Authenticate: Workshop proceedings

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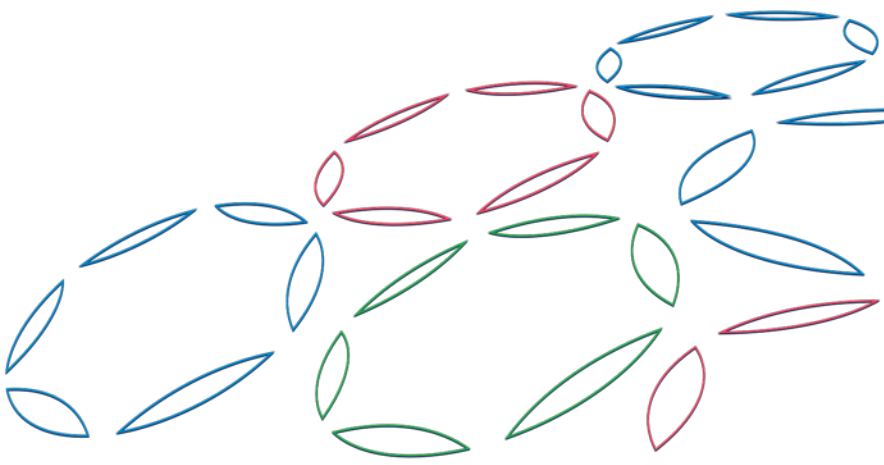

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Icelandic Food and Biotech R&D

Report summary

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Titill / Title	**Authenticate: Workshop proceedings**		
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Summary in English:	Growing societal demand for food authenticity, safety and broader food security is creating both new opportunities and increased challenges for Nordic food suppliers, manufacturers and retailers. The mislabelling of food products came to great prominence during the 2013 "horse meat scandal" in Europe, when a range of supposedly beef products were found to contain horse meat. What makes this discovery surprising is that it took place despite the clear set of European Union (EU) regulations relating to food traceability and labelling, which require a complex system of checks to ensure that food remains authentic and traceable. Research have shown that the seafood sector is particularly vulnerable when it comes to fraud, partly due to the fact that seafood is the world's most international traded food commodity and because seafood has extreme biological diversity and variable characteristics that can create or hamper competitive advantage in marketing of products. Among the issues relevant for this discussion are species substitution, false claims of origin, social responsibility, sustainability, food safety and fair trade. A handful of Nordic institutes and companies came together few years ago to initiate networking among stakeholders in the Nordic seafood industry, with the aim of discussing the challenges and opportunities related to food integrity for the sector. As results a series of workshops were organised in Iceland, Norway and Denmark; and the outcome of these workshops were then discussed at a final workshop held in Faroe Islands on Nov. 14th 2017. This report contains the proceedings from that workshop.		
English keywords:	*Food Integrity, Food fraud, species substitution, seafood, false claims*		
Ágrip á íslensku:	Heilindi í viðskiptum með matvæli hafa verið mikið til umræðu á undanförnum árum og hefur sjávarútvegurinn ekki farið varhluta af þeirri umræðu. Rannsóknir hafa sýnt að hlutfall svika er sérstaklega hátt í viðskiptum með sjávarfang. Fjöldi rannsókna hafa til að mynda farið fram þar sem tegundasvindl hefur verið skoðað í þaula og hafa margar þeirra rannsókna sýnt að algengt hlutfall slíkar svika sé um 30%. Aðrar tegundir svika eru t.d. falskar yfirlýsingar um sjálfbærni, heilnæmi, upprunaland o.s.frv. Nokkrar Norrænar stofnanir og fyrirtæki komu saman 2014 og ákváðu að reyna að skapa umræðugrundvöll um heilindi í viðskiptum með sjávarfang. Þeim fannst augljóst að tækifæri lægju í samstarfi Norrænna þjóða á þessu sviði. Í kjölfarið voru haldnir vinnufundir á Íslandi, Noregi og Danmörku. Niðurstöður þeirra funda voru svo ræddar á lokafundi sem fram fór í Færeyjum 14 nóv. 2017. Þessi skýrsla inniheldur umfjöllun og fundargögn frá þeim fundi.		
Lykilorð á íslensku:	*Matarheilindi, matarsvindl, tegundasvik, sjávarfang, falskar yfirlýsingar*		

[1] Matís ohf. Iceland. [2]Norima, Norway. [3]AZTI technalia, Spain. [4]Havforskningsinstituttet, Norway. [5]DTU aqua, Denmark.

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Introduction

Food authenticity and in particular mislabelling of food products came to great prominence during the 2013 “horse meat scandal” in Europe, when a range of supposedly beef products were found to contain horse meat. What makes this discovery surprising is that it took place despite the clear set of European Union (EU) regulations relating to food traceability and labelling, which require a complex system of checks to ensure that food remains authentic and traceable. It was primarily through the use of DNA based methodologies for identifying species that this fraud was detected.

Growing societal demand for food authenticity, safety and broader food security is creating both new opportunities and increased challenges for Nordic seafood suppliers, manufacturers and retailers. Research have shown that the seafood sector is particularly vulnerable when it comes to fraud, partly due to the fact that seafood is the world’s most international traded food commodity and because seafood has extreme biological diversity and variable characteristics that can create or hamper competitive advantage in marketing of products. Among other issues that the seafood sector has to deal with in regard to food fraud are:

- Species substitution is among the highest of all food commodities, as published research has identified an average substitution rate of around 30%, and much higher for certain high value species. Many of the species supplied from the Nordic countries have favourable characteristics, which make them a target for substitution.
- False claims of origin, where the Nordic sector is particularly vulnerable. Seafood from the Nordic countries is in many cases having competitive advantage because of its clean and natural image, sustainable sourcing practices, good management etc.
- False claims of social responsibility, where fish processed by for example slave labour is being sold in competition with Nordic products.
- False documents where IUU catches are being sold in competition with Nordic products.
- Unsafe products that have not been produced in accordance with Nordic or EU standards are being sold in competition with Nordic products.

These are only few examples of the severity of the problem and how it may affect the Nordic seafood sector.

A handful of Nordic institutes and companies came together few years ago to initiate networking among stakeholders in the Nordic seafood industry, with the aim of discussing the challenges and opportunities related to food integrity for the sector. The Authenticate project was formulated from that discussion. The Authenticate project identified the following five key objectives as discussion points in the beginning: 1) issues and methods for monitoring of feed composition (e.g. in aquaculture); 2) possible issues and methods for detection of specific microbial pathogens (e.g. common to seafood borne diseases that contribute significantly to reduced consumer confidence in safety and lead to increased costs for public health); 3) identification of optimum technical platforms for testing through the development of validated, (SOP based) genomic authenticity assays; 4) Exploration and evaluation of economic, legal and regulatory barriers that may influence the development and deployment of new and novel technologies in the marine food system; 5) promotion of the role of genomics in traceability and speciation within the industry.

To ensure the intended progress and results of the project, a total of six milestones were identified; which were:

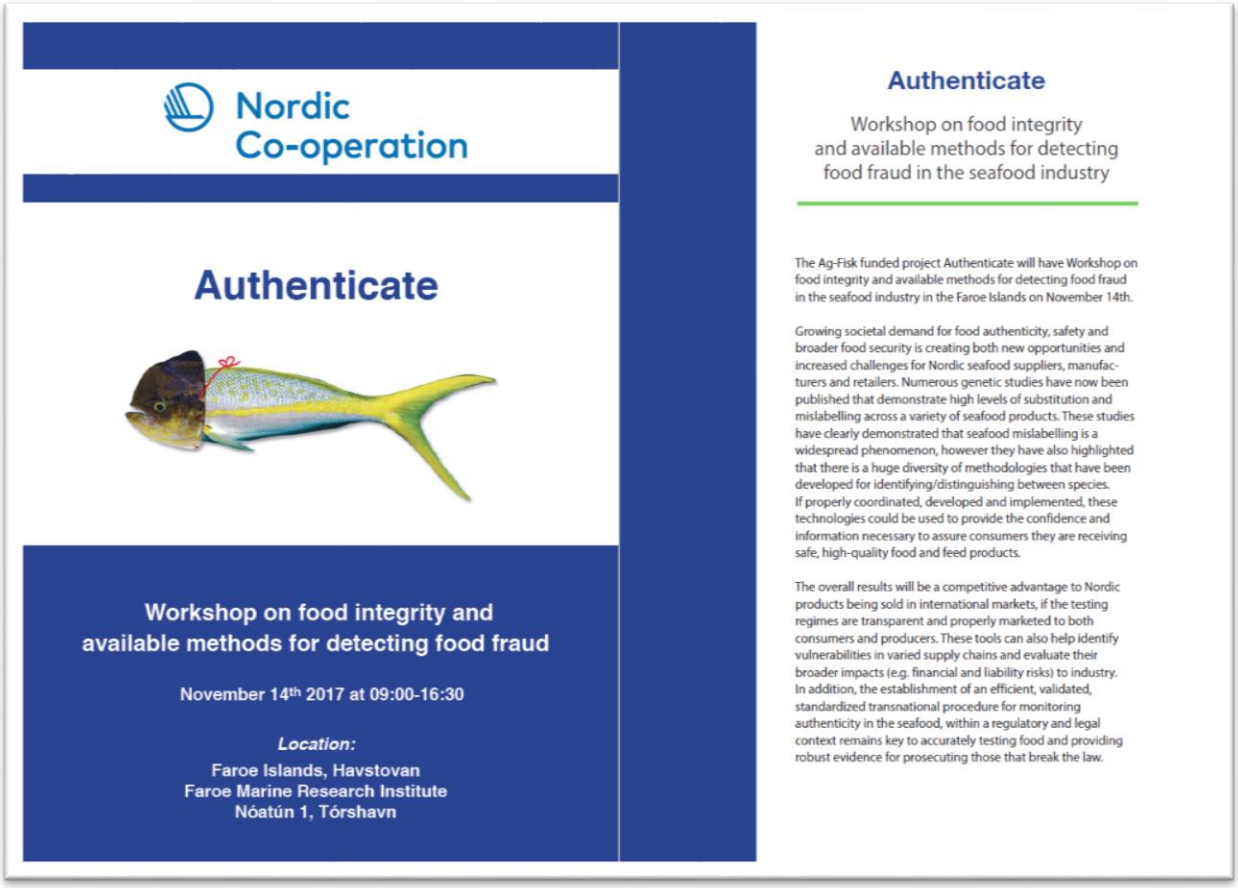
1. An official Kick-off meeting; which took place during ICES WG meeting in Italy 4-8 May 2015.
2. Proposal writing meeting for H2020-SFS-14b-2015, which took place in Bilbao 27 Mars 2015.
3. H2020-SFS-14b-2015 application (Authent-Net) – Which was submitted and funded. The project partners include Matís and Nofima and the total H2020 contribution to the project is 500,000 EUR. The project will among other things facilitate ERA-NET projects that the Nordic countries will have a chance of taking part in.
4. Facilitating workshops in Iceland, Norway and Denmark where national stakeholders would be brought together to discuss the issue of food fraud in the seafood sector.
   The first workshop was held in Iceland on March 16th 2016. The meeting got considerable attention amongst stakeholders and the media. Over thirty stakeholders attended the meeting, which was a great success. The presentations and further discussions are available on the Matís webpage.
   The second workshop was facilitated by IMR in Bergen on October 26th 2016. The workhop was primarily attended by professionals in the field of genetics and served as such an interesting role in bringing together leading Norwegian experts in that field.
   The third and final workshop was organised by DTU and held at DanFish 2017. The workshop was attended by researchers, managers and the fishing industry. Some really good discussions were initiated.
5. Organise a final meeting in Faroe Islands where the input from the national workshops would be discussed along with a selection of relevant presentations. The meeting took place at Havstovan in Torshavn on November 14th 2017. The meeting was attended by around 20 people, but the event was also broadcasted on Facebook where it got 180 views. Discussion on the meeting, along with the presentations can be seen on the Matís webpage.
6. Final reporting.

