Causes of detentions and rejections in international fish trade[1]

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ABSTRACT

Fish and fishery products are one of the most traded food commodities. About three-quarters of the world's fish exports are destined for three main areas: the European Union (EU), the United States of America (USA) and Japan. These three markets dominate in terms of both prices and market access requirements.

Thousands of tonnes of seafood products are detained, rejected or destroyed each year at the national borders of importing countries. This is a post-harvest loss that could and should be prevented. Despite World Trade Organization (WTO) agreements calling for the harmonization of standards, exporters still face safety and quality standards and control regimes that vary from one market to another.

This paper summarizes an FAO study comparing fish safety and quality import regulations in the EU, North America and Japan, and the causes of detentions and rejections of fish products entering those markets. It calls for agreed international control systems and import standards based on objective and science-based criteria and techniques.

INTRODUCTION

Fish and fishery products are one of the most traded food commodities. This trade is likely to increase in future in response to the ever-increasing demand for fish and seafood. However, thousands of tonnes of imported fish and seafood products are detained, rejected or destroyed each year at national borders of many importing regions in the world. This is a post-harvest loss that could be prevented, at least in part, thereby providing more value for fishing efforts, making more fish and seafood available for human consumption, and reducing pressure on fish stocks.

One of the most serious difficulties for exporters is that their products encounter standards and safety and quality requirements that vary from one market to another. These differences concern regulations, standards, and control procedures, including controls at the border where seafood products can be rejected, destroyed or put in detention while decisions are taken as to whether they meet importation requirements. To promote harmonization and equivalence among seafood trading nations, these differences need to be reduced and ultimately removed. They should be replaced by agreed international control systems and standards based on objective criteria and scientific techniques.

RELATIVE FREQUENCY OF 'BORDER CASES' BY IMPORTING REGION

The term 'border case' is used to describe any situation where a fish product is detained, rejected, destroyed, returned to sender, or otherwise removed, even if only temporarily, from the trade flow.

[1] This paper is a summary of "Causes of Detentions and Rejections in International Fish Trade" prepared by Ababouch *et al.* (FAO, 2005).

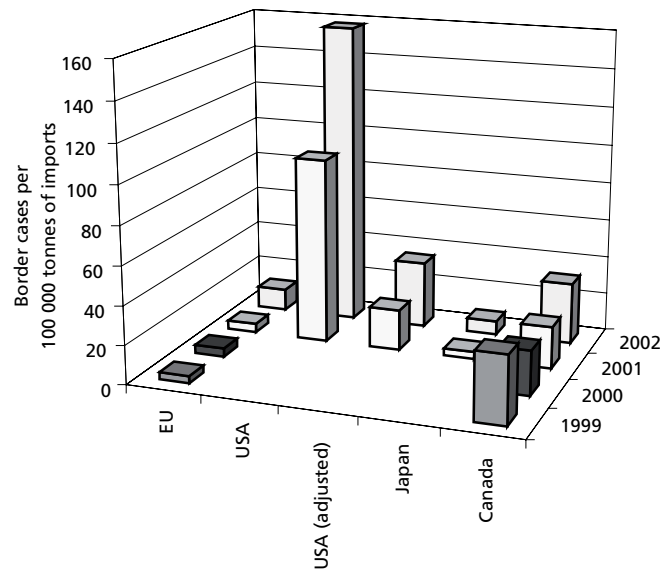
Figure 1 shows a quite dramatic difference in the absolute numbers of border cases in the various importing countries and regions, when shown relative to import quantities. At first glance, the United States of America (USA) has around 10 times as many border cases per 100 000 tonnes of product as the EU or Japan, and 3 to 4 times as many as Canada. This does not necessarily mean that the USA has a higher performance in border controls or that products exported to that market have more non-conformity problems. The data need to be adjusted to enable comparisons of performance between the regions studied. There are three main reasons why the number of border cases in the USA is overstated.

Firstly, a high percentage of cases end up with the product actually entering the USA after re-examination, sorting, re-packing, new documentation and information, or new labelling. During 1999–2001, 78 percent of detained shipments were released for import into the USA (Allshouse et al., 2003). Therefore, only around 22 percent of the USA cases should be considered as a bona fide border case. Taking this into account, the USA had only about twice as many border cases as the EU and Japan, and only 60 to 80 percent more than Canada (see Figure 1, adjusted USA data).

Secondly, the other countries or regions, especially the EU, use some sort of 'prevention at source' approach. Indeed, the EU relies on national Competent Authorities (CAs) in exporting countries to examine establishments and products to assess their conformity to EU requirements prior to shipments. Therefore, some potential non-conforming cases are detected and stopped before they leave the exporting countries. This approach has proven to be more cost effective than relying solely on controls at the border. However, it can also penalize seafood companies, however well managed, in countries that do not have the resources or the capacity to establish a CA that meets EU requirements.

Likewise, Canada, and to some extent Japan, have adopted a 'prevention at source' approach, although less formalized and less active than that of the EU. Canada has concluded 'agreements' with a limited number of countries: Australia, Ecuador, Iceland, Indonesia, Japan, New Zealand, Philippines and Thailand. Japanese importing companies have a long tradition of fielding quality controllers to work at exporting sites. In both cases, a number of non-conformity cases are eliminated before consignments are shipped.

FIGURE 1
Total border cases for EU, USA, Canada and Japan for 1999–2002, relative to import quantities



In more and more countries, including the USA (NAS, 2003), experts advise administrations to adopt a 'prevention at source' approach because of its higher performance and cost effectiveness. Prevention at source creates a win-win situation for the exporter and for the importer. While reducing safety and quality problems experienced by the importer, the inherent costs and damages of border cases are reduced for the exporter. At the same time, administrations save significantly on resources needed to manage controls at their borders and are better able to target problem cases, thereby further increasing

efficiency. Moreover, reducing losses due to rejections and detentions should eventually result in a larger supply of safe fish and less illnesses from consuming unsafe foods. However, care must be exercised when introducing the 'prevention at source' approach to ensure that exporting developing countries are helped to build the national capacity needed to ensure the safety and quality of their fish products destined for export.

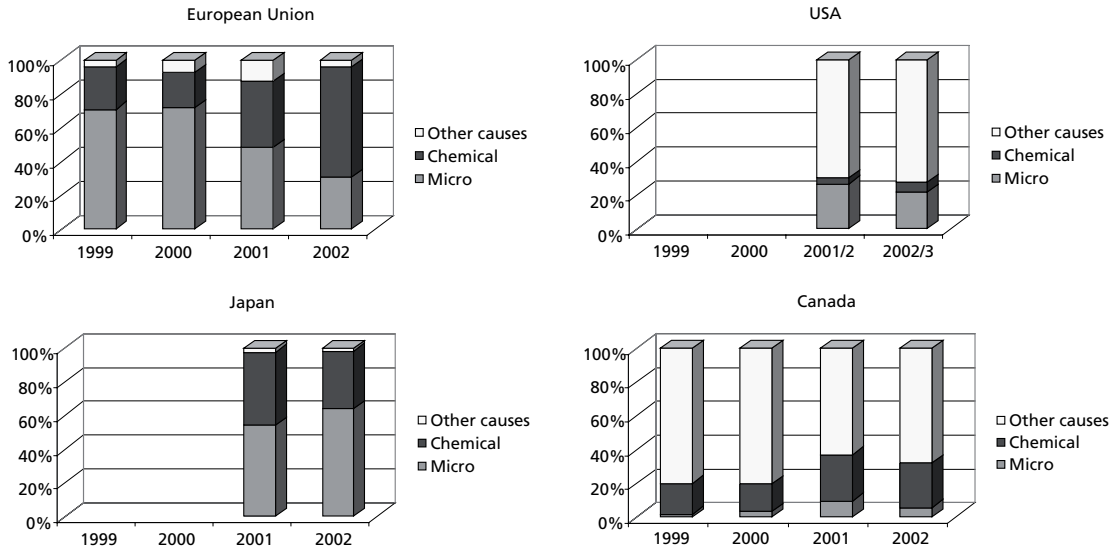
A third difference is the types and methods of control and the standards applied at the border by the importer. In the countries studied, not only are border checks different, the analytical techniques used and the criteria or standards applied to judge conformity or non-conformity also differ from one country to the other. Most importantly, criteria and standards are not always based on fully-fledged scientific risk assessments. This can create arbitrary barriers to trade and is also costly, as it may cause safe products to be refused in some regions while unsafe products are distributed in others. Consequently, there is a need to harmonize procedures and standards, at least as a first step amongst major markets, using risk assessment methodologies where applicable.

Categories of border cases: patterns and trends

The breakdown of border cases into three main categories—microbial, chemical, and other causes—for three countries and the EU are summarized in Figure 2. The differences in the profile of these major importers are quite obvious. The EU and Japanese border cases are predominately microbial or chemical in origin, while these causes only account for a quarter to a third of border cases in the USA and Canada. Notably, the well-publicized increase of chemical (veterinary drugs) contamination of fish products originating in Asia in 2001/2 (especially for shrimps) becomes evident in the EU data, where chemical contamination becomes a dominant category. Yet for other major importers there is no discernable change. As these other regions were also importing large quantities of shrimp from Asia during this period, they were clearly handling the imported products differently, or recording the relevant data differently.

The obvious differences again point to significant variations in approaches to controls at the borders of the countries being studied. For exporters, it would be helpful if these procedures were harmonized, so that products are treated the same way at importers' borders irrespective of where those borders are. The multitude of

FIGURE 2
Relative frequency of causes of border cases for the EU, USA, Canada and Japan



approaches to border control imposes extra costs on traders. They may be significant but are difficult to quantify because of the dearth of relevant data, particularly the quantities and value of rejected products, and the costs of controls.

Incidence of border cases for exporters, grouped by continents, in major markets

Available data on the incidence of border cases experienced by exporters permit only a crude analysis, but the results provide a useful basis for discussion. The only two importing regions with full data over the four-year period, 1999–2002, to allow comparison of the performance of exporting continents are the EU and Canada. The Japanese data allow this comparison for the two periods 2000/2001 and 2001/2002 (Table 1).

Looking at the data from the perspective of the importing market, there are some significant differences in the relative performance of exporters in the five continents, depending on whether fish is being sent to the EU, Canada or Japan. There are two main explanations for these differences. The EU, Canada and Japan may apply different criteria for border actions (whether sampling frequencies, limits for contamination levels, or other procedures) and/or the five continents export different volumes and types of products to those markets (either different risk categories or of varying quality).

If the latter explanation is correct, given that the products exported to the EU and Canada are fairly similar (frozen fish dominates, and there are significant numbers of crustacea, cephalopods, molluscs, etc.), individual exporters seem to recognize the differences in market criteria and target their products accordingly. This certainly does

TABLE 1
Performance of continents in exporting to the EU, Canada and Japan

From	To	1999		2000		2001		2002	
		Cases per 100 000 t	Rank	Cases per 100 000 t	Rank	Cases per 100 000 t	Rank	Cases per 100 000 t	Rank
Oceania	EU	—	1	—	1	5.9	5	—	1
North America	EU	—	1	1.0	3	1.1	2	0.7	2
Europe (not EU)	EU	0.1	3	0.3	2	0.3	1	1.0	3
C&S* America	EU	1.8	4	4.8	4	2.8	3	5.9	4
Africa	EU	7.0	5	5.7	5	4.4	4	6.2	5
Asia	EU	12.9	6	13.9	6	16.4	6	51.5	6
USA	Canada	1.0	1	0.5	1	2.6	1	1.3	1
C&S* America	Canada	31.6	2	19.1	3	25.6	3	25.2	2
Europe (not EU)	Canada	32.0	3	18.3	2	9.1	2	29.1	3
Asia	Canada	67.5	4	44.6	4	32.6	4	56.8	4
Oceania	Canada	113.8	5	177.7	5	136.0	5	144.2	5
EU	Canada	199.4	6	178.9	6	198.3	6	245.4	6
Africa	Canada	277.4	7	1029.9	7	1436.8	7	1069.9	7
Europe	Japan					0.3	2	0.3	1
North America	Japan					0.5	3	0.5	2
Africa	Japan					0.0	1	1.1	3
C&S* America	Japan					0.8	4	1.5	4
Oceania	Japan					3.9	5	5.7	5
Asia	Japan**					6.6	6	12.5	6

NOTES: * Central and South America. ** 2001 detention figures used are an average 12-month period in Apr 2000-Oct 2001, 2002 figures are from Nov. 2001 to Oct. 2002.

happen. However, it is probably more likely that importing regions treat imports (as a whole) in different ways, resulting in different border actions. In the case of the Japanese market, the high number and frequency of border cases reported for products imported from Asia may reflect the higher risk products that Japan imports, presumably from its neighbouring countries, where the species are similar to those produced by Japanese fisheries. This can only be conjecture given the nature of the data.

A look at the incidence of border cases by each exporting continent is revealing. Oceania ranks as the best exporting region when exporting to the EU, but ranks very poorly when exporting to Canada and Japan. Africa is the poorest performer in exports to Canada and second poorest to the EU. However, the continent performs quite well in exports to Japan. The poorest performer by some margin in exporting to the EU is Asia, exacerbated in later years by the veterinary drug issue referred to earlier. It is also the poorest performer in exports to Japan. However, Asia outperforms both Oceania and the EU in exporting to Canada, though it still only performs moderately. Central and South America perform very well in exports to Canada but less well when exporting to the EU and Japan. North America is consistently a top-performing exporter.

It is not easy to determine the significance of these differences or what has caused them. As noted above, there seems to be a tendency for countries or regions exporting the smallest absolute quantities to have more border cases per unit volume. This certainly applies in the case of exports to Canada. However, it does not apply to the EU. Oceania is the smallest exporter to the EU market but is one of the top performers with the lowest frequency of border cases. Neither does the pattern apply to Japan, where Asia is the largest exporter but also a poor performer.

Further research to establish why these differences occur may give misleading results because of the overriding influence of two factors: importing nations use different procedures (sampling plans, analytical techniques, type of defect) or criteria, or both, for imports; and the products exported differ from one importing region to the other. This again highlights the importance of having the rules of importation harmonized, both in terms of their governing legislation and how they are applied. Harmonization would benefit international trade and ultimately consumers.

Economic implications of border cases

Costing the impact of products of substandard quality and dubious safety would be of interest to producers, processors, quality control authorities and consumers, as well as to governments, donors, public health authorities and development agencies. The economic losses incurred because of fish spoilage, product rejections, detention and recalls, and the subsequent adverse publicity for an industry and even a country are substantial, as are the human health-related costs. Billions of dollars in medical expenses stem from fish-borne illnesses and the loss of productivity of those infected causes large indirect costs to the community.

Risk managers, when weighing different mitigation strategies, need economic data to assess the cost effectiveness of the different options presented to them. Currently, the detention and rejections data, as they are generally collected, cannot be exploited to assess the cost of border cases. It is important to have access to such information in future.

The following is an attempt to estimate the cost of border cases in Japan using data available on the Ministry of Health, Labour and Welfare (MHLW) Web site (www.mhlw.go.jp/english). Similar data were not available from the other importing countries. Table 2 estimates the total volume of Japanese border cases at 255.2 t and 490.6 t, respectively, for 2001 and 2002. These represent a small fraction (respectively 0.0083 percent and 0.016 percent) of total imports to Japan in 2001 and 2002. They were valued at US$1 159 870 and US$2 230 465 (or 0.009 percent and 0.017 percent of total import values) respectively for 2001 and 2002. For the period 2001–2002, the average

TABLE 2
Estimates of volumes and value of border cases for Japan in 2001 and 2002

Product type	Import			Border cases		
	Volume (tonne)	Value (US$ million)	Unit cost (US$/tonne)	Number	Volume (tonne)	Value (US$)
2001						
Fresh fish	375 000	1 849	4 931	16	35.2	173 571
Frozen	2 344 000	8 647	3 689	84	184.8	681 727
Canned	281 000	1 786	6 356	4	8.8	55 933
Cured	34 000	320	9 412	11	24.2	227 770
Live	37 000	351	9 486	1	2.2	20 869
Total 2001	3 071 000	12 953		116	255.2	1 159 870
2002						
Fresh fish	329 000	1 603	4 872	15	33	160 776
Frozen	2 362 000	8 730	3 696	174	382.8	1 414 829
Canned	353 000	2 033	5 759	4	8.8	50 679
Cured	36 000	329	9 139	28	61.6	562 962
Live	38 000	356	9 368	2	4.4	41 219
Total 2002	3 118 000	13 051		223	490.6	2 230 465

export revenue lost was estimated at US$4 546 per tonne detained and US$10 000 per border case.

The revenues lost to exporting companies when consignments are rejected are, as a rule, much greater than the costs of preventive practices that would have enabled the concerned companies to avoid these border cases. This affirmation is based on several studies, compiled by Cato (FAO, 1998), which estimated the costs of implementing Good Management Practices (GMP) and Hazard Analysis and Critical Control Point (HACCP) systems. In the USA, 1995 cost estimates of HACCP implementation for seafood processing plants averaged US$23 000 in the first year and US$13 000 per year subsequently. As HACCP was introduced, prices for seafood were estimated to increase by less than one percent in the first year and less than 0.5 percent in subsequent years, with the larger cost increase expected to decrease consumption by less than 0.5 percent.

Other studies carried out in the USA estimated the costs of implementing the HACCP-based Model Seafood Surveillance Program (MSSP) in the USA crab industry at US$3 100 per plant, or US$0.04 per kilogram, representing 0.33 percent of processor price. Compliance costs were estimated at US$6 100 per plant. Investment costs averaged US$3 200 for large plants and US$1 700 for small plants. All in all, added cost per kilogram of product for compliance was US$0.02 for small plants and insignificant for large plants. For molluscan shellfish (oysters, mussels, clams), these costs were estimated at US$5 500 per plant. Annualized compliance costs per kilogram were estimated at US$0.11 for small plants and US$0.01 for larger plants.

In Bangladesh, plant upgrades and implementing HACCP for the shrimp industry were estimated to cost between US$0.26 and US$0.71 per kilogram of product, and between US$0.03 and US$0.09 for its maintenance. Those were higher than the figures estimated in the USA, mainly because the Bangladesh shrimp industry had to start from scratch, and it also had more small- and medium-sized enterprises than the USA. It is well established that in the fish processing industry economies of scale lower the costs of safety and quality systems. Even though the costs appear high, they represent only 0.31 percent (implementation) and 0.85 percent (maintenance) of the 1997 product price (Cato and Lima Dos Santos, 1998).

More importantly, the cost of installing and operating HACCP systems remains very low in comparison with the revenue lost by exporters in border cases, estimated at US$4.55 per kilogram on average. Indeed, the per kilogram costs of implementing

and maintaining HACCP or HACCP-based systems represents between 1.46 percent and 3.4 percent (for the USA) or 6.45 percent to 17.6 percent (for Bangladesh) of the revenue lost in border cases. Furthermore, as noted above, these revenue losses are only the tip of the iceberg. The cost of transportation, the resulting adverse publicity, the requirements for systematic physical checks of subsequent shipments, the loss of client confidence, the loss of market share, market diversions, loss of momentum, decreased prices, and reduced capacity due to temporary or permanent closures, are certainly additional costs with far reaching impacts, albeit difficult to quantify.

