Traceability in the EU Fisheries Sector

- Rationale and implementation in the EU and the international context -

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The Structure of Fish Populations
and
Traceability of Fish and Fish Products

Traceability in the EU Fisheries Sector

- Its rationale and its current implementation in the EU and the international context -

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Contents

Summary

The EU fisheries sector faces major challenges due to declining resources caused by strong fishing pressure. Also an increasing dependence on fish (product) imports and ever more complex marketing patterns impede efforts to regulate, monitor and control the EU fisheries trade. In this context traceability, the ability to track the flow of product or product attributes throughout the production process or supply chain, constitutes a powerful tool to warrant product authenticity, but also to ensure compliance with existing rules. This is especially true if traceability based on a stringent documentation procedure (labelling, certification *etc*.) is supported by independent control measures that allow for verification of the documents required to comply with the traceability scheme.
This document outlines how and to what extent traceability in the fisheries sector is presently implemented in the EU, and discusses traceability schemes of other sectors and countries. It also reflects on how traceability could be further improved and assured, and how the project strategy of **FishPopTrace** is tailored in support of improvement of the traceability scheme in the fisheries sector.

Introduction

The FAO estimates that today 80% of marine fish stocks are fully or overexploited worldwide[1], a dire situation which is further aggravated by the continuously increasing demand for fish and fish products. Additionally the fishing sector is penetrated by an extremely high level of illegal fishing activities. Illegal, Unreported and Unregulated (IUU) fishing has been assessed to amount worldwide €10 to €20 billion[2], which is about twice the value of landings by the EU fleet (€6.8 billion in 2004)[3]. IUU fishing not only threatens marine ecosystems and habitats, obstructs sustainable fisheries and has highly negative socio-economic consequences but also impedes sound scientific fisheries assessment.
Furthermore, along the supply chain mislabelling of fishery products leads to misinformation of consumers. This, together with the globalisation of the fishery industry and highly complex marketing patterns, poses great challenges to policy makers as well as control and enforcement authorities.
Traceability schemes provide powerful tools to ensure compliance with rules and to fight fraud, which is why traceability worldwide is high on the fisheries policy agenda. However to be fully efficient, such traceability schemes must be legally binding and be supported by independent control measures.
This document presents how traceability is anchored in the EU legislation, how it is implemented, how traceability is currently realized in the fisheries sector and how a EU fisheries traceability scheme could be further improved. Additionally traceability schemes in other sectors but fisheries and in countries outside the European Union are discussed and compared to the situation in the EU.

[1] FAO Fisheries and Aquaculture Department (2009) "The State of World Fisheries and Aquaculture"
[2] Agnew , D.J. et al. (2009); "Estimating the Worldwide Extent of Illegal Fishing"; PLoS1 Vol4(2)
[3] European Commission DG Mare Press Corner
http://ec.europa.eu/fisheries/press_corner/press_releases/archives/com07/com07_69_en.htm

A short introduction to the FP7 project FishPopTrace

FishPopTrace is funded under the European Union Seventh Framework Programme (FP7) and aims at developing a forensic framework for the enforcement of regulations and laws to reduce the amount of Illegal, Unreported and Unregulated fishing (IUU).
Starting out as a fundamental and explorative research project, results emerging from FishPopTrace will be translated into end-user tools for fish population structure analysis and fish (product) traceability. These tools will be scrutinized applying forensic standards and developed for monitoring, control, surveillance (MCS) and enforcement in the fisheries sector.
To reach this goal, FishPopTrace takes advantage of the rapid progress in life science technologies. At present our research focuses on four commercially important fish species, cod (*Gadus morhua*), hake (*Merluccius merluccius*), herring (*Clupea harengus*) and common sole (*Solea solea*), by using state of the art DNA-based analytical methods (Single Nucleotide Polymorphisms - SNPs) for population identification. At the same time the consortium explores the potential of otolith microchemistry and shape, fatty acid analysis, proteomics, gene expression, and microarrays.
The FishPopTrace consortium consists of 15 partners with expertise in fish biology, population and conservation genetics, molecular biology, biochemistry, and wildlife forensics. It has members of the food industry and strong ties to European fisheries policy making. Moreover a scientific advisor from the US National Oceanic and Atmospheric Administration (NOAA) is participating.

From Farm to Fork: The agricultural sector as a forerunner for traceability schemes

The agricultural sector has set milestones in the development of traceability schemes, by developing systems to keep track of data on livestock and products with relevance for the industry and for consumer protection, throughout the production chain ("Farm to Fork").
While traceability of agricultural products and particularly cattle has a long history[4], the design and implementation of such schemes within the EU has been greatly boosted by the need to adapt to challenges emerging through the unconstrained trade within the community market as well as by a number of food crises. To protect consumers in the EU member states against incorrectly labelled food, the 'Farm to Fork' principle has been implemented in the EU agricultural sector since 2002[5]. This principle implies the tracking and identification of food products during their transit through the supply chain from the cattle to the consumer.
For bovine animals, this is guaranteed at the source by compulsory individual tags (identical tags in both ears). Each individual animal is thereby identified by a unique number and barcode, and any trade related transfer is recorded. All information is stored in national databases (compulsory for each Member State). At the end of the product chain the tracing consists of labels on the final meat product, indicating place of birth, fattening, and slaughter[6]. One of the major drivers for the development of these elaborate traceability schemes was the risk of spreading disease such as Bovine Spongiform Encephalopathy (BSE) or Foot-and-Mouth Disease (FMD). The recorded data allows for quick identification of potentially affected animals and prompt withdrawal from the market chain.

