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INVESTIGATION ON TRACEABILITY OF FISH PRODUCTS IN ICELAND - A TRACEABILITY STUDY FOR FISH PROCESSING INDUSTRY IN CHINA

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ABSTRACT

From the point of view of marketing frozen fish products on the EU markets, the relevant EU regulations and standards were reviewed in order to get an integrated overview for the enterprises in China who are aiming at exporting fish products to the EU markets. A field study was carried out in an Icelandic fish processing and marketing company, to study the quality management or own check system of the Icelandic fisheries industry with emphasis on the traceability system. Data relevant to the traceability of products in the Icelandic Group were collected and compared with the TraceFish standards. The TraceFish standards are the outcome of an EU funded concerted action project "Traceability of Fish Products". The results show that the standard for captured fish is both practical and realistic for the frozen cod distribution chain in Iceland. It was concluded that the standard is a suitable scheme to ensure an efficient traceability system in a distribution chain of frozen fish products. An exporting company in China was taken as an example to study the status of traceability in the distribution chain of frozen fish products exported in China. The improvements of labelling in some links in a distribution chain in China are recommended based on comparison with the TraceFish standards for traceability. The quality management system in the Icelandic Group was also used as a reference to advise on the improvement of the current situation in China.

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1. INTRODUCTION

Fishing and aquaculture are important economic industries in China. Fisheries in China have entered a rapid growth period since 1985. The average annual growth rate was 13.6%, much higher than the world average, which was 1.5%. The total fisheries production in China was about 25 million tons in 1995 and 28 million tons in 1996 ranked first in the world and accounted for about one fourth of the world's total. To take vigorous measures to promote fish processing and trade is one of the general principles in current fisheries development policies and strategies in China (China Fishery 1999).

There are increasing demands for detailed information on the origins of food products. When problems arise, products must be traced to the cause and all unsafe products recalled or withdrawn.

Traceability of food products is also required for commercial reasons. Such as for production and distribution efficiency, for verifying market claims for a product or its production (including ethical, moral and environmental claims such as organic production and sustainable fishery etc.)

The facilitation of full-chain traceability for food products will aid the consumer in guaranteeing safe and healthy products with well-documented characteristics. Food businesses are increasingly demanding traceability to assure their standards and to protect their businesses.

The EU is now implementing regulations requiring increasingly more traceability for fish products (EU 2002). China is one of the biggest fish product exporters in the world. Fish trade represents a significant source of foreign currency earnings in China. The full-chain traceability of fish products is quite recent in the Chinese fisheries industry. Fisheries industry in China will be confronted with the challenges of new regulation. Traceability will be a major concern for all export orientated seafood companies in China. The ability to provide better and timelier information about fish and products exported can enhance Chinese competitive advantage in the world's fish trade.

Globally the same requirements on traceability are being enforced. In the United States a new legislation on Country of Origin Labelling will take effect on September 30, 2004 (Gutting 2003). According to this regulation, fish product retailers must provide detailed information on raw fish such as country-of–origin, production method, etc.

However, traceability does not ensure good quality or safe food. In other words, traceability includes not only the principal requirement to be able to physically trace products through the distribution chain, but also to be able to provide information on what they are made of and what has happened to them. The further aspects of traceability are important in relation to food safety, quality and labelling according to legislations relating to labelling, animal health and welfare and fish marketing product liability and safety.

To export fish products to the EU market, fishery businesses in China should integrate whole EU regulations related to health and safety requirements and business standards e.g. European Article Numbering (EAN) system. EAN coding system provides a standard way to identify, track and trace products, services, and locations. Tracing is the retrieval of information to reconstruct the history of products. A flow of information has to be systematically associated with the physical flow of goods. Tracking is the retrieval of the actual status of a shipment, a package, etc. It is the capability to follow the path of a specified unit or batch of a trade item downstream through the supply chain as it moves between trading partners. EAN´s role in traceability of fish product is tracking items from the point of origin to the retail point of sale.

Given the complexity and variety of EU regulations and standards, it is necessary to review the related regulations on fishery products to be able to give recommendation or advice to China's fisheries exporting companies.

The overall objectives of this project are:

- To give an overview of EU regulation related to fish products to use as broad background information for China's fisheries enterprises that are aiming at exporting fish products to the EU market.

- A study of the fish quality management system and traceability system in an Icelandic fish processing and marketing company

- To suggest a traceability scheme for a Chinese fish product exporter based on EU regulations and standards.

This project is a preliminary pilot research on traceability in Chinese fisheries industry. The idea of establishing a traceability model for a fish processing company in China meets the requirement of Chinese fish processing industry to adapt to international fish product market according to new regulations and standards. This project could be helpful to put a standardised traceability system into practice in Chinese fisheries industry in future. The final report of this project will also introduce the integrated quality assurance system of Icelandic fishery industry in order to give some recommendation for promoting fish quality management system in fisheries industry in China

2. LITERATURE REVIEW

The EU fish product market is controlled by regulations and standards regarding fish product trade. As a background for the project it is necessary to get an integrated overview of the EU market requirements including quality control of raw material, legislation for fish products, the new requirements for traceability of fish products, and the EAN trade standard.

2.1 Quality of raw material for processing

Food safety and food quality are important issues nowadays. Therefore, it is important to keep the quality of fish, which is of the most vulnerable and perishable food items, at a high level in each link of the whole complex fishery chain. This is necessary to be able to guarantee the consumer a healthy, fresh and high quality end product.

2.1.1 Quality changes

Fish quality, regardless of the species characteristics, in terms of safety and shelf life, is highly influenced by non-visible factors such as autolysis, contamination, and growth of microorganisms. These effects can only be assessed long after the damage has occurred, and the proper procedures must thus be based on knowledge about the effects of the different factors involved. The details of biophysical and biochemical mechanisms will not be dealt with in this paper. A comprehensive review has been summarised by Sikorski *et al*. (1990) and the FAO book on Quality and Quality Changes in Fresh Fish in Huss (1995).

Until fish reaches the consumer, its quality attributes are prone to change because of the post-harvest handling. Sikorski and Sun Pan (1994) concluded that biological variations, harvesting conditions and post-harvest handling were the three major factors affecting the loss of quality in fresh fish.

Effective bleeding on board preserves the desirable colour of white fish flesh. In general, for groundfish it is very desirable to have a fillet that is white. This is achieved by properly bleeding the fish before it dies (Botta and Bonnell 1988). During storage the blood residues in fish fillets may undergo oxidation to brown methemoglobin and may also catalyse lipid oxidation reactions. Bleeding is most effective when the fish come on board alive and are cut properly, e.g. cod by severing the dorsal and ventral aortas (Thrower 1987).

The most dramatic change is onset of rigor mortis. In the case of cod, high temperatures give a fast onset and a very strong rigor mortis. This should be avoided because strong rigor tensions may cause gaping, i.e. weakening of the connective tissue and rupture of the fillet (Huss 1995). Rough handling of fish in rigor increases the incidence of gaping.

2.1.2 Quality monitoring

Quality management can enhance the value of the product along the fish supply chain. The quality of raw fish may affect the quality of the ultimate fish products and must be critically monitored. Quality assurance systems require monitoring of fish freshness as a critical parameter throughout the fishery chain. According to Botta (1994), the freshness quality of any seafood refers to the degree of excellence of that species. The degree of excellence must refer to all sensory variables (appearance, texture, odour and flavour) normally associated with this seafood. Rapid and reliable standardised methods to evaluate fish freshness are needed both in fish processing industry and trade of fish. Methods to evaluate the freshness of fish have been summarised comprehensively by Ólafsdóttir (1997). Development of various rapid techniques to evaluate fish freshness were discussed in terms of volatile compounds, microbial methods and predictive modelling, protein, lipids, ATP, sensory analysis,

and physical measurement by instruments. Currently, no rapid methods have been implemented in the fish industry to detect changes in freshness except for sensory evaluation methods.

It was clear that rapid and reliable standardised methods to evaluate fish freshness are needed both in fish processing industry and in the trade of fish. Sensory analysis gives a holistic and integrated picture of the fish whereas instrumental methods generally measure only one specific compound or set of attributes related to one set of properties (Nielsen 1997). Sensory evaluation is the most important method for freshness and quality assessment in the fish sector.

Eating quality is perhaps the most important component of overall quality, and is greatly influenced by how well the fish is kept, whether in ice or in frozen storage. A characteristic pattern of the deterioration of fish stored in ice has been summarised and divided into four phases by Nielsen (1997) as shown in Table 1.

Table 1: Changes in eating quality during chilled storage (Nielsen 1997).

Chilled storage - days in ice	Changes in eating quality
0 – 2	Very fresh, has a seaweedy and delicate taste. It can be slightly metallic. In cod, haddock, whiting and flounder the sweet taste is maximized after 2-4 days in ice. Pre-rigor texture is soft and pasty, in-rigor tough and dry. Post-rigor firm succulent and elastic.
3 – 7	A loss of the characteristic odour and taste. Flesh becomes neutral but has no off flavours. Texture elastic.
8 –16	Range of volatile, unpleasant smelling substances is produced – e.g. trimethylamine (TMA) has characteristic fishy smell. Others can be slightly sour, cabbage-like, bitter, ammoniac and rancid. Texture both soft and watery or tough and dry.
>16	Spoiled and putrid

In general, both the texture of raw fish and the texture of cooked fish are important and attempts have been made to measure both.

The texture of raw fillets has also been mechanically measured using numerous different methods. Botta (1991) developed a patented method for the rapid, non-destructive texture measurement of Atlantic cod fillets.

European fisheries research institutes have developed schemes for various fish species according to the Quality Index Method (QIM). QIM is a seafood freshness quality grading system developed in Australia by Bremner (1985), which is used to assess fish freshness in a rapid, reliable and systematic way. QIM is a practical rating system, in which the fish is inspected and the index points are recorded (Luten and Martinsdóttir 1997). The QIM can be used in two different ways: 1) the quality index follows a theoretical straight line and thereby makes it possible to predict remaining shelf life in ice; 2) a modified form where it is either very difficult or not necessary to determine the shelf life (Hyldig and Nielsen 1997).

A strategic alliance called QIM Eurofish was established with the aim of promoting the use of the QIM method for quality assessment (Martinsdóttir *et al*. 2001). The mission of QIM Eurofish is to implement the QIM as a versatile tool within any fisheries distribution or production chains in Europe. In the year 2002, QIM Eurofish

issued the QIM scheme for a number of fish species. Table 2 is the QIM scheme for cod (QIM Eurofish 2002).

Table 2: Quality Index Method (QIM) scheme for cod (QIM Eurofish, 2002).

Freshness quality parameters		Description	QIM score
Appearance	Skin	Bright, iridescent pigmentation	0
		Rather dull, becoming discoloured	1
		Dull	2
	Stiffness	In rigor	0
		Firm, elastic	1
		Soft	2
		Very soft	3
Eyes	Cornea	Clear	0
		Opalescent	1
		Milky	2
	Form	Convex	0
		Flat, slightly sunken	1
		Sunken, concave	2
	Colour of pupil	Black	0
		Opaque	1
		Grey	2
Gills	Colour	Bright	0
		Less coloured, becoming discoloured	1
		Discoloured, brown spots	2
		Brown, discoloured	3
	Smell	Fresh. seaweedy, metallic	0
		Neutral, grassy, musty	1
		Yeast, bread, beer, sour milk	2
		Acetic acid, sulphuric, very sour	3
	Mucus	Clear	0
		Milky	1
		Milky, dark, opaque	2
Fillets	Colour	Translucent, bluish	0
		Waxy, milky	1
		Opaque, yellow, brown spots	2
Blood	Colour	Red	0
		Dark red	1
		Brown	2
Quality Index			0-23

QIM is expected to become the leading reference method for the assessment of fresh fish within the European community in the future.

2.2 European Union regulations relevant to fish product

Many fishery enterprises in China are not familiar with the structure of the EU and the details on who is responsible for the EU regulations related to fish products, and what the meanings of the law-terms are. Therefore, it is important to give a brief overview of the legislation, structure and the types of regulation measures in the EU.

2.2.1 Fishery legislation in the EU

Four institutions are responsible for the EU regulations. The *European Commission* is the EU executive body. It has three main tasks: to initiate EU policies, to act as the

guardian of EU treaties, and to supervise implementation of EU law; *Council of Ministers* is responsible for determining EU polices and to vote on legislation; *European Parliament* has the power of vetoing legislation in certain areas such as consumer protection, health, environment, or the single market; *European Court of Justice* rules on disputes involving interpretation and application of the EU treaties and legislation.

Four types of measures issued by EU were explained by Vrignaud (2002):

Regulations: a regulation is a law that is binding and directly applicable in all Member States without implementing any national legislation. Both the Council and the Commission can adopt regulations.