CONCLUSIONS

The FAO study from which this paper is drawn (FAO, 2005) detailed the regulations governing imports into the EU, USA, Japan and Canada, and analysed the available data on border cases (detentions, rejections, re-exports, etc.) in the same countries or regions.

The study highlighted the need to harmonize the procedures and methods used to govern imports. Safety and quality control systems need to be based on risk assessment, especially where consumer safety is in question, and any actions taken should be communicated to all interested parties in a manner that is unambiguous, transparent, and accessible.

Governments and industry can and should help to facilitate trade in fish and fish products by improving border control systems, including by augmenting border control data collection and dissemination. Promoting harmonization and equivalence among fish trading partners will help to minimize the use of safety and quality standards as technical barriers to trade, and help to improve overall export performance. The current multitude of approaches to border controls imposes significant costs on exporters, in particular those in developing countries where there is a limited capacity to adapt safety and quality control systems to a range of market requirements. Further work needs to be undertaken in this important and poorly studied aspect of international trade.

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Development of risk assessment methods for fishery products

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INTRODUCTION

Both "risk" and "risk assessment" have become a kind of "buzz" word today. In the new hygiene package from the European Union (EU), the focus is on risk assessment and risk-based inspections. Another aspect has been developing in recent years, namely risk-benefit or cost-benefit analysis. This kind of analysis has been applied to financial issues for quite some time. In the food safety perspective, this method is used to weigh the benefits of consuming a certain foodstuff against the risk associated with consuming it. A good example of this kind of analysis was published in the Journal of American Medical association in 2006 (Mozaffarian and Rimm, 2006).

In this paper I will go briefly into the history of risk assessment in a food safety context, and also take a look at newer trends, namely risk-benefit analysis. When looking at risk-benefit analysis, it will be interesting to ask the question of whether regulators should take into account in their work only the risk associated with certain products, or should they also look at the benefits. Lastly, I will present some of the work the Icelandic Directorate of Fisheries has started in order to fulfil the requirements of the EU in the new hygiene package when it comes to risk assessment and risk-based inspections.

SOME DEFINITIONS

In order to understand the concepts of risk assessments and risk-benefit analysis, it is important to define some of the concepts used in this field.

The most important concept to define is "risk". What is risk? Risk is a *function of the probability of an adverse health effect and the severity of that effect, consequential to a hazard(s) in food* (FAO, 2004). In other words: The likelihood that a hazard will affect us and the severity of its consequences if it does.

Another important concept is "Risk analysis". It is a process consisting of three components: risk assessment, risk management and risk communication, which all interact one with the other.

"Risk assessment" implies a scientifically based process, consisting of four steps: hazard identification, hazard characterization, exposure assessment and risk characterization (FAO, 2004).

These three definitions are the same as used by the EU in regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002, laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety. Other definitions can be found in this regulation or in FAO Fisheries Technical Paper No. 442: Application of risk assessment in the fish industry (FAO, 2004).

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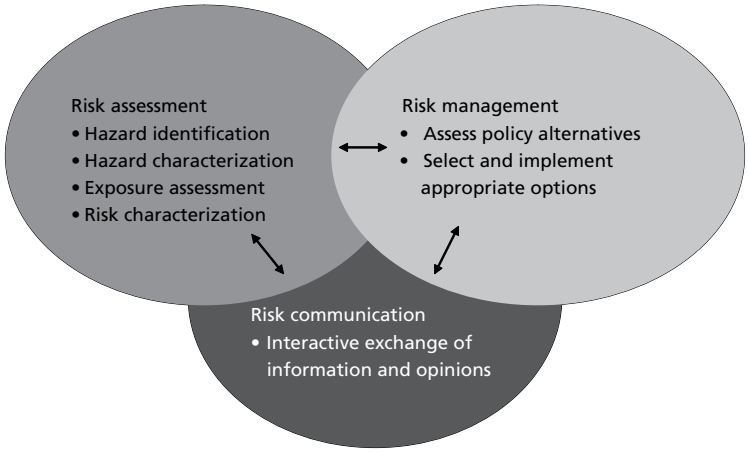
FIGURE 1
The three components of risk analysis, adapted from Fazil



FAO, 2005.

If we take a closer look at risk assessment, it consists, as noted above, of four steps.

- The first step is hazard identification. That involves identifying those biological, chemical and physical agents capable of causing adverse health effects and that may be present in a particular food or group of food. Examples are Listeria monocytogenes in smoked fish, or methyl mercury in seafood.
- The second step is hazard characterization, involving qualitative and/or quantitative evaluation of the nature of the adverse health effects associated with biological, chemical and physical agents that may be present in food. Hazard identification can further be divided into two parts, description of the hazard and dose-response relationship if it exists.
- The third part is the exposure assessment; it is a qualitative and/or quantitative evaluation of the likely intake of biological, chemical and physical agents via food, as well as possible exposure from other sources. It is important to know the level of contamination in food at the time of consumption, and the number of servings of food that is potentially dangerous.
- The final part of the risk assessment in the risk characterization. That is the process of determining the qualitative and/or quantitative estimation, including attendant uncertainties, of the probability of occurrence and severity of known potential adverse health effects in a given population, based on hazard identification, hazard characterization and exposure assessment (FAO, 2004).

Basically we are putting together all the work from earlier steps in the risk assessment to provide an estimate of the risk, which is the outcome of risk characterization. The estimate can in turn be qualitative, giving an estimate in terms of "high", "medium" or "low". It can be a semi-quantitative estimate, where an estimate is in the form of risk ranking, i.e. a certain number in a given range, or it can be a quantitative estimate, where you predict the number of people you expect will become ill from the particular product+hazard pairing.

There are several different types of risk assessments that fall under three broad categories:

- Quantitative risk assessment, which is a risk assessment that provides numerical expressions of risk and indication of the attendant uncertainties.
- Semi-quantitative risk assessment, which can be seen as a mixture of qualitative and quantitative data.

TABLE 1
Qualitative risk assessment

Risk criterion	Raw molluscan shellfish	Canned fish	Dried fish
Bad safety record	+	+	-
No CCP for the hazard	+	-	-
Possibility of contamination or recontamination	+	+	-
Abusive handling possible	+	-	-
Growth of pathogens can occur	+	-	-
No terminal heating step	+	+	+
Risk category	High	Low	No risk

Adapted from Huss, Reilly and Ben Embarek (2000).

- Qualitative risk assessment, which is a risk assessment based on data that, while forming an inadequate basis for numerical risk estimation, nonetheless, when conditioned by prior expert knowledge and identification of attendant uncertainties, permits risk ranking or separation into descriptive categories of risk.

Several methods have been used for qualitative risk assessment; an example is the one proposed by Huss, Reilly and Ben Embarek (2000) (See Table 1).

Here pluses are ascribed to hazards, and then risk is ranked as "high" (four or more pluses) or "low" (less than four pluses).

For semi-quantitative risk assessment we use a mixture of qualitative and quantitative data. This requires a lot of work, but not as much as for a full quantitative risk assessment. To facilitate this kind of risk assessment, Sumner and Ross (2002), developed a simple spreadsheet tool, Risk Ranger, in Microsoft® Excel software and used standard mathematical and logical functions.

Quantitative risk assessments are complex and usually take a long time. It is a probabilistic approach that offers many advantages, but also some difficulties. It makes full use of the available information and facilitates integration of microbiology, toxicology and epidemiology. It takes into account the overall degree of variability and uncertainty, addresses sensitivity, and appreciation of the confidence that can be placed on the analysis and its findings. It involves complex modelling, often Monte Carlo simulation. Tools such as the @Risk software program have been used to facilitate the process. One problem is that this kind of risk assessment is very time consuming, taking up to three years or more, and resource demanding.

For seafood, there have been several quantitative risk assessments carried out:

- Risk assessment of *Vibrio vulnificus* in raw oysters (FAO/WHO, 2005b).
- Risk assessment of choleragenic *Vibrio cholerae* O1 and O139 in warm-water shrimp in international trade (FAO/WHO, 2005a).
- Risk assessment of *Listeria monocytogenes* in ready-to-eat foods (FAO/WHO, 2004a,b).
- Quantitative risk assessment on the public health impact of pathogenic *Vibrio parahaemolyticus* in raw oysters (FDA, 2005).
- Quantitative assessment of the relative risk to public health from food-borne *Listeria monocytogenes* among selected categories of ready-to-eat foods (FDA, 2003).
- *Listeria monocytogenes* in smoked fish in Sweden (Lindqvist and Westöö, 2000).

As implied by the brevity of the list, there are not many quantitative risk assessments available for seafood, or for any other food for that matter, the reason being the complexity and the time it takes to implement a quantitative risk assessment.

We have only discussed microbiological risk assessments (MRAs); they have a very short history compared to chemical risk assessments. To date, there are available, from FAO/WHO, chemical risk assessments for more than 1500 food additives, more than 40 contaminants and more than 90 residues of veterinary drugs. The beginning of MRA

at FAO/WHO can be traced back to the guidelines on risk assessment issued in 1999 by Codex Alimentarius (CAC, 1999). Since that time, several MRAs on food have been published, but, as has been said before, an MRA is time consuming and resource demanding (Voysey and Brown, 2000).

Risk-benefit analysis

A relative new way of thinking of food and risks associated with food has been emerging in recent years. Instead of looking only at the risk associated with a certain foodstuff, the benefits from consuming it are also taken into the equation, hence the term "risk-benefit analysis".

In January 2004, Hites *et al.* (2004) published an article in Science that caused much debate about the safety of farmed salmon and potential harmful effects of contaminants in the salmon, especially salmon from Northern Europe. Other studies followed on the benefits versus the risk of consuming salmon, among other things (Gochfeld and Burger, 2005; Mozaffarian and Rimm, 2006). What these discussions have done is to make the issue of balancing the risks and benefits of fish consumption a very visible public health topic. Scientists have mainly been focused on the beneficial effects of n-3 polyunsaturated fatty acids (PUFAs) versus the negative effects of some contaminants, such as methylmercury and dioxins. There have, however, also been claims that antioxidants and other substances in fish can also have beneficial effects on health (Astley, 2003; Gunnarsson et al., 2006).

This illustrates the complexity of risk-benefit analysis. It is very difficult to list all the substances that have beneficial effects vs. those that have negative health effects. To make it even more complex, substances that are considered to be beneficial can in high doses be dangerous. The bottom line is that this topic is a very complex one, but at the same time very interesting and important.

UPCOMING REQUIREMENTS

Iceland is not part of the EU, but is a part of the European Free Trade Association (EFTA). Through this organization Iceland and other EFTA countries (excluding Switzerland) signed an agreement with the EU creating the European Economic Area (EEA). Basically this means that Iceland gains access to the Internal Market, but in turn has to comply with EU laws and regulations on most issues.

The Directorate of Fisheries in Iceland is the competent authority responsible for implementing these regulations and has to ensure Icelandic fish producers comply with these regulations. Regulation (EC) No. 178/2002, Chapter II, Article 6 states:

> *"In order to achieve the general objective of a high level of protection of human health and life, food law shall be based on risk analysis except where this is not appropriate to the circumstances or the nature of the measure."*

This focus on risk and risk analysis is further emphasized in Regulation (EC) No 882/2004 of the European Parliament and of the Council of 29 April 2004, on official controls performed to ensure the verification of compliance with feed and food law, animal health and animal welfare rules. In Article 3, Chapter I, it says:

> *"Member States shall ensure that official controls are carried out regularly, on a risk basis and with appropriate frequency, so as to achieve the objectives of this Regulation, taking account of:*
>
> *"(a) identified risks associated with animals, feed or food, feed or food businesses, the use of feed or food or any process, material, substance, activity or operation that may influence feed or food safety, animal health or animal welfare;*
>
> *"(b) feed or food business operators' past record as regards compliance with feed or food law or with animal health and animal welfare rules."*

The Directorate of Fisheries in Iceland has started work on risk categorization of the fish industry and of establishments. The evaluation has been done according to a Danish model (Fødevarestyrelsen, 2006) and is based on six risk categories:

1. Microbiological risk associated with the type of product and final use.
2. Microbiological risk associated with the type and scope of handling of the products.
3. Processes that decrease the microbiological risk.
4. Chemicals from the primary production stage (catch).
5. Risk because of the use of chemicals in the production process.
6. Estimation of the size of the consumer group.

The production processes are then divided into:
- High risk (fresh fish, frozen);
- Medium risk (salted, dried, cold smoked, gravad); and
- Low risk (canned).

Every production type is evaluated according to the 6 risk categories.

Points are allocated in a pre-determined manner, and these are then used to place the individual sector into an inspection-frequency bracket (2–4 visits a year, 4–6 visits, etc.). For example, frozen fish received 55 points, which results in an inspection frequency of 2–4 times a year.

After the different branches of the industry have been evaluated in general, the individual establishments are evaluated according to 4 main categories:
- conditions in the establishment and in the production process;
- risk associated with production conditions;
- own-check system (HACCP, etc.); and
- results of earlier inspections or sampling.

To assist in this evaluation, the Directorate of Fisheries has developed an evaluation scheme for use in the evaluation process. There still is a lot of work needed in order to make the Danish model fit Icelandic reality, but the results will be used to develop a risk-based control programme.

CONCLUSION

Risk assessment of food can be a highly complex process, depending on the type of risk assessment used. A quantitative risk assessment is the most comprehensive risk assessment, and also the most complex. To illustrate that, only a handful of quantitative risk assessments are available today. The process involves various experts from different disciplines: food science, toxicology, biology, microbiology, chemistry, etc.

Risk-benefit analysis is an emerging field. The idea is to take into account both the benefits and risk associated with consuming a certain product. It has been especially interesting to follow the developments in this field in the debate about the health benefits of seafood: good fish/bad fish. The challenge in this field is huge: "How do you weigh up the different benefits versus the risks?" and "What is the dose-response of the different parameters?" Many other factors need to be considered, which makes this a very interesting, but also a very difficult and complex, field.

One question arises with this emerging analysis: "Should regulators take account of the benefits of certain foodstuff when creating legislation, maximum limits, etc?" This is not an easy question to answer. This is still a very new field and I would recommend that, before benefits are taken into the equation, some international guidelines should be issued providing guidance on how a risk-benefit analysis should be conducted.

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The WTO Negotiations – an update and the Dispute Settlement Understanding

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BACKGROUND TO THE CURRENT ROUND OF WTO NEGOTIATIONS

The Doha Round of the World Trade Organization (WTO) negotiations was launched in November 2001 in Doha. The fisheries sector features in the Ministerial Declaration, with specific reference to work to be undertaken in relation to fisheries subsidies. Other areas of relevance to fisheries are the non-agricultural market access (NAMA) negotiations (which include fish and fish products) and the discussions on trade and environment.

In relation to fisheries subsidies, the Ministerial Declaration specifically states that that:

> *"... participants shall also aim to clarify and improve WTO disciplines on fisheries subsidies, taking into account the importance of this sector to developing countries."*

In relation to NAMA, the Declaration states that:

> *"... negotiations which shall aim, by modalities to be agreed, to reduce or as appropriate eliminate tariffs, including the reduction or elimination of tariff peaks, high tariffs, and tariff escalation, as well as non-tariff barriers, in particular on products of export interest to developing countries. Product coverage shall be comprehensive and without a priori exclusions. The negotiations shall take fully into account the special needs and interests of developing and least-developed country participants, ... "*

In relation to trade and environment, the Declaration states that negotiations should consider:

> *"... the relationship between existing WTO rules and specific trade obligations set out in multilateral environmental agreements (MEAs). The negotiations shall be limited in scope to the applicability of such existing WTO rules as among parties to the MEA in question. The negotiations shall not prejudice the WTO rights of any Member that is not a party to the MEA in question".1*

STATE OF PLAY IN THE NEGOTIATIONS

WTO negotiations

The WTO negotiations were suspended in July 2006 due to lack of progress in the agricultural negotiations, and in particular the inability to agree on cuts to farm subsidies and tariffs. However, in November 2006, WTO Director-General Pascal Lamy gave Geneva-based trade diplomats the 'green light' to start informal discussions on all issues in the stalled Doha Round talks. This has included informal discussions on technical issues related to the fisheries subsidies negations, including the input that FAO could provide in the development and implementation of new disciplines.

[1] Regional Fisheries Management Organizations (RFMOs) are examples of MEAs.

Fisheries subsidies negotiations

The fisheries subsidies2 negotiations achieved a fair amount of progress before the WTO negotiations were suspended. Although a final text was not finalized, there was broad agreement to:

> *"strengthen disciplines on subsidies in the fisheries sector, including through the identification and prohibition of subsidies that may contribute to overcapacity and overfishing."*

Issues that remain to be resolved include agreement on how the needs of developing countries will be reflected in special and differential provisions.

Non-Agricultural Market Access (NAMA)

As noted previously, fish and fishery products are included in this category. While there has been some progress in these negotiations, their final outcome is to a large extent dependent on how much progress is made in the agriculture negotiations. Until WTO members, and in particular developing countries, are satisfied with the progress in the agriculture negotiations it is unlikely there will be much progress in the NAMA negotiations.

At the Hong Kong Ministerial meeting, in December 2005, Ministers agreed to apply the "Swiss formula" for tariff reductions in NAMA. This formula cuts higher tariffs more aggressively than lower tariffs. Agreement remains to be reached on the coefficients that will be used in the formula, and hence determine to what extent tariffs will be cut. Agreement also remains to be reached on how the special needs of developing countries will be reflected.

It should also be noted that some (limited) progress has been made on the sectoral tariff component of the negotiations, based on a "critical mass" approach. Fish has been identified as one of the sectors concerned. According to this approach, a critical mass of major fish producing, importing and exporting countries could agree to a sector-specific agreement that would liberalize fish trade separately from the general agreement on market access for non-agricultural goods. Several countries have in the past proposed to eliminate or substantially reduce tariffs and address unjustified non-tariff barriers within the fish sector. Other countries are, however, opposed to liberalizing trade in fish products on a sectoral basis.

Trade and environment

The trade and environment component of the Doha Round, and in particular the work that has been achieved in relation to the examination of the relationship between existing WTO rules and specific trade obligations set out in multilateral environmental agreements (MEAs), has to date had little bearing for the fisheries sector. Of direct relevance to the fisheries sector is the relationship between WTO rules and the trade obligations set out in Regional Fisheries Management Organizations (RFMOs). It should be noted that the mandate for this component of the negotiations states that: "the negotiations shall not prejudice the WTO rights of any Member that is not a party to the MEA in question."

