A Guide to Traceability within the Fish Industry

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Preface

With the introduction of recent legislation by both the European Union and the USA, traceability of products throughout the supply chain is now an important and mandatory aspect of company operations in what is a global market for fishery and seafood products.

Although many components of a traceability system are implemented within the fishing industry, as part of other management systems, it is essential that they are integrated into a single management system in order to demonstrate an individuals company has an effective operation and proves that it works.

In this publication, the requirements of traceability systems are presented, together with examples from the supply chain of different methods available to ensure product traceability and a structured approach to developing the necessary documentation.

It is hoped that this guide will assist companies in understanding and implementing traceability within the fisheries industry. The guide is a shared publication from Eurofish and the Swiss Import Promotion Programme *(SIPPO)*.

EUROFISH

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The objective of this book is to provide a practical guide to establishing traceability systems within the fish industry and to act as a source book for further information on the subject. This project is on-going and comments, questions and suggestions on improving traceability would be welcomed.

The book is based on a series of practical project's on traceability led by the Institute based in our own pilot plant or in real factories. Support has been received from the Learning Skill's Council in the UK *(LSC)* as their funding assisted in the creation of the educational programmes to support the projects. Further the New Technology Institute funding enabled the pilot testing of a range of modern technology which enables traceability in a complex factory environment. The project outputs and a draft of the booklet were presented to the Bremen Fish Trade meeting attended by a large number of Government and Industry representatives interested in working on resolving the traceability issues.

The traceability projects discussed in Bremen were developed in the Institute pilot plant (Food Dynamo) and are being transferred into working systems in local factories. HIFF also leads the Centre of Excellence in Food Manufacturing (CoVE) - between the CoVE and NTI over 100 factory supervisors or managers will be involved in work-based projects this year.

This is the beginning of the traceability story, the forty people we have currently working in a range of seafood traceability projects will continue to add to our knowledge on what works in practical situations. We look forward to sharing the knowledge as we advance.

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Foreword

Food traceability, and in particular fish traceability, is today high on the agendas of fish inspection services and the fisheries industries all around the world. By January 2005 the food and fishery industry in the EU, and in third countries wanting to export food and fish products to the EU, must have implemented systems to comply with requirements of Regulation (EU) No 178/ 2002 of the European Parliament and the Council of 28 January 2002.

Traceability in itself may be one of those broad concepts, like quality and quantity, for which philosophers have said that only working definitions could be attempted. Actually, as of today (April 2004) and after years of discussions, there is no official FAO/WHO Codex Alimentarius Commission definition of “traceability”. It is even likely the final definition of the CAC would refer more to “product tracing” or “tracing” than to traceability. These issues, and ongoing discussions on the same subject, give a proper idea of the practical difficulties faced in this field.

Nevertheless, traceability systems are not foreign to the fishery industry, and a number of methods and procedures at different levels of complexity but related to traceability, such as FIFO (First In First Out), are utilized in practice. However, not all the concepts, purpose and scopes, methodologies to achieve regulatory compliance, etc. are clear enough, particularly with regard to fish and food exporters in developing countries. The main questions may be put as follows:

- What it is traceability for my company? Need of a clear definition and scope of traceability.
- Which information should be available for tracing?
- Which methodology could my company utilize in practice to achieve compliance?
- How much would it cost my company?

In this context the “Guide to Traceability within the Fish Industry” is a timely and very useful effort to answer in a simple, but effective way, most of the questions discussed in the previous paragraph. Proposed tracing methods have been practically tested in the Grimsby College’s pilot plant (“Dynamo”) and are rather similar to methods already in use in many EU fish industries. Even though further development could be expected in the regulatory area of traceability/ tracing in the coming years, surely this Guide will continue to be useful to all segments of the fishery industry chain and to fish inspection services, as well as to training and educational institutions, for many years.

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1. The Significance of traceability to the fishing industry

What is traceability?

Traceability is the ability to trace, follow and identify UNIQUELY a product unit or batch through all stages of production, processing and distribution.

It needs to show the path of that unit or batch through all the intermediate steps of the production flow and the supply chain. The International Standards Organization *(ISO)* define traceability as:

"The ability to trace the history, application or location of that which is under consideration…. when considering products this can relate to the origin of materials and parts, and the processing history."

Another way of defining a traceability system is provided by Notermans S. & Beumer H. *(Safety & Traceability of Animal feed in Food Authenticity & Traceability (2003))*, who suggest that a traceability system has the following components.

Supplier traceability, ensures that the source of all raw materials/ ingredients can be identified from the records and documentation.

Process traceability, ensures the ability to identify all ingredients and process records for each individual product produced by the factory.

Customer traceability, ensures that the customers for all products can be identified.

The overall system therefore enables the trace-forward of product for the purpose of product recall, the availability of all processing records during the investigation of an incident and the trace-back of all raw materials if this was identified as the source/cause of the incident necessitating the product recall.

There are two categories of traceability that are commonly discussed under the same heading of traceability:

Internal traceability relating to the traceability of product and the information relating to it, within the company or factory, and;

External traceability which relates to product information that a company either receives or provides to other members of the supply chain.

It should be noted that in both cases, traceability concerns only the ability to trace things, i.e. the specific product should be able to be identified and linked to the related records. This does not mean that all the information should be permanently visible by being included on a product label. In many cases the amount of information that relates to a specific product and is required by the end user is too great to be included on a label or bar code.

The information itself can be classified as either:

Product data which describes details of the product, raw material or ingredient, e.g. weight, grade, species, *Or*

Transformation data, which list the ID's of all raw materials and ingredients or products and by-products produced from this batch.

The normal approach would be to identify each lot/batch of fish with a unique identification code that can be used to identify the origin and be linked to the records of other companies in the supply chain from which the entire process history can be determined.

Although simple in theory, product traceability is more complicated to put into practice since:

The processing chain for even a simple product such as fresh fish is often complex, often involving various countries with different standards and legal requirements.

Even within a single country the supply chain is often complex, with differences in the routes products take from harvesting to consumption. The complexity derives from the wide range of fishing practices, species, final products and the practices of individual companies involved.

Where fish are sourced from non-EU countries the use of incompatible data-systems and accessibility to records in different languages may cause additional problems.

A large amount of data is recorded by individual companies for each product, however, not all this information is relevant or useful to every company in the processing chain.

For example, a fishing boat would keep records of exactly where, the amount of each species, and the time the fish were caught. However the only information that is of interest to a processor would be the species, quality, location and date of capture of the fish.

Information is often lost during transfer between links in the processing chain.

Fish landed at a market are often identified only by the species and the date of landing, the identity of the fishing boat, however, is often lost as the ownership of the batch passes from market to purchasing agents before reaching the processors or retailers, therefore information relating to the location, time and method of capture is lost since it is not possible to trace back to the records of individual boats.

Mixing of individual batches of product commonly occurs at points through out the supply chain.

It is essential that when this occurs, the identification of each batch is recorded and linked to the product identification code of the “mixed” consignment. This ensures that, even if physical traceability of the individual lots/batches are lost the identities of the component batches within a mixed batch are known and retained.

The need for traceability.

Globalization of the fish industry in terms of sourcing raw materials, processing and marketing has resulted in demands for increased traceability of products. This is due mainly to the increased length of the supply chain providing more opportunity for fishery products to either lose quality or gain the potential to cause harm to the consumer. In order to ensure both the quality and safety of products, more information concerning the sourcing and processing of the products needs to be communicated throughout the supply chain and ultimately to the consumer.

To ensure that this occurs, legislation has been established which places the responsibility of proving the products safety and quality onto the producers, processors and retailers. This is often referred to as demonstrating "Due Diligence".

Due Diligence

"It shall be a defence for the person charged to prove that he took all reasonable precautions and exercised all due diligence to avoid the commission of the offence".

Or put another way

There must be documented evidence of a system that works. i.e. the procedures employed and the records collected must be available for review.

A food company is presumed guilty of an offence until proved innocent by means of its documentation and evidence it verifies effective control.

Recent incidents such as the BSE in the UK beef industry, Chloramphenical from contaminated seafood *(Appendix 1)* being used in animal feed and most recently the introduction of potato ring-rot disease into the UK, have demonstrated to both companies and the consumers the inability to identify and trace products through out the food chain has a high cost.

The Competent Authorities in Europe see traceability as an integral part of a control system for maintaining food safety and consumer protection.

The UK Food Standard's Agency has identified the following roles for traceability in the food industry.

Food safety incidents: Product recall is simplified where both the source of potentially hazardous materials can be rapidly identified and similar potentially hazardous products removed from the supply chain. The ability to trace a product back to the source of the hazard means that controls can be established to prevent, or at least reduce, the likelihood of it re-occurring. Being able to identify all the potentially harmful products will enable their recall and so minimise any harm to consumers that could negatively affect the public opinion about a specific product and result in a reduction of sales.

Food residue surveillance programs: Product traceability facilitates the identification of key points within the supply chain at which product sampling is necessary to monitor residue levels *(e.g. pesticide, antibiotic)*.

Risk assessment from food exposure: By linking information to provide access to the entire history of a product from net to plate, the origins of products or ingredients that may have food safety implication can easily be identified.

Prevention of fraud and enforcement of labelling claims: Traceability together with regular audits of records can prevent fraud with respect to product origin, species, etc.

Consumers are requesting greater information related to products on which to base purchasing choices, for moral, ethical and religious reasons. Examples of information often requested include; environmental and ecological issues, GMO, ingredients and nutritional data.

It is not only the consumers that are requesting further information; processing companies and retailers often require documented evidence to support marketing campaigns and to promote the sale of their products, in line with customer expectations. Examples of this would include "dolphin friendly tuna", "Caught from a sustainable fishery", MSC accreditation or to denote the source for marketing purposes e.g. Scottish Salmon.

There are therefore definite benefits for a company from implementing traceability systems which include:

A company's obligations under EU legislation are met. This of course only applies to those companies who operate within, or wish to export to, the EU markets.

Other links within the supply chain require traceability, therefore by providing this information with the product the potential market for the product is increased.

Consumer expectations are demonstratably achieved. This can provide added value to the product when the product origin is linked to specific branded products or claims such as "Wild Scottish salmon".

Process control and factory efficiency can be improved by:

- minimising losses during a product recall to only the affected products.

- using product information linked to processing data to improve quality and consistency by proactively reviewing records and identifying improvement opportunities.

To summarise, traceability is an integrated concept in modern regulatory and management systems governing not only food safety but also other issues such as consumer information.

Traceability is also an essential risk management tool enabling individual members of the supply chain to identify the source(s) of problems quickly and rapidly disseminate this information to affected parties, thus increasing business efficiency.

2. Traceability: standards and legal requirements

There has always been a degree of traceability within the food industry, with individual companies able to identify both their suppliers and customers. In recent years however the role of traceability in the control and safety of food has been identified as requiring greater transparency and regulation. This has been achieved by the development of international standards, industry guidelines and legislation.

Codex Alimentarius Commission

The Codex Alimentarius Commission *(CAC)*, was formed under the joint sponsorship of the United Nation's, World Health Organisation *(WHO)* and Food & Agriculture Organisation *(FAO)* in 1962, to develop international standards for food safety. The main purpose of the CAC is to protect the health of the consumer and ensure fair trade practices by developing standards based on sound scientific evidence. The World trade Organisation *(WTO)* has designated CAC the organisation with the responsibility for settling trade disputes relating to food, specifically as they relate to the Codex standards of Application of Sanitary and Phytosanitary measures *(SPS)* and the Agreement on Technical Barriers to Trade *(TBT)*.

As such the CAC produce guidelines to be incorporated into regulations of individual countries, rather than specific legislative requirements.
In terms of traceability the issue has been discussed in various committees and the following standards that relate to product traceability have been developed:

General Standard for Pre-packaged Food (GSPPF).

Sec. 4.5.1: The country of origin of the food shall be declared if its omission would mislead or deceive the consumer.

Sec. 4.5.2: When a food undergoes processing in a second country which changes its nature, the country in which the processing is performed shall be considered to be the country of origin for the purpose of labelling.

Guidelines for Generic Official Certificates Formats and the Production and Issuance of Certificates. CAC/GL 38-2001

16. The details of the product being certified should be clearly documented on the certificate which should at least contain the following information.

- nature of the food;
- name of the product;
- quantity, in appropriate units;
- lot identifier or date coding;
- identity and, as appropriate the location of production establishment;
- name and contact details of importer or consignee;
- name and contact details of exporter or consignor;
- country of dispatch;
- country of destination;

These details are not specific to food but constitute the normal fields of information contained in any Bill of Lading for trade between two countries.

There is currently an ongoing debate within CAC on the extent to which traceability should be made a mandatory requirement in the food industry. Although much of the discussion is based on the introduction of genetically modified organisms *(GMO)* and therefore only of minor concern to seafood *(e.g. use of GMOs in fish feed production)*. The implications and in many cases the regulations that have been introduced apply to the entire food industry including the fisheries sector.

On one side of the debate is the European Union, whose position is that traceability is an integral component of food safety control and as such its use should be made mandatory for all food sectors.

TraceFish

The TraceFish project was established under an EU concerted action project *(QLK1-2000-00164)*. Voluntary standards were agreed on for specific sectors. The specifications were established by the group of European business and research organizations. The standards relate to the information that should be recorded at each stage of the supply chain in order to maintain traceability. These standards detailed:

- required information for captured fish distribution chains;
- required information for farmed fish distribution chains;
- a technical specification for the electronic encoding of data, based on the EAN.UCC numbering system.

Each piece of information *(data element)* that was to be collected was provided with a unique identity code and categorised as either:

Shall; The information is necessary to ensure product traceability e.g. processing establishment identity *(name, address, registration number etc).*

Should; It is recommended that this information is recorded, e.g. Product temperature at reception. This category normally may not be critical for ensuring product traceability but provides important links to processing records.

May; The information is not necessary for traceability however it may be beneficial for the business to do so, e.g. names of fish quality, or food safety GMP schemes by which processor is certified.

The key to this system is the labelling of each unit of goods traded with a unique identifier *(ID)* by the business responsible for producing or transforming the product.

The term *"transforming the product"* is used to describe the assigning of a new ID whenever specific units are mixed i.e. mixing of individual batches, addition of ingredients etc.

Each company then relates all process data to this unique identifier code all of which is held on their own computer database.

Since all information is encoded in the specified format, when the source and history of a product needs to be traced it is easily achieved since all the information throughout the supply

chain is in the same standardised format.

This also means that when necessary, the information is easily transferred to other databases via e-mail, for collation and analysis with data from other links in the supply chain, by either the competent authority or independent auditors.

Full details of the Tracefish project and the specifications are available on the website: **www.tracefish.org.**

EU Legislation

Food legislation in the European Union (EU) and how it is implemented within individual member states can seem complicated and confusing. In general directives are classed as either horizontal or vertical; with *"horizontal"* legislation being applicable to ALL food stuffs e.g. hygiene, additives, labelling requirements etc, and vertical being applicable to specific food sectors, such as Fish, Meat, Dairy.

Current EU Legislation refers directly and indirectly to traceability both for general food and specifically fishery products.

The most significant E.U. legislation relating traceability is:

Council and European Parliament Regulation (EC) No 178/2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety. *(O.J. L31 1Feb 2002).*

A central component of this regulation is that in order to ensure the safety of food the food production chain should be treated as a continuum from primary production to the consumer and that this includes production of animal feeds.

Included in this regulation are;

Article 18: Traceability
This makes it compulsory for all substances intended or expected to be incorporated into food to be traced back to the supplier and customers; and that systems are operated in order to provide this information to the competent authority upon request. It is also necessary that all food or animal feed placed in the market be adequately labelled to facilitate its identification and traceability.

Article 19: outlining the responsibilities of food business operators.

Article 20: outlining the responsibilities of feed manufacturers

Articles 19 & 20 make the responsibility of individual companies to immediately:

withdraw product suspected of being unfit for human consumption.

inform the competent authority of such incidents and cooperate with them to reduce or eliminate the risk associated from a product.

Article 11: Requires that all food and feed imported from third countries exported to the EU meet the requirements of this regulation or at least be equivalent.

Although the regulation came into force in 2002, the articles relating to

traceability will not come into force until January 1st 2005. Other legislation concerning traceability is:

Directive 2001/95/EC on general product safety which requires companies to:

- have traceability back to point of production
- have systems to recall unsafe products
- to notify competent authotities of unsafe products

Traceability and product recall systems are therefore a current requirement for all food products in the E.U.

Other EU legislation, although not specific to traceability and product recall systems, regulate various components of such systems in the fisheries industry. The following regulations are not an exhaustive list but provide details of specific examples that are related to traceability.

Directive 93/43/EEC on the Hygiene of foodstuffs:

Details the obligations of food businesses with respect to hygiene and introduces the requirement for all food handlers to exercise due diligence.

Directive 91/493/EEC laying down the health conditions for the production and the placing on the market of fishery products, provides further regulations on hygiene specific for the fish industry.

Directive 89/396/EEC made it a requirement that all food products were identified by a "lot" number, where a lot was defined as

"a batch of sales units of a foodstuff produced, manufactured or packaged under practically the same conditions".

Where the food was pre-packed this means a label attached to the packaging or in the case of non - pre - packed products by accompanying documentation.

Directive 2003/89/EC amending Directive 2000/13/EC as regards indication of the ingredients present in foodstuffs, which must be implemented by Member States by 25 November 2004 removes the earlier regulation that exempts from labelling those compound ingredients constituting less than 25% of the final product and replace it with mandatory labelling for ALL compound ingredients and in particular those food known to be potential allergens, such as nuts and seafood.

Other E.U. legislation that applies to the capture or production of fishery products and contains points related to traceability includes;

Council Regulation (EEC) No 2847/93 establishing a control system applicable to the common fisheries policy and Council Regulation (EC) No 2371/2002 on the conservation and sustainable exploitation of fisheries resources under the Common Fisheries Policy

require that all vessels over 15 m (from 1 January 2005) are monitored by satellite and that member states keep computer records relating to vessel identity, position and catch data.

An essential component of any traceability system is the product labelling. The legal requirements in **Council Regulation (EC) No 104/2000** on the common organisation of the markets in fishery and aquaculture products forms part of the Common Fisheries Policy (CFP) with the aim to:

Stabilise the markets in these products and establish certain marking or labelling requirements for fish sold to the consumer. These state states that certain product categories including fresh fish, are required to be labelled with the:

- Species, common name and Latin name.
- Method of production caught at sea, inland water or farmed.
- Area of capture, FAO defined marine / inland fishery areas or the country in which products are produced by aquaculture.

Commission Regulation (EC) No 2065/2001, laying down detailed rules for the application of Council Regulation *(EC)* No 104/2000 as regards informing consumers about fishery and aquaculture products.