[4] Blancou, J. "A history of the traceability of animals and animal products" (2001) OIE Revue Scientifique et Technique, 20 (2), pp. 420-425.
[5] OJ L 31, 01.02.2002: Regulation (EC) 178/2002
[6] OJ L 204, 11.08.2000: Regulation (EC) 1760/2000

Nowadays radio-frequency identification (RFID) is progressively introduced to ensure traceability of livestock. It. has become compulsory in the EU by 01.01.2009 for sheep and goats[7]. RFID is an automatic identification method, enabling electronic retrieval of the identification code of RFID tags or transponders. For animals, RFID is based on international standards[8] A RFID tag can also be applied to or incorporated into a product for the purpose of identification and tracking using radio waves[9]. Recently a RFID-enabled traceability system has also been proposed for the supply chain of live fish[10].

Genetically Modified Organisms: New Challenges and Solutions for Traceability in the Agricultural sector

The above discussed strategies are sufficient to trace cattle movements and the sale of derived products within the European Union. However, with the use of genetically modified organisms (GMO) and genetically engineered (GE) food new challenges arose. Consequently other technologies and strategies for detecting and tracing the presence and amount of GMOs in agricultural products had to be established[11].

If companies apply for the release of a new line of crops with a genotype modified by modern molecular and biotechnology methods, and having succeeded to launch it on the market after the control of the European Food Safety Authority (EFSA), it falls under the remit of the European Network of GMO Laboratories (ENGL[12]) to control the further steps. ENGL was inaugurated in 2002. It constitutes EU experts working on the development, harmonisation and standardisation of methods for detection, identification, verification, and quantification of GMOs or derived products such as seeds, grains, food, feed and environmental samples[13].

Detection and quantification of GMOs in food and feed based on validated protocols are indispensable, since, according to EU legislation, any content of more than 0.9% GMO in an authorized product (0% threshold if non-authorized) must be indicated on labels[14]. An additional challenge arises since each genetic modification requires a specific detection protocol ("event-specific detection"). To ensure that monitoring and control of each new GMO is possible, ENGL provides since 2004 assistance to the Community Reference Laboratory (CRL)[15] for GM Food and Feed, particularly with respect to the validation of analytical methods for the event-specific quantification of GMOs that are under marketing approval. Details of these tasks are anchored in Regulation 1829/03 on GM Food and Feed. The identification of new GM products during the application process and later surveillance is simplified by compulsory insertion of a nucleotide-sequence (undisclosed information) in the DNA by the producer and the communication of this information to the CRL[16].

It should be noted that while the regulatory framework within the EU is well established and harmonized, this is far from true on the international level. For example the European Union follows the precautionary approach and the right of consumers to be informed, with stringent approval, labelling and traceability standards on any food produced from or

[7] OJ L 5, 09.01.2004: Regulation (EC) 21/2004
[8] ISO 11784; ISO 11785
[9] Attaran, M. "RFID: An enabler of supply chain operations" (2007) Supply Chain Management, 12 (4), pp. 249 257.
[10] Yu-Chia Hsu et al. "A RFID-enabled traceability system for the supply chain of live fish" IEEE International Conference on Automation and Logistics 1-3 Sept. 2008. ICAL 2008. Page(s):81 - 86
[11] Reviewed in Miraglia, M. et al., "Detection and traceability of genetically modified organisms in the food production chain" (2004) Food and Chemical Toxicology, 42 (7), pp. 1157-1180.
[12] http://engl.jrc.ec.europa.eu
[13] European Network of GMO Laboratories: Activity Report 2002-2004
[14] OJ L 268, 18.10.2003: Regulation (EC) 1829/2003
[15] http://gmo-crl.jrc.ec.europa.eu/
[16] OJ L 102, 07.04.2004: Regulation (EC) 641/2004

derived from GM ingredients. US regulations on the other hand are based on differences in the end product, and include a voluntary safety consultation and voluntary labelling guidelines for GM food[17]. Many other countries follow intermediate approaches. These particularities with regards to national attitudes towards GMOs complicate the trade with GMOs and also traceability approaches.

