

International seafood trade: challenges and opportunities

FAO/University of Akureyri Symposium
1–2 February 2007
Akureyri, Iceland



Háskólinn
á Akureyri
University
of Akureyri



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Preparation of this document

These proceedings contain the manuscripts from the symposium on International Seafood Trade: Challenges and Opportunities, held in Akureyri, Iceland from 1 to 2 February 2007.

The University of Akureyri, Faculty of Business and Science organized the meeting in collaboration with the FAO Fisheries and Aquaculture Department.

The University of Akureyri, Faculty of Business and Science hosted the symposium. The Icelandic Ministry of Foreign Affairs and the Icelandic Ministry of Fisheries provided financial support.

Abstract

These proceedings contain the manuscripts from the symposium on International Seafood Trade: Challenges and Opportunities, held in Akureyri, Iceland from 1-2 February 2007.

The University of Akureyri, Faculty of Business and Science organized the meeting in collaboration with the FAO Fisheries and Aquaculture Department.

The meeting included a range of views regarding the risks and challenges inherent to the recent developments in international seafood trade. These included views from government officials, business representatives and academia.

The symposium reviewed developments related to:

- recent trends in the seafood sector;
- seafood safety and quality market access requirements;
- WTO dispute settlement process;
- developing countries perspectives;
- investment opportunities;
- ecolabelling;
- consumer trends; and
- education and training in the seafood sector.

The symposium highlighted that the seafood sector is extremely dynamic and is increasingly becoming a global sector. Risks include the pressure of global demand on capture fisheries that are often over-exploited, meeting the higher sanitary and phytosanitary requirements being set by the markets, and the development of voluntary eco-labels. Opportunities include the further development of the aquaculture sector, the advancement of technology to meet sanitary and phytosanitary requirements, and the further development of the value-added sector in developing countries.

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Foreword

The promotion of free trade is at the core of Icelandic foreign trade policy. Through free trade and commercial interaction with other nations, Icelanders have secured their economic independence. Active foreign trade in products of the living natural resources of the ocean has been fundamental to the prosperity and welfare of the Icelanders.

This has been reflected in Icelandic policy statements at the Food and Agriculture Organization of the United Nations in recent years. The Organization is an important forum for the promotion of free trade ideas in the food sector, since it is charged with the mammoth task of securing the world's food security. More free trade in food products goes hand in hand with increased food security. This is especially important for developing countries and in the global fight against hunger.

At FAO, Iceland has repeatedly drawn attention to the importance of fisheries for the world's food security. Many developing nations, struggling to secure their livelihood, have enormous potential in use of their living marine resources, be it through small-scale fisheries or highly technically advanced fisheries. These resources need to be made use of for the food security of the people of these countries.

Iceland has directed its development cooperation mainly to countries with potential to utilize their fish stocks in a sustainable way. This cooperation involves numerous aspects of fisheries, such as catching, processing and inspecting the products, as well as trading and marketing.

Icelandic companies have acquired extensive experience in trading with fish. In a relatively few years they have become active participants in the global trade in fish products. This, along with long experience in fisheries research, led to the idea of organizing a Symposium on *International Seafood Trade: Challenges and Opportunities*, in cooperation with FAO and its Fisheries and Aquaculture Department.

Icelandic authorities attach great importance to the work of the FAO in the field of fisheries, and consider its Committee on Fisheries (COFI) to be the appropriate forum for global discussion of fisheries issues within the UN system. COFI's Sub-Committee on Fish Trade has contributed greatly to the discussion on global fish trade, as demonstrated by the Sub-Committee's endorsement this year of the voluntary technical guidelines aimed at promoting responsible international trade in fish and fishery products.

The Symposium on International Seafood Trade brought together at the University of Akureyri in North Iceland professionals from many different fields and representatives of various interests. The content of this book demonstrates the many-faceted discussion that took place in Akureyri. It was a great pleasure for the Permanent Mission of Iceland to FAO in Rome to assist in organizing this symposium and enjoy the cooperation with so many professionals involved in fish trade. This should also be seen as a demonstration of the wish of the Icelandic authorities to contribute to creating healthy global trade in fish and fishery products, and thus contribute to food security and the fight against hunger in the world.

Guðni Bragason

Permanent Representative of Iceland to FAO

Acknowledgements

The symposium “International seafood trade: Challenges and opportunities” was held in Akureyri, Iceland, 1–2 February 2007. It was organized by the University of Akureyri, Faculty of Business and Science, in collaboration with the Fisheries Department of FAO in Rome. The Organizing Committee consisted of:

Dr Eyjólfur Guðmundsson, Professor, University of Akureyri, Iceland

Dr Hjörleifur Einarsson, Professor, University of Akureyri, Iceland

Mr Pétur Bjarnason, Director and Chairman, Fisheries Association of Iceland

Dr Tumi Tómasson, Programme Director, UNU Fisheries Training Centre, Reykjavik, Iceland

Dr William Emerson, Senior Fishery Industry Officer, FAO, Rome, Italy

Dr Grímur Valdimarsson, Director of Fishery Industry Division, FAO, Rome, Italy

Financial support was generously provided by the Icelandic Ministry for Foreign Affairs and the Icelandic Ministry of Fisheries. The object of the symposium was to bring together leading experts on seafood trade-related issues in order to identify the opportunities and challenges that lie ahead in the sector. Special thanks to Dr Thorsteinn Gunnarsson, Rector of the University of Akureyri, and Mr Gudni Bragason, Permanent Representative of Iceland to FAO, without whose enthusiasm the symposium would not have materialized. Thanks are extended to all those who made presentations and chaired sessions.

Thanks to AK Travel for travel arrangements.

Final language and style editing and preparation for publication were by Mr Thorgeir Lawrence.

Opening address

Inaugural address by

Her Excellency Valgerður Sverrisdóttir,

Minister for Foreign Affairs and External Trade of Iceland

Ladies and Gentlemen,

It gives me great pleasure to open this Symposium at the University of Akureyri. Since the nineteenth century, Akureyri has been a vibrant centre for agriculture, commerce and fisheries in northern Iceland. I, myself, grew up not far away from Akureyri and benefited greatly, like so many others, from its intellectual and cultural life.

I would like to use this opportunity to congratulate Dr Thorsteinn Gunnarsson, the Rector of the University, and his staff for providing us with this platform to discuss the challenges and opportunities for international seafood trade. Allow me also to thank the United Nations Food and Agriculture Organization in Rome—and especially Dr Grímur Valdimarsson—for cooperating with the University on the Symposium.

We can hardly overstate the importance of fisheries for Iceland's economic development. To quote one of the most memorable characters of the great Icelandic novelist, Halldor Laxness, "life is cod above all else". Indeed, cod still is our most important export. Iceland's history in the twentieth century is mainly the story of how the expanding fisheries sector transformed a country, once among the poorest in Europe, into a highly developed welfare state. This reflects the vital role that fisheries continue to play in our economy.

But Iceland has also had to grapple with many of the same challenges as other fishing nations. The increased capacity of our fishing fleet meant that the threat of overfishing became a pressing matter. Giving our dependence on fisheries, this issue was particularly important for us, as any collapse in our fish stocks would have brought serious consequences for our economy. As early as in the beginning of the 1980s, both the industry and the Government realized that sensible fisheries management was essential, not only for the fisheries sector but also for Icelandic society as a whole.

In 1984, we introduced a new fisheries management system that was based on transferable quotas. This system is actually quite simple. While the Government sets the total allowable catch for each stock every year, catch quotas can be traded between operators of fishing vessels. This means that we trust the individual operators to decide on the most efficient allocation of our fisheries resources. This system also nurtures responsible thinking in the fishery sector, as the operators of fishing vessels have in the long run everything to gain from a responsible and sustainable management of the fish stocks. I can say with pride that when it comes to ensuring sustainable fisheries and the rational utilization of our living marine resources, the Icelandic fisheries management system is second to none.

But even the best fisheries management system in the world cannot alter the fact that when we have reached the maximum sustainable yield of our fish stocks: it is simply not possible to increase catches without causing serious harm to individual fish stocks. The fish industry is therefore faced with a new challenge: Is it possible to increase the profitability of the fish industry when we have reached the maximum sustainable yield of our fishing grounds?

In my view, the answer to this question is "Yes". With better quality products, enhanced technology and sensible marketing, we can get better prices for our products. So, even though there are strict limits to how much we can raise output, there is still a potential for growth in income.

In many ways, Akureyri and the surrounding communities are among the best examples of how this is possible. In this part of the country, you can find some of the world leaders in catching, processing and trading with fish. A stable and sustainable fisheries management system played a large part in their success. But these companies became world leaders also because they took advantage of the best available technology and had good marketing skills. Most importantly, these companies benefited from the fact that they sell a product that is much in demand by consumers around the world.

Icelandic fish is renowned for its quality. This reputation is not only due to the fact that the fishing grounds around Iceland are among the richest in the world. It is also the result of rigorous quality control, which aims at preserving the quality and freshness of Icelandic fish from the moment it is caught to the moment when it is served to the consumer in Europe, North-America or Asia.

FAO has made an important contribution to the development of international norms on sustainable fisheries and responsible fish trade. This symposium is one step in a long line of efforts undertaken by FAO on strengthening sustainable utilization of natural resources. This is not least done in order to eradicate extreme poverty and hunger, a goal recognized in the 2001 *Reykjavík Declaration on Responsible Fisheries in the Marine Ecosystem*.

Fisheries are one of the most valuable sources of nutrition and income for the developing countries. Ninety-five percent of those who live from fisheries are in the developing world. Trade with fish is a significant source of foreign currency earnings for the countries in question. The high value of fishery products for developing countries is demonstrated when one considers that the net earnings from trade with fish is higher than for any other major traded food commodity, including coffee, bananas and rubber. When discussing trade with fish, we must therefore take the need of the developing countries into considerations, also in terms of food security and hunger reduction. Here, let me add that enhancing food security has been the core of Iceland's development cooperation through the Icelandic International Development Agency and the UN University Fisheries Training Programme.

I am of the firm belief that liberalization of world trade is essential for global development, as well as for food security in the world. The developed countries must ensure that gains from trade liberalization will benefit the developing countries as well. Free trade agreements, bilateral and multilateral, which take into account parties' diverse level of development, are of great importance in this respect. Those considerations were an integral part of the Free Trade Agreement signed between the EFTA countries, Iceland among them, and the Southern African Customs Union last summer. Last weekend, I signed a Free Trade Agreement between EFTA and Egypt, which also takes into account these very same considerations.

Fish is the subject of this symposium and I have talked a lot about fish here. But I would also like to bring up a topic that is close to my heart—and which touches upon many of the issues that I have raised here—namely agriculture. The northeast of Iceland is renowned for making agricultural products of the highest quality. I should know, being a farmer myself. Indeed, my farm is just a few kilometres away from Akureyri. To those of you that might suspect that I am not completely neutral on the matter, I have only this to say: Have a taste for yourself!

Sheep farming was long the mainstay of Icelandic agriculture - and Iceland is especially well suited to it. In Iceland, sheep are sent out to graze in the hills and mountain pastures of Iceland, where the animals run free until autumn, feeding on the rich and nourishing vegetation of the highlands of Iceland. The result is the distinct, gamy taste of Icelandic lamb—which in our view is equal to none. But scientists have also discovered that this has also the added benefit of making Icelandic lamb, especially from this part of the country, particularly rich in Omega-3 fatty acids. This means that enjoying Icelandic lamb has many of the same health benefits as the consumption of fish.

You might be surprised, not only by the quality of Icelandic agricultural goods, but also by the range of products made here, just south of the Arctic Circle. I could for example

mention the honey produced in Kelduhverfi, which has a particular birch taste—something that is much sought after when making honey. When it comes to making high quality food products, Iceland has more to offer than just fish.

However, the fact is that while Iceland has a global reputation for selling quality fish, our agriculture has yet to acquire a similar reputation. There are, of course, many reasons behind this. The first one has simply to do with economics. While many of Iceland's agricultural products are of world-class quality, the harsh climate and difficult conditions makes agricultural production in Iceland much less cost effective than in the major exporting countries. At the same time, the high tariffs on agricultural products in Europe have made it much more difficult to break through into the European market. It has also been our experience that it is very difficult to enter other markets. For example, a costly marketing campaign in the United States of America has reaped few benefits in terms of actual increase of exports of Icelandic agricultural products.

In my view, the European market still holds the most promise for our agricultural products. I sincerely believe that Icelandic agriculture holds a lot of promise to the future, if we focus on producing agricultural goods of the highest quality for the affluent and discriminate consumer. But in order to succeed, we have to gain better access to markets, most importantly the European market.

Recently, we made a big step towards that goal when we concluded an agreement with the EU on lowering tariffs on trade with agricultural goods between Iceland and the EU. This agreement will benefit both consumers and farmers in Iceland. The consumers will hopefully have to pay lower prices for agricultural products imported from Europe. Icelandic farmers will also gain better access to the European markets for Icelandic lamb, butter and “skyr”

I am particularly pleased that we have been able to organize this conference in the University of Akureyri. It certainly was very ambitious when the first university in Iceland outside of Reykjavík was established in Akureyri twenty years ago. The relatively short history of the university has, however, demonstrated clearly the foresight of this decision. The University of Akureyri has for the last two decades become a driving force in this community and has made an important contribution to our society as a whole.

In this Symposium, the University of Akureyri and FAO have succeeded in bringing together leading experts in the seafood industry to discuss the many challenges and opportunities that now face the international seafood trade. This is a subject that the University of Akureyri is especially suited to focus its work on. In my view, the University of Akureyri has every potential of becoming a global centre of learning on trade with fish and seafood. The already close cooperation between the University and the United Nations University Fisheries Training Programme, lead by Dr Tumi Tómasson, will be an important contribution to the realization of this goal. This symposium also marks an important step in this progress, and I look forward to a lively exchange of views on this important subject, which affects the livelihood of millions of people.

Enjoy your stay in Akureyri.

Closing address

Closing of Symposium by His Excellency Einar K. Guðfinnsson, Minister of Fisheries for Iceland

Ladies and Gentlemen,

Trade is a cornerstone of development. Iceland has witnessed at first hand the positive economic effects of trade. In the course of a few decades, the Icelandic population has come from poverty to enjoy one of the highest living standards in the world. Trade liberalization has been crucial in this development. We not only believe, we know that trade works and millions of people could be lifted out of poverty like the Icelandic nation in the past.

The last decade has seen increased freedom of trade in Iceland. Capital transfer was liberated; the state finances have become stable, with debts being paid and decreased; state-owned enterprises have been privatized; and the economic management framework is as good as it can be. There is one area, however, where things might have moved a bit faster, namely in international trade.

The main measurement of the prosperity of nations is the gross domestic product (GDP) per capita. Varied research indicates that there is a strong correlation between freedom in international trade and economic growth. Such research also indicates that nations that have increased their free trade experience a higher long-term level of economic growth. Measures that are aimed at increasing international trade therefore have a positive impact on the prosperity and welfare of the citizens. The old theory of the British economist, David Ricardo, certainly fully applies today: he said that every nation should specialize itself in the production of the commodities in which it has a comparative advantage. Increased international trade and the free flow of commodities promote the specialization of the workforce and generate increased competition and innovation. Free international trade serves the interests of all because:

- Local consumers pay lower prices for comparable goods.
- Employees receive higher wages for their input.
- Manufacturers receive higher payment for their production.
- Deadweight loss by the society is minimized.

This certainly applies to fisheries. Subsidies and other economic distortions have served as obstructions to free trade in fisheries production. It therefore lays burdens on fish producing nations and definitely leads to overexploitation of fish stocks. One can therefore say with full confidence that isolationist policies are contrary to the concept of good and responsible fisheries management. Not least with reference to this fact, I would like to urge all those who want to exploit new potential in fisheries to bear this in mind. A prerequisite to progress and maximum yield in exploiting our natural marine resources is a free trade environment for fishery products on a global scale.

Improved economic growth is a goal of all authorities, of all countries. I have at least never heard any government say that it does not want higher growth. With economic growth, poverty can be reduced, education improved, children can be fed, and so on and so forth.

But how can countries increase their economic growth? This is certainly a complex question and there are many possibilities. I for one do not pretend to have the answer to such a million-dollar question. But I am surely not the only one to wonder why fisheries

are not more often mentioned in this context. That, in my view, is a mistake. Fisheries can be, and in many countries really should be, an engine of growth. I say this judging from our own experience, because in my country this has been the case for decades. Iceland was one of the most backward countries in Europe in the beginning of the nineteenth century but is now one of the most prosperous ones.

This of course is due to a number of factors. An emphasis on fisheries as a modern industry nevertheless plays a major role. We have never been able to afford anything less than an efficient fishing industry. Fisheries are the major industry in our economy and have been for decades. The high growth rate has therefore been driven mainly by the outstanding performance of our fisheries and fishing industry, although I would not like to underestimate other very important contributors to our economic performance. Particularly in recent years.

In too many countries, fisheries are not looked upon as a modern industry, reflecting the strict rules of the market economy. Fisheries is unfortunately in industrialized countries all too often seen as an integral part of social measures, which thus has contributed to its poor economic performance. That is a model to avoid. Fisheries and the fishing industry should be seen as means of generating better living standards.

In many places one sees new potentials, not least in the field of aquaculture, in improved fisheries management, increased knowledge, better yields and marketing. This is an objective of every progressive industry and will be the key to further achievements. This is where I believe Iceland can play a role, by helping with the development of fisheries and aquaculture in developing countries. I would be the first to admit that we have had our share of mistakes in the past. We have, however, tried to learn our lessons and move forward, although we still have a lot to learn.

Today, however, we are at the forefront of fisheries in the world. We define our fisheries as a knowledge-based, efficient industry, run by able management and employing an efficient workforce. Fisheries as such are a relatively well paid occupation, though one must admit that the processing is unfortunately lagging behind. Due to increased efficiency, the number of people employed in fisheries, is declining—technological advancement has led to that development.

The presence of a thriving and dynamic fishing industry in Iceland has initiated new industries that are based on the idea of serving the fishing industry, first in Iceland and later the whole world. This has been an important part of our economic development through the years.

We have participated quite extensively in development fishery projects in developing countries. The policy behind these projects has been to listen to our partners and never attempt to impose our culture on others. We see our work as a mutual objective in order to achieve a common goal. This may have its disadvantages, but the positive consequences certainly outweigh them. Our government has furthermore committed itself to a gradual increase in its overseas development assistance, which has resulted in new and exciting projects. We want to believe that we can have a role to play, not least in the fields where we have special knowledge and have excelled—and fisheries are certainly among these.

If I try to specify, I would like to mention that areas where Iceland could make a contribution are:

- **Training of fishermen**, in particular training of trainers. In Namibia, for example, Iceland has assisted in the development of a training institute for fishermen, NAMFI in Walvis Bay.
- **Quality control of fishery products**. To give examples, in a number of African countries, Icelandic experts have in the past assisted with the development of legislation in this area, for instance incorporating EU requirements into such legislation. They have also assisted with the organization of competent authorities, development of inspection methods and procedures.

We will not claim to have solutions to all problems. Far from it. But it is the hope of the Icelandic people that we may in some small way assist other countries on their development path in fisheries, based on our own experience.

I do hope that the discussions and deliberations during the past two days have been informative. We all have a common goal, namely to make fisheries and aquaculture contribute more to the well-being of the people in our countries—to become an engine of growth.

With these few words, I now declare this symposium on International seafood trade: Challenges and opportunities closed.

ANNEX 1

Programme

1 February 2007

09:00 – 10:00	Coffee and registration
10:00 – 10:05	Welcome address by the Rector of the University of Akureyri (UNAK)
10:05 – 10:20	Address by the Minister of Foreign Affairs, Her Excellency Valgerður Sverrisdóttir
10:20 – 10:25	Symposium organization and overview presented on behalf of the Dean of the Faculty of Business and Science, Eyjólfur Guðmundsson

CURRENT STATUS OF INTERNATIONAL FISHERIES AND SEAFOOD TRADE

Session chair: Valtýr Hreiðarsson

Time	Title	Presenter
10:30 – 10:55	Fish in the global food chain: challenges and opportunities	Grímur Valdimarsson, FAO, Rome
11:00 – 11:25	International trade in seafood products	James L. Anderson, University of Rhode Island
11:30 – 11:55	Distribution of revenues through the seafood value chain	Eyjólfur Guðmundsson, UNAK.
12:00 – 12:25	Current situation for developing countries	
12:30 – 13:30	Lunch	

CHALLENGES

Session chair: Sigurður Bogason

Time	Title	Presenter
13:30 – 13:55	The new “Hygiene Package” and implementation for the fish industry	Alan Reilly, Food Safety Authority of Ireland
14:00 – 14:25	Causes of rejections and detentions in international seafood trade.	Lahsen Ababouch, FAO, Rome
14:30 – 14:55	Development of risk assessment methods for fishery products	Guðjón Gunnarsson, Icelandic Directorate for Fisheries
15:00 – 15:25	Coffee break	
15:30 – 15:55	WTO disputes relating to fisheries products.	William Emerson, FAO, Rome
16:00 – 16:25	Changing compliance for exported fishery products: A developing country perspective.	Geoffrey Nanyaro, Tanzania
16:30 – 17:00	Private quality standards and labels	Birgir Össurason, Samherji
19:00 -	Dinner at the invitation of the Minister of Foreign Affairs.	