Directives: a directive is a law binding to the Member States as to the result to be achieved, but the choice of method is their own. In practice, national legislation deemed appropriate in each Member State is necessary in most cases. All directives set a date by which Member States have to transpose it into national legislation.

Decisions: a decision is binding entirely to whom it is addressed. No national legislation is required. Both the Council and the Commission can adopt decisions.

Recommendations: a recommendation has no binding effect (it is not a law). Both the Council and the Commission can adopt recommendations.

2.2.2 Quality and safety related regulations

This is a review of key EU legislations governing trade in edible seafood products.

Directive 91/493/EEC is the main text for fish and fishery products (EU 1991). In this directive, the health conditions for the production and placing on the market of fishery products are laid down. It also lays down rules on conditions applicable to factory vessels; on-shore plants, packaging, storage and transport. Provisions that may require more details, are set concerning own-checks, parasites (all visible parasites must be removed), organoleptic, chemical and microbiological checks. 91/493/EEC concerns both domestic (EU) and third countries (non-EU) production. It defines EU standards for handling, processing, storing and transporting fish.

Directive 92/48/EEC lays down the minimum hygiene rules applicable to fishery products caught on board certain vessels in accordance with article 3(1) (a) (i) of directive 91/493/EEC. (EU 1992a)

Commission Decision 94/356/EC was issued to implement an own-check system (HACCP)(EU 1994), it lays down detailed rules for the application of Council Directive 91/493/EEC, as a regards own health checks on fishery products (EU 1994).

Other texts considered as complements to Directive 91/493 and 91/492 are listed in Appendix1.

2.2.3 Food labelling regulations

The two main regulations with respect to labelling are the Council Regulation 2000/104/EC (EU 2000b) and the Council Directive 2000/13/EC (EU 2000a). Three sets of information are compulsory on the label of any fishery products on sales at retailers according to the consumer information in Article 4 of 2000/104/EC:

- the commercial name of the species
- the production method (caught at sea or in inland water or farmed)
- the catch area (especially for the products caught at sea)

FAO codes the general catch area as the Area codes (FAO 1999).

Recognising a need to improve consumer information related to fish, EU issued a compulsory labelling of fish regulation -Commission Regulation 2001/2065/EC. The detailed rules for the application of 2000/104/EC as regards informing consumers about fishery and aquaculture products were laid down in this regulation (EU 2001).

Regulation 2002/178/EC is a milestone in EU food legislation. The European Food Safety Authority (EFSA) was established in terms of Chapter 3 (EU 2002). To transform EU food law principles is the mission of this new EFSA.

The so-called new EU food law system, the General Principles of Food Law, was laid down in this regulation. In the new regulation, food safety matters are covered in the same way at all stages of the food supply chain. The bottom line is that food must be safe. All existing legislation will be reviewed before 2007, and the principles, requirements, and definition in the general food law will gradually take effect. All new Commission proposals will use them and all existing legislation will be reviewed before 2007 to ensure that it is compatible (Consumer Voice Newsletter 2002).

The General Principles of Food Law was considered the main text on food traceability.

2.2.4 Traceability

- **Traceability in law**

There are many regulations on food traceability that impinge on the sector. The lead document is Council Directive 92/59/EEC (EU 1992b), where products and product batches are required to be marked so they can be identified.

ISO 8402:1994 defines traceability as the ability to trace the history, application or location of that which is under consideration, and notes that when considering products this can relate to the origin of materials and parts and the processing history (ISO 1994).

In ISO 9000:2000 replacing ISO 8402:1994, traceability is defined as the ability to trace the history, application or location of that which is under consideration. In terms of products it relates to the origin of materials and parts, the processing history, and the distribution of the product after delivery (ISO 2000).

Denton (2001) summarised the direct and indirect requirements in EU law relating to traceability in the fish industry. The relevant aspects of product liability and safety, fish marketing, fisheries control and food law (food labelling, food safety and animal health and welfare) were included.

The Commission Regulation 2001/2065 concerning information available to consumers about fishery and aquaculture products became effective in 2001 (EU 2001).

Regulation 2002/178/EU, called General Principles of Food Law, lays down the general principles and requirements of food law (EU 2002). It defines traceability in Article 3, specifies traceability requirements in Article 18 and specifies related product recall requirements in Article 19 (Appendix 2).

The information required for traceability includes what the food is and what has happened to it, as well as where it comes from and who was responsible for it. These further aspects of traceability are important in relation to food safety, quality, and labelling.

Traceability concerns only the *ability* to trace things, which means that the necessary information must be available when required. It does not mean that the information must at all times be *visible* by being labelled on the food or being with it.

- **TraceFish project in Europe**

Full supply chain traceability is one of the significant requirements. TraceFish is the short title for the concerted action project "Traceability of Fish Products", co-ordinated by the Norwegian Institute of Fisheries and Aquaculture and running from December 2000 to November 2002. It was funded by the European Commission under the "Quality of Life and Management of Living Resources" thematic programme, project number QLK-2000-00164.

Three workgroups were responsible for developing the TraceFish standards, for captured fish, farmed fish and technical aspects, respectively. Three standards were delivered at the end of the project in October 2002 (TraceFish 2002a, 2002b and 2002c). TraceFish Standard for captured fish specifies what data should be recorded, how and where in the captured fish chain (TraceFish 2002a). It is the basic reference for this project.

The TraceFish Standards are now CWA (CEN Workshop Agreement) documents under the CEN system (CEN 2002a). The CWA document was approved during a CEN Workshop at the final meeting of the TraceFish project in November 2002 and will be published in February 2003. However, it was decided that the last part of the CWA dealing with the specification of information encoding will not be published as part of this CWA for technical reasons (CEN 2002b).

According to the TraceFish standard for captured fish, the key to the operation of traceability of fish product is the labelling of each unit of goods traded, whether of raw materials or final products, with a unique ID. The method of identifying the units

of goods traded is based on the EAN.UCC numbering system that is already in use throughout the world, and will be discussed in section 2.3.

2.2.5 Icelandic regulation structure

In Iceland there are four government sectors involved with the making and implementation of fisheries regulations (Zoega pers.comm.).

First, *the Ministry of Fisheries* is legally responsible for activities in the fish industry. The Ministry sets all main polices and issues all relevant regulations. Second, *the Directorate of Fisheries* is responsible for implementing government policy on fisheries management and handling of seafood products. It is the competent authority responsible for enforcing laws and regulations regarding the handling, processing and distribution of marine products etc. The *Quality Management Department*: is a part of the Directorate of Fisheries. It is responsible for the Directorates function as the Competent Authority (CA) as regards the handling, processing and distribution of marine products. The Department issues Processing Licences to processors, Inspection Manuals, Licences to private inspection bodies and Health Certificates for exported fishery products. Finally, *the Accreditation Department* performs accreditation of inspection bodies.

Sigurlinnason (pers. comm.) explained a Private Inspection Body as a private body that conducts regular inspection of hygiene, equipment and own check systems in fish processing establishments and fishing vessels on behalf of the Competent Authority (CA). An inspection body is operated as a private company and shall operate in accordance with the ÍST EN 45004:1995 standard (ÍST EN 1995).

2.3 European Article Numbering (EAN) system

EAN.UCC is the abbreviation for European Article Numbering Uniform Code Council. It provides a standard way to identify, track and trace products, services, and locations. As the so-called global language of business, EAN.UCC identification numbers identify trade items, logistic units, locations, and assets. They are keys to access computer files. EAN.UCC identification numbers are both unique and international, which is important for traceability of products.

EAN.UCC is a tool to implement a traceability system effectively. The TraceFish Standard is based on the EAN.UCC system that is already in use throughout the world (TraceFish 2002a, 2002b and 2002c).

2.3.1 EAN.UCC numbering system

There are three main elements of the numbering system covered in EAN numbering system, i.e. GTIN, SSCC and GLN (EAN 2002b).

The GTIN is used for the unique identification of *trade items* worldwide. The basic characteristics of a *trade item* are the product type and variety, the brand name, the dimensions of the packaging and its nature and the quantity of product. Each different *trade item* is allocated a different Global Trade Item Number (GTIN). The GTIN stays the same as long as there are no changes to the trade item.

Tracking and tracing of logistic units in the supply chain is a major application of the EAN.UCC system. For this purpose, a standard EAN identification number known as the SSCC is used for the unique identification of *logistic units* (pallets, barrels, crates, containers, etc.). A *logistic unit* is a unit established for transport and/or storage which needs to be managed through the supply chain. *Logistic units* are individually identified with the SSCC. It allows the physical movement of units to be individually tracked and traced by providing a link between the physical movement of items and the association flow (EAN 2002a).

A Global Location Number or GLN is simply a number that identifies any legal functional or physical location within a business or organisational entity. Each location is allocated a unique identification number. GLNs are "keys" to retrieving information from databases.

2.3.2 Bar code and pallet

EAN operates a bar code system with the advantages of being complete, compact, continuous and reliable. The UCC/EAN-128 code is used to represent the SSCC, and any additional data required, in machine readable form. It provides a link between the physical flow of goods (using bar codes) and the electronic information flow using Electronic Data Interchange (EDI).

The purpose of the pallet is to improve storage and product distribution efficiency and to protect the product. The pallet is the base of the unit-load material handling, the fundamental method of transporting, distributing and storing almost all products. There are Europallets and ISO pallets. Many European customers prefer Europallets. Products arriving in another style may need to be offloaded onto EuroPallets for use in European warehouse system (EuroPallet 2002).

2.3.3 EAN traceability of fish guidelines

The Traceability of Fish Guidelines were developed together with the EAN Member Organisation, the TraceFish project, and the national working groups (EAN 2002c). They address EAN.UCC numbering and bar coding for the purpose of traceability. They provide recommendations and guidance needed to understand and implement the EAN.UCC system for the numbering and bar coding of trade units (e.g. cases, boxes) and logistic units (e.g. pallets).

The Fish Traceability Guidelines provide for the unique identification and physical labelling of fish products using Global Trade Item Number (GTIN). Other key standards are Global Location Number (GLN) for identifying the facilities of the companies and Serial Shipping Container Code number (SSCC) in transport. The UCC/EAN-128 standard symbology is used for physical labelling with bar codes.

The Specification of TraceFish Standards fully supports the use of the EAN.UCC system (TraceFish 2002a, 2002b, and 2002c).

The guidelines define the minimum requirements for traceability of fish. These guidelines only apply to fish that has been farmed, caught from the wild and to

products processed from such fish. The adoption of the Traceability of Fish Guidelines is voluntary (EAN 2002c).

3. INVESTIGATION IN ICELANDIC GROUP

The main investigation for this project was carried out in the Icelandic Group, an exporting company in Iceland. The aim was to study the traceability and quality system for frozen product from catching to exporting, and information was collected mainly in the the relevant divisions of the Icelandic Group.

Frozen cod products were taken as examples for the tracking and tracing study in the Icelandic Group. A field study was carried out in Hradfrystihusid-Gunnvor Ltd one of the producers of the Icelandic Group. The company was visited twice to study the quality system and the traceability of products in the links from catch through processing.

3.1 The operation structure for frozen fish products in Icelandic Group

The Icelandic Group operates an international network of production and marketing companies selling seafood products on the international markets with emphasis on frozen fish. Icelandic Services is a subsidiary of the Icelandic Group and serves the Icelandic marketing and production companies in Iceland and overseas. The World Wide Web is used in order for these tasks to run effectively. Suppliers and buyers within the group use the Icelandic Services net ordering system to deal with seafood products and to keep track of the collection and shipment of products. They have a traceability system for frozen fish products based on their own coding system.

The traceability system was the focus of this study and the following divisions e.g. QA (Quality Assurance) Division, Sourcing Division and Logistic Division were visited to collect data relevant to information flow and traceability. As a core division responsible for quality/safety controlling and products labelling, the QA Division provided a lot of information during the visits.

3.1.1 Sourcing Division

The Internet plays a key role in the ordering system to get orders and shipping information between buyers, producers and the Icelandic Services. It is based on HTML and no software is needed by the users to run it. Each user has its own user id and password. All data is stored in the Informix database.

The order is entered by the buyer on the Internet or in the relevant system (Navision), and sent via the Internet to the producer. The response goes back to the buyer whether the producer accepts or rejects. The buyer sends it via the Internet to the Icelandic Services for delivering. The buyer can see up to the minute how the shipping is going and the status of individual orders.

Wise Fish is a Navision software that many producers in Iceland use. It is developed by the company Maritech and sold in Iceland, Norway, East Canada and elsewhere. It enables all information to flow directly between systems, e.g. labels, orders, shipping information, payment information, quality reports etc.

Figure 1 shows the information flow pattern between buyers, each division in the Icelandic Services, producers and shipping companies for the frozen fish products according to the investigation in the Icelandic Services.