THE DISPUTE SETTLEMENT UNDERSTANDING AND THE FISHERIES SECTOR

This presentation is based on work commissioned by FAO to examine how the rights and obligations of WTO members have been interpreted in the context of the WTO dispute settlement process.

The Dispute Settlement Understanding (DSU) took effect in January 1995, when the WTO came into being. Previous to the WTO and the DSU, GATT provided the legal basis for contracting parties to seek redress if their benefits were nullified.

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[2] Fisheries subsidies are estimated to total US$15 billion annually.

However, GATT's effectiveness was compromised as dispute resolution required consensus between the parties. Resolution could therefore be blocked if consensus could not be achieved.

Under the WTO, it is impossible for the country losing a case to block the adoption of the ruling. Rulings are now automatically adopted unless there is a consensus to reject a ruling. Any country wanting to block a ruling has to persuade all other WTO members (including its adversary in the case) to share its view.

Over 10 cases involving fish and fish products have been submitted to the WTO's dispute settlement process since the DSU's inception. The case I will present illustrates how the WTO dispute settlement process has interpreted the general exceptions related to environmental objectives under GATT article XX.

United States of America: Import Prohibition of Certain Shrimp and Shrimp Products (DS58)

(a) The Parties:

United States of America (USA) versus Thailand, Malaysia and India (DS58).

Australia, Ecuador, El Salvador, European Communities, Guatemala, Hong Kong, Japan, Nigeria, Philippines, Singapore and Venezuela reserved their rights to participate in the Panel's proceedings

(b) The issue:

Commencing in October 1996, India, Thailand, Pakistan and Malaysia requested consultations with the USA regarding the ban on imports of shrimp and shrimp products from certain countries. Following unsuccessful consultations in November 1996, in January 1997 Thailand and Malaysia requested the DSB to establish a Panel to examine the partial embargo on certain shrimp and shrimp products. In February, India made a similar request.

India, Malaysia, Pakistan and Thailand requested the Panel to find that Section 609 of US Public Law 101-162 ("Section 609") and its implementing measures:

(a) were contrary to Articles, XI:1 and XIII:1 of GATT 1994;
(b) were not covered by the exceptions under Article XX(b) and (g) of GATT 1994;
(c) nullified or impaired benefits accruing to India, Malaysia, Pakistan and Thailand within the meaning of Article XXIII:1(a) of GATT 1994.

India, Pakistan and Thailand additionally requested the Panel to find that Section 609 was contrary to Article I:1 of GATT 1994.[3]

The USA under Section 609 of U.S. Public Law 101-1621 ("Section 609") and the 'Revised Notice of Guidelines for Determining Comparability of Foreign Programs for the Protection of Turtles in Shrimp Trawl Fishing Operations' placed a ban on the importation of certain shrimp and shrimp products.

The ban arose as a result of the determination in December 1995 of the United States Court of International Trade (CIT) that guidelines to Section 609 in 1991 and 1993 were wrong in limiting the geographic scope of Section 609 to shrimp harvested in the wider Caribbean/western Atlantic region and requiring that from 1994 all such shrimp harvests demonstrate the use of turtle excluder devices (TEDs) on all shrimp trawl vessels. The CIT determined that all shrimp harvested in all foreign nations and imported into the US be required to demonstrate the use of TEDs.

In April 1996, the US Department of State published new guidelines that extended Section 609 to shrimp harvested in all foreign nations. The Department of State further determined that, as of 1 May 1996, all shipments of shrimp and shrimp products into the USA were to be accompanied by a declaration ('Shrimp Exporter's Declaration

[3] WTO document WT/DS/58/R

form') attesting that the shrimp or shrimp product in question was harvested "either under conditions that do not adversely affect sea turtles ... or in waters subject to the jurisdiction of a nation currently certified pursuant to Section 609."

The 1996 Guidelines define "shrimp or shrimp products harvested in conditions that does not affect sea turtles" to include:

(a) Shrimp harvested in an aquaculture facility.
(b) Shrimp harvested by commercial shrimp trawl vessels using TEDs comparable in effectiveness to those required in the USA.
(c) Shrimp harvested exclusively by means that do not involve the retrieval of fishing nets by mechanical devices or by vessels using gear that, in accordance with the US program ... would not require TEDs.
(d) Species of shrimp, such as the pandalid species, harvested in areas in which sea turtles do not occur.4

(c) The process:

The DSB formed a Panel in April 1997. The Panel met with Parties in June and September and with third parties in June. It met with scientific experts selected by the Panel in January 1998. It issued its interim report to Parties in March 1998 and its final report in April of the same year. The Panel found in favour of the disputing Parties and recommended that the USA be invited to bring the measure into conformity with its obligations under the WTO Agreement.

The USA appealed the Panel's ruling and the Appellate Body produced its report in October 1998 and upheld the conclusions of the Panel Report.

(d) The outcome:

The case alleged that Section 609 was contrary to Articles XI:1 and XIII:1 of GATT 1994.

Article XI:1 states

"No prohibitions or restrictions other than duties, taxes or other charges, whether made effective through quotas, import or export licences or other measures, shall be instituted or maintained by any contracting party on the importation of any product of the territory of any other contracting party or on the exportation or sale for export of any product destined for the territory of any other contracting party."

Article XIII:1 states

"Notwithstanding the provisions of paragraph 1 of Article XI, any contracting party, in order to safeguard its external financial position and its balance of payments, may restrict the quantity or value of merchandise permitted to be imported, subject to the provisions of the following paragraphs of this Article."

The disputing Parties alleged that Section 609 was not covered by Article XX (b) or (g)

Article XX sets out general exceptions to the GATT Agreement and states

"Subject to the requirement that such measures are not applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail, or a disguised restriction on international trade, nothing in this Agreement shall be construed to prevent the adoption or enforcement by any contracting party of measures:

(b) necessary to protect human, animal or plant life or health;

(g) relating to the conservation of exhaustible natural resources if such measures are made effective in conjunction with restrictions on domestic production or consumption;"

In regard to Article XI:1, the Panel found

4 WTO document WT/DS58/R

"the United States admits that, with respect to countries not certified under Section 609, the measures imposed in application of Section 609 amount to 'prohibitions or restrictions' on the importation of shrimp within the meaning of Article XI:1 of GATT 1994. Even if one were to consider that the United States has not admitted that it imposes an import prohibition or restriction within the meaning of Article XI:1, we find that the wording of Section 609 and the interpretation made of it by the CIT are sufficient evidence that the United States imposes a 'prohibition or restriction' within the meaning of Article XI:1. We therefore find that Section 609 violates Article XI:1 of GATT 1994."[5]

Given this conclusion, the Panel found for reasons of judicial economy that it was not necessary to review the allegations of the complainants in regard to Articles I:1 and XIII:1 of GATT 1994.

The Panel concluded in regard to Article XX (b) and (g) that Section 609 was unjustifiable discrimination as terms of the opening statement (chapeau) of Article XX and thus did not determine further whether it was also contrary to (b) and/or (g).[6] *It stated*

"In our view, if an interpretation of the chapeau of Article XX were to be followed which would allow a Member to adopt measures conditioning access to its market for a given product upon the adoption by the exporting Members of certain policies, including conservation policies, GATT 1994 and the WTO Agreement could no longer serve as a multilateral framework for trade among Members as security and predictability of trade relations under those agreements would be threatened."[7]

The Appeal Body disagreed with the Panel's ruling in regard to Article XX in that the Panel had not examined whether Section 609 conformed to either Article XX (b) or (g). The Appeal Body concluded that Section 609 served an environmental objective that it recognized was legitimate under Article XX (g). However the Appeal Body concurred with the Panel that the measure had been applied in an arbitrary and unjustifiable manner and therefore was contrary to the requirement of the chapeau to Article XX.[8]

Comment

The decision of the CIT in 1995 that Section 609 should be applied globally was implemented unilaterally by the US Department of State through its 1996 amendments to Section 609. The Panel and the Appeal Body both noted that there was no evidence that the USA sought to negotiate the expansion of the scope of Section 609 with any affected WTO member. Nor was there any evidence that the USA sought to implement the ruling of the CIT through any multilateral agreement.

The Appeal Body is clear about what it was not ruling on:

"We have not decided that the protection and preservation of the environment is of no significance to the Members of the WTO. Clearly, it is. We have not decided that the sovereign nations that are Members of the WTO cannot adopt effective measures to protect endangered species, such as sea turtles. Clearly, they can and should. And we have not decided that sovereign states should not act together bilaterally, plurilaterally or multilaterally, either within the WTO or in other international fora, to protect endangered species or to otherwise protect the environment. Clearly, they should and do.

"What we have decided in this appeal is simply this: although the measure of the United States in dispute in this appeal serves an environmental objective that is

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[5] WTO document WT/DS58/R Paragraph 7.17
[6] WTO document WT/DS58/R Paragraph 7.49
[7] WTO document WT/DS58/R Paragraph 7.45
[8] WTO document WT/DS58/AB/R Paragraph 186

recognized as legitimate under paragraph (g) of Article XX of the GATT 1994, this measure has been applied by the United States in a manner which constitutes arbitrary and unjustifiable discrimination between Members of the WTO, contrary to the requirements of the chapeau of Article XX. For all of the specific reasons outlined in this Report, this measure does not qualify for the exemption that Article XX of the GATT 1994 affords to measures which serve certain recognized, legitimate environmental purposes but which, at the same time, are not applied in a manner that constitutes a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail or a disguised restriction on international trade."[9]

[9] WTO document WT/DS58/AB/R Paragraphs 185 and 186

Changing compliance for exported fishery products: a developing country perspective

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ABSTRACT

The fisheries sector in Tanzania has many challenges, such as maintaining market shares of products, little ability to control fish prices in foreign markets, and the high cost of modern technology in the fishing industry. Fishery products from developing countries entering the global market—especially the European Union market—have to comply with frequently amended Directives and Regulations. Resources in terms of funds and materials, and human capacity constraints in terms of staff numbers and skills, restrict the compliance ability of developing countries in the global market. Most fish sales benefits are used to maintain market compliance.

INTRODUCTION

The Tanzanian mainland has a total surface area of 945 000 km2 and an estimated population of 35 million (Census data, 2002). The agricultural sector dominates, accounting for 56 percent of total exports (in value terms) and employing 90 percent of the work force. Industry accounts for 15 percent of GDP and is mainly limited to processing agricultural products and light consumer goods.

Tanzania has three major transborder water bodies—three great lakes of Africa, namely Victoria, Tanganyika and Nyasa—and borders the Indian Ocean. The country also has diverse river systems, numerous wetlands and other minor water bodies.

Tanzania lands between 350 000 and 400 000 tonne per annum, and exports about 20 percent of this. Major markets are Australia, the European Union (EU) and Japan. The fisheries sector provides employment to about 2 million people.

CHALLENGES

Although the fisheries sector in Tanzania supports the national economy and population in terms of food security and employment, it is faced by several challenges:

- Maintaining market share for our products.
- Accommodating ever changing new market legal requirements.
- Stiff competition from other producers and from substitute products.
- Retaining customer satisfaction.
- Inadequate information on the size of the wild marine resource.
- Continuing decrease in landings.
- Little or no ability to influence fish prices in foreign markets.
- The high cost of modern technology in the fishing industry.
- Domination of the sector by artisanal and small-scale fishers.

COMPLIANCE FOR FISHERY PRODUCTS

Fishery products from Tanzania, like any other products that enter the global market, and especially the EU market, have to complying with the EU Directives as set in:

- Council Directive 91/493/EEC of 22 July 1991, which laid down the health conditions for the production and the placing on the market of fishery products; and Council Directive 92/48/EEC, laying down minimum hygiene rules applicable to fishery products caught on board vessels.
- In 2002, new EU Regulation (EC) 178/2002 of the European Parliament and of the Council laid down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety was introduced and came into force on 15 January 2005.

In addition, four Council Regulations on Food Hygiene were introduced. These replaced Council Directives 91/493/EEC and 92/48/EEC. These are:

- Council Regulation (EC) No. 852/2004 of 29 April 2004 on hygiene of foodstuffs;
- Regulation (EC) No. 853/2004 laying down specific hygiene rules for the hygiene of foodstuffs;
- Regulation (EC) No 854/2004 laying down specific rules for the organization of official controls on products of animal origin intended for human consumption; and
- Regulation (EC) No 882/2004 on official control performed to ensure verification of compliance with feed and food law, animal health and animal welfare rules.

There are also additional supporting legislations, including:

- Commission Regulation (EC) No. 2073/2005 of 15 November on Microbiological Criteria for Foods;
- Commission Regulation (EC) No. 466/2001 of 08 March 2001 setting maximum levels for certain contaminants in foodstuffs; and
- Commission Regulation (EC) No. 2074/2005 of 05 December 2005 laying down implementing measures for certain products under Regulation (EC) No. 853/2004 and for the organization of official controls under Regulation (EC) No. 854/2004 and Regulation (EC) No. 882/2004, derogating from Regulation (EC) No. 852/2004 and amending Regulations (EC) Nos. 853/2004 and 854/2004

Appreciating the importance of protecting consumers, Tanzania embarked on a range of programmes to ensure that the country attains full compliance or gains an equivalent status with the importing countries. A very frustrating aspect of complying is coping with the ever-changing directives and regulations.

EFFECT OF CHANGING COMPLIANCE

Full compliance for a developing country like Tanzania itself is a problem, because it calls for investment in human resources, infrastructure and equipment. All these need to be catered for from meagre financial resources.

In addition, the time required for transformation to comply is relatively short, since some requirements need to be sourced from outside the fisheries sector, ministry and region, or from abroad.

We have indeed invested heavily to comply with directives 493/91/EEC and 92/48/EEC in terms of training of operators in the fish establishments, fishers and officials, and in infrastructure improvement. However, as noted earlier, there have been frequent changes in and amendments to the various regulations and directives, which developing countries, such as Tanzania, find extremely difficulty to cope with, unless some other important activities are forgone.

Some problems caused by the changing directives are considered below.

Difficulty in understanding new concepts

Changing directives and regulations requires thorough understanding of the concepts by both operators and control officials. This requires training of the Competent Authority (CA), industry operators, fishers and any stakeholders concerning their

responsibility and understanding of the new Directives and Regulations. This takes time for adoption, and in many cases introduction of anything new faces resistance by implementers.

For example, EU Regulation (EC) No. 178/2002 on Food Law introduced with new concepts, including Traceability, Risk Analysis, Management, Precautionary Principle, Rapid Alert System, Crisis Management and Emergencies, all of which required understanding of both the concept and its implementation. This implied the need for financial resources, knowledgeable human resources and time, which required re-scheduling of activities.

Cost of review of National Fisheries Act and Regulations

Following changes in the EU Food Law and amendment of several EU Regulations, we were forced to review the national Fisheries Regulations. It is difficulty for a developing country like ours to cope with the pace at which developing countries change their legislation. Legal procedures take longer to implement in our country, as the officials must first be imbued with the knowledge of what needs to be changed. Gaps identified must be discussed through being tabled at a number of consultative meetings at different levels. The Draft Act and Regulation are then submitted to the Minister, and later to Parliament for endorsement. This is costly and time consuming. But in practice, once a Regulation is passed in the EU, it is supposed to be promptly adopted and in operation in the developing country, with only a short period of grace being given. For example, Tanzania was inspected last year (2006) based on the new hygiene package and the supporting regulations, such as the microbiological criteria (2073/2005) and implementing measure (2074/2005), both of which were still new to us.

Compliance with the new directives and regulations

Changing legislation in developed countries compels developing countries to invest massively in terms of changing infrastructure and facilities. For example, installation of hot water for hand washing was not mandatory in Directive 493/91/EEC; however, it became a requirement in Regulation 853/2004. This is a costly requirement and problematic for the least developed countries to comply with, as it involves reconstruction. This has a negative effect as the establishment must stop production activities while the requisite changes are introduced.

In parallel there have been problems in understanding concepts and establishing definitive universal interpretations of some clauses, such as:

- "Enough space" — a subjective term and depends on individual understanding;
- "Hot water" in the processing room for tropical countries like ours; and
- the "equivalency" concept. This is confusing, especially when FVO Inspectors request that everything in the EU Regulations must feature in any third party legislation. For example: the poisonous family Gempilidae does not exist in our waters, but the FVO inspector insisted that, for equivalency reasons, this family must be included in our revised regulation. While appreciating the philosophy of new regulations being founded on logical thinking, providing room for the implementer to decide based on scientific reasoning in some case seems to not apply.

Difficult in compliance with market requirements

National compliance with Directives, Regulations and International agreements is a necessity for global market access. However, some trading blocks impose stricter regulatory requirements and give short time frames to comply. For example, Tanzania was inspected by the EU veterinary inspectors last year (2006). The objective of the audit was to check the performance of the official control, based on Regulations (EC) No. 852/2004; (EC) No. 853/2004; (EC) No. 854/2004; (EC) No. 882/2004; (EC) No. 2073/2005; and (EC) No. 2074/2005.

The first time frame for adapting to changes was not insufficient, and it becomes difficult and expensive for a developing country to cope with the requirements to analyse the wide range of parameters. For example, it is mandatory to analyse for polychlorinated biphenyls (PCBs), organophosphorus compounds (OPs), organochlorines (OCs), Pyrethroids, dioxin and polyaromatic hydrocarbons (PAHs) in the environment in an accredited laboratory. This is expensive and costly, as we have to pay external laboratories for the various tests done. For example, Tanzania uses the services of the South African Bureau of Standards (SABS) to test for pesticide residues in fish and the environment. Veterinary drugs, dioxin and PAHs are tested at Chemiphar laboratory in Uganda, which also sometimes subcontracts to an external laboratory in Europe. All this despite the fact that our environment in reality is not that much polluted. This is costly to developing countries with meagre budgets.

Cost of building capacity

In order to comply with the new directives, capacity has to be built amongst officials and operators, possibly involving new recruitment, and in imparting new skills and technology, and improvement of infrastructure in the processing establishments and laboratory.

For the Tanzanian case, in the long-term plan for improvement of laboratory facilities, the new infrastructure put in place has cost the country about US$1 million. The microbiological wing is operational. The chemical section needs about US$800 000 for the purchase and installation of necessary equipment. This is a relatively expensive investment, but it is mandatory for verification purposes.

Budget constraints

Funds from the Government are limited to finance capacity building activities so as to comply with the continuously changing laws, directives and decisions from the importing markets. The Tanzanian Government has set a Medium-Term Expenditure Framework budget system whereby only those activities that have been approved are eligible for funding. Any request for funding out of the approved budget is difficult to push through. However, for the case of compliance with the changing EU legislation, the government has had to cancel some of planned activities to accommodate the requirements of the new legislation, solely to maintain market access.