In general, the project has delivered what was intended. It has brought together stakeholders in the field of food authenticity in the Nordic countries, raced awareness of the issue of food fraud in the Nordic seafood sector, facilitated networking, contributed to work on standardisation of methods for detecting fraud, and contributed to the writing of a successful H2020 proposal.

This report contains the proceedings of the final workshop, which was held in the Faroe Islands on November 14th 2017. This report does also serve as the final report of the Authenticate project.

Workshop proceedings

The workshop was broken into ten presentations and connected discussions, focusing on the different priorities that had been identified at the national workshops in Iceland, Norway and Denmark. The agenda for the workshop is shown below:



Nordic Co-operation

Authenticate

Workshop on food integrity and available methods for detecting food fraud

November 14th 2017 at 09:00-16:30

Location:

Faroe Islands, Havstovan
Faroe Marine Research Institute
Nóatún 1, Tórshavn

Authenticate

Workshop on food integrity and available methods for detecting food fraud in the seafood industry

The Ag-Fisk funded project Authenticate will have Workshop on food integrity and available methods for detecting food fraud in the seafood industry in the Faroe Islands on November 14th.

Growing societal demand for food authenticity, safety and broader food security is creating both new opportunities and increased challenges for Nordic seafood suppliers, manufacturers and retailers. Numerous genetic studies have now been published that demonstrate high levels of substitution and mislabelling across a variety of seafood products. These studies have clearly demonstrated that seafood mislabelling is a widespread phenomenon, however they have also highlighted that there is a huge diversity of methodologies that have been developed for identifying/distinguishing between species. If properly coordinated, developed and implemented, these technologies could be used to provide the confidence and information necessary to assure consumers they are receiving safe, high-quality food and feed products.

The overall results will be a competitive advantage to Nordic products being sold in international markets, if the testing regimes are transparent and properly marketed to both consumers and producers. These tools can also help identify vulnerabilities in varied supply chains and evaluate their broader impacts (e.g. financial and liability risks) to industry. In addition, the establishment of an efficient, validated, standardized transnational procedure for monitoring authenticity in the seafood, within a regulatory and legal context remains key to accurately testing food and providing robust evidence for prosecuting those that break the law.

Following is a discussion on each of these presentations, along with the presentations themselves.

Welcome and introduction

Jónas R. Viðarsson from Matís opened the workshop, introduce4d the Authenticate project and the issue of food authenticity in general. He presented some of the research that have been done on food fraud in the seafood industry, which highlight what a severe problem it is for the entire industry. The issue is particularly important for the Nordic seafood industry, since Nordic seafood has many favourable characteristics that provide competitive advantage. Food integrity presents therefore both challenges and opportunities for the Nordic seafood sector.

Nordic Co-operation

Name	Nationality
Andreas Stokseth	Norwegian
Anita Kjeilen Steinseide	Norwegian
Arnór Snæbjörnsson	Icelandic
Birgitte Jacobsen	Greenlandic
Daniel Valentinsson	Swedish
Erling Larsen	Danish
Geir Huse	Norwegian
Geir Oddsson	Icelandic
Gunilla Vannmer	Swedish
Helge Paulsen	Danish
Jákup Mørkøre	Faroese
Jenny Eklund-Melander	Ålandsk
Klaus Nygaard	Greenlandic
Lars Horn	Norwegian
Leon Smith	Faroese
Max Nielsen	Danish
Mikkel Stage	Danish
Ole Thomas Albert	Norwegian
Orian Bondestam	Finnish
Richard Hudd	Finnish
Sigurjón Arason	Icelandic

Nordic Co-operation

The Authenticate project

Food fraud / Food Integrity

Food fraud and various sorts of "cheating" have been an intrinsic part of the food industry as long as we can remember

With globalization and expanding food value chains the fraud has become increasingly lucrative. Food fraud has therefore become a part of organized crime in some instances.

Food fraud is in most cases Low risk vs. high return for the "criminals"

The horse meat scandal in 2013 was a turning point. Regulations, traceability and awareness has improved.....and penalties have become stricter

Food fraud is common in all food systems

Sweden's National Food Agency has issued a warning after as much as 20 tonnes of meat labelled as beef turned out to be coloured pork.

Mr. Kyösti Siponen, Evira, Finland. 2014

Beef and sheep meat: no tracebility

Kymmeniä tuhansia kiloja lihaa tiellä - lihalastissa ollut rekka kaatui

documentar 20.4.2016
indeer – hart (hjörtur)
ild boar – Pig
mon sole – pangasius

p://www.vgtv.no/#!/video/1027/matjuks-paa-menyen

Operation Opson V (March 2016)

3 illicit production sites of spirits have been discovered and raided by the police forces in Greece in the course of OPSON. In the warehouses, police found and seized all the equipment used to manufacture the fake bottles

More than 10,000 tonnes and one million litres of hazardous fake food and drink have been seized in operations across 57 countries in an INTERPOL-Europol coordinated initiative to protect public health and safety.

An illegal abattoir discovered by police in Hungary during the INTERPOL-Europol coordinated Operation Opson V

red more than 85 tonnes of olives which th copper sulphate solutions to enhance their colour.

In the UK, authorities recovered nearly 10,000 litres of fake or adulterated alcohol including wine, whisky and vodka. In Burundi, mor than 36,000 litres of illicit alcohol were seized in addition to nine Kalashnikov rifles and ammunition along with three grenades which wer recovered during the operation.

Operation Opson VI (April 2017)

EUR 230 MILLION WORTH OF FAKE FOOD AND BEVERAGES SEIZED IN GLOBAL OPSON OPERATION TARGETING FOOD FRAUD

Press Release

Operation OPSON VI, the joint Europol-INTERPOL operation targeting counterfeit and substandard food and drink, as well as the organised crime networks behind this illicit trade, has resulted in the seizure of **9 000 tonnes**, over **26.4 million litres**, and **13 million units/items** worth an estimated EUR 230 million of potentially harmful food and beverages ranging from every day products such as alcohol, mineral water, seasoning cubes, seafood and olive oil, to luxury goods such as caviar.

Portugal – More than 300 000 tin cans of fish seized in a factory

The Portuguese Food Safety and Economic Authority (ASAE) raided a factory in the area of Porto which resulted in the finding of processed fish manufactured without respect of safety rules. This outcome was achieved after several weeks of investigation and surveillance work. The plant was targeted as its licence to process food had been already withdrawn. ASAE uncovered illicit activities containing re-repacking almost expired sardines in tomato sauce, regardless of traceability and hygienic rules. Products were intended for exportation and intra-EU deliveries. The business has been closed immediately after the action day. All material found in the premises was seized, namely 311 000 cans, 16 jars of tomato sauce, 9 900 packing boxes, 24 730 labels and 700 Kilos of salt.

Most fraudulent food items

1. Olive oil
2. Milk / dairy
3. Honey
4. Saffron
5. Orange juice
6. Coffee
7. Apple juice
8. Tea
9. Fish
10. Spices, balsamic vinegar, caviar, vines and spirits etc..

Seafood mislabeling – Species substitution

Species substitution are the most common fraud in the seafood industry:

Report from Oceana published in 2013 about mislabeling in the USA

- 1.200 samples from 674 outlets in 21 states of USA
- 33% mislabeling
- Red snapper 87% mislabeling
- White tuna 59% mislabeling
- Cod 32% mislabeling
- Salmon 7% mislabeling

Seafood mislabeling – Species substitution

Oceana report from 2015 focusing solely on salmon showed

•The situation was much worse than the 2013 report indicated.

•43% mislabeling.

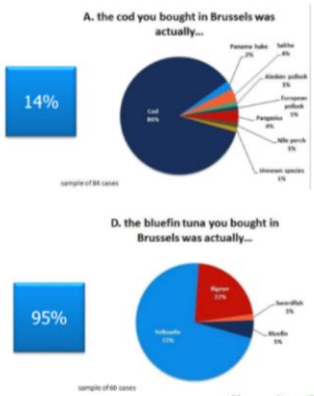
•Most common to sell farmed Atlantic salmon as wild Chinook, King and Sockeye

•Mislabeling much more common in restaurants than in grocery stores

Seafood mislabeling – Species substitution

Oceana report about seafood mislabeling in Brussels

"Oceana carried out DNA testing on 280 fish samples collected from major restaurants and EU institutions canteens in Brussels – facilities used by EU civil servants and politicians. The testing focused on commonly served fish species under the denomination of cod (Gadus spp.), common sole (Solea solea) and bluefin tuna (Thunnus thynnus), and aimed at verifying the exact species sold and its origin in comparison to EU and Belgian law. Samples were analysed by the Laboratory of Biodiversity and Evolutionary Genomics from the Katholieke Universiteit of Leuven. The results show an overall 31.8% of clear cases of mislabelling based on information gathered from either the menu or from restaurant staff. More than 77% of samples focused on popular restaurants from the EU districts and the city centre, with a particular focus on specialised fish restaurants. 15% of samples came from within the EU institution's own canteens (EU Commission and European Parliament), while the remaining covered sushi restaurants."



Seafood mislabeling – Species substitution

Oceana report about seafood mislabeling in Brussels

EU has invested a lot of funds and efforts in addressing food fraud.
Oceana did therefore look specially at mislabeling of seafood in EU canteens in Brussels.

The results were shocking.....38% mislabeling

Seafood mislabeling – Species substitution

The UK Food Safety Authority published a report in 2011 revealing that 7% cod sold in Britain was not really cod.
This was followed with a similar research in Ireland that showed 28% mislabeling.