The legal framework of traceability in the European Union

The approaches discussed above in the agricultural sector have beyond doubt improved food safety and decreased the risk of spreading diseases, and they contribute to consumer information. However, with the exception of GMO products, traceability relies presently mainly on labeling and accompanying documents throughout the production process and market chain. This approach is prone to fraud due to false declarations, and independent control measures are therefore needed to ensure compliance with the law.
In the light of diseases such as the Bovine Spongiform Encephalopathy (BSE) and other food crises caused by feed and food contamination with substances such as dioxin, or pathogens like various *Escherichia coli,* strains or *Listeria monocytogenes*, traceability has gained great attention on the policy agenda. Well elaborated traceability systems are indispensable to guarantee quality and production control throughout the supply chain and to protect and inform consumers adequately. However to ensure that (supra)national traceability schemes function efficiently and reliably, and are harmonized across borders, they have to be accompanied by robust policy making and ultimately be anchored in a legal framework. This is especially true for the European Union where the common market without internal borders requires common standards. EU legislation addresses this issue and in the following section receptive regulations and directives are shortly discussed.

Regulation (EC) No 178/2002: A central European Union law document underpinning the current EU traceability scheme.

Regulation (EC) 178/2002[18] is currently the core EU legislative document with respect to food safety and traceability. It lays down general principles and requirements of food law, and establishes the European Food Safety Authority (EFSA). This regulation sets procedures regarding food safety and refers explicitly to traceability as a means to ensure safety of food and consumer protection. In Article 3 traceability is defined as "***the ability to trace and follow a food, feed, food-producing animal or substance intended to be, or expected to be incorporated into a food or feed, through all stages of production, processing and distribution***".
Article 18 further delineates how traceability should be ensured which is summarized in the following:

1. Traceability must be established at all stages of production, processing and distribution.
2. Business operators must be capable of identifying any person from whom they have been supplied and have to have systems in place which allow for this information to be made available to authorities on demand.

[17] Ramessar, Ket al. "Trace and traceability - A call for regulatory harmony" (2008) Nature Biotechnology, 26 (9), pp. 975-977.
[18] OJ L 31, 01.02.2002: Regulation (EC) 178/2002

3. Business operators must be capable to identify to which business entity their products have been supplied and provide this information to authorities on demand.
4. Point 2 and 3 support and ensure traceability throughout the market chain by the so called "*one-step-back one-step-forward*" approach.
5. Food or feed which enters the market chain within the Community must be adequately labelled or identified to facilitate its traceability. This should be ensured through relevant documentation or information in accordance with specifications provided in Article 58(2).

While not explicitly referring to fish and fish products, these are covered by Regulation 178 since it implements rules about food and feed in general. Importantly it intends to ensure traceability by enacting every operator along the market chain to identify the predecessor and successor.
In article 17 this regulation defines the distribution of responsibilities to ensure the proper implementation of the rules laid down:
First food and feed business operators are obliged to ensure at all stages of production, that food or feed satisfy the requirements of food law which are relevant to their activities.
Secondly, the EU member States monitor, control and enforce the food law, and survey that the business operator fulfil their respective obligations.
For that purpose, they must maintain a system of official controls and food and feed safety surveillance and other monitoring activities covering all stages of production, processing and distribution.
Additionally Member States lay down the rules on measures and penalties applicable to infringements of food and feed law, which have to be effective, proportionate and dissuasive. Interestingly these latter specifications are analogous to the Common Fisheries control and enforcement scheme, where infringement penalty measures are also introduced on member state level, leading to a highly heterogeneous enforcement landscape in the European fisheries sector.
Legal documents complementing regulation 178 are Regulation (EC) 104/2000[19], which establishes that commercial name, production method and catch area or country of production on each product are required for labelling. Regulation 104/2000 was subsequently extended by Regulation (EC) 2065/2001[20], adding more specific details to the final information given to the customer in terms of production method and geographic origin. The labelling information has to be given at every step of the production and retailing chain.
The current legal framework for traceability in the European Union relies essentially on labelling of goods and the accompanying documents serving as certificates. It is therefore to a vast extent dependent on primary information provided by the producer and other stakeholders involved in the production and supply chain.
This is why, to ascertain reliable and proper control and enforcement schemes, independent validation methods are indispensable. Labels do provide authorities and consumers with information about the product, but as shown in numerous examples this information is prone to counterfeit.
The aim of FishPopTrace is to develop independent control tools for end-users, as well as methods to generate evidence in cases of suspected fraudulent activities, which can be admitted as proof in court cases.

[19] OJ L 17, 21.01.2000: Regulation (EC) 104/2000
[20] OJ L 278, 23.10.2001: Regulation (EC) 2065/2001

Traceability in non-EU countries

As outlined above, the EU has developed a comprehensive legal framework to ensure food safety and consumer protection as well as to fight fraudulent activities.
However, worldwide efforts exist to address food safety issues, following similar but also quite different strategies as the EU, some of which are briefly discussed below.
In the US, the so called "Lacey Act"[21] sets rules for the labelling of fish and wildlife products. Originally introduced to fight illegal hunting in the beginning of the last century, its scope has been broadened considerably through numerous amendments. Nowadays it prohibits the selling of unlabelled fish and wildlife products and penalises mislabelling. The Lacey Act is a very powerful law in that under its remit any U.S. citizen is liable if he breaks an underlying foreign fisheries or wildlife law and subsequently imports, exports, transports, sells, or receives that product into the U.S. Any misdoing is regarded as a felony provided that the matter under investigation amounts in value to more than $350 and that the investigating authorities can prove that the defendants had knowledge of their wrongdoings, *i.e.* acted intentionally (if no knowledge can be proven the wrongdoing is regarded as a misdemeanour)[22].
The pertinent part is 16 U.S.C. §3372 Prohibited Acts and its wording runs as follows:

