

Seafood provenance and authenticity

This factsheet is aimed at businesses that buy, trade or sell seafood products.

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Introduction

During the early part of 2013, confidence in the food manufacturing industry across Europe was rocked by the discovery of widespread substitution of beef with horsemeat. Major retailers and food brands across a number of different countries became implicated in this major food fraud issue, casting doubt over the effectiveness of the existing regulatory measures and industry practices in guaranteeing food traceability and provenance.

Food Fraud is defined as “food which is deliberately placed on the market for financial gain, with the intention of deceiving the consumer” (FSA, 2016). Species substitution, adulteration and dilution are examples of food fraud risks in seafood supply chains, and unlicensed food additives and product enhancement. Treatments may also be used to illicitly increase financial gain for irresponsible operators. Given that some aspects of provenance, such as country of origin and catch methodology may lack any empirical means of verification, the consumer may be exposed to unnecessary risk through loss of food chain traceability.

Seafood businesses operate in a complex marketplace where the motives and opportunity for criminal activity are manifest and ever-present – in other words; seafood is traded within a heavily risk-laden landscape. History also shows, that criminal activity is by its very nature adaptive and innovative, and is by design, intended to elude detection. This briefing note aims to provide information on the nature of food fraud risks in seafood supply chains and outlines some useful counter-measures that may be deployed to reduce those risks.

What do we mean by ‘provenance and authenticity’?

The word ‘provenance’ refers to the known history of an item, with particular respect to its history of ownership. Provenance is an important concept in the food and drink industry as it is used to differentiate between products of various origins, often as means to derive added value by influencing the consumer’s perception that the item is of premium quality. Actual differences may be real or perceived, but in some cases, a claim of provenance added to the basic legal name of a product can add significantly to the selling price to the consumer.

Authenticity refers to the item being genuinely as it is described to the consumer, this may relate to any claim of provenance, but also to the physical composition of the product itself.

Such examples of provenance in the seafood sector include:

- Tuna – ‘pole and line’ differentiates from purse seine caught product
- Cod – ‘line caught’ differentiates from trawled product
- Mackerel – ‘hand lined’ differentiates from trawled product
- Scallops – ‘hand dived’ differentiates from dredged product
- Salmon – ‘organic’ differentiates from non-organic product or ‘wild’ differentiates from farmed product
- Langoustine – ‘creel caught’ differentiates from trawled product

Accepting that specific claims of provenance are able to add value to a product, there is a risk that irresponsible operators may be incentivised to seek fraudulent gain through making false provenance claims. In order to address this risk, a number of regulations and codes of practice have been developed to control the use of provenance claims and to set clear rules for the justification of their use.

Legal requirements and Codes of Practice for provenance labelling

a) *Mandatory requirements*

Food Information to Consumers Regulation

Since its introduction in December 2014, consumer interests have been specifically protected under the Food Information to Consumers Regulation (EU Regulation No 1169/2011). Requirements for labelling outlined in this Regulation include:

- The name of the product
- A list of ingredients
- A use-by or best before date
- Storage conditions
- The name and address of the manufacturer or packer.

The Regulation also contains several other labelling requirements, such as those that cover allergens, nutritional information, country of origin, and health claims.

Fish Labelling Requirements

As part of the recent reform of the EU Common Fisheries Policy, the requirement to provide the consumer with information on the production of fisheries and aquaculture products was reviewed and extended under a new Common Organisation of the Markets Regulation (EU) No 1379/2013 (CMO). This requires additional information to that previously provided to be made available to the consumer and extended this to include mass caterers. It generally applies to unprocessed fishery products only and came into force in December 2014.

The EU fisheries control regulation (EC) 1224/2009 requires the traceability and availability of production information on unprocessed fishery and aquaculture products throughout the supply chain. This has been amended to account for the additional catch information required. The control regulation only applies to fishery and aquaculture products from EU waters and landed into the EU. Although not included within the scope of this guidance, control measures are also applied to imports from non EU countries under Regulation (EC) 1005/2008. This establishes a control system to prevent, deter and eliminate illegal, unreported and unregulated (IUU) fishing, on fishery products entering the EU market.

New food labelling requirements under the Food Information to Consumers (FIC) Regulation (EU) 1169/2011 also came into force in December 2014. Fishery and aquaculture products must comply with both regulations when presenting these products to the consumer and mass caterer. This guidance deals with the provision of information under the CMO regulation only. Seafish guidance on the FIC as applied to fishery and aquaculture products is available at: http://www.seafish.org/media/Publications/Seafish_labelling_update_2016_v2_1.pdf

Chapter 3 of the Customs Code Combined Nomenclature (CN Codes) requires fish products which are marketed within the European Community, irrespective of their origin, to be appropriately marked or labelled at the point of retail sale to the final consumer with the following information:

- a) The commercial designation of the species
- b) The scientific name of the species
- c) The production method (caught at sea or inland waters or farmed)
- d) The catch area or country of origin
- e) The word 'defrosted' where appropriate
- f) Durability indication where appropriate - this has been clarified as when the FIC applies.
- g) Catch method (if on the list, if not on the list doesn't need to be declared)

Regarding the description of the catch area, for fishery products caught in the North-East Atlantic (FAO Fishing Area 27) and the Mediterranean and Black Sea (FAO Fishing Area 37), the name of the sub area or division is to be provided. In addition, this should include the name of this zone expressed in terms understandable to the consumer or a map or pictogram showing that zone. The need for this additional description depends to some extent on the intended consumer. For consumers in the UK the name 'North Sea' should be understandable on its own. A consumer in Italy might need an additional descriptor such as 'off the Eastern shores of the UK'. A full list of the sub-areas required in FAO27 and FAO 37 can be found in the Seafish briefing note or in the Appendices of this note: http://www.seafish.org/media/1630641/web_traceability_cmo_guide_v5_2016.pdf

For other FAO areas, derogation allows for the indication to be the name of the FAO fishing area only.