CONCLUSION

Changes are inevitable, and welcome in as much as they are for consumer health benefit. The problem is that the cost of compliance is high for a developing country like Tanzania, to the extent that most of the income from exports goes to maintain market access. In real terms, little is left for growth. The end result is therefore that the expected benefits from this trade are not realized by some developing countries. This vicious circle can only be broken if the importing countries develop dialogue with developing countries on how to implement necessary changes in a manner that benefits both parties.

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Tanzania – Facts and Figures.

Opportunities in seafood trade

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Looking at the agenda, and the abstracts that were enclosed in the folder of this conference, I started to think back in time. One of the few things I remember from my university studies in Norway about 25 years ago was the big disappointment I felt when I started at the university, as the first semester was all about mathematics and philosophy, nothing at all about seafood. But one of the few things I still remember from these years at the university was when one of the philosophy professors was trying to teach us to see things from different perspectives. He painted a picture of a big mountain and then he mentioned 5 or 6 people that were looking at the mountain and one of the them saw big possibilities for building a hydroelectric power plant on the slopes of the mountain, another one saw possibilities for mining and the third one saw the challenge of going to the top as a mountaineer and so on. Looking at today's agenda, it is quite similar. There are people from various parts of the world, not only from different physical parts but from different stand points. We are all talking about the same things, but we are seeing it from quite different angles. Mine is the investor's angle. I am going to take you through a short presentation of how we, who work in the seafood team of Glitnir bank, look at the seafood trade.

For us, the seafood industry is first and foremost big business. Yesterday you got scientific data and exact figures. We have looked at the volumes and added some rough estimates for monetary amounts: 140 million tonnes in total, of which the value of the aquaculture part is about US$60 billion and the value of capture fisheries about US$80 billion. But the seafood trade is more than this. Aquaculture and capture fisheries value represent just the tip of the iceberg. Primary processing, the value addition of secondary processing, distribution and trade—all these add up to quite a big number.

The seafood business is truly globalized. Globalization is an advanced process in the seafood industry. From exports of raw materials and processed to semi-processed, to imports for consumption, re-imports, all in all a very globalized business. In Iceland, it is one of the most globalized businesses and in truth it was very global long before that word became fashionable.

Glitnir bank has been involved in seafood for over a century, and taking advantage of the vast experience and involvement in the seafood industry in Iceland we formed an international seafood team about a decade ago. People from the industry have been recruited, people that have been in various parts of the seafood industry, and we have had great success in building this international platform for our business, building on the experiences gained within the Icelandic seafood industry. We see this as an interesting and exciting business, and, in our view, there are vast oceans of opportunities in this industry for any commercial player. Now, just to give you the figures, our total loan portfolio currently is about US$22 billion, of which fisheries and seafood is about 10 percent, or over US$2 billion, and I think both in percentage and volume you will have trouble finding any bank in the world that has bigger exposure specifically invested in the seafood industry.

Although we are doing business in several countries across the globe, large parts of the world still remain untouched, and return to this topic later, discussing why that

is so. Obviously, the places in which we have invested are not the only places where seafood is business or the only places where there are opportunities. I would like to give you a few of the reasons why we are where we are, and why we are not in a lot of countries.

There are a number of issues we evaluate when we look into a business opportunity, whether to touch it, what conditions to put in and how to go forward. First of all, we have a number of criteria. We take a close look at several measurable figures. But at the end of the day, if your gut feeling does not follow suit, forget it. The gut feelings include "How is the management team presenting itself? Will it be there in times of trouble? Do they have a track record? Are they reputable? Are they honest? In all these things, every criterion has to be fulfilled, not some of them, and it is a long list. When we feel comfortable with the people, with the management, people who are taking the decisions on what to do and what not to do, we look at the other factors. Then we come to things like the cash flow generated: "Is it stable or is it up and down?" "What are the risks attached to it?" From my stand point we often say that cash is king and return on the capital is obviously of paramount importance. An investor who considers investments obviously looks for return on their capital. And if they have several options—and in most cases they have—they will pick the most potentially profitable, weighted against the risks faced.

Another factor is the very important one of capital structure: "Is there enough equity in the deal?" "Is the balance between the long-term debt and the short-term debt acceptable?" In several cases, banks have been lending too little, putting constraints on the initial phase of a project, causing trouble or even killing the project unintentionally. So obviously this is important as well. Understanding the operational environment is important, and that is why a bank that has a lot of financers, economists and so on, is hiring industry expertise in order to understand the business.

There are competitive factors: "What is the stability of the industry?" "What is the competition?" "What are the trade barriers?" "What are the political risks?" Now if we talk specifically, for instance, about the aquaculture industry, we have been very active within the salmon industry and we believe that the aquaculture sector has a great future. We are doing business in this industry, but we are selecting carefully where to invest. We are in Norway, Canada and Chile, and there are reasons for why we are there and not in some other places, and that is maybe the main message I want to convey to you today. Let me clarify this.

As I have noted, there are several important issues that have to be taken care of. And there are more issues, some of them both basic and crucial. There is the issue of security and transparency. This is often expressed in country ratings. Can and does an international investor feel secure in the place of investment? Do you feel secure that next year or in 5 years or in 10 years—because we are often talking about an involvement that lasts for decades—you can be comfortable with your money in this place? Will it be nationalized next year or not? To keep an operation running, or to be able to focus on the operational issues and building of the business, stability is obviously important. And for stability it is important that the legal framework and the fisheries management system are stable and predictable. One has to feel confident that the government in charge is responsible and measures are appropriate to protect the resources. Sustainability is important, not only because we want the diversity of life and the right utilization of our earth, but also in our own interests it is important that there will be fish in the sea next year and the year after, etc.

Legal environments and policy can be touchy issues in many countries, too often distorting the economy of projects, businesses and industries. Subsidies, legal favouritism and tax issues can and often do distort the economy. Taxation varies from one place to another, variable tax levels depending on geographical location, varying

from one year to the other, etc. How can a project over 10, 20 or 30 years be planned in such an environment?

When a bank or any other investor is thinking about investment, the foreseen ability and the credibility of the legal environment is obviously taken into account, and this has to be in the mind of legislators. Another important issue for a bank is collateral. Lending to an operation in a certain geographical location requires knowing if the law there is such that, in a worst-case scenario where the collateral would have to be taken and replaced, it is doable in a proper manner? Is the legislation adequate? And is the legislation going to be in place if there is a problem in some years' time? These are all crucial issues for legislators and regulators. Do they want to allow the seafood business to be business like any other, or do they want to use it as a political tool and are ready to pay subsidies to keep it alive, rather than let it grow by its own dynamics.

Let me give you an example of how important legislation and all these basic conditions are. The salmon farming industry is an important industry where Glitnir bank has invested, while we are not at all in the shrimp farming business, even if it is very profitable, promising and has a lot of opportunities. Globally, it is even bigger business in volume and value than the salmon industry. If we take these two industries, salmon farming and shrimp farming, and look at the countries that are the biggest players and make a comparison on how feasible they are for investment for an international investor, you will see that if you take the country credit ratings of the 5 nations in each group and compare them, one scores 53 and the other 13, which is quite a difference. It has nothing to do with the companies, it has nothing to do with the business: this is about politics. Similar comparisons can be made for contracts and law index figures, and for corruption index figures. This is why we as a bank are not investing in the shrimp farming industry. It has nothing to do with the business, the people or the figures of the operations. What I am trying to tell you is that it is not necessarily what the business is doing, but rather the framework of the business, made by governments, is crucial.

To go from the challenges discussed by earlier speakers to the opportunities, this actually speaks for itself in my opinion. Peter Drucker, a very well known thinker and economist, stated that it is neither technology nor the Internet that will provide the greatest investment opportunities in the future. In his opinion it is the aquaculture industry. *The Economist* has recently featured in several articles what it calls "the blue revolution, the promise of fish farming" and this demonstrates in my opinion the potential this business has, if it is allowed to be a business.

We believe in the opportunities of the seafood industry and we are going to be participating there, being very selective. There is a growing demand for animal protein. Seafood is seen as healthy, seafood prices are high and are predicted to remain high. There is growth and that is always interesting for investors. We can also see an opportunity in that there is a call for stronger units and consolidation in the industry. The consumers and the customers of the seafood industry, the steadily growing retail industry insists that supplies are steady. For that you need a certain critical minimum size, not only because you need to supply regularly, but also you need to have marketing and negotiating power. A comparison between the meat and seafood industries shows that if the top 10 companies of each are compared, the combined annual turnover in the companies in the meat industry is about US$8.5 billion with earnings before interest, taxes and depreciation of almost 10 percent, while the 10 biggest seafood companies are less than one-quarter of this in size and the profits are half the size. This is an opportunity. In the international seafood trade there are a lot of opportunities.

Ecolabelling of fisheries products: assessment of its benefits

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INTRODUCTION

In this presentation we will be taking a cursory look at market benefits of seafood ecolabelling. The goal of ecolabelling is to harness the power of the market to achieve environmental goals, and, in the case of seafood ecolabelling, to promote sustainable fisheries. Seafood ecolabelling may not only apply to fisheries, but may also apply to aquaculture. During this presentation I will generally be speaking about capture fisheries.

The premise behind ecolabelling as a programme is that when offered a choice between an ecolabelled product and a non-ecolabelled product, some consumers might prefer the ecolabelled product (e.g. seafood from sustainable fisheries). This might lead to things such as a price premium for the ecolabelled product and/or increased market shares. It might also allow access to markets to which products from certified fisheries previously did not have access.

THE SUSTAINABLE SEAFOOD MOVEMENT

My first goal in this presentation is to put ecolabelling in the context of the larger sustainable seafood movement. The sustainable seafood movement is taking place in only a few of the world's major seafood markets. Earlier presentations in this symposium showed us the world's major producing and consuming nations. We found that a significant portion of seafood exports are coming from the developing world, but are being exported to three major markets: the European Union (EU), the United States of America (USA) and Japan. The sustainable seafood movement is active in the USA and the EU, primarily, although also in the small markets of Canada, Australia and New Zealand. The sustainable seafood movement uses the market, via consumers, chefs and the supply chain, to influence demand for seafood in an effort to affect ultimately management of either fisheries or aquaculture of a variety of species. Generally, these movements are initiated and run by environmental non-governmental organizations (NGOs), or at least private non-profit organizations. Among the tools being used are: boycotts, consumer guides to sustainable seafood (such as wallet cards), and labelling. A detailed analysis of the costs and benefits of each approach appears in Roheim and Sutinen (2006).

What are these boycotts? Well, in the USA it is a little bit more of an issue than in the EU, but in the USA we have had a couple of major boycotts. "Give swordfish a break" was a fairly well known boycott. This was promoted by an environmental group called National Resource Defence Council and a public relations firm called SeaWeb. The issue of concern was global overfishing of swordfish, fishing of juvenile swordfish, and importation by the USA of products from juvenile swordfish. One of the intents of the boycott was to pressure the USA government to make changes in the fishing management related to swordfish and also imports of swordfish, both domestically and internationally. There were claims of success by the sponsors of the boycott, in that the

USA government did make changes to fisheries management, although it is not clear what the actual market effects of the boycott were (SeaWeb, 2002).

There continues to be another boycott in place aimed at consumers and the supply chain to reduce their consumption of Chilean Sea bass (i.e. Patagonian toothfish). This is being led by an environmental group called National Environmental Trust (National Environmental Trust, 2002). There have been retail supermarket chains and restaurants that have taken the product off their shelves and menus. The market impacts of the boycott are not clear, and it is not clear that the boycott is being effective at the environmental level.

Another boycott, focused on chefs more than on consumers, has been related to Sturgeon caviar from the Caspian Sea.

The interesting economic questions regarding boycotts are many, and include:

(a) do they have a market impact?;
(b) do the market impacts cause the boycotts in turn to have an environmental impact?; and
(c) how are the costs of the boycotts distributed among those in the fishery who are practicing 'poor' fishing practices versus those who are practicing 'good' fishing practices?

With respect to the last question in particular, only costs are put onto the fishing industry (e.g. a stick as opposed to a reward or carrot). So if any members of the fishing industry in question are in fact fishing in the fishery sustainably, they are not being rewarded for their practices, but rather punished.

Consumer guides to sustainable seafood products, such as wallet cards, are something that you find in Europe, the USA and other places where environmental groups take it upon themselves to provide the consumers with a list of suggestions of what they should eat and what they should avoid. Some of you are probably familiar with these. One that is produced by the Monterrey Bay Aquarium in California[1] has rather small print so you may not be able to see it, but on the right it says "Make choices for healthy oceans" and it says "You have the power" so this is what they are telling consumers "Your consumer choices make a difference", "Buy seafood from the green or yellow columns." It is based on a traffic light system. "Buy seafood from the yellow or green columns to support those fisheries and fish farms that are healthier for our oceans, wildlife and environment." The cards help the consumer identify which seafood product they should or should not buy, including products from both capture fisheries and aquaculture.

Some of the issues with these cards are their lack of specificity. For example, Atlantic cod appears on the red list – consumers are being told not to buy Atlantic cod. There's no distinction here of where that cod comes from. It could come from Canada, from the North-Eastern USA or it could come from Iceland or Norway. The consumers are not told that if the cod comes from Iceland, then it is permissible to buy it because Iceland has an excellent management system and cod stocks are sustainable. There is no distinction as to who is doing a good job of fishing, managing their fisheries and who is doing a bad job. Further down the list, farmed shrimp and imported wild-caught shrimp is on the red list. Again, there is no distinction as to who is doing a good job and who is doing a bad job, so even if you are doing a good job, you are not being rewarded for it.

So into this mix I toss ecolabelling and assessing the benefits of ecolabelling. If one views the sustainable seafood movement, a distinction then of ecolabelling programmes relative to the other approaches is that ecolabelling rewards sustainable fisheries or good aquaculture practices certified to scientifically-approved standards. In contrast to

[1] Monterey Bay Aquarium, 'Seafood Watch: Make Choices for Healthy Oceans." www.mbayqu.org/cr/seafoodwatch.asp

the previous approaches, good management practices of fisheries for Chilean sea bass, Atlantic cod, and others that lead to sustainable fisheries can lead to certification and ecolabelled products that potentially reward the good fisheries within these species, as opposed to punishing the good fisheries with the wallet card or boycott approaches. The same can be true for aquaculture certification.

ECOLABELLING

A good ecolabelling programme ought to be based on an independent third-party certification process, and be transparent. It should include, and generally would include, stakeholder involvement from all sources, industry, environmental groups and scientists. It would include objections procedures, so that you can have an objection to a ruling from any particular party, and the standards would be based on sound science consistently applied. A good ecolabelling programme would be 100% compliant with the FAO guidelines for ecolabelling.

Of course, the programme that we all know, because it exists, the only major international programme for capture fisheries, is the Marine Stewardship Council (MSC). I think everyone knows it was established in 1996, it uses independent third-party certification firms to assess fisheries against its principles and criteria and as of right now there are upwards of 40 fisheries that are either certified or in the assessment process. This does not include fisheries that are in the pre-assessment process, which is a confidential process. The standard is made up of three principles. The fishery must have a healthy and productive stock, ecosystem function must meet certain criteria, and there must be effective management. The standard has roots in the FAO Code of Conduct for Responsible Fishing (FAO, undated).

Now of course the questions that everyone wants answered are "What are the market benefits from fisheries certification?" and "Does the consumer actually reward those that have sustainable fishing practises and who get certified?" As of right now, and based on the market research seen in the paper from Denmark (Karen Brunsø, this volume), it is not clear that the consumers themselves are driving the demand for ecolabelled products. Rather it seems, in particular in Europe, where most of the action is happening with respect to ecolabelled products, that retailers and processors are creating the market. In other words, the supply chain is creating sustainable seafood products and providing it to the consumers.

CORPORATE SOCIAL RESPONSIBILITY

So the question becomes: "What is the motive behind the supply chain providing sustainable seafood to the consumer in the absence of consumer demand?" One hypothesis might be corporate social responsibility (CSR). Portney (2005) defines corporate social responsibility as a consistent pattern of private firms doing more than they are required to do under applicable laws and regulations governing the environment in the communities in which they operate. It is reasonable to begin with an investigation of the potential drivers of corporate social responsibility. What is motivating major corporations such as Findus in Sweden, Frosta in Germany, Young's in the UK, and Walmart in the USA to sign up to procuring sustainable seafood? What are some of the things that are driving these companies to supply ecolabelled products, most particularly MSC-labelled products from MSC-certified fisheries?

One might hypothesize that it is a minimization of supply risk. That is one possibility. Unilever, when they first joined with World Wildlife Fund to create the MSC, had as one of their stated objectives that they were concerned about the future of supply. If fisheries continued to be overfished, the company would not have anything to supply to their customers. So there was an issue of assurance of future supplies of stocks of fish at a reasonable cost. That's certainly addressing supplier's risk. More recently in Europe, there have been some issues related to purchase of illegally-caught

fish. Reportedly vessels were catching cod illegally that then made its way into the supply chain of well respected processors and brands (Leigh and Evans, 2006). So companies are now requiring increased traceability in the supply chain and demanding that boats provide proof that they caught their fish legally. These are additional benefits of sustainability certification and chain-of-custody certification. The Patagonian toothfish fishery certified in South Georgia by the MSC has a very rigorous chain-of-custody certification, in order to make sure that no illegal, unreported and unregulated (IUU) fish are entering the supply chain of Patagonian toothfish.

Another possible benefit brought about by CSR relates to public relations issues. ASDA in the UK was probably not particularly happy when Greenpeace protested on their rooftops as ASDA customers were coming into the store (Cherry, 2006). Basically, why was Greenpeace there? If you are not familiar with that story, Greenpeace was protesting that ASDA was selling some species believed to have been unsustainably harvested—particularly skate, dogfish, Dover sole and ling. Rooftop protests can create public relations nightmares. Shortly after this, coupled with subsequent press releases aimed at ASDA by environmental groups, ASDA adopted sustainable seafood buying practices, and announced it would follow its parent company, Walmart in the USA, in sourcing all its wild-caught fresh and frozen fish from fisheries certified by the MSC within the next three to five years (IntraFish Media, 2006).

Other possible reasons for pursuing a policy of CSR include customer loyalty, and the creation of a more loyal workforce. In addition, in corporate reporting, environmental responsibility and social responsibility are important sections of annual reports, particularly in Europe.

MARKET BENEFITS FROM SUSTAINABLE SEAFOOD

Assessing market success, one question frequently asked is "What are the market benefits of fisheries certification and sustainable seafood?" Put in another fashion: "Is there a price premium for sustainable seafood?" This is a very difficult question to answer, for a number of reasons, and in fact may not be the most appropriate question, as market access may be a more appropriate market benefit to assess (or reduction in supply risk or other market benefits). However, price premiums are what most people focus on as the measure by which they wish to quantify success of certification.

If we look specifically at the MSC, MSC-labelled products are sold in more than 25 countries worldwide (MSC, 2006). Retail sales, in US dollar terms, showed a 76 percent increase between 2004/2005 and 2005/2006, to US$236 million.