- Takeaway sector with highest portion of mislabeling
- Pangasius og Alaskan Pollock most commonly substituted for cod
- 90% of the mislabeling is breaded & battered products or smoked products

Seafood mislabeling – Species substitution

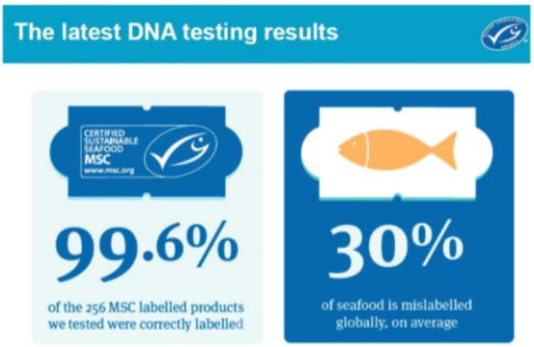
Mislabeling also common in the scandinavian countries

2014 Danish fishmongers cod red handed

MARINE conservation organization, Oceana has revealed high lebels of seafood fraud amongst fishmongers in Denmark. Alongside the Danish newspaper Søndagsavisen and the TV program Go'Aften Denmark, Oceana conducted a study revealing that 18% of cod sold in fishmongers is not actually cod, but haddock or saithe. In total, 120 samples were collected from fishmongers, supermarkets and restaurants in the wider Copenhagen region in order to undergo DNA analysis.

MSC putting emphasis on tackling species substitution

MSC putting emphasis on tackling species substitution



The testing sampled 256 unique products and 13 species of fish, sourced from retailers across 16 countries

Regulations have been made stricter

- Traceability, documentation and labeling laws are now much stricter than before (EU and US leading the way:

- EC 1224/2009 (Traceability): 'all lots of fisheries and aquaculture products shall be traceable at all stages of production, processing and distribution, from catching or harvesting to retail stage".

- EC 1169/2011 and EC 1379/2013 (labelling): FAO sub-area, previously frozen, production method

Regulations have been made stricter

And enforcement has improved

UK 2015
A businessman from Cumbria was sentenced to six months in prison and a fine of more than USD 75,000 for his involvement in a scandal originated in a seabass sale fraud. Substituted Atlantic seabass with Japanese seabass.

UK 2012
Cumbrian Seafoods lost reputation and incurred heavy losses in 2012 following a scandal where they were caught selling scrimp with BAP ecolabelling, which was not coming from BAP certified

Europol – Operation Opson

Other fraud than species substitution

- IUU – Illegal Unreported and Unregulated (pirate) catches have to be sold somewhere....and one way is to falsify documentation.
- Favourable characteristics are important. Mislabelling of origin, ethical claims, fishing method
- Certifications of all sorts
- Fresh vs. frozen
- Food miles – CO2
- Additives – For example using Citric acid or phosphates
- Food Safety i.e. that the fish is processed in sanitary circumstances
- Short-weighting
- Over glazing

How do producers react?

Retail chains and processors have increasingly set up own labratories or outsorsed such service.

- ✓ **DNA**
- ✓ **NIR - Near-infrared spectroscopy**
- ✓ **MNR - Nuclear magnetic resonance spectroscopy**
- ✓ **Stable Isotope Analysis**
- ✓ **WHC – Water Holding Capasity**
- ✓ **Additives**

Research projects on seafood integrity

Labelfish.

Labelfish finished last year. Thousands of DNA testing were done. Mislabeling dependent on geographical area, food sectors and how fragmented the value chains are.
http://labelfish.eu/

Research projects on seafood integrity

FOOD INTEGRITY

https://secure.fera.defra.gov.uk/foodintegrity/index.cfm

Food integrity Network
Publications

Research projects on seafood integrity

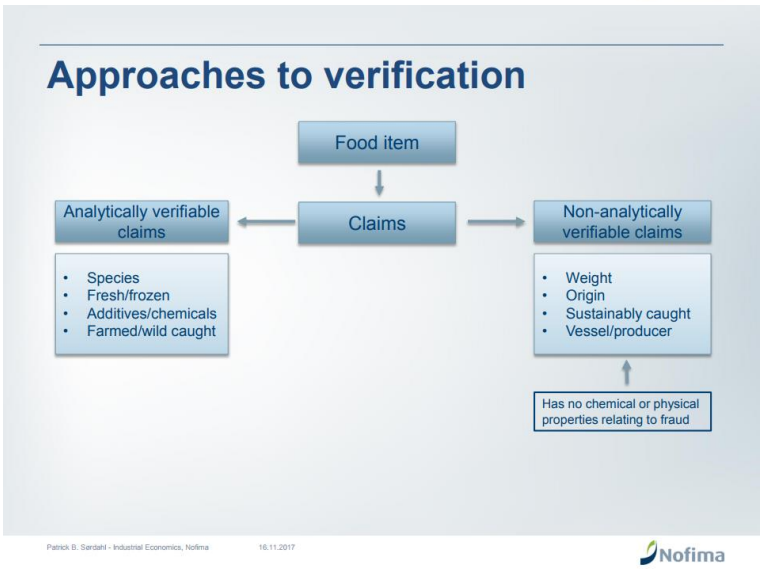
http://www.authent-net.eu/

FARNHub
http://www.authent-net.eu/AN_FARNH.html

CEN-Workshop Agreement – European standard on key terms and concepts
Published mid 2018

Food Integrity – Overall challenges and standards

Patrick Sørdahl from Nofima discussed how complex and variable fraud in the seafood sector can be. There are numerous claims and favourable characteristics that can presented on the product packaging or on the documents accompanying the products, and validation of such claims can be difficult. There are analytical methods available to detect some of these, but others cannot be validated so easily. Example of claims that is difficult to validate through analytical methods are for example claims on sustainability, fair trade, legal/illegal landings, social responsibility etc. A combination of analytical methods and „paper trail" traceability is therefore often needed to validate authenticity of seafood products.



Non-analytical verification methods

- Using public registrations in the food sector to identify sources of discrepancy
- Case study: Norwegian fisheries
- In cooperation with «FoodIntegrity»
  - www.foodintegrity.eu

Discrepancies in the Norwegian fisheries sector

- Various studies indicates different levels of misreporting
  - Survey by Nofima in 2013 indicates 5% misreporting (Svorken & Hermansen 2013)
- Registered imports and landings do not match consumption and exports – why?

What causes a discrepancy?

- Intentional actions
  - Misreporting
  - Mislabeling
  - Substitution
  - Adulteration
  - Counterfeiting
  - Etc...
- Unintentional
  - Product conversion factors
  - Storage conditions
  - Time delay in reporting
  - Mismatch between registrations
  - Poor quality control
  - Production process error
  - Human error

Discrepancies in the Norwegian fisheries sector

- Map and identify mandatory registrations relating to product properties
- Establish the relation between registrations
- Identify sources of discrepancies

Patrick B. Sørdahl - Industrial Economics, Nofima 16.11.2017

Nofima

Mapping of registrations

Authority	Fisheries directorate									Food safety authority				
Value chain	Catch		Production			Transport/export					Transport		To retail or consumer	
Information type	Electronic recording	Advance landing notice	Landing note	Landing report	Labelling and separation	Transport report	Catch certificate storage	Catch certificate production	Catch certficate export	Product traceability and hygiene	Trade document inland	Trade document export	Food labelling	Quality regulation
Vessel identification	x	x	x	x	x									
Landing business ID	x	x	x			x	x							
Production county														
Sender ID											x	x		
Receiver ID									x		x	x		
Landing date/time	x	x	x	x			x							
Species	x	x	x	x		x				x	x	x	x	x
Product ID											x		x?	
Product type ID													x?	x?
Quantity	x	x	x	x		x		x	x	x	x	x	x	x
Catch date	x		x											x
Catch area	x		x										x?	x
Gear type	x		x											
Quota ID	x		x											
Product form		x	x	x		x	x		x		x	x	x?	
Conservation			x										x?	
Size grade			x	x		x								
Recorded weight			x	x										
Landing ID			x	x		x								

Patrick B. Sørdahl - Industrial Economics, Nofima 16.11.2017

Nofima

Mapping of registrations

Ansvarlig myndighet	Fiskeridirektoratet									Mattilsynet			Toll - Utførselsdeklarasjon (TVINN)			
Verdikjeden	Fangst		Produksjon			Transport/eksport					Transport					
Opplysning	Elektronisk sporing	Forhåndsmelding om landing	Landings- og sluttseddel	Journalføring landing	Adskillelse, merking og lagring	Journalføring transport	Fangstsertifikat lagererklæring	Fangstsertifikat produsenterklæring	Fangstsertifikat eksportør	Produktsporing, hygiene og sporbarhet	Handelsdokument innenlands, transport (biprod.)	Handelsdokument samhandel EU/EØS, transport (biprod.)	Identifikasjon	Finansielle opplysninger	Kolli og varebeskrivelse	Sporing
Identifikasjon om den som lander (fartøy)	x	x	x	x	x											
Identifikasjon mottaker/landingshavn	x	x	x			x	x									
Produksjonsfylke																x
Identifikasjon avsender											x	x	x			
Identifikasjon mottaker/importør									x		x	x	x			
Dato og tid for landing	x	x	x	x			x									
Art	x	x	x	x		x				x	x	x			x	
Identifikasjon av produkt											x					
Varens handelsbetegnelse (identifikasjon)															x	
Kvantum/mengde/produktvekt	x	x	x	x		x		x	x	x	x	x			x	
Fangstdato	x		x													
Fangstfelt/sone	x		x													
Redskap	x		x													
Fiskeritillatelse? Kvotetype? Fartøyrolle?	x		x													
Produkttilstand/produkttype		x	x	x		x	x		x		x	x			x	
Konserveringsmåte (fersk, frossen)			x												x	
Størrelsessammensetning			x	x		x										
Vektavlesning (?)			x	x												
Seddelnummer (ubearbeidet fisk)			x	x		x										
Antatt anvendelse			x													
Pris/verdi			x													x
Omsetningsdato			x													
Leveringsmåte			x	x												
Posisjonsrapportering	x															
Fiskeriaktivitet	x															
Transportør/transportmiddel inn (ved annen måte enn landing)				x			x				x	x				
Transportmiddel (ut)						x					x	x	x			
Dato/tid for transport/eksport						x	x		x	x	x	x				
Lagringsmåte							x									
Importland (bestemmelsessted)									x			x	x			
Behandlingsmetode											x	x				
Transit annet medlemsland/tredjeland												x				
Lagringssted													x			
Utgifter transport (leveringsvilkår)														x		
Fakturabeløp														x		
Transaksjon (om varen skal betales eller ikke)														x		