1. FAO18 Arctic Sea
2. FAO21 North-West Atlantic
3. FAO27 North-East Atlantic (sub-areas must be given – see Appendix 1)
4. FAO 31 Central-Western Atlantic
5. FAO 34 Central Eastern Atlantic
6. FAO 37 Mediterranean and Black Sea (sub-areas must be given – see Appendix 2)
7. FAO 41 South-West Atlantic
8. FAO 47 South-East Atlantic

9. FAO 48 Atlantic Antarctic
10. FAO 51 Western Indian Ocean
11. FAO 57 Eastern Indian Ocean
12. FAO 58 Indian Ocean Antarctic and Southern
13. FAO 61 North-West Pacific Ocean
14. FAO 67 North-East Pacific Ocean
15. FAO 71 Western Central Pacific
16. FAO 77 Eastern Central Pacific
17. FAO 81 South-West Pacific
18. FAO 87 South-East Pacific
19. FAO 88 Pacific Antarctic

For products caught in freshwater, the origin must be indicated by reference to the member state or if not from within the EU, the third country of origin. For farmed products, the origin must be indicated by reference to the member state or third country in which the product undergoes final development.

Further information on the seafood traceability and labelling regulations that are in place to ensure that seafood can be tracked throughout the supply chain and to ensure it is described accurately to consumers can be found at: <http://www.seafish.org/industry-support/legislation/traceability-and-labelling>

b) Voluntary measures

Country of Origin Labelling

In addition to the specific requirements of the Fish Labelling Regulation (see above), additional information regarding country of origin may be provided on a voluntary basis, but legislation demands that this information must not mislead the consumer.

Country of Origin is defined by reference to customs legislation. The country of origin of a food shall refer to the origin of a food as determined in accordance with Articles 23 to 26 of Regulation (EEC) No 2913/92.

Article 23

1. Goods originating in a country shall be those wholly obtained or produced in that country.
2. With respect to fish and seafood, the expression 'goods wholly obtained in a country' includes that nation's territorial sea and means:
 - a) products of sea-fishing and other products taken from the sea outside a country's territorial sea by vessels registered or recorded in the country concerned and flying the flag of that country
 - b) goods obtained or produced on board factory ships from the products referred to in subparagraph (f) originating in that country, provided that such factory ships are registered or recorded in that country and fly its flag
 - c) products taken from the seabed or subsoil beneath the seabed outside the territorial sea provided that that country has exclusive rights to exploit that seabed or subsoil

Goods whose production involved more than one country shall be deemed to originate in the country where they underwent their last, substantial, economically justified processing or working, resulting in the manufacture of a new product or representing an important stage of manufacture.

As an example, salmon smoked in Scotland but made from Norwegian farmed salmon may not be described as 'Scottish smoked salmon' but should be described as 'Norwegian salmon smoked in Scotland', or 'imported salmon smoked in Scotland'. This information may be supplied on a voluntary basis and must be in addition to (not instead of) the designation 'farmed in Norway,' which is the mandatory requirement of the Fish Labelling Regulation.

During 2016 there has been further discussions about a more widely adopted and explicit legal regime for Country of Origin Labelling (CoOL). The Commission held discussions with industry in May 2016 regarding a draft Regulation for new rules indicating the country of origin or place of provenance of the primary ingredient of a food.

The regulation requires that where the primary ingredients have an origin that is different from the declared origin of the product, the origin of the primary ingredients must also be declared. The declaration must be at the same level of precision as the declared product origin. So if a product declares 'made in the UK', the origin of the ingredients should be at specific member state level not just EU level. The Commission view is that the primary ingredient origin should be displayed near to the place where the origin of the food is given.

To trigger this requirement there must be a declaration of origin made on the product. The Commission view is that names used to describe a product that are not primarily understood to be a claim of origin e.g. a 'frankfurter' sausage will not trigger the requirement, but 'made in' or 'processed in' statements would. When products are processed their origin can change to the country of processing; in these cases, this regulation will make it a requirement to also give the origin of the raw material.

Protected names such as Protected Designation of Origin (PDO), Protected Geographical Indication (PGI), and Traditional Speciality Guaranteed (TSG) will fall within the scope, this differs from previous interpretation of origin declaration for single ingredient foods which did not include protected names. The name and addresses of businesses and health marks are excluded but the Commission is considering whether registered trademarks should be treated similarly.

On the levels of precision, the rules could be relaxed where the raw material source is necessarily variable. The use of EU/non EU could be possible in certain situations and is preferred to 'from different origins'. Where there are specific rules in place for the primary ingredient, such as the fish labelling regulations, those rules would have to be followed. So where unprocessed fish is used as an ingredient, the catch area or country of farming would need to be given if a different origin is declared on the product.