2 February 2007**OPPORTUNITIES**

Session chair: Geir Oddsson

Time	Title	Presenter
08:00 – 08:30	Coffee	
09:00 – 09:25	Opportunities in seafood trade for developing countries	Kristján Davíðsson, Glitnir Bank
09:30 – 09:55	Trends in consumer attitude and selection	
10:00 – 10:25	Ecolabelling of fisheries products	Cathy A. Roheim, University of Rhode Island,
10:30 – 10:45	Coffee break	
10:45 – 11:10	Processing quality seafood	Marel
11:15 – 11:40	Traceability	Matís
11:45 – 12:10	Human capacity building/ training	Tumi Tómasson, UNU Fisheries Training Centre
12:15 – 12:30	Closing remarks by the Minister of Fisheries in Iceland	
14:00 – 18:00	Optional excursion.	

ANNEX 2

Participants

Name	Affiliation	Country
Aðalheiður Sigursveinsdóttir	Utanríkisráðuneytið [Ministry for Foreign Affairs]	Iceland
Alan Reilly	Food Safety Authority of Ireland	Ireland
Alen de Llano Massion	UNU-FTP and INDEPES	Cuba
Anna Guðrún Árnadóttir	UNAK [University of Akureyri]	Iceland
Arndís Ármann Steinþórsdóttir	Sjávarútvegsráðuneytið [Ministry of Fisheries]	Iceland
Baldur M Einarsson	UNAK [University of Akureyri]	Iceland
Bataringaya Amos	UNU-FTP	Uganda
Bára Eyfjörð Jónasdóttir	UNAK [University of Akureyri]	Iceland
Benedikt Jónsson	Utanríkisráðuneytið [Ministry for Foreign Affairs]	Iceland
Birgir Össurarson	Samherji	Iceland
Björk Sigurgeirsdóttir	UNAK [University of Akureyri]	Iceland
Cathy Roheim	University of Rhode Island	USA
Cyprian Ogambe	UNU-FTP	Kenya
David Bamwirire	UNU-FTP	Uganda
Davíð Ólafur Ingimarsson	Sjávarútvegsráðuneytið [Ministry of Fisheries]	Iceland
Demian Schane	UNAK [University of Akureyri]	USA
Eileen Nkondola	UNU-FTP	Tanzania
Einar Kr. Guðfinnson	Minister of Fisheries	Iceland
Elín Flygering	Utanríkisráðuneytið [Ministry for Foreign Affairs]	Iceland
Eyjólfur Guðmundsson	UNAK [University of Akureyri]	Iceland
Geir Oddsson	ICEIDA	Iceland
Geofrey Nanyaro	Fisheries Division, Tanzania	Tanzania
Gestur Geirsson	Samherji	Iceland
Gholam Reza Shaviklo	UNU-FTP	Iran
Grímur Valdimarsson	FAO, Rome, Italy	UN
Guðbjörg Stella Árnadóttir	UNAK [University of Akureyri]	Iceland
Guðjón Gunnarsson	Fiskistofa [Directorate of Fisheries]	Iceland
Guðmundur Óli Hilmisson	UNAK [University of Akureyri]	Iceland
Guðni Bragason	Utanríkisráðuneytið [Ministry for Foreign Affairs]	Iceland
Haraldur Bergvinsson	UNAK [University of Akureyri]	Iceland
Hreiðar Þór Valtýrsson	UNAK [University of Akureyri]	Iceland
Heiðrún Pálsdóttir	Utanríkisráðuneytið [Ministry for Foreign Affairs]	Iceland
Helgi Gestsson	UNAK [University of Akureyri]	Iceland
Hilmar Hilmarsson	UNAK [University of Akureyri]	Iceland
Hjörleifur Einarsson	UNAK [University of Akureyri]	Iceland
Hlynur Herjólfsson	UNAK [University of Akureyri]	Iceland
Hosni bin Ahmad		
Hörður Sævaldsson	UNAK [University of Akureyri]	Iceland

Name	Affiliation	Country
Ilidio Banze	Ministry of Fisheries	Mozambique
Isabel Omar	Ministry of Fisheries	Mozambique
James L. Anderson	University of Rhode Island	USA
Jón Ingi Benediktsson	RHA [Research Centre of the University of Akureyri]	Iceland
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PAPERS PRESENTED AT THE SYMPOSIUM

Fish in the global food chain: challenges and opportunities

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ABSTRACT

Fish plays an important role in the world's food system. In the rich world it is increasingly seen as a healthy luxury food, but in many developing countries it still constitutes an important part of the staple diet. For the developing world, fish exports have become an ever more important source of foreign exchange. This is causing strains regarding trade policies and has exacerbated the need for fisheries management capable of keeping catches within sustainable limits. Capture fisheries are now levelling off globally. In 2005 they produced 93.5 million tonne, while aquaculture production was at a record 47.5 million tonne, or 34% of total fish production. If calculated on the basis of fish for human consumption only, aquaculture production constitutes 44.6% of the total, but 22.3% if China is not included. Global consumption of fish per capita in 2005 was at a peak of 16.6 kg per capita. An FAO study projects that capture fisheries could produce some 12 million tonne more by 2015, compared with 2005 levels, and that aquaculture production could reach 66.8 million tonne by then.

Fish constitutes truly part of the modern food industry. The variety and quality of fishery products is on par with any other food production sector. Fish is classified in the world trading system with industrial products, and thus carries very low tariffs compared with agricultural goods. Some 38% (by volume) of all fishery production enters international trade, with over half of that originating in developing countries. Fish exports reached a record level in 2004 of US\$71.5 billion, a growth of 51% over the preceding decade.

So the market for fish is strong, but the growth potential is limited, not the least for products from the capture sector. Capture fisheries are putting pressure on fish stocks worldwide. Currently, FAO estimates that 25% of the 600 fish stocks on which it has information are overfished, depleted or recovering from depletion, whereas 52% of the stocks are fully fished. While overfishing and its consequences are highlighted in the world's news media, the fundamental flaws of the fisheries management policies that have led to that state of affairs have received less attention. Instead, solutions are suggested as being capable of curbing overfishing in their own right, such as establishing Marine Protected Areas, a ban of trawling gear, ecolabelling and an ecosystem approach to fisheries management. As much as these approaches have their just place in managing fisheries, they do not deal with the fundamental flaw affecting most capture fisheries, namely the open, or semi-open, access to the resources, combined with a lack of fishing rights. FAO acknowledges that it is not enough to simply limit access and restrict fishing operations: one has to establish legally defensible fishing rights. That will foster conservation and a sense of stewardship of the resource among the sector's participants and communities. However, the nature of the rights must be tailored to suit the national and regional cultures and value systems.

Thus, the biggest challenge for fisheries is to make fisheries and aquaculture management work in a way that puts to rest the serious concerns of fish consumers and society at large regarding overfishing and the environment.

The opportunities for the sector lie in further product diversification and value addition, as well as better scientific awareness of the benefits and risks of fish consumption.

INTRODUCTION

Capture fisheries and aquaculture supplied the world with about 106 million tonne of food fish in 2004, providing an apparent per capita supply of 16.6 kg (live weight equivalent – LWE). Of this total, aquaculture accounted for 43%. However, because of the overwhelming importance of China in aquaculture production, this figure drops to 22% for the world without China. Figure 1 shows development of fish production.

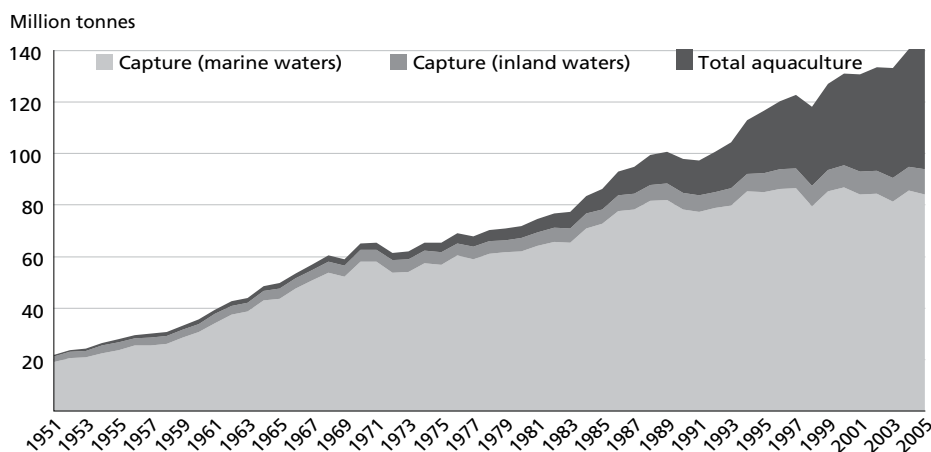
In 2004, per capita food fish supply was estimated at 13.5 kg, if data for China are excluded. Overall, fish provided more than 2.6 billion people with at least 20% of their average per capita animal protein intake. The share of fish protein in total world animal protein supplies grew from 14.9% in 1992 to a peak of 16.0% in 1996, declining to about 15.5% in 2003. Notwithstanding the relatively low fish consumption by weight in low-income food-deficit countries (LIFDCs) the contribution of fish to total animal protein intake was significant—at about 20%—and is probably higher than indicated by official statistics in view of the unrecorded contribution of subsistence fisheries (FAO, 2007). Figure 2 shows how fish supply per capita has been constantly increasing.

It is expected that fish consumption will go up in both developed and developing countries alike (FAO, 2005a). Not only has the availability of fish and fishery products been increasing, but FAO estimates that total food production in the world measured on a per capita basis has also been steadily increasing over the last 30 years, averaging an annual growth rate of 1.2% over the last decade. This growth has been much higher in developing countries than developed countries. Despite this good news, the world is faced with the sad fact that in 2000 to 2002 it was estimated that 852 million people were undernourished. Food security is a complex phenomenon that relates more to economic development and poverty than to increasing production per se (FAO, 2005b).

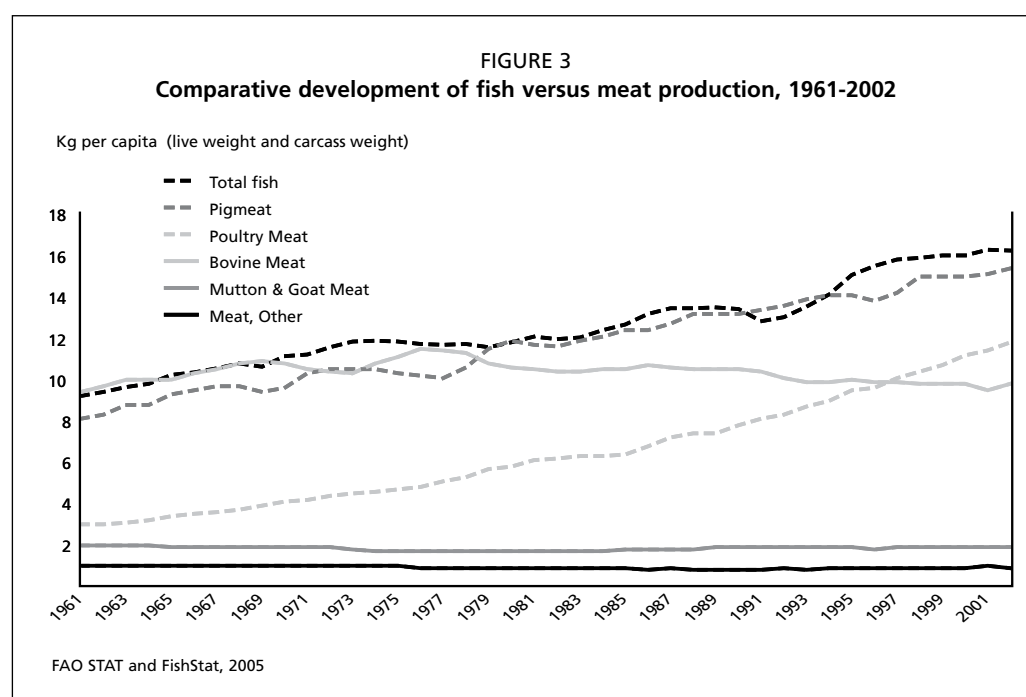
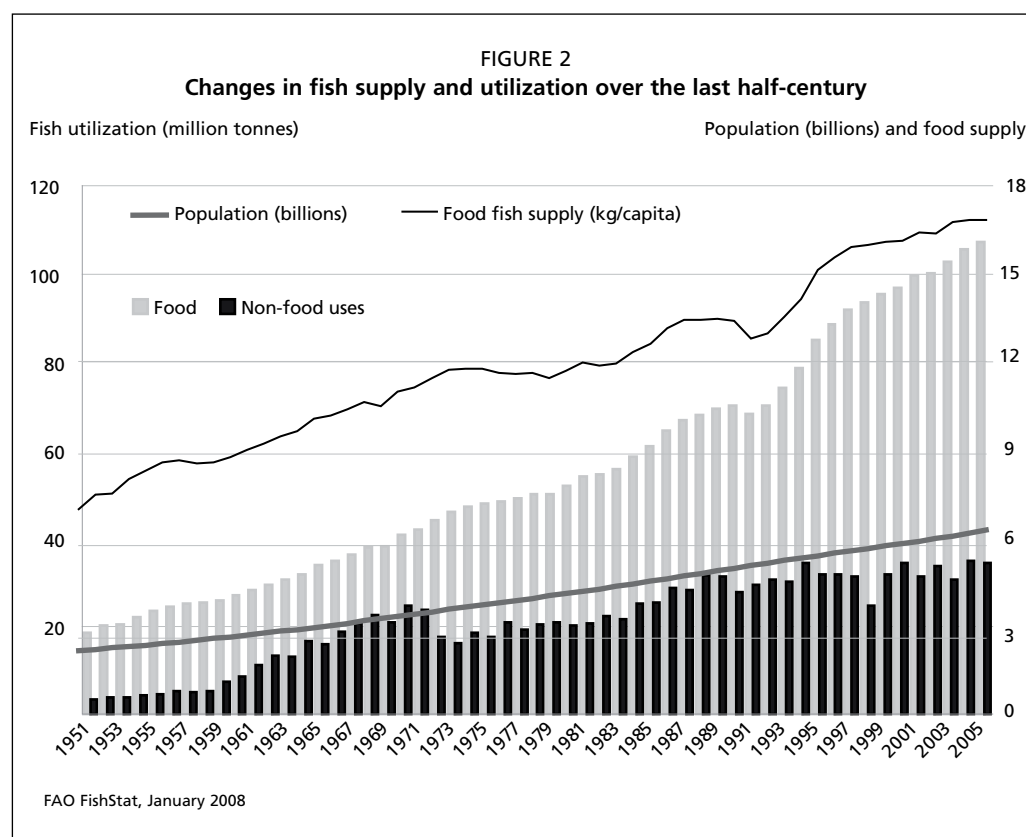
From 1982 to 2002, the increase in fish consumption has been much in line with that of pig meat, but albeit lower in consumption; chicken meat consumption has been growing faster; whereas consumption of bovine meat has been decreasing (FAO, 2005c). Figure 3 shows the developments in fish and meat consumption.

There is a renewed international commitment to fight hunger, not the least by FAO and its programme termed “The Right to Food”, and FAO Council has produced

FIGURE 1
Development of fisheries production in the last half-century



FAO FishStat, January 2008



specific “Right to Food Guidelines”. This work is based on the 1948 Universal Declaration of Human Rights. Its Article 25 states:

“Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control”.

Two international targets for hunger reduction have been established. The World Food Summit in 1996 set a target of halving the absolute number by 2015, but the Millennium Summit in 2000 set a somewhat less ambitious target of halving the percentage of hungry by 2015. Regrettably, it seems obvious that neither of these targets are likely to be reached.

The explosive growth in fisheries and aquaculture over past decades has been accompanied by a boom in international fish trade. In 2004, total world trade in fish and fishery products reached a record value of US\$71.5 billion (export value), representing 23% growth relative to 2000 and 51% increase since 1994. Preliminary estimates for 2005 indicate a further increase in the value of fishery exports. In real terms (adjusted for inflation), exports of fish and fishery products increased by 17.3% during the period 2000–04, 18.2% during 1994–2004 and 143.9% between 1984 and 2004. Fish is traded widely, so today it can be said that fish from all corners of the world can be found on the international market. In 2004, about 38% of all fish produced (LWE) was exported as various food and feed products. Developed countries exported some 23 million tonne of fish (LWE) in 2004. Although a part of this trade may be re-exports, this amount corresponds to about 75% of their production. Exports from developing countries (30 million tonne LWE) totalled around one-quarter of their combined production, but, remarkably, the share of developing countries in total fishery exports was 48% by value and 57% by quantity (FAO, 2007).

The globalization of fisheries and the wide participation by both developed and developing countries in world fish trade is testing the current and emerging regulatory framework regarding safety and quality regimes, but today's environmental concerns are increasingly coming into play in a marketplace that is ever more competitive.

STATE OF FISH STOCKS

FAO estimates that 52% of fish stocks are fully fished to Maximum Sustainable Yield (MSY), whereas 25% of the stocks are overfished, and only 23% of the stocks could produce more (FAO, 2007). It has taken a while for the sector to come to grips with the fact that there are practically no more virgin fisheries to be developed. The widely used interpretation of MSY is now increasingly contested by fishery biologists, because it is currently widely interpreted as a goal to be reached rather than the absolute maximum, and thus outside safe limits. Therefore, the “fully utilized” fisheries are exceeding precautionary and sensible limits. Yet, this situation has been relatively stable over the past 10–15 years.

Moreover, there is general agreement that aquatic ecosystems are in decline in most parts of the world. The cause is well publicized in the news media: widespread overfishing, coastal degradation, and pollution. This is all well documented and has been a media favourite for years. The focus of the media has been very much on the outcome of failed fisheries management rather than on their causes.

The long list of problems negatively affecting fisheries include:

- overfishing, and illegal, unreported and unregulated fishing (IUU), on a significant scale;
- overcapacity and overcapitalization—which means too many vessels chasing too few fish, increasing the risk of collapse;
- by-catch and discards, and the negative impacts of these on biodiversity; and
- degradation of aquatic habitats and ecosystems: primarily coastal, adding fishing to other land-based stresses, but degradation is also apparent in high seas areas.

The increase in the number of coastal fishers and fishing vessels over the last decades is one of the major contributors to overexploitation of fisheries resources.

There is widespread agreement that capture fisheries plays an important part in these problems and fisheries as a sector is on the defence. Indirect environmental effects of fishing—such as entanglement of marine mammals in lost fishing gear—can

be another problem often highlighted in the media. Unregulated aquaculture can also degrade the coastal system.

There is an agreement among politicians, industry, NGOs and the public that sustainable and responsible fisheries must be achieved because, despite the limits on capture fisheries production, these fisheries continue to be very important for many countries, in terms of both income and nutrition. Therefore, the issue of how to restrain capture fisheries and prevent further overfishing is gaining wider attention.

WHY IS MANAGING FISHERIES SO DIFFICULT?

The main message coming from analyses around the world is this: the methods by which the world has chosen to govern fisheries are largely ineffective in restraining an ever increasing fishing effort. But perhaps more seriously, as many authors have pointed out, is that today's management objectives are often unclear or even contradictory (Cochrane, 2000; Cochrane and Doullman, 2005). In addition, when cultural values or socio-economic objectives of fisheries are also taken into account, management does indeed become complicated. This, of course, makes management of fisheries more difficult than for most other production systems, which simply concentrate on producing goods that the market wants at competitive prices.

When the need for limiting the amount of fish caught first became generally acknowledged, fisheries agencies focused on the need to ensure that enough fish remained in the water to keep reproducing. However, this biological mandate expanded as new instruments were developed. The Rio Declaration, Agenda 21 of the Summit on Sustainable Development, the Convention on Biological Diversity (CBD), and the Code of Conduct for Responsible Fisheries are all instruments that recognize the nutritional, economic, social, environmental and cultural importance of fisheries and the interests of all those concerned with the fishery sector—in addition to the need for biological considerations. In summary, contemporary thinking focuses not only on the biological sustainability of the fishery sector, but also on its contribution to the economy and society as a whole.

This author believes that the various futile attempts to manage fisheries have somewhat echoed the seductive inexhaustibility idea, i.e. some restrictions to fishing may be necessary but that it is not necessary to be too pedantic about it as “long gives the ocean”. Exact landing figures are really not necessary—keep the accountants away. Ironically, the main lesson that we have learnt—or should have learnt—about fisheries over the last decades is that sooner or later the open or semi-open access fisheries will suffer from overfishing.