Patrick B. Sørdahl - Industrial Economics, Nofima 16.11.2017

Nofima

Mapping of registrations

Authority	Fisheries directorate									Food safety authority				
Value chain	Catch		Production			Transport/export				Transport			To retail or consumer	
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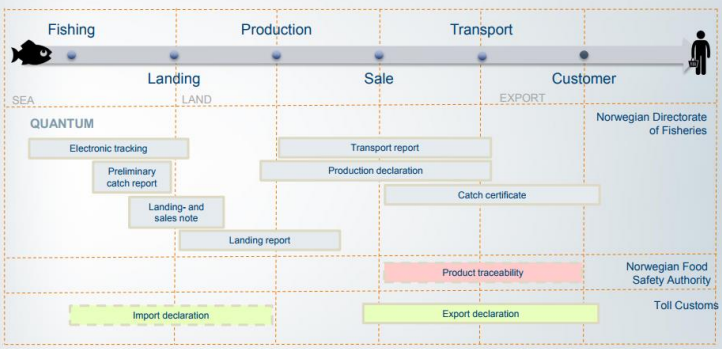
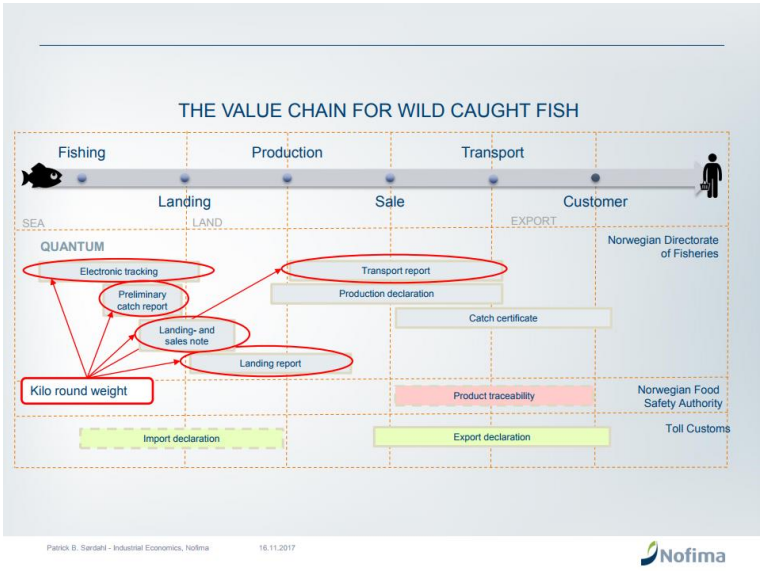
Vessel identification	x	x	x	x	x									
Landing business ID	x	x	x			x	x							
Production county														
Sender ID											x	x		
Receiver ID									x		x	x		
Landing date/time	x	x	x	x			x							
Species	x	x	x	x		x				x	x	x	x	x
Product ID											x		x?	
Product type ID													x?	x?
Quantity	x	x	x	x		x		x	x	x	x	x	x	x
Catch date	x		x											x
Catch area	x		x										x?	x
Gear type	x		x											
Quota ID	x		x											
Product form		x	x	x		x	x		x		x	x	x?	
Conservation			x										x?	
Size grade			x	x		x								
Recorded weight			x	x										
Landing ID			x	x		x								

Mapping of registrations

Authority	Fisheries directorate									Food safety authority				
Value chain	Catch		Production			Transport/export				Transport			To retail or consumer	
Information type	Electronic recording	Advance landing notice	Landing note	Landing report	Labelling and separation	Transport report	Catch certificate storage	Catch certificate production	Catch certficate export	Product traceability and hygiene	Trade document inland	Trade document export	Food labelling	Quality regulation
Vessel identification	x	x	x	x	x									
Landing business ID	x	x	x			x	x							
Production county														
Sender ID											x	x		
Receiver ID									x		x	x		
Landing date/time	x	x	x	x			x							
Species	x	x	x	x		x				x	x	x	x	x
Product ID											x		x?	
Product type ID													x?	x?
Quantity	x	x	x	x		x		x	x	x	x	x	x	x
Catch date	x		x											x
Catch area	x		x										x?	x
Gear type	x		x											
Quota ID	x		x											
Product form		x	x	x		x	x		x		x	x	x?	
Conservation			x										x?	
Size grade			x	x		x								
Recorded weight			x	x										
Landing ID			x	x		x								

THE VALUE CHAIN FOR WILD CAUGHT FISH




THE VALUE CHAIN FOR WILD CAUGHT FISH
Fishing
Production
Transport
Landing
Sale
Customer
SEA
LAND
EXPORT
QUANTUM
Electronic tracking
Preliminary catch report
Landing- and sales note
Landing report
Kilo round weight
Transport report
Production declaration
Catch certificate
Product traceability
Import declaration
Export declaration
Norwegian Directorate of Fisheries
Norwegian Food Safety Authority
Toll Customs
Patrick B. Sørdahl - Industrial Economics, Nofima
16.11.2017
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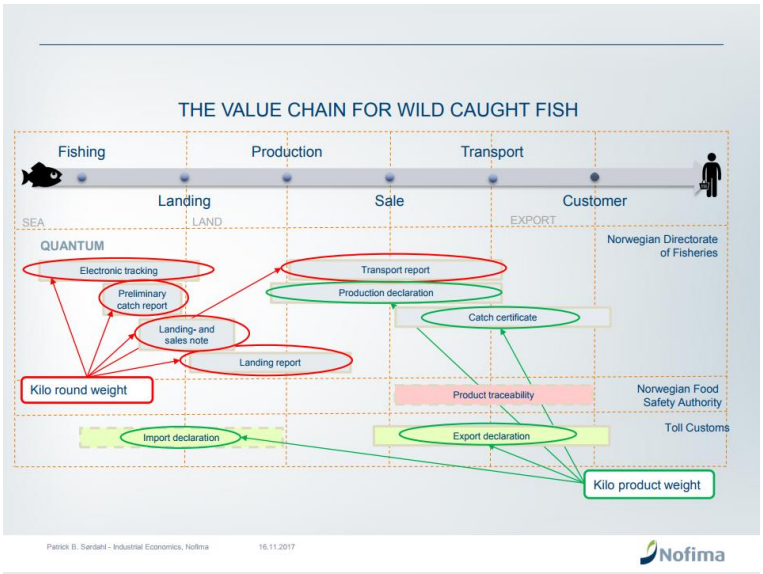
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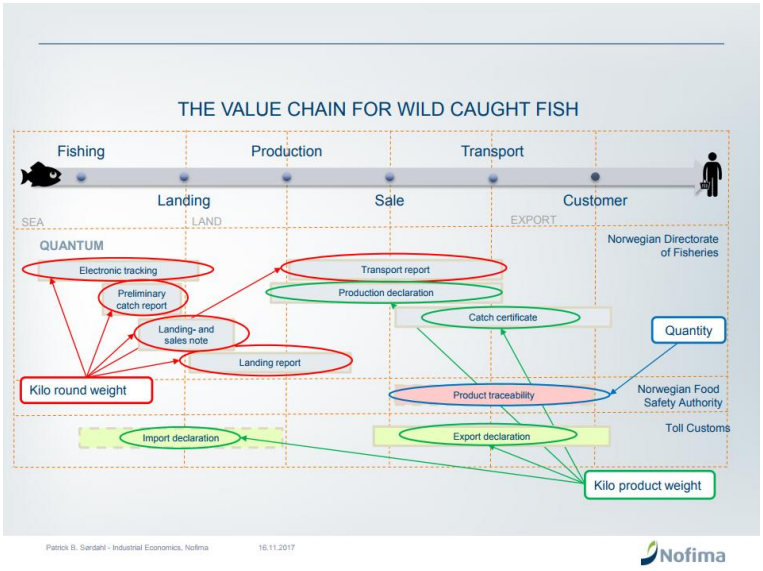
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Non-analytical verification methods

- Used in combination with various other methods
  - Document study
  - Interviews with value chain actors
  - Material-flow analysis
- Strengths
  - Can detect fraud that has no analytical component
  - Can highlight nodes in the value chain susceptible to fraud
  - Can give indications of the scope
- Weaknesses
  - Requires considerable contextual knowledge
  - Vulnerable to data access
  - Preferably requires micro-level data

In conclusion

- Fraud comes in all shapes and sizes – must use a combination of various approaches to identify fraud
- Is a more holistic system needed?
- New technologies might provide new avenues for preventing food fraud
  - Blockchain?

Nofima

Thank you for your attention

www.nofima.no

The research leading to these results has received funding from the European Union's Seventh Framework Programme (FP7/2007-2013) under grant agreement n°613688 – FoodIntegrity.

Food integrity and animal feed

Jónas R. Viðarsson from Matís discussed issues relatedto food integrity and animal feed; particularly aquacluture feed. There are to a point different issues that come up when discussing authenticidy and animal feed, than when discussing food for human consumption. The main importance for aquaculture feed is that it fulfills nutritional requirements, ensures health and animal welfair, contains low volumes of anti-nutritional elements and is affordable in prices. Most of the aquacluture feed used in the Nordic coutnries is produced in Europe and the suppliers (feed producers) have, as far as we know, been very responsible in their raw material sourcing.

Food Integrity and animal feed

Majority of aquaculture feed used in the Nordic countries is produced in Europe.

Approximately 70% of the production cost in salmon farming is feed.

Big emphasis on R&D by aquaculture feed producers.

The feed producers take on responsibility for sustainable-, ethical-, responsible sourcing.

The Nordic aquaculture industry generally not willing to take chances in sourcing feed from producers in other continents.

Aquaculture feed – What is important?

1. **The feed needs to fulfill nutritional requirements – different depending on species and life-stages.**
2. **The feed has to ensure health and animal welfare issues**
3. **The feed has to include low volumes of anti-nutritional elements**
4. **The feed has to be affordable/inexpensive**

Nutrition

The feed needs to fulfill nutritional requirements – different depending on species and life-stages.

Nutritional elements:
- protein(amino acids), fat, carbohydrates, phosphorus, Calcium, natrium and potassium

Trace elements:
- Vitamins, minerals and other amino acids

Energy:
- Feed has to be high in energy

Ratio of nutritional elements:
- Dependent on species, life-stages, age and size

Low amounts of anti-nutritional elements
- For example trypsin inhibitors. Lipase, antibody catalyst, lectin, saponin and other elements that can have negative effects on digestibility and growth.

Nutrition - ingredients

What are the most common ingredients

Protein sources:
- Animal- other fish proteins, seeds, beans (Soya), nuts, by-products from olive- and grain/cereal production.