Council Regulation (EEC) No 2092/91 on organic production of agricultural products and indications referring thereto on agricultural products and foodstuffs: this regulation gives the possibility to make national provisions for organic aquaculture including traceability.
EU legislation can be retrieved from the internet at the address: http://europa.eu.int/eur-lex/en/index.html

Non-EU legislation regarding product traceability

In Europe traceability is seen as an integral component of the food safety legislation however in the USA it is seen as a tool to be applied where it is appropriate to:

- meet specific food safety objectives e.g. product withdrawal.
- substantiate voluntary product claims e.g. "organic".

The emphasis in the US is therefore that traceability/trace-back should be not mandatory in the absence of specific food safety concerns *(NFPA 2001).* This ongoing debate has still to be resolved, however despite the apparent differences of opinion regarding traceability there is still a requirement to implement traceability in order to export to the US market.

The responsibility for ensuring seafood products imported into the USA meet the legal requirements fall to the Food and Drug Administration.

Whilst verified HACCP systems are a requirement for importing seafood to the US markets under the FDA rule 21 CFR 123, "Procedures for the Safe and Sanitary Processing and Importing of Fish and Fishery Products" there is no specific requirement to implement a product traceability system. However as part of a HACCP system there must be linkage between batches of product and processing records that can only be achieved by recording batch identification codes onto processing records.

As part of recent legislation introduced

in order to enhance the security of the food supply in response to threats from terrorist attack, the US introduced the **Public Health Security and Bioterrorism Preparedness and Response Act of 2002** ***(PL107-188)*****.**

This act is divided into five sections, of which **Title III: Protecting Safety and Security of Food and Drug Supply** has the most relevance to traceability.

This section has the following provisions.

Section 305 Registration of Food Facilities - requires the owner, operator, or agent in charge of a domestic or foreign food processing facility to register with the FDA no later than December 12, 2003.

Section 306 Establishment and Maintenance of Records - requires the creation and maintenance of records needed to determine the immediate previous sources and the immediate subsequent recipients of food, *(i.e., one up, one down)*. Such records are to allow FDA to address credible threats of serious adverse health consequences or death to humans or animals.

This section is important since it make it a requirement for companies who wish to export food to the US markets to implement internal traceability of their products.

Section 307 Prior Notice of Imported Food Shipments - requires that prior notice of food shipments be given to FDA. **The notice must include;**

- a description of the article /product
- the manufacturer and shipper
- the grower *(if known)*
- the country of origin
- the country from which the article is shipped
- the anticipated port of entry

The amount of notice required depends on the method of transportation but should not exceed 5 days and should be at least 8 hours from time of arrival at the port of entry.

In addition to the legislation the FDA has issued guidelines, that include company's ensuring;

- An effective product recall strategy is in operation.
- Incoming materials correspond to the orders sent to specific suppliers.
- Suppliers of all materials including; packaging, ingredients, labels, etc. are known, preferably by means if independent audit.
- The coding and packaging of incoming product should be known in advance and authenticated upon receipt.
- The location, storage and use of all materials should be *"tracked"* throughout their time in the factory.
- Final product *"tracking"*, be conducted.

All of which rely on the food processors operating a system of traceability *(or as it is known in the USA; "trace-back")*.

Labelling requirements for fishery products.

An essential element of a traceability system is correct labelling so that information relating to the identity, composition and source of the product is clearly and easily transmitted to the next link in the supply chain. In addition there are a number of legal requirements that must be met.

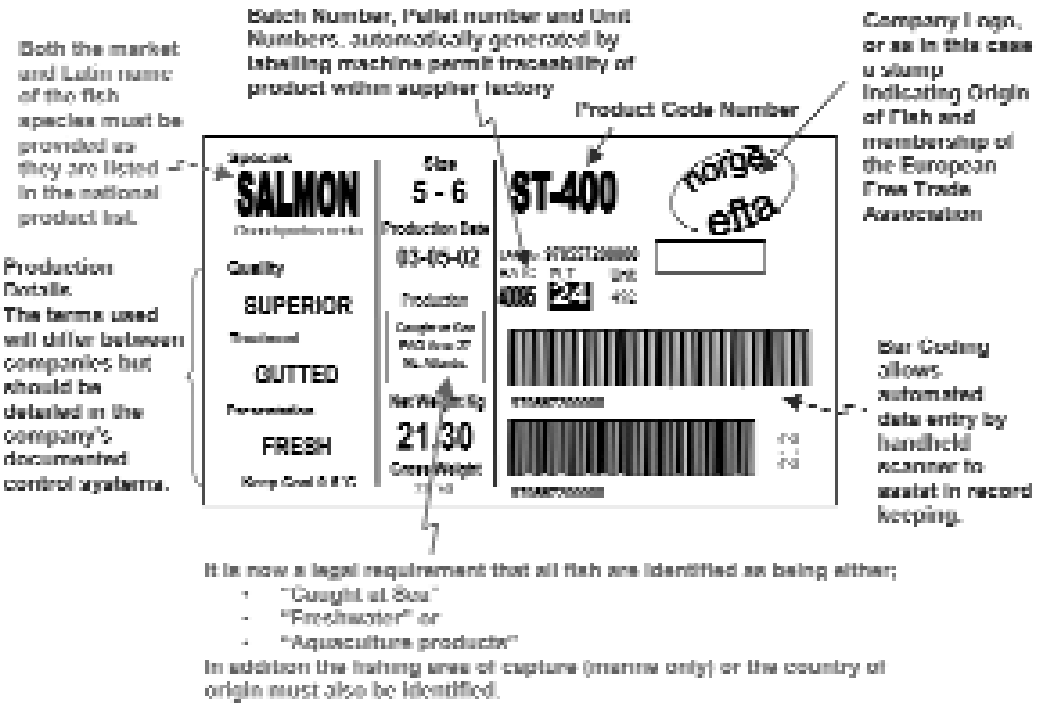
Under current legislation *(EU Council Regulation - 104/2000.)*, the following information must be displayed on the final packaging of fish products that are offered for retail.

Fish species, both the commercial and common name.

whether the fish is from a marine resource or aquaculture.

Area in which fish is caught or farmed. (FAO area or country of origin for farmed and freshwater fish).

However during the bulk transfer of materials through the supply chain additional information is normally required to be included on box and pallet labels, to ensure the identification and traceability of specific units of product is maintained.



Example of Pallet Label for fresh gutted salmon,

3.Internal traceability systems

Components of an internal traceability system

Product identification (ID) codes

The key to a successful traceability system is the assigning of identification codes to specific *(batches of)* products and then maintaining the integrity of the individual batch together with its information throughout its time within the factory. Maintaining the separation of batches can be achieved either in space or time i.e. physical separation of product in separate containers or processing at different times in the same location.

What is meant by a batch? i.e. what amount of product should be treated as a uniquely identifiable trade unit *(T-Unit).* The EAN.UCC has defined a trade unit as;

Any item (product or service) upon which there is a need to retrieve predefined information and that may be priced or ordered or invoiced at any point in the supply chain"..."this definition covers raw materials through to the end-user products and also includes services, all of them having pre-defined characteristics.

This will depend to a large extent on the product involved, whilst it is possible and often necessary to identify whole tuna individually, the same can not be said for shrimp. Some common sense rules should be applied:

The trade unit should be the maximum amount of product that meets the following requirements:

- Originates from the same source at the same time of harvesting.
- Has been processed at the same time and under the same conditions.

The actual code to be used to differentiate individual T-Units will depend on the company and the system of traceability to be used, but in most cases the ID code should;

- be unique to specific product.
- be short enough to be easily read and written.
- convey sufficient information so as to link the specific product to the relevant records.

Supplier		Date	Species	
A B C	Arnold Smith ltd Big Fish Co. Cheeky Cod Bros.	Short date format dd/mm/yy	**Cd** **Hd** **Pl** **Mk** **M**	Cod Haddock Place Mackerel Monkfish

The format for the Batch codes is : Supplier code/Reception code/Species code
e.g. B/070603/Cd
i.e. Cod supplied by Big Fish Co, on 7/6/03

Example of table used to define a simple batch coding system.

In the simplest form of the code, each batch of raw material is assigned a unique 4 digit number which relates to the purchasing records that provide a full description of the material. This has an obvious drawback in that without access to the purchasing records, persons on the production floor can not determine any relevant details from the number.

An alternative would be to encode further details using an alpha-numeric substitution code to provide details of supplier, capture date, species name etc. Providing a key for the code is supplied then the information is easily read *(refer to diagram on previous page).*

This simple form of batch coding can be further developed to include additional code attributes that relate to other product information. This, however, would make the resulting batch code much longer and therefore more complicated to write or understand.

This coding principle has been taken to the logical limit in the use of bar codes and bar code scanners where the code is converted to a sequence of vertical lines of various thickness *(bar code)* that can be read by a laser scanner and converted by the scanner to a series of numbers, each of which in turn relate to a computerised database of product descriptions. *(Further details on EAN standardisation are provided in Appendix 2)*.

The main principle in product coding is to ensure that the various sources of information that are already being used in factory operations are linked, so that if necessary the history of the product whilst in the factory can be established.

Methods by which records can be linked will depend on the type operations being carried out and the records that are kept.

Data management

Traceability within a factory is principally concerned with management of information.

When the product undergoes a processing operation e.g. filleting, then the information that is linked to that product must undergo a parallel operation if the product and the information are to remain linked.

There are several types of data operation that are used in typical factory operations, these are;

1. Transfer

This is the simplest of operations, where it is essential that product ID codes are transferred with the product during processing.

> ***Example:*** *Filleting. Whole fish are taken from a fish box labelled with the batch ID-code; they are filleted and placed into a clean fish box. It is essential for traceability that the ID code is also transferred to the new box. (or in the case of bar codes both the old and new boxes are scanned so as to link the product identity).*

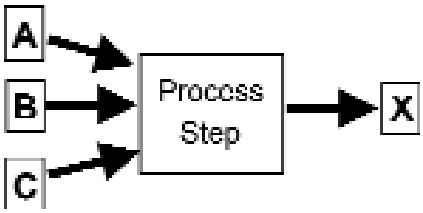
2. Addition

Where during processing additional

ingredient(s) are added to the product. In this situation since the ID-code is still unique to the product, it is continued to be used, although the processing records should identify the ID-Code of the ingredient(s) used.

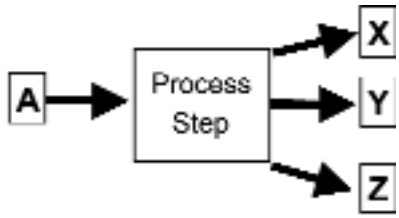
Example: *Brining operation. The same ID-code would be kept by the fish after this process step, although the processing records would show the ID-code of the salt used to produce the brine (as well as brine strength, time of processing etc.).*

3. Joining



Where one process step combines several Traceability-units *(batches),* each with a unique ID-Code.
Here a new ID-code should be established for the new combined T-unit and the records should clearly indicate the ID-codes of all the component T-units.

Example: *A processor has insufficient raw material from one source to fulfil an order. This would require that material with two different ID-codes needs to be combined to provide one batch with a new unique ID-code with the records demonstrating the ID-codes of the original materials.*



4. Splitting

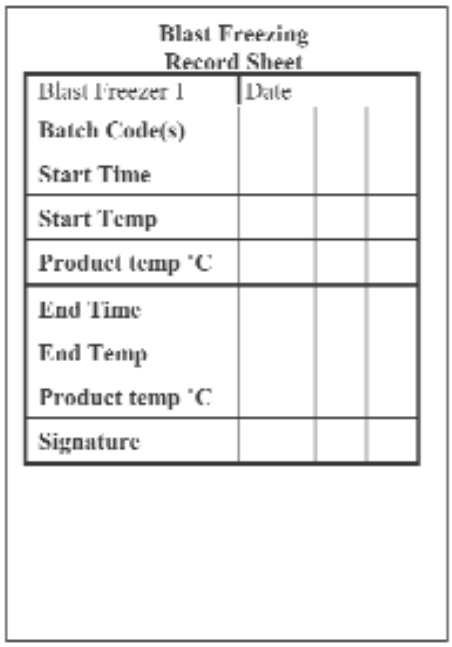
Where one Traceable-unit *(batch)* is split for use in different processes or products.

New ID-codes should be given to each of the split units, although in practice the new code may not be assigned until they have undergone the next process step.

Example 1: *Fish from the same source are placed in chill store waiting to be blast frozen as 3 separate batches. Here the product in the chill store will all have the same ID-code up to the point at which they are transferred into the blast freezer. It is the blast freezer records that should clearly identify the ID-codes of the batch being frozen (A) and the new ID-code assigned to the batch after freezing (Y). In addition it would be advisable to also record the time at which the freezing started so that the time in storage can also be determined.*

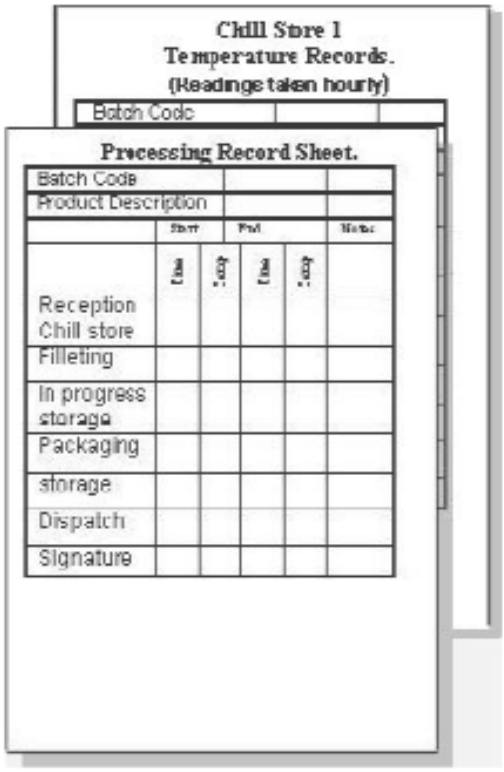
Example 2: *Re-working of material. Materials that are reworked will have processing histories that differ from the rest of the batch being processed and therefore will need to be assigned either different or modified ID-codes to be used on all subsequent processing records.*

In addition to the data operations described the method of recording the information will depend on the process being conducted.



Blast Freezing
Record Sheet

Blast Freezer 1	Date		
Batch Code(s) Start Time			
Start Temp			
Product temp °C			
End Time End Temp Product temp °C			
Signature			



Chill Store 1
Temperature Records.
(Readings taken hourly)

Batch Code

Processing Record Sheet.

Batch Code					
Product Description					
	Start		End		Notes
	Date	Time	Date	Time	
Reception Chill store					
Filleting					
In progress storage					
Packaging					
storage					
Dispatch					
Signature					

Examples of processing records, for batch (blast freezing) and continuous (chill store temperature) operations.

Batch operations:

Batch operations are where the processing is carried out on one lot or batch at a time, *(e.g. Blast Freezing, Smoking, Hand filleting etc).*

Here the processing records provide the batch ID-code and the time/date at which the process was carried out, in addition to other information relating to the processing conditions that may be required in terms of product safety or quality assurance.

> ***Example:*** *blast freezer not large enough for all the same batch then the batch numbers should be modified to take this into account.*

Batch Code: 0406 B

> *Where the 0406 is the batch ID number and the B indicates it was the second batch to be frozen and therefore relates to the second set of temperature results.*

Continuous operations:

In other operations such as automatic gutting/heading, tunnel freezing, metal detection and storage *(chill or frozen)*, processing records are often taken continuously and often automatically. In order that a linkage is established with a particular batch code, the date and time that the particular batch started and finished the process should be recorded separately, on for example the batch processing record.

It may sound strange that storage is a continuous process, however, the temperature is continuously being maintained throughout the storage period and as such the records should reflect this by linking the batch code to

the time the product enters and leaves storage.

A vital point to remember is that a traceability system does not require that all information relating to a specific batch is provided on the product as a label, only that it is possible to link the necessary information. This is usually achieved by using unique individual batch codes that can be linked to all other records.

In practice this can be achieved by either modifying existing paper based systems or implementing a more technological approach relying on bar codes, Radio Frequency Identification (RFID) tags, scanners and computerised systems. These tools and techniques are discussed further in Chapter 4.

Implementing traceability in the factory.

Since a company is required not only to operate a traceability system, but also provide evidence to demonstrate that this is the case, it is essential that the system is documented in a traceability plan.

In the majority of factories, elements of a traceability system will already be in operation as part of other company procedures such as purchasing, marketing, quality assurance etc. The first step in establishing a documented traceability system is therefore to analyse the current procedures and operations to establish what elements are already present and identifying where any breaks in the transfer of traceability information occur.

For clarity the term "operation" will be used to describe any activity that may be carried out by a company as part of its daily routine, this may include process steps, management activities, purchasing sales etc.

A. Analysis of current system

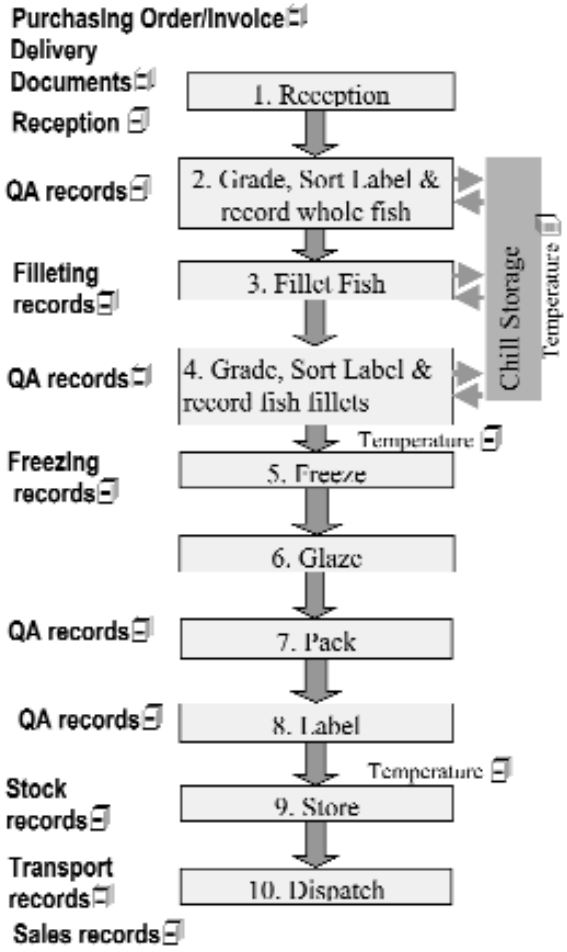
In common with the development of other documented systems within a company's operations, the project needs to be effectively managed and key steps in the development identified. These would include:

Establish the management team: It is essential that the development of a documented traceability system is a team effort since it is unlikely that any one person has the required knowledge and experience due to the diverse nature of the company operations that must be included in the project.