(a) Offenses other than marking offenses

It is unlawful for any person

-(1) to import, export, transport, sell, receive, acquire, or purchase any fish or wildlife or plant taken, possessed, transported, or sold in violation of any law, treaty, or regulation of the United States or in violation of any Indian tribal law;

(2) to import, export, transport, sell, receive, acquire, or purchase in interstate or foreign commerce -(A) any fish or wildlife taken, possessed, transported, or sold in violation of any law or regulation of any State or in violation of any foreign law;

(B) any plant taken, possessed, transported, or sold in violation of any law or regulation of any State; or

(C) any prohibited wildlife species (subject to subsection (e) of this section);

(3) within the special maritime and territorial jurisdiction of the United States (as defined in section 7 of title 18)

- (A) to possess any fish or wildlife taken, possessed, transported, or sold in violation of any law or regulation of any State or in violation of any foreign law or Indian tribal law,

Or

(B) to possess any plant taken, possessed, transported, or sold in violation of any law or regulation of any State;

Or

(4) to attempt to commit any act described in paragraphs (1) through (3).

Recently traceability schemes have been focused on in the US Act on Bioterrorism. It follows a similar principle as the "one-step backward, one-step forward" approach and requires the announcement of every food shipment prior to the arrival[23]. All data (food item

[21] 16 U.S.C. 16 § 3371-3378
[22] Paul Raymond, NOAA Office of Law Enforcement OLE, USA; Personal Communication.
[23] Public Law 107-188, 12.06.2002: Public Health Security and Bioterrorism Preparedness and Response Act of 2002.

specification, country of production, *etc.*) must be submitted electronically to the authorities in charge to allow for immediate control and a rapid countermeasure response in case of a perceived threat.
Australia and New Zealand have developed a joint set of rules to cope with threats regarding food and consumer protection. The "Australia New Zealand Food Standards Code" defines, inter alia, the label requirements for GM food[24]. Under the umbrella of this shared legislation Australia has developed its own body of rules, including the "one-step backward, one-step forward" approach.
Regarding radio-frequency identity (RFID) tags to simplify access to the stored tracing data, the Ministry of Agriculture, Forestry and Fisheries in Japan and the National Livestock Identification System in Australia use this latest electronic advancement in traceability. All parameters are stored in unique devices that will remain with the cattle until slaughter, enabling contactless data transmission on demand (Japan, *e.g.*, stores these data in the Individual Cattle Identification Register, managed by the National Livestock Breeding Centre).
Currently traceability schemes benefit worldwide from the developments and fast progress in logistics and information technology, which facilitate greatly acquisition, storing and retrieval of data and support networking. However there remains room for improvement in the development of methods and technologies allowing for independent data validation and control of labelling and declarations. These gaps provide an opportunity for initiatives proposing the utilisation of advanced technologies to improve traceability schemes around the globe, and the European Union is well positioned to be at the cutting-edge of these initiatives by supporting research in this area.

The rational of traceability in the fisheries sector

Modern fisheries are a highly industrialized sector exploiting a common natural and profitable resource, characteristics which make fish stocks vulnerable and highly prone to overexploitation. Consequently, to ensure sustainability, regulation of the fisheries sector is indispensable. On the other hand, because fish stocks represent a common resource, and because nowadays the marketing pattern of fish and fish products is highly complex, control and enforcement of these regulations is extremely intricate.
This is why any traceability scheme, being supported by independent and validated control technologies, would be highly beneficial to fisheries and the manifold components of it, such as fisheries management, conservation, aquaculture, and also consumer protection. Immediately at the beginning of the market chain, the landing of fish, it would provide inspection authorities with powerful tools for control and support enforcement. These aspects will be further touched upon in the following.
In terms of consumer protection, traceability gives the consumer access to information and control authorities tools to verify labels and validate information provided. Labels such as 'protected designation of origin' (PDO) and 'protected geographical indication' (PGI) state a certain origin and unique production method to the customer[25]. These European labels are similar to the French 'Appellation d'origine contrôlée' (AOC) or the Italian 'Denominazione di origine' (DOC).
In the fisheries sector an analogue system backed up by scientific data would help to increase the reputation and credibility of companies and other stakeholders of the market chain, and provide beneficial information to the customer. Initiatives to produce recognized certificates (*e.g.* "eco-lables" or labels of "sustainable fisheries") have recently gained momentum, and with rising awareness of the clients, the fishing industry shows a steadily increasing interest to obtain such certificates. Currently probably the most common of such

[24] Australia New Zealand Food Standards Code (http://www.foodstandards.gov.au/thecode/)
[25] From farm to fork: Safe food for Europe's customers. European Union 2004

certificate schemes is that of the global non-profit organisation Marine Stewardship Council (MSC)[26]: The fishery certification and seafood eco-label program, recognising and rewarding sustainable fishing. Many fisheries attempt to obtain this certificate, one of the latest examples being the Southern Brittany's (France) purse seine sardine fishery which entered the full assessment process to be certified by the Marine Stewardship Council (MSC) as sustainably managed[27].