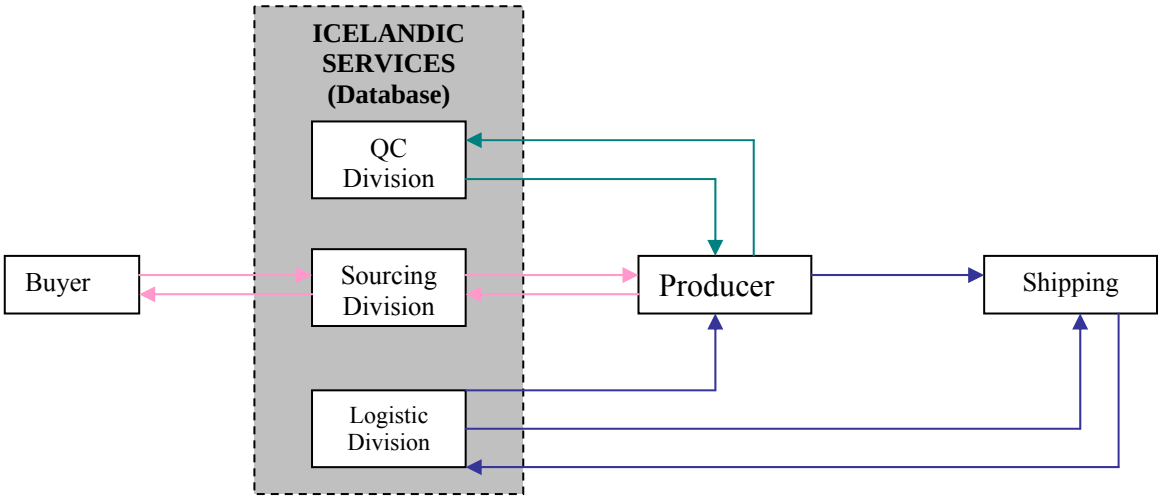

Figure 1: The information flow chart in Icelandic Services
Ordering, Products and production , Delivery and dispatch

3.1.2 QA Division

The QA Division is the key to quality control and information creation and collection in the Icelandic Group. The QA Division issues the Quality Manuals based on EU and Icelandic regulations and standards, and product specifications for all products purchased by the Icelandic Group. The information is distributed electronically to producers over the Internet and contains product descriptions, loading information and packaging specifications. Information on market requirements for packaging labels is also distributed through the QA Division.

In addition, the QA Division has quality inspectors to provide the Icelandic Group marketing companies with services to land-based manufacturers. These services entail regular visits where audits are carried out on production facilities and products, in addition to providing advice on all aspects of production.

3.1.3 Logistic Division

The Logistic Division is responsible for the goods supply chain. They receive orders electronically, and negotiate freight contracts for the Icelandic Group, and organise shipping and oversee it for the marketing companies.

The Logistic Division takes delivery of orders electronically and organises loading and shipment from the producers to destinations (Figure 1). In addition, the division handles all documentation, relations with public authorities, applications for certificates and other required documents, and delivery of such documents to the buyer.

3.2 Quality controlling system in Icelandic Group

Traceability of fish product is required under international legislation relating to quality and safety. However, traceability does not ensure good quality or safe food. Therefore, the quality management system in Icelandic Group was studied to fulfil one of the aims for this project.

The company has its own quality management system, not only complying with related regulation on safety and hygiene but also controlling the quality of their product to ensure the high quality brand. The following data was based on the company's Quality Manual and the field study at the company.

3.2.1 Quality management in Icelandic Group

Icelandic Group issues and implements its own quality standards. Quality management is carried out through a constant supervision of quality at the processing plants of their producers to control that the production meets the quality agreed upon by buyer and seller.

The Quality Manual, issued by the QA division, are distributed to each producer. The quality manual combines codes of practices and quality standards definitions with allowed tolerance limits. Every producer has its own internal quality control. QC inspectors from Icelandic Group visit the processing plants regularly (Figure 2 and 3), to assist producers in maintaining, inspecting and monitoring quality systems, perform product inspection and to check hygiene and monitoring. Their customers audit the producers on a regular basis. The Directorate of Fisheries is a premise for the official production license (EU number).

Figure 2: QC inspector inspecting the product in HG plant (H039).

Figure 3: QC inspector recording result in HG plant (H039)

The role of the Icelandic Group's quality control includes supervision of quality management in fish processing, the verification of the efficiency of this through special examinations, and being of assistance to quality management as required.

3.2.2 Assessment of raw material

Raw material assessment of round fish covers the freshness of fish prior to processing. It is based on a scoring system (Table 3).

Table 3: Scoring system for the assessment of raw material in Icelandic Group (VER 2-1, Quality Manual).

Score		Description
Grade 5	Very good	Colour characteristic of species. No unnatural colouring due to blood, insufficient washing or storage. Flesh is firm and not gaping. Odour very fresh (seaweedy).
Grade 4	Good	Colour normal, except for a slight discoloration on occasional fillets (barely perceptible). Flesh reasonably firm, whole and not gaping. Odour fresh and normal.
Grade 3	Passable	Slight discoloration perceptible. Reddening of flesh (not definite blood colouring) and tiny blood clots in occasional fillets. Flesh is limp and some fillets or parts of fillets clearly gaping. Odour slightly fishy but no unnatural smell of fillets.
Grade 2	Doubtful	Fillets or parts of fillets have lost their natural colour. Grey, yellow or brown colouring visible on some fillets. Reddening or other discoloration due to blood apparent. Raw material obviously old. Flesh is limp or torn and gaping. Fresh seaweedy odour has mostly disappeared and occasional fillets have an unnatural odour (stockfish smell or thawing-up odour).
Grade 1	Unfit	Same as doubtful raw material with respect to appearance and texture. Off odours clearly noticeable (strong stockfish smell, sour or putrid odours).

3.2.3 Icelandic Group standards

The Icelandic Group Standards define production defects that may affect the quality of frozen fish products. A table of permissible deviations for each product category accompanies each definition.

Each perceptible defect is recorded as well as its weighting (small bone, large bone). When the inspection has been completed, the defects are re-checked and calculated whether any of them exceed the reference standards given (average or maximum). The collection is deemed to be in order if there are no such deviations. If any type of defects exceeds the standards, a large sample shall be taken from the collection to ascertain whether the defect is a coincidence or whether the entire collection is faulty.

3.2.4 Coding system

The traceability system in Icelandic Group is based on their own code system.

- **Product code**

Each kind of frozen fish product from the Icelandic Group's producer has a box-label. QA division will send the box-label to producer once the producer receives the order. Figure 4 shows the box-label of Cod Fillet Wraps (PWFW), pasted to the master case.

Figure 4: The example of box-label (Cod Fillet Wraps) in the Icelandic Group.

From the label, product code number 010-550 can be seen. The information on the product is indicated by the product code according to the product code system of the Icelandic Group (Figure 5).

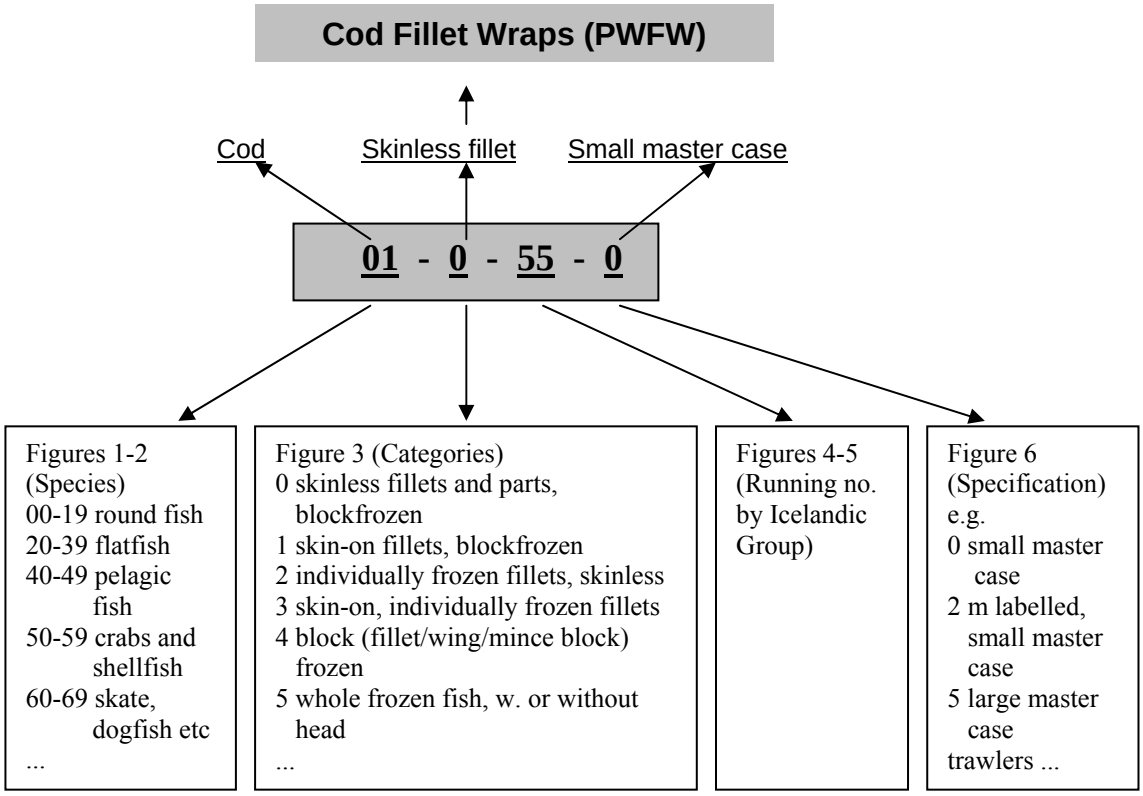

Figure 5: The Product Code System in the Icelandic Group for Cod Fillet Wraps (PWFW).

- **Date Coding System**

The Icelandic Group Date Coding System is a 7-figure number where the first figure indicates the processing year, the second, third and fourth figures indicate the processing date. The fifth, sixth and seventh figures indicate the producer (Figure 6).

Again an example is taken of the product shown in Figure 5, the label of Cod Fillet Wraps, production date is 2337-039. It means this product was made from HG plant (039), and was processed on December 3rd, 2002.

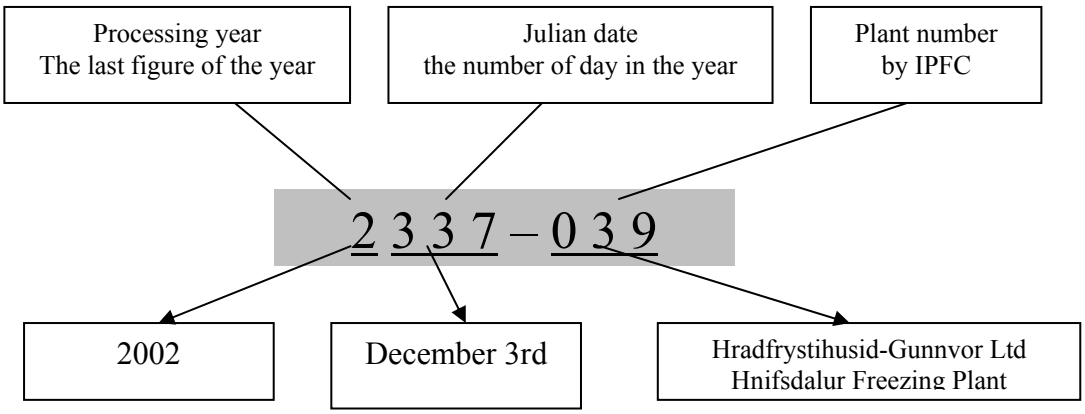

Figure 6: The Icelandic Group Date Coding System.

3.3 Investigation in Hradfrystihusid-Gunnvor Ltd.

A field study on the production, quality management and traceability system was carried out in the company Hradfrystihusid-Gunnvor (HG) focusing on cod products. They have implemented a traceability system for their products and a documentation to verify the quality. HG was visited twice for this project. The basic data about fishing and production of cod products were collected during the visits.

Icelandic Group has around 35-40 land based frozen product producers and they code each producer. HG Company has two plants processing groundfish and prawns with the Icelandic Group code numbers H-039 and H-052, respectively.

The main study was carried out in the plant (H-039). The production of this plant is mainly based on fresh iced raw material, mainly cod and haddock but also to some extent, saithe and catfish. For example, three species and 14 kinds of products were processed on December 4th (Table 4).