Determine an operation flow diagram: Of all operations that are carried out from the purchasing raw materials to the dispatch of the final product. It should include all the major processing steps.

Identify Procedures in place: Using the operation flow diagram as the basis for the investigation all documented procedures that relate to product information should be identified. This may include purchasing/accountancy procedures, quality assurance monitoring, batch coding procedures etc.

Identify Records in place. It is necessary to identify what records are kept and how these records are linked to specific products and operations.



This information should be collated and written to provide documentation for the traceability system.

The flow chart (left) indicates a simplified process flow diagram for primary fish processing, typical paper based records that are kept and notes of how the information can be used within a traceability system.

The procedures and records should not only include the name of the document but also a cross reference as to its location within company documentation.

Alternatively the information collected during the analysis could be tabulated as below.

Confirm on site. It is essential that all of the above information is confirmed to be taking place within the factory/office.

Analysis of factory operation can either be recorded as a process flow diagram (above) or as a written record in a table (below). The table has the advantage in that cross referencing to specific written procedures or records is easier to achieve.

Analysis of Procedures & Records Currently in Place

	Operation	Procedures	Records	Checked
1.	**Purchasing**		Invoice	1/5/03 DS
2.	**Reception**	Quality Check Assigning Batch code	Quality Assessment	5/5/03 DS
3.	**Chill Storage**	Stock register	Chill store records	3/5/03 DS
4.	**Processing 1**	Filleting procedure	Processing records	1/5/03 PL
5.	**Packaging**	Packaging Procedure	Packaging records Product Labels	1/5/03 DS
			Sales invoice	

B. Assessment of traceability in the factory

With the procedures and records for product information identified within the company, the next step is to assess whether the current system will allow the traceability of product information through the company. The recommended method of achieving this is to use a decision tree and record sheet to ensure that the analysis is both systematically applied to all operations and is fully documented, i.e. records of the system analysis are available to provide evidence of due diligence.

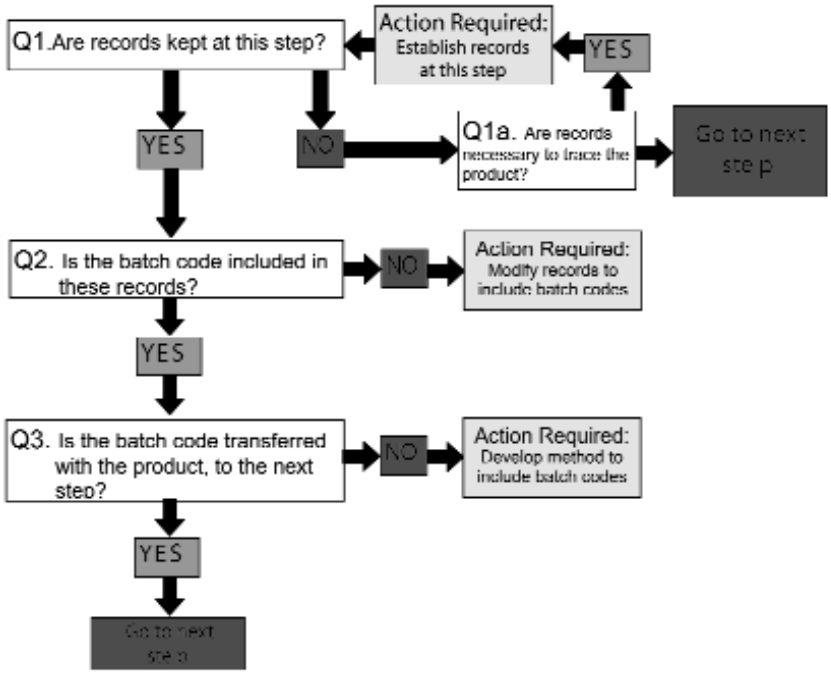
Starting with the first step on the process flow diagram the questions of the decision tree are asked for each process step in sequence.

Question 1 identifies company procedures and records that are relevant to traceability. If records are not kept at this process step and are necessary to ensure traceability then the procedure should be modified.

Question 2 identifies whether batch identification codes are recorded so as to link process data with individual batches.

Question 3 determines whether the batch identification codes are transferred with the product to the next step.

If the answer to any of the questions is no, then action is required to be taken to modify the records or the procedures, so as to maintain traceability of product through the factory.



Decision tree for determining the components of the traceability system in operation and identifying of procedures that need modifying to ensure traceability

The answers to the decision tree questions should be recorded to provide evidence of due diligence and link records and procedures from other management systems operated within the company to the traceability system. This use of cross referencing operations, minimises the repetition of similar procedures for different purposes e.g. by ensuring batch codes are recorded on processing records that are kept as part of Quality Assurance or HACCP system. These records and procedures are also a part of the traceability system.

Having carried out the assessment of the management systems already in operation within the factory and identified steps in the process where traceability is not kept, the relevant procedures can be modified to ensure that traceability is maintained.

Trcability decision tree record

	Question 1		Question 2		Question 3	
	Yes	Record Identity?	Yes	Go to Question 3	Yes	How are codes transferred?
Operation/ Process step	No	Action conducted	No	Action conducted	No	Action conducted
1. Purchasing	✓	Invoice Form AK 101	✓		✗ ✓	Details from agent not linked to batch codes. Batch codes now assigned by purchasing Dept. and passed to Reception QA Staff.
2. Reception	✓	Delivery note Reception QA Records: QAR-022	✗ ✓	Link between batch code given at reception and invoicing details not linked. This achieved by Batch codes now assigned by purchasing Dept. and passed to Reception QA Staff.	✓	Reception Procedure QAP-101 Each box labelled with batch code
-						

C. Product recall procedure

Of crucial importance in establishing traceability system is the requirement to use the product information obtained by the system to recall any product that is found to have the potential to pose a risk to consumer safety. For this reason it is essential that a company has a clearly defined product recall procedure documented as part of their traceability system.

A recall procedure will be specific to an individual company's operations and management systems but should include the following 9 elements, based on the procedure developed by the Canadian Food Inspection Agency:

1. Recall management team

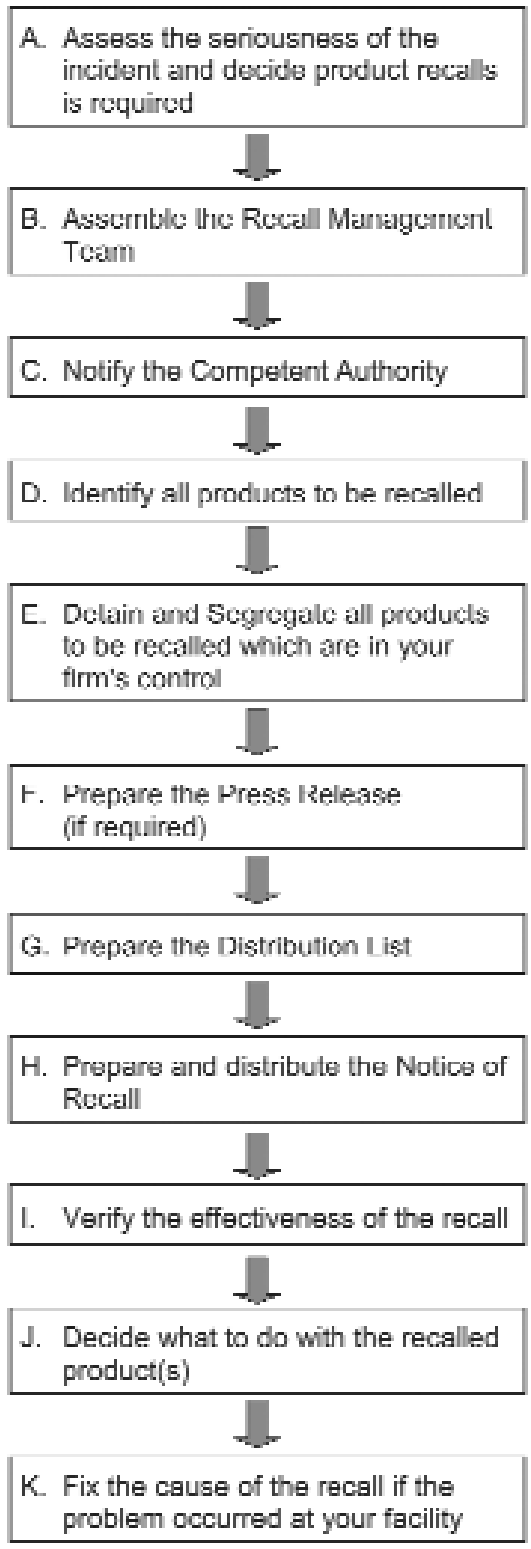
The identity and contact details of each team member and a substitute should be listed together with their responsibilities with respect to the recall procedure. The team should include members of senior management from all departments' involved (QA, sales, production etc), legal and media experts.

2. Complaint file

A formal procedure for recording complaints and specification non-conformance should be established, in which the nature of the complaint is recorded together with the actions taken by the company to investigate the cause and prevent reccurrence.

3. Recall contact list

The contact details of the persons and organisations to be contacted in the case of a product recall should be kept on file and regularly checked.
The list would include;



Example of defined sequence of events for product recall procedure. *(Canadian Food Inspection Agency)*

The competent authority; normally it is a legal requirement to inform the authorities of an incident that warrants a product recall.

Customers: In order to trace the food through the supply chain, the next step in the chain should be informed.

Suppliers: Should be informed of any product found to be out of specification so that they can take appropriate action.

Media organisations: if product has already been sold it will be necessary to inform the consumers of the product details and potential risk.

4. Tracing of products

This can be cross referenced to documented traceability procedures that have been developed by the company.

5. Supply and distribution records

From the traceability records a company should be able to determine who supplied affected raw materials and where products that included the same batches of raw materials were dispatched to. The person responsible for compiling these lists should be identified.

6. Recall procedures

As part of this procedure the different levels of response to degrees of non conformance should be defined. This may range from re-imbursement or replacement for poor quality to a full product recall for an incident that poses a serious risk to consumer safety.

In the event of a product recall it is important that a clear sequence of events is established and followed. Each of the individual steps should have a written procedure detailing what is to be conducted, how and by whom.

7. Recalled product records

For the purposes of accounting, ensuring all affected products have been removed from the supply chain and measuring the effectiveness of the recall plan, records of recalled product should be kept. This should include details of the product, the amount recalled, the date of recall and of product removal from the supply chain and details of what was done with the product i.e. method of disposal.

8. Recall effectiveness procedures

It is good management practice to not only have procedures in place to ensure that the actions take place and are recorded, but that analysis of the events also takes place so as to further improve the system.

9. Testing the recall plan

If a product recall is required, it is too late to discover that the system doesn't work. For this reason it is important that the recall procedure is regularly tested. This may form part of the traceability verification procedure as described in Chapter 7 or may be conducted on a more regular basis.

A simple test would be to select a batch identification code that you know has reached the retailer and then implement the product recall procedure. This would have the

advantage of not only testing the procedures but also providing the personnel with experience and training in their individual roles.

Records of the test, problems identified and corrective actions undertaken to resolve them should be kept.

D. Documentation and records

Although a traceability system is likely to involve components of numerous other management systems already established by a company, it is recommended that the company should also develop separate policies and procedures that are specific to traceability.

These would form the traceability plan and would include the following sections:

- Statement of traceability policy, detailing the company's commitment to ensure traceability.
- Process flow diagram or table.
- System analysis record sheet, this provides a summary of the procedures employed and cross references to complementary management systems.
- Product recall procedure.

In addition to these written procedures that form the traceability plan, records should be maintained of the following points;

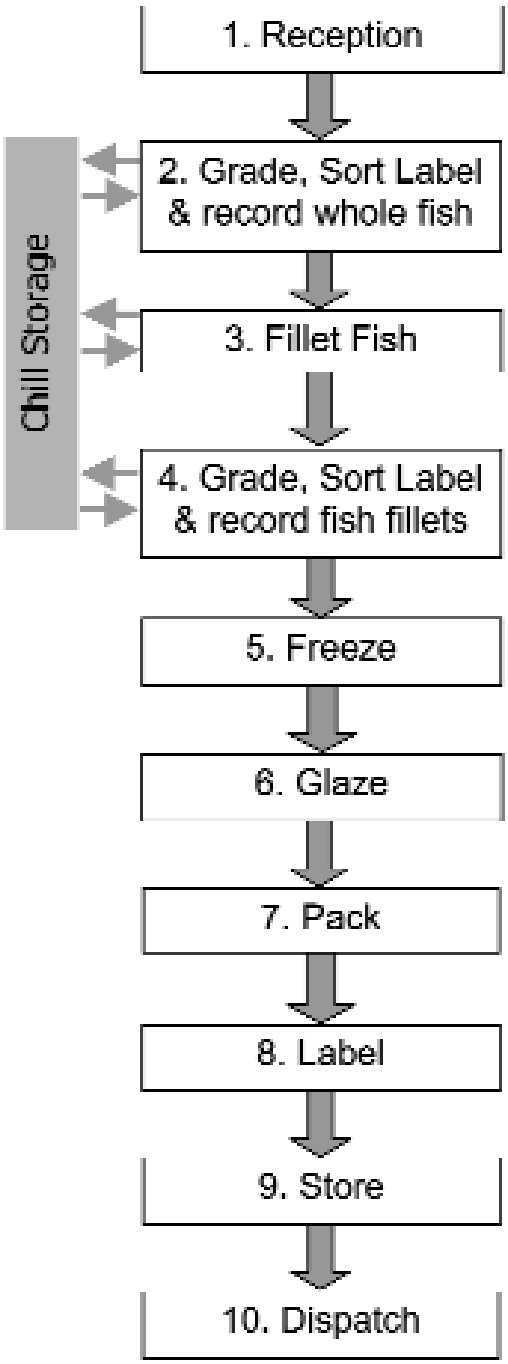
Traceability audits conducted either by the company themselves or by outside organisations e.g. competent authority, customers etc.

Problems encountered, non-conformances and corrective actions.

Modifications to the system due to:

- installation of new equipment/procedures;
- corrective actions;
- customer requests.

4. Traceability systems in practice



Generic process flow diagram for traceability systems.

The key factors to successfully implementing a traceability system within the food processing sector are:

- Obtaining details of raw materials and ingredients from the suppliers.
- Identifying individual batches by product coding, throughout the time that they are within the factory.
- Maintaining batch separation throughout the processing and storage.
- Linking batch codes to production records e.g. frying, freezing or chill storage.
- Of the various different methods by which traceability can be achieved the following are provided as examples;
- Paper-based traceability
- Bar code/scanner systems

The principles that are illustrated in these examples, however, can be used for the development of traceability systems using either a more technological approach *(See section C of this chapter)* or a combination of methods to ensure the transfer and recording of data for the purpose of traceability.

The given example is based on the primary processing of fish and production of frozen fillets in an SME processing facility in Grimsby, UK. A flow diagram of the processing steps is provided on the left.

A. Paper-based traceability system.

All fish processors, irrespective of size will have some form of purchasing, factory order processing, sales and invoicing systems. In smaller companies these systems usually rely on the completion, storage and review of paper based records by employees. Traceability of the product can be achieved by linking these individual systems and implementing some additional procedures during the processing and monitoring of the product in the factory.

Ordering procedures should link information relating to suppliers and raw materials to batch identification codes.

Receiving fish at the factory

Having placed an order with his supplier, whether it is a fishing vessel, sales agent at auction or primary processor, the purchaser on receipt of the fish will receive a delivery/ consignment note which he will sign as proof of delivery. This note will give information as to the origin of the fish and will have its own number, or reference to a purchase order number or buy number. Any of these numbers may be used as the unique number in tracing the product through the process.

Alternatively the purchaser may generate his own unique batch number but this must link back to the originating documentation e.g. purchase order, delivery note or buy number. In this case the batch number information must be passed onto the supervisor at raw material reception so that the product can be correctly identified and labelled as it arrives at the factory.

Raw material intake tickets colour coded by day of arrival e.g. Monday - pink Tuesday - white etc.

Raw material intake

On receiving the fish the supervisor enters his name and the date on the intake record and completes the raw material intake record by noting the following details as provided by documentation from the supplier and or the purchasing department.

Date purchased: this is the date on which the order was placed with the supplier and provides a link with the purchasing records.

Supplier: this can be the vessel, agent or a primary processor

Species: e.g. cod, haddock, plaice

Quantity: the number of containers or units and the weight in each

Grade: will typically be by weight range in kilos or large, medium or small and will describe the form whole, gutted or headed and gutted

Port Landed: the original port.

Vessel: The name of the fishing vessel

Catch location: normally the FAO fishing area. *(refer to map on page 57)*

Date of catch

Buy number: this can be buy number from auction , purchase order number, delivery note number

Batch number: this is the unique number which will follow the product through the process. It can either be the same as the buy number *(i.e. derived from the supplier).*

Or a unique number that is generated within the factory.

Factory Raw Material Intake Record

Purchase Date	Supplier	Species	Quantity	Grade	Port Landed	Vessel	Catch Location	Date Caught	Buy Number	Batch Number
28/09/03	Jubilee	Haddock	30x10Kg	Large Gutted	Grimsby UK	Attain II	VII b	26/09/03	254	01

Intake ticket

On completion of the raw material intake record, the supervisor will make out the intake ticket which will be attached to each pallet in the consignment.

He will also make out an intake ticket, which is a different colour for each day of the week. This provides easy visual identification of stock in stores or processing, as well as identifying the product batch identification code.

Processors will often use their own product code system to simplify the recording of product information.

The code will refer to the species, weight grade, form *(whole, gutted etc.)* and whether fresh, chilled or frozen.

Description; species name, quality grade and form *(whole/gutted, fresh/frozen).*

Source; vessel name, agent or supplier.

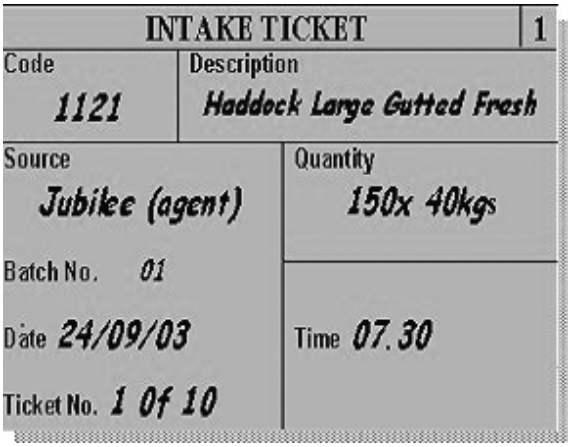
Quantity; the number of units by weight on this pallet.

Batch No. as per intake document.

Date of intake
Time of intake

Ticket No. The total intake quantity as stated on the intake document may equate to several pallets, so the ticket number will be e.g. box 1 of from batch of 10 boxes.