The Common Fisheries Policy (CFP) is the European Union's instrument for the management of fisheries and aquaculture and aims to ensure sustainable exploitation of living aquatic resources. This goal is implemented through a variety of fisheries management tools which include monitoring and control of the fishery sector.

Indeed fraud, poaching, and Illegal, Unreported and Unregulated (IUU) fishing endanger the success of the CFP, and recently the Court of Auditors and the European Commission pointed out severe shortcomings in the CFP control scheme[28]. The severity of illegal fishing activities, also in EU waters, is stressed by various studies: The Baltic Fisheries Assessment Working Group (WGBFAS) reported that In the Eastern Baltic, probably 35-45% more cod is landed than reported[29]. Illegal fishery products imported into the European Union each year are estimated to be at approximately 500,000 tons; reaching 30% of total catches value in some fisheries[30]. Control and inspection measures within the frame of the CFP certainly address these issues, *e.g.* by documentation on every stage of the marketing process, with documentation consisting of species, landing date, vessel name, skipper *etc*.[31].

However, again documentation relies exclusively on labelling and the correctness of the information provided. - As stressed before such an approach is vulnerable to fraud (see also above for the agriculture sector).

Fish stock assessment is the "cornerstone" of fisheries management, and also forms the baseline for output management tools such as Total Allowable Catches (TACs)[32]. The methods of fish stock size estimation underwent considerable change recent years. While formerly single stocks were assessed mainly by recording the amount of landings and from targeted surveys. More recently a shift towards an ecosystem approach of fisheries management ("Ecosystem Based Fisheries Management"), which takes into account the multi-causal interactions of fisheries, fish stocks, marine ecosystems, and also socio-economic aspects has occurred[33,34]. A traceability scheme, also based on data enabling the geographical origin assignment of fish, and anchored in a legal framework, can contribute to compliance with current management schemes such as assigning catch quotas to distinct fish populations, formerly identified by scientific analysis.

Keeping in mind management issues, global developments of marine food availability have to be taken into account as well. Global production of fish products by aquaculture has reached more than 50 million tonnes annually[1]. The United Nations Environment Programme (UNEP) expects an increasing demand for high-value seafood by 1.5 per cent during the next decades[35]. Aquaculture production increased by 9.1 per cent/year between

[26] http://www.msc.org/

[27] FIS World News; FRANCE Wednesday, February 11, 2009; www.fis.com.

[28] European Court of Auditors (2007) Special Report No 7/2007 (pursuant to Article 248(4) second paragraph, EC) on the control, inspection and sanction systems relating to the rules on conservation of Community fisheries resources together with the Commission's replies.

[29] Report of the Baltic Fisheries Assessment Working Group (WGBFAS). ICES 2005

[30] Discards in the worlds marine fisheries - An update. FAO 2005

[31] http://ec.europa.eu/fisheries/cfp/control_enforcement_en.htm

[32] Total Allowable Catches (TACs) involves the fixing of maximum quantities of fish that in accordance with the management objectives can be caught from a specific stock over a given period of time. They are set annually for the EU.

[33] Implementing Ecosystem-based management. D. Slocombe 1993, BioScience (43) 9

[34] Models for an ecosystem based approach to fisheries. FAO 2007

[35] Global Environmental Outlook 4. UNEP 2007

1987 and 2004 and, in order to meet the constantly growing demand, will most likely continue to increase. Meanwhile in the EU, an annual production of 1.2 million tonnes of aquaculture products amount to nearly 20% of the total volume of products derived from fisheries and aquaculture[36].

This rise in aquaculture production is paralleled by an increase of environmental threats: For example escapees from fish cages can have highly adverse effects on the fitness of wild stocks: If aquaculture individuals, which are *comparably* less well adapted to conditions in the wild, do escape, they might reproduce with members of natural populations thereby reducing the overall fitness of the wild populations.

An example is the introduction of a group of individuals with reduced genetic variability or even specific genetic strains into natural populations. This can lead to a significant decline of natural populations[37] as a result of a "facilitation of the spread of pathogens"[38].

Such threats are further enhanced by the potential use of genetically modified (GM) strains in aquaculture, chosen for higher productivity and resistance to specific pathogens[39]. These scenario emphasize the need for precise technological tools backed by legislation to trace escaped individuals back to their source, as to diminish further damages, and if needed to produce means of evidence, *e.g.* for court trials. Such an approach would first need the genetic characterisation of the aquaculture fish strain, as well of the respective natural populations which is part of the scope of FishPopTrace. Ultimately this would allow to identify escapees and to trace them back to their origin. It would also provide both support for additional security and, if needed, evidence material for enforcement measures in cases of question of liability.

