breaded or Battered*" (CODEX-STAN 166-1989, Rev.1 - 1995), but to "*fish contents*", which excludes water and additives from the declaration. The U.K. proposed to prepare a paper for consideration at the next session.

1999

At the 23rd Session of the **Codex Alimentarius Commission**[6], the delegation of Canada expressed its objection to the adoption of the draft amendment referred from the CCFL regarding the declaration of fish core in the Standard for Fish Sticks, recalling that since the initial proposal had been made, additional issues had been put forward in CCFFP, especially the definition of fish core and fish content and the methodology for the determination of fish flesh. This position was supported by several countries. As there was no consensus on this issue, the Commission agreed to "return the draft amendment to Step 6 for further consideration by CCFL at its 28th Session to determine the need for labelling requirements and by 24th Session of the CCFFP as regards the technical aspects such as the definition of fish core/fish content and the methodology."

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[1] Alinorm 95/18, para 64

[2] Alinorm 97/22, para 4 - 5

[3] Alinorm 97/22 A, para 49 - 51

[4] Alinorm 99/22, para 33 - 36

[5] Alinorm 99/18, 103

[6] Alinorm 99/37,para 127 -129

2000 - 2002

At the 28th Session of the **CCFL**[7] (2000) under Agenda Item # 2, the Committee agreed in principle the declaration of fish content should be included in the labelling section of the "*Codex Standard for Quick Frozen Fish Sticks (Fish Fingers), Fish Portions, Fish Fillets - Breaded or Battered*" (CODEX-STAN 166-1989, Rev.1 - 1995) and asked the CCFFP to consider a definition of "fish content" and the method for its determination. In addition, the CCFL agreed to hold the Draft Amendment at Step 7 and to consider it further at its next session in light of the information provided by the CCFFP with a view to its finalization.

Later in the same session of the **CCFL**[8] under Agenda Item # 10, the Committee considered the "*Discussion Paper on Quantitative Ingredient Declaration*" (CX/FL 00/12) and agreed to undertake new work on a Proposed Draft Amendment to the General Standard for the Labelling of Prepackaged Foods.

It is essential to note that due to the sequence in which these two issues where discussed by the Committee (i.e. discussions on a definition of "fish content" and the method for its determination preceded the discussions on QUID), the CCFL may not have had the benefit of considering the implications of both standards together.

At the 24th Session of the **CCFFP**[9] (2000) and 25th Session of the **CCFFP**[10] (2002), the Delegation of the United Kingdom, tabled discussion papers on the "labelling of fish sticks" that considered various issues related to the definition of fish content and proposed that nitrogen content calculated by using chemical analysis (coupled with a programme for in-factory inspection for compliance with GMPs) should be used for its determination. Several delegations expressed reservations concerning the use of this approach since it would create practical difficulties for regulatory agencies and because nitrogen factors vary between species, the use of a strict nitrogen limit could negatively impact on the accuracy of the labelling information presented to the consumer. The Committee agreed that the UK would continue the work on the practical implications of the change from the term "*fish core*" to "*fish content*," as it relates to consumer information, in order to propose a definition and a method of analysis for consideration by the Committee.

Proposed Canadian Approach

The discussion paper by the United Kingdom has presented a chemical method for measuring the amount of fish ingredient relative to all other ingredients (including water and additives) in the food. According to the U.K., the premise of declaring the amount of fish ingredient is based on Quantitative Ingredient Declaration Labelling (QUID) principles. Canada notes that QUID Labelling principles and guidelines are currently being revised by the Codex Committee on Food Labelling (CCFL). The Proposed Draft Amendment to the General Standard for the Labelling of Pre-packaged Foods, (Quantitative Ingredient Declaration Labelling) (Alinorm 03/22A, Appendix VII) is currently at Step 3 of the Procedure. The revised standard will apply to all foods that are sold as a mixture or combination and to, among other things, any ingredient that "is essential to characterise the food" or "appears in the common or trade name of the food." Breaded or battered fish sticks, fish portions, fish fillets are examples of foods that are sold as a mixture or combination where the ingredient (fish) is essential to characterise the food and appears in the common or trade name of the food.