The fish will now move into chill store until needed in the factory.



Placing of intake tickets on each batch of raw material as they arrive at the factory.

Grading of fish using established criteria e.g. Torry grading scheme or Quality index method (QIM).

Grading

When taken from the intake chill store to the grading station the supervisor will remove the box and retain the intake ticket from the pallet and enter the information from the ticket onto the quality assurance records for incoming materials. The information vital to maintaining traceability that needs to be recorded is:

Time; the time the fish arrives at the grading station.

Batch code; this is the same batch code that appears on the intake ticket.

Species; e.g. haddock.
Weight in; the number of units times the weight of each unit on the pallet.

Quality grade; as the fish is graded, in this case to large, medium, small and waste. Each grade is placed into a clean fish box which is labelled with a batch ID label (left).

Weight out; the weight of each grade of fish from the original batch is determined and recorded.

Batch ID Label

Batch Code: 01	Description: Haddock Whole Gutted Fresh
Size: Medium	Quality Grade: E
Date: 24/09/03	Weight: 40kg
Notes: Box 3 of 8	

Daily Quality Record Sheet

Date: 24/9/03

Time	Batch Code	Species	Weight In	Grade	Weight Out kg	Grader
08:45	01	Haddock	10x40kg	E	290	SD
				A	70	
				B		
				Waste	40	

Examples of batch ID labels (above) and quality record sheets (right), used during grading of fish.

Filleting

The filleting supervisor on receiving the graded whole fish will complete the documentation using the information from the batch code ticket. He will also record the weight of fish received and the output weight of the fillets produced; from this the yield can be calculated.

The supervisor will retain the batch code tickets from the graded whole fish and put a new batch code ticket into each unit.

This ticket will be the same colour and contain the same information but will have the product described as haddock fillets.

The fillets are then graded, and again the processing records will be completed and the batch code identification procedure repeated.

The batch code identification ticket will contain the detail of the species, fillet grade, and will be the same colour as the batch ID ticket so as to continue to indicate the day of arrival at the factory.

Batch ID Label	3
Batch Code: 01	Description: Haddock Fillets Fresh
Size: 150 - 250g	Quality: E
Date: 24/09/03	
Notes:	

Information on batch ID labels used to complete filleting records.

The completion of new batch ID labels may be necessary since more than one batch of material may be used to fulfil a consignment.

Filleting Record

Time	Batch Code	Grade	Species	Weight In	Weight out	Yield %	Size	Grade	Comments
10.30	01	E	Haddock	290kg	10		<150	E	
					100		150-250	E	
					40		>250	E	Total yield = 52%
10.50	01	A	Haddock	70kg			<150		
							150-250		

Batch ID labels used to identify fish within the blast freezer need to be securely attached.

Information from batch ID label used to complete processing records

Freezing

Fish fillets from the in processing chill store or directly from the filleting line are transferred to trays and placed on racks to be placed in the blast freezer.

Individual trays or racks will then be labelled with the batch identification label.

It is recommended that the labels be tied to the rack and so can not be blown away during blast freezing.

During the loading, the blast freezer processing records will be completed and include,

The product ID (batch) codes of products to be frozen.

The time and temperature at the start of the freezing cycle.

Temperatures readings during the freezing cycle.

The time and temperature at the end of the freezing cycle.

Upon completion of the freezing cycle, the fillets will be removed from the trays, glazed by dipping individual fillets into cold potable water and then

Blast Freezing Record

Date	24/9/03	Freezer		A		
Batch Code	Product	Start		Finish		Comments
		Time	Temp	Time	Temp	
01	Haddock fillets	10.30	10°C	15:30	20°C	Batch No. 01A
01	Haddock fillets	15:45	10°C	20:30	-20°C	Batch No. 01B

placed into clean fish boxes with an appropriate batch identification label. The fish are then transferred to subsequent packaging and storage steps.

Bulk packaging

Where frozen fillets are placed into to polythene lined card board boxes for bulk storage until final packaging of product is conducted.

Each box would be labelled either with a final product label or a hand written label containing the essential product information, from which all other details are determined by referencing the processing records.

Final product packaging

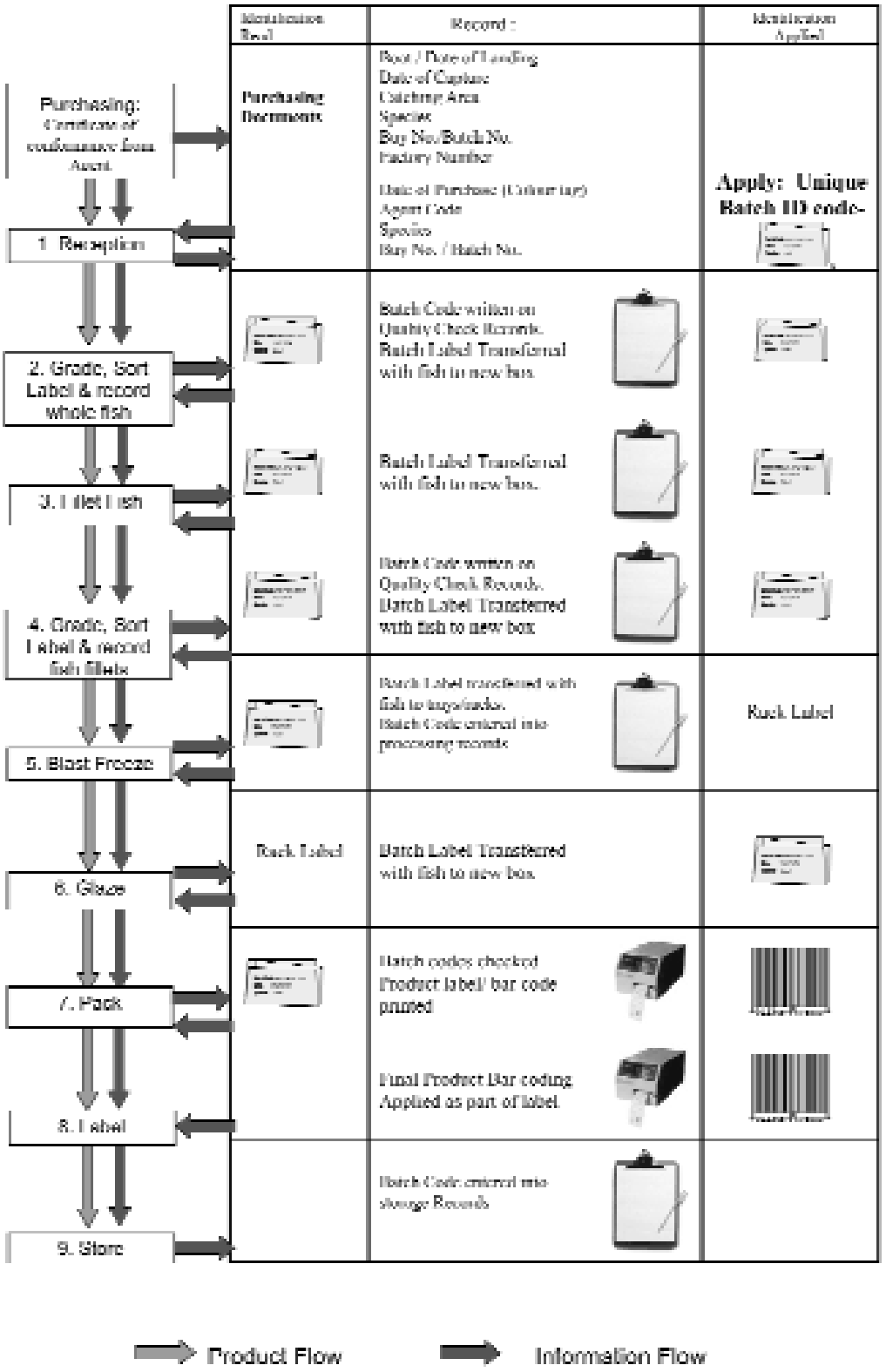
At the packing stage the batch code will be entered into the label printer along with the full product description that will appear on the label, normally below the production date.

As each pallet is completed a pallet label is produced and this again will contain the full product detail and batch code.

Bulk Label	4
Batch Code 01A	**Description** HaddockFillets Frozen
Size 150-250g	**Quality** A
Production Date 4/09/03	**Weight** 25 kg
Notes:	

All product packaging retail packs, bulk boxes containers etc. need to be appropriately labelled with the identity (batch codes) product they contain..

Summary of an example paper based traceability system



Demonstrating traceability through the records.

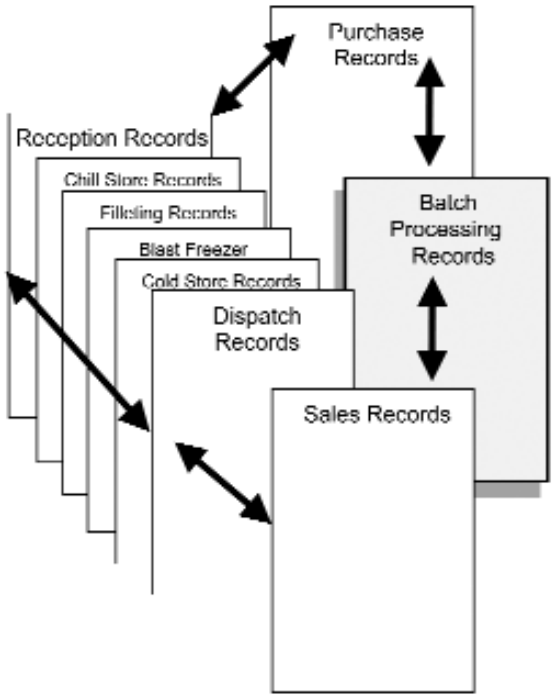
In order to trace information relating to a specific product in a paper based traceability system it is necessary to firstly identify the "batch identity code" of the final product, which should be clearly indicated on the product label.

Using the batch identity code, individual processing records are then consulted to determine the process history. This can be time consuming since processing records are usually stored in date order and a particular product may have been within the factory for more than one day.

The number of processing records even in a relatively simple process means that finding the information manually can be a time consuming task.

This would be made more complex if the final product was composed of raw material from more than one source where at some point within the records, the linking of the two original batch codes would be recorded and process steps that occurred before the mixing of batches would need to be identified thus doubling the number of records to be reviewed.

A method that could be employed to simplify the process of tracing information in a paper based system is to record all process information on a single record for each batch. This "batch processing" record would follow the product around the factory as it is processed. Where batches are mixed the appropriate record sheets would be joined, together with a new record sheet, containing the new batch identification code and all subsequent processing records. The advantage to such a system is that product information is available in a single record, which is ordered according to the final product identification code. There is, however, a problem in that processing records are used for other purposes besides traceability, e.g. HACCP, yields, equipment performance etc. where records are required to be ordered by time/date, meaning that the information needs to be recorded twice, therefore doubling the amount of time completing records within the factory.



Process, purchase, sales and batch processing records linked by means of batch identification codes.

Advantages and disadvantages of paper-based traceability

Advantages	Disadvantages
Based on existing quality assurance/ stock control documentation systems. Inexpensive to implement Flexible in terms of the processing systems to which it can be applied.	Compared with other traceability methods such as bar coding and integrated IT Systems Manually intensive, with respect to writing and collating of records. Reliant on correct procedural operations being carried out, i.e. may be unreliable in the factory due to operator error. Trace-back of information is time consuming and difficult for paper based records. This is especially true where the process operations involve more than one raw material/ingredient. Records not easily reviewed, especially from different parts of the factory operations; therefore only limited strategic use of records/information can be made.

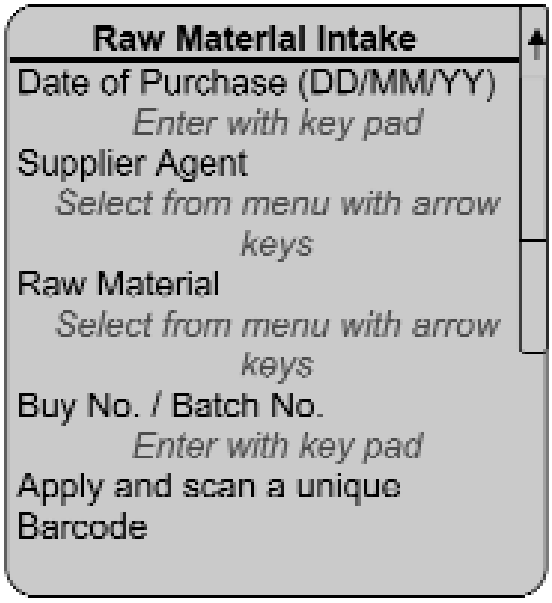
B. Traceability using bar coding systems

Bar codes can be used not only to label and identify the product during all stages of processing, but also individual pieces of equipment. The use of bar codes rely on the use of hand held scanners for reading bar codes and inputting additional data, printers for re-labelling and a coordinated computer system to manage the information.

The major difference between bar codes and a paper based system is with respect to data management. A paper based system relies on transferring the batch ID code with the product throughout the process. Bar-codes, scanners and a computer data-base allows the individual batch to be linked (in the data-base) to each process, fish box or record each of which are themselves identified by an unique bar code.

The system can be implemented to various levels, from only reading information on incoming raw materials and labelling of final product with all other records being paper based, to a fully integrated, traceability system for all factory operations. An intermediate system is provided as an example.
The individual scanners are pre-programmed to request the relevant information to be inputted by means of either;

- the key pad,
- selection from drop down menus,
- by scanning a bar code.



Hand held bar code scanner and example of menu driven data input screen.

Fish box labels with product information both written and in bar code (above).

Product information input to a computer by using a handheld scanner (below).

Additional information can be entered into the scanner using the key-pad (above).

Each process step that has been identified as requiring a data input is listed on the main menu. When information is entered the scanners transfer it to a central data base either by means of a base station or wireless communication (infra red or radio frequency).

At the same time any additions to menus or modifications to the system can be downloaded to the scanner.

Receiving fish at the factory

The purchaser on receipt of the fish will either find that each box of product is already labelled with a bar code encoding the origin of the fish and the other information that is required to ensure traceability or that the information is provided as a written record. In the first case, provided that the bar codes are compatible with the system operated in the factory, then each box will be scanned upon entry to the factory.

Alternatively the information as outlined in the paper-based system as being necessary for traceability needs to be input into the central database and appropriate bar code labels printed and placed on each box as it enters the factory.

On entering the factory and being scanned the time and date will be automatically recorded and linked to the batch code (encoded in the barcode) on the database. At this point additional information may be entered into the system by means of the keypad on the hand held scanner.

Such information may include the box number, net weight, temperature or any other information that is required

with respect to either traceability or product quality.

If the consignment is placed in the reception chill store the boxes should again be scanned together with the bar code for the chill store (see general procedures).

Grading

When taken from the intake chill store to the grading station the supervisor will scan the barcode of the processing area and on each box as well as enter the product information such as quality grade weight etc. into the handheld scanner unit.

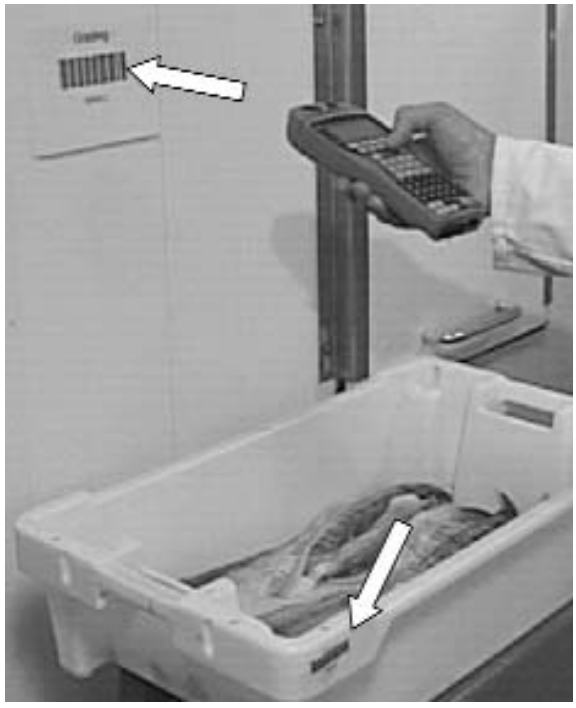
Where fresh clean boxes are used, labels with appropriate barcodes are printed and applied to the boxes to ensure traceability.

Process steps (general)

All process areas, including chill storage, are assigned a unique identifying barcode. This enables the product to be easily associated with a particular process step or storage area at the specific time by simply scanning both the product bar code and the process area bar code.

For example, as each box is placed in the chill store at any point during processing, it is scanned together with the chill store identifying code and the time of entry is automatically recorded. If the same procedure is conducted upon removal from the chill store, not only is it possible to determined the processing history of the batch but also have a real time assessment of stock levels in storage or processing throughput in the factory.

Each location at which a processing operation occurs is identified by a unique bar code.



To link specific batch to a processing operation both the location and box bar codes are scanned.

It is recommended that bar codes and scanners should be used in conjunction with paper-based records.

Glazing

Upon completion of the freezing cycle, the fillets will be removed from the trays, glazed by dipping individual fillets into cold potable water and placed into clean fish boxes with an appropriate batch identification label. They are then transferred to subsequent packaging and storage steps.

Bulk packaging

Where frozen fillets are placed into polythene lined card board boxes for bulk storage until final packaging of product is conducted. Each box would be labelled with a final product label containing the essential product information (see chapter 3) together with a final product bar code, from which all other details can be determined by scanning the bar code and referencing the central data base.

Final product packaging

At the packing stage the bar code of the fish box (or freezer rack) will be scanned and a label containing the final product bar code and other product details will automatically be printed.

As each pallet is completed a pallet label is produced and this again will contain the full product detail and bar code.

Storage

As each pallet of packaged product enters the cold store the pallet label bar code is scanned, and entered into the data base. This could enable a computerised stock control system to be implemented within the factory.

Boxes of frozen fillets are scanned as they are packed. The database combines the information relating to the batch identity, with the weights of individual boxes and prints out label with the appropriate bar code.

Further quality control checks (eg verification of metal detector operation) can be conducted on the packaging line by scanning the location bar code and using the drop down menus.

Each filleter (above) will be provided a unique code on a form (below) so that the supervisor can scan the boxes and filleter ID, to record the rate and quality of work for each person.

Filleters

	Date 24/9/03	
Name	Bar code	ID
Steve		0201
Dave		0202
Andy		0203

Each time product is transferred to a clean fish box or in this case a freezing rack the bar codes of both the old and new container need to be scanned.

Filleting

Each filleter will receive a bar coded box of fish from the supervisor who will scan in the box and identify the filleter either by scanning in an identifying bar code or entering an identification code into the scanner.