Whereas we have extensive literature and persistent media attention highlighting the symptoms of poor fisheries management policies, and texts describing where we want fisheries to be, there has been much less attention given to the fundamental flaws in current management policies and to what is at the heart of getting to sustainable fisheries. The fisheries management failures, largely the institutional ones, were neatly summarized by (Garcia, 2005) as:

- the free and open nature of fisheries (lack of enforceable rights);
- perspectives of short-term political or financial gain or losses;
- poor decision-making processes (in Regional Fisheries Management Organizations [RFMOs]);
- the poor participatory nature of most systems (top-down systems);
- lack of transparency and accountability;
- weak enforcement (both at national and regional levels); and
- scientific uncertainty (affecting the precision of the advice) and errors (affecting the accuracy of interpretations).

SMALL-SCALE FISHERIES VERSUS LARGE-SCALE FISHERIES

By far the highest number of fishermen operate small, non-motorized vessels. Various names are given to these fisheries, such as artisanal, small-scale or subsistence fisheries. The numbers of these fishers has been constantly rising over the last decades and were estimated to be over 41 million in 2004, including some 11 million fish farmers, but often the same individuals are engaged in both (FAO, 2007). In contrast, fishers in industrialized countries were estimated to be about 1 million. The contribution of the small-scale fleet to fish for human consumption may be as high as 50%.

The distinction between the small-scale fisheries and the large-scale (or industrialized) fisheries is not clear cut. Traditionally, the small-scale sector has been seen to be very important for local food security or subsistence, and the industrial fishing fleet for exports and thus generating financial revenues. This distinction is becoming more blurred with time as it now acknowledged that pure subsistence fisheries are indeed very rare, and that almost all fisheries involve some kind of economic activity in terms of trade or barter.

Due to technological advances, smaller vessels are getting much more effective at locating and catching fish and they are increasingly engaged in fisheries that aim for marketing the products on the international market. Due to increased pressures on inshore areas there is now mounting pressure to “professionalize” the small-scale fisheries sector so as to make fishing effort commensurate with the productive capacity of the resources. This is particularly important in the light of the economic and nutritional dependency on these fisheries by millions of coastal people. The importance of involving the stakeholders in the fisheries decision-making process is becoming increasingly recognized, as well as devolving fisheries management to the communities themselves, and establishing defined fishing rights plays a significant role in various types of co-management arrangements.

ECOSYSTEM APPROACH

The obvious failures of the methods currently employed to govern capture fisheries have spawned a swathe of suggestions as to how that situation can be improved. An obvious one is that the classical single-species focus is inadequate, as each fish stock is only one piece in the whole eco-puzzle. Taking one species out of the system has various consequences for all the other components. Thus, the ecosystem approach to fisheries management aims at looking at the bigger picture—a more holistic approach.

Collectively, the FAO Code of Conduct for Responsible Fisheries, the 2001 Reykjavik Declaration on Responsible Fisheries in the Marine Ecosystem and the 2002 Plan of Implementation of the World Summit on Sustainable Development establish an ecosystem approach to fisheries (EAF).

The interactions between fisheries and the ecosystem can include direct impacts of the fishery on target species, on by-catch species (whether retained or discarded) and on critical or important habitats. Indirect impacts of fishing are typically transmitted through the food web: for example, heavy fishing of a prey species is likely to lead to a decline in abundance and productivity of its predators, which may be target species for other fisheries, or constitute food for higher marine life.

In all cases, a pragmatic approach to EAF needs to make use of the best available information with reasonable application of the precautionary approach in a participatory manner. Good progress is being made in this way in Australia (e.g. Fletcher *et al.*, 2005), the Alaska region of the United States of America (Fluharty, 2005) and by Angola, Namibia and South Africa, the countries of the Benguela Current large marine ecosystem (Cochrane *et al.*, 2007).

Nevertheless, high levels of scientific uncertainty are a significant obstacle in many cases to implementation of EAF. The Reykjavik Conference on Responsible Fisheries in the Marine Ecosystem reinforced the point that ecosystems, as such, cannot be controlled. They are simply too complicated. “As the models become more detailed

and complex, they are able to address more issues that are of concern to managers, but at the same time it becomes ever more difficult to interpret results” (Stefansson, 2003).

Thus ecosystems as such cannot be managed, but only the human activities exploiting them (FAO, 2003a). And for the human activities to be amenable to management, the incentive structures have to be right. Fishing rights and responsibilities must go hand in hand (Garcia and Boncoeur, 2004) because without rights there is little reason for fishers to engage in responsible fishing (France and Exel, 2000). Defined and secure fishing rights are the core of what is good fisheries governance (Sinclair *et al.*, 2002). Finally, the main conclusions of an FAO study on non-sustainability and overexploitation in fisheries (FAO, 2003c) were:

- Poor governance is a major cause of the inability to attain sustainable fisheries. Failure to have good governance is in itself sufficient for fisheries management to fail.
- There is a need to grant secure rights to resource users (individually or collectively) for the use of a portion of the resource, space, or other relevant aspect of the fishery.
- Inappropriate incentives and lack of good governance are often predominant issues preventing sustainability, and both link to the absence of secure rights.

Whatever way the “Ecosystem Approach to Fisheries Management” might develop, it is clear that it will require far more information to be collected about the fishing operations than hitherto, and that such information will have to be presented to the authorities, and even to society at large, in a manner that is transparent and verifiable. To prove compliance with ecosystem-related standards, fishing operations would have to address and report such things as amount of by-catch and incidental catch of seabirds, turtles and dolphins, to name only a few. Ultimately, as with other Quality Management Systems (QMSs), the fish producers will have to be able to prove that they have complied through auditing and verification by independent inspection bodies.

The industry will request that the objectives of eco-certification be set clearly, specifying what information will need to be collected and how that information will be used. That underlines the all-important issue of incentives for such an undertaking, and the cost implications (Valdimarsson and Metzner, 2005).

Since the launch of the Marine Stewardship Council in 1996, retailers have increasingly committed their companies to sell only fish that comes from sustainable fishery resources. They see this as a response to apparent consumer demands. Many leading food retailers in the developed world have now decided to sell only fishery products that are sustainably harvested, and that carry a statement to that effect. This is already putting significant pressure on both governments and the industry to set in place processes to respond to these demands. FAO has made guidelines that lay out the basic requirements for such Ecolabelling schemes (FAO, 2005d).

UTILIZATION OF FISH

In 2004, about 75% (105.6 million tonne) of estimated world fish production was used for direct human consumption, and the remaining 25% (34.8 million tonne) was processed into feeds, mostly fishmeal and oil (FAO, 2007), besides 7.3 million tonne discarded (see below).

Some 61% (86 million tonne) of the world’s fish production (2004 figures) underwent some form of processing, and 59% (51 million tonne) of this processed fish was used for manufacturing products for direct human consumption in frozen, cured and canned form. The rest went for non-food uses. Unlike many other food products, processing fish does not necessarily increase the price of the final product, and fresh fish is often the most highly priced product form. Freezing is the main method of processing fish for food use, accounting for 53% of total processed fish for human consumption in 2004, followed by canning (24%) and curing (23%). In developed countries, the

proportion of fish that is frozen has been constantly increasing, and in 2004 accounted for 40% of total production. In comparison, the share of frozen products was 13% of total production in developing countries.

Utilization of fish production shows marked continental, regional and national differences. The proportion of cured fish is higher in Africa (17% in 2004) and Asia (11%) compared with other continents. In Europe and North America, more than two-thirds of fish used for human consumption was in frozen and canned forms.

Fish for non-food purposes comes mostly from natural stocks of small pelagics, and some 90% of such catches were processed into fishmeal, with the remaining 10% being utilized directly for aquafeed or as feed for fur animals.

By-catch, i.e. non-targeted species and discards, is seen as an important issue in fisheries. In 1994, FAO estimated that the global discard could be as high as 27 million tonne annually. A more recent study by FAO re-estimated this figure by analysing data over a 10-year period (1992 to 2002) and came up with a very much lower figure of 7.3 million tonne (FAO, 2005e). Most of the discards (over 50%) are associated with trawl fisheries for tropical shrimp and demersal finfish.

Lower discard figures are probably a reflection of the fact that more of the by-catch is retained for use, particularly as feed for the booming aquaculture fish industry. From a utilization perspective, good use can be made of everything that comes out of the water, which puts the “by-catch” issue into a new perspective. This development, of course, underlines the need for effective fisheries management systems that properly address the need to protect spawning fish and their offspring.

CONCLUSION

The wild capture fisheries potential worldwide is largely at its limit: it has reached a plateau. Increases in wild capture fisheries would have to come through restoring overfished populations by vastly improved management practices. All projections point to increased demand for fishery products in the future, and it is evident that aquaculture will play a crucial role in satisfying that demand. The large amount of fish entering international fish trade will continue keep fish prices relatively high, and this may compromise access of the poor to adequate fish protein.

Over recent decades, the fish processing sector of the industry has gone through a significant change in philosophy concerning how to respond to ever more demanding product safety and quality regimes. In large, the successful approach has been to move away from centralized government controls towards making the industry responsible for implementing “self control” systems that are verified and audited by governments. Such systems require clearly specified objectives and ample record keeping for industry to be able to prove due diligence. A similar approach could well apply in complying with the new environmental demands, particularly at the hands of the large retailers that are increasingly committing their companies to sustainably sourced seafood.

To balance the utilization and conservation points of view, more effective and more sophisticated managements systems are being developed. Experience shows that for such systems to evolve, secure, legally binding fishing rights are necessary. Secure fishing rights foster responsible fisheries, leading to long-term stewardship of the fishery resources and their ecosystem.

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Trends in the international trade of seafood products¹

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The objective of this report is to present key factors and trends in international seafood trade and to make some suggestions as to where the sector is today and where it is going. Compared to other animal proteins, the seafood sector is the most complex and diverse. It is based on more species and it comprises a vast array of different technologies, which tends to complicate the analysis of emerging trends. It is clearly the most international of the food subsectors. For example, in the United States of America (USA) we import more seafood than we do all beer and wine combined. We import more seafood than we do coffee. It is also the most fragmented food subsector: you have people harvesting from canoes, and at the same time, you also have large, multinational companies investing resources in the trade. It is an industry that basically argues with itself all the time: fishermen fight with aquaculturists; offshore fishermen fight with near-shore fishermen; those that support transferable quotas fight with those that do not. The list goes on and on. It is incredibly volatile because of its nature and because of its fragmentation. The sector is very bureaucratic, being trapped in a messy regulatory environment in most cases. It is clearly our most wasteful food sector, and it is misunderstood by both consumers and chefs. The marketing of seafood tends to lack transparency. Given all these factors, I argue that the countries and companies that can address these problems—in other words, become less fragmented, reduce volatility and become less wasteful—will be the leaders in international seafood trade. And I also argue that those countries and sectors that adopt primarily rights-based management and technologies that use aquaculture will be the subsectors that will lead. Aquaculture currently accounts for about 40% of world fish production [1]. However, if we remove the non-food fish, such as fish for animal feeds, corals, pearls, etc., aquaculture accounts for nearly 50% of the seafood consumed [2], and it represents an even larger share of international trade.

If we take a look at the world harvest of certain fish groups, such as flatfish, we observe that the global harvest is either stable or declining. The world harvest has been declining, but actual trade has been increasing somewhat, according to FAO data [3]. Actual trade figures may be higher, as one of the key world traders, China, has a strong tendency to report a large portion of their exports as “fish fillets not elsewhere indicated.” Thus, we can observe a declining harvest but a gradually increasing trade. This trend is observed also with pollock and cod [4, 5]. Now, an examination of seafood consumption in the USA will illustrate two key points [6, 7, 8]. First, per capita consumption of aquaculture species has increased remarkably over the last two decades [6, 7]. Consumption of shrimp, the number one seafood, increased by 92% between 1987 and 2006. Consumption of salmon, third in the ranking, went up by nearly 360% over the same period. Consumption of catfish (sixth on the list) increased by more than

¹ The numbers in the brackets refer to the slides presented at the end of this paper.

² E-mail: jla@uri.edu

60%, while tilapia, a species virtually unknown in 1987, is now making great strides in the top ten list. It becomes obvious that growth in seafood consumption is being fuelled by aquaculture, while consumption of certain wild-caught species, such as cod, is declining. Thus, USA seafood consumption is currently dominated by imported aquaculture products. Second, seafood consumption is becoming concentrated on fewer species, at least in the USA [7]. The top five species accounted for 72% of consumption in 2006; in comparison, they accounted for only 56% of consumption just two decades ago. The top ten species comprised 71% of consumption in 1987; they now represent 90%. At this point, some might wonder: Why are we seeing the industry getting less complicated and more concentrated, at least in the USA and probably in many developed countries?

The answer to this question lies in the fact that growing markets and growing trade will come to those who can consistently deliver a high-quality product at stable or declining costs. In the seafood sector, this is what aquaculture producers have been doing for the past few decades. It can also be argued that sector diversity in the future is going to come from the “sauce” (i.e. the value-added component of the fish) and from image issues, such as ecolabelling, rather than being created through the production of a large number of species. Thus, despite the fact that over 1 500 different species are harvested—and will continue to be harvested—around the planet; in proportional terms, more and more of the supply is going to be concentrated in fewer and fewer species. Likewise, more of the diversity is going to come from the marketers because, as you take control of and manage the fish, you can market it better and start selling additional attributes.

This report will briefly touch on four different species (salmon, catfish, shrimp and tilapia) to emphasize the points made above. In the first place, farmed salmon production already accounts for about 70% of world supply, while the wild sector has remained relatively stable [9]. Regarding USA imports of salmon, most of the growth in recent years has come in the form of boneless, skinless fillets produced primarily in nations with significant aquaculture industries [10]. A natural consequence of having an industry based on something that has control of production systems is that more value-added and more processing activities take place. In Norway, the farmed salmon industry is now even more important than the traditional cod fishery. What is remarkable in a country like the USA is that we used to be the world leaders in salmon production. The USA had a US\$650-million trade surplus in 1992. By 2007, this surplus had evolved into a billion-dollar deficit, which continues to increase year after year. In conclusion, the industry is currently dominated by portion-control, value-added products. It must be mentioned that the negative media campaign associated with salmon aquaculture has had some impact on demand, while there has been some positive media reaction towards wild salmon. An analysis of these recent developments is beyond the scope of this report. For the purposes of this discussion, the point that must be emphasized is that salmon aquaculture has moved forward and gained market share, while there is still room for wild salmon in the special-premium segment.

Catfish aquaculture production in the USA has also increased significantly over the last 30 years [11]. The case of catfish is interesting because it is a fish that many people did not think could be sold. Nevertheless, because of the control associated with processing, it is being sold based primarily on the diversity of the sauces, not the fish. Catfish is also interesting because it epitomizes another key trend in at least the USA: trade barriers, mostly in the form of anti-dumping cases. The industry moved forward in the 1990s and then a surge of imports from Viet Nam in 2000–2001 drove down prices, which stimulated anti-dumping litigation. Domestic producers in the USA are particularly prone to these efforts. Increasing production volumes in the 1990s turned farmed catfish into the top fish species by value harvested in the USA, ahead of salmon and pollock. The success of catfish farming made Mississippi the second largest state

in the Union in terms of fish production. An important feature of the industry is the trade aspect. The industry developed with almost no trade, meaning that the USA did not export much and it did not import much either, and then a developing country (Viet Nam) came along exporting basa and tra, which precipitated the anti-dumping case. Trade litigation has also been stimulated by escalating shrimp and salmon imports. An important question that comes to mind is: Are these anti-dumping cases effective? Vietnamese catfish imports dropped after the Catfish Farmers of America filed the anti-dumping suit in 2002 but rebounded again in 2005, 2006 and 2007 [12, 13, 14]. The increase in imports has paralleled a decline in domestic production [11]. Despite the fact that, in general, these anti-dumping cases are ineffective, the USA domestic industries seem eager to waste millions of dollars hiring trade-litigation lawyers. Another important development is that the Vietnamese catfish is not being sold as catfish; it is being sold as tra or basa and it is also sometimes being passed as grouper and many other kinds of fish. This illustrates another international-trade issue, the problem of labelling and fraud. To summarize, the USA catfish market, even though historically it has been supplied primarily by a domestic industry, illustrates two key trends: a trend towards trade barriers (anti-dumping) and a trend to misrepresent the product in order to get higher prices.

In the case of the shrimp industry, growth has come mostly from export-oriented developing countries (China, Thailand, Viet Nam, Indonesia). World shrimp farming is increasing at an annual rate of about 16% [15]. A very high percentage of this production enters international trade. We have seen rapid growth, but market development has not kept track or pace with supply. An interesting trend, observed also with other species, is that value-added processing is taking place outside the USA and outside many developed countries. In other words, as developing countries improve their production technologies, a consistently higher proportion of their processing is occurring within their borders. China and Thailand, in particular, are doing much more processing than the USA; this trend has been reinforced by the recent anti-dumping case against shrimp producers, as anti-dumping margins were applied on uncooked shrimp. In response, China is now processing their shrimp, and, as a result, our processing industry is going out of business. Imports of breaded shrimp into the USA exploded after 2004 on the heels of the shrimp anti-dumping case [16].

Tilapia also supports strong aquaculture industries in developing countries (Egypt, Philippines, Indonesia, China) [17]. As observed previously with salmon, USA imports of tilapia are experiencing a shift from whole to processed fish [18]. Tilapia is seen as a substitute for flounder, snapper and all kinds of white fish. In addition, many environmental groups actually favour tilapia. Based on my own forecasts, I expect USA tilapia imports to potentially pass salmon imports by 2012 or so [19].

Another key point in this discussion has to do with the structure of costs. In the traditional fisheries, the primary costs are labour, fuel and maintenance of the boats. In the aquaculture sector, the primary costs are feed and fingerlings [20]. This is an important difference, as aquaculture has immense opportunities to reduce costs through genetics research and feed substitutions. In contrast, fisheries have less room for improvement unless a move is made towards more efficient management, such as rights-based fishing. The case of Norwegian Atlantic salmon is rather impressive, as production costs have decreased over 60% in the last 20 years [21]. No fishery on the planet (not even in rights-based fishing) has been able to do that. This is really a question of better management, biotechnology and related factors. The most impressive achievements have been attained in salmon aquaculture, but there is still much room for improvement with regard to production of tilapia and other new species.

It is important to examine real price trends of aquaculture species, as they indicate what might be in store for prices of wild-caught products. The real price trend for many fish species is going down because of the declining trends observed for shrimp

and salmon. Competitive pressures in the last few years have led the prices of salmon, catfish and cod to converge [22].

China is becoming a remarkable country in terms of its export and import values. It is now the number one seafood exporter and the number six seafood importer in value terms [23]. In quantity terms, it is the number one seafood exporter and the number one seafood importer [24], which illustrates the emerging trend whereby large volumes of seafood are sent to China to be processed for subsequent re-export. In the case of the USA, China has become the major source of finfish, frozen seafood and breaded shrimp imports. China is also the major supplier of tilapia, processed flatfish fillets, cod fillets and pollock fillets [25]. The emergence of China as a major force in the USA import market has occurred in just the last five years. China illustrates the case of a developing country that has basically taken control by sourcing products all over the planet and then selling them back to other nations. In terms of USA exports of seafood, China is actually number two in quantity and number three in value. China has also become the major destination of USA salmon exports, as well as exports of groundfish and flatfish [26]. This has occurred because USA processing plants are closing down, with processing taking place now in China. This trend has just started and has been in place for about the last five to seven years.

Finally, the USA, Japan and the European Union (EU) are net importers, but most other countries are net exporters. All the countries in Asia, except Japan, are net exporters. Net exporters are primarily developing countries (but not always). Comparing the list of top exporters in 1976 vs. 2004, it is evident that the countries that have recorded the most gains in export value (China, Norway, Thailand, Canada, Chile and Viet Nam) have all embraced aquaculture [27]. These are all countries that have taken control of their processing, handling and distribution systems. In terms of imports, it is interesting to see to the extent that China has risen in the ranking [28]. The main reason for this is that China has become a re-processor, but it will become a major consumer in the next few years. This is a fact we cannot afford to ignore.