Since Codex QUID requirements apply "horizontally" to all foods that are sold as a mixture or combination, the need to declare the amount of fish ingredient in fish sticks is already covered. Because of this, including requirements to declare the amount of fish ingredient in the breaded fish standard is repetitious and could create confusion between standards.

Canada proposes that the CCFFP discontinue work on elaborating any requirement that specifically deal with the declaration of the amount of fish ingredient as it relates to the "*Codex Standard for Quick Frozen Fish Sticks (Fish Fingers), Fish Portions, Fish Fillets - Breaded or Battered*" recognising that the Proposed Draft Amendment to the General Standard for the Labelling of Pre-packaged Foods, (Quantitative Ingredient Declaration Labelling) will provide the necessary "over arching" policy and guidance on the QUID issue.

If accepted by the CCFFP, it is recommended that the CCFL should be informed of this decision.

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[7] Alinorm 01/22, para 6 - 10

[8] Alinorm 01/22, para 78 - 81

[9] Alinorm 01/18, para 16 - 20

[10] Alinorm 03/18, para 141 - 147

ANNEX C

November 2002

SURVEY OF ADDED WATER IN RAW SCALLOPS, ICE-GLAZED (PEELED) SCAMPI TAILS, AND SCAMPI CONTENT IN COATED (BREADED) SCAMPI PRODUCTS

THIS SURVEY WAS CONDUCTED AS PART OF THE AGENCY'S FOOD AUTHENTICITY PROGRAMME, WHICH AIMS TO GATHER INFORMATION ABOUT THE DESCRIPTION OF FOOD IN THE UK.

KEY FACTS

- The aim of the survey was to determine the levels of added water in raw scallops and peeled scampi tails, as well as to check label declarations of percentage scampi content in breaded scampi.
- The results show high levels of added water in some samples of scallops and ice-glazed peeled scampi, which are not reflected in the product description. They also indicate a need to improve the labelling of some breaded scampi products.
- 48 percent of the scallop samples had added water in excess of 10 percent, and the maximum added water was 54 percent.
- 86 percent of the ice-glazed peeled scampi samples had more than 10 percent added water, and the maximum was 44 percent.
- 23 percent of the breaded scampi samples either did not give a declared scampi content or declared a scampi content at least 5 percent more than was determined by analysis. 22 percent of samples were also found to have more scampi than declared.
- All results have been passed to local authorities who will be following-up on the results. They will be checking manufacturers' compliance with a 1998 Code of Practice for Fish Products drawn up between sectors of the industry, LACORS and the Association of Public Analysts. The Code makes recommendations on the labelling of fish and shellfish products, as well as laying down good manufacturing practice to minimise the amount of water taken up in fish and shellfish during their preparation and processing.

Summary

1. The Food Standards Agency carried out a survey to measure levels of added water in raw scallops and peeled scampi tails, and to verify label declarations of percentage scampi content in coated scampi products.
2. A total of 255 samples, comprising 86 scallops, 21 ice-glazed, peeled scampi tails and 148 coated scampi products were collected in 16 local authorities throughout the UK and analysed by four laboratories. The following was found:

- 41 (48 percent) of the scallop samples, of which 23 samples were prepacked and 18 samples were sold loose, had more than 10 percent added water (excluding any ice glaze), which was not reflected in the product description. Levels of added water in the scallops ranged from 0 to 54 percent.
- Eighteen (86 percent) of the ice-glazed (peeled) scampi tail samples were found to have more than 10 percent added water (excluding any ice glaze), without an adequate indication of this. Levels of added water in the scampi tails ranged from 9 to 44 percent;
- 34 (23 percent) of the coated scampi samples were found either to have no declared scampi content (9 percent) as required by QUID labelling rules or to have a determined scampi content which was 5 percent or more lower than that declared on the label (14 percent). The maximum over-declaration of scampi content was 16 percent. 32 samples (22 percent) had a scampi content more than 5 percent than that declared. Fifty-five percent of samples were found to be labelled correctly in that they had scampi declarations which were accurate to within 5 percent declared on the label.