Grading

The fillets are then graded and again the process records will be completed. In addition the bar code of the original box & the batch code procedureis then repeated by scanning or inputting data.

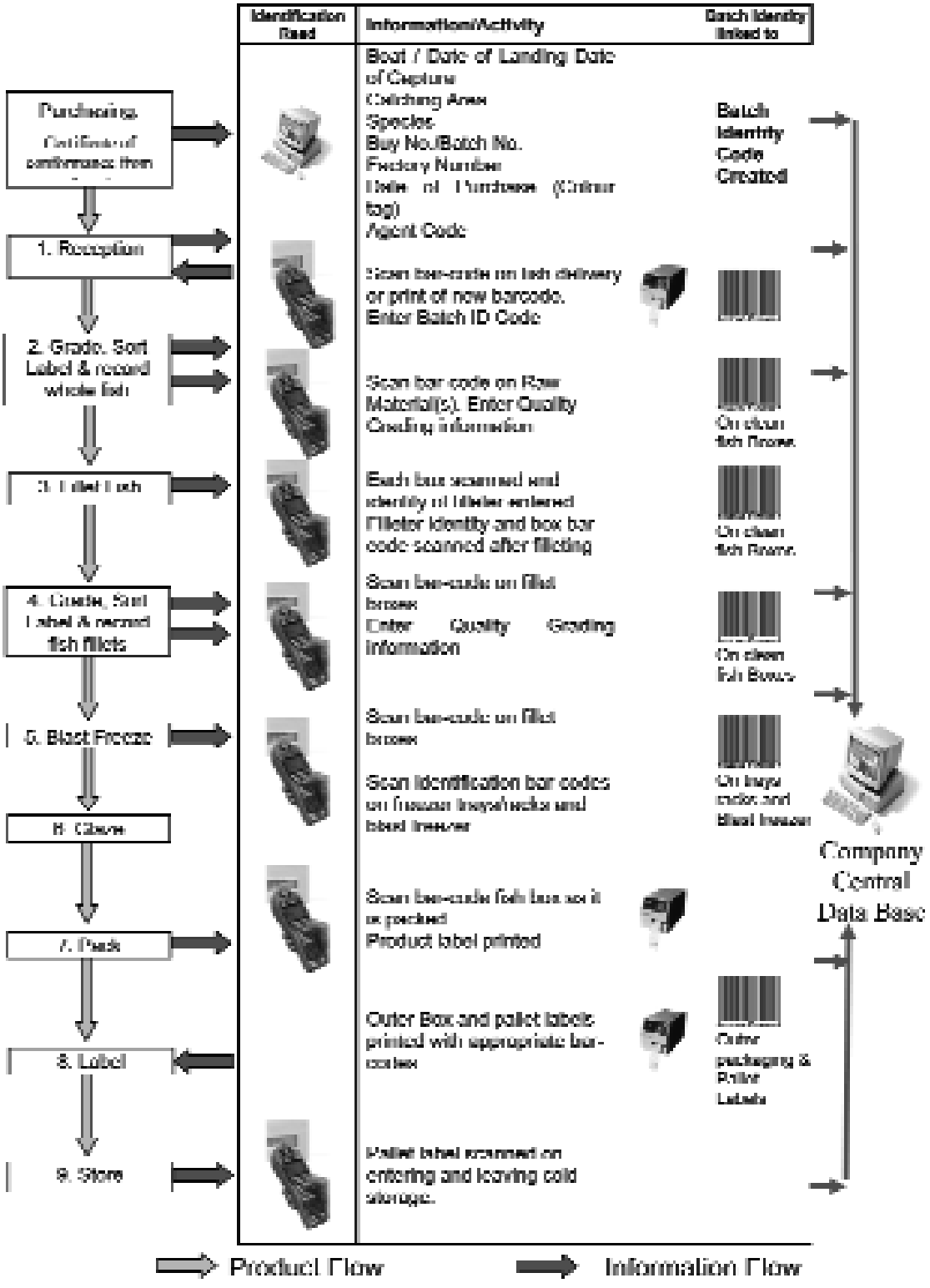
Freezing

Fish fillets from the in processing chill store or directly from the filleting line are transferred to trays and placed on racks to be placed in the blast freezer.

As the boxes are unloaded the bar code on the box is scanned and linked within the data base to the individually bar coded trays or racks that are also scanned.

During the loading, the bar code identifying the blast freezer will be scanned together with the bar code of the racks to identify which racks were frozen in which blast freezer at which time. The records of the freezing process may be paper based as in the paper system previously described. The paper records can be linked to the computer records providing the time, date and freezer identity are included both in the database and the records. Alternatively if there is an automated temperature logging device installed, the temperature profile of the freezing cycle can be automatically linked to the appropriate batch codes within the data base.

Frozen fish fillets processing flow diagram and traceability operations using hand held scanners



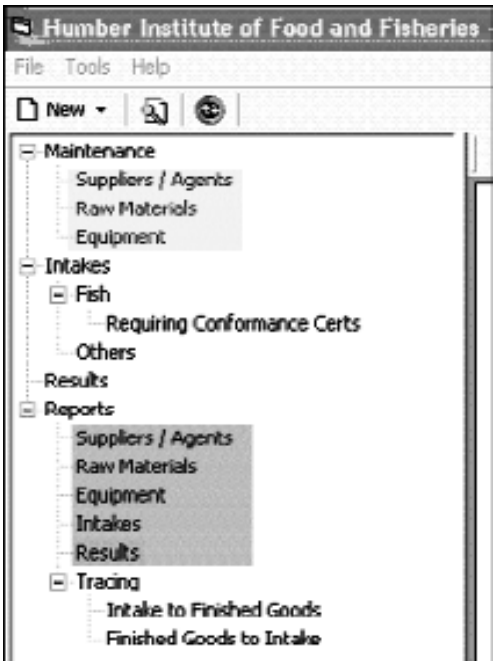
Demonstrating traceability through the records

The software that enables the bar code scanner to download data to the central data-base has a variety of supplementary functions that are shown in the screen shots (right). These are accessed via a main menu (Fig A) where the information necessary to produce the menu system on which the scanner operates is inputted into the system (yellow highlight). This information includes the raw materials, the details of the suppliers/agents, types of raw materials, and of course the identifying bar codes for individual boxes, containers, equipment (freezer) and processing steps (filleting, cold storage etc.) (Fig B).

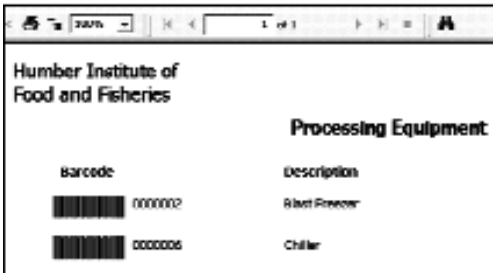
The software's main function is to collate and organise the data to produce a variety of different reports (pink highlight).

The outputs of the reports (Fig C) can be modified to suit the requirements of the company, but the information they present essentially identifies the product batch code to the time and date that the batch arrives at a specific process step (e.g. reception or freezing), as identified by the identity of the bar code for the specific box the product is in.

A



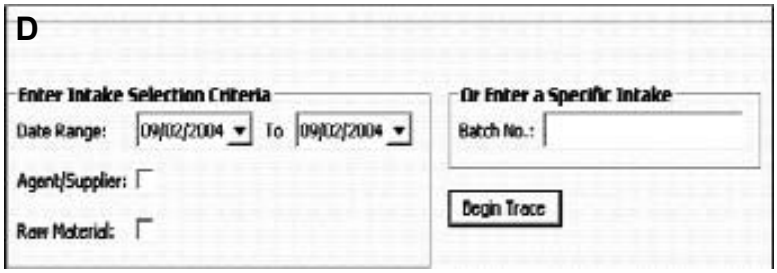
B



C

DateTime	Description	Container	InOut	Equipment	Materials
25/09/2003 10:24:40	Packaging / Finished Goods	ffdd2	Out	Packing Line	(Haddock - 25/09/03 - J.W.
25/09/2003 10:24:40	Packaging / Finished Goods	10010431	In	Packing Line	(Haddock - 25/09/03 - J.W.
25/09/2003 10:24:20	Freezing Out	10010431	Out	Chiller	(Haddock - 25/09/03 - J.W.
25/09/2003 10:23:58	Freezing In	10010431	In	Chiller	(Haddock - 25/09/03 - J.W.
25/09/2003 10:22:48	Forming	10010431	Out	Freezer	(Haddock - 25/09/03 - J.W.

D



Screen shots of scanner tracibilty software. Refer to text for explanation.

This makes reference to the paper based records much easier since both they and the batch code are linked by the time and date. The software is also able to organise the information within the database to provide a traceability report for any product selected by date type, a supplier, or batch code of raw material (i.e. traceability from intake to dispatch). The information can also be obtained by entering either the final product code and customer identity (finished goods to intake) i.e. trace back. The selection process is conducted on a simple menu screen (Fig D).

The advantage is that these reports are obtainable as soon as the data is transferred to the database. A paper-based system would require a person to review the records and manually trace the batch codes through the records for each of the situations described.

Advantages and disadvantages of using bar codes and scanners for traceability

Advantages	Disadvantages
Data input easy and often menu led, so minimising potential staff errors and maximising the potential efficiency of the work force, who will spend less time completing records..	Requires capital expenditure for equipment in order to successfully implement. This is especially true where processing information is to be automatically logged and integrated with the scanned data.
Additional information can be entered into the hand held device so that records such as product quality temperature etc are also included in the data-sets.	Paper Bar codes easily damaged, losing all information.
Each Scanner can be used to collect data from various process steps therefore minimising capital expenditure and maximising use of equipment	Technology can be unreliable, so an additional paper based system is recommended as a back-up system
Central data-base means that data is easily collated and utilised for strategic control of on-going processing, maintaining records and writing reports.	
Real time availability of records results in improved stock and process control.	
This information is down-loaded to a central data-base which can collate and process the information to provide the necessary reports and records.	
Integration of Traceability into all factory operations not just quality assurance.	
IT and the data-base can be used to easily receive and transmit selected data both from the suppliers and to customers, therefore ensuring traceability throughout the supply chain.	

C. The use of modern technology in traceability

During the last decade there has been huge developments in the design and implementation of Information Technology (IT) systems. The technological innovations and techniques developed for other purposes are increasingly being used within the fishery sector for the management of key activities e.g. accounts, process management, quality assurance etc. They can also be used to manage and collect, information necessary to ensure product traceability.

Central to the use of IT is the use of computers within the factory. More importantly their connection to form an intranet within the company allows for the rapid communication of information.

The use of e-mail and the World Wide Web make the transmission of information between suppliers and customers easier and quicker. The information should be formatted to facilitate integration into the company's data-base.

In both cases the information needs to be stored on a central database which is normally designed to meet the requirements of each individual company or system. This provides a variety of tools with which the information can be collated and analysed to give the necessary reports and records.

There have been several technological innovations that have been successfully used in maintaining traceability of fishery products.

Radio frequency identification (RFID) tags

RFID technology has been extensively used in non-food products to provide real-time automatic product identification and as such is an established technology that has an extensive range of uses.

RFID systems use radio waves of specific frequencies to read, and/or modify data stored in electronic circuits or a micro-chip that is usually encased in durable plastic to form a "tag". The RFID system consist of 3 components, The transceiver which transmits energy (in the form of radio waves) via an antenna, which when it encounters an RF tag, results in the tag emitting a radio signal that can be picked up by the transceiver and decoded to reveal the information contained in the tag. The transceivers can be incorporated into various types of equipment ranging from portals (doorways); handheld scanners similar to the bar code scanners; specific pieces of equipment e.g. weighing scales and have even been built into the glove of the person who handles fish boxes.

There are two types of RFID tags,

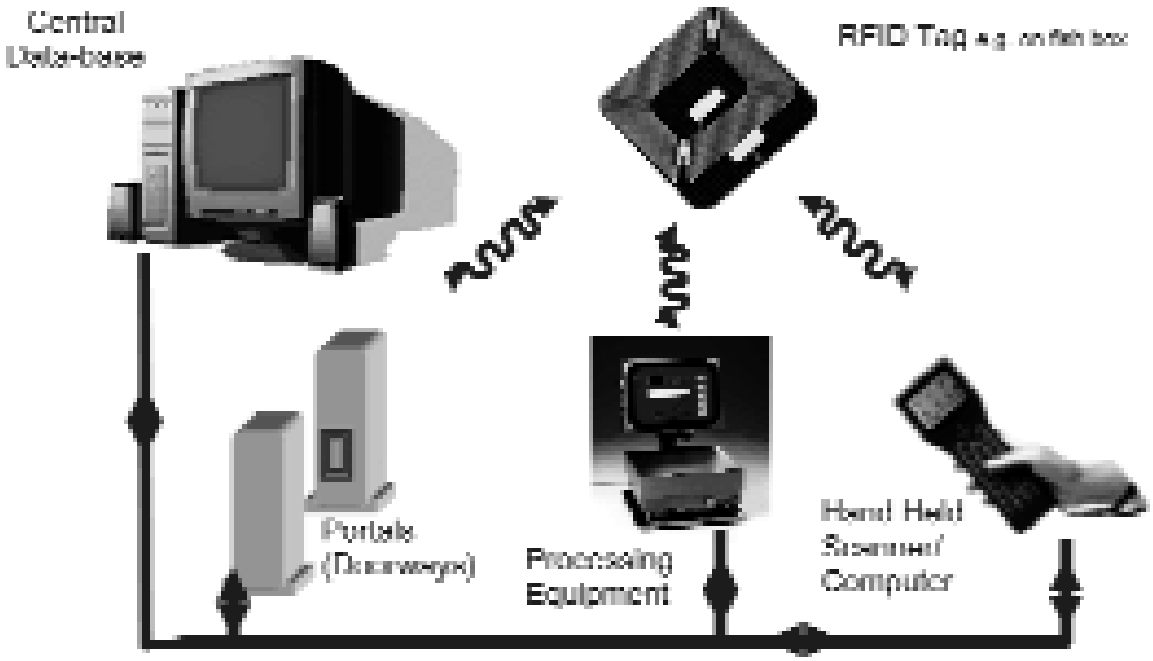
Active: which has the ability to transmit their information by using an internal power supply.

Passive: which rely on the transceiver to provide power in the form of radio waves in order to transmit their information to the transceiver. Being cheaper and not needing a power source it is this type that is most

commonly used for product identification.

RFID tags vary in the amount of data that they can encode and store. The simplest (and cheapest) tags, store only a unique identification number that can be linked in a data base to the details of a specific product. Others can encode much more product related information, in a similar format to that used by bar-codes (see Appendix 2).

RFID tags can be attached to fish boxes, freezing racks etc. and are used to carry the traceability information in a format that can be read automatically and at a distance. The advantage to this method is that the box needs only to be placed on a scale or passed through a detector for the identification information to be automatically determined and only additional information added e.g. quality grades, weight etc. This can be achieved by inputting the data via drop down menus on a touch screen interface.



Network of equipment linked by wire and radio transceiver enable the linking of process information with specific product identities, location and time with a central computer database.

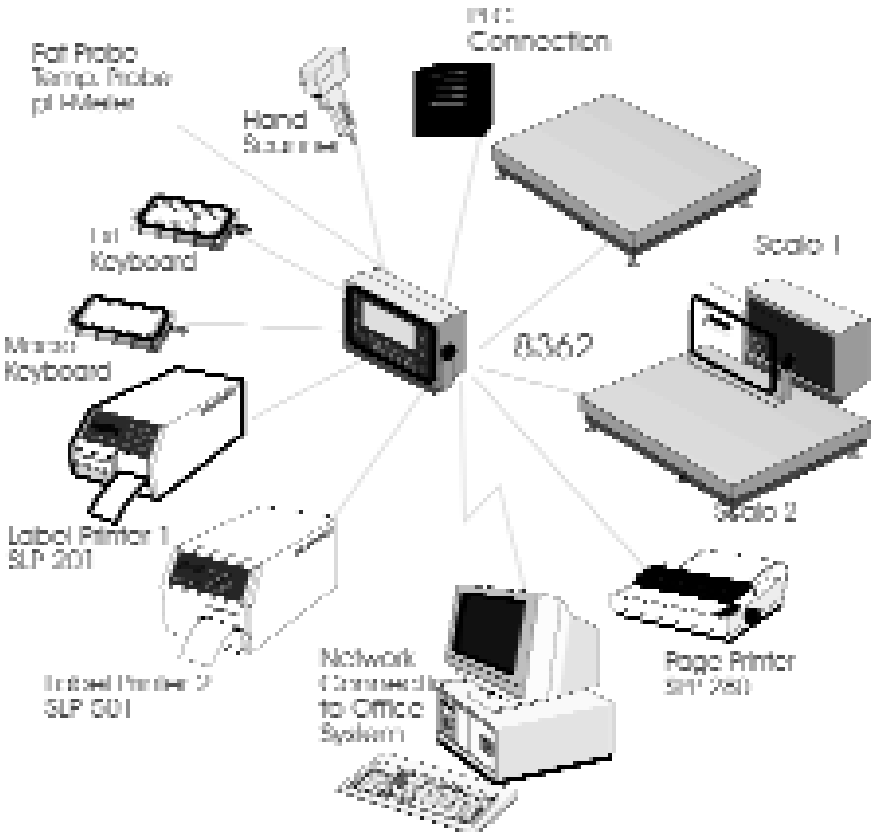
Computer linked equipment

The linking of specific processing equipment to a computer network has become increasingly common place since it:

- Reduces the need to manually record process information, hence reducing the possibility of error and improves the productivity of the employee.
- Provides continuous monitoring of a process, therefore making it possible to correct any deviations before they become critical.
- Records are easily stored on a central database for collation and analysis as required.
- The technology is now relatively cheap in relation to the equipment itself.

Whilst most computer-linked pieces of equipment are used to gather process related information for purposes of Quality assurance, e.g. temperature monitoring of cold and chill stores, some systems have been developed to also have a role in product traceability.

An example system has been developed by Scanvaegt Ltd. (see below) in which a range of equipment including office workstations, product balances, label printers and hand held scanners have all been linked into a single integrated data managements system. Such systems use specialised equipment that are specifically designed to record and transfer information to the central database.



A wide range of processing equipment is now produced, that can be linked to computer databases for automatic recording of processing records.

Nesco's Traceway touch screen data input system on a weighing scale at reception (above). The operator is able to select information from a series of drop down menus (below) by simply touching the screen on the selected item.

A

Screen A provides options to link a supplier to a specific consignment.

B

Screen B gives a reading of the weight whilst allowing for selection of either tare weights or several boxes from the same batch to be measured.