A certified traceability scheme supports the credibility of honest fishery companies since they are able to prove the validity of their products at every stage of the production and retail chain, thus having an advantage in the fisheries market. Also, these companies are best prepared for a potential withdrawal of products in case of a detected contamination.

The possible application of up-to-date analytical methods can contribute considerably to improvements in the various scenarios described above. In co-operation with the stakeholders such technologies can be implemented such that they are tailored and adapted to specific conditions and needs.

An example for a fisheries control measure referred to in the EU legislation: the Vessel Monitoring System (VMS)

The integration of methods based on advanced technologies into a legislative framework is not trivial: Before any such technology can be referred to in a legislative document, it has to be scrutinized according to strict standards, and prove its applicability, reliability and benefits.

An example of the successful inclusion of a modern technology into the EU legislation are the satellite based Vessel Monitoring System (VMS) [40] and Vessel Detection System (VDS) [41]. Already in the Regulation (EC) No 2371 of 2002[42], on the conservation and sustainable exploitation of fisheries resources under the Common Fisheries Policy, it is stated that "... *a fishing vessel* [exceeding 15 metres length] *shall have installed on board a functioning*

[36] Facts and figures on the CFP. European Communities 2008

[37] Declining wild salmon populations in relation to parasites from farm salmon. M. Krkosek et.al 2007, Science (318)

[38] Fugitive Salmon: Assessing the risks from escaped fish from net-pen aquaculture. R.Naylor et. al. 2005. Bioscience (55) 5

[39] Ethical analysis of the use of GM fish: Emerging issues for the aquaculture development. K.Millar, S.Tomkins 2007. Journal of Agricultural and Environmental Ethics (20) 5

[40] OJ L 333/17, 20.12.2003: Regulation (EC) 2244/2003

[41] OJ L 409/1, 30.12.2006: Regulation (EC) 1966/2006

[42] OJ L 358/59; Regulation (EC) No 2371/2002

system which allows detection and identification of that vessel by remote monitoring systems." (Article 22(1)(b)). This is further and specifically delineated in the Commission Regulation (EC) No 2244/2003, laying down detailed provisions regarding satellite-based Vessel Monitoring Systems, according to which "*A Community fishing vessel subject to VMS* [*i.e.* exceeding 15 metres in length] *is not allowed to leave a port without an operational satellite-tracking device installed on board.*" (Article 4).

European seas are not the only areas where satellite based monitoring of vessels is established. Although there is no nation-wide legal framework in US waters (such as the Lacey Act in terms of conservation, see above), fisheries are managed by Regional Fishery Management Councils. They consist of representatives from the industry, NGOs, fishermen, and staff from the National Oceanic and Atmospheric Administration (NOAA). Already in 1988, NOAA's Office of Law Enforcement (OLE) introduced VMS in the first of these regional fisheries[43].

Furthermore, VMS was approved in 1991 by the now called Pacific Islands Forum (PIF), an inter-governmental organisation of Pacific States and the US. It demands *"...the development and implementation of vessel monitoring systems, including, as appropriate, satellite transmitter systems..."* to support MCS of vessels and their fishing operations[44].

Later, in 1998, the US introduced VMS in its Exclusive Economic Zone (EEZ), but not all fisheries (see organisation above) are using it yet.

Australia followed a similar approach: In 1992 VMS was introduced for the Orange Roughy (*Halpostethus atlanticus*) fisheries following a request of compliance officers and fishery managers who wanted to prevent mis-reporting between fishing zones. Thereafter also other fisheries implemented VMS, acknowledging that it constitutes a valuable business tool and management device[45]. Finally, the Australian Fisheries Management Authority (AMFA) made VMS compulsory for all Australian fisheries in response to a formal directive of the Federal Minister of Fishery, Forestry and Conservation[46]. Because this directive demanded to halt overfishing and to support the recovering of fish stocks, AFMA decided that inter alia VMS can contribute to this task.

Formerly, at the onset of the Common Fisheries Policy in 1983, the usage of standardized log-books, to be filled in by the master of the fishing vessel, recording the course and landings of the fishing vessel, was obligatory by legislation to ensure compliance with rules[47]. This is to some extent reminiscent to the current system of food tracing in the EU, which is based on labelling and documentation (see above).

For the EU fisheries sector this situation has changed with the introduction of VMS and VDS, currently the only independent methods to control for compliance with fishery rules, which are anchored in the EU legislation.

These examples illustrate well the process leading to the gradual implementation, based on a legal framework, of VMS in many fisheries worldwide. Importantly, data based on VMS and VDS have generally been accepted as evidence material in court cases[48], proving their value for fisheries control and enforcement. The success of the implementation of VMS (and VDS) in the fisheries sector should serve as a paradigm and encourage the introduction of other complementing new technologies for fisheries control and enforcement within a legal framework.