3. The results of the survey show that there are large amounts of added water in many of the scallop and ice-glazed (peeled) scampi tail products investigated and that some of the label declarations of scampi

content in the coated scampi products are inaccurate. All results have been passed to local authorities for any follow-up action. They will be checking industry compliance with the 1998 Code of Practice for Fish Products (the Code) drawn up between industry, LACORS and the Association of Public Analysts [(1)]. The Code makes recommendations on the labelling of fish and shellfish products, as well as laying down good manufacturing practice (GMP) to minimise the amount of water taken up in fish and shellfish during their preparation and processing.

Background

4. The preparation of fish and shellfish utilises large quantities of water to achieve good manufacturing and hygienic practice. However, fish and shellfish in particular absorb water and lose soluble nitrogen very readily during preparation and processing. In recognition of these particular difficulties, a Code of Practice on the Declaration of Fish Content in Fish Products[(1)] was published in 1998 by UK food industry organisations together with enforcement authorities. This laid the ground rules for the measurement of fish content and the definition and labelling of fish as an ingredient in fish products. It was drawn up by manufacturing, retail and catering sectors together with trading standards and public analysts, and serves as the basis for the implementation of Quantitative Ingredient Declaration (QUID)[(2)] legislation. QUID legislation requires a percentage fish content declaration to appear on the label of most fish products (where fish appears in the name of the food or is the main characterising ingredient).

5. The Code defines what is a fish or shellfish ingredient, taking account of the technically unavoidable process water uptake and loss of soluble protein associated with good manufacturing and hygienic practice. In order to verify whether these practices were adhered to, agreed interim nitrogen factors to calculate fish content or added water are detailed in the Code. The Code also gives a recommended procedure for industry and local authorities to investigate cases that do not appear to follow the Code, as well as due diligence defence procedures.

6. This survey has examined raw scallops, ice-glazed (peeled) scampi tails and coated (breaded) scampi to determine the levels of added water, as well as to verify that consumers are being provided with accurate information on the scallop and scampi content of products they are purchasing.

Nitrogen factors

7. Nitrogen content is generally used to calculate the amount of fish by means of a conversion factor (nitrogen factor). However nitrogen levels vary naturally between different species of fish and shellfish, and even for the same species because of different fishing grounds, size, sex or spawning cycles as well as handling variables such as icing. This variation is normally taken into account by choosing an appropriate average factor. In addition for the purposes of calculating a fish or shellfish ingredient content due account needs to be taken of the decrease in nitrogen that occurs during handling and processing before the shellfish is incorporated into the product, as well as any process variation. The nitrogen factors in the Code were agreed on an interim basis of taking all these factors into account and assume the fish or shellfish ingredient has been prepared under GMP. The factors serve as a trigger for further investigation by enforcement if fish contents do not match their declared values.

8. The factors for scallops were based on statutory limits of water content set by French authorities. These limits were based on data of scallop composition throughout the year. In the case of scampi tail, the factor was revised by the AMC, in 2001, from 2.33 to 2.45. The revision used data from an extensive study of scampi composition and changes in composition after processing[(3)].

Scampi and Scallop Preparation and Processing

9. Scampi is manufactured from the crustacean tails of the species *Nephrops norvegicus*, normally fished from the Irish and North Sea. Scallops are a wide family of molluscan shellfish, which include the *Pectinidae*. The King scallop (*Pecten maximum*) is the best known, but there is also the commonly called Queen scallop (*Chlamys opercularis*).

10. Initial processing of scallops and scampi involves de-shelling. Scampi normally have the head removed and are frozen in blocks at sea. Removal of the tails can be achieved either mechanically using rollers to crack the shell, or manually by using water jets to force the tail out of the shell. Because the mechanical method uses less water it has replaced much of the manual de-shelling. For scallops, manual de-shelling is followed by removal of the skirt, eyes, roe, as appropriate, and washing prior to freezing/glazing to

remove grit. The washing stage, which may also include soaking, is a critical step for minimising water uptake.