An example of this approach is the range of weighing scales (Traceway) developed by Nesco Ltd. for use within the fish processing chain. They not only weigh the product and record the information on a central database but also enable additional information to be added to that database. This information can relate to the origin of the fish and/or other process information such as quality grades etc.

This additional information can be added to the central database by various methods, including:

Touch screen technology: allows the operator to select and enter information from a series of drop down menus by simply touching an icon visible on the screen. The data to be included can include supplier details, product information such as species, fresh/frozen, quality grades, temperature, and batch code.

C

Screen C provides summary of all information entered for a specific batch. Since this information is held on a central database a report can be easily printed

Barcode scanner; can read the product information on a product label and transfer it automatically to the database along with the product weight and time/date.

RFID Transceiver; automatically reads the information contained in the RFID tag and transfers this information to the database.

The advantage to traceability is that once the information is entered onto the database, the additional information can be linked to the product either within the database or by updating the information carried by that particular box of product by either printing a new Batch Identification Label (with bar code) or updating the data on the RFID tag.

In an integrated IT traceability system the batch identification code is not necessarily physically attached to the product. Like the bar code system, batch ID is retained within the database and its progress through the factory is monitored by the equipment linked to the database which inputs to the database what was processed and additional to process related data.

It is recommended that product is labelled with identifying information in the form of product labels so that the process workers can also identify the product.

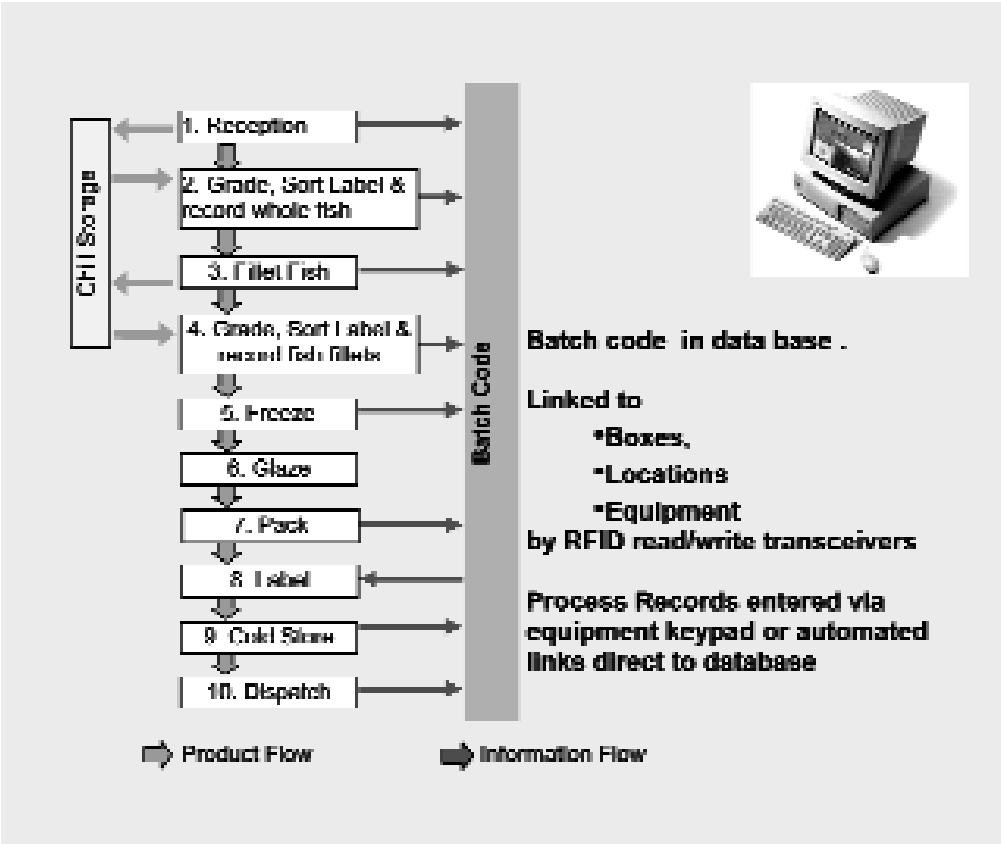


Diagram of product and information flow through the process with the use of an integrated IT approach to traceability.

An integrated IT traceability system

Using the example of primary processing previously used to demonstrate how traceability is implemented in a factory; the following components were installed to provide a simple integrated IT Traceability system based on RFID technology:

- Internet connection.
- Computer data-base and monitoring software.
- Temperature monitoring system linked to the computer.
- Computer linked weighing scales at reception and packaging.

Wall mounted RFID transceivers located at entrance/exit, to the factory, chill store, blast freezer cold store and start of the packaging line (1, 3, 5, 6 & 7).

Hand held RFID transceivers for use at grading and filleting stations (2 & 4).

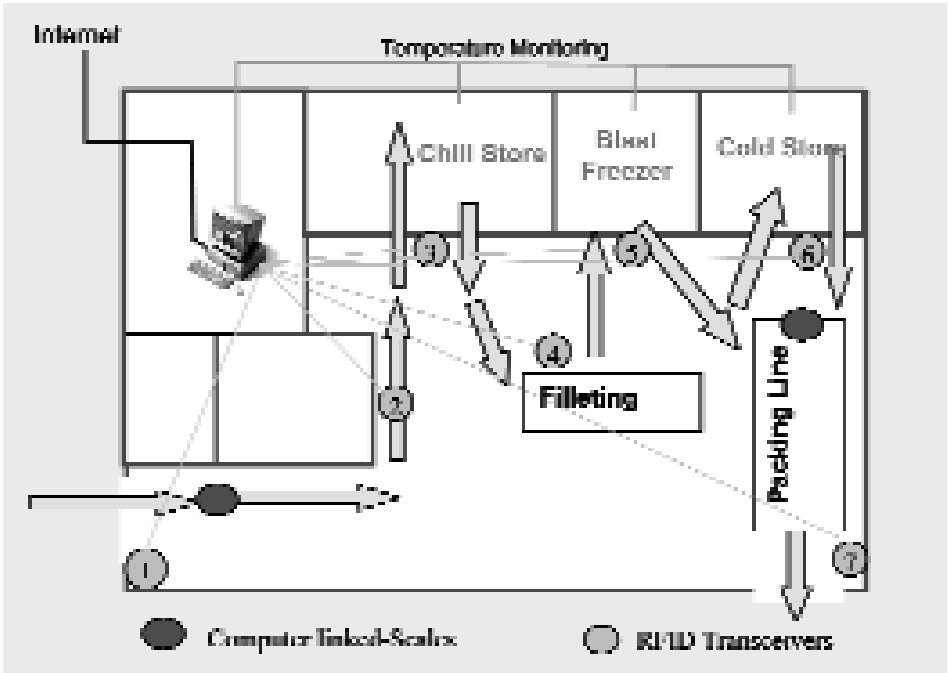
Receiving fish at the factory

Information relating to the identity, quantity and source of raw materials are entered into the central database either by a factory worker or directly from the electronic transfer of the data via the internet.

On arriving at the factory the fish are identified either by the RFID tags on the boxes, bar coded labels or accompanying documentation.

Where RFID tags are not present the fish can either be transferred to boxes with RFID tags attached or a plastic label containing a RFID tag placed in the box to identify the batch.

The advantage of initially using such a label is that product information can also be written on it with a water proof marker pen so that process workers



Example floor plan for fish processing with position of RFID transceivers and integrated scales identified.

can easily identify the product. It also means that the label can be transferred with the product from one box to another therefore reducing the number of RFID tags that are required.

The raw materials then enter the factory and the time and date is automatically logged by transceiver 1. Each box is then weighed and the details of the raw material are checked and linked to the RFID tag using computer linked weighing scales.

If the consignment is placed in the reception chill store the RFID tag will be automatically logged as it enters or leaves the chill store (transceiver 3).

Grading

In order to grade a box of fish the QA supervisor will scan the RFID tag with a hand held scanner, grade the fish and enter the results into the data base via the scanner.

Process steps (general)

When the fish are transferred to a clean box any process step then using the batch identification code encoded in the RFID tag is erased from the old box and transferred to the new box using the hand held transceiver. Alternatively the RFID containing box label is simply transferred to the new box.

Filleting

As each box is removed from the chill store to the filleting area the time & date is automatically logged. At the filleting station the box is scanned using a handheld scanner (4) and the identity of the filleter, the weight and quality assessment of the fillets is entered by means of a drop down menus on the transceiver screen.

Alternatively, an additional set of computer linked scales could be introduced at this point to automatically record the weight of the whole fish and fillets, whilst the identity of the filleter is similarly entered via drop-down menus on a touch screen.

Freezing

The fish fillets are transferred to freezing racks containing RFID tags and the product identification codes are transferred using handheld transceivers. The time and date that the racks and fillets enter and leave the blast chiller are automatically recorded as is the temperature, which is automatically monitored throughout the freezing cycle.

It should be noted that if product temperatures are required then the use of a temperature probe inserted into the product will be required.

There is a minor problem in that most RFID tags currently in used are only certified to work down to -30°C and as such may suffer data loss or damage at -40°C commonly used in blast freezing. To overcome this problem the hand-held transceivers can be used to input both the identity of the freezing rack a particular product is placed on and the start time of the freezing cycle, therefore avoiding the need to place the RFID tags into the blast freezer.

As frozen product is removed from the blast freezer and placed into clean fish boxes the Product identification number is transferred to the new box.

Packaging

As RFID tagged boxes of final product are placed on the packaging line the product identity is automatically transmitted to the database which if linked to a suitable printer and product ordering software can automatically print out the required product label, containing product information and bar codes.

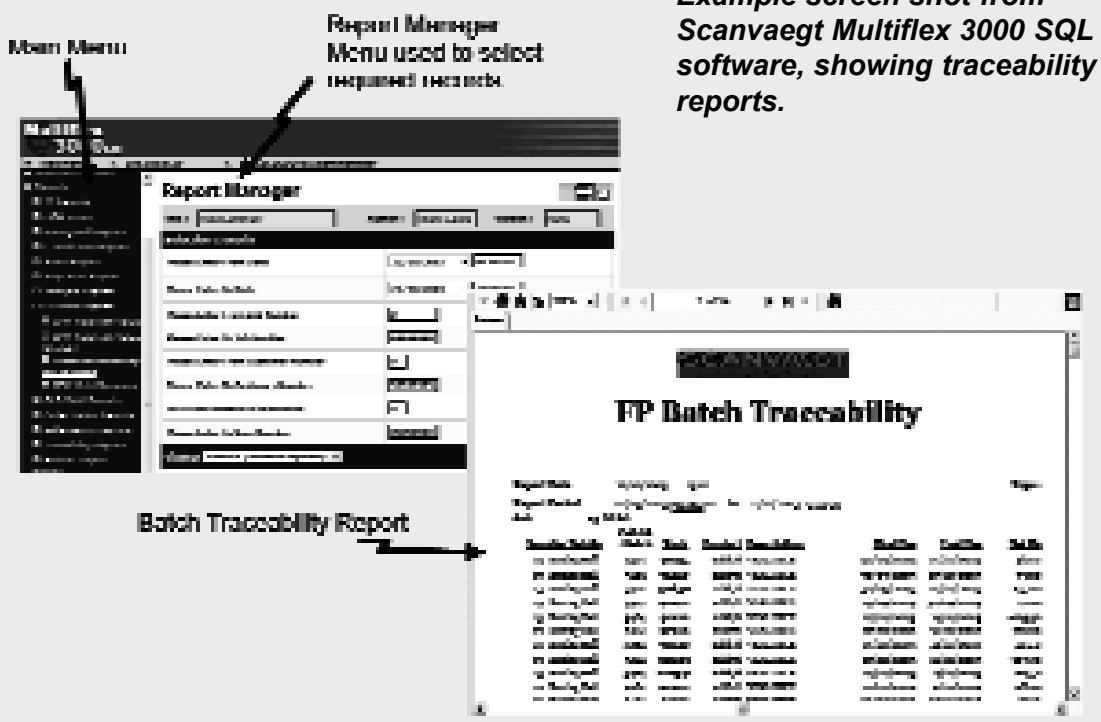
Storage

As packaged products are placed on a pallet for storage and transport, the identity of the pallet can be determined ether from an integral RFID tag or by means of a pallet label containing a RFID tag. This will update the database upon entry or exit to the cold store (6) and on leaving the factory (1).

Demonstrating traceability through the records

The major advantage of using a fully integrated system is that all product and process information is linked on a central data-base, and as such the collation and analysis of the large amounts of data generated by a fully integrated system is conducted in real time by the relevant data-base software programmes.

Each database system will differ in its operation. However an example from the Scanvaegt Multiflex 3000 Sql software system is used to demonstrate the principles of producing traceability reports with a fully integrated IT Traceability system.



Example screen shot from Scanvaegt Multiflex 3000 SQL software, showing traceability reports.

Using this system to obtain product traceability information means the identity of the product to be traced is entered into the report manager page.

The information can be requested in terms of the supplier, customer, date of intake, processing or dispatch, or the batch identification number.

The specific report that is required is then simply selected from the main menu on the left hand side of the screen. The resulting report can then be printed out or sent via e-mail to other offices.

Since such integrated systems can provide real-time information as to the location of product within the factory it is possible to present a systematic layout of the factory and identify which batches are being processed at individual steps or in storage, at any specific time. This allows the efficient management of the factory and process to meet required orders for the product.

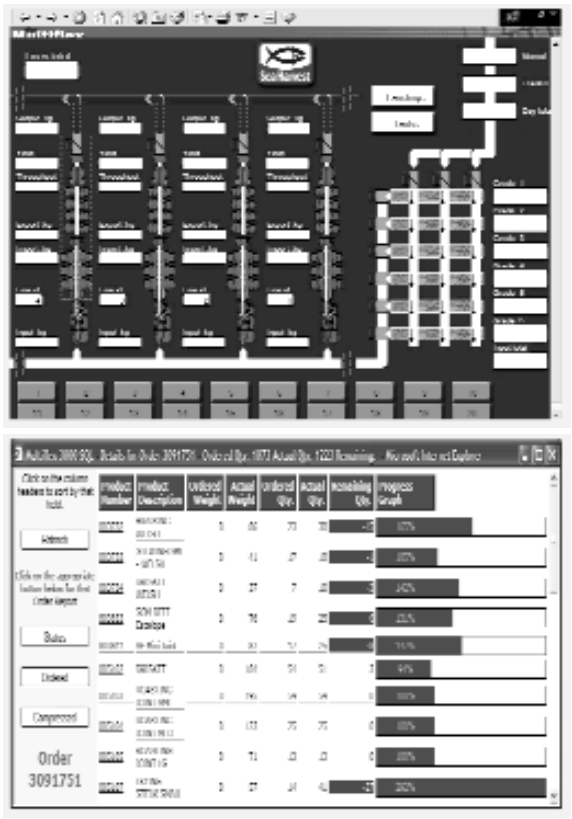
Discussion of traceability methods

The examples of traceability systems discussed have shown how traceability can be achieved in the primary production of fish using either paper based records or a bar code/scanner system combined with computerised central database.

It is, however, more likely that within a factory a combination of different methods would be employed to ensure product traceability and the linking of specific batches to processing records.

Providing that the integration of new technologies or methods into an existing traceability system is carefully managed the benefits of a technological approach can be provided in a stepwise development of the system, with minimal capital expenditure.

An example would be the use of a paper-based system during processing but using barcode scanners to record the reception of raw materials and control of packaged product i.e. those parts of the process where barcodes



Screen shots from software used in an intergrated IT approach to traceability showing how the progress of product through the factory (top) and how product orders are being completed (bottom), in real time using batch identification via RFID tags.

are already on the product either as part of the supplier documentation or final product labelling.

This could be achieved with the purchase of only one or two scanners, depending on the size of the factory, and appropriate software. The benefits could be significant in terms of reducing the amount of supplier information that needs to be entered into the company records and stock control of the final product.

Although the differences between the methods of establishing traceability are minor when used in a simple process such as filleting and freezing fish, the benefits of using a more automated system become more apparent where processing involves more complex operations such as the manufacture of breaded fish product.

Advantages and disadvantages of technology-based approaches to traceability

Advantages	Disadvantages
Flexibility: The system can be customised to user's specific needs. The types of equipment, scanning systems, data-base software etc can be adapted to meet individual companies requirements data input easy and menu led, minimising errors.	Primary function is as a management tool to capture processing data, with traceability as a consequence of the system rather than the primary design reason.
Compatible with hand held scanning systems and paper systems.	Requires capital expenditure for equipment.
Provides detailed management information from central data base.	This should be evaluated against potential cost savings in material, labour and other resources.
Starting with a simple yield control system it can be developed into a Full Factory order process system, providing full traceability across all factory operations.	Relies on either ID tags/labels throughout process or Bar code scanning an additional capital cost.
Incorporates recipe management system providing full traceability of all ingredients, yield control and stock management information.	
Real time availability of records.	
Data from database is easily transferable throughout the supply chain.	

5. Traceability in the supply of fish

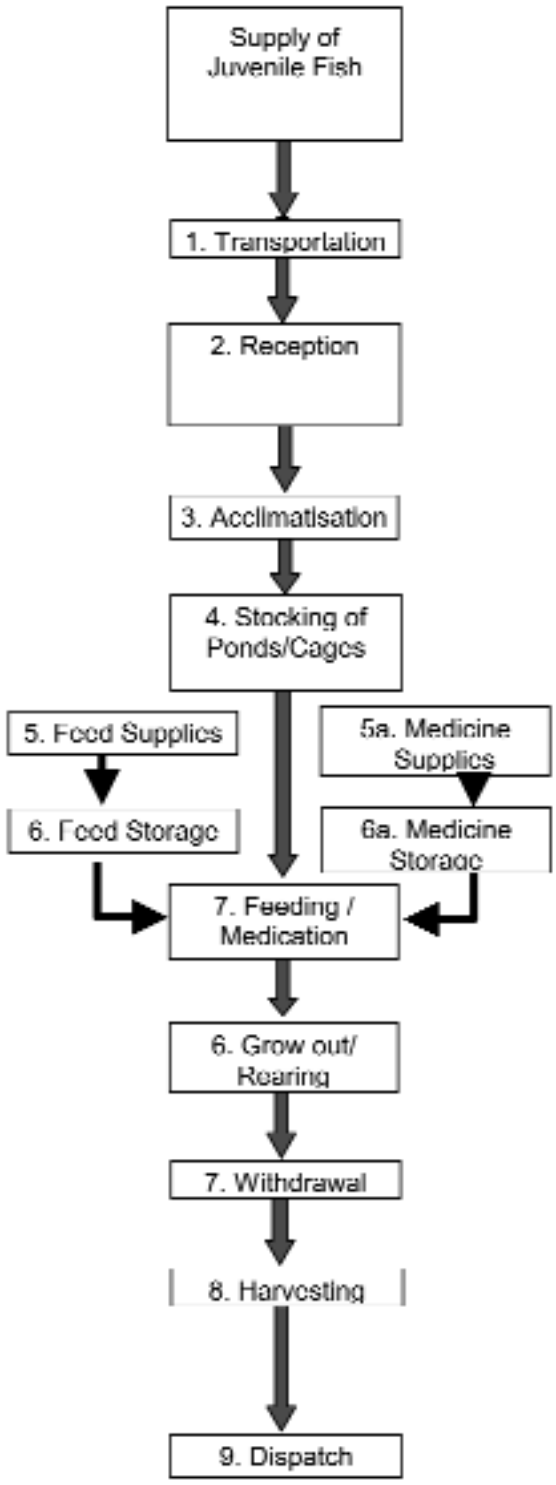
Aquaculture

The rapid development of aquaculture products in the market and perceived risks through uncontrolled feed and medicine demands increased safety and traceability control. The greatest expansion has been in developing countries with the result that international trade in aquaculture production has seen increased demand for traceability. Whilst ensuring product safety has been the primary concern of the regulatory bodies, trade, environmental and quality issues are also seen as vital. This has resulted in a wide range of legislation, industry guidelines and international standards being developed for the industry. Although traceability is not necessarily specifically mentioned all matters that relate to safety, quality and trade rely on the ability to identify and trace the product.