[43] http://www.nmfs.noaa.gov/ole/vms.html
[44] The Australian Fisheries Management Act, 1991.
[45] AFMA, Mark Farrell & Bob Stanley, personal communication May 2008.
[46] Future Operating Environment for Commonwealth Fisheries. AFMA 2005.
[47] OJ 276 10.10.1983: Regulation (EC) 2807/1983
[48] Evidential value of VMS position reports. FISH Final Report 2002/11

Traceability in the fisheries sector: present state

Traceability in the EU fisheries sector relies at present substantially on labelling and written certificates. The criteria to be fulfilled are laid down in the European legislation and aim mainly at the protection of the consumer.
As already outlined above, specific rules for fish products do not exist but are covered by the overall legislation since all food sold in the EU must meet fixed labelling and information standards during transport and retail.
Under certain certification schemes, such as that of the Marine Stewardship Council (MSC), labelling rules have been taken further and are backed up by elaborate control procedures. As discussed, this global non-profit organisation evaluates fisheries upon request, and awards certification, after examination applying strict criteria, with a label accrediting sustainable and environment-friendly fisheries practices. The high and constantly increasing number of fisheries applying for these certificates shows the interest the fishery industry has in such programs, and the resulting benefits are manifold. The industry can respond to the rising awareness of consumers about the negative impact of fisheries on the environment and the increased exigency on specific product characteristics. The consumer on the other hand receives trustworthy product information supporting consumer choice and consumer protection. Finally, the industry has a great interest to comply with set rules as to maintain the trust it has gained on the consumer side, which ultimately results in more sustainable and transparent fishing behaviour.
Interestingly the above reasoning is reflected in the foundation history of the MSC: It was launched in 1997 as a global non-profit organisation in a combined effort by the WWF and Unilever before becoming independent in 1999. Unilever's support might well have originated from the incentive to improve its reputation (as depicted in the "rational of traceability" break). Subsequently the initiative quickly gained momentum and stimulated many other stakeholders to join in.
Obviously also for these schemes independent control technologies are extremely valuable. Indeed the MSC has contacted FishPopTrace in order to receive information about whether and how results emanating from this project could be used to back up MSC certificates[49].

Discussion

An elaborate traceability scheme for the EU fisheries sector could indeed contribute greatly to improve the currently difficult and, with respect to declining fish stocks, even alarming situation. A fully functional traceability framework would support various aspects of fisheries, including control and enforcement of rules set in the frame of the fisheries management measures, as well as monitoring all along the market chain and information/protection of the consumer.
This document highlighted examples of traceability successfully applied in sectors other than fisheries, namely the agricultural sector. It also discussed satellite vessel monitoring (VMS) and vessel detection (VDS). Both are applied for monitoring and control of EU fisheries and referred to in the EU legislation, therefore serving as examples for the use of advanced technologies *e.g.* based on genetics and forensics to support fisheries control and traceability.
Worldwide, traceability has gained importance on the policy agenda, in the agricultural and food sector, but also, and increasingly so, in the fisheries sector. Examples of countries where efforts to apply traceability schemes are considerably advanced are the U.S.A., Australia and New Zealand. Especially in the US the legal framework appears to be very powerful with respect to law enforcement in the area of wildlife crimes, as shown by the recent disclosure of illegal importation and sale of over ten million pounds of falsely

[49] G.R. Carvlaho; Bangor University; Coordinator of FishPopTrace; Personal communication.

labelled catfish[50] and illegal shark fin trade[51]. Interestingly in both cases evidence based on forensic genetics constituted a substantial element during the investigation and in court trials.

Cases like these illustrate the great potential of advanced technologies based on biotechnology, molecular biology, genetics, chemistry and forensics for fisheries control and traceability. However, to ensure that such technologies are applied consistently and homogenously throughout the EU, they must be embedded in a legal framework, similar to VMS and VDS.

A promising event in this respect was the presentation of the Commission proposal for a reform of the CFP control scheme, elaborated by DG Mare and submitted in November 2008. Article 13 of this document refers explicitly to new technologies and traceability tools such as genetic analysis[52]. FishPopTrace is referred to in the Impact Assessment accompanying the Commission CFP control reform proposal[53]. It has to be seen whether and to what extent advanced technologies as defined above find their way into the EU policy making. While it is certainly true that such technologies are partly already and successfully applied in various EU member countries[54], it is desirable to extend such an approach to the entire EU and to encourage cooperation on all levels between the EU member states. This would be an important step towards a further improved Common Fisheries Policy and would greatly facilitate monitoring and control of the EU fish market chain. Moreover the EU has established important links in terms of fishing rights or as a trade partner with third countries, and certain responsibilities are arising with regards to this issue. For example it has to be assured that such trade relations do not involve IUU fishing and that fishing in third country waters does not perturb local socio-economic structures[55]. Also in this context advanced technologies as defined above can be employed to support MCS as to determine compliance with rules. Obviously such an approach would be much more powerful if backed up by a legal framework. The project FishPopTrace is designed to take the needs and requirements of all relevant stakeholders that are concerned with MCS and traceability issue in the fisheries sector into account. This includes an elaborate technology transfer approach aiming at providing end user tools, optimally adapted to requirements in the field, and our attempts to contribute with scientific input to policy making[56]. We believe that ultimately the successful application of advanced technologies for MCS and traceability in the EU fisheries sector will indeed depend on their uptake into policy making, their anchoring in a legal framework and the implementation of the underlying rules and laws.