11. Scallops and scampi tails that are to be sold frozen will often be ice-glazed. The glaze is applied after freezing usually in the form of a spray of water before re-freezing the product and packing it. The glaze serves as a protective layer to reduce the effects of dehydration and oxidation, which can occur during frozen storage.

12. Coated scampi tails are described differently depending on whether the core is made from wholetails (single or several), reformed small tails and pieces of tail, or formed from minced scampi products, which are extruded into scampi shapes. The reformed core may also contain polyphosphate solution to help hold the pieces together, which would be taken into account in the scampi content declaration. The core is coated by passing through a series of batter and breadcrumb stages. The coated product may also be flash fried before freezing. Since the frying may cause migration of protein from the core to the coating it is usual to determine scampi content on the whole product. All the stages of processing will give rise to some variability in the scampi content which the manufacturer should take into account when calculating the declared value.

Legislation

13. There is no specific legislation controlling the labelling and composition of fish or shellfish products in the UK. General provisions regarding misleading labelling, and requirement that food shall have the nature, substance or quality of food expected by consumers are controlled by the *Food Safety Act 1990*[4]. More detailed legislation governing the labelling of food is given by the *Food Labelling Regulations* 1996[2].

14. For pre-packaged products, when water has been added to a food and is present in amounts greater than 5 percent in the finished product, then it must be declared in the ingredients list. In addition, provisions on the quantitative ingredient declaration (QUID) in the Food Labelling Regulations[2] have been in force since February 2000. These require the characterising ingredient or an ingredient mentioned in the name of the food to be quantified. For most fish products, the QUID declaration would be based on the characterising fish content, not the water. The amount of water present can however be inferred indirectly from the QUID declaration of the fish content. Yet, there are cases where a QUID declaration is not required even for a product where fish is the main ingredient. For example, where a drained weight or weight net of glaze is given on products with a covering medium of water (such as ice glazing), but this is provided that the fish or shellfish core does not contain any other ingredient than fish or shellfish. A QUID declaration is not required for non-prepacked products i.e. those sold loose, however the name of the product should still reflect its true nature i.e. declare added water if it is added in significant amounts. The Code of Practice also gives non-statutory guidance on descriptions of fish and shellfish ingredients e.g. fish blocks made up with fillets or mince, as well as how to calculate fish content in fish products.

Sampling

15. Samples were collected, during November 2001, by local authorities in the following areas of the UK: Aberdeen, Birmingham, Cornwall, Cumbria, Denbighshire, Essex, London Borough of Ealing, Luton, Medway, Moray, North Yorkshire, Northern Ireland, Nottingham, Somerset, Tyne & Wear and West Lothian. Collecting officers were provided with a written sampling protocol and sampling plan detailing the type of samples to be collected and the product information to be recorded on a specially designed sample collection form.

16. Samples were collected from a range of retail outlets including supermarkets, independent retailers, catering suppliers, fishmongers to other retailers.

17. A total of 255 samples, comprising 86 scallops, 21 ice-glazed scampi tails and 148 coated scampi products were collected. Scampi products included fresh/frozen coated (breaded) scampi (single wholetail, wholetail, formed and reformed scampi), uncooked meal packs containing scampi (e.g., scampi and chips ready meal); and ice-glazed (peeled) scampi tails. Scallop products included raw fresh/frozen whole scallops (with or without viscera and roe) and scallop meat (including ice-glazed products). Details of the samples collected are included in Tables 1, 2 and 3.

18. Analysis of the samples was by a combination of 4 separate accredited laboratories, two public analyst (PA) laboratories, one former PA laboratory and one private laboratory.