The latest update from Defra is that for products containing in excess of 50% primary ingredients, the new CoOL labelling will apply and there would need to be a change the FIC Regulation to stop the new rules applying to all food types. A staggered transition period and guidance for all foods is being discussed.

Protected Status

Protected Status claims are governed by Regulation (EU) No 1151/2012 of the European Parliament and of the Council, which was introduced in 2012, in part to overhaul and regulate the existing protected status system, which was first introduced in 1993. The EU employs three different protected status schemes, which provide differing levels and types of protection:

Protected Designation of Origin (PDO): this designation covers products that are "produced, processed and prepared" in a specific area, using a particular, usually traditional, method.

Protected Geographical Indication (PGI): this designation covers products whose "production, processing or preparation" takes place in a specific area.

Traditional Speciality Guaranteed (TSG): this designation covers products with a "traditional character" or "customary names", distinguishing them from similar products. Unlike PDO and PGI, these products do not need to be connected to a specific area or method of production. In order to be considered for TSG status, a product must demonstrate that the materials and methods used in its production have been consistent for a minimum of 30 years.

Current UK seafood products that benefit from protected status are:

- Arbroath smokies (PGI)
- Cornish sardines (PGI)
- Fal oysters (PDO)
- Isle of Man Queenies (PDO)
- Lough Neagh eels (PGI)
- Scottish farmed salmon (PGI)
- Scottish wild salmon (PGI)
- Traditional Grimsby smoked fish (PGI)
- Whitstable oysters (PGI)

Organic certified

The use of the term 'organic' is clearly defined in the EU. The regulation (710/2009) on organic aquaculture animal (fish, molluscs, crustaceans) and seaweed production, entered into force on 1 July 2010. The Regulation deals with the separation of organic and non-organic units and specifies animal welfare conditions including maximum stocking densities, a measurable indicator for welfare. Prior to this, certification in the Member States used to be based on private standards or national specifications, but the new Regulation imposes minimum criteria to be used in all countries of the European Union.

Assessing the risk of provenance fraud (Vulnerability Analysis and Critical Control Points – (VACCP))

In January 2015 the British Retail Consortium (BRC) introduced additional requirements for upstream risk analysis and targeted mitigation into the new version 7 of their Global Standard for Food Safety. In this completely new Section (5.4), the onus is clearly placed on manufacturers to understand and monitor their supply chains through the application of a vulnerability assessment study, which requires that:

“The company shall have processes in place to access information on historical and developing threats to the supply chain which may present a risk of adulteration or substitution of raw materials.”

And...

“Where raw materials are identified as being of particular risk of adulteration or substitution appropriate assurance and/or testing processes shall be in place to reduce the risk.”

Since the horsemeat crisis of 2013, it has become evident that there is a clear and immediate need for the food industry to 'raise its game' in understanding its vulnerability to deliberate acts of criminal fraud; and to respond with the deployment of effective, risk based counter measures. This process has become known as Vulnerability Assessment at Critical Control Points (VACCP). Because fish and shellfish are often sold in formats that have seen the visual indicators of speciation such as fins, skin, heads or shells removed, seafood is one of the high-risk food groups for vulnerability to criminally motivated substitution and adulteration.

In the same manner that the food safety discipline Hazard Analysis and Critical Control Points (HACCP) has become a standardised food safety discipline, it is probable that VACCP will increasingly be seen as an entry level requirement for major food markets in the UK and beyond.

Examples of seafood provenance fraud

The following list is not definitive but serves as an example of some of the risks that may be identified as part of a comprehensive VACCP study of some typical seafood supply chains. For businesses that do not carry their own in-house technical expertise on food authenticity issues, there are a number of professional laboratory service providers available in the marketplace, and these are able to provide advice on the range of testing methods that are

currently available. When seeking analytical services, it is important to look for laboratories that have achieved accreditation against a credible laboratory management standard such as that provided by the United Kingdom Accreditation Service (UKAS).

It is also important to note that not all forms of fraud can be tested for and in these cases, we will need to rely on such supply chain audit tools which seek evidence of action through documentation. The term 'forensic auditing' has been used in this context and given that 'forensic' means the application of scientific methods and techniques to the detection of a crime, we can see the basis of this term. In the same way that 'forensic accounting' is the use of accounting skills to investigate fraud or embezzlement, 'forensic auditing' is the use of food chain auditing skills to determine the potential occurrence of a food crime.

Species substitution

The substitution of a high value product with a lower value alternative is one of 'the oldest tricks in the book'. For instance, the substitution of whiting for haddock, coley for cod, dab for plaice or sole and bigeye tuna for yellowfin tuna are just a few examples. This trick is particularly used in product formats where species identification through visual means is difficult due to the removal of the head and skin, or the addition of flavours and/or colours through smoking or other value addition processes.

There are a number of empirical mitigation measures available to detect species substitution, ranging from traditional wet chemistry methods such as Gel Electrophoresis to more sophisticated DNA sequencing.

Gel Electrophoresis is a low cost accredited method but is limited in that it is not accurate on cooked materials due to the denaturing of the protein within the sample by the cooking process. It also has limitations on mixed species samples, as it will not determine the species within a mix, although it will indicate that the sample is atypical. This method also requires a confirmed known standard to test against.