CONCLUSIONS

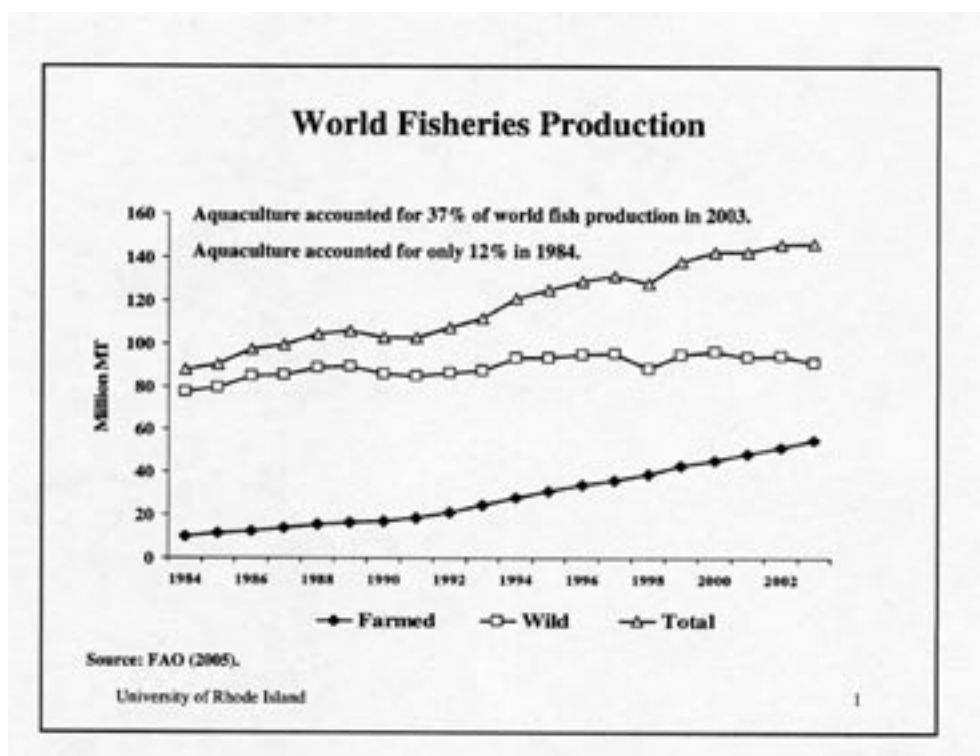
- Growth in the seafood industry will be fuelled by aquaculture imports.
- There will be increases in per-capita seafood consumption; however, consumption will be concentrated on fewer species, with diversity coming in the “sauce” and on labelling issues, such as ecolabelling.
- The growth of aquaculture parallels a shift in the market towards value-added products. Technology, innovations, better nutrition, and disease management will continue to reduce costs in aquaculture. Lower production costs will increase supply from aquaculture and hold prices down for all fish. The trend towards value-added creation will drive processing to countries where labour costs are low (China, Viet Nam).
- Despite criticism from environmental organisations, aquaculture will not go away. The potential constraints for aquaculture development, in particular the fish meal trap, will be circumvented by new technology and substitution.
- Aquaculture will dominate the commodity market, but there will be increasing opportunities for wild market products in the upper-end segments, especially the niche market.
- Retail outlets are becoming increasingly important. Supermarkets and club warehouses, at least in the USA, are major distribution channels. Chain restaurants have also become important outlets. All these channels care about quality and portion control, a important phenomenon that extends control all the way through the system. Supply, stability and product standardization will be foremost for these companies. We are starting to see more long-term contracts, which were very uncommon in the fish industry just a decade ago.

- Anti-globalization trade barriers are likely to increase. This is unfortunate because economic growth will be undermined, not just in developing countries but also in developed countries.
- There will also be an increased use of labelling and certification programmes (Marine Stewardship Council, organic production, etc.). All these are important strategies for diversifying a product and making it seem different from others. Credibility issues might emerge as competing certification programmes will tend to conflict with each other.
- China will become an increasingly important force, both as a food processor and a significant consumer.

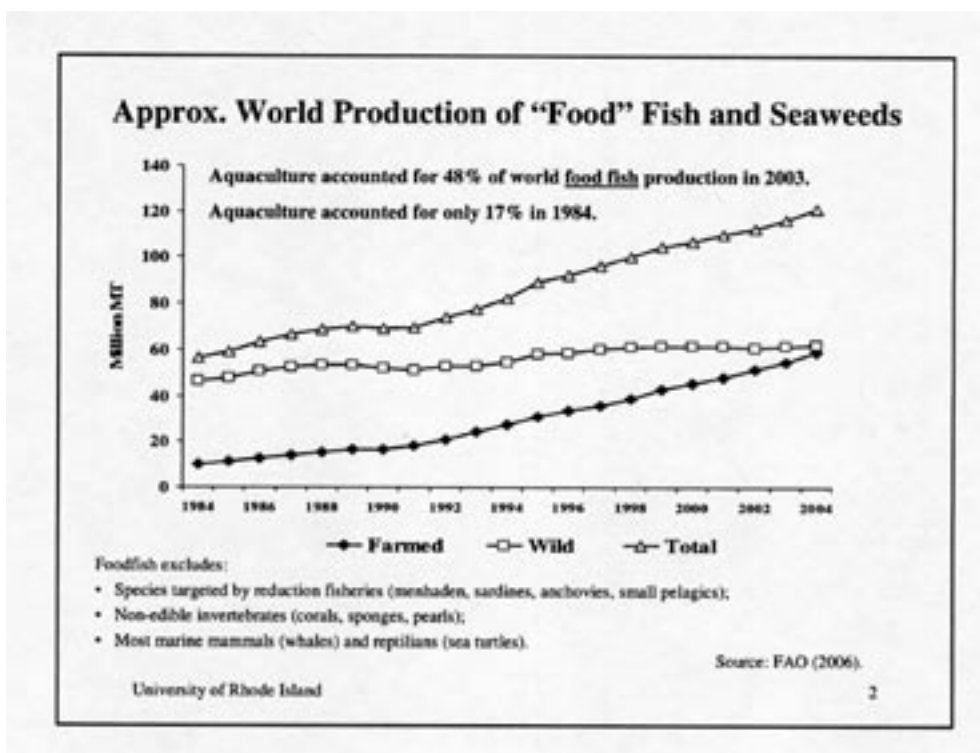
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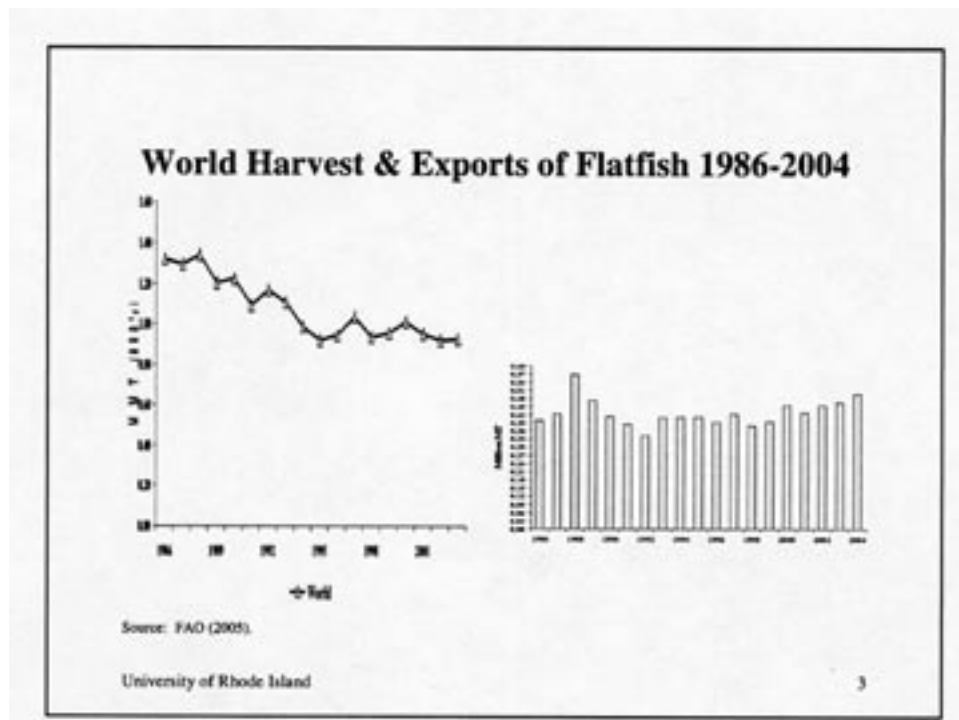
APPENDIX



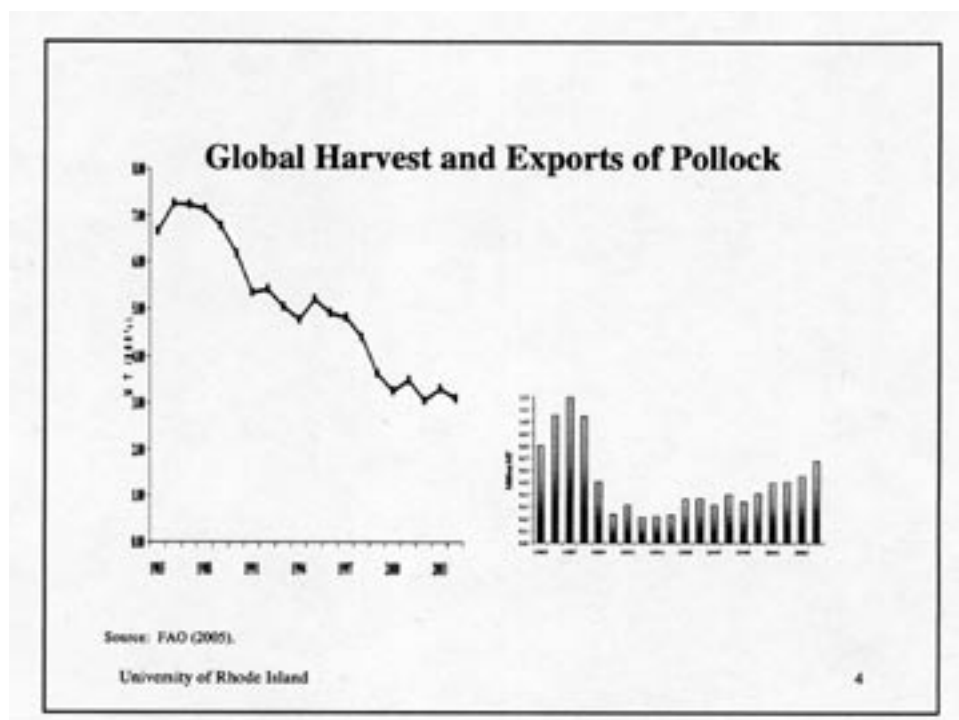
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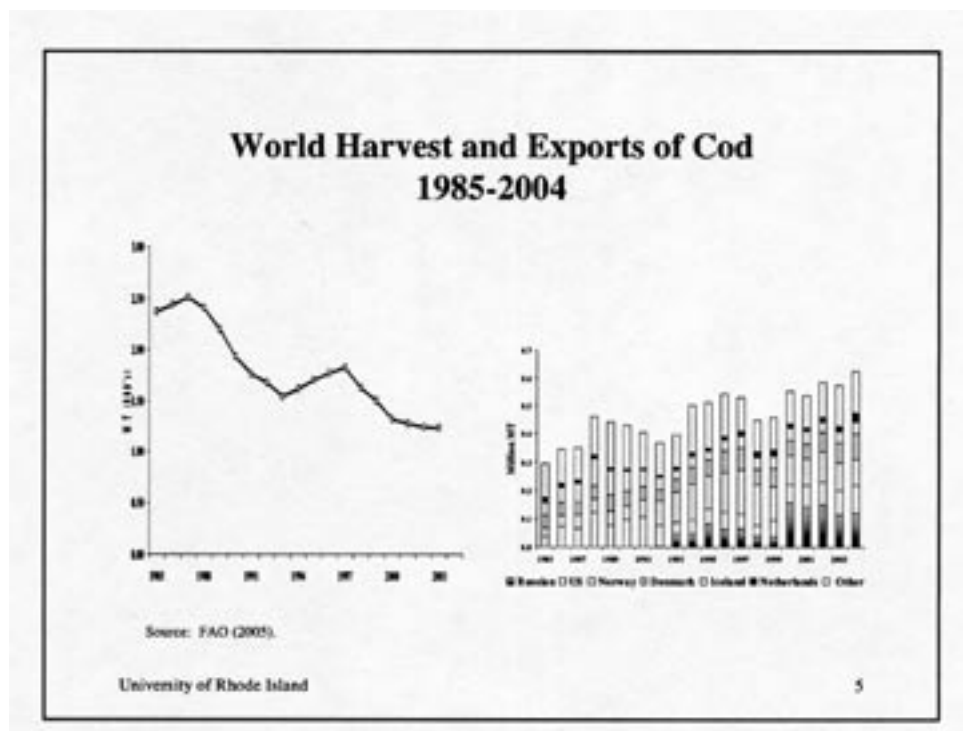
SLIDE 02



SLIDE 03



SLIDE 04



SLIDE 05

U.S. Annual Per Capita Consumption of Commercial Fish and Shellfish (edible kg per capita): 1987 vs. 2003

	1987		2003	% change	
1 Tuna	1.59	→	Shrimp	1.81	+74
2 Shrimp	1.04	→	Tuna	1.54	-3
3 Cod	0.76	→	Salmon	1.01	+403
4 AK Pollock	0.40	→	AK Pollock	0.77	+93
5 Flatfish	0.33	→	Catfish	0.52	+91
6 Clams	0.30	→	Cod	0.29	-62
7 Catfish	0.27	→	Crab	0.28	+84
8 Salmon	0.20	→	Tilapia	0.25	N/A
9 Crab	0.15	→	Clams	0.24	-21
10 Scallops	0.15	→	Scallops	0.15	0
Other	2.16	→	Other	0.55	-75
Total	7.35		Total	7.40	+1

Sources: USDC/NMFS (2003) and NFI (2005).

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SLIDE 06

Seafood Consumption is Concentrating on Fewer Species						
Edible kg per Capita						
1987			2003		% change	
71%	1 Tuna	1.59	93%	Shrimp	1.81	+74
	2 Shrimp	1.04		Tuna	1.54	-3
	3 Cod	0.76		Salmon	1.01	+403
	4 AK Pollock	0.40		AK Pollock	0.77	+93
	5 Flatfish	0.33		Catfish	0.52	+91
	6 Clams	0.30		Cod	0.29	-62
	7 Catfish	0.27		Crab	0.28	+84
	8 Salmon	0.20		Tilapia	0.25	N/A
	9 Crab	0.15		Clams	0.24	-21
	10 Scallops	0.15		Scallops	0.15	0
Other		2.16	Other		0.55	-75
Total		7.35	Total		7.40	+1

Sources: USDC/NMFS (2003) and NFI (2005).

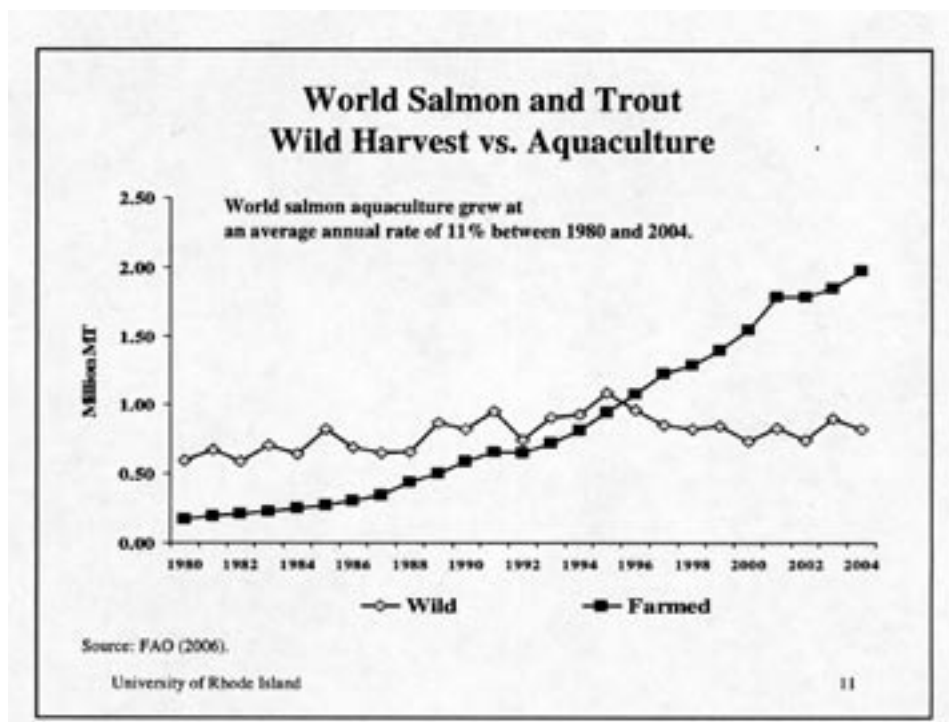
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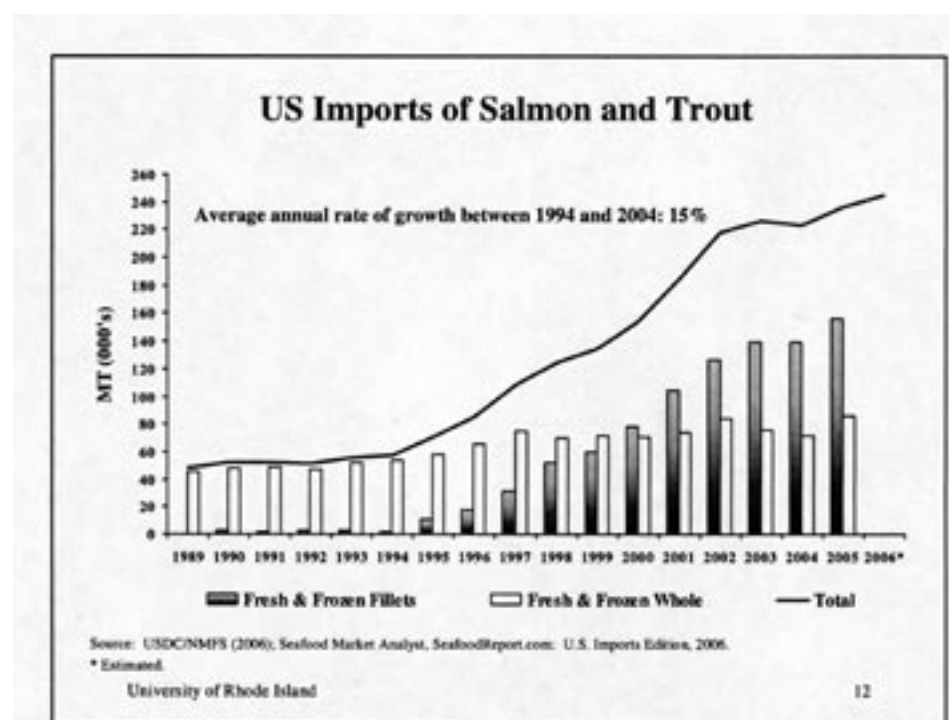
SLIDE 07