METHODOLOGY

19. Each sample of raw scallop or ice-glazed scampi was analysed for nitrogen and moisture, whilst coated scampi products were analysed for nitrogen, moisture, fat, and ash using internationally accepted methods or approved equivalents[5] outlined in an analytical protocol provided by the Agency. For ice-glazed products it was necessary to first determine the amount of glaze, before analysing for the fish content of the core. The method outlined in the CODEX Standard for quick frozen shrimps or prawns, *Codex Stan 092-1981 (rev.1 – 1995)* was used. As a precaution, to ensure that there was no loss of nitrogen during ice glaze determination, a portion of the water used to remove the ice glaze was analysed for nitrogen. However, no sample required correcting for such loss.

Analytical Quality Assurance

20. As a quality control check on the chemical analyses, each laboratory was required to analyse in each batch, in duplicate, a reference material from round 03 of FAPAS series 25 with assigned levels of the above analytes. Acceptable batches had to show measurements for this material within two standard deviations of the assigned value and the duplicate analyses were required to be within the repeatability characteristics of the method. All of the laboratories returned satisfactory data for the analysis of the FAPAS material.

21. Because the Codex method is operator dependent, two laboratories experienced in using the Codex method for ice glaze were chosen to carry out this analysis and some 23 of the 86 scallop samples were cross checked between the two laboratories.

Calculation of results

22. The scallop or scampi content of the sample was calculated using the following

equation:

$$\% \text{ scallop or scampi} = \frac{\% \text{ total nitrogen } *}{\text{N factor } **} \times 100$$

*for ice-glazed samples, % total nitrogen is nitrogen content of sample plus any nitrogen in water bath (i.e. 100ml aliquot of water taken from container in accordance with ISO 937 or equivalent)

** appropriate N (nitrogen) factors:

Scallops (King)	= 2.64
Scallops (Queens)	= 2.55
Scallops (not specified)	= 2.55
Scampi tail	= 2.45

23. The percentage of added water was calculated by difference using the following equation (percentage protein calculated as total nitrogen x 6.25, ice glaze removed and deducted first):

% added water = % moisture - (% scallop/scampi - % protein)

Method Uncertainty

Scallops and ice-glazed Scampi – Determination of ice-glaze, moisture and nitrogen

24. A statistical analysis of the results gave an uncertainty of 6.8 percent. This figure reflects both inter/intra laboratory variance as well as sampling variation in the products. It also takes account of the 23 scallop products that were analysed in duplicate by two laboratories (see para 21). When this value is applied to each result, a range of values is given, within which the true value is expected to lie with a level of confidence of 95 percent. This agrees well with published reproducibility data for the Codex method in a collaborative trial comparing 4 methods of ice-glaze published in 1989[6] of 5.0 percent for scampi and 4.3 percent for scallops. A combined uncertainty for nitrogen and moisture determination of 2-3 percent[5] is assumed at the 95 percent confidence level. On consideration of all these factors, it

was decided to apply a 10 percent method uncertainty to the added water results for scallops and scampi, and hence only highlight values above 10 percent added water.

Coated Scampi Products (Chilled and Frozen) – Determination of moisture, nitrogen, fat and ash content

25. The chemical analysis involved the determination of moisture, nitrogen, fat and ash[5] content of the homogenised sample by preparing the whole coated product for analysis. For 'meal pack' type products comprising a coated scampi and a chips portion, only the coated scampi portion was analysed. Where a percent scampi declaration was given for a meal pack product and this related to the whole pack as sold, both the coated scampi portion and the chips portion were separately weighed prior to analysis. This was so that the on-pack declaration could be converted to represent just the coated scampi portion analysed (i.e. excluding the chips).

26. An appropriate allowance has to be made for any 'non-shellfish' nitrogen associated with the coating. The scampi content was calculated from the nitrogen content of the sample by the Stubbs and More approach[7], which deducts any nitrogen from other ingredients before calculating the meat or fish content. It was noted that in some cases samples had other ingredients (apart from breadcrumbs or wheat flour) which may contribute nitrogen. In most cases the ingredients were so minor that their relative nitrogen content would be insignificant, but samples declaring soya addition were analysed for their soya content and the nitrogen contribution calculated. In all these cases too, the differences were not considered significant.