DNA testing is expensive per sample but will usually work on cooked protein unless it has been grossly degraded through heat processing (e.g. surimi). DNA testing is a very accurate and reliable indicator of species and is increasingly being used in a wide range of regulatory and academic surveys of the seafood market place.

More detail on the range of speciation tests available can be found on the Seafish website (see further information).

Fishery substitution

This has become more of an issue in recent years as the market has moved towards a greater significance of fishery provenance, with commercial preferences for particular areas of capture as a point of specification or for marketing purposes. An example of this would be the sale of fish from a depleted fishery with a poor market perception as if it were derived from a more abundant and well-managed fishery.

DNA analysis to a specific population level is now available for some species, albeit with a limited level of certainty. This technology has been evolving since the EU FishPopTrace project aimed at the construction of an advanced technology Pan-European framework for product traceability in the fisheries sector. The FishPopTrace project final report was delivered in July 2011, and in April 2012, the United Kingdom government launched a project that aims to directly utilise its outputs to address fish traceability issues. The research, funded by the UK Department for Environment Food and Rural Affairs (Defra) seeks to identify DNA indicators for the geographic origin of cod, hake, herring and sole.

Given the developing nature of DNA analysis to a specific population, the main supply chain tool for deployed mitigation remains largely with auditing, albeit recognising that a more forensic approach may be required.

IUU substitution

IUU substitution takes place where all or part of the batch is derived from illegal, unreported or unregulated fisheries (IUU). IUU includes such fish as those captured over quota, under-sized or by un-licensed vessels. IUU fishing depletes fish stocks, destroys marine habitats, distorts competition, puts honest fishers at an unfair disadvantage, and weakens coastal communities, particularly in developing countries. This fish is difficult to detect once it has entered into the supply chains, as the illegal fish is morphologically and genetically identical to the legal part of the catch.

No empirical testing is possible to identify IUU product. The reliance for mitigation therefore remains with auditing, albeit recognising that a more forensic approach is required. “An Advisory Note for the UK Supply Chain on how to avoid IUU fishery products” (BRC/EJF/WWF-UK) recommends auditing and supply chain verification, with indications where more “forensic” information is called for. This advice note is available from:

<http://ejfoundation.org/report/advisory-note-uk-supply-chain-how-avoid-illegal-unreported-and-unregulated-iuu-fishery>

Species adulteration

Species adulteration differs from species substitution in that it is the *partial* addition of non-declared, non-specified species to a named product. There is particular vulnerability to this type of fraud in the manufacture of primary processed raw material commodities such as fish blocks or formed fillet or scampi cores. Whilst the primary species used is as declared to the consumer, there is an addition of a lower value product of similar characteristics to 'make weight'. In some cases, the addition could be of non-fish protein such as binders derived from cereal or rice.

DNA testing is an effective means to determine the presence of a range of different types of fish or other animal species contained within the material. Depending upon the type of test used, this technology can either deliver a 'qualitative result' in which the simple presence or absence of the target species is recorded, or a 'quantitative result' in which the test estimates the proportion of target DNA detected. In the case of a qualitative result, a further quantitative test may be required if the presence of non-target DNA is detected. This is because the presence of that DNA may be at trace levels caused by machinery of food handler cross contamination rather than by intentional substitution.

In the case of a qualitative result, it would be necessary to test the item for the range of suspected adulterants as well as for the target DNA so that an assessment can be made as to the likelihood that the level of non-target DNA discovered is the result of deliberate addition.

In cases where there is a specific suspicion that vegetable based compounds have been used to adulterate a seafood raw material, more traditional and cost effective wet chemistry may be used to detect the presence of carbohydrate or fibre.

Chain of Custody abuse

Chain of Custody (CoC) is the chronological documentation of the ownership or control of a commodity. In the food industry, this term is typically used to describe the means of supply chain control for certified assurance schemes such as that of the Marine Stewardship Council. The abuse of CoC is the substitution or addition of fish from uncertified sources into product that has been produced in accordance with an independent third party certification scheme. This abuse threatens the integrity of the retailer or brand owner selling the fish, and the credibility of the sustainability certification scheme itself.

DNA analysis to population level is now available for some species, albeit with a limited level of certainty – this method can be used to determine whether or not a product has been derived from a specific fishery. However, even this high resolution DNA testing cannot differentiate between certified and non-certified materials extracted from the

same fishery. The reliance for mitigation remains with supply chain auditing, albeit recognising that a more forensic approach is required.

Catch method fraud

In a market where consumers are demanding to understand more about the origin of their food products, the issue of catch method has become a significant and unique factor for the marketing and labelling of seafood. Catch method fraud is the mis-description of the métier used to capture the product, such as describing trawl caught fish as line caught or dredged scallops as hand dived. To an experienced or highly trained eye, it is possible in some cases to identify visual and other qualitative indicators of the fishing method used, but catch method fraud is very difficult to detect, especially in product formats where the visual indicators of fishing have been removed through primary processing.

There are no empirical tests that can differentiate for instance, between trawl caught and line caught fish. In some cases, where heads and skin are intact, an experienced seafood specialist can identify trawl caught versus gill net or line caught fish, albeit with an element of subjectivity, but the reliance for deployed mitigation remains with supply chain auditing, albeit recognising that a more forensic approach is required.