Seafood Business Survey: U.S. Retail Sales, 1994 vs. 2004		
Best Sellers		
	1994	2004
1	Shrimp	Shrimp
2	Salmon	Salmon
3	Pollock, Cod, Haddock	Tilapia
4	Catfish	Tuna
5	Flounder	Catfish
Fastest Growing Items		
	1994	2004
1	Salmon	Salmon
2	Shrimp	Tilapia
3	Tilapia	Shrimp
4	Catfish	Tuna
5	Orange Roughy	Crab
Sources: Perkins, C. (1994) and Robinson, F. (2004)		
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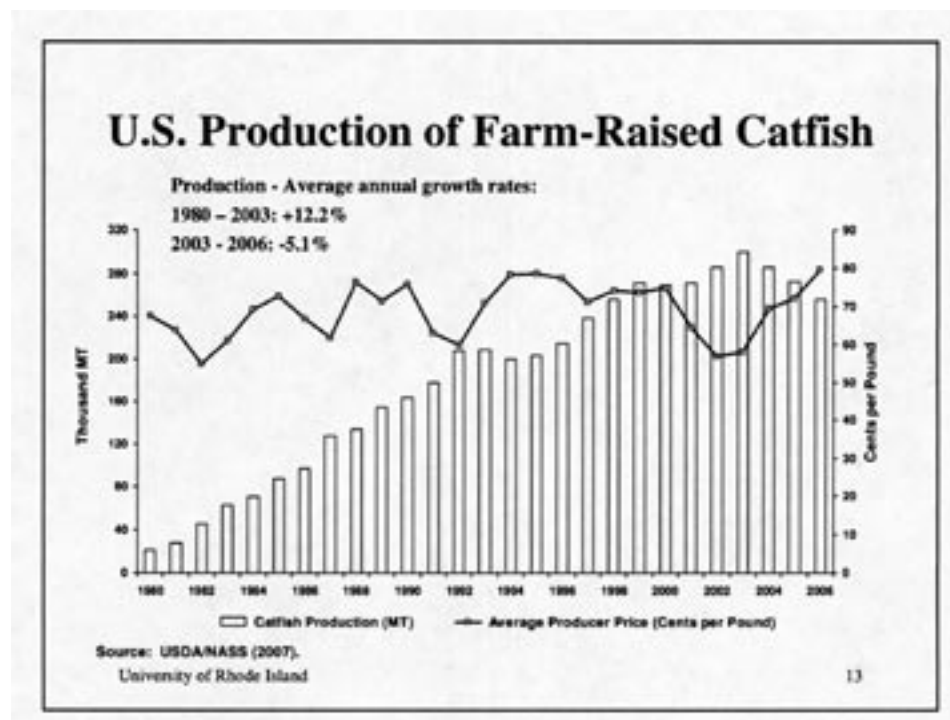
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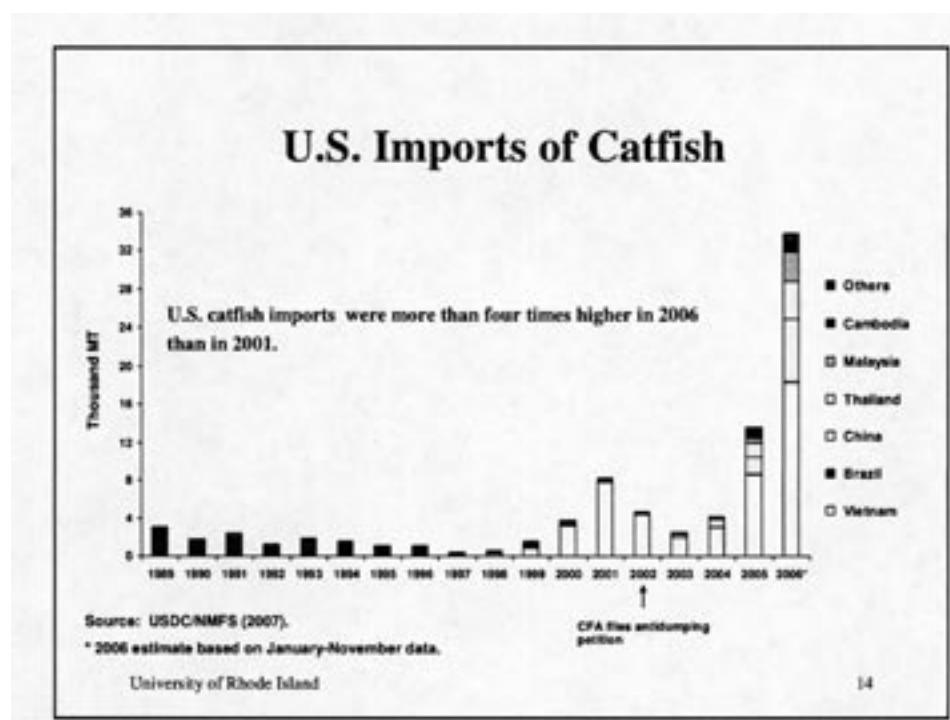
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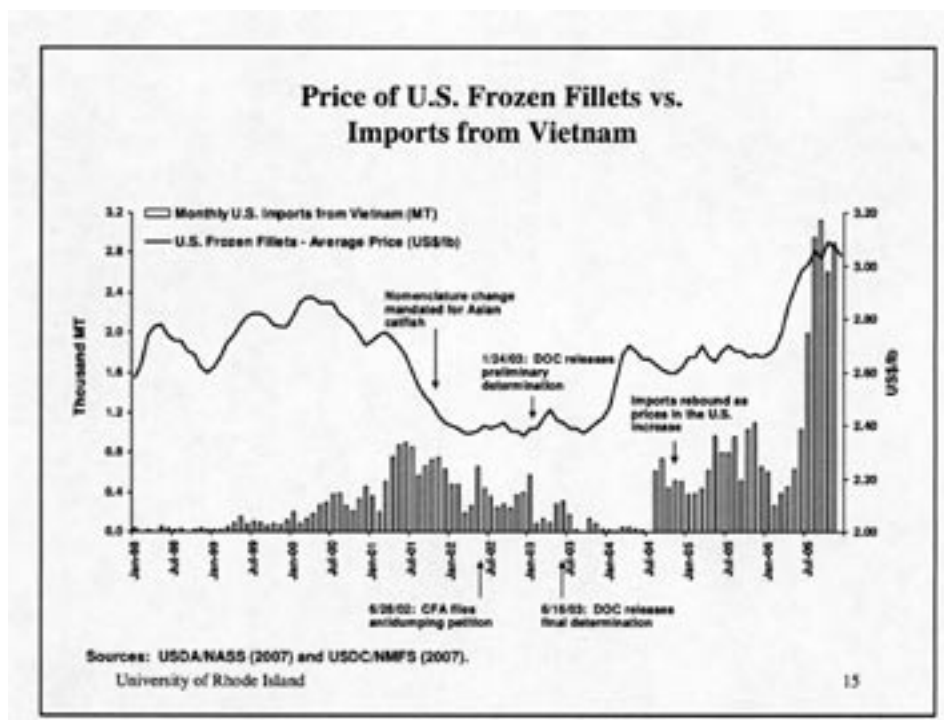
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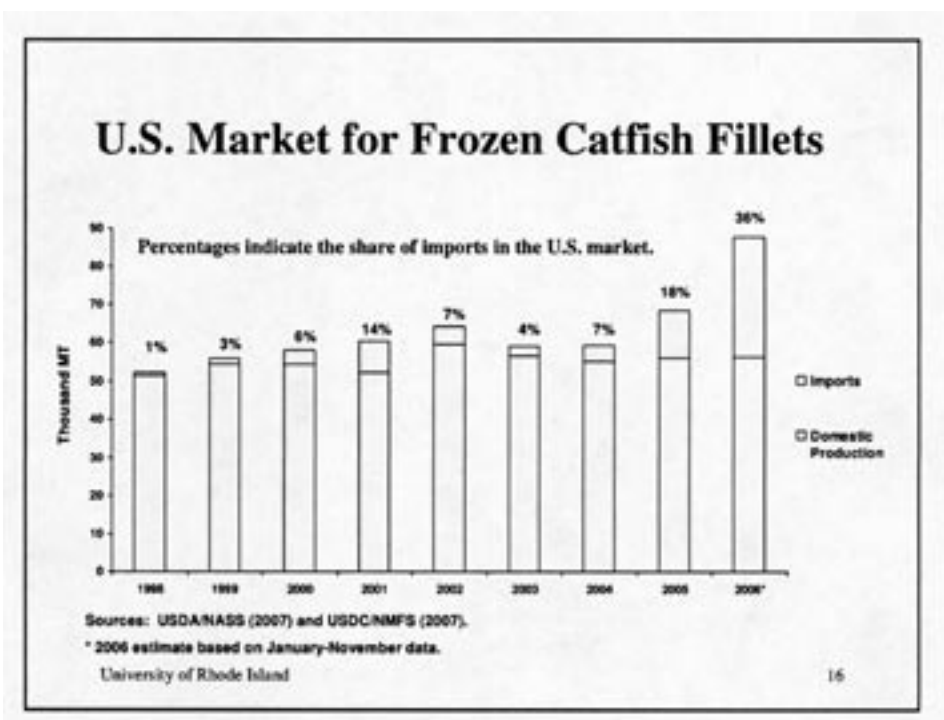
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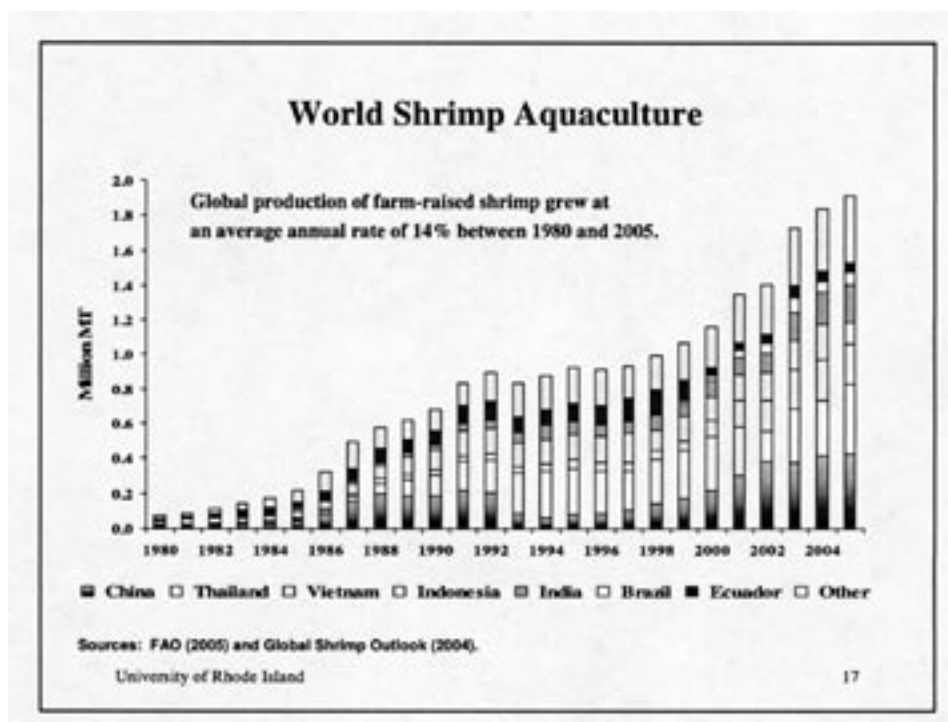
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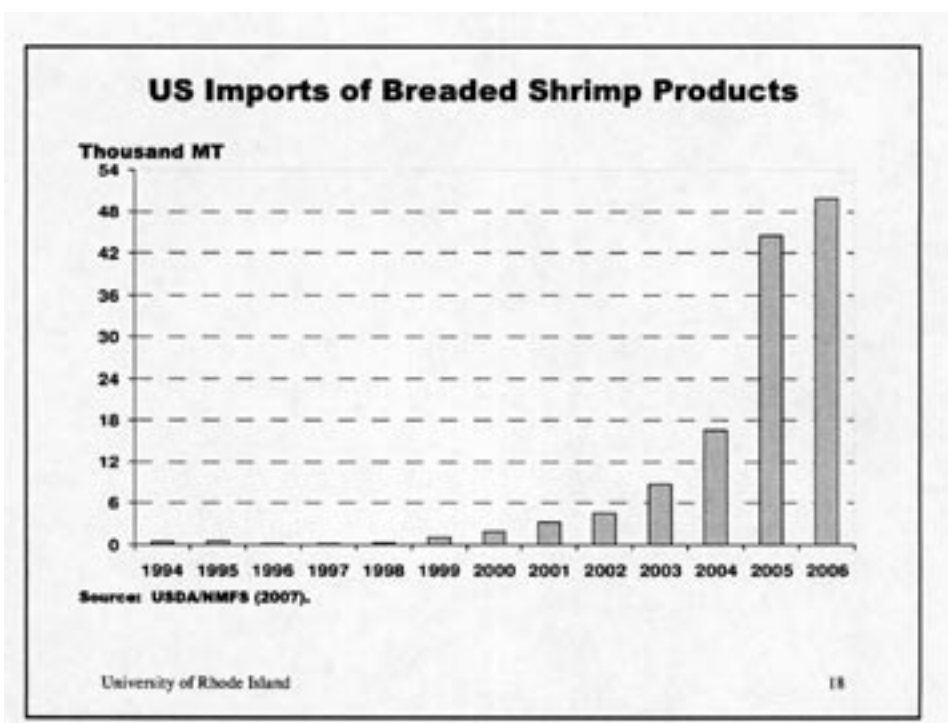
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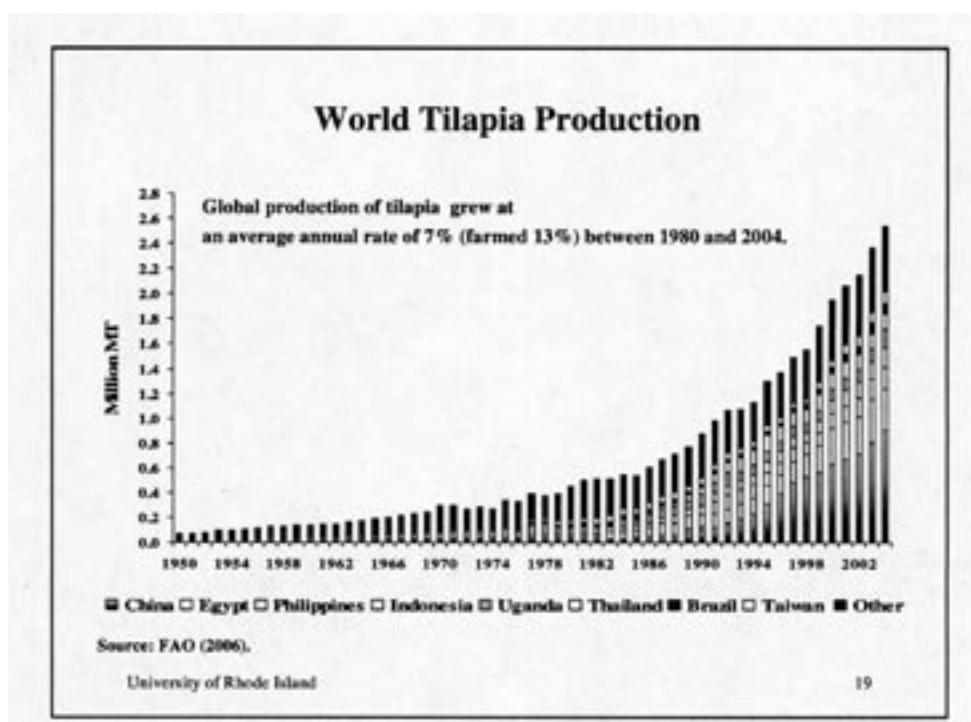
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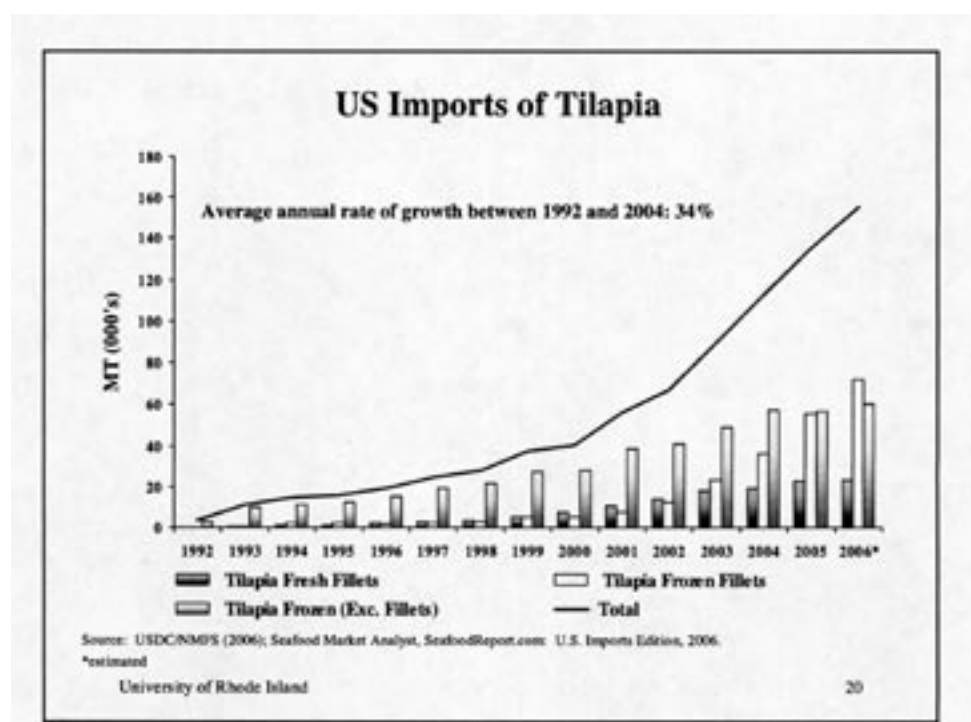
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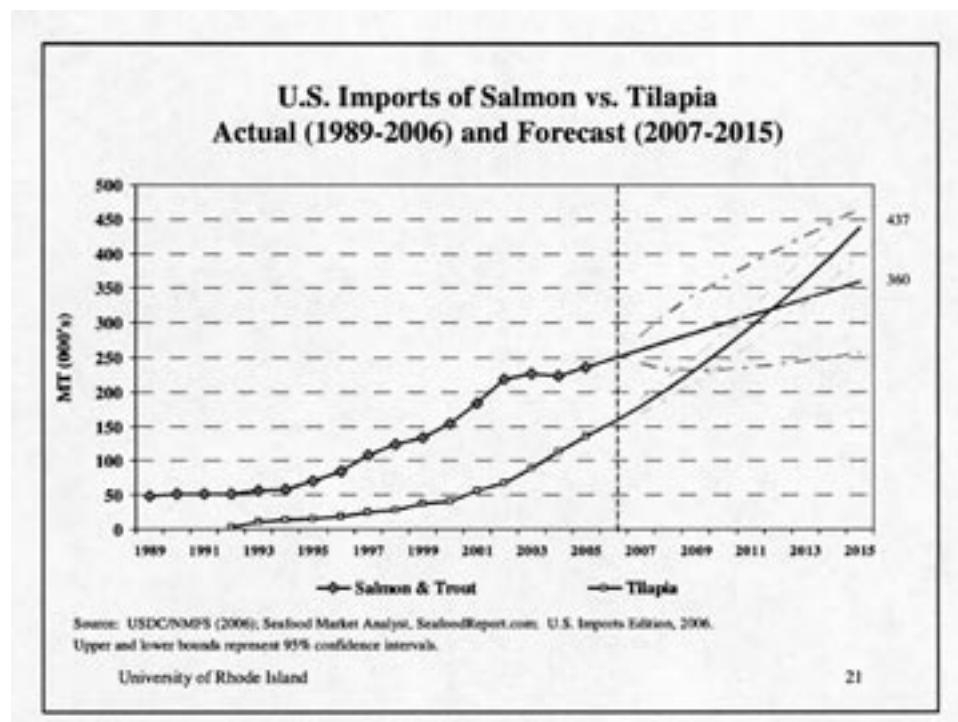
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SLIDE 17



SLIDE 18



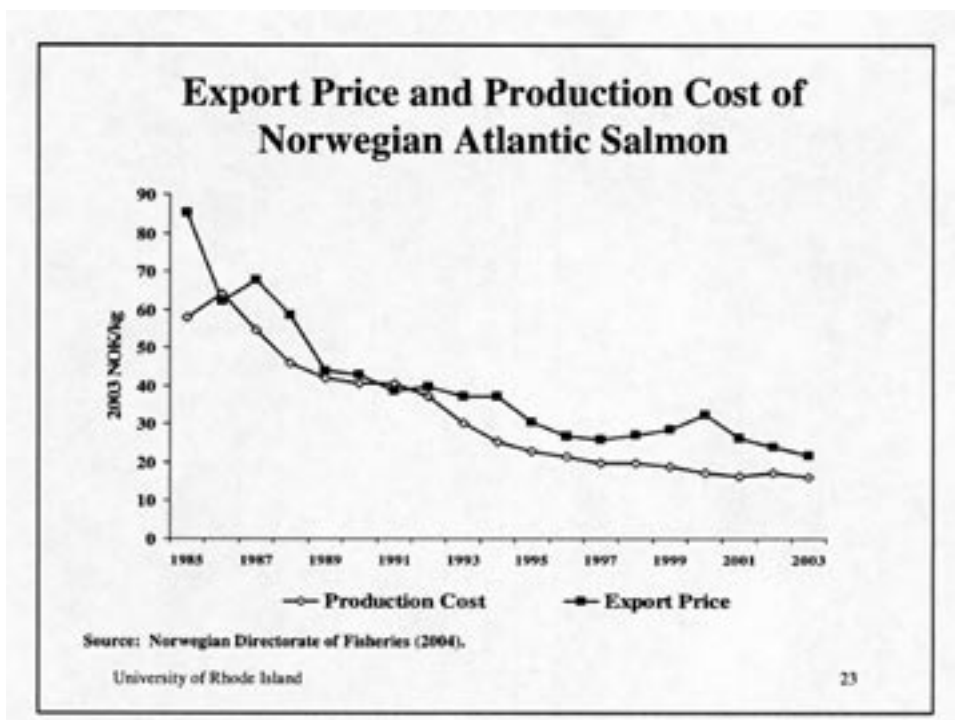
SLIDE 19

Cost Share: Aquaculture vs. Fishery

Item	Aquaculture	Fishery
Labor	4-10%	25-45%
Maintenance	2-4%	9-23%
Fuel	1-4%	4-11%
Fingerlings	2-15%	—
Feed	40-60%	—