27. The generally accepted amount of nitrogen contributed by wheat flour is 2 percent. Hence the carbohydrate content of the coated product (calculated by difference) is multiplied by 0.02 to calculate the "non-scampi" nitrogen. Some manufacturers are also using wheat or other types of starch in the batter mix, which have an insignificant amount of protein. Where starch-containing ingredients were listed as an important/significant ingredient of the batter, a more appropriate factor of 0.015 has been used to calculate any 'non-meat' nitrogen. In all other coated scampi products a factor of 0.02 was used.

Calculation of results

28. The percentage scampi content, corrected for the non-meat nitrogen contributed by the carbohydrate coating, was calculated as follows:

$$\% \text{ scampi} = \frac{(\% \text{ total nitrogen} - \% \text{ non-meat nitrogen})}{\text{N factor*}} \times 100$$

*appropriate N (nitrogen) factor:

scampi = 2.45

29. The non-meat nitrogen was calculated as follows:

% non-meat nitrogen = % carbohydrate X *0.02

*(or 0.015 in appropriate cases, see para 27)

Where the carbohydrate is calculated by difference:

% carbohydrate = 100 – (%water + %fat + %protein + %ash)

Method Uncertainty

30. In a statistical analysis of the determined scampi content results, the average measurement uncertainty associated was 3.1 percent. This figure reflects the FAPAS analysis results incorporated as a quality control procedure in the method. This agrees with reproducibility data of the methods[5]. It was decided to apply a 5 percent method uncertainty at the 95 percent confidence level to the scampi content results, and highlight those samples which differed by more than 5 percent of the declared value**.**

Results & Discussion

Scallops

31. Of the 86 scallop samples tested, 40 were ice-glazed and 46 were not. Thirty-five (41 percent) of the 86 were loose (non pre-packed) products. Of the samples which were not ice-glazed, 14 (30 percent) were

frozen (without ice-glazing) and 32 (70 percent) were fresh (unfrozen) samples. The full results are listed in Table 1.

32. The levels of added water found in all the scallop samples tested ranged from 0 to 54 percent. Twenty-four (28 percent) of the samples had water as a listed ingredient on the product label, 1 product had an added water content declaration (accurate to within 3 percent of the results found) and 23 (58 percent) of the ice-glazed products had drained weight information.

33. Of the 86 scallop samples, 41 (48 percent) were found to have more than 10 percent added water without an indication of this in the description. However, 14 (34 percent) of them did have water listed as an ingredient on the label. Thirty (73 percent) of the 41 samples with more than 10 percent added water were ice-glazed and 11 were not. Twelve (40 percent) of the 30 ice-glazed samples with more than 10 percent added water had neither water listed nor any drained weight information on the product label.

34. Eighteen (44 percent) of the 41 samples with more than 10 percent added water were loose (non pre-packaged) scallops collected from fishmongers and supermarket delicatessen counters and the added water found in these ranged from 11 to 42 percent. Non pre-packaged foods are exempt from the requirements of QUID[(2)], but must be accurately described to consumers and should still be prepared/processed in accordance with GMP. The other 23 (56 percent) prepacked samples with more than 10% added water should have given a scallops content in the list of ingredients.

Ice-glazed (peeled) Scampi tails

35. Twenty one non-coated scampi tails were tested for their added water content, all of which were ice-glazed and prepacked. The full results are listed in Table 2.

36. The levels of added water found in these samples ranged from 9 to 44 percent. Sixteen (76 percent) of the samples had water as a listed ingredient on the product label, 2 products had water content declarations (accurate to within 3 percent of the results found) and 3 samples did not list water. Nineteen (90 percent) had either a glaze weight declaration or drained weight information. Ten samples also listed polyphosphate as an ingredient.

37. Of the 21 samples, 18 (86 percent) were found to have more than 10 percent added water (excluding any ice glaze), without an indication of the scampi content in the list of ingredients. Of the 18 samples, 15 (83 percent) had water in the list of ingredients, one sample had a drained weight, and two samples had neither water listed nor any drained weight information.