Undeclared product extension (dilution)

Soak and injection processes, sometimes using salt (sodium chloride) or possibly using other chemical additives can reduce the analytical fish content of seafood significantly and there is anecdotal cause for concern that the use of production technologies to enhance the water retention capabilities of fish muscle and produce low fish content product is becoming increasingly common. In some markets there is an acceptance of this practice as a means of value engineering product to meet low price points, and manufacturers of primary processed fish products are able to deliberately produce to specifications targeting fish contents as low as 60% to meet this demand. Water retention technologies however, could result in the sale of water to the consumer for the price of fish if the buyer was unaware of their use.

Because we are dealing with physical parameters that can be measured empirically in a laboratory, there are a number of tests that can be carried out to determine whether or not the weight of a seafood product has been enhanced through undeclared water retention. The science of understanding the classes of substances present in food is generally referred to as 'proximate composition' – this aggregates all of the individual sub-components, such as different types of proteins or fats into their five higher level orders: proteins, water, fats, minerals and carbohydrates. The three principal proximate components of fish flesh are:

- Water
- Protein
- Fat

Water Content – the water content of a sample can be measured in a number of ways by a food chemistry analytical laboratory, and given that the main exposure to risk is the reduction of analytical fish content by deliberately increasing fish muscle water-holding capacity, it follows that the measurement of water as a percentage of the product is also a good indicator of whether or not the product has been treated. This is especially useful when taken in conjunction with an analytical fish content result as for many white-fleshed fish species the predominant proximate balance is between the two principal components of water and protein.

As a proxy for protein, it is possible to measure the amount of Nitrogen present in a sample. Nitrogen is one of the easiest parameters to test for when measuring protein and, consequently, this value can be used as a method to determine the analytical fish content of a product, with low levels potentially indicative of the pro-rata addition of water.

With some slight seasonal variation caused by stress levels during capture or seasonality, fish muscle tends to have a fairly stable pH balance. The post-capture pH of cod and haddock muscle for instance tends to be consistently around 6.7¹. The water-holding capacity of fish muscle can be increased by shifting the pH either towards acid or alkali. A number of proprietary technical ingredients have been developed to achieve this pH shift during primary processing, including citric acid and sodium bicarbonate based binders, which are used as soaks or are injected into the fillets. Atypical pH tests can be used to indicate whether these proprietary binders have been used to increase water retention and extend product.

Most seafood naturally contains salt (NaCl or sodium chloride), but because brine soaks can be used as a means of enhancing water retention in fish muscle, higher than typical levels of sodium compounds in a product can be seen as an indicator of reduced fish content. Because there are a number of sodium based compounds that have water retaining qualities (not just salt), it is important to test product for sodium chloride and for total sodium levels. For more information about analytical fish content, see the Seafish fact Sheet 'Fish Content and QUID.'

Fresh v frozen

The Food Information to Consumers Regulation requires that certain mandatory particulars must accompany the name of the food regarding its physical condition or treatments it has undergone, including the use of the word 'defrosted' where foods have been frozen before sale and are sold defrosted. Because fresh fish markets are volatile in terms of availability of supply and fresh raw materials have relatively short shelf lives for stock holding purposes, it has long been a working practice in the seafood trade to supplement fresh fish supplies with longer shelf life frozen materials held in cold storage and subsequently sold on the defrost. Since the Food Information to Consumers Regulation made labelling requirements for defrosted products more explicit, this practice has become problematic, although the supply chain demands for order fulfilment remain the same.

In some cases, unscrupulous traders may even deliberately try to sell lower value frozen materials for the price premiums commanded by the fresh (never frozen) trade and benefit from improved profitability by deceiving the consumer about the true nature and provenance of the product.

Fish are largely water, 60-80 per cent depending on species, and the process of freezing converts most of that water into ice. Ice crystal formation during freezing causes the expansion of the natural water in the fish flesh, causing disruption of the muscle cell walls. The size and number of ice crystals depends on the speed of freezing and the appearance of the flesh is affected by the size of these crystals. Unlike the glossy appearance of fresh fish muscle, on defrosting, a previously frozen piece of fish can have a matt-white appearance due to changes to the surface cell structure caused by ice crystal formation, causing light to scatter rather than to reflect.

Whilst visual appearance can give some indication as to whether the product has been previously frozen, this requires an experienced or highly trained eye and even then, there is some subjectivity in making the decision. The reliance for mitigation remains with supply chain auditing, albeit recognising that a more forensic approach is required.

Official documentation fraud in third countries

Imports of fish and seafood from outside the EU are very strictly regulated, with official documentation required for health certification, traceability to legal fisheries and for the payment of appropriate customs tariffs and taxes.

Health Certificates: Seafood falls under the imported product Veterinary Checks Directive (97/78/EC). The Directive prescribes that seafood originating from third countries has to be imported via a Border Inspection Post (BIP) and

¹ The Post-mortem pH of Cod and Haddock Muscle and its Seasonal Variation by R Malcolm Love (Torry Research Station), 1978

has to be subjected to a series of veterinary checks. All consignments are also subjected to a document check. This is to ensure that the details on the Health Certificate agree with the accompanying documents. The inspector will also check countries of origin and that the products have been manufactured in EU approved establishments.