In the proceeding chapters, the principles and practical aspects of applying traceability to the fish processing sector were discussed.

The same principles and methods can also be applied to the production of fish in the aqua/mari-culture sector of the fish industry.

The wide range of seafood /freshwater products that are now being cultured together with the diverse nature of production methods, mean that only the principle components of traceability system are within the scope of this publication.



Generic Process Flow chart for aquaculture of fish on which traceability system is discussed.

Individual tanks, ponds and cages should be uniquely identified so that fish batches can be traced throughout their lifecycle.

Supply of juvenile stock

The source of the juvenile fish, fry or eggs should be recorded, whether this is from a commercial supplier, in-house hatchery or from the wild.

At the start of the production chain it is important that the species identity should be determined. Industry should use the correct scientific, rather than the local, name.

It is recommended that the health of the stock be confirmed by a veterinary examination and certification.

Where the stocks are being supplied from a commercial source this information should accompany the consignment together with the batch identification code of the supplier. If this is not the case then it is the aquaculture company's responsibility to ensure that this information is collected and recorded.

Transportation

The consignment of stock will be accompanied during transport to the aquaculture facility by documentation from the supplier.

Reception at the aquaculture facility

At reception at the aquaculture facility all documentation should be checked and together with the time and date of arrival entered into the farm records. A batch code should be also assigned to link the suppliers batch code(s) with that used at the farm. The batch code used within the farm (and for final product) may relate to stock of the

same species from more than one source/supplier if this is the situation then all the supplier batch codes should be recorded. It should be noted that the records can be either paper-based or entered onto a central data-base, using keyboard, barcode scanners or other IT methods.

Stocking in specific tanks, ponds or cages

In many cases stock arriving at a fish farm will be first placed into tanks to provide them the opportunity to recover from transportation and acclimatise to local conditions. As with any transfer of stock from one tank/pond/cage to another the identity of the stock in a specific location should always be recorded. This means that every tank/pond or cage should have its' own identity code that can be linked to a specific stock batch code in the records.

Additionally the identity of the stock (Batch code, species/common name) and production information should be written so as to be easily available for workers to check and refer to whilst recording farm operations.

Feed

Of critical importance in ensuring product safety in aquaculture is the nature and composition of the feed used, particularly with carnivorous species whose feed will be derived from other marine resources. The amount and timing of feeding the stock is also seen as critical in ensuring that the growth efficiency is maximised. Therefore traceability of both the source of the feed used and the feeding records for each specific batch are essential. As is obtaining feed from

Monitoring of the environmental conditions and amounts of feed supplied to the fish are necessary throughout the growth of the fish both in tanks (above) and in cages (below).

All records should be linked to the batch ID code of the fish and the specific tank/cage identity.

Storage of fish feed needs to be tightly controlled with good stock rotation and pest control procedures in operation. All products should be clearly labelled and traceability back to specific supplier batch codes should be maintained.

reputable suppliers who have implemented their own QA and traceability systems, to ensure that the fish-feed meets the required specifications and is not contaminated with chemicals that potentially could result in safety (or quality) incidents.

Each consignment of fish-feed will have its own batch code which should be recorded at reception, where appropriate stock control procedures should be conducted during feed storage. At the time of feeding the batch code and amount of feed given to each tank, pond or cage should be recorded and linked to the stock batch code.

Application of medicinal drugs

Equal in importance to the traceability of feed and feeding records, is that of providing documented evidence of the application of medicinal drugs to the stock. This is because certain drugs including antibiotics such as Chloramphenical. Whilst available and widely used in some production countries these are banned in many importing countries including the EU.

Other drugs, although permitted for use, require that the stock be held for a "withdrawal period" to ensure that the drug is fully metabolised and that residues are not present in the final product. In both cases it is essential that the nature and source of the drugs used and storage conditions be recorded.

In a wide number of cases antibiotics are administered in the feed, so it is essential that such medicated feed is clearly identifiable, stored separately

and used only where its use is both approved and necessary.

Harvest/Dispatch

The time/date and conditions of harvesting each batch of stock should be recorded, and the product labelled in accordance with the regulations detailed in Chapter 2 (Labelling Requirements), before being transported to the packing/processing facility that would conduct traceability as described in Chapter 3.

The overall objective of a traceability system in an aquaculture facility is therefore to be able to provide a documented history of each batch of stock, from the time it arrives, to the time it is harvested. The records should show what, when and how much feed or medicinal drugs were provided and hold the information by which these "ingredients" can be traced back to the suppliers records.

Additional records will also be linked to the stock batch code to allow the efficient control of productivity, quality and safety assurance systems.

The methods by which traceability can be implemented within the aquaculture sector are the same as for the processing industry. It is likely that most records will be paper-based although these may be transferred to a computer database for ease of access in producing reports. The use of technological solutions such as integrated weighing scales, bar code labels and scanners may provide benefits in the storage and dispensing of medicinal drugs and feed. The benefits of using such a system include:

Harvesting records should include the batch identification code of the fish, the time, date.

• Reducing the likelihood of human error.

• Real time access to current information relating to specific stock.

Marine capture

Each box of fish that is landed should have the following information associated with it.

Identity of the boat: In the majority of countries fishing is now limited to licensed vessels, each with an identification number.

Date of capture: This is vital since it provides the time at which spoilage starts to occur. Ideally the time of landing and the length of time the nets/lines were deployed would also be included but this is rarely the case in smaller boats.

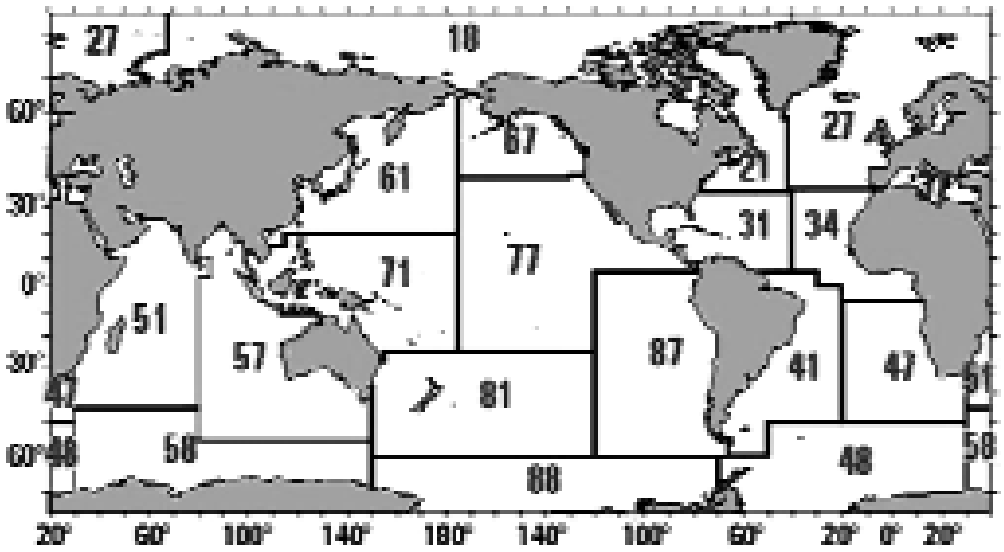
Location of capture: Although the exact coordinates are often available it is usually only necessary to identify the FAO area, e.g. Area 27, NE Atlantic: Area 51, Indian Ocean, etc.), although for marketing purposes more specific terms may be used e.g. North Sea Cod.

Species identification; both the common and scientific name are required.

Net weight; of fish in each box/container.

Batch codes; may be applied to specific batches of fish on board the fishing vessel to facilitate the control of internal quality assurance systems. They are not compulsory provided that the information accompanies the fish.

In many cases this data is routinely recorded as part of the legal requirements of fishing vessels. It is, however, essential that the information is passed onto the next link in the process chain with the product, whether this be the market or a processor.



Map of FAO Areas for fishery activities for use in identifying the location of marine harvest.

In many countries where artisanal fishing predominates, although individual vessels may be registered, the on board recording of catch data is very unlikely due to lack of time and resources available to a 2-4 person crew on a small boat. Many catches are also landed on beaches and transported directly to the processor or market place by road. This is often the point at which traceability is lost, since one truck may mix and transport the daily catch of more than one boats. In such circumstances it is the agent/collector or the processing factory who should take responsibility for recording the identity of the boat, and other information listed as necessary for traceability.

Where an agent/collector is buying from various boats that are landing product on a beach, then the fish should be placed in fish boxes and identified with labels as to the date and time of landing, the vessel identity and the beach or location of landing.

In industrialised EU fisheries, the capture and landing of fish is a highly regulated process. Significant amounts of information are collected that can be used not only to provide traceability of the fish but also provide accurate data on the location, conditions e.g. weather, sea temperature, length of time nets were deployed, depth of trawl etc. This information, although of great commercial value to the fishermen, is of lesser significance to product traceability.

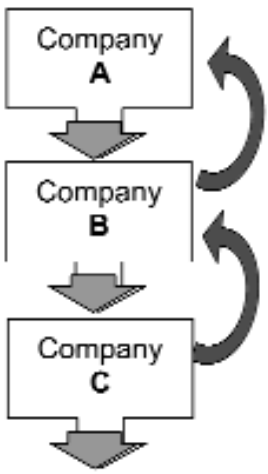
The collection of all this data has been facilitated by the integration of IT to both the control of such vessels using satellite navigation systems, electronic control of machinery and equipment and the recording of fish capture data in terms of species and weights.

The identification of individual containers has been helped further with the development of weighing scales that are not effected by the motion of the boat at sea, and have the option of entering additional information e.g species quality grades, by means of a touch screen, The location, time and date of capture are transferred from a central data system on board ship. This system developed by NESCO Ltd and demonstrated in the Tracefish project can be used to print the batch data on a box label containing a bar code or transmitted to an RFID tag embedded in the box.

The size of boats and the subsequent size of the catch will influence at which point in the chain product traceability starts.

6. External traceability: Tracing the product through the supply chain

The supply or processing chain is defined as the entire sequence of events that occur from the moment raw material is obtained until the product is consumed. This is often termed "net to plate" approach. In the fishery industry this can start at the moment the fish is caught, although in the case of aquaculture it will also include where the fish fry were obtained and records of feeding and medication etc.



In order for traceability to be effective information gathered by an individual company within the supply chain must be shared with others also in the supply chain.

This exchange of information operates in parallel with the product through the supply chain. The need for a parallel system of data transfer is because the nature and amount of information linked to a product far exceeds the capacity of either product labels or bar-codes.

Whilst simple in theory, there are many obstacles to be overcome in establishing systems that efficiently put traceability into practice, these include:

Commercial confidentiality: Product information is increasingly seen as being an asset and companies are often reluctant to give information away.

Identification of the necessary information to be transferred along the chain. Which of the large amount of product related information is necessary to maintain product traceability?.

Compatibility of the information between individual Internal traceability systems.

Differences in legislative requirements for product in different global markets.
There are two main models for information exchange across the supply chain, Independent and Integrated systems. In both models it is still essential that product is labelled since the product must still be linked to the additional data provided by this exchange of information.

Independent traceability systems.

Sometimes termed a "closed system" this is where individual companies take responsibility for obtaining the information necessary for traceability from their suppliers, and providing such information to their customers. This transfer of information meets the minimum legal requirements under EU legislation. and is some-times termed the "push-pull" model, since the customer request (push) a supplier to provide the information in the required format and the supplier responds (pulls).

In such a system a processing company would ensure that all information that it needs to identify its supplier and the supplier's product identification code is obtained. In most cases this means receiving product information in the form of a consignment/delivery note together with labelling on the product itself.

What information is needed to be transferred? The minimum information to be included would be:

- Supplier Name (& contact details)
- Product Description
- Supplier Product Codes
- Date of Production

All other details required by appropriate legislation, i.e. species name, country of origin etc.

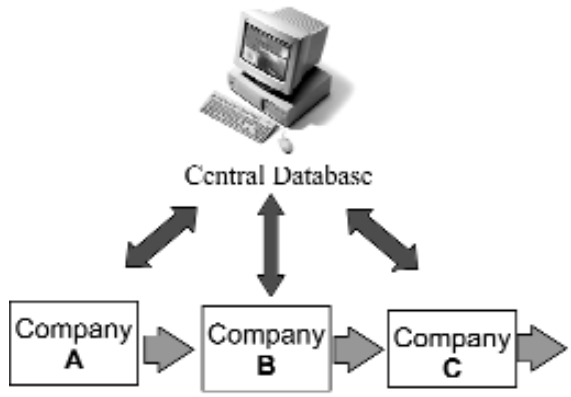
Although such paper based systems for information transfer can be used, exchanging data in this way is inefficient since the information must be entered into the individual company's information system at every link in the supply chain. The electronic transfer of information in an agreed format would greatly improve the efficiency.

The problem is that each company has many suppliers and just as many customers each which are likely to require the information in different formats.

A simple solution is the use of standardised bar codes on product labels, which can be easily read by scanner and the information transferred to the company database. This is where an integrated approach to traceability can benefit the entire supply chain.

Integrated traceability systems

Integrated or "Open" Systems differ in the degree of integration involved, from the simple use of standardised bar-coding on labels to the transmission of all information regarding the product during its progress through the supply chain to a central data-base.



There have been a number of Open systems that have been developed that provide examples of how traceability can be implemented within industry.

Such systems have been established by multinational sea-food groups who wish to collect and analyse data from across the supply chain for commercial reasons.

More recently the development of on-line auctions on the internet for fish has resulted in information relating to fish (species, quality, weight, location of capture and boat) being transmitted to the auction site from the boat by satellite link and that buyer purchase

the fish based on this information before the fish are even landed at port. Due to the standardised systems of data capture and management the information is easily transmitted to the processor or retailer over the internet, so maintaining traceability of product information.

7. Verification of traceability

Irrespective of the area of fisheries operations for which a traceability system has been established, the operation of the system needs to be verified. From the product identification code, or alternatively a bar code on the retail label, it should be possible to trace back through the records of each company in the supply chain. At each link the source and (original) identity of all raw materials as well as the entire product processing/transport/storage history can be traced.

Although this is the primary objective in establishing traceability systems, it is rare that such a detailed review is undertaken due to the time and effort necessary to trace all the records. The cost of such an exercise, even for a simple supply chain, would mean that only in the instance where public health was at risk and a product recall was necessary, would such a review be conducted.

There is no benefit in waiting until such an incident occurs before reviewing and validating a traceability system. By then a product recall is required and the system must work.

In addition to validating its own traceability system (termed 1st party audit) the system may also be validated by external auditors.

Supplier audits: conducted by customers who need to verify that, their raw materials can be traced to the original producer.

Legislative audits: conducted by the competent authority to verify that the legal requirements for traceability systems are implemented by the company.

Accreditation audits: conducted by independent auditors to establish whether the criteria of specific standards are met by the traceability system. An example of such a standard is the, Marine Stewardship Council (MSC) Chain of Custody Certification, which sets out the requirements of a traceability system to ensure that only fish that originate from an MSC certified fishery as being sustainable are labelled with the MSC Eco-label.

It is important that such verification of traceability is managed systematically and efficiently. There are many approaches that can be taken to verifying traceability and the following is one example based on the work of Dillon & Griffith in their book "How to Audit". The management of an audit is divided into the following steps;

- Planning and preparation
- Conducting the audit
- Analysing the results
- Agreeing Corrective Actions
- Verifying effective completion

Planning and preparation

Probably the most important of the steps in which the questions; why? what? where? who? when? and how? are answered with relation to the audit.

Why?

The objective in establishing a traceability system is to provide a documented history of the processing and sources of raw materials for a specified final product in order to demonstrate "due diligence".

The reasons for verification of traceability system may include; internal verification of system efficiency, supplier audits, competent authority inspection, accreditation, etc.

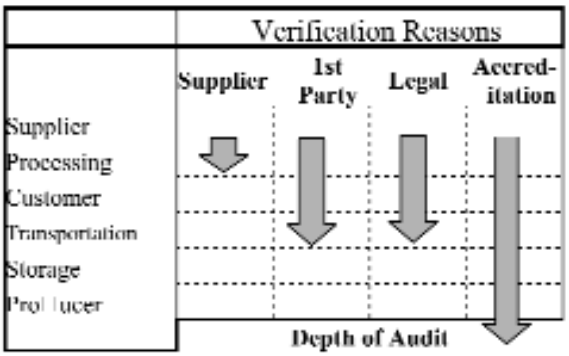
The 5 W's and the big H used in effectively asking and answering questions.

What is to be verified?

Verification of traceability can be approached from two perspectives each of which can be conducted to different depths depending on the required objective, e.g.

Verifying that traceability is maintained through the entire processing chain. In this situation the depth of the audit can be defined as how far through the chain the audit is conducted. This will be dependant on the reasons for the verification.

Verifying traceability of product within a company's operations, including the integration of supplier and customer product information into the traceability procedures. In this case the depth of the audit is defined as being either a system or compliance audit.



Depth of audit is dependent on the objectives of the verification procedures.

System audits are often undertaken to develop an overview of the existing business performance or during the development of a new operation to ensure that the business has the relevant plans and procedures to ensure traceability. This level of audit would be used to ensure that the system meets the requirements of either the law or a given standard.

Compliance audits are more limited in scope and are used to verify in detail that a given traceability system is being adhered to by evaluation of objective evidence from the operation of a given task e.g. can the processing records for a specific product be traced through the companies operations.