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[50] Fis Worldnews 31/10/08 (http://fis.com/fis/worldnews/) & Paul Raymond (NOAA Office of Law Enforcement)- personal communication.

[51] U.S. Department of Justice – United States Attorney's Office; Los Angeles Times; The Ledger; Paul Raymond (NOAA Office of Law Enforcement) – personal communication.

[52] Proposal for a COUNCIL REGULATION establishing a Community control system for ensuring compliance with the rules of the Common Fisheries Policy (Brussels, COM(2008) 721 final).

[53] Commission Staff Working Document accompanying the proposal for a COUNCIL REGULATION establishing a Community control system for ensuring compliance with the rules of the Common Fisheries Policy: IMPACT ASSESSMENT (Brussels, SEC(2008) 2760/2).

[54] Personal Communication: Lars Bonde Erikson (Danish Directorate of Fisheries; Inspectorate of Fisheries); Einar Eg Nielsen (Technical University of Denmark); Dr. Norbert Hess, Department of Gene-Technology, Institut für Hygiene und Umwelt Hamburg, Germany; Montserrat Espiñeira Fernández, Área de Biología Molecular y Biotecnología, ANFACO-CECOPESCA, Spain.

[55] Sharon Lafranyere, International Herald Tribune, January 14, 2008.

[56] FishPopTrace position paper on the value of new technologies for fisheries MCS and traceability the public consultation on the CFP control reform, launched by the European Commission in February 2008 (http://ec.europa.eu/fisheries/cfp/governance/consultations/consultation_280208_en.htm).

Annex:

EU Regulations and Directives referred to in the text

Progressively legislative documents with relevance to the scope of FishPopTrace will be made available and commented on the FishPopTrace webpage in the "Policies" section. All EU laws are published in the *Official Journal of the European Union* (OJ) and can be found on the EURLEX website (http://eur-lex.europa.eu/en/index.htm).

[1] Commission Regulation (EEC) No 2807/83 of 22 September 1983 laying down detailed rules for recording information on Member States' catches of fish. (OJ L 276, 10.10.1983, p. 1–18)

[2] Council Regulation (EC) No 104/2000 of 17 December 1999 on the common organisation of the markets in fishery and aquaculture products. (OJ L 17, 21.1.2000, p. 22–52)

[3] Regulation (EC) No 1760/2000 of the European Parliament and of the Council of 17 July 2000 establishing a system for the identification and registration of bovine animals and regarding the labelling of beef and beef products and repealing Council Regulation (EC) No 820/97. (OJ L 204, 11.8.2000, p. 1–10)

[4] Commission Regulation (EC) No 2065/2001 of 22 October 2001 laying down detailed rules for the application of Council Regulation (EC) No 104/2000 as regards informing consumers about fishery and aquaculture products (Text with EEA relevance). (OJ L 278, 23.10.2001, p. 6–8)

[5] Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January2002 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 (OJ L 31, 1.2.2002, p. 1–24)

[6] Council Regulation (EC) No 2371/2002 of 20 December 2002 on the conservation and sustainable exploitation of fisheries resources under the Common Fisheries Policy. Official Journal of the European Communities. (OJ L 358, 31.12.2002, p. 59–80)

[7] Regulation (EC) No 1829/2003 of the European Parliament and of the Council of 22 September 2003 on genetically modified food and feed (Text with EEA relevance)
(OJ L 268, 18.10.2003, p. 1–23)

[8] Commission Regulation (EC) No 2244/2003 of 18 December 2003 laying down detailed provisions regarding satellite-based Vessel Monitoring Systems. (OJ L 333, 20.12.2003, p. 17–27)

[9] Council Regulation (EC) No 21/2004 of 17 December 2003 establishing a system for the identification and registration of ovine and caprine animals and amending Regulation (EC) No 1782/2003 and Directives 92/102/EEC and 64/432/EEC. (OJ L 5, 9.1.2004, p. 8–17)

[10] Commission Regulation (EC) No 641/2004 of 6 April 2004 on detailed rules for the implementation of Regulation (EC) No 1829/2003 of the European Parliament and of the Council as regards the application for the authorisation of new genetically modified food and feed, the notification of existing products and adventitious or technically unavoidable presence of genetically modified material which has benefited from a favourable risk evaluation (Text with EEA relevance). (OJ L 102, 7.4.2004, p. 14–25)

[11] Council Regulation (EC) No 1966/2006 of 21 December 2006 on electronic recording and reporting of fishing activities and on means of remote sensing. (OJ L 409, 30.12.2006, p. 1–10)

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