IUU Certification: In addition to the Health Certificate documentation, imports from third countries must also be accompanied by a validated catch certificate from the flag state of the fishing vessel. An extra certificate is needed if the fish has been processed or stored in a country that is not the flag state. Each country has its own form based on a template EU catch certificate form.

Catch certificates must:

- Be validated by the relevant authority from the country where the vessel is registered
- Contain all information included in the template
- Give accurate weights of the fish imported into the EU
- Give a 6-digit product code to identify the fish

Before fish arrives on a fishing vessel from outside the EU, the original catch certificates must be submitted to:

- The port health authority
- The Marine Management Organisation (MMO) catch certificate centre

If the importer has Approved Economic Operator (APEO) status, they must hold certificates but don't need to present them when importing.

Catch certificates are intended to prove that fish have been caught legally, they contain information about when the fishing took place, where the fishing took place and the quantity of fish caught. It is an offence to import fishery products without a validated catch certificate – offenders can be prosecuted and fined up to £50,000.

There is a clear risk that disreputable operators may seek to import products that have not been produced under the stringent conditions required by the Border Inspection Point process and therefore do not possess the appropriate official documentation. In order to enter the UK, fake documentation will need to be produced and whilst significant efforts are made at the BIP to identify fraudulent documentation, the importers themselves should also be aware of this risk and remain vigilant at all times when inspecting the documentation accompanying imports.

Customs tariffs and taxes: Import duty and taxes are due when importing goods into the United Kingdom from outside of the EU. Every product imported into the UK, must be classified under a Classification/commodity code. This code not only identifies what type of item it is, but it also advises the rate of import duty, as well as any restrictions or additional requirements, or if any exemptions, reliefs or quotas are available. An unscrupulous operator could seek to benefit from a preferential import duty or from tariff relief under a quota system by mis-describing the nature or format of the commodity through the use of a false code. The buyer should be aware of this fraudulent practice and ensure that all goods received are as they are described in the customs declaration.

Detailed guidance on the import requirements for seafood products can be found at: <http://www.seafish.org/industry-support/legislation/import-and-export/import-guidance#crossing%20the%20border>

Quality Enhancement Treatments

It is possible to enhance the perceived quality of seafood products by using either permitted or not permitted treatments. Such treatments are designed to make fish appear to be of high quality, primarily through enhancing their visual characteristics – so white fleshed fish can be made to appear even whiter, and red fleshed fish even redder through these treatments. Wherever these treatments are legal to use, they should be declared within the product specification, any additives used must be listed in the product's ingredient declaration and any maximum

legal limits observed and documented as part of the process-control management system. However, some such treatments are not legal and the additives used to achieve the visual improvements not approved for use in seafood production. It may also be the case that legally permitted additives applied at levels beyond those legally permitted could be used to enhance the appearance of products. Given that such treatments are used to maximise the value of inferior quality products, there is a clear incentive for illicit economic gain through unapproved quality enhancement treatments, and buyers should be aware that such technologies are constantly being developed.

As an example, a practice has recently emerged that involves the injection of fermented vegetable extract into low grade tuna in order to restore its red colour. It is then possible to sell the product as high-grade tuna at premium prices. The UK has always held that the use of nitrates/vegetable extracts are not permitted in tuna, although some EU member states have interpreted the regulation differently and have been permitting the use of vegetable extract as flavouring. This has been raised with DG SANTE for clarification that the practice is not permitted, and the Commission has issued a statement to all Member States that the practice is not allowed.

Following on from this there has been further discussion about the use of antioxidants. Antioxidants are legally used to preserve the quality of tuna; however very high levels can be used to transform the tuna in the same way as vegetable extracts do. Both uses will have similar labelling so it is not easy to differentiate.

The following signs will help to identify treated tuna:

- Bright red in colour and significant liquid in the pack which is not the colour of tuna blood.
- Softness of flesh with crumbling fibres on the surface, remaining even after cooking.
- The label might declare the use of antioxidants such as, E-331 (Sodium citrates), E300 (Ascorbic acid), E 301 (Sodium ascorbate) as well as an acidity regulator E500 (Sodium carbonates) and salt. These additives are needed to maintain the correct conditions for the reaction but they are not always declared.
- The label might declare the use of vegetable 'aroma'.
- After exposure to the air the tuna will blacken. This can take several hours as the antioxidants are added to slow this reaction.

More advice on the use of additives in food can be found here:

<https://www.food.gov.uk/sites/default/files/multimedia/pdfs/guidance/food-additives-legislation-guidance-to-compliance.pdf>

Durability indication alteration

All seafood must be labelled with a durability date. The date mark must comply with clear labelling requirements and be conspicuous, legible and indelible, it can either be in the form of a 'Use by' or 'Best before' date. A decision tree process is followed by the manufacturer or brand owner to determine which form of date marking is required on each type of product.

- 'Best before' indicates the period for which a food can reasonably be expected to retain its optimal condition (e.g. it will not be stale) and so relates to the quality of the food.
- 'Use by' is the required form of date mark for those foods which are highly perishable from a microbiological point of view and which are in consequence likely after a relatively short period to present a risk of food poisoning, and so relates to the safety of the food.

Durability indications can be altered by unscrupulous traders to extend product shelf-life. This enables the sale of product which may be approaching or even exceeding its original shelf-life as if it were still of prime value. Seafood is a perishable commodity and even when held in cold storage, it will deteriorate in quality over time. In some cases, especially with short shelf-life chilled products, that deterioration may also mean that the food is becoming increasingly microbiologically unsafe to consume.