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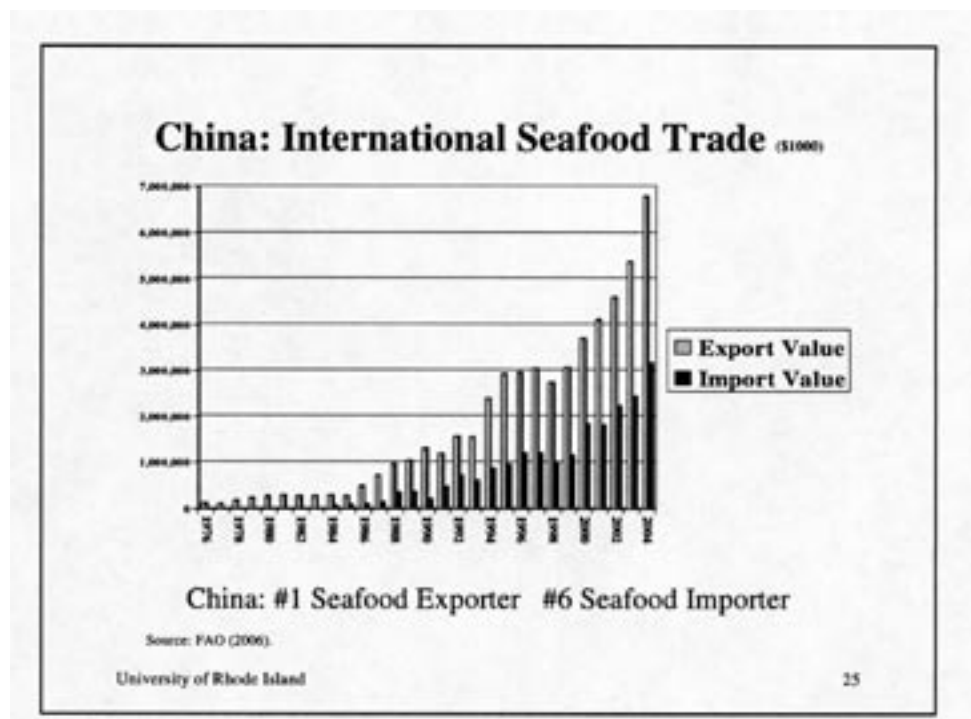
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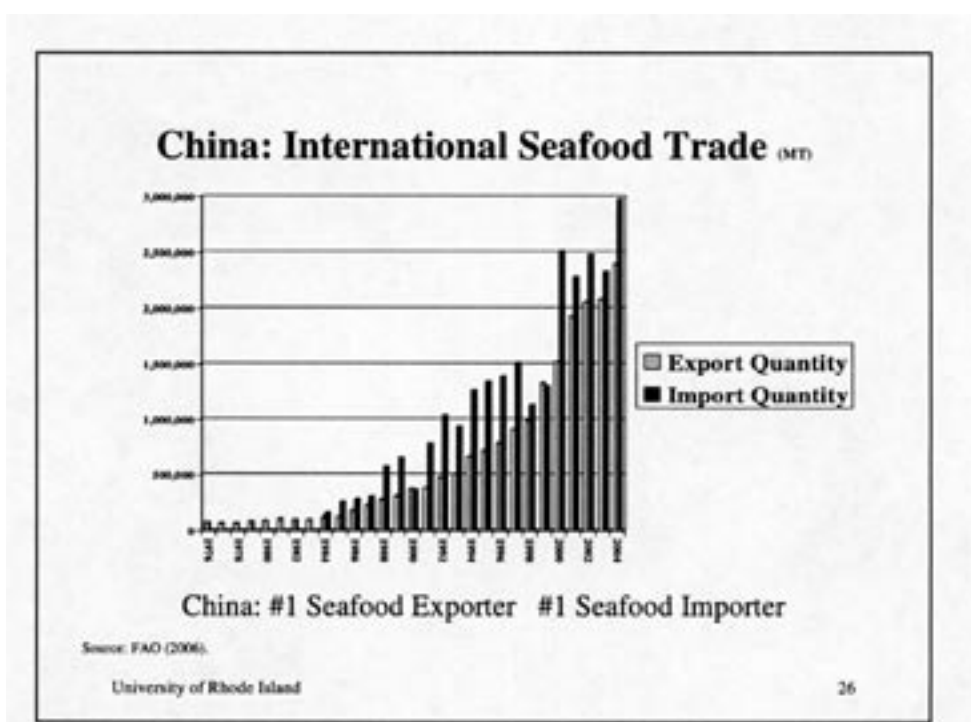
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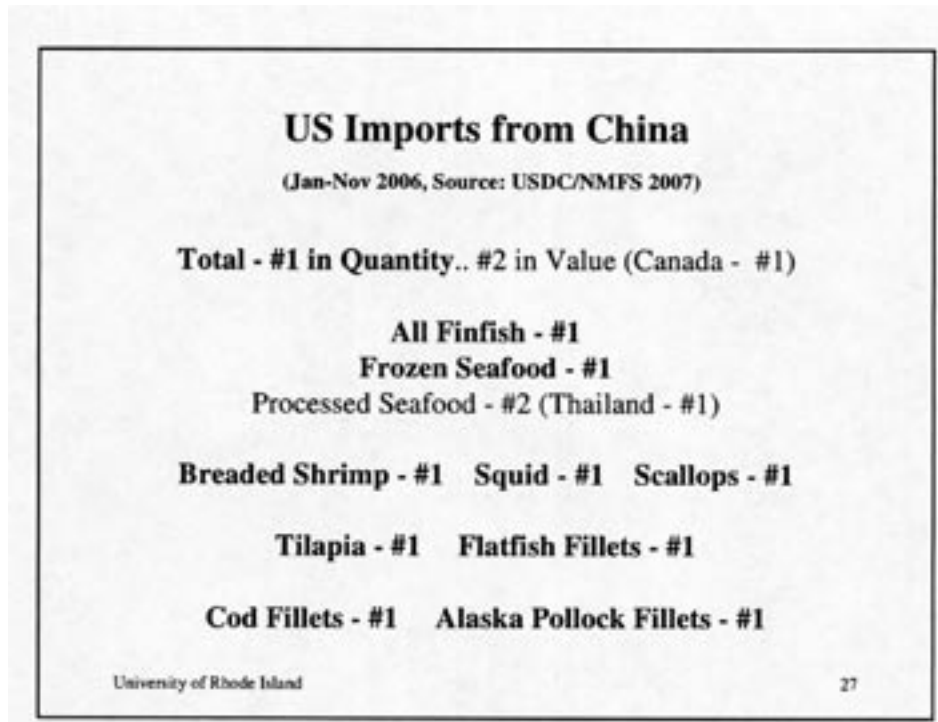
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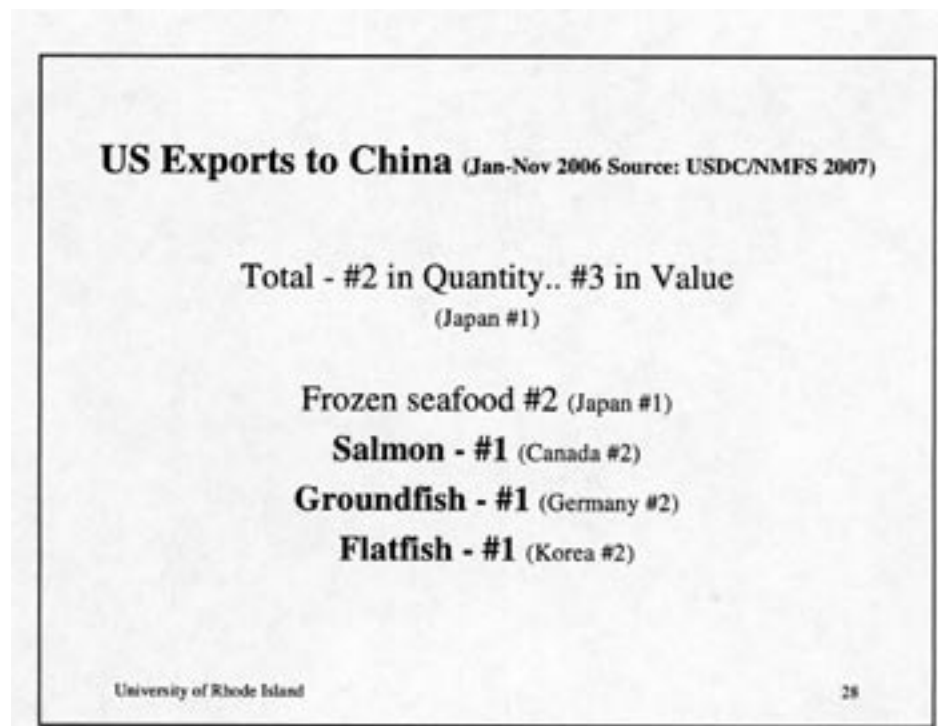
SLIDE 23



SLIDE24



SLIDE 25



SLIDE 26

Seafood Exports (1000\$)				
Rank	1976		2004	
	Country	Value	Country	Value
1	Japan	662469	China	6779909
2	Norway	654703	Norway	4170996
3	Canada	604232	Thailand	4053351
4	Denmark	520935	US	3693079
5	Taiwan	431893	Denmark	3576980
6	US	371899	Canada	3506676
7	Korea Rep.	329114	Spain	2581893
8	Iceland	290338	Chile	2547235
9	Netherlands	267130	Netherlands	2468384
10	Spain	244969	Vietnam	2408502

Source: FAO (2006).
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SLIDE 27

Seafood Imports (1000\$)				
Rank	1976		2004	
	Country	Value	Country	Value
1	US	1890921	Japan	14830080
2	Japan	1850360	US	12078689
3	France	575159	Spain	5238660
4	Germany	540102	France	4216736
5	UK	518737	Italy	3919082
6	Italy	397425	China	3167656
7	Belgium	216298	UK	2843021
8	Netherlands	200825	Germany	2830918
9	Sweden	194589	Denmark	2368838
10	Canada	183631	Korea Rep.	2258711

Source: FAO (2006).
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SLIDE 28

From farm to fork – new European food hygiene regulations

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ABSTRACT

A major review the European food hygiene regulations was carried out following recommendation of the White Paper on Food Safety published in 2000. Together with new regulations on the organization of official food controls these came into force in 2006. The focus of the new regulations is from “farm-to-fork” and place the responsibility for marketing safe food with the producer. This paper gives an overview of the new regulations and how they apply to the production, processing and marketing of fish and fishery products.

INTRODUCTION

January 1st 2006 marked a significant milestone for food safety in the European Union (EU), when a large body of updated food and feed legislation came into force. The new EU Food Hygiene Regulations focus on the need to protect public health in a way that is effective, proportionate and based on risk. A key aspect of the new legislation is that all food and feed business operators, from farmers and processors to retailers and caterers, will have principal responsibility for ensuring that food placed on the EU market meets the required food safety standards. The new Regulations apply at every stage in the food chain, including primary production (i.e. farming, fishing and aquaculture) in line with the EU’s “farm-to-fork” approach to food safety. The regulations apply to food businesses farming and handling live bivalve molluscs and catching and farming fish and crustaceans, and handling and processing fish and fishery products.

The new Regulations clearly set out the responsibilities of the food business operator. The Regulations require appropriate own-checks to be carried out and samples to be taken by the industry to ensure the marketing of safe products. The Regulations also includes provisions for guides to good practice to be developed by industry with support from other stakeholders. The legislation applies directly to food businesses and the effect the legislation will have depends on the size and nature of the business. The new food law separates aspects of food hygiene from animal health, and aims to remove any duplication and inconsistencies in approach that can cause difficulties for both businesses and regulatory authorities.

The new Food Hygiene Regulations constitutes a complementary set of rules to harmonize EU food safety measures. They are a suite of several regulations including Regulation (EC) 852/2004, which lays down the general hygiene requirements for all food business operators, and Regulation (EC) 853/2004, which lays down additional specific requirements for food businesses dealing with foods of animal origin, including live bivalve molluscs and fishery products. Regulation (EC) 854/2004 lays down the official controls for foods of animal origin. The basis for the new regulations is provided by the General Food Law Regulation (EC) 178/2002, which provided a framework to ensure a coherent approach in the development of food legislation. The General Food Law Regulation set down definitions, principles and obligations covering all stages of

food and feed production and distribution. Other related recent legislation includes the Regulation on microbiological criteria for foodstuffs, the Regulation on official feed and food controls, and the Regulation on feed hygiene.

When the new legislation was introduced on 1 January 2006, 17 separate pieces of previous legislation were revoked. This included Directives 91/492/EEC and 91/493/EEC, which related to the placing on the market of live bivalve molluscs and fish and fishery products. In order to permit a smooth transition to full implementation of the new rules, the EU has introduced provisions for transitional periods (up to 31 December 2009 in some instances), during which certain requirements can be progressively implemented. National legislation is also being introduced, and, when it is in place, it will revoke and replace most of the existing national food hygiene legislation.

EXPORTING FISH AND FISHERY PRODUCTS TO THE EUROPEAN UNION MARKET

For all food and feed, including fish and fishery products, the general principle applies that the product meets, or is equivalent to, EU standards. In addition, under current arrangements, in order to export products of animal origin to the EU, the country must be approved for the relevant commodity and the products must originate in an establishment that is approved to export to the EU. Lists are maintained at EU level of countries and establishments from which imports are permitted. Countries and establishments approved in this manner are commonly referred to as “listed”. In order to be listed the third country concerned must provide guarantees that exports to the EU meet, or are equivalent to, the standards prescribed in the relevant EU legislation.

FOOD BUSINESS REGISTRATION AND APPROVAL

Under the new legislation, primary producers involved in fishing and aquaculture will have to be registered with the national competent authority as food business operators. Operators will need to register before starting at a new location and will also need to inform the competent authority of the nature of the business. Furthermore, establishments must be approved if they handle products of animal origin for which specific hygiene conditions are laid down in Community legislation. This includes those handling live bivalve molluscs and fishery products. This does not apply to establishments engaged only in primary production, transport or storage of products not requiring temperature-controlled storage conditions, or retail operations. Premises in compliance with the new regulations should be issued an approval number.

IDENTIFICATION MARKING AND LABELLING

Approved food businesses must apply an identification mark to their products during or after production. This mark must be oval in shape, legible, indelible and clearly visible for inspection. It must show the name or two-letter code of the country (IE for Ireland), the approval number of the premises, and an abbreviation for the European Community (for example ‘EC’).

One of the transitional arrangements established by the EU allows for stocks of food of animal origin produced before 1 January 2006, in approved premises, to continue to be placed on the market provided that they have the appropriate health marks, such as those required under Directives 91/492/EEC and 91/493/EEC. Also, if these products have a defined shelf life longer than the transitional period, then they may remain on the market until the end of their shelf life. In relation to the use of packaging bearing identification marks in compliance with the revoked hygiene legislation (e.g. Directives 91/492/EEC and 91/493/EEC), food business operators may continue until 31 December 2007 to use stocks of such purchased by them before 1 January 2006.

Specific requirements for live bivalve mollusc products are that the label must contain the following information: the species of bivalve mollusc (common name and

scientific name); and the date of packaging, comprising at least the day and month. The date information may be replaced by the phrase ‘these animals must be alive when sold’. The label, including the identification mark, must be waterproof. There is also a requirement for retailers, where the live bivalve molluscs are not in individual consumer size packages, to keep the packaging label for at least 60 days after splitting up the contents.

PRIMARY PRODUCTION

The farm-to-fork approach of the legislation embraces primary production, and the general principles of food hygiene legislation now extend to all operations involved in the primary production of food.

‘Primary production’ is defined as the production, rearing or growing of primary products up to and including harvesting, hunting, fishing, milking and all stages of animal production prior to slaughter. Fish and shellfish farmers as primary producers and certain associated operations listed below need to follow good practice and manage their operations as set out in Annex 1 of Regulation (EC) 852/2004. Derogations may be granted for small businesses, provided that they do not compromise the achievement of the Regulation’s objectives. Primary producers are not required to implement a HACCP system. (www.fsai.ie/legislation/food/eu_docs/Food_hygiene/Reg852_2004.pdf)

In practical terms, the requirements for primary producers amount, in the main, to fairly basic hygiene procedures. Primary producers must ensure that hazards are acceptably controlled and that they comply with existing legislation. Under the new rules, primary producers need to take steps, for example, to:

- prevent contamination arising from water, soil, feed, veterinary products, waste, etc;
- keep animals intended to be placed on the market for human consumption clean;
- take account of results from tests relevant to animal and human health; and
- use medicines appropriately.

The requirements for food business operators in Annex 1 of Regulation 852/2004 also apply to certain associated activities that include:

- the transport, handling and storage of primary products at the place of production, where their nature has not been substantially altered;
- the transport of live animals, where this is necessary; and
- transport, from the place of production to an establishment, of products of plant origin, fishery products and wild game, where their nature has not been substantially altered.

GENERAL REQUIREMENTS FOR FOOD BUSINESS OPERATORS

- Food business operators carrying out activities other than primary production shall comply with the general hygiene provisions of Annex II of Regulation 852/2004. This Annex sets out the details for the hygiene requirements for:
 - food premises, including outside areas and sites;
 - transport conditions;
 - equipment;
 - food waste;
 - water supply;
 - personal hygiene of persons in contact with food;
 - food;
 - wrapping and packaging;
 - heat treatment, which may be used to process certain foodstuffs; and
 - training of food workers.

Requirements for live bivalve molluscs and fishery products

Food business operators making or handling products of animal origin must comply with the provisions of Regulation (EC) 853/2004 and, where appropriate, certain specific rules concerning microbiological criteria for foodstuffs, temperature control and compliance with the cold chain, and sampling and analysis requirements. Foods of animal origin include live bivalve molluscs and fishery products. The provisions of Regulation (EC) 853/2004 apply to unprocessed and processed products of animal origin, but do not apply to composite foods, i.e. foods containing both products of plant origin and processed products of animal origin. (www.fsai.ie/legislation/food/eu_docs/Food_hygiene/Reg853_2004.pdf)

Regulation (EC) No 854/2004 lays down specific rules for the organization of official controls on products of animal origin intended for human consumption. The Regulation supplements Regulation (EC) 852/2004 on hygiene of foodstuffs and Regulation (EC) 853/2004 on specific hygiene rules for foodstuffs of animal origin. This official control regulation gives details of the controls to be carried out on live bivalve molluscs and fishery products. (www.fsai.ie/legislation/food/eu_docs/Food_hygiene/Reg854_2004.pdf)

Details in relation to the approval of establishments and the withdrawal of approval if serious deficiencies are identified on the part of the food business operator are also set out in Regulation (EC) No 854/2004. Food business operators must provide authorized officers with all assistance needed to carry out the controls, notably as regards access to premises and the presentation of documentation or records. The official controls include audits of good hygiene practices and HACCP principles, as well as specific controls that have requirements determined by sector (including live bivalve molluscs and fishery products).

Regulation (EC) 2074/2005 sets out implementing measures for certain provisions of the new legislation. The Regulation includes rules for fishery products encompassing detection of parasites, maximum levels for total volatile nitrogen for certain species as a determinant of “fitness”, testing methods for marine biotoxins, and labelling with cooking instructions for specified fish. (www.fsai.ie/legislation/food/eu_docs/Food_hygiene/Reg2073_2005.pdf)

Live bivalve molluscs

Harvested live bivalve molluscs intended for human consumption must comply with high health standards applicable at all stages of the production chain. With the exception of the provisions on purification, the rules also apply to live echinoderms, tunicates and marine gastropods. The Regulations include provisions for cooperation by food business operator in the classification system. Approved dispatch and purification centres are now required to establish a HACCP system, as explained below.

Regulation (EC) 853/2004 specifies requirements for the following areas:

- production of live bivalve molluscs – classification of production areas (Class A, B or C);
- harvesting of molluscs and their transport to a dispatch or purification centre, relaying area or processing plant;
- relaying of molluscs in approved areas under optimal conditions of traceability and purification;
- essential equipment and hygiene conditions in dispatch and purification centres;
- health standards applicable to live bivalve molluscs: freshness and viability; microbiological criteria, evaluation of the presence of marine biotoxins and harmful substances in relation to the permissible daily intake;
- health marking, wrapping, labelling, storage and transport of live bivalve molluscs; and
- rules applicable to scallops harvested outside classified areas.

Regulation 854/2004 specifies that new production areas, after 1 January 2006, require a sanitary survey and the establishment of a representative sampling programme based on the sanitary survey data.

Fishery products

Specific requirements in the new legislation for fishery products cover the following elements:

- equipment and facilities on fishing vessels, factory vessels and freezer vessels: areas for receiving products taken on board, work and storage areas, refrigeration and freezing installations, pumping of waste, and disinfection;
- hygiene on board fishing vessels, factory vessels and freezer vessels: cleanliness, protection from any form of contamination, washing with water and cold treatment;
- conditions of hygiene during and after the landing of fishery products: protection against any form of contamination, equipment used, auction and wholesale markets;
- fresh and frozen products, mechanically separated fish flesh, endoparasites harmful to human health (visual examination), and cooked crustaceans and molluscs;
- processed fishery products;
- health standards applicable to fishery products: evaluation of the presence of substances and toxins harmful to human health; and
- wrapping, packaging, storage and transport of fishery products.

Regulation 853/2004 requires the use of potable water in relation to fish processing, but transitional arrangements in (EC) Regulation 2076/2005 allow clean water to be used up to 31 December 2009 in certain situations, including for making ice for chilling fresh fishery products, during gutting and filleting operations and for cooling after cooking crustaceans and molluscs.

Record-keeping

Under the new Regulations, food business operators will be required to keep records relevant to food safety, including:

- the nature and origin of animal and fish feed (if used);
- any veterinary products administered and their withdrawal dates (if used);
- any occurrence of disease that may affect food safety;
- the results of any analyses carried out; and
- the health status of the animals prior to slaughter.

Hazard Analysis Critical Control Point (HACCP)

The new legislation requires food business operators (except primary producers) to put in place, implement and maintain a permanent procedure, or procedures, based on the principles of HACCP. The requirements take a risk-based approach and can be applied flexibly in all food businesses regardless of the size or nature of the business. The application of procedures based on HACCP principles is a new requirement for live bivalve mollusc approved premises, although the requirement was already in place for fishery product premises.

Guides to good practice and guides to the application of HACCP

The Regulation encourages the development of national guides to good practice in food business sectors, which should include guidance on compliance with the general rules of hygiene and the HACCP principles. If a Member State or the Commission considers that there is a need for uniform Community guides, the Commission shall consider the case for such guides. Food business operators may refer to national guides or Community guides equally.