Table 4: List of products processed on December 4th, 2002 in the plant (H-039)

Cod		Haddock		Saithe	
Code	Product	Code	Product	Code	Product
010-550	Fillet Wraps	030-400	Frozen fillets (pieces)	104-840	Block
014-395	Mince block	042-010	IQF smoked portions	104-395	Mince
014-845	Fillet block		Mince		
014-830	Pieces block		Block		
013-410	IQF salted fillet				
011-200	Light salted loin s				

The study was focused on cod product. One of the company's own vessels, the trawler Pall Palsson (IS 102) is the main supplier of fresh cod for the plant (H-039).

3.3.1 Cod processing description

Reception of raw material: fish is received bled, gutted, washed properly and iced from fresh fish trawlers or boats and from fish auctions. The temperature in the cooler is kept at 0- 4°C.

Washing: the fish in the plastic tubs is emptied into a hopper with incline steel conveyors with fresh iced water. The fish is washed there before beheading. In the hopper there is a steady overflow of fresh water.

Beheading, filleting and skinning: The fish is beheaded, filleted and skinned mechanically. Figure 7 shows the cod fillets after mechanically beheading and skinning in HG plant. For lightly salted fillets or loins, it will be skin-on.

Trimming and cutting: the fillets come directly from the filleting area on plastic conveyor belts to the trimming lines (Figure 8). Each fillet is checked on a candling table. Defects regarding bones, blood spots and bruises, skin spots, black membranes, parasites, napes and foreign objects are removed according to the quality standards.

Figure 7: Cod fillets skinless ready to be trimmed in the plant (H-039).

Figure 8: Trimming on the candle table in the plant (H-039).

IQF processing line: the fillets and fillet portions are put on an in-feeding conveyor belt and transferred to an IQF freezer. The core temperature of the frozen fillets must reach –24°C before they are glazed by water spraying, after which the fillets or portions are graded by size.

Weighting and packing: The fillets are weighed in plastic trays according to specifications. The fillets are shatter packed into cartons or packed into plastic envelopes and then packed into cartons. Figure 9 shows Cod Fillet Wraps being packed into plastic envelopes in HG plant. Fillets blocks and piece blocks and minced blocks are packed directly into 16.5 lbs block cartons. The inner cartons are labelled according to specifications. The finished packed products are placed into freezing pans or block frames. The freezing pans are placed into racks. The IQF fillets are weighed in plastic bags into master cases.

Plate freezers and depanning: the freezing pans are taken from the racks and into the plate freezers. Freezing time is usually 2 1/2 - 3 hours or until the core temperature has reached at least –24°C. After freezing the cartons are depanned.

Casing, labelling and palletising: the cartons are packed in cases, taped or closed with plastic straps and labelled according to specifications. Cases are stacked on pallets and strapped with plastic and labelled (Figure 10). IQF products other than retail packs are already in master cases and therefore only labelled and palletised at this stage.

Figure 9: Envelope packaging of cod fillet wraps in the plant (H-039).

Figure 10: Pallets of PWFW in the plant (H-039).

For instance, the master cases for Cod Fillet Wraps (PWFW, 010-550 were closed with at least two straps. Master labelling was placed on both long sides properly. The stacking of cases on pallets was in accordance with rules set by the Icelandic Group.

Frozen storage: Palletised product is placed immediately into frozen storage at a minimum temperature of –24°C.

Shipping: palletised product is taken directly from frozen storage to freezer containers at –24°C.

3.3.2 Cod products and production

During the visit in this plant, a study was done to have an overview of cod processing. Figure 13 shows a flow chart of the chain for cod processing and three product categories, i.e. fresh cod products, frozen cod products and by-products or waste of cod.

- **Fresh products**

Fresh cod products usually called ‘fly fish’ in the plant because that kind of product is air freighted to foreign markets, such as N-Europe and UK. Two fresh cod products were produced in the HG plant during the visit. Fresh skinless loins were made from the company’s own vessel Pall Palsson IS 102 (Figure 11). Gutted and bled fresh farmed cod bought from fish farmer was beheaded, washed and chilled, packaged and then exported by air (Figure 12). Fresh cod products in HG plant are not provided to the buyers of the Icelandic Group.

Figure 11: Fresh skinless cod loin in the plant ready to be air freighted.

Figure 12: Fresh beheaded gutted cod in the plant ready to be air freighted.

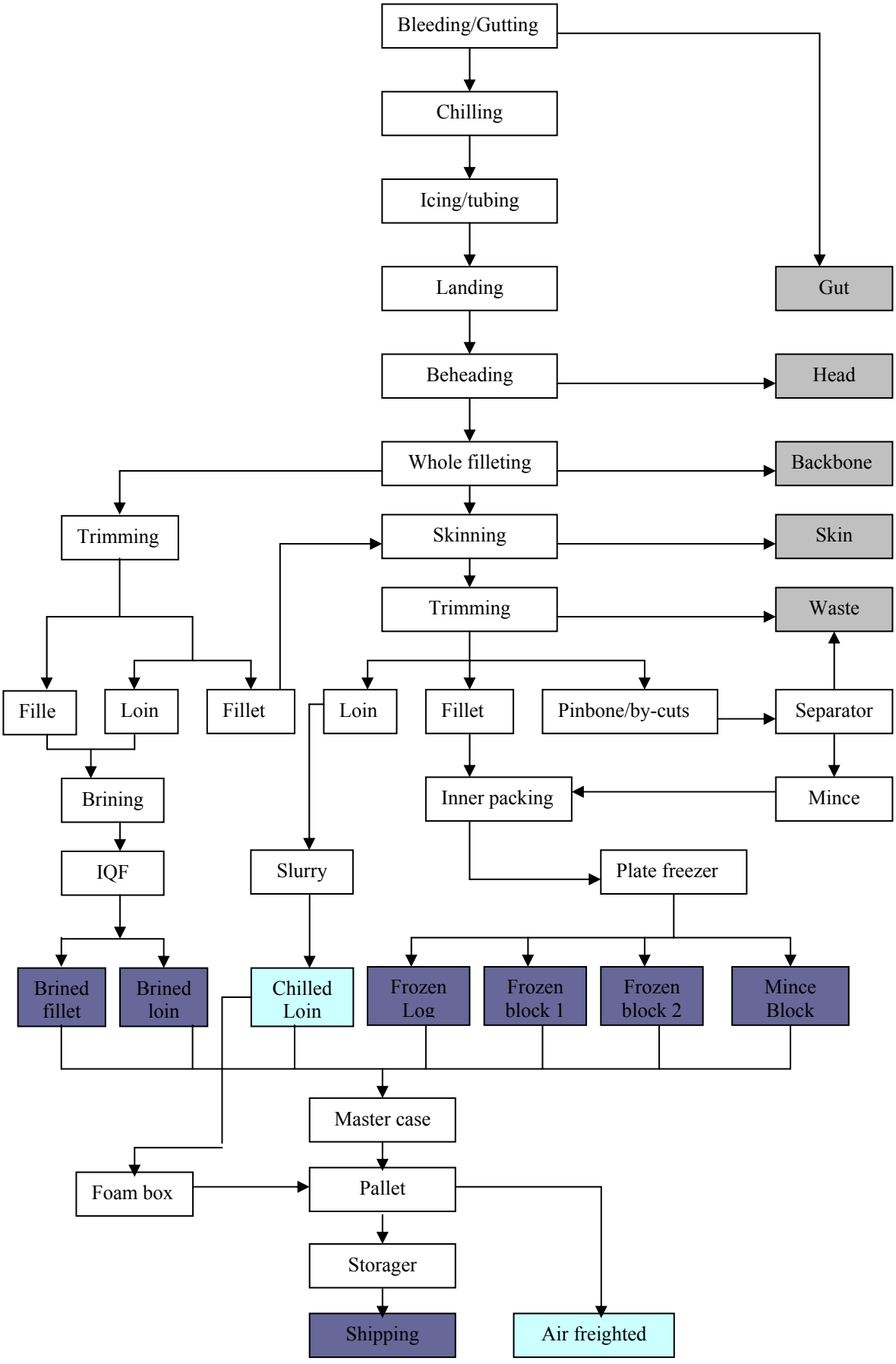

Figure 13: Flow chart of cod processing

Frozen | Fresh | By-product/waste

- **Frozen products**

Frozen product is the main product group in the cod processing industry. At least three kinds of products were processed during the visit. Usually fillets over grade 4 are used for PWFW, grade 3 is used for fillet or pieces block. Pinbones, by-cuts and belly flap are collected and transported to the separator machine. The mince collected was block frozen.

Each product is processed according to the specification of the QA Division. For example, for the product PWFW, the product code is 010-550, and the specifications give the requirement that minimum grade of raw material is 4. Texture 3 is no longer permitted. After trimming, the fillets should be skinless and boneless, and parasites will be removed by candling. The fillets are wrapped in an envelope and packed onto a pallet in unlabelled blue plastic envelopes.

- **Lightly salted frozen products**

Lightly salted products have skin on. Two products were processed during the visit, salted fillets (with pinbones) and salted loins. Raw material used should be grade 4. It is important that temperature is kept low during production including brining. The salt content shall be 1.7-2.3%, of net weight, measured without glaze. The salt content shall be ranging from 1.7- 2.3%, (weight percentage). Figure14 shows the trimmed cod fillets brined in a tank. Figure 15 shows the loins ready for salting.

Figure 14: Cod fillets were brined in tank in the plant (H-039)

Figure 15: Cod loins ready to be put into tank with brine (H-039).

- **Waste and by-products**

After bleeding and gutting, the fish viscera are thrown into the sea to go into a new lifecycle. This is the first waste on the fishing vessel. The main by-products are heads and backbones, which are sold to another company to process dried products. Dried heads and backbones have a huge market in Nigeria.

Figure 16 shows the heads from the farmed fish in the plant. The information about dried cod by products were collected when visiting Laugafiskur Ltd. in Akureyri in September 2002 (Figure 17). The skin is block frozen and exported to make gelatine. And the waste from separator is transported to the fishmeal plant to process fishmeal.

Figure 16: Farmed cod heads in the plant (H-039).

Figure 17: Backbones are ready to go into the drier at Laugafiskur Ltd.

3.3.3 Quality control

- **Vessel**

Usually each fishing trip takes one week, and it will take another week to process. The oldest catch is landed first and processed as soon as possible. So the average age of the raw material is 6-7 days. The quality of grade 4 according to the Icelandic Group Standard (3.2.2) is the most common quality score since the raw material is always of the same age.

The temperature of sea water is 2-6°C during cod fishing, so the caught fish is around 5°C. Each haul of fish is bled and gutted alive then chilled in the tank with temperature of –2°C immediately for 20 minutes. The tank is injected with ice-slurry made from seawater. The fish is chilled down from 5°C to 0°C. The chilled fish is separately in tubs by the size category after grading. It's essential to ensure that an ice layer, made from fresh water, separates each layer of fish. The bottom of each tub is put into ice before loading fish.

- **Landing and reception**

There is no quality assessment for the raw material in HG plant; the company arranges each fishing trip according to their processing plan. The plant usually can make sure the homogenous quality in their products because of the handling and the overall operation is very well controlled.

- **Raw material storage**

As mentioned earlier, each fishing trip's raw material is 1-7 days old, the oldest catch being processed first. The raw material is iced and stored in chilling room until it is processed. The temperature in the cooler is kept at 0-4°C.

- **Beheading and grading**

The raw material is beheaded before going into the processing line. Each size category is kept separate after beheading in a tank with flake ice water with 1.5% salt (Figure 18) to ensure the temperature of the fish before being processed.

- **Inspection**

Temperature controlling is always the key factor to control fish product quality. Temperature and time have a high influence on fish flesh gaping. Samples are taken at the end of processing line, and the temperature is tested to make sure that the temperature has been well controlled during the processing (Figure 19).

Figure 18: The flake ice water was filled into the tank for the beheaded fish (H-039).

Figure 19: Temperature testing for a product sampled at the end of the processing line (H-039).

The inspector samples and inspects the products according to the plant's quality rules (Figure 20). The parameters to be tested are shown in Table 3-3 and the results are put into the computer immediately (Figure 3-21). The information is kept in the database and can be traced back at any time. Table 5 shows other parameters tested in the plant for the frozen product with code no. 010-550.

Figure 20: The plant's inspector testing the products (H-039).

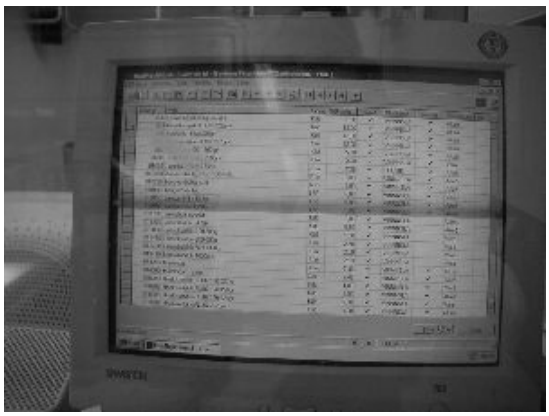

Figure 21: The electronic record of the inspections (H-039).