Fat sources:
- Fish oil, plant oil, fat from other animals

Carbohydrate sources
- Cereals of different types

Mineral sources:
- From animals/other fish

Vitamin sources:
- Various ingredients

Labelling laws on feed and feed ingredients

Nutritional values:
- Water/solid materials
- Protein
- Fat
- Minerals/ash
- Carbohydrates NFE (Nitrogen-free extract)

Ingredients composition:
- The order of ingredients by volume

Example of a salmon feed formula

Recipe	3624 Salmon 2500 anno 2015			
N°	Name	Share	Min	Max
500011	WHEATGLuten meal800 PF	14.714		
7	WHEAT	8.798		20.00
228	SUNFLOWERSDML 361 cp	2.658		10.00
500013	SPC 60 PF	6.466		20.00
200	SOYA Hipro 49 CP	15.000		15.00
380	RAPESEEDOIL	24.894		
2152	Premix Polarfeed	0.500	0.50	0.50
452000	Panaferd	0.200		
519	MONOCA-PHOSPHATE	2.111		
600001	FM MEAL710/81 Polarf	14.000	14.00	
2509	FISH OIL Polar mix q1 14	10.660	10.66	

R&D on optimising feed is important

351	Astaxanthin	mg/kg	44.000	44.000
362	Av P fish	g/kg	3.864	3.800
65	Crude ash	g/kg	60.512	
60	Crude fat	g/kg	380.000	380.000
41	Crude protein	g/kg	350.000	350.000
366	GE	MJ/kg	330.421	
147	Histidin	g/kg	8.483	5.500
105	Lysine	g/kg	17.900	17.900
110	Methionine	g/kg	6.968	6.500
120	Methionine+Cyst	g/kg	13.141	9.300
81	Phosphor	g/kg	10.000	10.000
61	Starch	g/kg	75.000	75.000
392	SUM EPA DHA	g/kg	19.316	13.500
170	Vit A	IU/kg	2.500	
174	Vit B1	mg/kg	15.000	7.000
178	Vit B12	µg/kg	20.000	
175	Vit B2	mg/kg	25.000	15.000
177	Vit B6	mg/kg	15.000	
184	Vit C	mg/kg	124.997	99.000
171	Vit D3	IU/kg	1.500	
172	Vit E	mg/kg	199.996	99.000
173	Vit K	mg/kg		

Need for official monitoring / traceability

Ingredients

- Governmental monitoring – Food and veterinary authorities in most countries
- Feed producer – information from suppliers and internal monitoring/own measurements
- Feed buyer – information from producer and certifications e.g. ASC
- Consumer – Certifications from producer or third party

Ready made feed

- Governmental monitoring / regulatory - Food and veterinary authorities in most countries
- Certifications – such as ASC
- Feed buyers – information from producer and certifications e.g. ASC
- Consumer – Certifications from producer or third party

The most common measures

Most common: Water, protein, fat, minerals (ash), Carbohydrates
Often: Vitamins and minerals (what vitamins and minerals)
DNA / Isotopes: what is exactly in the feed

Testing for:

- **Amino acid gives limited information on protein sources**
- **Fatty acids gives more detailed information on the sourcing of the fat**
- **DNA og RNA provides as detailed information as possible**

Other considerations

Organic producers

Sustainability of the feed

Ethical considerations

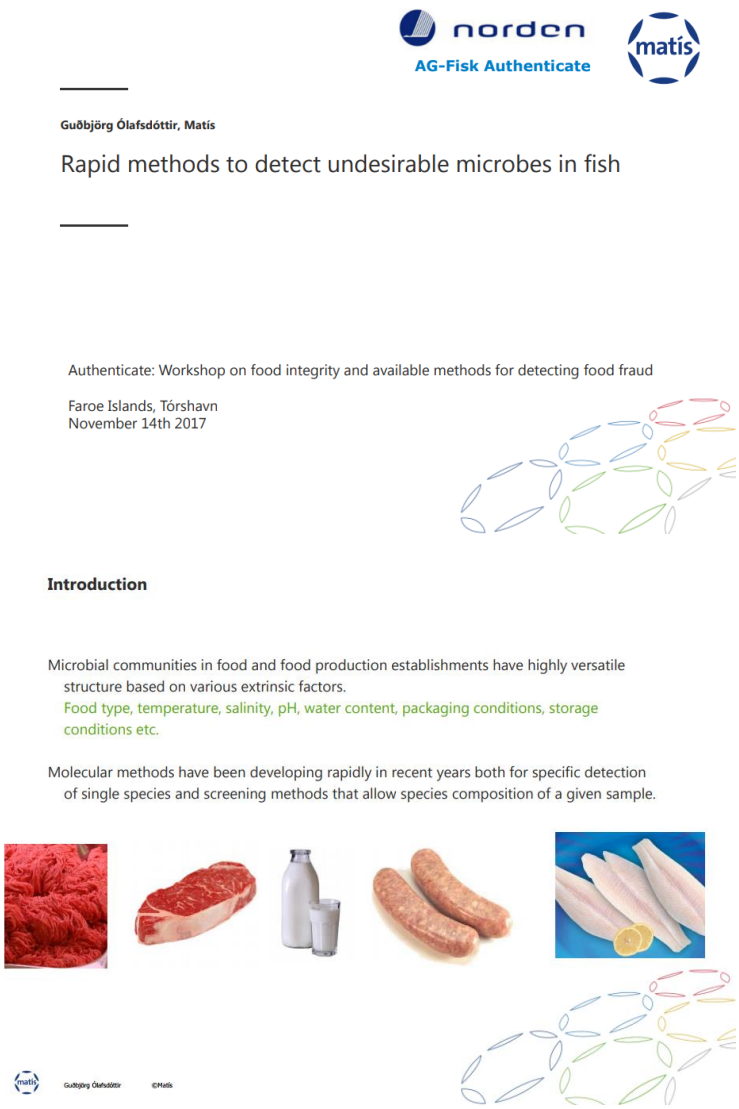
Cannibalism – e.g. not to use salmon rest raw materials to produce salmon feed

Food miles / CO2

Organic certification – but otherwise mostly trusted to the feed producers

Rapid methods to detect undesirable microbes in fish

Guðbjörg Ólafsdóttir from Matís dscussed advances in detecting undesirable microbes in fish using rapid methods. Real-time PCR technology can now be used to ditect microbes in fish in just few hours (4-24 hours) which used to take 3-7 days using conventional methods. This allows suppliers to detect problems before the products are put on market.



Monitoring of spoilage bacteria in the supply chain

What are the advantages?

Whatever storage time or conditions have been applied, the number of spoilage bacteria does not lie

Gives an independent observation an product quality and estimate of freshness

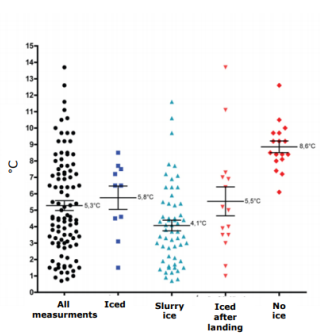
Could be a valuable addition to quality management at production sites and an unbiased quality control for buyers of fresh food

First steps in the supply chain

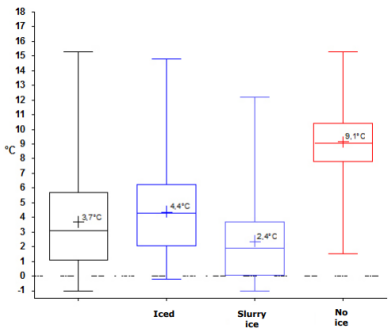
- Large corporations
  - With their own supply chains
  - Large vessels – processing (onboard/in land) – transportation – secondary processing abroad – distribution
  - Catch can be few days old when landed
  - Streamlined production and quality of raw material

- Small corporations
  - Small vessels
  - Catch is sold through fish markets
  - Catch landed same day
  - Diverse handling of fish and therefore on quality of raw material
- How is the quality monitored?

Temperature of landed catch



July 2010



July 2011

What controls microbial quality?

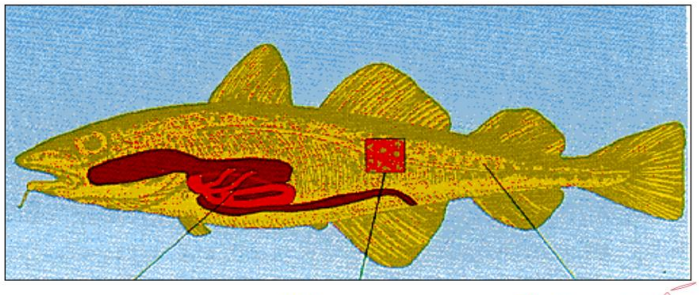
What controls microbial quality?

- Temperature in the whole process
- Time of bleeding
- Time of gutting
- Handling
- Time of storage
- Processing methods
- Processing conditions
- Storage conditions

Is it possible to use a single microbial parameter as a reference for quality control?

No

Bacteria on fresh cod



Intestine:
10-100.000.000/g

Skin:
100-
100.000/cm²

Flesh:
No bacteria

Microbial indicators: Specific Spoilage Organisms (SSO)

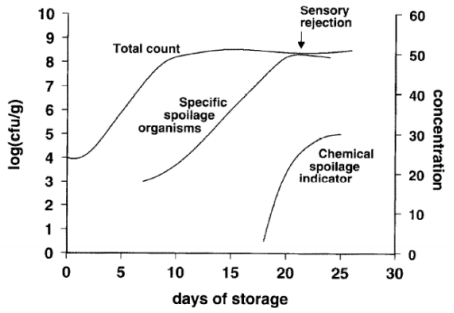
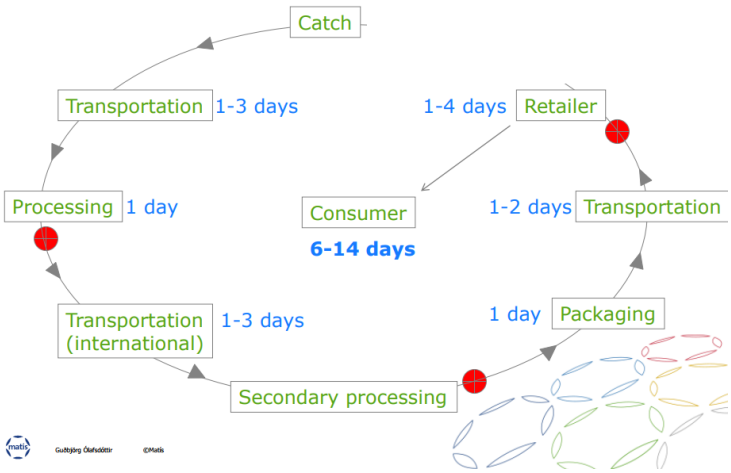


Fig. 1. Model of changes in total count (TVC), specific spoilage organisms (SSO) and chemical spoilage indices during chill storage of a fish product (modified from Huss et al., 1996).

Fish in the supplied chain



Relevant microbial parameters to estimate spoilage

Until now, no single method is available for the rapid detection or quantification of these bacteria.

Cultivating the most important bacteria can give a good estimate on product quality during processing, transportation or storage

The time frame however is to large to be able to use it for processing management purposes.