Training

Food business operators are responsible for ensuring that food handlers have received adequate instruction or training, or both, in food hygiene to enable them to handle food safely. Training should be appropriate to the tasks of staff in a particular food business and be appropriate for the work to be carried out. Training can be achieved in different ways. These include in-house training, the organization of training courses, information campaigns from professional organizations or from regulatory authorities, guides to good practice, etc. With regard to HACCP training for staff in small businesses, it must be kept in mind that such training should be proportionate to the size and the nature of the business and should relate to the way that HACCP is applied in the food business. If guides to good practice for hygiene and for the application of HACCP principles are used, training should aim to make staff familiar with the content of such guides.

Microbiological criteria of foodstuffs

The Microbiological Criteria for Foodstuffs Regulation (Regulation (EC) 2073/2005) includes limits for certain micro-organisms in specified foodstuffs and complements the new Regulations. The microbiological criteria established in previous EU legislation have been revised as part of a risk-based approach to food safety. The legislation sets limits for food safety criteria and process-hygiene criteria. The Regulation sets *E. coli* and *Salmonella* limits for placing live bivalve molluscs and live echinoderms, tunicates and gastropods on the market for human consumption. It also sets limits for fishery products for the following:

- *Listeria monocytogenes* for ready-to-eat food;
- *Salmonella* for cooked crustaceans and molluscan shellfish;
- Histamine for species associated with high amounts of histidine; and
- *E. coli* and coagulase-positive staphylococci for shelled and shucked products of cooked crustaceans and molluscan shellfish (process criteria).

Regulation EC/2073/2005 contains detailed controls encompassing sampling and analysis requirements. It is structured so it can be applied flexibly in all food businesses, regardless of their type or size. Food business operators should apply the criteria within the framework of procedures based on HACCP principles. The criteria can be used by food business operators to validate and verify their food safety management procedures and when assessing the acceptability of foodstuffs, or their manufacturing, handling and distribution processes.

Traceability and withdrawal of food products

In accordance with Regulation (EC) 178/2002, food business operators must set up traceability systems and procedures for ingredients, foodstuffs and, where appropriate, animals used for food production. Similarly, where a food business operator identifies that a foodstuff presents a serious risk to health, they shall immediately withdraw that foodstuff from the market and inform users and the relevant Competent Authority. (www.fsai.ie/legislation/food/eu_docs/Food_hygiene/Reg178_2002.pdf)

Animal health rules

Council Directive 2002/99/EC lays down the animal health rules governing the production, processing, distribution and introduction of products of animal origin for human consumption. Aquaculture animals and controls of certain fish and bivalve diseases are covered by the legislation. The Directive harmonizes veterinary public health requirements and covers all production stages of a product of animal origin: primary production, processing, transport, storage and sale. It also applies to live animals intended for human consumption.

New official food control regulations

In addition to the new Food Hygiene Regulations that came into force on 1 January 2006, a second group of Regulations were introduced that focus on how official food controls are organized at national level across the EU. While the Food Hygiene Regulations set out the responsibilities of the food business operator, the Regulations on Official Food and Feed Controls (EC/882/2004) and the General Principles and Requirements of Food Law (EC/178/2002) specify the responsibilities of national authorities in integrating food controls at all stages of production and in all sectors, using the farm-to-fork principle. The basic principles relating to the responsibilities of EU Member State authorities are laid down in Regulation EC/178/2002, on the general principles of food law and establishing the European Food Safety Authority (EFSA). The Regulation on Official Food and Feed Controls (EC/882/2004) describes in more detail how these basic principles shall be interpreted and implemented. Specific requirements on how official controls for fish and fishery products are organized at national level are detailed in Regulation EC/254/2004 on the organization of official controls on products of animal origin intended for human consumption. (www.fsai.ie/legislation/food/eu_docs/Food_hygiene/Reg882_2004.pdf)

Exporting fish and fishery products to the EU market

For all food and feed, including fish and fishery products, the general principle applied is that the product meets or is equivalent to EU standards. In addition, under current arrangements, in order to export products of animal origin to the EU, the country must be approved for the relevant commodity and the products must originate in an establishment approved to export to the EU. Lists are maintained at EU level of countries and establishments from which imports are permitted. Countries and establishments approved in this manner are commonly referred to as “listed”. In order to be listed, the third country concerned must provide guarantees that exports to the EU meet, or are equivalent to, the standards prescribed in the relevant EU legislation.

Organization of official food and feed controls at national level

The overall aim of the new regulations are to improve the efficiency of Member State control services through the introduction of performance criteria for the national authorities responsible for food safety and to harmonize the role of control services and integration of controls across the entire food and feed chain along the farm-to-fork principle. Regulation EC/882/2004 provides for:

- a harmonized EU-wide approach to the design and development of national food and feed control systems;
- support and cooperation between national authorities in the Member States where the results of official controls require action by more than one Member State;
- a common approach to imports of food and feed;
- the inclusion of general audits of national control systems against national control plans, as a means of verifying the effectiveness of national control systems;
- auditing of national food control organizations in order to verify compliance or equivalence of third country legislation and control systems with EU requirements;
- the provision of technical assistance to developing third countries, including training of control officials from these countries; and
- enforcement measures at national level or EU level to address problems of non-compliance with regulations.

There are a number of new requirements in EC/882/2004 aimed at harmonizing how official food controls are organized at national level. There is a requirement for all Member States in the EU to develop and report on multi-annual food control plans, to

ensure that official food laboratories are accredited, and to follow prescribed rules on the delegation of control tasks to non-governmental bodies.

Requirements for a national food control system

The new regulations specify a number of basic principles for the successful functioning of national food control systems across the EU. National control authorities must meet a number of operational criteria that must ensure their efficiency, effectiveness and impartiality. They must have access to a sufficient number of suitably qualified staff and implement documented control procedures. In addition to current requirements for contingency plans in the feed and veterinary sectors, contingency plans for food crises must be established and staff must be properly trained to implement these plans. Audits subject to independent scrutiny shall be carried out to ensure that the authorities achieve the objectives specified in the new regulations. It requires controls to be carried out on imported food and feed with a control frequency based on risk.

The regulation provides the possibility to delegate specific and defined tasks to non-governmental control bodies, such as the analysis of samples by private accredited laboratories. This is based on the principle that tasks can be delegated but the responsibility remains that of the national food control authority.

Organization of official controls for fish and fishery products intended for human consumption

Specific requirements for official controls for placing on the market of live bivalve molluscs (echinoderms, live truncates and marine gastropods) and fishery products are described in Annex II and Annex III of EC/254/2004. National authorities are required to put in place a comprehensive monitoring programme for live bivalve molluscs, which includes the classification of production and relaying areas according to the microbiological quality of the water. The monitoring programme also includes a requirement for monitoring for the presence of toxin-producing marine algae and the presence of a number of algal biotoxins. Production areas are closed when statutory levels of biotoxins are exceeded (EC/254/2004, Annex III, Chapter V). Requirements for official controls for placing on the market of fishery products include the inspection of hygiene conditions of landing and first sale, and hygiene on board fishing and factory vessels. Provisions also include analytical checks to be carried out by national authorities on fishery products to determine suitability for human consumption. These include sensory analysis, tests for total volatile nitrogen (a freshness indicator), histamine in scombroid species, levels of residues and contaminants, checks for parasites and microbial contamination and check for poisonous species of fish. Fish that are found to be unfit for human consumption are not allowed on the market.

Import controls

The new regulations do not make major changes to the current controls in place for the import of products of animal origin, including fish and fishery products. The Regulation provides for a more harmonized approach to controls on imports of food and feed of non-animal origin from third countries.

In order to export fish and fishery products to the EU, the third country concerned must provide guarantees that exports to the EU meet, or are at least equivalent to, the standards prescribed in the relevant EU legislation. The European Commission requests third countries intending to export fish and fishery products to the EU to provide all necessary information on the general organization and management of sanitary control systems operated by the competent authority of the third country. This information may relate to results of national controls carried out on products intended to be exported to the EU as well as written records kept of the implementation of these controls.

Guidelines have been drawn up to assist third countries in meeting these requirements, which can be found on the website of the European Commission (EC) at: europa.eu.int/comm/food/fvo/pdf/guide_thirdcountries_en.pdf.

Where developing countries experience difficulties in complying with the provisions of this new Regulation, a number of initiatives are planned by the EC to assist, including: a phased introduction of certain specific requirements; technical assistance projects; twinning projects between developing countries and Member States; the development of guidelines to assist developing countries in organizing official controls on products exported to the EU; visits by EU experts; and the participation of developing countries' control staff in the training courses organized in the EU.

Inspections and auditing to verify compliance

The Commission has three main instruments at its disposal to ensure that EU legislation is properly implemented and enforced. It verifies the transposition by Member States of EU legislation into national laws, and analyses reports received from Member States and third countries on the application of aspects of EU legislation, such as national residue programmes and animal feed controls. Additionally it carries out inspections in Member States and third countries to check the implementation and enforcement of EU legislation by national competent authorities.

The control function at EU level is mainly the responsibility of the Food and Veterinary Office (FVO), a directorate of DG Health and Consumer Protection. Its main task is to carry out on-the-spot inspections to evaluate national control systems, to report on its findings and to follow up on the action taken by national competent authorities in response to its reports. The European Commission has published guidance for the importation of fish and fishery products from third countries. ec.europa.eu/comm/food/international/trade/interpretation_imports.pdf

Border inspection posts

For introduction of import consignments of fish and fishery products into the Community, they must enter via an approved Border Inspection Post (BIP) located in a Member State. BIPs are placed under the authority of official veterinarians, who are effectively responsible for health checks on incoming consignments.

According to Community legislation, each consignment of live animals and products of animal origin, including fish and fishery products, must be subject to official veterinary checks in the border inspection. The official controls include at least a systematic documentary check, identity check and, as appropriate, a physical check. In some cases, the frequency of physical checks can be reduced and they depend on the risk profile of the product and also on the results of previous checks. There is extensive EU legislation concerning the entry of products of animal origin, including procedure. These include a pre-notification procedure to the BIP 24 hours before arrival of some consignments and the use of common veterinary entry documents (CVED) and the recently developed veterinary computer application (Trade Control and Expert System, TRACES). Consignments that are found not to be compliant with Community legislation will either be destroyed or, under certain conditions, re-dispatched within 60 days.

European food law

One of the main objectives of Regulation EC/178/2002 is to establish common definitions and guiding principles for food law, with the aim of ensuring a high level of health protection and the effective functioning of the internal market. It requires national authorities to base risk management decisions on independent scientific risk assessments. Where possible harmful effects on health are identified, but scientific uncertainty exists, provisions are included in the regulation to allow for precautionary

measures to be taken until a full risk assessment can be carried out. National authorities are also required to be open and transparent during the development of food law. Only food that is safe can be placed on the market and the labelling of foods cannot mislead the consumer.

Key sections of the regulation cover obligations of the food industry with regard to placing only safe food on the market and the requirement for national authorities to enforce regulations at all stages of the food chain. The need for full traceability is recognized in the regulation, as there are requirements for food business operators to put in place systems to trace food and feed in the event of having to withdraw products from the market. This provision covers all stages of production, processing and distribution in the EU from the importer up to the retail level. For the first time in European regulations, there are specific requirements for food businesses to have systems in place for the withdrawal, recall and notification of food that are not in compliance with regulations.

Guidance on the implementation of EC/178/2002 has been published by the European Commission and can be found on the EU Web site at: ec.europa.eu/comm/food/food/foodlaw/guidance/guidance_rev_7_en.pdf

Causes of detentions and rejections in international fish trade¹

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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.

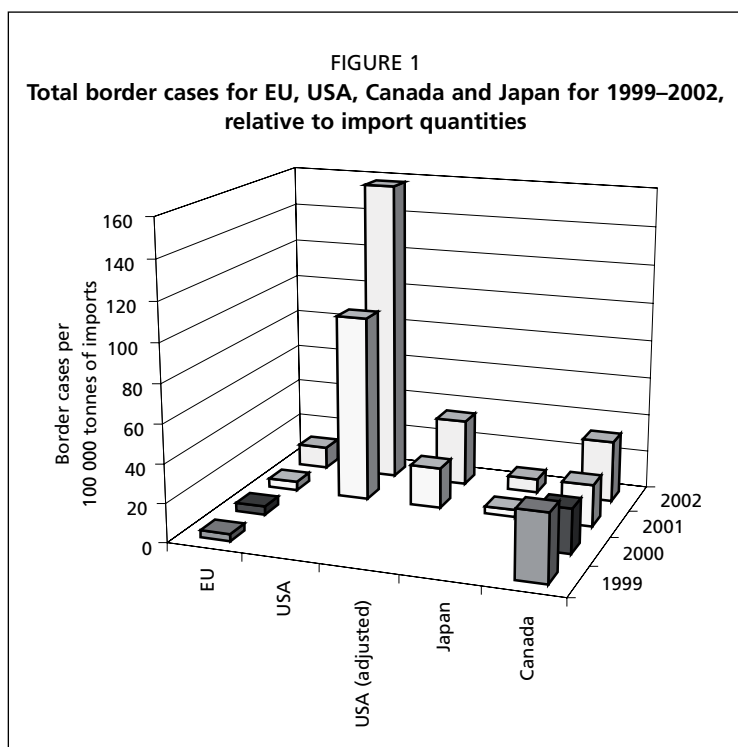
Firstly, a high percentage of cases end up with the product actually entering the USA after re-examination, sorting, re-packing, new documentation and information, or new labelling. During 1999–2001, 78 percent of detained shipments were released for import into the USA (Allshouse et al., 2003). Therefore, 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.

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



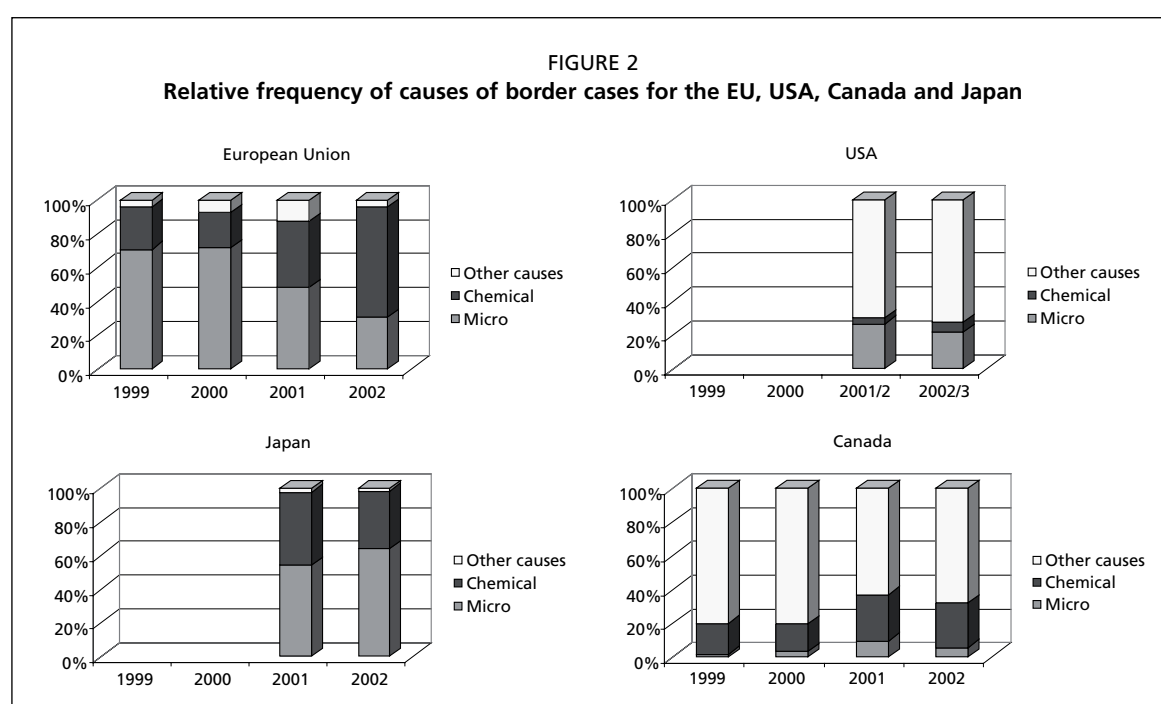
efficiency. Moreover, reducing losses due to rejections and detentions should eventually result in a larger supply of safe fish and less illnesses from consuming unsafe foods. However, care must be exercised when introducing the 'prevention at source' approach to ensure that exporting developing countries 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



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	Volume (tonne)	Import	Unit cost (US\$/tonne)	Number	Border cases	Value (US\$)
		Value (US\$ million)			Volume (tonne)	
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.

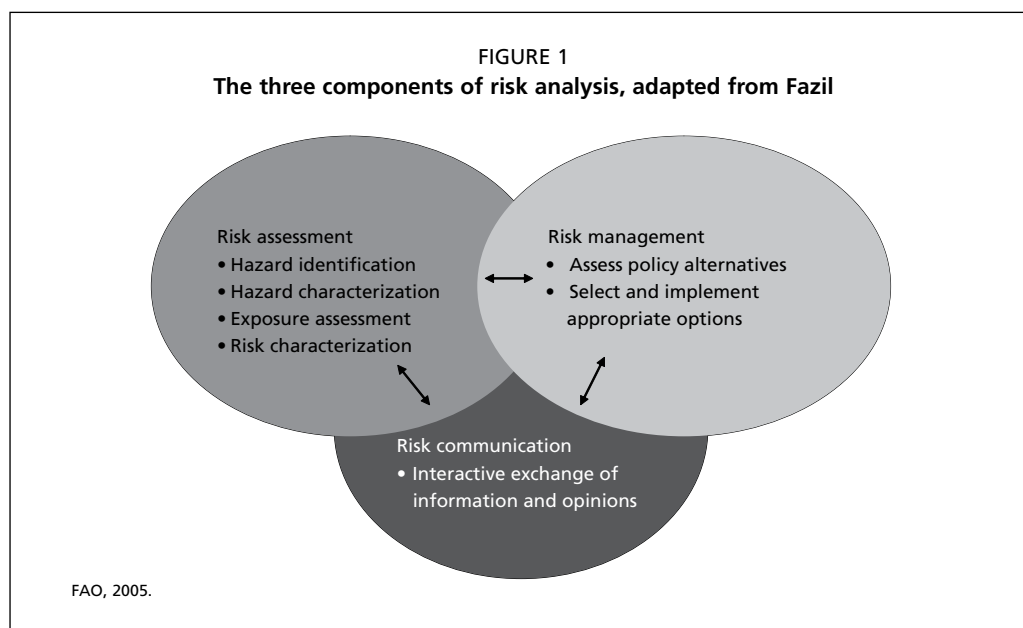
The most important concept to define is “risk”. What is risk? Risk is a *function of the probability of an adverse health effect and the severity of that effect, consequential to a hazard(s) in food* (FAO, 2004). In other words: The likelihood that a hazard will affect us and the severity of its consequences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

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

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 difficult 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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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 financiers, 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 Monterey Bay Aquarium in California¹ 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.