- **Cold storage and transportation**

When the product has been stacked on pallets, it is moved to a cold storage as soon as possible. The temperature in a cold storage shall be -25°C or lower. Care should be taken to keep the time that the product is exposed to warmer air to a minimum. For long distance transporting on land, trucks equipped for transporting frozen commodities should be used. When a product is loaded into containers, care must be taken that the stack does not extend above the red load line of the container.

Table 5: An example of a report of daily inspection on the product of cod in HG plant (H-039) with production code 010-550 on November 18th, 2002

Parameter	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6
Date	18.11.02	18.11.02	18.11.02	18.11.02	18.11.02	18.11.02
Time	7:25:26	8:12:31	9:41:55	10:43:30	12:47:43	13:52:28
Temp °C	7,4	5,8	4,8	5,0	5,0	7,2
Gross W	1742	1728	1746	1724	1830	1742
Net W	1728	1716	1732	1708	1818	1728
Large bone	0	0	0	0	0	0
Small bone	0	1	0	0	0	2
Large parasite	0	1	0	2*	2*	0
Small parasite	0	1	2*	3*	1	1
Total pieces	4	6	7	6	4	5
Loins	4	0	0	0	4	5
Triming	0	0	0	0	0	0
Texture 5	0	0	0	0	0	0
Texture 4	1728	1716	1732	1708	1818	1728
Texture 3	0	0	0	0	0	0
Texture 2	0	0	0	0	0	0
Pieces 100gr	0	0	0	0	0	0
color	4	4	4	4	4	4
odor	4	4	4	4	4	4
Blood bruises	0	0	0	0	0	0
Blood spots	0	0	0	0	0	0
Skin and membrance	0	0	0	0	0	0
Foreign material	0	0	0	0	0	0

3.4 Links and units for traceability of frozen cod product

A traceability system for frozen fish product has been implemented in the distribution chain in the Icelandic Group. The system is based on their own coding system in each link from fishing to export.

The main resources of raw material are from the company's own vessel. But a small amount of raw material is bought from small fishing boats or from the local fish auction market. Here, an example is taken of the company's own fishing vessel and it is explained how and what data can be carried and transported by the labelling of each unit. Raw material from other small boats and local fish auction can also be traced back to obtain the fishing date, fishing area and catching time. Details will not be given on these two cases. The main links, identifiers (IDs) or labelling of each unit and data carried by IDs are discussed and summarized in the following sections.

3.4.1 Fishing

In the beginning of the whole chain, catching is a key link for traceability of the origin of products. After bleeding, gutting, chilling and size grading, the fish was ice-chilled in each tub with fixed number on it. The first unit was created, and the detailed information such as haul number, fishing date and fishing area will follow with each tub (Table 6), so the fixed number of each tub (Figure 22) is the key to tracing back to the fishing date/area, even the exact fishing time.

An example of catching trip on November 18th, 2002 was given to show how the data and IDs in this link are controlled for traceability. *Tub no*. carries the detailed information listed in Table 6. This batch of raw material has a total of 224 tubs, originating from 6 catching days from November 13th to November 18th. The information will be carried by a *batch no*.

Table 6: Fishing report of the raw material received on November 18th

Fishing vessel: Pall Palsson IS 102 Species: Cod Total 224 tubs

Tub	Size	Weight	Haul	Quantity	Smallest	Distribution	Biggest	Date	Time	Area
6	2	401	17	240	1,020.00		2,200.00	15.11.02	19:06:00	674
8	2	401	1	258	1,020.00		2,200.00	13.11.02	07:49:00	674
9	2	401	25	264	1,010.00		2,190.00	17.11.02	02:20:00	674
18	1	236	31	259	690		1,000.00	18.11.02	00:27:00	674
46	3	402	25	147	2,210.00		4,650.00	17.11.02	02:34:00	674
49	2	401	13	286	1,010.00		2,200.00	15.11.02	02:25:00	674
60	2	401	5	242	1,020.00		2,200.00	13.11.02	22:12:00	674
79	2	400	27	263	1,010.00		2,200.00	17.11.02	11:48:00	674
85	3	405	16	139	2,210.00		4,660.00	15.11.02	14:52:00	674
98	3	401	27	145	2,210.00		5,010.00	17.11.02	12:14:00	674
104	2	401	21	256	1,010.00		2,200.00	16.11.02	14:24:00	674
114	3	402	26	149	2,210.00		4,600.00	17.11.02	08:11:00	674
115	3	401	22	150	2,210.00		4,490.00	16.11.02	16:38:00	674
139	1	359	2	392	100		1,000.00	13.11.02	12:16:00	674
157	2	400	2	269	1,020.00		2,200.00	13.11.02	12:03:00	674
168	2	401	18	280	1,010.00		2,200.00	16.11.02	00:08:00	674
180	3	402	26	152	2,210.00		3,940.00	17.11.02	07:16:00	674
182	2	401	11	238	1,010.00		2,200.00	14.11.02	19:02:00	674
183	2	400	30	279	1,010.00		2,200.00	17.11.02	23:32:00	674
...	...	...	...	...	...	...	...	...	...	...

3.4.2 Landing and reception

The *batch no*. of raw material is created in the processing plant when the raw material is received. Each batch of raw material may be processed in several days; the products can be traced back to the raw material used by this *batch no*. So, the batch no. is the key to link products to raw material.

The plant has the detailed record of raw material used every day. For example, six batches of raw material were used on November 25th, 2002. There were two species, cod and haddock. Raw material came from three resources, from the company's own vessel (UH-02884, UH-02897), small fishing boats (UH-02883, UH-02887), and local fish market (UH-02894, UH-02903), respectively (as shown in Table 7).

Table 7: An example of the raw material labelling used on November 25th in the plant (H-039)

Batch No	Date	Species	Resource	Landed
UH-02883	25.11.2002	Haddock	Jón Emil ÍS-19,	14.11.2002
UH-02884	25.11.2002	Cod	Pall Palsson IS-102	18.11.2002
UH-02887	25.11.2002	Cod	Jón Emil ÍS-19	16.11.2002
UH-02894	25.11.2002	Haddock	Íslandsmarkaður	21.11.2002
UH-02897	25.11.2002	Cod	Pall Palsson IS-102	25.11.2002
UH-02903	25.11.2002	Cod	Sjókví HG	21.11.2002

The data about the raw material carried by labelling is summarised in Table 8.

Table 8: The units and labelling information in the first link (H-039)

Unit	ID	Data
Tub	Tub no.	Fishing vessel name and ID Species Total number of tubs Each tub's no.
Batch	Batch no.	Fishing area, date, time, haul no. Size, grade, quantity, smallest, biggest and size distribution (Table 7)

Figure 22: Fixed no. on the tub with ice-chilled raw material in the plant (H-039).

Figure 23: Four size grading after beheading in the plant (H-039).

The ice-chilled fish in tubs were transported into the chilling storage after being received in the plant. The information about the raw material provided by the vessel can be accessed through the internet. All the detailed information about the raw material is carried with the batch no.

3.4.3 Processing

As discussed above, different batches of raw material come from different vessels and it usually takes more than one processing day to process all tubs from each batch of raw material. In other words, several batches of raw material may be processed to produce different products in one day in the plant. For instance, six batches with two species raw material were processed on November 25th, 2002.

The question is if it is possible to trace back from each kind of product to each original batch of raw material, and if different batches are mixed during the processing line?

Firstly, the raw material is beheaded and graded mechanically. Four size-grades of beheaded fish are put into 4 tanks according to the size (Figure 23). Each *Tank* has a *fixed no.* as well as an *electronic no.* So, a new unit is created after beheading/grading in the processing plant. The new ID is a fixed no. on each tank. The electronic card on each tank makes automatic data recording of the ID of the tank possible.

Figure 24 shows a fixed tank no. 97 53 and a patch of electronic card. The fixed tank no. has a link with tub no. in the recording system. Figure 25 shows the installation of

the electronic reading device. The tanks which store the beheaded and graded fish ready to be processed are new units, and the fixed no. of each tank carries the message, which can be traced back from final product to tub no. of raw material. The connections between processing line (products) and the tank no. are recorded when beheaded and graded fish are put onto a processing line.

Figure 24: Fixed no. and electronic card on the tank with beheaded fish (H-039).

Figure 25:Installation of the electronic reading device (H-039).

The plant has a daily report on the traceability, which includes the information on the links of batch no., tub no. and tank no. of raw material processed. The information carried between links by *Batch no.* with *Tub no*. and *Tank no.* to final products (Table 9). *Tank* and *Tank no.* are the *Unit* and its ID in this link, respectively.

Table 9: The pattern of the connection between *Batch no*. to *Tank no*. (H-039)

IDs	Data
Tank no.	Each *Tub no.* (*Batch no.* can be traced back) Total number of tubs Processing date and time Processing line (*Product code*)

Beheading and grading are the critical *links* in the plant, the good labelling and recording system make it possible to trace finished products back to its *Batch no*. with the more detailed information of *Tub no*. From *Tub no*. it is easy to get the catching date, catching area, etc. of the raw material for appointed products.

3.4.4 Packaging and labelling

For each individual package, inner carton or master case the information are indicated on the tag. From the master case label (Cod Fillet Wraps) in the Icelandic Group (Figure 7), the information listed in Table 10 can be obtained. In this case, *Master case* is a new *unit* to link the product to buyer. The *ID* of this unit, *Box label* on the master case label carries detailed information linked to raw material.

Table 10: Information carried by master case label from Cod Fillet Warps in H-039

Product	Description	COD FILLETS, 16 UNITS, SKINLESS, BONELESS 16 x 3,75 lbs, TOTAL 60 lbs (27, 22kg)
	Product code	010-550
	Production date	2322
Producer	Icelandic Group no.	039
	EU license no.	IS-01403
Exporter	Name	ICELANDIC FREEZING PLANTS CORP. plc
	Address	REYKJAVIK, ICELAND
Buyer	Name	COLDWATER Seafood Corp
	Address	904 Woods Road Cambridge MD 21613 USA
	Code (IFPC)	5315
With EAN bar code		

3.4.5 Palleting

When a pallet has been stacked with cases containing one product type, the product is encased in plastic (Figure 3-26), strapped and a pallet-number label pasted on the pallet.

Each *Pallet* is a new *unit* for the product storing and transporting, and has its ID (*Pallet no.*) indicated by the pallet label (Figure 27). Detailed information is shown in Table 11. This is a key link for further storage and shipping.

Figure 26: Pallets of cod fillet wraps in the plant (H-039).

Figure 27: An example of a pallet label for cod fillet wraps in the plant (H-039).

Table 11: Information carried by pallet label from Cod Fillet Warps in H-039 plant

Product	Specification	16 x 3,75 lbs
	Product code	010550
	Production date	18.11.02
Producer	IFPC´s no	039
	EU license no.	IS - 01403
	Name	HG hf - Fiskvinnsla
Pallet	Total cases	040
	Pallet no.	021125
EAN bar code		

3.4.6 Loading and Shipping

After being loaded into container, product will have a new *unit* as *Container* for shipping freight. Each container has its own fix no. *Seal no*. for this batch of products. as the new ID, *Seal no*. is the link to the former *unit*. The unit in shipping freight *Dispatch* has its own ID as *Dispatch no*. and Table 12 shows the information report about loading and shipping from the company's database. Table 13 is the traceability interpretation of Table 12. A clue for traceability of products exported abroad is very clear.

Table 12: Record of shipment for the Dispatch SKO 0248 in the Icelandic Group

Order no.	T0207767	Date of loading	21.11.02
Seal no.	678285	Dispatch no.	SKO 0248
ID no. container	EIMU 466 132-6	Date of dispatch	29.11.02
Stacking company	Hús/Mótt	Ship	SKO Skógafoss
Shipping company	EIM Eimskip	Harbour of destination	USEVE Everett

Products code	Description	Producer	Cases	Weight	Pallet no.
034395	Wing/bone	039	1	1.280,00	020982
034395	Wing/bone	039	1	1.280,00	021037
010550	16x3,75 lb log	039	40	1.200,00	021099
010550	16x3,75 lb log	039	40	1.200,00	021106
010550	16x3,75 lb log	039	40	1.200,00	021107
010550	16x3,75 lb log	039	40	1.200,00	021114
010550	16x3,75 lb log	039	40	1.200,00	021124
010550	16x3,75 lb log	039	40	1.200,00	021125
010550	16x3,75 lb log	039	40	1.200,00	021126
010550	16x3,75 lb log	039	40	1.200,00	021127
010550	16x3,75 lb log	039	40	1.200,00	021128
010550	16x3,75 lb log	039	40	1.200,00	021130
010550	16x3,75 lb log	039	40	1.200,00	021131
010550	16x3,75 lb log	039	40	1.200,00	021134
010550	16x3,75 lb log	039	40	1.200,00	021135
010550	16x3,75 lb log	039	40	1.200,00	021136
907390	Shark	039	1	4,40	021143
010550	16x3,75 lb log	039	40	1.200,00	022895
034395	Wing/bone	039	1	1.280,00	208370

Table 13: Units and IDs in loading and shipping in the Icelandic Group

Unit	ID	Data
Container	*Seal no. and fixed no. of container*	Pallet no Container ID (fix no.) Stacking company Loading date Products code Description Producer Number of cases Weight
Dispatch	*Dispatch no.*	Seal no. Order no. Shipping company Ship name and ID Destination (harbour)

3.5 Results and discussion

The TraceFish standard is compared with the current traceability system in the Icelandic Group to verify the rationality of TraceFish standard. The critical link for traceability in frozen fish product distribution chain is discussed. Some operating practices in the traceability system in the Icelandic Group are summarized and it is suggested to improve the labelling of the traceable units by using the EAN coding system to ensure a global traceability system.