Now let us look at price premiums. There are several levels of the market one can investigate to ascertain the presence of price premiums: the retail, wholesale or ex-vessel levels. In our research, we have purchased scanner data of the UK market from Information Resources Inc. The UK, Switzerland, and Germany are the leading markets in terms of numbers and volumes of MSC-labelled products sold that can be tracked with retail scanner data. Scanner data provides weekly unit sales and prices on a brand-level basis.

The leading MSC-certified products in the UK market are pollock, salmon, hake and hoki. We are trying to establish whether there a premium for these products. We have just obtained the data, so below are three graphs—one each for frozen processed salmon, hoki and Pollock—to try to determine in a qualitative fashion if there are price premiums. This is not statistical analysis, but just cursory glance.

Below (Figure 1) is a graph that shows retail prices for three different frozen processed wild Alaska salmon products, two by Birds Eye and one which is a private label (unknown source, store own-brand) sold in the London, UK, metropolitan area from 11 February to 4 November 2006.

The two Birds Eye products are both labelled with the MSC ecolabel. The prices are adjusted to be on a per-100-gram basis. Generally, the two Birds Eye (MSC-labelled)

FIGURE 1
Comparison of salmon retail prices in a supermarket in London, UK, at fortnightly intervals in 2006

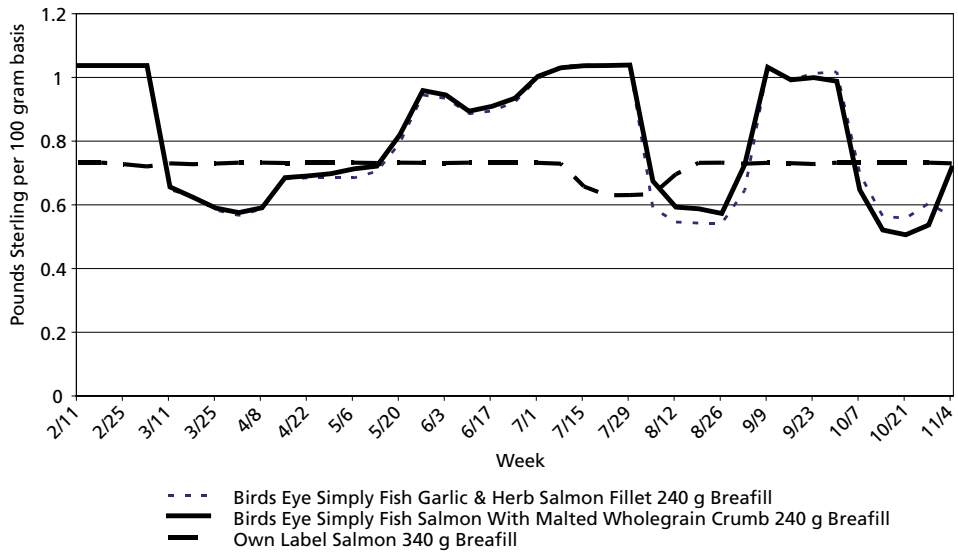
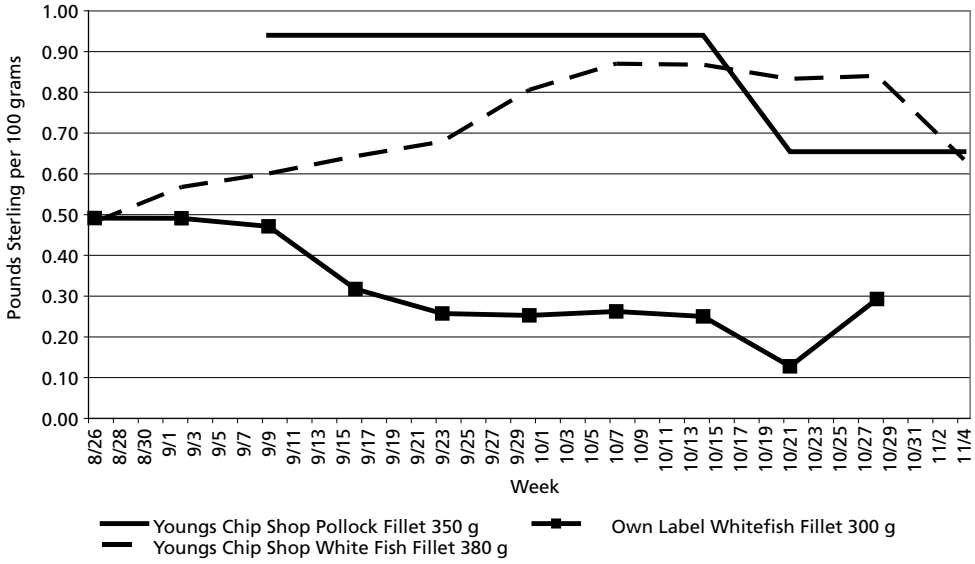


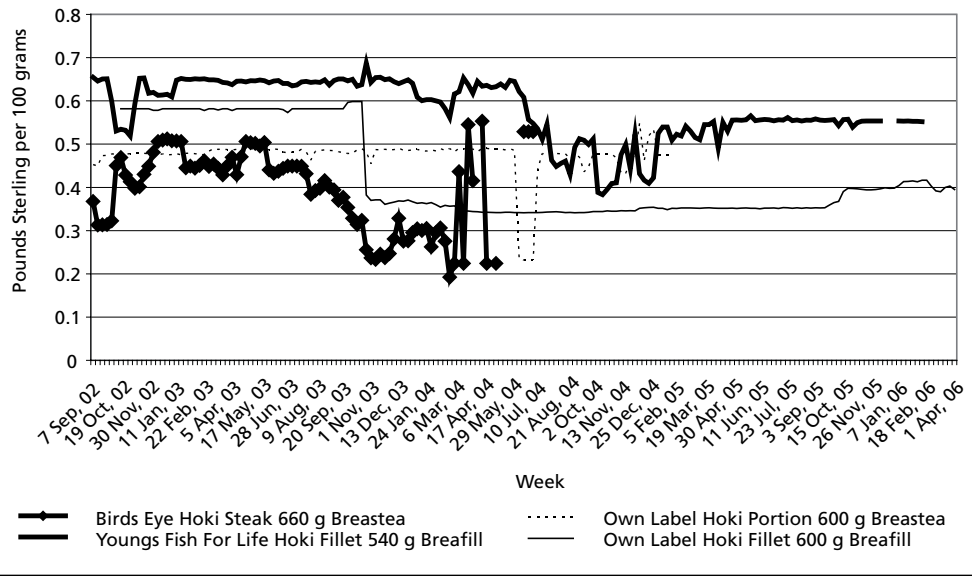
FIGURE 2
Comparison of prices (two-day basis) for three fish categories in supermarkets in London, UK, in autumn of 2006



products have higher prices than the own-label (non-MSC-labelled) product, with the exception of three different periods. These prices do not account for promotions that may have occurred in the markets.

The next graph (Figure 2) shows retail prices for frozen processed pollock fillets compared to products that the dataset terms 'whitefish', but which are highly likely

FIGURE 3
Comparison of retail prices of four hoki products, both commercial and own-label, in London, UK, from September 2002 to April 2006



to be Pollock. The two Young's pollock products are MSC-labelled, and show higher prices than the other non-MSC labelled products. Again, these prices are on a per-100-gram basis.

Finally, the third graph (Figure 3) shows prices for hoki from September to April 2006. There are some issues with hoki. A Birds Eye hoki product was labelled with the MSC logo, as well as a Young's product. The prices in between are unlabelled own-brand hoki products. There were some marketing issues related to hoki, both in terms of positioning it as an alternative whitefish to cod and haddock, and quality issues suffered by Birds Eye in processing of the product, which had an impact on the success of the launch of this species in the UK market (Porritt and Goodman, 2006). Young's appears to have been able to capture a premium from the MSC logo, while Birds Eye did not.

The question remains: if there is a retail price premium, is there also a transmission of that premium down the supply chain to a wholesale premium and further to the ex-vessel level? We do not know. Research continues. We do not even know in any rigorous fashion if there is a retail premium yet. What was presented above is only a snapshot, for only one area in a country, and not conclusive.

ENVIRONMENTAL BENEFITS

The purpose of ecolabelling programmes is not to just provide a market benefit, but ultimately it was intended to provide an environmental benefit. The point is to improve the environment, to create sustainable fisheries if they do not already exist or to reward those that do exist. So do market benefits lead to environmental benefits?

The MSC recently posted an environmental benefits study on its website, conducted by Marine Resources Assessment Group (MRAG) (Agnew *et al*., 2006). This study looked at the environmental benefits generated from certification of fisheries. Some selected outcomes from this study are that in the case of the certification of the New Zealand hoki fishery, habitats and trawl grounds have been mapped. For the same fishery there has been increased observer coverage on the reliability of detection of

the seal mortality that has resulted. In the case of the Western Australian rock lobster fishery, there has been a reduction in seal mortality as a result of the assessments. In the Patagonian toothfish fishery of South Georgia, there has been a reduction in hooks that have been discarded, and a reduction in albatross mortality.

Of course, environmental benefit is not only about improving fisheries that have met certification standards, it is also about providing market incentives to improve fisheries that do not currently meet the standards. One of the things that we have seen is that the Alaska pollock has been successful now that it is certified, evident in terms of increased market access into markets that it did not have previously. It could be concluded that the reason the Russian Pollock fishery has now entered into pre-assessment—which required making changes to their fishery management institutions and policies to improve their practices—is the incentives created by losing high-value markets to the Alaskans post-certification (Rogers, 2007).

CONCLUSION

In conclusion, we have to recognize that the sustainable seafood movement is here to stay. Some of the alternatives approaches to market-based mechanisms, such as boycotts and consumer choice guides, are what I would classify as "less preferred" to ecolabelling, for a host of reasons. Market benefits of ecolabelling are as yet unproven from the rigorous statistical perspective of an economist, but the behaviour of corporate social responsibility on the part of many fisheries, processors, retailers and others in the supply chain of the international seafood industry seems to indicate that there are market benefits in a sense broader than simple price premiums. In the future, quantification of those benefits will be of interest to many: industry, environmentalists and policy-makers alike.

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Processing quality seafood

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ABSTRACT

Automation of food processing has made significant progress in recent years due to improvements in hardware and software. The processing flowline, which in addition to fish processing has been applied in poultry and other food processing, is a central component in many modern factories. The flowline provides means for systematic inspection of food and workmanship through manual inspection stations. Fully automatic inspection is offered by X-ray based scanning systems, which automatically locate bones and foreign material, selectively discharge the items for rework, and display an image for the operator, pinpointing the location of the undesired artefact. Finally, a data recording and reporting system accumulates information from the process and creates various reports on screen or on paper, showing key parameters or trends from the process in real-time or over extended periods.

INTRODUCTION

Flowlines for fish processing have revolutionized the industry in recent years (Andersen and Magnusson, 2002; Andersen, 2003). In addition to potentials for added profit and yield for the processing plant, material handling is improved, and the work environment of the employees can be improved. Yet another benefit from the flowlines is the possibility of improved quality control (QC) and raw material traceability.

Numerous examples of this technology can be found in advanced fish processing plants, particularly in northern Europe and North America. Furthermore, it is interesting to note that many of the concepts introduced in fish processing lines are being transferred to other food processing industries, such as poultry and meat processing. In this paper, some examples are given of state-of-the-art equipment for food processing, made available from the firm Marel.

APPROACHES TO QUALITY INSPECTION

There are a number of approaches to quality inspection in food processing, and two aspects should be specifically recognized: total vs. sample inspection, and automatic vs. manual inspection.

Total inspection refers to the inspection of all of the raw material or products that are processed. None of the material leaves the process without having been inspected. Alternatively, in sample inspection, limited samples are taken and the results of their inspection are used as representative for the whole. Automatic inspection does not rely on human participation in the evaluation or inspection of the products, while manual inspection requires people to take part in the process.

Quality control in the fish processing flowline

Sophisticated product inspection and QC has been implemented in flowlines designed for fish processing, and these concepts have been duplicated into poultry processing systems. The quality inspection in the fish processing flowline is essentially a sampling

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FIGURE 1
A typical fish processing flowline may employ up to 20-30 operators, carrying out trimming that is checked afterwards by quality inspection

system, using manual inspection. In a typical manual fish processing line, a number of workers work with individual fillets, where the outlines are trimmed, skin patches are cut away, and bones and parasites are removed. After trimming, each worker leaves their fillets in a buffer, which automatically discharges them onto a take-away conveyor. This conveyor accumulates the fillets from all operators on the line and carries them onwards (Figure 1).

At the end of the line, samples from the stream of fillets are periodically taken aside by an automatic discharge unit and delivered to a QC station, where a human quality inspector evaluates the fillets. The system keeps track of each batch of fillets from the point where they were dropped from the operator, and as they travel along the take-away conveyor. Thus, the system has information on which operator trimmed the fillets that are taken aside for quality inspection at any given time. The quality inspector evaluates the work done on the fillets, such as by counting the number of bones found, parasites remaining in the fillet, skin that may still remain, and other quality aspects of the work. Furthermore, the fillets delivered from the operators are automatically weighed and compared against the raw material before trimming, weighed on the way to the operators. With this information, the quality of the work performed by each operator can be evaluated and compared against the throughput and yield. Sampling from the operators is primarily done randomly, but the system is equipped with intelligence to increase the rate of sampling from those who appear to consistently deliver products of inferior quality. The benefits from such an "adaptive random sampling" QC system include:

- Quality defects are traced to individual operators, permitting corrective action.
- Salaries may be paid according to individual performance, which can be based on a combination of work quality and throughput.
- Statistics about quality can be benchmarked, analysed and traced over a period of time.
- A measure of quality can be conveyed to the customer purchasing the processed products.

The exact timing and routeing of raw material through the system, as well as sophisticated recording and presentation capabilities of the software, make the QC capabilities of the flowline possible. All data from the process is stored in a central database system, the MPS (Marel Processing System), which allows the user to carry out analyses and print reports of various types.

A CASE STUDY: AUTOMATIC BONE DETECTION

While the fish processing flowline is sample-based and uses manual inspection, other systems may carry out total inspection, where all of the processed material is inspected, and implement this by fully automatic means. The fish bone inspection systems using the Marel SensorX unit are an example of this (Figure 2).

The SensorX is a low-energy X-ray unit that scans a stream of individual pieces or continuous flow for the presence of bones and contaminants of higher density than the food material. The SensorX was developed to automatically find pinbones in whitefish fillets, such as cod.

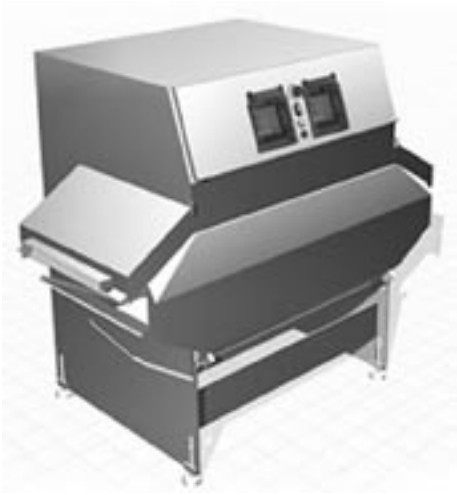
In some ways the principle is similar to other conveyor inspection units, such as those used for luggage inspection at airports. The raw material, typically fish fillets,

enters an opening at one side of the unit, in one or two parallel lanes. A low-energy X-ray scan is performed and the resulting images are routed to a computer for analysis, where the computer applies sophisticated software to detect bones. The raw material and the location of bones is tracked as the product leaves the SensorX through an opening at the other side and continues on another conveyor for further processing. Discharge stations are placed along this conveyor and receive signals to catch those items that contain bones, while the remainder of the material continues along, without interruption. Each discharge station is equipped with a graphics monitor displaying a picture of the item containing bones, as well as coloured marks where the bones are located. This permits the human operator to work on each piece, locate the bones with the aid of the monitor, remove them and return the piece back into the flow of material (Figure 3).

The minimum size of bones detected by the SensorX depends on numerous factors, such as the calcium content of the bones, the condition of the fillets, and the location and orientation of the bones, to name just a few. During the development of the unit, the aim was to produce an instrument that could process fillets at a typical throughput rate for filleting machines, on two lanes (left and right fillets), and detect bones that would be considered dangerous to consumers. The SensorX has been able to detect bones down to 0.3 mm diameter and 4 mm length, which meets these criteria.

The use of a bone detection unit help reduce claims from customers and puts the user in a unique position regarding delivering products that have been thoroughly inspected for bone content, on an individual basis.

FIGURE 2
The SensorX bone detection unit



Fillets or continuous streams, such as unfrozen block material, run through the machine in dual lanes.

FIGURE 3
Discharge stations following the SensorX bone detector

Fillets with bones are received at the stations and monitors show operators the location of the bones.

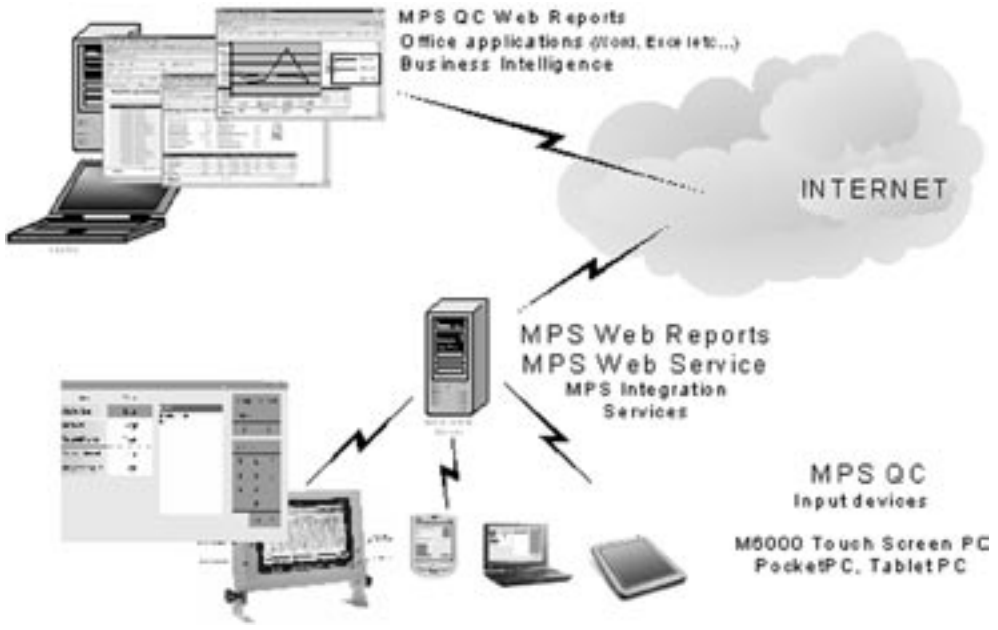
MPS: data recording, analysis and reporting

Data accumulated from the SensorX bone detector, from manual QC inspection stations or other points of quality evaluation, are sent over a local network to a central computer system, such as the MPS (Marel Production System).