It is an offence to alter or remove a date mark if you are not the manufacturer, packer or EU seller originally responsible for marking the food, unless each alteration is authorised by the person originally responsible for setting the date mark. It is also an offence to sell food after the 'use by' date. Products may be sold after the 'best before' date provided the product still complies with the General Food Law Regulation (EC) 178/2002, which prohibits the sale of food which is not of the nature, substance or quality demanded by the purchaser, or to sell food which does not meet food safety requirements.

Advice to buyers

It is impossible to discuss provenance in the food industry without considering the potential scale and severity of the impacts of the criminal activity that seeks to compromise it. Professor Chris Elliott identified this in his recent review of UK food supply networks:

*"Industry, Government and enforcement agencies should, as a precautionary principle, always put the needs of consumers above all other considerations, and this means giving **food safety and food crime prevention** – i.e. the deterrence of dishonest behaviour – absolute priority over other objectives... The prevention of food crime can be achieved by all parties involved in production, handling and transport following good practice; by agreeing food specifications; checking and ensuring conformity through sampling; adhering to recognised standards of testing; and deciding whether their governance of production, processing or labelling systems is adequate."* Professor Chris Elliott²

Professor Elliott's comments describe the imperative to protect the provenance of our food through a systematic process of risk analysis, good supply chain practice and product testing. The seafood industry is complex, it is truly international in its nature, with diverse and extended supply chains for multiple types of raw materials – it is therefore, open to manifold risks of fraudulent activity, potentially resulting in perverse impacts on the market and placing the health and safety of the consumer at risk. The horsemeat crisis of 2013 provided clear evidence of the need for food suppliers and manufacturers to take a more analytical and holistic approach to protect the provenance of food products and to the mitigation of risk.

For many businesses, especially those in the small-to-medium-sized sector, this may appear to be a highly technical challenge, but the deployment of a few simple measures could help to significantly reduce those risks.

- Consider and document what claims of provenance you are making for the range of products that you buy/sell (e.g. 'line caught', 'organic', 'British' etc.)
- Ensure that you have credible evidence that each of these claims can be verified, either through analysis or supply chain traceability records
- Ensure that you understand the risks for each of these claims – identify them, map them out, work collaboratively with suppliers and on a pre-competitive basis with like-minded businesses to extend your knowledge and influence
- Work with your suppliers to ensure that all activities in the supply chain are as transparent as possible, and therefore auditable.
- Consider how market trends of availability and price may incentivize mal-practice and focus inspection and analysis on higher risk commodities.
- Consider whether or not you are being asked to pay a reasonable market price for the item – there is some truth in the old adage that 'if it appears to be too good to be true, then it probably is.'
- Implement a risk based empirical analysis plan wherever the analytical tools exist – take advice from professional laboratory service providers on the range of testing regimes available to you.

² Elliott Review into the Integrity and Assurance of Food Supply Networks – Final Report. A National Food Crime Prevention Framework (July 2014)

- Embrace and use the new tools such as DNA analysis; these are now widely available from commercial analytical laboratories.
- Where no analytical tools exist consider how a more forensic approach to auditing with a greater emphasis on mass balance reconciliation and financial accounting may be deployed.

Once deployed, these measures should form the basis of an effective VACCP plan for your business. Such a documented plan would support your due diligence position and protect the consumer by assuring the provenance of the seafood products that you supply into the marketplace. There are now a number of organizations offering training courses on how to conduct a VACCP exercise. These can be found on-line or, if applicable, on advice from your BRC Certification Body.

VACCP is designed upon the underlying principles of the existing Hazard Analysis and Critical Control Points (HACCP) protocol. Typically, a business will use HACCP style documentation to record their process to identify and mitigate the potential risk of food fraud in upstream supply chains. This may take the following form:

1. Draw up a complete list of materials (or groups of materials)
2. Identify the potential forms of fraud that these materials may be subjected to
3. Evaluate the risk that these frauds may have taken place
4. Identify and implement control measures appropriate to the levels of risk
5. Record the findings
6. Review the above on a regular basis as appropriate

APPENDIX 1: FAO 27 SUB-AREAS

SUB-AREA	NAME	DIVISION	NAME
I	Barents Sea	I a	Barents Sea NEAFC Regulatory Area
		I b	Barents Sea Non-NEAFC Regulatory Area
II	Norwegian Sea, Spitzbergen and Bear Island	II a	Norwegian Sea
		II b	Spitzbergen and Bear Island
III	Skaggerak, Kattegat, Sound, Belt Sea and Baltic Sea	III a	Skaggerak and Kattegat
		III b, c	Sound and Belt Sea or Transition area
		III d	Baltic Sea
IV	North Sea	IV a	Northern North Sea
		IV b	Central North Sea
		IV c	Southern North Sea
V	Iceland and Faroes Grounds	Va	Iceland Grounds
		Vb	Faroes Grounds
VI	Rockall, Northwest Coast of Scotland and North Ireland (Northwest Coast of Scotland and North Ireland also known as West of Scotland)	VI a	Northwest Coast of Scotland and North Ireland or as West of Scotland
		VI b	Rockall
VII	Irish Sea, West of Ireland, Porcupine Bank, Eastern English Channel, Western English Channel, Bristol Channel, Celtic Sea North, Celtic Sea South, Southwest of Ireland – East and Southwest of Ireland - West	VII a	Irish Sea
		VII b	West of Ireland
		VII c	Porcupine Bank
		VII d	Eastern English Channel
		VII e	Western English Channel
		VII f	Bristol Channel
		VII g	Celtic Sea North
		VII h	Celtic Sea South
		VII i	Southwest of Ireland – East
		VII j	Southwest of Ireland - West