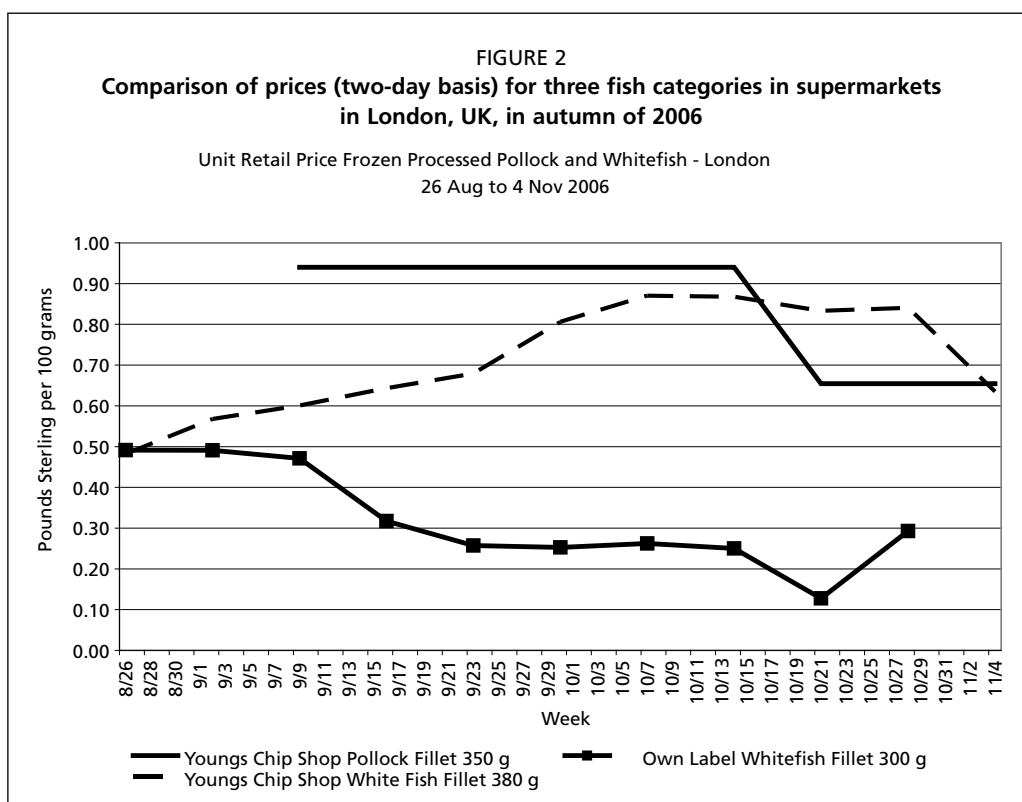
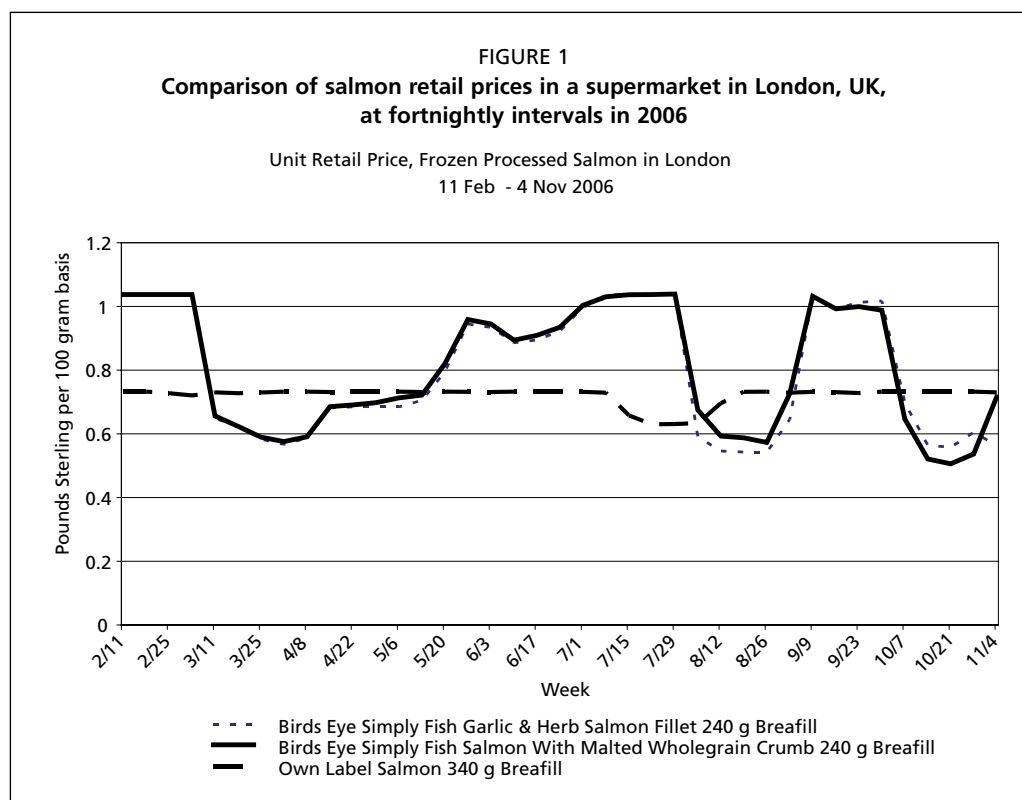
If we look specifically at the MSC, MSC-labelled products are sold in more than 25 countries worldwide (MSC, 2006). Retail sales, in US dollar terms, showed a 76 percent increase between 2004/2005 and 2005/2006, to US\$236 million.

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.

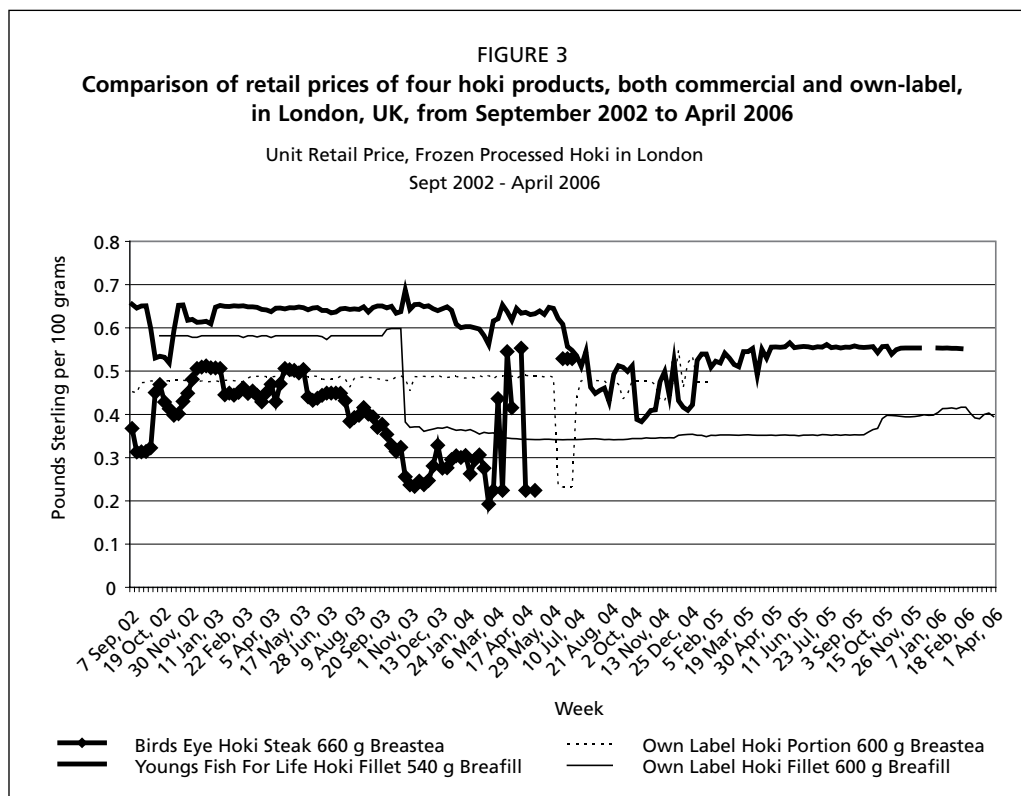
Below (Figure 1) is a graph that shows retail prices for three different frozen processed wild Alaska salmon products, two by Birds Eye and one which is a private label (unknown source, store own-brand) sold in the London, UK, metropolitan area from 11 February to 4 November 2006.

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)



products have higher prices than the own-label (non-MS-C-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



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 alternative 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 routing 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.

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 2
The SensorX bone detection unit

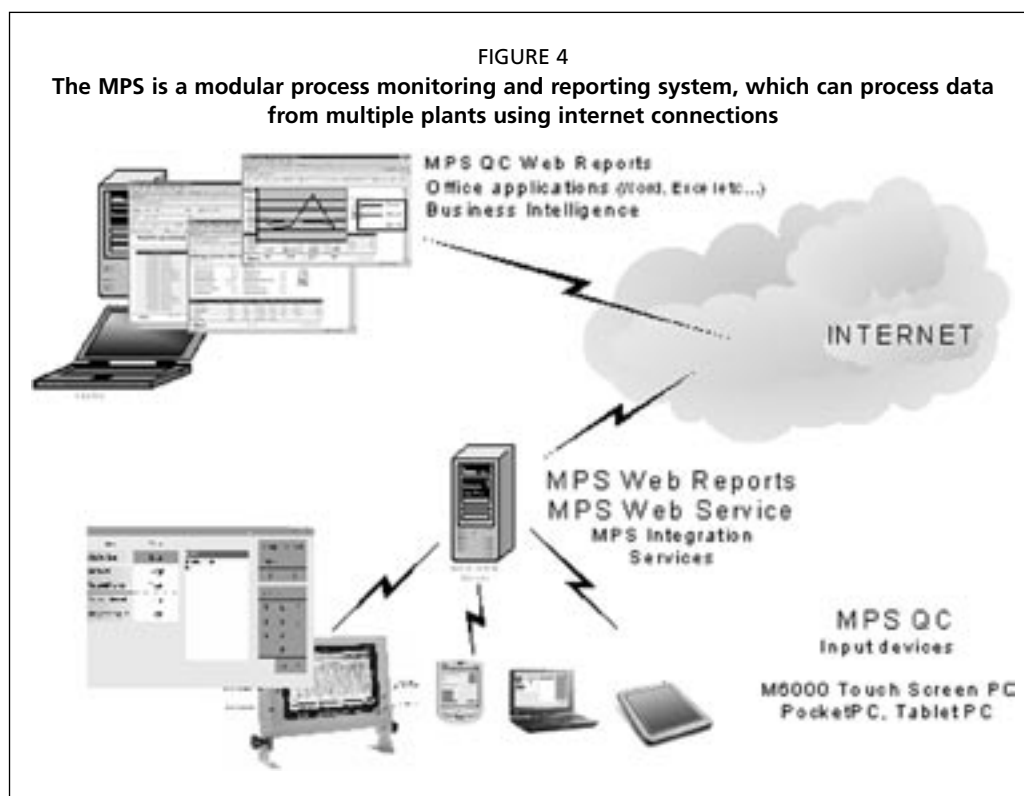


Fillets or continuous streams, such as unfrozen block material, run through the machine in dual lanes.

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.



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 the 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 it 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

Tumi Tómasson and Thór Ásgeirsson

United Nations University Fisheries Training Programme

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.

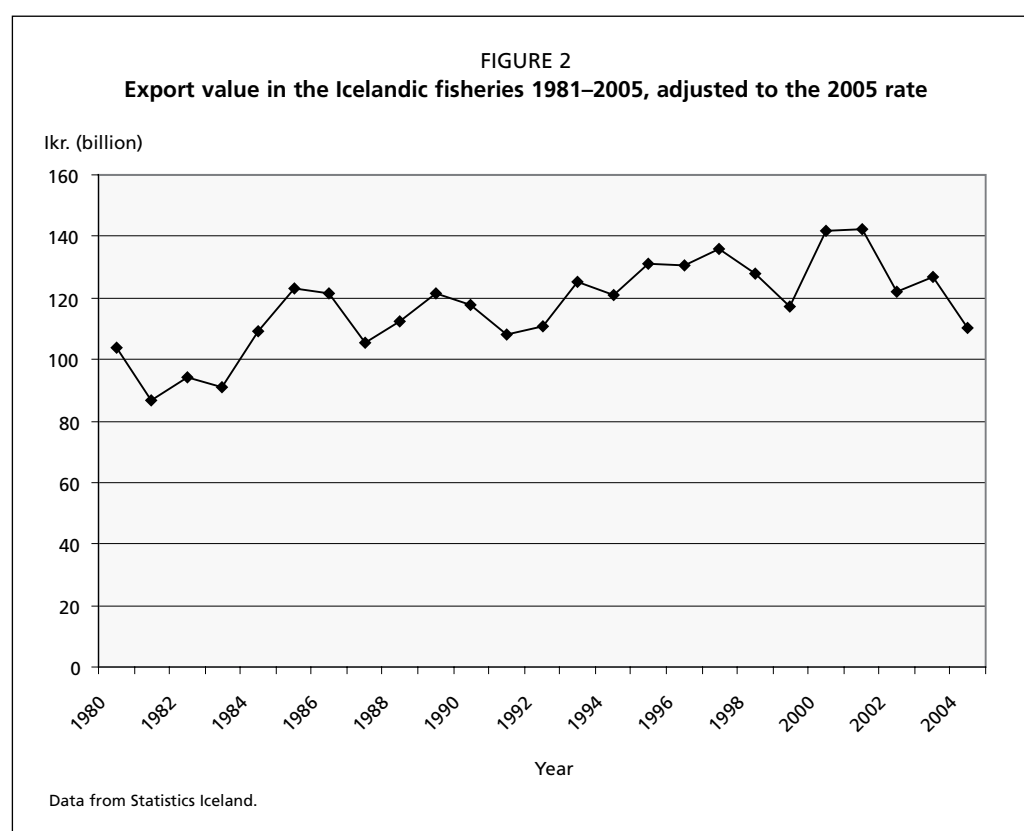
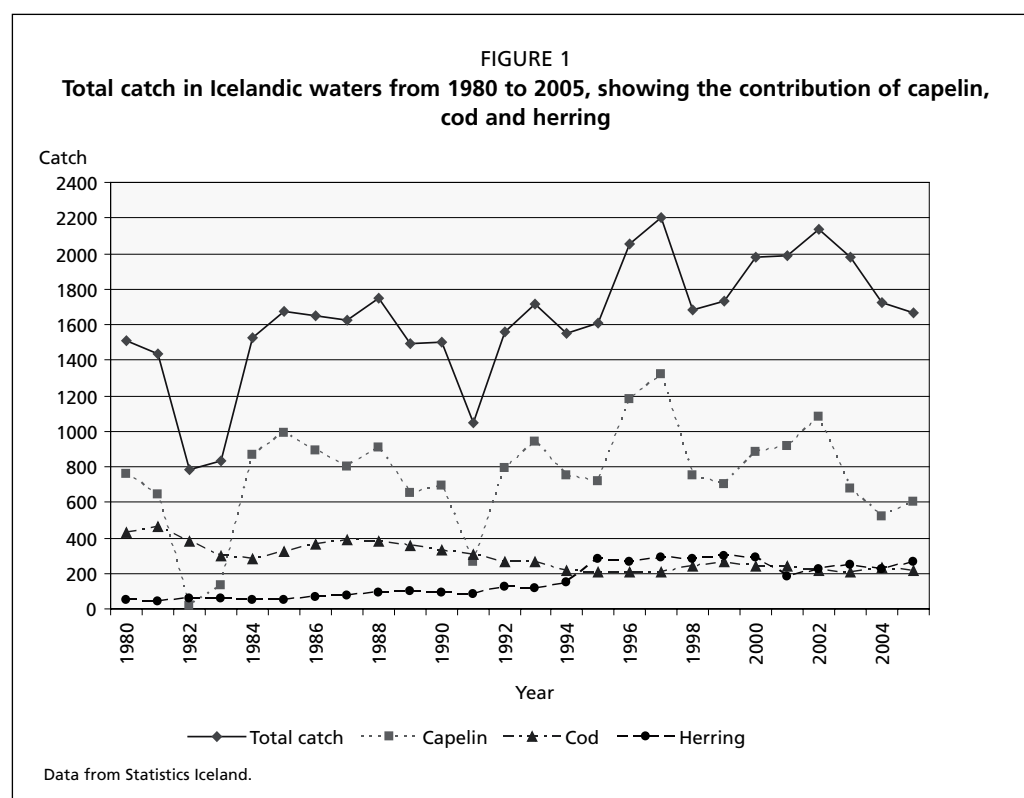
DEVELOPMENTS IN THE ICELANDIC FISHERIES SECTOR SINCE 1980

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.

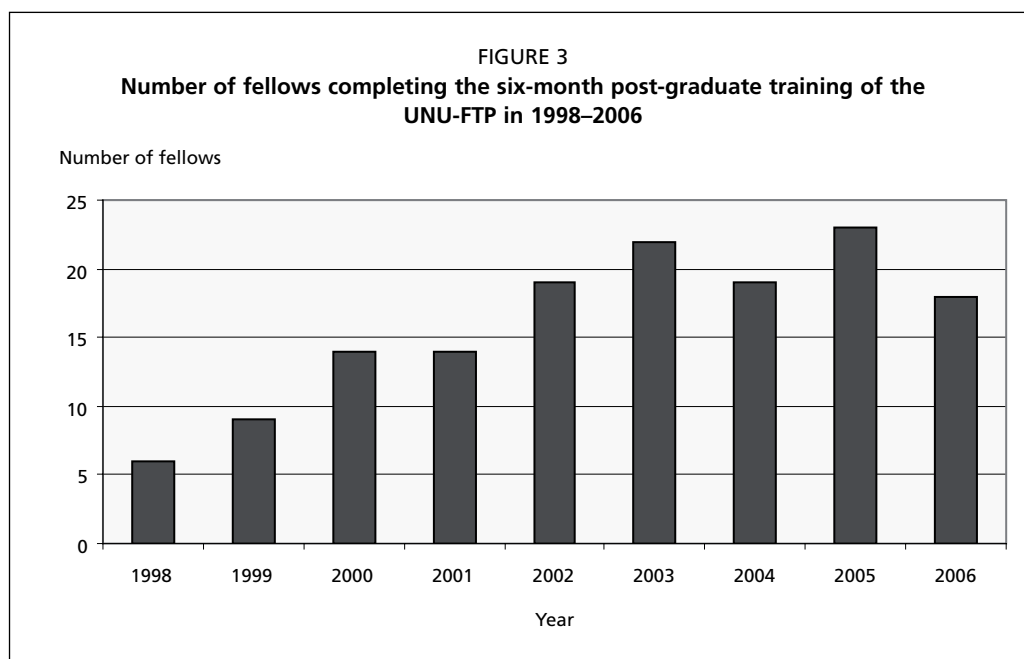
THE UNU FISHERIES TRAINING PROGRAMME

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



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



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

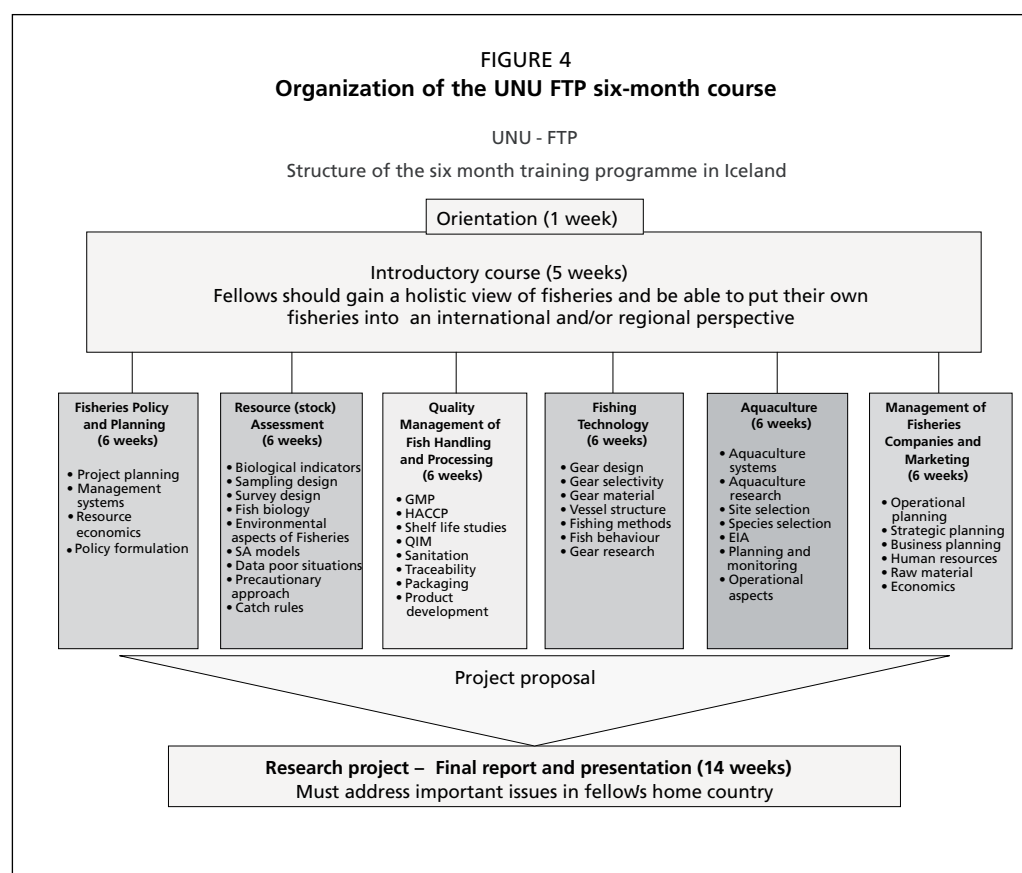
The programme starts in late August or early September with one week of orientation. This is followed by a five-week introductory course, which offers an overview of fisheries. Fellows contribute to the introduction by presenting aspects of their own fisheries, which they have to put into a regional 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						Total
	Quality Management	Policy & Planning	Resource Assessment	Fishing Technology	Company Management	Environmental Studies	
Angola						1	1
Argentina		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



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 Össurarson¹

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

Karen Brunsø

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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 (Brunso, 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 than 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
Filletted 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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International seafood trade: challenges and opportunities

FAO/University of Akureyri Symposium

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These are the proceedings from the Symposium on International Seafood Trade: Challenges and Opportunities, held in Akureyri, Iceland, from 1 to 2 February 2007, organized by the University of Akureyri, Faculty of Business and Science in collaboration with the FAO Fisheries and Aquaculture Department.

The meeting included a range of views regarding the risks and challenges inherent to the recent developments in international seafood trade with views from government officials, business representatives and academia.

The symposium highlighted that the seafood sector is extremely dynamic and is increasingly becoming a global sector. Risks include the pressure of global demand on capture fisheries that are often overexploited, meeting the higher sanitary and phytosanitary requirements being set by the markets and the development of voluntary ecolabels. Opportunities include better management of marine resources, further development of the aquaculture sector, advancement of technology to meet sanitary and phytosanitary requirements and enhancement of the value-added sector in developing countries.

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