Species	Method	# days
Pseudomonas	Cultivation on CFC agar at 22°C	3
Photobacterium	Malthus conductance method	2
Shewanella	Cultivation iron agar at 17°C	5

New Methods to study fish microbiota

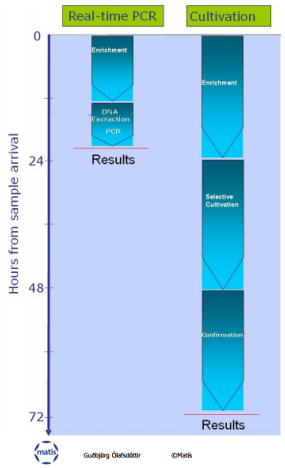
rt-PCR methods: rapid tests developed for
Estimation of P. phosphoreum and Pseudomonads

Cell count by flow cytometry: FACS (Aria II)

Community analysis (molecular level):
16S rRNA gene sequence analysis
Next Generation Sequencing (NGS)

Sensory evaluation
Smell, taste, texture, appearance, colour

Analysis procedures



Analysis procedure and time (no preenrichment)

• 25g food sample diluted in 225mL buffer	15 min
• DNA extraction	90 min
• PCR analysis	120 min
• Results analysis	15 min
Total	**4 hours**

Real-time PCR technology

Required instrumentation:

Stomacher

DNA extraction robot

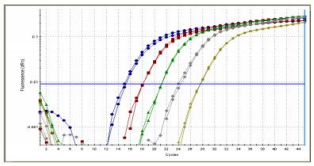
Real-time PCR cycler

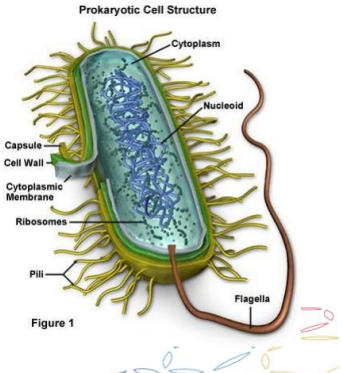
Real-time PCR technology

Small part of the DNA molecule from the bacteria is amplified using DNA polymerase

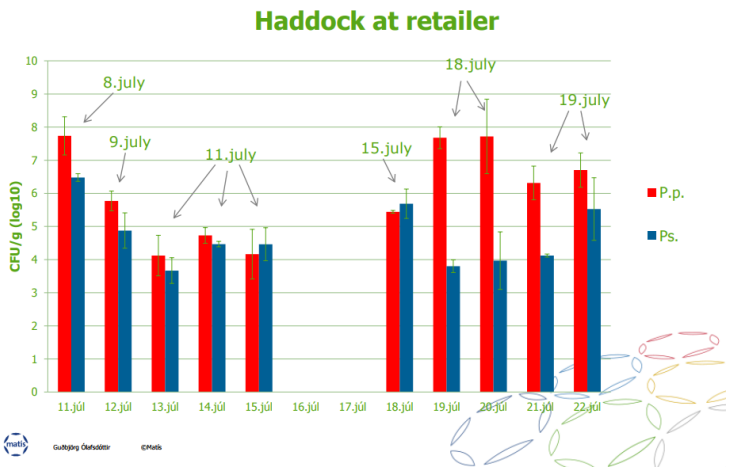
During amplification fluorogenic substances in the reaction emit light and is detected by the instrument

The more bacteria present in a sample – the sooner the light is detected





The situation in retail – week days in same store



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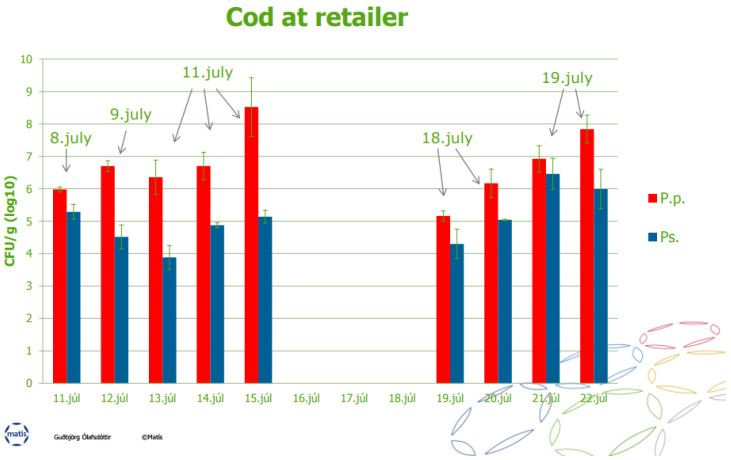
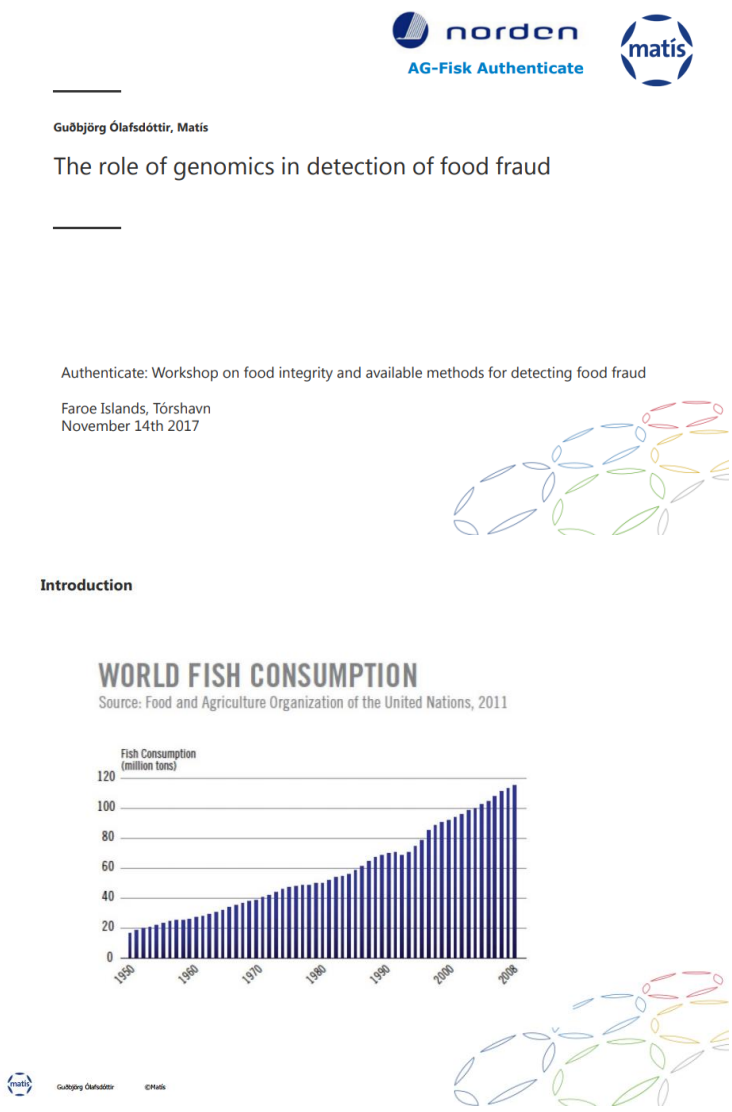


Conclusions

- Large variation in number of spoilage bacteria can be expected to be present in fresh fish
- Direct monitoring of spoilage potential is rare. Data on number of spoilage bacteria in flesh upon landing and processing is not available.
- Methods have been developed for rapid quantification
- Can provide pressure to the industry to handle the material in the best way
- Higher overall quality, increased shelf life and higher value.
- Can be of use in shelf life prediction where bacterial load is needed.

The role of genomics in detection of food fraud

Guðbjörg Ólafsdóttir from Matís discussed how genomics are used to detect food fraud and in particular species substitution in the seafood sector. DNA based methods are the most reliable approaches available to detect fraud of this kind and there have been significant advances in the field in the last few years. The methods are becoming easier to use, take shorter time and are less expensive than they used to be. Rapid methods and portable devices have also been developed that make DNA authentication more applicable for the seafood sector; and can potentially within not too long time be adopted as a tool within the production line of seafood processing plants.



Introduction

Neytendur gera kröfu um stöðugt framboð

Keðjan frá veiðum og eldi er flókin

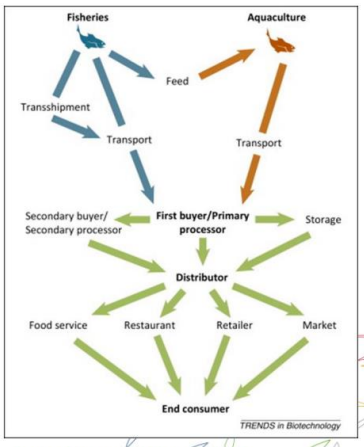


Figure from Leal MC et al. 2015

Seafood Fraud

Seafood is one of the most common foods subjected to fraud/mislabelling

1. Orange juice
2. Honey
3. Truffle oil
4. Blueberry's
5. Milk
6. Fish
7. Saffron
8. Olive oil
9. Pomegranate juice
10. Coffee

Source: consumers.nl

The problem: Species substitution

OCEANA

SEAFOOD FRAUD IN THE HEART OF EUROPE: 2015 TESTING IN BRUSSELS

One out of three fish served in Brussels is not what consumers pay for

Bluefin tuna, sole and cod are substituted by species up to 40% cheaper

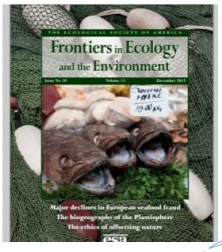
DNA testing found that one-third (33 percent) of the 1,215 samples analyzed nationwide were mislabeled, according to U.S. Food and Drug Administration (FDA) guidelines.

Labelfish®

"Low mislabeling rates indicate marked improvements in European seafood market operations" Mariani et al. 2015

Mislabelling rate of 4.93% which can be further broken down into the following country-specific mislabelling rates:

- France – 2.7%
- UK – 3.25%
- Ireland – 3.9%
- Germany – 6.21%
- Portugal – 6.7%
- Spain – 8.9%



New Scientific Methods to Detect Fraud

Molecular techniques and Documentation procedures have improved.
Internationally funded research in this area, includes:

Labelfish® FOOD INTEGRITY iBOL Working Group | 1.1 Vertebrates Fish barcode of life (FISH-BOL) Authent-Net DiscardLess DNAqua-Net EU COST ACTION

Matís use DNA profiles for species, stock and individual ID

Stock and individual identification, traceability, parental analysis, QTL, etc.:

- Herring
- Mackerel
- Lumpfish
- Catfish / Wolffish
- Turbot
- Halibut
- Cod
- Redfish
- Clown fish
- Tuna
- Norwegian Lobster
- Salmon
- Arctic charr
- Brown trout
- Minke whale
- Fin whale
- Blue whale
- Blue mussel
- Scallops

Species identification:

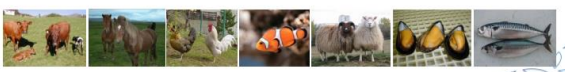
- Fish species (3 gen)
- Meat, etc.
- Fish eggs
- Algae

Parental and breeding:

- Horse
- Sheep
- Dog
- Cow
- Chicken

For:

- Monitoring, Control and Surveillance (MCS)
- Illegal, Unreported and Unregulated (IUU) fishing



DNA-based Tools for Seafood Identification

Species identification

DNA sequencing

- DNA sequencing can be used to identify the species against all known sequence in a database (DNA barcoding)

Real time PCR (qPCR)

- Species-specific PCR method

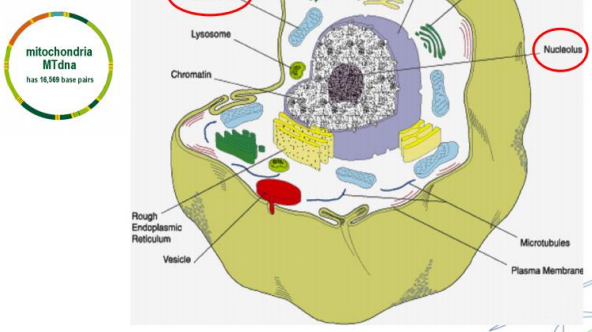
Population and population origin identification

Based on analysis of microsatellite or SNPs (single-nucleotide polymorphisms) markers

Which method and molecular marker to use?