In answering the what? is to be verified the question where? is usually also answered, since the locations of the operations to be audited should be clearly identified using a flow diagram.

Scope of audit

It is important that the areas of company operation to be covered by an audit are clearly defined so the project remains focused. This is especially true for an area such as traceability which itself is integral to many different company operations and procedures (e.g. purchasing, processing sales etc). It is often important to keep the scope of an audit as simple as possible which may mean that the scope is initially limited to only one product or process and is later expanded to encompass all company operations.

Who will conduct the verification?

This will be dependant on the reasons for verification and may be an internal or external auditor. It is essential that the team of people with knowledge and experience of the product and processes are used to develop and conduct the audits. The audit focus on confirming control within key elements of the traceability systems demands product and process experience.

A team approach to verification is essential.

When?

The key to effective management of any audit is advance planning and defining times, resources, and responsibilities. There are many management methods by which this can be achieved including the use of a Gannt Chart.

How to verify traceability.

A structured checklist can be used within a traceability audit to ensure a thorough analysis of the controls. This is developed specifically for the scope and depth of the audit and may be modified to suit an individual process or production facilities.

A checklist poses a series of questions to be answered for each element of the procedure to be audited. The questions may be derived from elements identified in published standards e.g. Codex, ISO 2000, MSC, where each statement containing a "shall" or "must" statement is turned into a question. e.g.

The company must have a documented product recall procedure.

Is converted to the question

Does the company have a documented recall procedure?

These questions can be further developed using the 5W's and the big H, to provide a full description of the situation.

Depending on the depth of audit verification being required the checklist questions may result in;

- Simple yes / no answers; often using a tick or cross.
- Detailed descriptions of the procedures or operations and observations of their effectiveness in achieving objectives.

		Time (days)					
	%	1	2	3	4	5	6
Planning	30						
Conducting Audit	20						
Analysis	20						
Corrective Actions	20						
Verifying Completion	10						

Simple Gannt Chart for verification of establishing time management for a traceability audit.

Traceability Audit Checklists

1. Is there a Traceability System in operation ✓

2. Outline the components of the company's traceability system

3. Is the operation of the traceability system
   - Absent 0
   - Sporadic 1
   - Continuous 3

4. The number of traceability failures over the last 12 months was,

Examples of how similar questions can be asked in order to obtain different results and hence different levels of assessment.

	Standard	Look At	Look For
2.1	Pack Codes & Labelling	Coding type used	Raw material ID
			Work in progress ID
			Finished Product ID
			Codes traceable through process

Excerpt from verification requirement table detailing the standard, what to look at and what to look for. The full table is reproduced in Appendix 3.

- Qualitative assessment of compliance; where the auditor makes a judgement on how well a procedure complies with the requirement.

- Quantitative evaluation of compliance; in which performance measurements are made to determine the efficiency of a procedure/operation.

One method for determining which questions should be asked during verification is to identify each element or requirement of a standard necessary to meet the audit objective. Then determine what evidence in terms of procedures, records and other documents should be looked at to provide evidence that they comply. In order to determine whether the standards have been met, details of what should be looked for should also be defined. The points that are to be looked for, can in turn be scored as to their compliance, from which a quantitative analysis of the traceability system can be completed.

This approach has been developed into a dedicated audit software tool now used by the Greek and East African Government's to confirm effective control in export fish and food products. The IT tool has a specific section on traceability compliance wihich is also described in the Government inspection manuals. The tool was used to assist the African Governments (Tanzanaia, Uganda and Kenya) to strengthen their control systems and was supported by the United Nations Industrial Development Organization (UNIDO).
(www.foodcontrolinternational.co.uk)

8. Concluding Remarks

The book has outlined the legal requirements and international standards related to traceability and highlighted the increasing market requirements for such control.

The project team also reviewed traceability approaches in different parts of the fish supply and processing chain and documented how the practical traceability of products can be achieved within the normal working environment. The work demonstrated that a traceability system links many procedures and management systems that are normally operated within a factory, vessel or aquaculture unit. A generic traceability system can not exist since each company will differ in its procedures and systems. This book therefore provides a practical step by step illustrated guide to building traceability systems which can be applied to similar operations by individual companies at any stage of the supply chain.

Traceability control can be successfully achieved using a paper based system of labelling and recording. However the benefits of using modern technology are clearly shown in larger or more complex operations as they reduce the time and manual work required to operate the paper-based systems. Traceability systems also provide benefits to the individual company beyond meeting the legal and commercial requirements. The necessary data collection and recording sytems enable the rapid measurement and analysis of process efficiency and therefore drive improvements thus increasing the company's competitiveness.

As mentioned at the start of this book this is the beginning of the traceability story-future seafood traceability projects will continue to add to our knowledge on what works in practical situations. We are currently implementing the fully integrated systems into our own pilot plant and the local factories and we look forward to sharing this experience.

The next step is to place example traceability procedures and a full paper based system on the partner web-sites (www.eurofish.dk and www.foodsector.com) in the near future. The information collected on the time and cost of the differing systems will be dealt with through web-site discussions.

APPENDICES

Appendix 1
Case study: demonstrating the importance of traceability

Chloramphenical in Shrimp

In January 2002 officials at the German Ministry of Agriculture and Consumer Protection were investigating a report from their Dutch counterparts that shrimp containing the banned antibiotic Chloramphenical, had been mistakenly exported to a German animal feed manufacturer and had the potential to enter the human food chain.

Chloramphenical is a powerful antibiotic with restricted use to combat serious infections such as typhoid and anthrax but it is banned from all food products because of a risk that it may cause a potentially lethal form of anaemia. In normal shrimp production, the use of antibiotics is common practice to ensure disease free maximal growth of shrimp at high stocking densities. However, before harvest there is normally a period (10-30 days) where antibiotics are not used. All traces of antibiotic residues are naturally eliminated from the shrimp by being metabolised to harmless products.

Over the next few weeks using records that enabled traceability it was found that a Dutch company had imported 27.5 tons of shrimps containing the powerful antibiotic. They had been imported into the Netherlands from the Far East. This consignment was tested at the port of entry to the EU and found to contain Chloramphenical. The normal procedures of either returning the product to the supplier (over 200 tonnes of frozen peeled shrimp were returned to China in 2001) or destruction and removal from the food chain by incineration were not followed. Due to procedural errors, the shrimp became part of a consignment of 188 tons of fish scraps shipped to a feed maker in the German state of Lower Saxony in November and early December 2001.

The fish waste was then distributed to six animal feed producers in Germany and three other companies - one each in Denmark, Poland, and Romania. The authorities in each of these countries were investigating the records of each to establish whether the contaminated material had been processed into animal feed and entered the human food chain.

Fortunately, recent food scares concerning bovine spongiform encephalopathy (BSE) in the cattle industry had resulted in the implementation of good standards of record keeping and traceability of both raw materials and final products being implemented throughout the EU. This enabled the rapid identification of how the contaminated shrimp had passed through the food chain. Apart from 4 tonnes of the potentially contaminated fish meal that had been sold to Danish farmers and had probably been consumed before the problem was identified, the entire contaminated product was identified and prevented from entering the food chain.

This food scare was caused by an error in the procedures employed at the seafood processing company. Although it cost individual companies and Government time and money, it demonstrates how a traceability

system can safeguard the consumer.

The effects of this incident were widespread, with the EU placing a ban on all shrimp imports from China that resulted in much political discussion that only just averted a wider scale trade dispute.

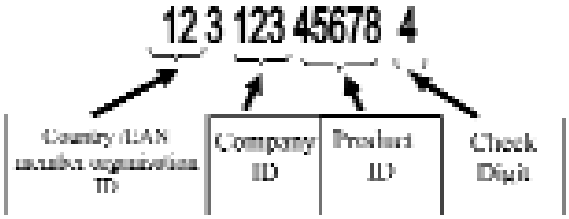
The example also demonstrates how integrated the food industry has become with the waste of one sector becoming the raw material for another, which makes the supply chain even more complicated and the need for adequate traceability more important.

Appendix 2

The EAN-UCC Coding system.

The International Numbering Association (EAN) Universal Code Council (UCC), have developed a series of coding systems that have been globally adopted. This gives a standard means by which product, location and services can be uniquely identified. The EAN is a global network of organisations with member organisations in currently 99 different countries. Each of the member organisations are responsible for issuing company identification codes together with the EAN member identification code.
Global Trade Item Number (GTIN)

EAN-UCC 13

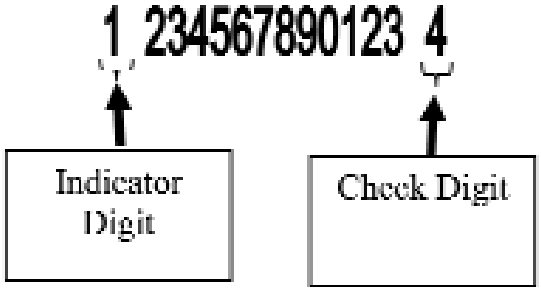


Standard format of code number

Depending on the length of the country and company identification digits this system has the potential to individually identify from 1,000 to 100,000 unique products.

The check digit is automatically calculated from proceeding digits by the labelling software and acts as an error checking device.

EAN-UCC 14, is the full 14 digit number of the EAN-UCC system.



It is used to identify trade items that do not cross a retail point of sale i.e. it is generally used for transportation of bulk consignments.

EAN-UCC 12,

Is also known as Universal Product Code (UPC) it is similar to EAN-UCC 13 but only has 2 digit country identifier. Used exclusively in USA & Canada at point of sale i.e. retail labelling.

EAN-UCC 8

Is a truncated form for use in store item identification, the preceding digits being replaced with zeros so that number complies with the EAN-UCC 12, 13 or 14 format.

UCC/EAN 128

A more recent development is **UCC/EAN 128** this builds on the success of the previous systems. This system expands the amount of information that can be encoded on a bar code to include supplementary information such as batch codes, production date etc. It achieves this by introducing additional prefixes termed Application Identifiers (AI).

The AIs provide an open standard which can be used and read by all companies in the supply chain irrespective of the company that originally issued the code.

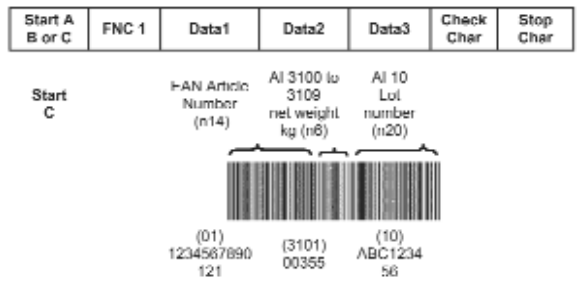
The system is based on Code128 which is a compact system, which has three character sets (A, B & C) that facilitates the encoding of the full ASCII 128 character set. In Character set C numeric data can be represented in a double density mode where 2 digits are represented by one character.

There are also 2 independent self-checking features that reduce errors in printing and scanning.

FNC1 is a non-data character that always follows the start character of the bar code; this enables scanners and processing software to identify the code as UCC/EAN-128 so as to ensure that the correct data is processed.

The UCC/EAN-128 is generally not used in the retail outlets since the scanners used are unable to read or process the additional information.

The importance of the additional information is most useful in the supply chain and where traceability of the product is considered essential.



Structure of the **UCC/EAN 128** bar code data, the details are explained in the accompanying text.

Appendix 3
Traceability systems checklist
Mathew Thompson 2003 (unpublished)

No.	Standard / Element / Requirement	Look At	Look For
1.0	Management Control Documented system for allocating roles and responsibility to ensure traceability and product recall systems operate effectively	Product and Traceability ID Manual/Procedures Significance Determination Proc. Legislation	Scope of Manual and Procedure – RM, GMO, Allergen Linkage to other policy statements – i.e. allergen free Risk Assessment and determination justification Emergency recall procedure responsibility Procedures linked to key legislation i.e. EU/UK GMO, Labelling, Allergens, Pathogens Copies of key legislation available on site
1.1	Management Review	Review of Traceability	Responsibility Frequency
1.2	Contract Review	Traceability Specification Product Specification Raw Material Specification	Supplier and Finished Product Coding Supplier Agreements Customer Agreements
1.3	Traceability Responsibility	Organisation Chart Job Descriptions Resource Planning and Budgeting	Responsibility allocated Roles clearly defined against procedure Budgets and targets with Management Review
1.4	Training and Experience	Company Training Plan Records of Staff Training and Experience	Training Records and Procedures Evidence of Qualification, Training and Experience Appropriate Labour Resource for Appropriate Tasks
1.5	Recall Manual	Product Recall Manual Contents Emergency Recall Procedure Records Scope of Recall – Target Contaminant	Key Contents and actions Emergency Recall Team Experience Records of Mock Recall and Actual Frequency Designed according to product & raw material

1. Verification of traceability control

No.	Standard / Element / Requirement	Look At	Look For
1.6	Risk Assessment	Significance Determination Logic identification of hazards and risk	Scope of Determination Consideration of all Hazards Risk Assessment and Justification
1.7	Traceability and Product ID to Finished Product Recipe	Traceability and ID Procedure	Scope of Procedure Coding of all Raw Materials, Intermediates and Finished Products is clear and correct to recipe Supplier Agreement
1.8	Document Control and Traceable Records	Document and Product Control Company Records and Documentation List of Key Traceability Records	Most recent issues (issue, revision, clear and concise Designed to ensure traceability back to source and forth to consumer
1.9	Internal Audit	Procedure Records of In-house inspections	Checklists and Scope of Procedure Frequency of audit and review Corrective Actions and Improvement Processes Strength and weakness analysis
1.10	External Audit	Supplier Assurance	Supplier Audit Records Customer Audit Records
2.0	Factory and Operational Control Logical sequence, easy to manage system for effective recall system	Traceability procedures and records (ref no.s) Observations of activity (audit ref. No) Preparation for mock recall testing (rec. no.) Logical sequence for coding (flow charting) Process descriptions and justification	Flow diagram and key controls (Approval, Issue, Stored) Authorised Signatory, Stored Compliance to documented procedure Compliance to Actions Logic of procedure and process achieves traceability
2.1	Pack Codes and Labelling	Coding type used (i.e. barcode) Factory Coding Checks	Raw Material Identification Work in Progress Identification Finished Product Identification Codes traceable through process

No.	Standard / Element / Requirement	Look At	Look For
2.2	Law	Traceability and Recall Activity Compliance Responsibility	company operations and procedures linked to Relevent Legislation Personnel assigned to ensure legal operation
2.4	Resource Utilisation (Traceability for Profit)	Raw Material Utilisation Labour Utilisation Equipment Utilisation Chemical Utilisation Water Utilisation Waste Control and Rework Energy Use	Effective line performance and utilisation Compliance of labour use to defined procedure Compliance of equipment use to defined procedure Compliance of chemical use to defined procedure Compliance of water use to defined procedure Waste and re-work do not compromise the customer Energy use
2.5	Production and Process Control	Production Scheduling Process Controls Ingredient and Raw Material Lists Raw Material and Finished product Inventory and Stock Control	Production schedules and records with key codes Control Records i.e. CCP's and recall controls Preparation of product follows recipe and coding is designated to all raw materials – check compliance Inventory Balance Sheets for Raw Materials and Ingredients Use of Key ingredients and additives / allergens is controlled to maintain legislative requirements
2.6	Rework and Waste Control	Re-work Procedure Re-work does not compromise customer requirement – Key allergens/GMOs etc Reject and Corrective Action procedure	Segregation and labelling of re-work product Segregation and labelling of non-conforming and waste product Re-work product meets product and customer specifications Rejects disposed or re-worked as appropriate and clearly labelled and identified

2. Verification of traceability control

No.	Standard / Element / Requirement	Look At	Look For
2.7	Allergen Control	Legal Requirements Allergen Lists and Additives (Ref No.) Raw Material Guarantees Cleaning Control procedures and responsibility and frequency (i.e. every batch)	Relevant legislation and codes of practice to minimise use and ensure they remain below agreed levels within recipe Identification of key hazards and allergens as part of risk assessment Letters of Guarantees from Raw Material Suppliers Supplier Audit Records of between batch cleaning
2.8	Product Labelling	Labelling meets legislative requirement Labelling clearly identifies use of specific additives Recipe and ingredients lists	Records and legislative data available on site to confirm control Ingredient declaration lists Provision of product weight Identification of specific allergens or additives of concern on label i.e. preservatives or GMO's Product labels contain legally required information
3.0	Corrective Action Procedures Failures and their effects are monitored and known to reduce failure	Corrective Action Procedure Level 1 Corrective Actions – cost in chain Level 2 Preventative Actions	Approval, Issue, Stored Problem Identification and Quick Fix Action – in-supply chain- in-factory – ex-factory Success of Corrective Action
3.1	Level 1 Corrective Actions	Corrective Action Procedure Problem Case File Corrective Action Records Product Recall	Approval, Issue, Stored Quick Fix / Remedy - Approval and Issue Authorised Signatory, Stored Product Recall Procedures and Records
3.2	Level 2 Preventative Actions	Preventative Actions Procedure Risk Assessment of Recurrence Product recall and traceability system	Approval, Issue, Stored Scientific or experience basis through Cause and Effect Analysis, Records and Prevention Statistics Product Recall Mock Exercise and Measures

No.	Standard / Element / Requirement	Look At	Look For
4.0	Supplier Assurance Documented system to ensure logical traceability through the whole supply chain and future destinations	Approved supplier list Supplier assurance verification Legislation Pre and Post Processing Controls Recipe formulations Product Test Standards	Approved supplier product only and raw material identification for supplier is unique Supplier Verification and corrective actions agreed to confirm compliance Letters of Guarantees from suppliers to confirm compliance Procedures linked to key legislation i.e. EU/UK Ingredient Lists and declarations Allergy or Free from Lists
4.1	Supplier Agreement	Contract Review and Agreement	Supplier Specification Product Specification Transport and Distribution Specification
4.2	Supplier Screening	Supplier Audit and Review	Frequency of Audit Supplier Approval List
4.3	Supplier Management	Product Analysis	Product records Delivery and consignment records
5.0	Information Technology A system is documented and implemented to verify control of product through the chain	Documented Product ID and Traceability System Update of multiple finished product specifications from raw material changes Evidence of system validation	Procedures match paper based system Use of unique identifiers i.e. barcodes Use of Food Track for control Audit-IT software for verification QSA Specifications for complete control and tracing of material
6.0	Verification Systems Documented system for allocating roles and responsibility to ensure traceability and product recall systems operate effectively	Feedback and Monitoring System Audit Schedule Checklist scope and objective Internal, External and Supplier Audit Risk Assessment Corrective Action procedure Preventative Measures	Documented review procedures Preventative measures and corrective actions Audit frequency and mock recall exercise frequency Records of compliance to recall and traceability of product and intermediates Corrective Action Recommendations Improvement Teams

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