3.5.1 The TraceFish standard for captured fish compared to the Icelandic Group traceability system

The fish chain from catch to retailer was divided into six sectors in TraceFish captured fish standard (TraceFish 2002a). They are fishing vessels, landing and auction market, processor, transporter and storer, trader and wholesaler, retailer and caterer respectively (Table 14). For fish product with non-fish ingredients, the last part in this standard was interdicted for traceability of this product (COT).

A field study for this project was carried out in Iceland and data was collected from China in fish product exporting companies, which export frozen groundfish products. As a fish product exporting company, the Icelandic Group has mainly three sectors related to three of the six sectors in the TraceFish Standard for Captured Fish. The related sectors in this fish product chain referring to the Captured fish Standard (TraceFish 2002a) are Fishing Vessel (CFV), Processor (CPR), and Transport and Shipping (CTS), respectively. There are some overlapping data elements required in the standard in this distribution chain. For example, the producer HG Company has its own fishing vessel, so the supplier of raw material is the same as processor.

Table 14, 15 and 16 compare the TraceFish standard for captured fish with the information available for frozen cod products in the Icelandic Group related to the traceability of the products. The description of each data element in the standard can be found in Appendix 2 (TraceFish standard for captured fish).

Information itemised in the TraceFish standard are divided into three categories, i.e. the basic information necessary to identify and physically trace the products, that *shall* be recorded; Specific information that is required by law in relation to food safety, quality and labelling, together with important items of commercial needs, that *should* be recorded; and further specific and commercial information that *may* be recorded.

Table 14: Detailed information requirements for fishing vessels (according to TraceFish 2002a)

Data element		Available	Data in the Icelandic Group	Categorisation		
				Shall	Should	May
VESSEL						
CFV01	Food business ID	√	Hnifsdalur Freezing Plant (H039) IS-01403	x		
CFV02	Vessel ID	√	Jón Emil ÍS-102	x		
CFV03	GMP certification		No information given			x

FOR EACH TRADE UNIT CREATED						
Identity						
CFV04	Trade unit ID	√	Tub no. (by each tub), each fishing trip has hundreds of tubs (Table 6)	x		
Description						
CFV05	Type of unit	√	Tub	x		
CFV06	Net weight	√	Record by each tub (Table 6)	x		
CFV07	Species	√	Gadus morrhua or COD	x		
CFV08	Catch area	√	Record as 674 (Table 6)	x		
CFV09	Product form	√	Gutted	x		
CFV10	Size grade	√	4-score grading (Table 6)		x	
CFV11	Product condition	√	Ice-chilled	x		
Production history						
CFV12	Date of capture or sailing	√	Capture date and ice-chilling storage time. (Table 6)	x		
CFV13	Fishing method	√	Trawl		x	
CFV14	Trawl or soak time	√	Record of hauls no. (Table 6)			x
CFV15	Ethical aspects of fishery		No information given			x
CFV16	Size grading method	√	Mechanically on vessel			x
CFV17	Weighing method	√	Mechanically on vessel			x
CFV18	Stowage method	√	Tub		x	
CFV19	Storage temperature control method	√	Iced		x	
CFV20	Storage temperature record		no		x	
FOR EACH LOGISTIC UNIT CREATED						
Identities						
CFV21	Logistic unit ID	√	Batch no.	x		
CFV22	Trade unit IDs	√	Tubs	x		
FOR EACH UNIT DISPATCHED (either as a logistic unit or a separate trade unit)						
Identity						
CFV23	Unit ID	√	Batch no. the same as CFV21	x		
Destination						
CFV24	Next food business ID	√	Hnifsdalur Freezing Plant (H039) IS-01403	x		

CFV25	Date and time of dispatch	√	Document is available in electronic form	x		
CFV26	Place of dispatch	√	Local fish harbour	x		

Table 15: Detailed information requirements for processors (according to TraceFish 2002a)

Data element		Available	Data in the Icelandic Group	Categorisation		
				Shall	Should	May
PROCESSOR						
CPR01	Food business ID	√	Hnifsdalur Freezing Plant (H039) IS-01403	x		
CPR02	Processing establishment ID	√	Record is available in electronic form	x		
CPR03	GMP certification	√	On check system in plant			x
FOR EACH UNIT RECEIVED						
Identities						
CPR04	Unit ID	√	Batch no.	x		
CPR05	Trade unit IDs in logistic unit	√	Tub no.	x		
Source						
CPR06	Previous food business ID	√	Jón Emil ÍS-102	x		
CPR07	Date and time of reception	√	Record is available in electronic form	x		
Control checks (related to the logistic or separate trade units, as appropriate)						
CPR08	Temperature of unit when received		no		x	
CPR09	Unit temperature record		no		x	
CPR10	Further quality control checks		no			x
Production history (for each trade unit)						
CPR11	Raw material storage temperature control method	√	Chilled storage with ice		x	
CPR12	Raw material storage temperature record		no		x	
Transformation information (for each trade unit)						
CPR13	Related created trade unit IDs	√	Tank no. (3.4.3)	x		

FOR EACH TRADE UNIT CREATED						
Identity						
CPR14	Trade unit ID	√	Box-label (3.2.4 and 3.4.4)	x		
Description						
CPR15	Type of unit	√	Master case	x		
CPR16	Net weight	√	Indicated by label	x		
CPR17	Name/type of product	√	Indicated by label	x		
CPR18	Product specification	√	Paper			x
CPR19	Species	√	Gadus morhua or cod		x	
CPR20	Primary production method	√	Captured		x	
CPR21	Area of origin	√	Record		x	
CPR22	Composition	√	Gadus morrhua 100 %	x		
CPR23	Product condition	√	Chilled	x		
CPR24	Date of durability	√	Indicated by label		x	
Production history						
CPR25	Process specification	√	Paper			x
CPR26	Production line IDs	√	According to product code recorded			x
CPR27	Date and time of production	√	Indicated by production code		x	
CPR28	HACCP	√	Paper			x
CPR29	Hygiene checks	√	Paper			x
CPR30	Process temperature records	√	Paper			x
CPR31	Product quality control checks	√	Paper			x
Transformation information						
CPR32	Related received trade unit IDs	√	Pallet no.	x		
FOR EACH LOGISTIC UNIT CREATED						
Identities						
CPR33	Logistic unit ID	√	Pallet no.	x		
CPR34	Trade unit IDs in logistic unit	√	Box- label	x		
FOR EACH UNIT DISPATCHED (either as a logistic unit or a separate trade unit)						
Identity						

CPR35	Unit ID	√	Container fixed no. and seal no.	x		
Production history						
CPR36	Product storage temperature control method		Refrigerated		x	
CPR37	Product storage temperature record		No information given		x	
Destination						
CPR38	Next food business ID	√	Record is available in electronic form	x		
CPR39	Date and time of dispatch	√	Record is available in electronic form	x		

Table 16: Detailed information requirements for transporters and storers (according to TraceFish 2002a)

Data element		Available	Data in the Icelandic Group	Categorisation		
				Shall	Should	May
TRANSPORTER OR STORER						
CTS01	Food business ID	√	Eimskip	x		
CTS02	Transport vehicle or storage establishment ID	√	e.g. SKO Skógafoss (Table 12)	x		
CTS03	GMP certification		No information given			x
FOR EACH UNIT RECEIVED						
Identities						
CTS04	Unit ID	√	Container fixed no. and seal no.	x		
CTS05	Trade unit IDs in logistic unit	√	Each pallet no.	x		
Source						
CTS06	Previous food business ID	√	Hnifsdalur Freezing Plant (H039) IS-01403	x		
CTS07	Date and time of reception	√	Record is available in electronic form (Table 12)	x		
CTS08	Place of collection	√	Record is available in electronic form (Table 12)	x		
Control checks (related to the logistic or separate trade units, as appropriate)						
CTS09	Temperature of unit when received		No information given		x	
FOR EACH NEW LOGISTIC UNIT PRODUCED BY TRANSPORTER OR STORER						
Identities						

CTS10	Logistic unit ID	√	Container fixed no. and seal no.	x		
CTS11	Trade unit IDs in logistic unit	√	Pallet	x		
FOR EACH UNIT DISPATCHED (either as a logistic unit or a separate trade unit)						
Identity						
CTS12	Unit ID	√	Dispatch no. (Table 12)	x		
Production history						
CTS13	Transporter or storer temperature control method		Refrigerated		x	
CTS14	Transporter or storer temperature record		No information given		x	
Destination						
CTS15	Next food business ID	√	Record	x		
CTS16	Date and time of dispatch	√	Record is available in electronic form (Table 3-12)	x		
CTS17	Place of delivery	√	Record is available in electronic form (Table 3-12)	x		

The results in Tables 14, 15 and 16 show that all the information requirements categorised as "shall" in the standard are satisfied in the traceability system in the Icelandic Group for frozen cod product. Information requirements categorised as "should" and "may" are nearly all fulfilled in the Icelandic Group. Some information in the Icelandic Group relates to GMP certification, ethical aspects of fishery, quality control checks and temperature recording, stated as "no information given" in these three tables, may be available in the respective links upon request.

Based on this comparison it can be concluded that the Icelandic Group complies with the basic information necessary in the TraceFish Standard for captured fish, or vice versa, this TraceFish Standard for Captured Fish is practical and realistic. Furthermore, it is concluded that the TraceFish Standard will be helpful for companies who are aiming at implementing traceability system for their products.

3.5.2 The critical link for maintaining traceability of original batches of raw material

All of the above discussion is based on the premise of that raw material comes from the company's own fishing vessel. It is clear that the finished product can be traced back to the *Batch no.* of raw material, i.e. fishing vessel, or vice versa from the origin to the final destination at the end of the chain.

However, when the fish is bought in an auction market or from another fishing boat, the traceability is less secure. In some cases, fish from different batches/boats can be mixed if the plant buys fish from more than one vessel.

Therefore, it is possible that mixing of batches may occur in practice. The TraceFish standard does not demand traceability of particular product to a single vessel (TraceFish 2002a), but the standard ensures the traceability if the company records or labels the IDs of received trade units. The information will be carried by IDs and input to each created trade unit. The final product is then traceable back to a finite number of vessels or batches of origin. From the raw material labelling system in HG it is clear that the company ensures that all their products are traceable back to original resources.

3.5.3 Coding system is the key to traceability in the Icelandic Group

The Icelandic Group's coding system is the key to it's traceability system for their products. In this project, frozen cod products were chosen as a practical case of fish product chains. The key to its operation is the labelling of each unit of goods with a unique identifier (ID).

Product code, production date and producer no. carry a large amount of information (as shown in Figures 5, 6 and Tables 10, 11). If these codes are available, one can trace the product to the producer and look up the required information in the information system built in the database.

3.5.4 The advantage of IT in a traceability system

The results of the study in Icelandic Group show that a large amount of information was generated and used in each link, for both legal, commercial reasons and quota management in the company.

Traceability concerns only the ability to trace things, which means that the necessary information must be available when required. It does not mean that the information must at all times be visible by being labelled on the food or being with it. In the Icelandic Group, all the data from ordering to exporting are processed and stored by Information Technology (IT) on the internet. And information is stored in computer databases. It is available to provide any data required from any related business for any reason at once.

3.5.5 An operating scheme of frozen cod product distribution chain

Based on the study in the Icelandic Group, the scheme of existing material and information flow chain for frozen cod products is summarised, and the company's profile and organisation is shown in Figure 28. This operation scheme illustrates how the flow of traceability information has been implemented in the Icelandic Group effectively.

The flow chart (Figure 28) shows clearly that each unique label identifies the physical links handled by different participants in this distribution chain. It is evident that there are no broken links or absent IDs. This ensures the efficiency of the traceability system in this products distribution chain.