Population vs species identification
Available information on spawning locations
Existing genomic sequence data

Mitochondria



DNA barcoding

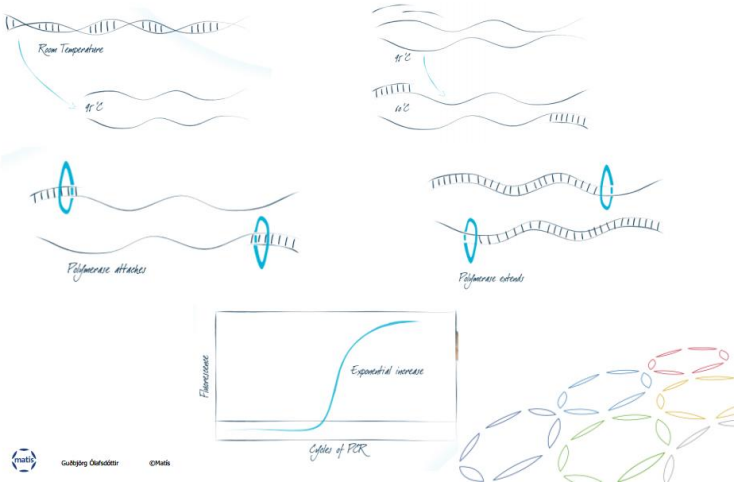



CCTATACCTAATCTTCGGAGCATGAGCGGGCATGGTAGGC....

BOLDSYSTEMS Databases

BLAST®

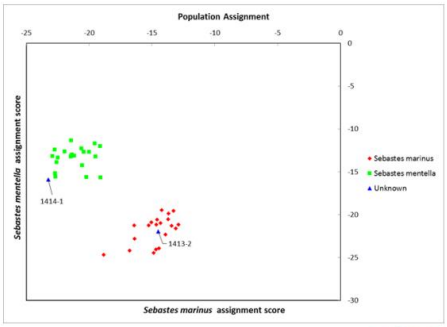
Real-time PCR (qPCR)



Stock assignment

Sebastes mentella (djúpkarfi)

Sebastes marinus/norvegicus (gullkarfi)



Metagenomics

DiscardLess

EU að vinna í því að banna brottkast

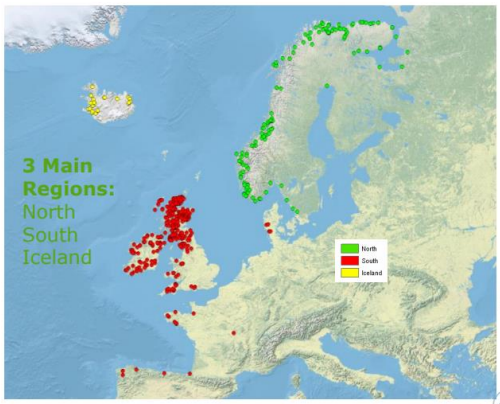
Matís er að þróa aðferðafræði til að greina fisktegundir og hlutföll í meltu

Notum MinION raðgreina

Genetic structure of Atlantic salmon in Icelandic rivers and the assignment of marine caught salmon

K. OLAFSSON, C. PAMPOULIE, S. HJORLEIFSDOTTIR, S. GUDJONSSON,
S. M. EINARSSON, J. GILBEY, G. O. HREGGVIDSSON

Identifying Salmon Stocks in North Atlantic

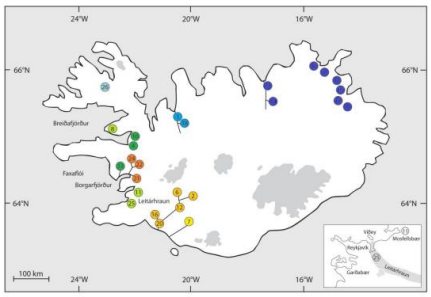


SALSEA-Merge

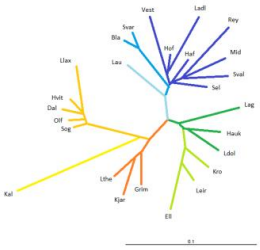
26,813 fish tested
284 rivers sampled

Data credit: John Gilbey and the Salsea genetics team

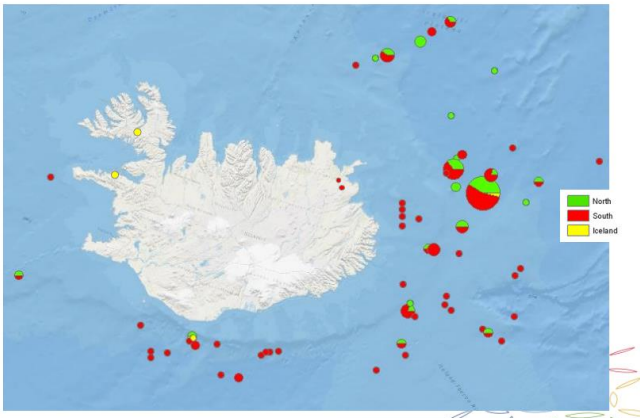
Genetic Profiling of Individual Rivers is Possible



Genetic distance (*Da*) phenogram
(neighbour-joining algorithm)



Tracing salmon by-catch in ocean to origin



Guðbjörg Ólafsdóttir ©Matís

Thank you

Guðbjörg Ólafsdóttir ©Matís

From Sea to Plate? Fish mislabelling in European restaurants

Miguel Angel Pardo from AZTI Tecnalia in Spain presented a work that he has been leading where mislabelling of seafood in the European HoReCa (Hotels, Restaurants and Catering) sector has been researched. A total of 283 samples were collected in 180 outlets across Europe, in 23 countries. The average mislabelling rate showed to be 31%; canteens had the highest rate of substitution of all outlets and the more expensive species, such as tuna, had the highest substitution rate. 72% of mislabelled fish wars substituted with less expensive fish species, suggesting economic motivation.

There is real need to assure fish authenticity and reduce misdescription incidents

WP6

Reduce product misdescription in the seafood sector

There is real need to assure fish authenticity and reduce misdescription incidents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Misdescription incidents in seafood sector

Miguel Ángel Pardo*, Elisa Jiménez, Begoña Pérez-Villarreal

Food Research Division, AZTI. Parque Tecnológico de Bizkaia, Astondo bidea 609, 48160 Derio, Bizkaia, Spain


Labelfish

ResearchGate

See discussions, stats, and author profiles for this publication at: http://www.researchgate.net/publication/284724776

Low mislabeling rates indicate marked improvements in European seafood market operations

ARTICLE in FRONTIERS IN ECOLOGY AND THE ENVIRONMENT · JANUARY 2015

The worldwide average of misdescription reported is **30 % (2010-2015)**

- A comprehensive literature search of **50 peer-reviewed**
- The number of data reported is **4150**
- Only 10 % from **restaurants**

The average of misdescription reported is **3-10 %**

- Specific **surveys in retail sector**
- The number of analyzed samples is **1500**

2015-2017

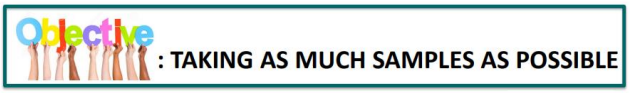
Country	Number of establishments	Number of samples	City	Fish species	Reference	Misdescription (%)
France	unknown	100	Paris	fish	Bénard-Capelle, 2015	**3**
Italy	23	185	-	sushi	Armani, 2017	**3,4**
EU	unknown	471	-	white fish	EC, 2015*	**8**
UK	31	115	3 cities	sushi	Vandamme, 2016	**10**
Belgium	150	280	Brussels	fish	Christiansen, 2017	**31**
German	24	47	5 cities	sole	Kappel, 2015	**50**
Spain	unknown	130	3 cities	tuna	Gordoa, 2017	**83**

- Great **variability 3-83%**
- Focused on a **limited number of species**
- **Local sampling plans**/limited number of cities
- Limited or **unknow number of restaurants**

SPECIFIC SURVEY IN EU RESTAURANTS SHOULD BE UNDERTAKEN

*Control plan coordinated at European Union level to assess the prevalence on the market of white fish mislabelled with regard to its declared species. 2015.

WHAT IS THE PROBABILITY THAT CONSUMERS BUYING FISH IN EUROPEAN RESTAURANTS, CATERINGS, CANTEENS ETC… WILL NOT GET THE FISH THEY THINK THEY ARE OFFERING ?



HOW? citizen SCIENCE

Volunteers collectors

citizen SCIENCE

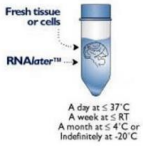
- **Scientific work** undertaken by members of the general public
- Under direction and according to specific **protocols**
- The **cost effectiveness** of citizen science data can outweigh data quality issues such as:
  - Risk of introducing bias into the data
  - Members may lie about data
- So, any mislabelling case must be **carefully checked**

CSI: THE EXPERIENCE

citizen SCIENCE

Step 1: Go out for dinner!
Step 2: Order fish
Step 3: Place a small amount in the provided tube*
Step 4: Send it back to us

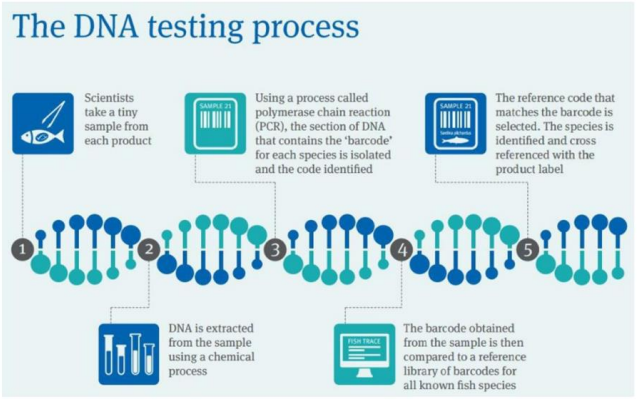
* which contains a preservation buffer (**RNA later™**):
✓ non-hazardous (under Directive 67/548/EH)
✓ odorless
✓ non-flammable



Sampling (2015-2016)

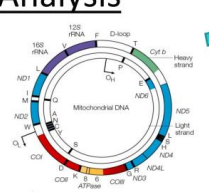
Country	Fish consumption (kg/capita/year)	Number of establishments	Number of samples
Iceland	90	21	51
Portugal	56,8	17	23
Spain	42,4	22	37
Finland + Baltic States	40	9	19
France	34,6	17	23
Sweden	31	4	5
Italy	25,4	12	14
Belgium	25,1	6	8
Netherlands	23,6	4	5
Denmark	23	6	12
Greece + Cyprus	19,6	7	11
UK + Ireland	19	22	24
Switzerland	15	3	5
Germany	14,2	7	14
Slovenia	12	2	2
Norway	12	6	9
Czech Republic	9,5	8	12
Romania	6,1	7	9
Total		**180**	**283**

23 EU countries



Genetic Analysis

PCR-FINS



qPCR (Tuna species)

iBOL Working Group | 1.1 Vertebrates
Fish barcode of life (FISH-BOL)