Coated Scampi

38. One hundred and forty eight coated (breaded) scampi products were tested for their fish content. The analytically determined fish content for each sample was then compared with any label declaration of fish content. The full results comparing the apparent scampi content and the declared scampi content are listed in Table 3.

39. Of the 148 products, 14 (9 percent) did not have any label declaration of percentage scampi content and a further 20 (14 percent) were found to have a determined scampi content which was more than 5 percent lower than that declared. A range of scampi content differences up to 16 percent less than that declared on the label was found. However, of these 148 products there were also 32 (22 percent) found to have a fish content more than 5 percent greater than that declared on the label, with differences up to 19 percent. Fifty-five percent of samples were found to be labelled correctly in that they had scampi declarations which were accurate to within 5 percent above or below that declared on the label.

Conclusions

Raw Scallops and Ice-glazed (peeled) Scampi

40. The survey found added water in amounts greater than 10 percent, in 48 percent of scallop samples and in 86 percent of ice-glazed scampi tail samples. Although 34 percent of the scallop samples and 83 percent of ice-glazed scampi samples found to have more than 10 percent added water listed water as an ingredient in the product, their product name failed to reflect this. Problems were found in products from 24 of the 44 processors of scallops sampled, and 11 of the 14 processors of ice-glazed scampi sampled. The levels of added water in these products indicate that their description or labelling needs improvement.

Coated Scampi

41. The survey found 34 (23 percent) coated scampi samples either to have a determined scampi content of more than 5 percent than that declared on the label or no declaration of scampi content. The 34 samples were produced by 18 of the 44 manufacturers. The largest over-declared scampi content was 16 percent, but 9 percent of samples failed to declare a scampi content. Six out of 44 companies had products without a scampi content, and 2 of these companies were responsible for 9 (75 percent) of the undeclared samples. There appears to be some problems in giving an accurate QUID declaration of scampi content, which need to be addressed.

Follow-up Action

42. Trading Standards Departments and relevant Home Authorities have been informed of the results to enable them to carry out any follow up action that they consider appropriate. In accordance with the Code, where the results of chemical analysis and calculation raise doubts on the veracity of label information, an in-factory inspection of the manufacturing premises should be triggered, after consideration of all relevant information available.

43. Advance results of the survey were sent to all companies from which either: coated scampi products were found to have a determined scampi content which was more than 5 percent lower than that declared on the label; or no declaration of fish content as required by QUID rules was present. Advance results were also sent to all companies from which scallop and ice-glazed scampi products were found to have the presence of more than 10 percent added water (excluding any ice glaze), without an adequate label indication of this. These companies were given the opportunity to comment on the results of the analysis. Comments received from companies are reproduced in Annex 1.

References

(1) Code of Practice on the Declaration of Fish Content in Fish Products, UKAFFP, BFFF, BRC, BHA, Seafish Industry Authority, LACOTS and APA. March 1998.

(2) Regulation 19 (Quantitative Ingredient Declaration) of the Food Labelling Regulations 1996 (as amended by SI 1999 No. 1483 (Food)). *Statutory Instrument* 1996 No. 1499. London: HMSO, 1996.

(3) Report by the Analytical Methods Committee. Nitrogen factor for *Nephrops norvegicus* (scampi). Analyst, 2000, 125, 347-351

(4) Food Safety Act 1990. S. 14.

(5) British Standards Institution, BS4401: Analytical methods for meat and meat products. Determination of ash: Part I, 1980 (ISO 936:1978); Determination of nitrogen: Part 2, 1980 (ISO 937:1978); Determination of moisture: Part 3: 1970 (ISO 1442:1997); Determination of total fat: Part 4, 1970/1986 (ISO 1443:1973)

(6) Hodson, G C, Scotter, M J and Wood, R. Methods of Analysis for the Determination of Ice-glaze on fish Products: Collaborative Trial. Journal of the Association of Public Analysts, 1989, 27, 85-108.

(7) Stubbs, G. and More, A. (1919). The estimation of the approximate quantity of meat in sausages and meat pastes. *The Analyst*, **44**, 125.