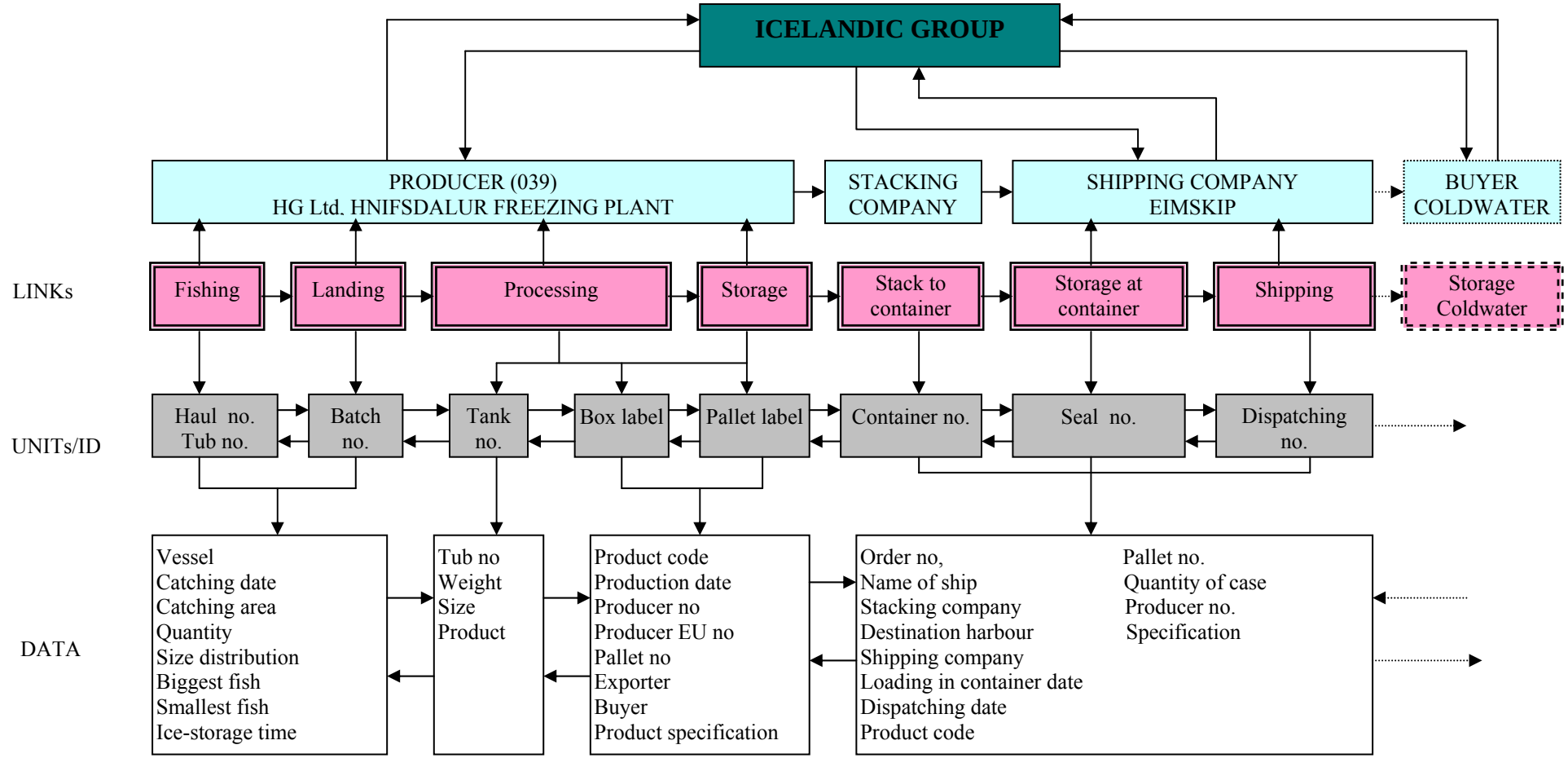

Figure 28: Operating structure and physical links for frozen cod product exported in the Icelandic Group, the units/IDs and data carried are detailed.

LINKs UNITs/IDs DATA

3.5.6 Applying EAN coding system in local sections of the distribution chain

The TraceFish standards suggest the use of EAN.UCC in every link in the distribution chain to identify the units.

For the tracking and tracing of products from the origin of the raw material, through processing, it is reasonable that processors implement their own labelling methods to identify the unit of each link existing in the plant. As a matter of fact, there is almost no EAN numbering used in the internal distribution chain for labelling units in the Icelandic Group. Catching and the processing are handled by the same business (HG) in this case, the company's own labelling method ensures the traceability of products. For example, the *tub no*. and *tank no*. are used to link the products to original batch of raw material. However, if the raw material is bought from another company, the raw fish labelling will change according to the suppliers system. Therefore, to ensure a worldwide identifying system, it is suggested to use EAN.UCC system for labelling units when traded between links handled by different businesses in the whole fish distribution chain both locally and abroad.

Item numbering by the EAN.UCC system provides the technical capability to know the origin of fish, both internally in each company and across the entire supply chain. EAN.UCC can improve the efficiency of recording and exchanging information between supply chain participants even between the local trading partner companies.

3.6 Conclusions and recommendations

Conclusions and recommendations are summarised as following:

- The TraceFish standard for captured fish is practical and realistic.
- The link between raw material to processing line controlled by processor is the critical link for maintaining traceability of original raw material
- The company's own coding system is the key to the traceability for frozen fish products in the Icelandic Group
- Application of Information Technology (IT) for data processed and stored by internet is valuable in a traceability system.
- Labelling of logistic units in each link by unique identifier is the assurance of an efficient traceability system. Broken links or absent IDs will cause problems.
- EAN coding system is suggested to be used between the trade links handled by different businesses both locally and abroad.

4. A TRACEABILITY STUDY FOR AN EXPORT COMPANY IN CHINA

Dalian Fengji Food Co., Ltd. is an export company in Dalian, China. They sell frozen fish products, and the main market is North American, United States and Japan. They have never exported their products to the EU market before. The company complies with international fish product regulations and requirements from markets. Fengji is a typical fishery export company in China, i.e. imports raw fish and exports final products. The company is a good example to fulfil the objective of this project.

In this study some recommendations are given on how to handle frozen fish products on the EU market emphasising on forthcoming EU regulation relevant to traceability of fish products. The analysis and recommendations are based on a comparison with the TraceFish standard for captured fish (TraceFish 2002a). The traceability system implemented in the Icelandic Group was also used for reference to the emendation of labelling of units and links in Chinese fishery companies.

This is a pilot study on traceability for Chinese fisheries industry to guide a fishery company that aims at exporting fish products to the EU market. The TraceFish standard is used as a guidance scheme on how to comply with traceability requirements.

4.1 The traceability status in Fengji distribution chain

Fengji has a similar operation pattern system as the Icelandic Group. The company receives orders from buyers abroad and has various producers that process the products. Fengji has different producers according to the products and markets. In this project, Donghai Freezing Factory has been taken as a case study.

The main relevant businesses in this distribution chain are raw material suppliers, shipping companies, storers, processors, buyers and exporting companies. Figure 29 shows the operation structure for frozen fish products exported in Fengji. The links shown as in double-broken lined cells indicate that those links are controlled by suppliers and buyers abroad. Fengji is responsible for the links in China.

The dissimilarity between Fengji and Icelandic Group is that all of the raw material frozen at sea in Fengji is imported. It means that both raw fish and finished product are involved with international trades that makes it more complex for traceability. There are more complex links in Fengji compared with the Icelandic Group. The diversity of species, products, suppliers, processors and markets is an another profile of Fengji. The main species of raw fish are yellowfin sole, ocean perch, Atlantic salmon, mackerel and halibut.

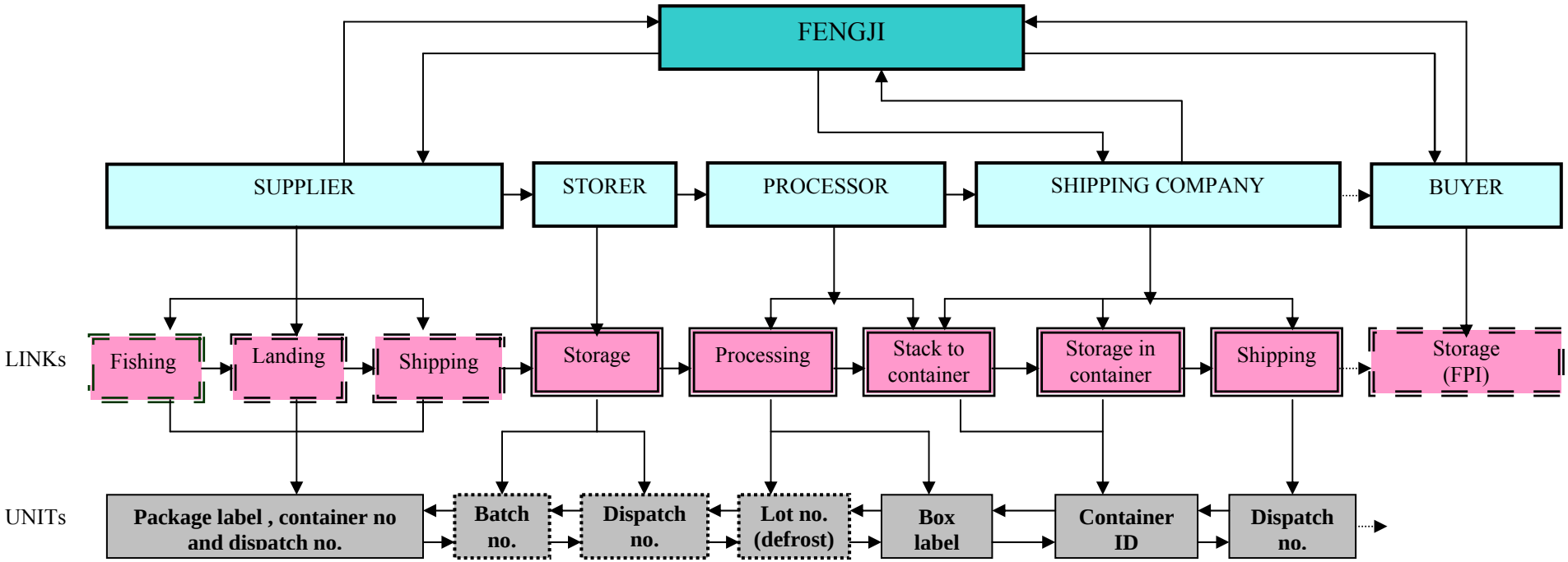

Figure 29: Operating structure and physical links for frozen fish product exported in Fengji, with the indication of modification suggested for labelled units.

Dalian Donghai Freezing Factory, licensed by the competent authority-CIQ (China Inspection and Quarantine Bureau) Liaoning Branch, is one of Fengji's processors. The quality assurance system in this plant, that controls the quality and safety of the products, is based on GMP and HACCP. Figure 30 shows hand-washing room in Donghai plant and Figure 31 shows filleting in this plant. Most of processing steps are carried out manually. This is the common case in the fish processing plants in China. No further discussion about the quality and safety controlling system in this factory will be included in this report.

Figure 30: Hand washing room in Donghai.

Figure 31: Manual filleting in Donghai plant

Production date code method is the same as in Icelandic Group as shown in Figure 32. Master case is their trade unit. They do not use any EU or ISO pallet for storage or transport. Products are produced in IQF fillet or portion, frozen block, etc.

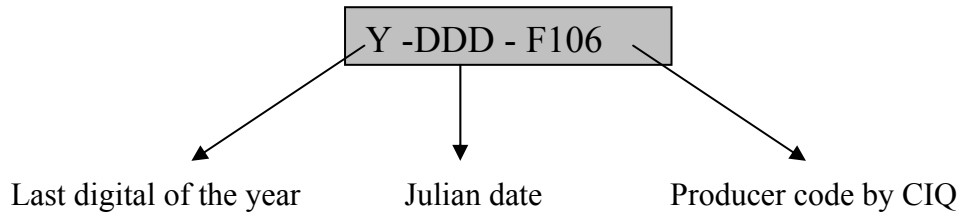

Figure 32: Production code method in Fengji.

The possibility to trace final products back to the original batch of raw fish was studied for the company. The results show that it is impossible from the current information system because of some links had insufficient or inappropriate labelling of their units.

4.2 Results and discussion

It was concluded in section 3.5.1 that the TraceFish standard for captured fish is practical and reasonable. The distribution chain in Fengji was analysed and recommendations were based on comparing to the TraceFish standard as a model for a traceability scheme for this export company in China.