The MPS keeps track of the flow of raw material through the factory and can link batches of the raw material to individual processing lines, equipment or human operators. This system is modular and one of the modules is the "MPS QC", an automatic data collection and reporting system designed for QC.

Each unit on the factory floor, such as individual scales, portioning machines, grading units, SensorX inspection units and terminals at operator stations, communicates with the MPS, periodically sending processing data for recording (Figure 4). The MPS can also be used to send configuration parameters back to the equipment, for example, to select a production programme. A central computer is typically located in a supervisor's

FIGURE 4
The MPS is a modular process monitoring and reporting system, which can process data from multiple plants using internet connections



office, where real-time information and statistics on throughput, quality and other aspects of the process can be viewed. Furthermore, such central computers can be interconnected through the internet, giving the users access to monitor the equipment and processes in different plants, and even in different parts of the world. All this access is protected through a password system and other security measures.

CONCLUSION

A number of devices are currently available to help evaluate the quality of processed food, such as fish fillets. The manual inspection or QC station is still a key part of the process, but various equipment items are increasingly used to provide automation and support the human quality controller. The SensorX bone detector is one such device, which automatically detects and locates bones and foreign artefacts, and sends a signal to reject the respective piece out of the raw material stream.

Advances in mechanical devices, electronics and software are continuously being applied to further automate the food processing operation, as well as to improve the yield and quality of the output material.

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Traceability – a necessary evil?

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ABSTRACT

There has been an increased interest in traceability in the last few years. This has not least been because of food scandals, well covered by the media, and the legislation that followed. The legislation requires that reactive systems be in place to facilitate a recall of products or to prevent them from reaching the consumer. Because of the reactive nature of traceability systems, many companies have considered them an added cost, with little obvious gain for the company.

But traceability methodology can also be used for things other than recall, and in a more proactive way. This can for example be for marketing or production management. In order for this to be possible, the traceability systems need to be connected to or integrated with other systems in the company, like HACCP, Quality Control systems, Production Management systems and others.

INTRODUCTION

Traceability methodology has been around for a long time and is an essential element in many production-related systems. However the focus on the term traceability and on specific traceability systems was increased greatly when the European Union (EU) and the United States of America (USA) put forward regulations (EU regulation 178/2002; Bioterrorism Act) that require all food and feed producing companies to have the ability to trace their products and the ingredients used. As a consequence of this, many companies have had to put in place systems or strategies to be able to trace their products, and in the event of failure, recall them from the market.

The reactive and insurance-like nature of traceability systems has led many to the understanding that these systems are only an added cost in the production – a necessary evil.

Traceability systems are necessary today because of legislation and also because of marketing and company image. If they are evil, in the sense that they only add cost but bring no value to the companies, depends mainly on how the systems are designed and used.

THE CONCEPT OF TRACEABILITY

There are various definitions of traceability, both in the legal text and in standards text. EU Regulation 178/2002 describes it as

> *"the ability to trace and follow a food, feed, food-producing animal or substance intended to be, or expected to be, incorporated into a food or feed, through all stages of production, processing and distribution."*

In the ISO definition, the term "ability to trace" is also present.

This is important if we look at what is needed to comply with the legal framework.

The definition of traceability and what is implied in the new regulations is the *ability* to trace and follow the food. These regulations deal with external traceability, or traceability between parties in the supply chain. They say little or nothing about

the traceability systems that you need to have in place, whether they be electronic or paper based. Also there is no direct mention of the size of batches or the reaction time in case of crisis.

So traceability is a very elastic concept, it can be pulled to all sides to fit the situation at hand. This is why traceability can just as well be applied in the developing countries as in the developed countries. The level of traceability that can be achieved may be different, the level of technology may be different and batch sizes may vary, but the systems can comply with the legal requirements.

What is important with regard to the legal requirements is to know where your supplies come from and where your products go.

INCREASED FOCUS ON TRACEABILITY

The increased demand for traceability that has emerged in the last decade or so is largely due to a number of food crises (BSE, dioxin, Sudan Red 1, etc.) that have occurred and, due to their seriousness, have had much media coverage. This prompted extensive discussions about food safety and food-safety-related matters.

The players in the food supply chain all want traceability but for slightly different reasons: governments have had food safety or consumer safety as the main driving force in putting in place the regulations; producers also have consumer safety as a big issue, but image, brand protection and minimizing the recall volume are also important; while retailers or buyers look at traceability on the producer side as a means of getting a more homogeneous supply. And of course green issues are an increasing driver for traceability. The consumers naturally want safe food, and consumers are beginning to think more about fair trade, ecolabelling and such matters: "Where is this food that I am eating coming from?" "How are the workers treated?" "What are the facilities they are working in?" "Is the stock managed in a sustainable way?" and so forth. These things all matter, and in an increasing manner.

TRACEABILITY IN MARKETING

Traceability is already being used for marketing in various ways. We have an example of an advertisement of the Thai Frozen Food association, where they are saying "If you think of shrimp, think of Thailand". They also mention traceability in this advertisement, so the message is "If you think of Thailand and shrimp, think of traceability". Traceability there is supposed to promote some sort of feeling of safety and freshness. So there is a connection between safety and freshness and the term traceability. The Australian Meat Association also has an advertisement where they connect safety and traceability, and what they say about meat could easily apply to fish: *before our fish hits the plate, it has to look good on paper.*

There was an *E. coli* outbreak involving spinach from the USA, in September 2006. The FDA said that possibly some of it was exported to Iceland. So the Icelandic industry reacted by recalling everything that could have possibly been affected. But there was an Icelandic company that at that time started to run a TV commercial where they said, "Our organic lettuce is traceable to the field". So this was in direct response to the news about the spinach from the USA and traceability was directly being used for marketing there. But the funny thing about this campaign is, did the US companies not have traceability? Well of course they had because the FDA managed to find out that the contamination came from three counties in California and some producers initiated a voluntary recall based on their traceability systems. So what was happening here? Well the Icelandic company was using the perception of the consumer that traceability means safety. Dr Valdimarsson quoted someone from the food industry in his lecture (this volume) saying that "customer perception is our reality", and this is maybe what this Icelandic advertisement was based on.

Traceability systems as such do not increase the likelihood of safe products reaching the market; they minimize the damage that unsafe products that have left the companies cause by implementing targeted recall.

TRACEABILITY IN PRODUCTION MANAGEMENT

As has been said before traceability systems are like insurance: they cost and you hope never to have to use them. However, by using traceability information in relation to other product and process related information, you can get returns from the traceability system, i.e. make it less evil.

With fish there are two problems in this regard. One is that fish is perishable by nature, so you really never know how much time you have unless you have very good control over the whole chain. The other problem is that between the medium and long term, it can be quite inhomogeneous as a raw material, so its suitability for certain products varies by time of year, by fishing ground, etc. This means that the profitability of production can vary in accordance with fishing ground and time of year, even with very stable market conditions. This is of course what makes the fish business so difficult, but through innovative use of the systems in the company, you can counteract this to some degree.

In each processing plant or in the supply chain as a whole there are numerous systems. We have traceability systems in many companies and all sorts of quality-related systems that are collecting data. We also have management systems and sales systems, and they are all collecting what I would like to call similar data. They are all in place for the same reason. To produce safe food at the lowest possible cost. The traceability system can not function properly if the other systems are not in place. A traceability system that stands alone and has no basis in other systems will be of little benefit because you have no way of limiting the recall volume if you do not have any monitoring information behind the system telling you where the fault in the product originated. This is why we can expect these systems to merge to some degree in the near future, or at least exchange information in a more systematic manner.

Still there is a fundamental difference in the data coming from these systems. Some of the systems are process oriented: they are looking at a specific stage in the process and they are proactive. They are proactive in the way that they are monitoring a certain place in the process and trying to prevent something from happening there. They may be checking the temperature and if it goes out of bounds, corrective action has to be taken. The traceability system, in contrast, is product oriented. Traceability is looking at material flow, it is looking at batches and it is reactive. The best thing to happen to you is to never have to use your traceability system. So it is reactive, it only kicks in if the other systems fail in some way. So traceability is like car insurance. You have to have it. Whereas the other systems are more like sensible driving, and if you drive sensibly you are acting in a proactive manner. But even if you are sensible and drive carefully, you still have to buy car insurance because the way you drive can affect others. It is the same with the traceability system: you need to have a traceability system in place because they way you produce your products can affect others in a negative way. So this is relevant when it comes to combining the data from these systems for use in a production management system, and we want to combine and use them all for the same goal.

So what is the product that the traceability system is following? A product is the sum of its attributes, attributes being size, salt percentage, species (is it cod or is it hake), microbial or chemical levels that are allowed, and so forth. And each product has a unique set of attributes, and each attribute has a maximum and a minimum, and these are put in place either by legal requirements or requirements from trade agreements. The proactive systems are monitoring the attributes. They are monitoring the processes

that are handling the products, and they take corrective action when attributes go out of bounds, because when a product is out of bounds or the attributes are out of bounds and the product reaches the market and is discovered, the traceability system reacts by recalling the affected products. To limit the recall volume you need to have as much information about the affected lot as possible. That's why you need to get information from all the systems that you have in place. But to do that you need to have a way to know which data is associated with which product or batch. One way of doing this is by mapping all the data to a common timeline, a traceability timeline. Then, if you know when a product was in a certain place in the system, you can gather all other data from that time and place and in this way build a snapshot of what was happening in each production phase when the product in question went through there.

Some companies in the fishing industry are looking into this already and it has also been looked into by the meat industry. So everything is mapped to a common timeline and to the traceability system or any other system.

What is important here is that events in the processing environment, product attributes and the situation in the product environment be recorded in such a manner that each bit of information can be connected to a time and a place, and thus to a certain product batch.

An end product usually has one batch number. In reality a product is part of numerous batches. Salted cod would be part of at least the following batches;

- the raw material batch;
- the salt batch; and
- the packaging material batch.

Usually, in Europe at least, most companies have good traceability for the main raw material, the fish, but when it comes to the ingredients and the packaging or the processing lines and so on, the traceability is less. So the level of traceability is different for the different batches. For the main raw material it is good, but for the other batches it is often less good. The situation is similar in developing countries.

Product recall depends on where the problem originates and, in the case of packaging, it would be a pretty big recall. If you have no control over packaging batches, it would be even bigger.

Using a timeline approach can help in this situation.

One added benefit of having all the data in one system is that we can start exploring relationships between various product attributes and/or process attributes. One could, for example, connect the yield and the profit margin to fishing ground or time of year. Many other possibilities open up when such relationships are looked into. There is ongoing research in this area in Iceland, led by the former Icelandic Fisheries Laboratories, now Matis, and it is very promising.

So the problem today, regarding combining data from different systems, is that there is not enough standardization regarding data handling and storage for the various systems. Some companies have been working on this issue so that the systems can better work together. The same methodology, as has been covered here for the production management within the company, can apply to the supply chain as a whole. You can use the same way of thinking and then maybe you can connect retail shelf life, to transport mode or transport route.

So I believe by gathering all the information into one system, and using the historical data, you can make the traceability systems pay back instead of just costing.

So, just to summarize, if you use traceability just to fulfil the legal requirements, it is a reactive, insurance-like system. But when you start using it for marketing, because of the perception of traceability being trust or safety, then you can use if for differentiation, for segmenting, by fitting the raw material to the product in each market segment. You can use it for production management, such as suitability of raw materials to certain products based on historical data. This is proactive use of traceability systems.

Using traceability systems just to fulfil legal requirements will cost you, and then the answer to whether or not it is evil is probably yes. But when you start using traceability systems in a different way and start making them work for you, even when nothing is going wrong, then the bottom line will not suffer—the traceability systems are no longer evil.

Education and training with and for the fisheries sector

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INTRODUCTION

Many developing countries have rich fishing grounds over which they have gradually been gaining control since the United Nations Convention on the Law of the Sea entered into force in 1994. This, along with expanding aquaculture, has made the export of fish and fish products of prime importance to many developing countries. A widespread lack of management and enforcement, however, has led to increased pressure on fish stocks, which threatens the livelihoods of fishers and their families. This also poses a threat to the supply of fish for processing and export.

Over the last few decades, fish production has declined in the more affluent societies, which are increasingly depending on imports. At the same time, fish production in developing countries, especially in Asia, has increased, and the volume and value of trade has increased more rapidly than for any other commodity.

Total fish supply from capture fisheries has remained around 90 million tonne per annum for the last quarter of a century (Grímur Valdimarsson, this volume) but the global supply of fish has increased considerably due to the growth of aquaculture, which exceeded 48 million tonne in 2005 (excluding plants). Aquaculture development, however, does not come without a cost, and it is a challenge to maintain and increase aquaculture production.

To meet the national and global challenges of fisheries and aquaculture, research and training are essential components. According to the Charter of the United Nations University (UNU) it shall prioritize its work in the areas "*..of pressing global problems of human survival, development and welfare that are the concern of the United Nations and its agencies*". The establishment of the Fisheries Training Programme (UNU-FTP) in Iceland in 1998 testifies to the global importance of fisheries and professional training in the fisheries sector.

In this paper we will first consider some criteria that need to be kept in mind when designing and implementing extended training at the graduate level. This will be followed by a short review of the development of fisheries in Iceland. Iceland is a special case, as the importance of fisheries in its economic development has no parallel in Europe, and, even if the relative importance of fisheries has declined in recent years, it still forms a substantial part of the economy. Finally, we will describe the UNU-FTP and assess the extent to which the programme meets the training criteria and involves the fisheries sector in Iceland.

CRITERIA FOR THE EDUCATION AND TRAINING OF FISHERIES PROFESSIONALS

We do not always know what training programmes we need, but we should at least be able to say something about how they should be run, and what criteria we need to meet for training in the twenty-first century. The general criteria of post-graduate training, i.e. an approach of enquiry, analysis and reflection, applies as much to fisheries as any other field. Training of professionals should also encourage the development of wider views, adaptability, taking responsibility and further learning.

Graduate professional training should:

- build on both intra- and interdisciplinary knowledge and methods;
- reflect training in basic and applied skills and should encourage innovation;
- reflect local and global issues and trends;
- encourage links between universities, institutes and the private sector;
- promote competence in the use of information and communication technology; and
- encourage lifelong development opportunities.

The Charter of the UNU indicates that UNU activities should promote the coexistence of people of different cultures and the application of science and technology in the interest of development and the proper use of natural resources. It shall also support the growth of vigorous academic and scientific communities, particularly in developing countries.

DEVELOPMENTS IN THE ICELANDIC FISHERIES SECTOR SINCE 1980

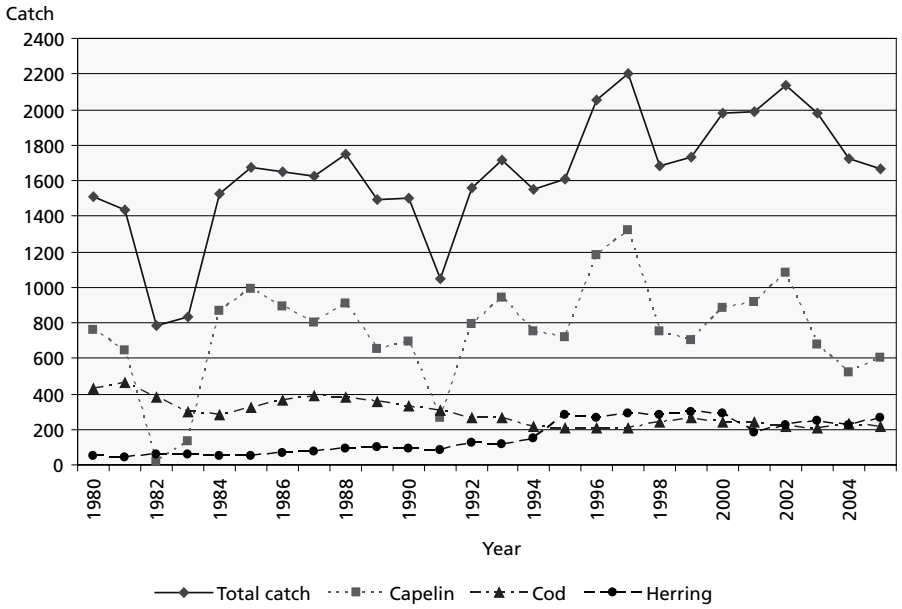
Fisheries have been the driving force of the modern economy in Iceland. Up until the 1970s, the emphasis was mainly on finding new fishing grounds and stocks to exploit, but as the realization set in that the marine stocks were finite, increased emphasis has been on the management of the resources. Even if Icelanders considered early on the need for university training in the fisheries sector, the perceived need has changed over time. A parliamentary committee established in the mid-1940s estimated that the fishing industry needed only a single trained microbiologist, mainly for the canning industry. In the early 1980s, the demand for food scientists was estimated to be 15 (Vilhjálmur Lúðvíksson, pers. comm.) and the introduction of university training in this area in Iceland was controversial. Today between 200 and 300 have graduated from this programme and most have been employed by the private sector. This example shows how difficult it can be to predict future training needs, but it also reflects how the fishing industry has been evolving into a knowledge-based industry. By looking at the trends in the fisheries, we may be able to identify the type of training that is required and the role the sector can play in the training.

Since 1980, the total annual catch in Icelandic waters has fluctuated between 0.8 and 2.2 million tonne and in most years has been from 1.5 to 2 million tonne (Figure 1). The fluctuation is largely determined by the catch of capelin, a short-lived pelagic species. Economically, though, the most important part of the catch is cod. Although it only contributes 10-15% in terms of volume, cod is a major contributor in terms of value, as reflected in an Iceland saying cited by the minister for foreign affairs in her opening address, "*life is a (salted) cod*". Fisheries management in Iceland revolves around cod, but, even so, in the last quarter of a century, annual cod catches have declined from over 400 000 t to around 200 000 t (Figure 1). Even if the catch is increasingly made up of less valuable species, the export value of fish over the same period appears not to show a declining trend, even if there are inter-annual fluctuations (Figure 2). This is not only the result of the large number of food scientists being employed by the fishing industry during this period, but reflects the transition of an industry from being mainly a provider of raw materials to a knowledge-based industry that is sensitive to changes in market demands. Without the increased level of education and technology in the sector, fisheries in Iceland would not have been able to adjust the way it has to the changes in the catches.