		VII k	
VIII	Bay of Biscay	VIII a	Bay of Biscay – North
		VIII b	Bay of Biscay – Central
		VIII c	Bay of Biscay – South
		VIII d	Bay of Biscay – Offshore
		VIII e	West of Bay of Biscay
IX	Portuguese Waters	IX a	Portuguese Waters – East
		IX b	Portuguese Waters - West
X	Azores Grounds	Xa	Azores Grounds
		Xb	Northeast Atlantic South
XI	Subarea defunct as incorporated into Eastern Central Atlantic (FAO 34)		
XII	North of Azores	XII a	Southern mid-Atlantic Ridge
		XII b	Western Hatton Bank
		XII c	Central Northeast Atlantic
XIII	Subarea defunct as incorporated into Eastern Central Atlantic (FAO 34)		
XIV	East Greenland	XIV a	Northeast Greenland
		XIV b	Southeast Greenland

APPENDIX 2: FAO 37 SUB-AREAS

SUB-AREA	NAME	DIVISION	NAME
37.1	Western Mediterranean	37.1.1 37.1.2 37.1.3	Balearic Gulf of Lions Sardinia
37.2	Central Mediterranean	37.2.1 37.2.2	Adriatic Ionian
37.3	Eastern Mediterranean	37.3.1 37.3.2	Aegean Levant
37.4	Black Sea	37.4.1 37.4.2 37.4.3	Marmara Sea Black Sea Azov Sea

References and further information

- European Food Information to Consumers Regulation No 1169/2011 (FIC); <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX%3A32011R1169&from=en>
- Seafish Guidance Note -Traceability and consumer information under EU fisheries control measures and fish marketing requirements (Version 5 09/02/2016); http://www.seafish.org/media/1630641/web_traceability_cmo_guide_v5_2016.pdf
- Defra Guidance notes on Fish Labelling legislation The Fish Labelling Regulations 2013 Regulations (EC) 104/2000, 2065/2001, 1224/2009 and 404/2011 (September 2013); https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/245013/pb13760-fish-labelling-regs-guidance.pdf
- Regulation (EEC) No 2913/92 Establishing the Community Customs Code; <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31992R2913:en:HTML>
- Food Standards Agency Country of Origin Labelling Guidance; <http://www.food.gov.uk/sites/default/files/multimedia/pdfs/originlabellingguid0909.pdf>
- European Commission Agriculture & Rural Development – Organic Farming; https://ec.europa.eu/agriculture/organic/eu-policy/eu-rules-on-production/seaweed-and-aquaculture/index_en.htm
- UK.Gov Guidance on EU protected food names; <https://www.gov.uk/guidance/eu-protected-food-names-how-to-register-food-or-drink-products#logos>
- COMMISSION REGULATION (EC) No 710/2009 as regards laying down detailed rules on organic aquaculture animal and seaweed production; <http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32009R0710&from=EN>
- Illegal fishing (IUU) - The EU rules to combat illegal, unreported and unregulated fishing; http://ec.europa.eu/fisheries/cfp/illegal_fishing/index_en.htm
- Joint Research Centre – About FishPopTrace; <https://fishpoptrace.jrc.ec.europa.eu>
- Torry Advisory Note Number 27 (revised): The Quick Freezing of Fish; <http://www.fao.org/wairdocs/tan/x5906e/x5906e00.htm#Contents>
- Food Standards Agency – Food Additives Legislation Guidance to Compliance; <https://www.food.gov.uk/sites/default/files/multimedia/pdfs/guidance/food-additives-legislation-guidance-to-compliance.pdf>
- Elliott Review into the Integrity and Assurance of Food Supply Networks – Final Report. A National Food Crime Prevention Framework (July 2014); https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/350726/elliott-review-final-report-july2014.pdf
- <http://www.food.gov.uk/sites/default/files/pas96-2014-food-drink-protection-guide.pdf>
- FSA/Defra Guidance on the application of date labels to food; https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69316/pb132629-food-date-labelling-110915.pdf

Further information from Seafish

- Seafish Fact Sheet: Fish Content and QUID (2016) - http://www.seafish.org/media/publications/FS95_07_16_-_fish_content_quid.pdf
- Seafish Guide to DNA - http://www.seafish.org/media/Publications/SeafishGuidetoDNATestingofSeafood_201312.pdf
- Species identification testing– http://www.seafish.org/media/Publications/SeafishFactSheet_RecentAdvancesintheuseofDNAintheSeafoodSupplyChain_201109.pdf
- Seafish guides to traceability and labelling (various) - <http://www.seafish.org/industry-support/legislation/traceability-and-labelling>
- Seafish webpage on product integrity - <http://www.seafish.org/responsible-sourcing/product-integrity>

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supporting the seafood industry for a sustainable, profitable and socially responsible future