The distribution chain of fish products from raw fish to final products in Fengji is complex because the raw material is sourced from the international markets. The raw material suppliers are responsible for the operation of fishing vessels, vessel landing and auction, and shipping to China (Tables 1, 2 and 4 in Appendix 2). The respective information required for those links in the TraceFish Standard shall be provided by suppliers.

Fengji receives frozen raw fish, transports and stores, processes, and ships products abroad. Here we will discuss the current status and the recommendation to improve the traceability of their frozen fish products based on the TraceFish Standard the for captured fish. Weakness of traceability in Fengji is the absence of labelling in some key links. It is impossible to keep a continuous information chain without identifying a unique unit in every link.

Tables 17, 18 and 19 show the information required by the TraceFish standard compared with the real case in Fengji in landing, processing and shipping. Some recommendations and advice for improvements for key units and labelling are given at the weak links as shown in shadowed cells, and the corresponding data elements marked with "*". The description of each data element in the standard can be found in Appendix 2.

Table 17: Detailed information requirements for transporters and storer (according to TraceFish 2002a)

Data element		Available	Data in Fengji	Categorisation		
				Shall	Should	May
TRANSPORTER OR STORER						
CTS01	Food business ID	√	Raw material store, e.g. Liaoning Fishing Corp. Address and License no. are available.	x		
CTS02	Transport vehicle or storage establishment ID	√	No detailed information, it is available if required.	x		
CTS03	GMP certification		No detailed information			x
FOR EACH UNIT RECEIVED						
Identities						
CTS04*	Unit ID		Create a batch no. for each reception which links the dispatch no. from the suppliers	x		
CTS05	Trade unit IDs in logistic unit	√	Containers ID, i.e. fixed no. or seal no. from the suppliers	x		
Source						
CTS06	Previous food business ID	√	Transporter, whose detailed information available from the suppliers.	x		
CTS07	Date and time of reception	√	It is recorded	x		
CTS08	Place of collection	√	Landing harbour , Dalian detailed data is available	x		
Control checks (related to the logistic or separate trade units, as appropriate)						
CTS09	Temperature of unit when received	√	No detailed information , It is available if required		x	

FOR EACH NEW LOGISTIC UNIT PRODUCED BY TRANSPORTER OR STORER						
Identities						
CTS10*	Logistic unit ID		Dispatch no. (labelling each dispatch with a no.)	x		
CTS11	Trade unit IDs in logistic unit	√	Package (raw fish) label	x		
FOR EACH UNIT DISPATCHED (either as a logistic unit or a separate trade unit)						
Identity						
CTS12*	Unit ID		Dispatch no. (labelling each dispatch with a no.)	x		
Production history						
CTS13	Transporter or storer temperature control method	√	Refrigerated		x	
CTS14	Transporter or storer temperature record	√	It's available		x	
Destination						
CTS15	Next food business ID	√	Processor. e.g. Dalian Donghai Freezing Factory, Dalian Econ. & Tech. Development Zone, China. Plant no. F106 by CIQ (CA)	x		
CTS16	Date and time of dispatch	√	It is recorded	x		
CTS17	Place of delivery	√	The same as processor	x		

Table 18: Detailed information requirements for processors (according to TraceFish 2002a)

Data element		Available	Data in Fengji	Categorisation		
				Shall	Should	May
PROCESSOR						
CPR01	Food business ID	√	Dalian Donghai Freezing Factory, Dalian Econ. & Tech. Development Zone, China. Plant no. F106 by CIQ (CA)	x		
CPR02	Processing establishment ID	√	e.g. 2100/02229 for Frozen arrowtooth flounder and 2100/02292 for Frozen halibut flesh, etc. licensed by CIQ (CA)*.	x		
CPR03	GMP certification	√	Document is available both in electronic form and in paper			x
FOR EACH UNIT RECEIVED						
Identities						
CPR04*	Unit ID		Labelling each reception no. as the same as dispatch no. from the storer.	x		
CPR05	Trade unit IDs in logistic unit	√	Package (raw fish) label	x		
Source						
CPR06	Previous food business ID	√	The same as the storer	x		
CPR07	Date and time of reception	√	Document is available both in electronic form and in paper	x		

Control checks (related to the logistic or separate trade units, as appropriate)						
CPR08	Temperature of unit when received	√	It is inspected and recorded		x	
CPR09	Unit temperature record		No detailed information		x	
CPR10	Further quality control checks	√	Not sure but it is available if required			x
Production history (for each trade unit)						
CPR11	Raw material storage temperature control method	√	Refrigerated		x	
CPR12	Raw material storage temperature record	√	No detailed information it is available if required.		x	
Transformation information (for each trade unit)						
CPR13*	Related created trade unit IDs		Create a lot no. for each defrosting, which corresponds to one lot of product	x		
FOR EACH TRADE UNIT CREATED						
Identity						
CPR14*	Trade unit ID	√	Master case label	x		
Description						
CPR15	Type of unit	√	Master case	x		
CPR16	Net weight	√	Indicated by label	x		
CPR17	Name/type of product	√	Indicated by label	x		
CPR18	Product specification	√	Indicated by label			x
CPR19	Species	√	Indicated by label		x	
CPR20	Primary production method	√	Indicated by label		x	
CPR21	Area of origin	√	Indicated by label		x	
CPR22	Composition	√	Indicated by label	x		
CPR23	Product condition	√	Frozen, indicated by label	x		
CPR24	Date of durability	√	Indicated by label		x	
Production history						
CPR25	Process specification	√	Document is available both in electronic form and in paper			x
CPR26	Production line IDs	√	The same as CPR02 each product has a code			x
CPR27	Date and time of production	√	Indicated by label		x	
CPR28	HACCP	√	Document is available both in electronic form and in paper			x
CPR29	Hygiene checks	√	Document is available in paper			x
CPR30	Process temperature records	√	Document is available in paper			x
CPR31	Product quality control checks	√	Document is available in paper			x

Transformation information						
CPR32	Related received trade unit IDs	√	Stays in master case	x		
FOR EACH LOGISTIC UNIT CREATED						
Identities						
CPR33*	Logistic unit ID	√	Container no.	x		
CPR34*	Trade unit IDs in logistic unit	√	Master case label	x		
FOR EACH UNIT DISPATCHED (either as a logistic unit or a separate trade unit)						
Identity						
CPR35	Unit ID	√	Container no.	x		
Production history						
CPR36	Product storage temperature control method	√	Document is available both in electronic form and in paper		x	
CPR37	Product storage temperature record	√	Document is available both in electronic form and in paper		x	
Destination						
CPR38	Next food business ID	√	Shipping company, e.g. P&O Maersk	x		
CPR39	Date and time of dispatch	√	Document is available both in electronic form and in paper	x		

Table 19: Detailed information requirements for transporters and storer (according to TraceFish 2002a)

Data element		Available	Data in Fengji	Categorisation		
				Shall	Should	May
TRANSPORTER OR STORER						
CTS01	Food business ID	√	Different transporters, e.g. P&O Maersk, detailed data is available from the transporter if required.	x		
CTS02	Transport vehicle or storage establishment ID	√	Detailed information is available from the transporter	x		
CTS03	GMP certification		No detailed information			x
FOR EACH UNIT RECEIVED						
Identities						
CTS04	Unit ID	√	Container no.	x		
CTS05	Trade unit IDs in logistic unit	√	Master case label	x		
Source						
CTS06	Previous food business ID	√	The same as the processors	x		
CTS07	Date and time of reception	√	Recorded	x		
CTS08	Place of collection	√	The same as the processors	x		

Control checks (related to the logistic or separate trade units, as appropriate)						
CTS09	Temperature of unit when received	√	Not sure, it is available if required.		x	
FOR EACH NEW LOGISTIC UNIT PRODUCED BY TRANSPORTER OR STORER						
Identities						
CTS10	Logistic unit ID	√	Container no.	x		
CTS11	Trade unit IDs in logistic unit	√	Master case	x		
FOR EACH UNIT DISPATCHED (either as a logistic unit or a separate trade unit)						
Identity						
CTS12	Unit ID	√	Dispatch no. corresponding to the order no.	x		
Production history						
CTS13	Transporter or storer temperature control method	√	Refrigerated		x	
CTS14	Transporter or storer temperature record	√	Not detailed information, it is available if required.		x	
Destination						
CTS15	Next food business ID	√	Buyers, e.g. Fishery Products International (FPI), Canada. detailed information is available	x		
CTS16	Date and time of dispatch	√	Recorded	x		
CTS17	Place of delivery	√	Harbour in Dalian , detailed information is available	x		

The improved information chain is shown in Figure 17, and the modifications are shown in dot lined cells. This distribution chain now with the modifications suggested has a traceability system complying with the TraceFish standard. The TraceFish standard is practical and reasonable as a guideline to lead fisheries enterprises to implement a traceability system in their distribution chain.

4.3 Recommendations

Some recommendations are suggested to improve the labelling system of the distribution chain in Fengji for the purpose of implementing the traceability. Those modifications are based on the comparison with the TraceFish standards for captured fish.

4.3.1 Creating new units and IDs in key links

The only two unique units existing in this distribution chain are *package* of raw fish and *master case* of final products. It is a possible scenario that one batch of products will be processed by mixing of batches of raw fish produced by different suppliers. In this case the products can not be traced back to original batches of raw fish. The solution is to create unique units in key links and label these units to carry the original information along the chain.

- Batch no. of each reception of raw material from supplier (Table 17 CTS04)

- Dispatch no. of each dispatch of raw material from storer to processor (Table 17 CTS10 and CTS12).
- Lot no. for each lot of raw material defrosted for the labelling of the processing line in the factory (Table 18 CPR04)

Batch no. is created at each landing and receiving of raw fish. Storer creates dispatch no. at each dispatch of raw fish to processor; meanwhile, the processor labels each reception from the storer as the same dispatch no. number (Table 18 CPR 04).

The defrosting process in the plant is the key to link the products with the origin of raw material. Therefore, a defrosting no. is created to label the processing line ensuring the traceability of the products. The defrosting is as same as beheading/grading in HG plant (H-039), both of them are the key to link finished product with original raw fish.

4.3.2 Applying IT in traceability system for fisheries industry in China

Information technology (IT) has obvious benefits for business efficiency, including rapid communication and information flow in the traceability system in Icelandic Group.

Both paper and electronic documentation exist in Fengji. E-mail or fax is mostly used for the communication of data. It is difficult to operate a sound documentation system and ensure that data can be accessed efficiently. The solution is to develop an electronic database with the access for the relevant participants in this distribution chain.

4.3.3 Applying EAN coding system and EU pallet in fish distribution chain

The EAN.UCC system offers a global traceability solution using unique numbering with related bar codes. The EAN system enables efficient supply chain management and international trade by providing standard tools that allow the fish supply chain participants to communicate in one common global language of business.

As a global business standard, EAN.UCC is a helpful tool to implement a cost-effective and efficient traceability system to satisfy markets and legal requirements. Implementing the EAN.UCC system in fisheries enterprises that are aiming at exporting fish products to the international markets is suggested.

When exporting fish products to the EU markets, using EU pallets for transporting or storage in China's fisheries industry is suggested.

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Appendix 1: List of laws considered as complements to Directive 91/493 and 91/492:

- Decision 93/140 concerning parasites (visual inspection, non-destructive method);
- Decision 93/351 concerning the maximum level of mercury;
- Directive 95/71/EC modifying the annex of the Directive 91/493;
- Decision 95/149 fixing TVB-N level for certain species;
- Decision 93/51 fixing microbiological criteria for cooked crustaceans and molluscs;
- Regulation 2001/466/EC setting maximum levels for certain contaminants in foodstuffs, last amended by Commission Regulations 2001/2375/EC and 2002/221/EC;
- Directive 2001/22/EC laying down the sampling methods and the methods of analyzing for the official control of the level of lead, cadmium, mercury and 3-MCPD in foodstuffs;
- Directive 2001/13/EC on the approximation of the laws of the Member States relating to the labelling, presentation and advertising of foodstuffs;
- Decision 2001/183/EC laying down the sampling plans and diagnostic methods for the detection and confirmation of certain fish diseases and repealing Decision 92/532.
- Commission Decision 2002/225/EC laying down detailed rules for the implementation of Council Directive 91/492/CEE as regards the maximum level and the methods of analysis of certain marine biotoxins in bivalve molluscs, echinoderms, tunicates and marine gastropods.
- Commission Decision 2002/226/EC establishing special health checks for the harvesting and processing of certain bivalve molluscs with a level of Amnesic Shellfish Poison (ASP) exceeding the limits lain down by Council Directive 91/492/CEE.
- Commission Regulation 2001/2065/EC laying down detailed rules for the application of Council Regulation 2000/104/EC as regards informing consumers about fishery and aquaculture products.

APPENDIX 2 TraceFish Standards for Captured Fish