THE UNU FISHERIES TRAINING PROGRAMME

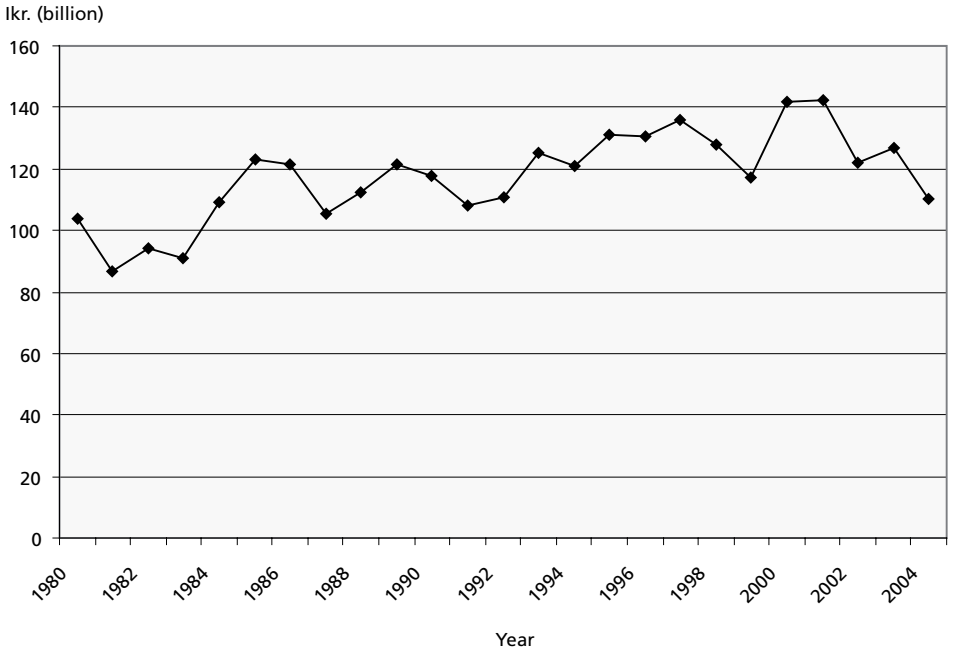
Fisheries are a rapidly changing field, and how we train professionals could be just as important as the knowledge and skills acquired in the training. The UNU-FTP provides post-graduate training to fisheries professionals from developing countries. How we carry out our mandate reflects both the policies of the UNU and our view of what type of professionals derive the greatest benefit from what we can offer in

FIGURE 1
Total catch in Icelandic waters from 1980 to 2005, showing the contribution of capelin, cod and herring



Data from Statistics Iceland.

FIGURE 2
Export value in the Icelandic fisheries 1981–2005, adjusted to the 2005 rate

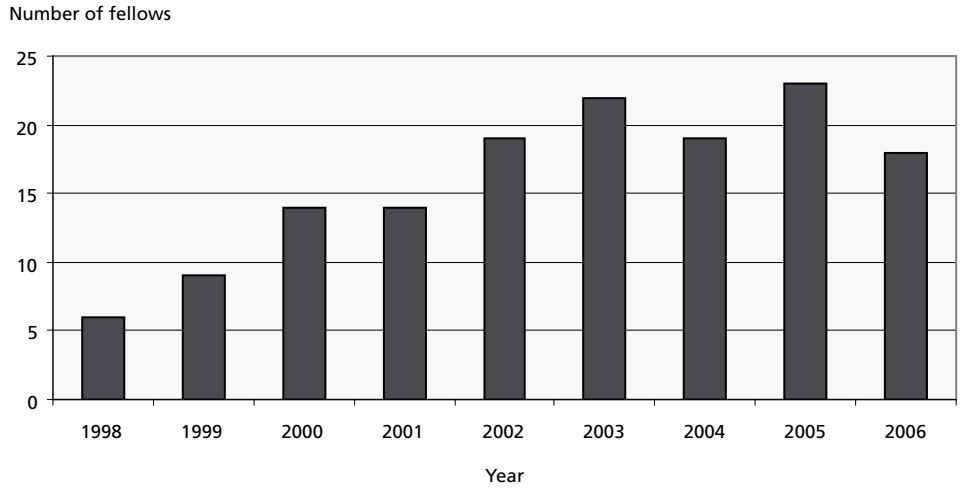


Data from Statistics Iceland.

Iceland. Our ready access to private companies and other parts of the fisheries sector in Iceland is a major strength of the programme and makes it unique.

There are several conditions that must be met when selecting partner countries. Apart from an expression of interest, fisheries have to be important, either nationally

FIGURE 3
Number of fellows completing the six-month post-graduate training of the UNU-FTP in 1998–2006



or provincially, and authorities have to regard fisheries as an important sector. Partner institutions are then selected on the basis of expressed priorities and their importance in the implementation of a government fisheries policy. Only a limited number of candidates are taken from each country in any given year. To qualify for the programme, candidates must have at least a first degree, two years of work experience, and they must have the support and recommendation of their home institution.

Since the establishment of the UNU-FTP in 1998, its core activity has been the six-month post-graduate course in fisheries. During the first year, six fellows from three countries participated in the training, but over the following years the number of fellows gradually grew and is now around 20 per year (Figure 3). So far 144 fellows from 25 countries have completed the six-month programme (Table 1).

Candidates are selected following an interview in their home country and in consultation with their institutions. The selection process is aimed at inviting candidates who have enough knowledge, understanding and experience of their own fisheries sector to be able to make comparisons and draw lessons from their studies in Iceland. The programme should not be seen as competing with training opportunities in partner countries, but rather the aim is to strengthen and complement such training.

Programme structure

The programme starts in late August or early September with one week of orientation. This is followed by a five-week introductory course, which offers an overview of fisheries. Fellows contribute to the introduction by presenting aspects of their own fisheries, which they have to put into a regional or international context, thereby gaining an appreciation of the challenges and development potential of their home fisheries. After the introduction, fellows split into different areas of specialization (Figure 4). The specialization consists of six weeks of formal course work and a 14-week research project. The research project has to address an important issue or area of priority in their home institution or country.

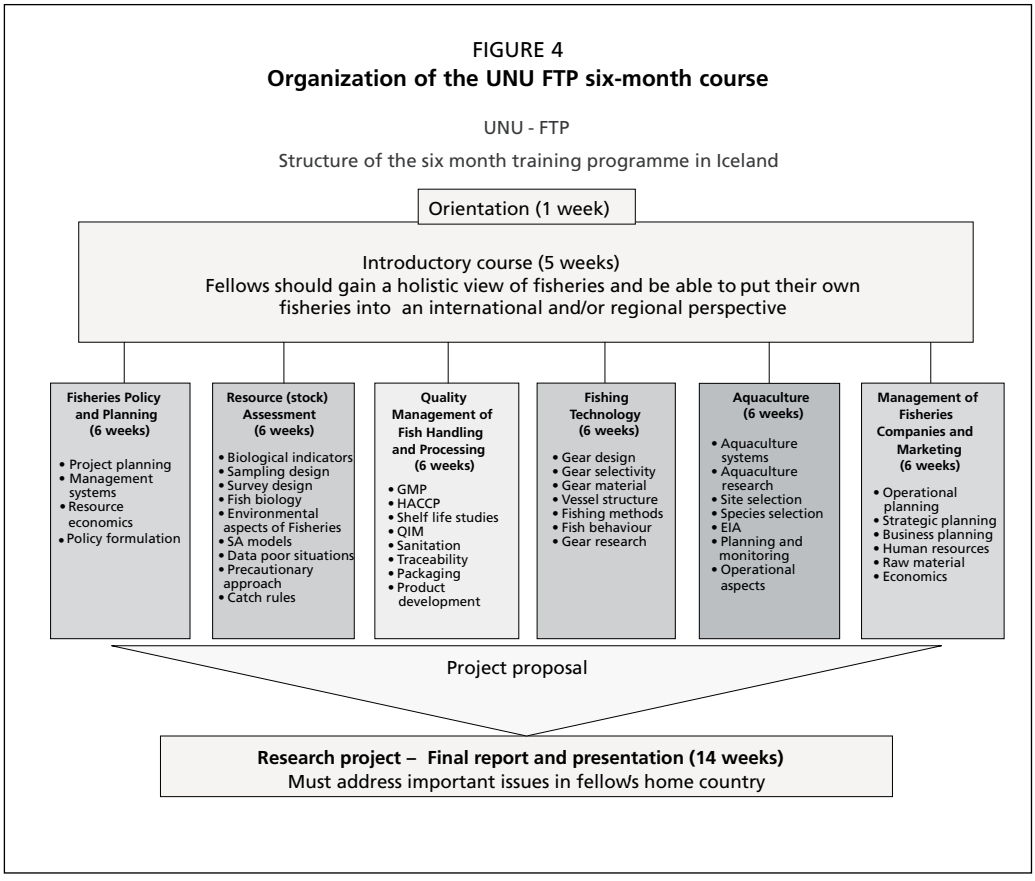
The acquisition of skills and application of knowledge is important. The practical orientation of the programme is emphasized as it is based within research institutions, as well as universities. The UNU-FTP is a cooperative programme between the UNU and the Marine Research Institute in Iceland, Matís (formerly Icelandic Fisheries Laboratories), the University of Iceland and the University of Akureyri. In addition,

TABLE 1
UNU-FTP fellows in 1998–2006, according to country and area of specialization

Country	Area of specialization						
	Quality Management	Policy & Planning	Resource Assessment	Fishing Technology	Company Manage-ment	Environ-mental Studies	Total
Angola						1	1
Argentine		1					1
Cape Verde	2		1	1	2		6
China	5	2	1		1	1	10
Cuba	4	1	3		3	1	12
Estonia	1	2	2				5
Iran	3	1	1			1	6
Kenya	2		2		1	2	7
Malawi		1	1	2			4
Malaysia	1			1	4	1	7
Mauritius	1		1	1		1	4
Mexico	2			2		1	5
Mozambique	4	1		1	1	1	8
Namibia	1	4		2			7
North Korea (DPRK)	1			1			2
PICs*		2	1				3
Russia	1		2	1		1	5
South Africa		2					2
Sri Lanka	5	1	1	2	2		11
Tanzania	2	3		1		1	7
The Gambia	1		3	1	1		6
Uganda	7	3	2		1		13
Viet Nam	7	1	2	1	1		12
Total	50	25	23	17	17	12	144

NOTES: *Pacific Island Countries: Fiji, Tonga and Vanuatu

FIGURE 4
Organization of the UNU FTP six-month course



other institutions and companies are engaged depending on the interests of the fellows. One of the main strengths of the programme is the support the fisheries sector in Iceland has always lent the programme, be it institutions, companies or individuals.

There are a number of specific points that have been kept in mind when designing the programme to serve the needs of professionals from a variety of fields in the fisheries sector:

- Fisheries training should build on both intra- and interdisciplinary knowledge and methods.
  The developmental goals for fisheries usually have ecological, economic and social elements. These are also present in international treaties and resolutions and reflected in consumer awareness and demands in the largest import markets. In the introductory course, the interaction and roles between different disciplines in the private and public sectors is examined and the international environment explored. Initially, many fellows are impatient and would like to engage sooner in their own area of specialization, but, with time, most come to appreciate this part of the course as a time when they developed a larger view of fisheries and their own role in the larger context.
- Fisheries training should reflect training in basic and applied skills, and should encourage innovation.
  There is a need to find a balance between training for immediate efficiency and training of innovative capacity. General skills encourage reflectivity and ability to learn from local and global experiences, but specialist knowledge is often needed to deal with urgent issues. The six-week specialist courses are designed to strengthen the understanding of fellows on fundamental aspects of their disciplines and latest developments. The application of existing knowledge through the use of accepted methodologies is the focus of the research project. which fellows carry out in close cooperation with their supervisors.
- Fisheries training should reflect local and global issues and trends.
  Fisheries is a rapidly changing field and one which has to adapt to the problems that come with highly perishable products and large seasonal and inter-annual fluctuations in supply, as well as global issues and trends. At the beginning of the studies, teachers and supervisors get information about the fellows and are encouraged to use examples that relate to issues applicable to the home countries of the fellows. Global issues are well illustrated in lectures and during the visits to companies and public institutions that form an integral part of the course work in the programme.
- Fisheries training should encourage links between universities, institutes and the private sector.
  A rough estimate shows that private sector investment and trade contributes 10 to 100 times more to fisheries in developing countries than does development cooperation. We must therefore not only look at the public sector. We must also work with the private sector and promote cooperation between the two, something which appears not to be common in developing countries. The close cooperation between the private and public sectors in Iceland is reflected in the structure and content of the six-month programme of the UNU-FTP.
- Fisheries training should promote competence in the use of information and communication technology.
  There has been an escalation of information, but not necessarily of ideas. How do we judge the value and validity of information? Does it make sense? How do we evaluate it? We need to recognize the potentials, benefits and risks in information and communication technology. Upon their arrival in Iceland, fellows get their own laptop computer. They have 24-hour internet access, and they receive training in the use of computers and the Internet. The use of important and acknowledged

internet sites and databases in fisheries is practiced. A critical discussion on the reliability and validity of the data fellows use is part of their presentations on aspects of their home fisheries described earlier.

- Fisheries training should encourage lifelong development opportunities.
  Fisheries training should offer individuals the opportunity to develop both personally and professionally. Training programmes and training are perhaps not least about people living significant events, that moment when things fall into place, when a new view has been formulated. But it is also about being able to take responsibility, argue and debate. In the programme, we encourage open debate, and fellows should always be able to justify their selection of problems, their approach to solving them, and their analysis and interpretations. At the same time, they form significant relationships with teachers, mentors and fellow students.

CONCLUSION

Training programmes in fisheries should be like the sector itself, constantly changing and evolving in response to changes in the environment and challenges of the sector.

The UNU-FTP takes advantage of the unique opportunities Iceland offers for applied and problem-oriented post-graduate training in fisheries, through strong cooperation among public institutions and private companies. At the same time, it is guided by the overall principles of the UNU. Fellows come from a wide variety of backgrounds. Usually about 15 countries are represented in the six-month training course, coming from a wide geographical area. Regional and international cooperation is encouraged. Several fellows publish their final projects in refereed journals together with their supervisors, and each year 3 or 4 fellowships for further post-graduate studies in Iceland are awarded. Further professional opportunities are created for former fellows through their participation in the development and implementation of short courses and workshops in their home countries or region.

Through the programme, we try not only to improve knowledge and skills. Training of individuals should strengthen their institutions and societies. The fellows should have a keener sense of their own worth, but also of their obligations towards their profession, their institutions, society and the international community.

Opportunities and challenges in international seafood trade – a company perspective

Birgir Össurarson[1]
Samherji hf, Iceland

SAMHERJI HF

The company has been one of Iceland's leading fishing companies for many years. It is a vertically integrated operation, with a strong holding of fishing quotas in Icelandic waters and abroad. It owns about 30 trawlers and boats.

It is in charge of production, and handles sales through its own sales departments, selling products to all over Europe, Asia and USA.

Samherji was founded back in 1983, starting with one rusty trawler. For the next 15 years most effort was in trawling operations. Things have changed a lot over the years. Nowadays, most of our Icelandic cod is processed in our land-based factory, for a simple reason: products from there are providing higher returns than producing them frozen at sea. It is a fluid situation, so we have to decide every time how to maximize returns from our quota. What can we get for the fish swimming in the sea? We have various options: production of frozen-at-sea fillets; production in land-based factories, and either fresh or frozen; production of saltfish; dryfish; or even selling it whole fresh out of the country. The situation can change from one year to another, and we need to be able to adapt to this and the markets.

Being a vertically integrated operation is really one of our main strengths. For me as salesman, it is very important to know what I have behind me. I know how much quota we have, I know our production facilities (factories and trawlers) and the production options we have. And I know how to transport goods to the market. This gives me confidence in what I am doing, and I try to sell the whole story as I believe in it.

Icelandic operations

- ***Whitefish factory –*** Cod and Haddock produced as fresh and frozen portions, and sold to UK, France and Scandinavia.
- ***Trawlers*** – frozen-at-sea products, including Cod, Haddock, Redfish, Greenland Halibut and Saithe, sold to all over Europe, Japan, Taiwan and USA.
- ***Cooked and peeled prawns –*** production of *Pandalus borealis* for the UK market, Scandinavia and Germany.
- ***Fish farming*** – Salmon, Arctic Char, Turbot and Halibut, sold to USA and all over Europe.
- ***Pelagic fish*** – sea- and land-frozen production of Herring, Capelin and Blue whiting, with main markets in Japan and eastern and central Europe.

Operations abroad

- ***Faeroe Islands*** – trawler operation and fish farming.

[1] Birgir Össurarson has been with the company for 15 years, as technical manager, operations manager, production manager and, for the past 10 years, sales and marketing manager.

- ***Germany*** – trawler operation and fresh fish factory.
- ***UK*** – trawler operations and fish factory.
- ***Poland*** – trawler operation and sales office.

AN EXAMPLE OF WHEN SOMETHING WENT WRONG

Only 15 years back, there were 27 cooked and peeled prawn factories in Iceland. Today there are 7 and almost certainly fewer by the end of year.

But why? What happened? What went wrong?

For a long period, Iceland was the largest producer of cooked and peeled *Pandalus borealis* ... until production really kicked off in Newfoundland in 1995–1998. In a short period they came from producing almost nothing to becoming the world's largest producer of coldwater prawns. Icelandic producers as an industry, and their sales people, did not react to this, or not until too late. At a similar time, warm water prawns came with power into the market, and coldwater producers in the North Atlantic (Iceland, Norway, Faeroe Islands) were left behind. We took no action, and did not protect our product in the market against the warm-water prawn invasion. So, what happened? There was oversupply over far too long a period. It went from a market with quite a good balance of supply and demand to a buyers market. Prices went down every year for 5 to 7 years. It is only just this year that we are seeing market improvements and higher prices.

It is a fact – a fact that has cost the coldwater prawn industry a fortune. And it really did not have to be this bad, if only we all had reacted earlier.

CULTURE

To be able to make things happen you have to accept the culture in every country. I can not expect success if I introduce myself to a new market and expect them to do things my way. It is very important to understand a new market, accept it and adapt to it.

I know too many examples of people attacking a new market, being arrogant and "gotta do things my way". This has not been successful.

When I travel to Japan, I have to behave in certain way, being very polite, and work on a long-term relationship. When I am in UK for meetings, I have to dress the right way! Being neither too casual nor overdressed. When having a meeting in the USA, I need to be prepared to listen! It is a fact that the Americans like to talk. Nothing wrong with that, it is just how it is.

When getting into a new market it is vital to know and understand what is on our potential consumers menu. In other words, we need to understand the consumers wish for what they like.

The customer is never wrong ... but maybe not always right!

COMMUNICATIONS

Communication is a key to successful business relationships. Although the world is getting smaller, with high technology and better connections making things easier for us, nothing will replace a personal relationship. How communications should be can vary much from one customer to another: some customers require a lot of service, information and general chat about this and that; others only want to concentrate on pure business.

HOW TO APPROACH NEW MARKET

We need to behave in a different way according to where we are going. It is a question of being able to adapt to the market, so it is all about flexibility.

First we need to know what kind of product we have, secondly we need to decide whom to approach. Again, this is very much different depending on where in the world we are heading. And that of course is the beauty of it all.

CHALLENGES

- ***Find the right partner*** – Find out with whom to work, because wrong decision can be costly.
- ***Understand the competition –*** Not necessarily within the world of seafood, but also competition from other foods, such as meat. The biggest challenge is to enter a new market with a new product.

OPPORTUNITIES

Our strength is that we do have the product, we believe in the product, and—what is very important—we have the know-how.

Although living on an island in the middle of nowhere, we as Icelanders are well informed about the global seafood industry. We do have a lot of experience, and we have access to wonderful fishing grounds that we protect carefully. We are aware of what is happening elsewhere and we are well connected to the wider world.

And we have a firm belief in who we are, what we are doing and where we are going ....

..... that's what makes us a bit special!

Trends in consumer attitude and selection

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ABSTRACT

This paper will focus on the understanding of consumer trends, consumer attitudes and consumers' selection and preferences in relation to seafood. Results from surveys of consumption levels in Europe reveal that seafood consumption varies a lot across Europe, not only in relation to frequency of consumption, but also in relation to types of fish products and types of species that are preferred in different countries. In order to understand what drives demand, it is argued that motive or value fulfilment in many situations is a major antecedent for decision-making and food choices. Thus, in the present paper, different attitudes and preferences are discussed, e.g. consumer perception of health, taste, process characteristics and convenience aspects in relation to fish. Results show that consumers perceive fish as a safe, healthy and nutritious food product. Consumers also consider fish as delicate and tasty, while bones are thought of as unpleasant, and fish is furthermore perceived as expensive. When it comes to evaluating fish quality, the handling of fish and the preparation of meals with fish, the results show that light users especially experience more problems and prefer easy solutions. Thus there is a need for a better understanding of how convenience is related to fish attitudes and consumption as well as on the development of targeted new convenience products. The light users need simple information, they need guidance in preparing the seafood and they really would like to have some products developed to address their problems and barriers in relation to seafood.

INTRODUCTION

This paper aims at introducing principles guiding the understanding of consumer trends, consumer attitudes and consumer selection and preferences in relation to seafood. First results of surveys on consumption levels in Europe will be presented, followed by a discussion on how to understand consumer motives and drivers for food and seafood choices. This will be followed by the presentation of results on consumer attitudes and preferences in relation to seafood, with a specific focus on light versus heavy users. Finally, the paper will provide a view on future challenges for the seafood sector.

It is a fact that seafood consumption levels vary a lot across Europe (Brunsø, 2003). Earlier findings have pointed out that the southern European countries as well as the Nordic countries have high consumption levels, with Portugal, Iceland, Spain and Norway having the highest consumption of fish, whereas Belgium *inter alia* presents a low level of average consumption. The span between the highest and the lowest levels in terms of kilograms consumed per year per person is around 50 kg. In order to have a closer look at the present situation, we have in connection with the EU project SEAFOODplus collected data in several European countries.

Data were collected by randomly selected representative household samples from Denmark (N = 1110), Poland (N = 1015), Belgium (N = 852), Spain (N = 1000) and the Netherlands (N = 809), resulting in a total of N = 4786 respondents. The fieldwork

and pre-testing of the questionnaire was handled by local market research agencies. Interviews were conducted in different ways in the five countries: In Poland and Spain, the interviews took place face-to-face in participants' homes. In Denmark and Belgium, data were collected by mail surveys, with response rates of 79 percent in Denmark and 53 percent in Belgium. In the Netherlands, consumers were asked to participate electronically by means of a web survey. In all countries a quota sampling procedure was applied, with age and region as main control factors.

The person mainly responsible for food shopping and cooking was selected as the respondent from each household, and as a result 77 percent of the respondents in the total sample are females. Except for the proportion of men and women, samples are representative for each country in terms of basic socio-demographics, such as age, education, town size and region. Due to cultural differences, seafood consumption differs across Europe with respect to amount, type of fish and species. In the following sections, the different consumption patterns will be presented.

OVERALL FISH CONSUMPTION

According to our results, European consumers eat fish 1.49 times a week on average, which is less than the recommended level of consuming fish twice a week. Furthermore, this figure includes both at-home consumption as well as out-of-home consumption, and thus the preparation of fish in the households will be even less that 1.49 times per week on average across the countries included. As can be seen in Table 1, the overall consumption frequency differs significantly from country to country, and while the Spanish consumers eat fish 2.6 times a week on average, the Dutch consumers eat it less than once a week. Thus, Spain is the most fish eating country followed by Denmark where consumers eat fish 1.41 times a week. In Belgium, the Netherlands and Poland it is less common to eat fish and here the average consumption of fish is about once a week. In general consumers primarily eat fish at home, thus averagely 81 percent of all fish meals are consumed at home. The findings reveal that only Spanish consumers live up to the recommendations about eating fish twice a week and suggest that actions should be taken to increase fish consumption across Europe.

TABLE 1
Average frequency of fish consumption.*

	N	Mean	F	Sig
			222 698	0.000
Belgium	851	1.10		
Denmark	1096	1.41		
Netherlands	809	0.95		
Poland	1012	1.20		
Spain	999	2.60		
Total or average	4767	1.49		

NOTES: * times per week, based on the sum of fish meals eaten at home and outside home.

TABLE 2
Consumption of different product types: shares in total consumption (percentage basis)

	Share (percentage basis) per country					Typical in
	Belgium	Denmark	Netherlands	Poland	Spain	
Whole fresh fish	13.3	9.8	8.8	9.9	28.5	SP
Filleted fresh fish	24.3	11.6	19.3	12.5	15.7	BE, NL
Raw fresh fish	6.6	3.7	11.8	5.7	4.8	NL
Pre-packed fresh fish	13.3	7.3	13.6	5.2	6.9	BE, NL
Deep-frozen fish	17.3	8.5	17.1	15.4	13.2	BE, NL, PL
Ready-to-eat meals with fish	5.8	2.7	8.8	9.4	6.4	NL, PL
Canned fish	13.3	29.0	14.9	22.7	20.6	DK, PL
Fish in glass (marinated)	5.8	27.1	6.6	18.8	3.6	DK, PL
Sum	**100**	**100**	**100**	**100**	**100**	—

TYPES OF FISH

In order to investigate how the intake of fish differs in relation to types of fish that are consumed in the five countries, respondents were asked to state the consumption frequency of eight typical European types of fish. Table 2 shows that whole fresh fish, for instance, is commonly consumed in Spain, where it makes up 28.5 percent of the types of fish examined. The preference for whole fresh fish may be due to the fact that Spanish consumers eat much fish and therefore have more experience in handling of fish.

In countries with relatively low fish consumption, consumers prefer more convenient types of fish than in Spain. In Belgium and the Netherlands, for example, consumers prefer filleted fresh fish, pre-packed fresh fish and deep-frozen fish, which are all products that are easier to prepare than whole fresh fish. In Denmark and Poland, canned and marinated fish are the most commonly consumed fish products. Deep-frozen fish is much more common in Poland than Denmark. Results also show that ready-to-eat meals are most common in the Netherlands and Poland.

Fish species

To investigate the consumption of various fish species, consumers were asked to state the consumption frequency of 11 different species. Across the five countries, tuna is the most commonly consumed species, while the consumption of eel and plaice is low in most countries (Table 3).

In Belgium cod and salmon are the most common species eaten, while Danish consumers prefer herring, which accounts for 21.9 percent of the total consumption. Another 18.6 percent of the fish consumed in Denmark are tuna, and 10.4 percent of the fish consumed by Danish consumers is plaice, which is quite much compared with other countries. In the Netherlands, tuna is the most popular species, followed by salmon, cod and herring. Eel counts for 6.6 percent of Dutch fish consumption, which is relatively much compared with other European countries. In Poland, herring is nearly as popular as in Denmark, while mackerel accounts for 18.9 percent of consumption. Poland has the highest share of Alaska Pollock. Tuna and hake make up nearly half of the Spanish fish consumption. The share for hake is much lower in other European countries (1.1 percent to 10.0 percent). In general, we must conclude that species typically consumed varies a lot between countries in Europe.

As expected, we can conclude that there are major differences in the consumption of fish across the five countries in relation to consumption levels and types of fish consumed. But how can we explain this huge variation, and what are consumers really interested in? What are the major trends driving demand on the market side?

TABLE 3
Consumption of fish species: percentage shares in total consumption per country

	Share on a percentage basis					Typical in
	Belgium	Denmark	Netherlands	Poland	Spain	
Cod	18.3	6.1	13.3	8.8	8.5	BE, NL
Salmon	16.2	10.8	15.0	4.7	9.3	BE, NL
Sole	9.6	1.8	7.1	1.5	13.9	SP
Trout	5.6	4.7	8.0	5.0	7.4	NL, SP
Tuna	15.7	18.6	15.9	12.1	24.3	SP
Plaice	6.1	10.4	1.3	1.8	2.0	DK
Hake	2.0	1.1	2.7	10.0	23.1	SP
Mackerel	6.1	16.5	9.7	18.9	6.0	DK, PL
Eel	2.5	2.5	6.6	2.1	1.4	NL
Herring	6.6	21.9	12.8	20.4	2.2	DK, PL
Alaska Pollock	11.2	5.0	8.0	15.0	1.8	PL, BE
Sum	**100**	**100**	**100**	**100**	**100**	**—**

DRIVERS OF DEMAND: MOTIVES AND ATTITUDES

It has been argued that motive or value fulfilment in many situations is a major antecedent for decision making and food choices, e.g. the achievement of desired consequences such as a nice enjoyable meal or the expected health benefits achieved by eating some specific foods (Brunsø *et al.,* 2004). Based on numerous studies, four general motives or drivers for food choices have been distinguished in Europe. They are health, taste, process characteristics and convenience (Brunsø *et al*., 2002). *Health* is a dimension that has become very important for many consumers, and consumers form preferences based on this dimension motivated by expectations of both a longer life and one of higher quality (Roininen *et al*., 2001; Vannoppen *et al.*, 2002). *Taste* of food has always been of high importance to most consumers: food is a matter of pleasure, and few people eat things of which they do not like the taste (Grunert *et al.*, 2000; Verbeke, 2006). Thus taste and other organoleptic aspects of food, like appearance and smell, are still an important issue for consumers. In recent years, consumers have attached increasing importance to the way food is produced, i.e. the *production process* has become a dimension of quality, even when it has no immediate bearing on the taste or healthiness of the product. Finally, *convenience* is becoming more and more important, and from a consumer point of view convenience is much more than just ease of purchase or quick consumption. Convenience means the saving of time, physical or mental energy at one or more stages of the overall meal preparation process: planning and shopping, storage and preparation of products, consumption, and the cleaning up and disposal of leftovers (Gofton, 1995). In the present study, we have also looked into issues of consumer perception of health, taste, process characteristics and convenience in relation to fish.

OVERALL ATTITUDES AND PREFERENCES IN RELATION TO FISH

Our results (Table 4) show that consumers perceive fish as a safe, healthy and nutritious food product. Consumers in the study also consider fish as delicate and tasty, while bones are thought of as unpleasant, i.e. the results confirm that bones are a barrier to fish consumption, as also found in other studies (e.g. Baird *et al*., 1988), while consumer perception of the smell of fish is neutral (average = 4.01). Earlier studies showed that fish is generally perceived as expensive and, in addition, consumers have stated that they would eat more fish if it was less expensive (Baird *et al.*, 1988; Nielsen *et al.*, 1997). Our results confirm that fish is perceived as expensive, but at the same time value for money is relatively high, indicating that the relationship between price and quality is considered to be relatively fair (average = 4.54). In Belgium and Poland in particular, the price is thought of as very high, which may indicate one of the reasons for the low consumption of fish in these two countries.

TABLE 4
Cross-cultural attitudes and preferences

Attitude	Belgium	Denmark	Netherlands	Poland	Spain	Average	Std Dev.
Eating fish is healthy	6.10	6.38	5.99	6.45	6.25	6.25	1.13
Eating fish is nutritious	5.74	6.30	5.62	6.17	6.22	6.04	1.64
Eating fish is safe	4.84	5.01	5.06	5.74	5.45	5.24	1.21
Eating fish is risky	2.87	3.11	2.97	2.77	2.51	2.84	1.39
Fish has a good taste	5.93	5.97	5.41	6.33	5.87	5.92	1.51
Eating fish is delicate	4.94	5.83	4.40	5.83	4.78	5.21	1.54
Fish has an unpleasant smell	3.69	3.70	4.15	4.28	4.22	4.01	1.60
The bones in fish are unpleasant	5.65	5.17	5.56	5.62	5.33	5.45	1.64
Eating fish is ethically correct	4.77	4.60	4.61	5.11	4.95	4.81	1.58
Eating fish is trendy	3.70	4.15	3.77	4.64	3.54	3.98	1.94
Eating fish is boring	2.38	2.31	2.68	2.52	2.99	2.58	1.82
Eating fish is expensive	5.71	5.32	5.32	5.82	5.28	5.49	1.44
Fish gives good value for money	4.46	4.72	4.70	4.74	4.10	4.54	1.63

NOTE: Attitude items were measured on a 7-point agree-disagree Likert scale (1 = totally disagree; 7 = totally agree).

Across countries, results show that health is an important motive for eating fish, since consumers in all five countries agree that fish is both healthy and nutritious. Eating fish is also considered relatively safe as opposed to risky, but Polish and Spanish consumers think of fish as being much safer than other European consumers. European consumers generally perceive fish as delicious and tasty, but Dutch consumers are less positive towards fish than other nationalities. As regards the smell of fish, the average evaluation is around 4, i.e. the smell is neither considered pleasant nor unpleasant. Consumers across the five countries agree that bones are unpleasant.

Eating fish is in general neither perceived as trendy nor boring. In Poland, however, it appears that fish is considered trendier than in other cultures, and this may be related to the fact that the price of it is also considered very high, i.e. in Poland fish is thought of as a luxury product. As can be seen from the analysis, nationality certainly has an impact on consumers' opinions about fish.

Light versus heavy users

Earlier findings have shown that the distinction between consumers with high and low consumption of fish is highly relevant when investigating consumer attitudes and preferences towards fish (Juhl and Poulsen, 2000). In Table 5, the total sample of consumers is divided into three groups depending on the frequency with which they eat fish at home. The groups (excluding consumers who never eat fish) were: "seldom eat fish / light users" who consume fish at home once a month or less; "regularly eat fish / medium users" who consume fish at home two or three times a month to once a week; and "often eat fish / heavy users" who consume fish at home twice a week or more.

The results reveal that 23.6 percent of the consumers in this survey eat fish at home only once a month or less. Almost half of the consumers eat fish between two to three times a month and once a week (47.8 percent), while less than one-third of the consumers eat fish the recommended at least twice a week (28.6 percent).

Four of the attitude statements are closely related to health, and for each of these there were significant differences between the three groups (P=0.000). The table of multiple comparisons showed that consumers who seldom eat fish perceive it as less healthy and less nutritious than those who eat it more frequently, and light users especially consider fish less safe or more risky. When comparing consumers who eat fish regularly with consumers who eat it often, the results follow the same pattern, i.e. heavy users are in every aspect more positive towards fish than medium users.

Consumers generally agree that fish has a good taste and is rather delicious, but light users in particular think of fish as less tasty than other consumer groups. The smell of

TABLE 5
Light versus heavy users of fish

Attitude	Seldom eat fish (mean)	Regularly eat fish (mean)	Often eat fish (mean)
Eating fish is healthy	6.01	6.32	6.45
Eating fish is nutritious	5.73	6.08	6.33
Eating fish is safe	4.87	5.29	5.56
Eating fish is risky	3.15	2.81	2.61
Fish has a good taste	5.49	6.10	6.29
Eating fish is delicate	4.92	5.32	5.44
Fish has an unpleasant smell	4.31	3.92	3.77
The bones in fish are unpleasant	5.76	5.47	5.13
Eating fish is ethically correct	4.58	4.87	5.02
Eating fish is trendy	3.92	4.10	3.90
Eating fish is boring	2.86	2.48	2.38
Eating fish is expensive	5.57	5.56	5.38
Fish gives good value for money	4.16	4.71	4.71

NOTE: Attitude items were measured on a 7-point agree-disagree Likert scale (1 = totally disagree; 7 = totally agree).

fish was neither perceived as pleasant nor unpleasant, while bones were considered unpleasant by all consumer groups. The study shows that the more positive attitudes consumers have towards sensorial aspects of fish, the more fish they consume.

There are significant differences between the three groups with respect to the four statements about taste, smell and bones (P=0.000), as can be seen in Table 5. However, when comparing the three groups, only some of the mean differences are significant at the 0.05 level. With respect to "Eating fish is delicate" and "Fish has an unpleasant smell", no significant differences can be found between medium and heavy users. The tendency however follows the identified pattern, i.e. medium users are less positive than heavy users, as expected. Two attitude-statements are related to price and value for money, and as it appears from Table 5, light and medium users fully agree that fish is expensive, i.e. in this respect there is no significant mean difference between these two groups. At the same time, we can conclude that among light and medium users the price of fish is considered higher than among heavy users. The perceived value for money differs significantly between the three groups (P=0.000). As expected, light users consider the value of fish less than others, whereas medium users have the same perception of value for money as heavy users.

We also included questions about evaluation of fish quality. Consumers find it difficult to evaluate fish quality and they do not feel very confident in evaluating safe and fresh fish. The light users especially experience more problems in evaluating quality. They do not feel they know whether they make the right choice of fish, and this lack of confidence in their own ability to choose the right fish in a supermarket, for instance, causes dependence on other people's evaluations of fish quality and a feeling of lack of control. Finally, we also investigated perceived problems in relation to handling of fish. The ones that eat fish often do not experience many problems and they know how to treat the fish, while consumers eating fish less often experience more problems and do not feel very skilled in relation to either handling or preparing fish.

FUTURE CHALLENGES

Based on the analysis above we can conclude that there are significant differences in attitudes and preferences among light, medium and heavy users across Europe, and this emphasizes the need for developing and promoting fish, targeting light users especially. Seen in this light, the topic of convenience becomes very important, since lack of knowledge, skills, abilities and time to prepare home meals influences consumer food attitudes and choices in the direction of more convenience food (Gofton, 1995). We find the same trend in our study in relation to fish, where light users experience more problems. From a consumer point of view, convenience is more than just ease of purchase or quick consumption. Convenience means the saving of time, physical or mental energy at one or more stages of the overall meal process: planning, shopping, storage, preparation of products, consumption, and the cleaning up and disposal of leftovers (Gofton, 1995). Since light users of fish particularly experience these problems when purchasing and consuming fish, we believe that more focus is needed on the understanding of how convenience is related to fish attitudes and consumption, as well as on the development of targeted new convenience products. The light users need simple information, they need guidance in preparing seafood and they really would like to have some products developed to address their problems and barriers in relation to seafood.

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