Significant bias were detected in tuna species where COI barcodes were not able to differentiate four ***Thunnus* species**. They share the same haplotype

Genetic Analysis

- Interpretable sequences were obtained in 282/283 samples
- Molecular identification was successfully addressed at species level in 97% of samples
- Eight rockfish samples were identified at genus level
- All tuna samples (n=50) were identified at species level

Mislabelling Determination

To conclude a **misdescription incident** we have compared the commercial name included in the menu with the scientific name for each fish species, in accordance with:

The National List of Commercial Names of different Member States

AND/OR

The FishBase Information System (www.fishbase.org)

Reg. (EU) 1379/2013 Article 37:
For the purposes of Article 35(1), Member States shall draw up and publish a list of the ***commercial designations accepted in their territory, together with their scientific names***

Applicable Legislation

The EU fishery and aquaculture products' market is regulated by **Reg. (EU) 1379/2013**, which introduced specific requirements for a common organization of the market and established traceability and labelling rules integrating the mandatory provisions of **Reg. (EU) 1169/2011** on food labelling

Reg. (EU) 1379/2013: *Mandatory information*: *"the commercial designation and scientific name"*
CHAPTER IV CONSUMER INFORMATION Article 35 (1) referred to in points (a), (b), (c) and (e) of Annex I

↓

Exclusion of prepared and processed products (except raw fish and cooked crustaceans)

↓

Restaurant owners are not obliged to put the mandatory information on their menus

But, legislation establishes that all the information provided to the final consumer (including "mass caterers") **have to fulfill the transparency requirements** as regards the description of the ingredients used

not mandatory but would be desirable

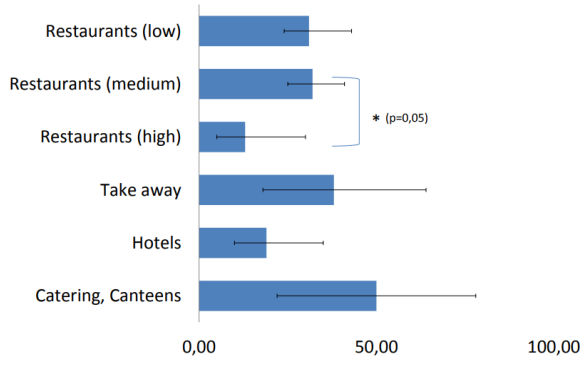
Results

WHAT IS THE PROBABILITY THAT CONSUMERS BUYING FISH IN EUROPEAN RESTAURANTS, CATERINGS, CANTEENS ETC… WILL NOT GET THE FISH THEY THINK THEY ARE OFFERING ?

31% [25-38%]
Confidence level of 95% (α = 0,05; Wilson's method) **(n=180)**
Margin of error of 7%

Disclaimer: The information expressed in this presentation reflects the authors' views; the European Commission is not liable for the information contained therein

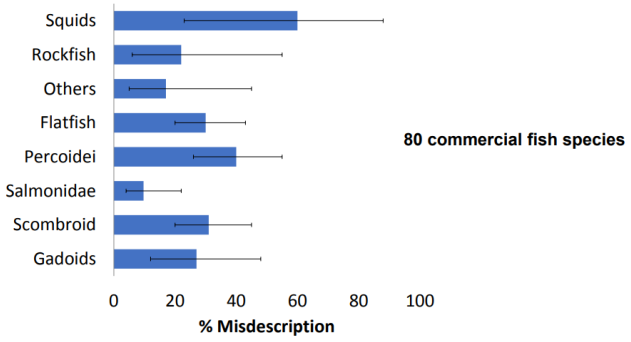
The higher % of fish mislabeling was detected in caterings, canteens and take away restaurants



Misdescription rates according to the origin of sample. All the confidence intervals (α = 0.05) were calculated using Wilson's method and represented like error bars. Analysis of variance were calculated by Statgraphics

The rate of mislabeling did not differ significantly between fish groups

72% [63-81] **of mislabeled fish were substituted with cheaper fish species suggesting economic motivation**



Misdescription rates according to the origin of sample. All the confidence intervals (α = 0.05) were calculated using Wilson's method and represented like error bars. Analysis of variance were calculated by Statgraphics

Great variability

Specific national surveys should be addressed

Country	N	NM	%	CI
Spain	22	11	**50**	(31-69)
Iceland	21	10	**48**	(28-68)
Finland + Baltic States	9	4	**44**	(19-73)
Germany	7	3	**43**	(16-75)
Portugal	17	6	**35**	(22-64)
Belgium	6	2	**33**	(10-70)
Norway	6	2	**33**	(10-70)
France	17	5	**29**	(13-53)
Romania	7	2	**29**	(8-64)
Italy	12	3	**25**	(14-76)
Netherlands	4	1	**25**	(5-70)
UK + Ireland	22	4	**18**	(7-39)
Denmark	6	1	**17**	(3-56)
Greece + Cyprus	7	1	**14**	(3-51)
Czech Republic	8	1	**13**	(2-47)
Sweden	4	0	**0**	-
Switzerland	3	0	**0**	-
Slovenia	2	0	**0**	-
Total	**180**	**56**	**31**	**(25-38)**

Misdescription rates according to the origin of sample. All the confidence intervals (α = 0.05) were calculated using Wilson's method and represented like error bars. Analysis of variance were calculated by Statgraphics

Spanish Survey

313 samples; 204 restaurants

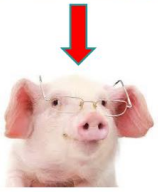
48% [41-54%]

Confidence level of 95% (α = 0,05; Wilson's method) **(n=204)**

EUSKO JAURLARITZA
GOBIERNO VASCO

Bluefin tuna
(*Thunnus thynnus*)

Mislabeling
58 % [36-77]
(n=19)



Tunas
(*T. obesus* / *T. albacares*)

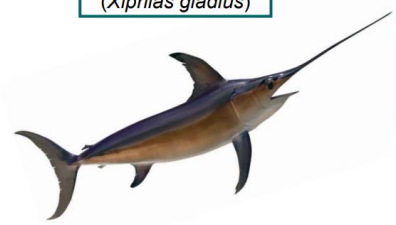
Significantly lower rates
that similar studies

Yellowfin tuna
(*Thunnus albacares*)

Mislabeling
43 % [16-75]
(n=7)

Bigeye tuna
(*T. obesus*)

Swordfish
(*Xiphias gladius*)



Mislabeling
14 % [11-37]
(n=7)

Stripped marlin
(*Kajikia audax*)

Dusky grouper "Mero"
(*Ephinephelus marginatus*)

Nile perch
(*Lates niloticus*)

Saithe
(*Pollachius virens*)

Mislabeling
100 % [77-100]
(n=13)

Atlantic wreckfish
(*Polyprion americanus*)

Panga
(*Pangasius hypophthalmus*)

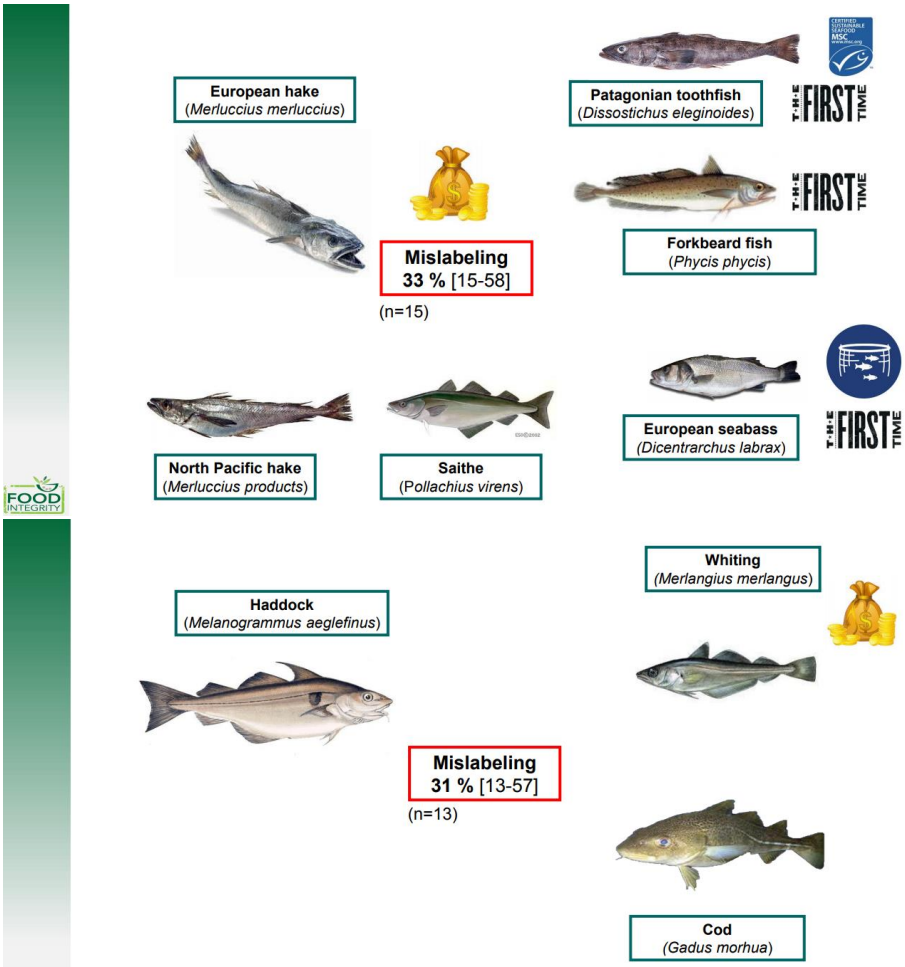
Common sole
(*Solea solea*)

Mislabeling
60 % [23-88]
(n=5)

Panga
(*Pangasius hypophthalmus*)

Yellowfin sole
(*Limanda aspera*)

Argentine hake
(*Merluccius hubbsi*)

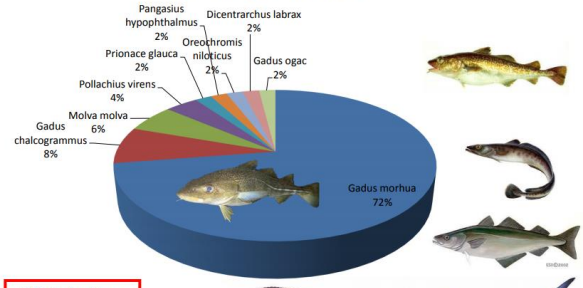


The case of Cod

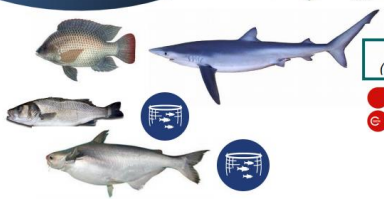
We have collected **51 samples** under different denominations

Baccala (*Gadus morhua*)	
Bacalao (*Gadus morhua*)	
Cod (*G. morhua, G. macrocephalus/ogac*)	
Cabillaud (*Gadus morhua,G. macrocephalus, G. ogac, Arctogadus glacialis, Boreogadus saida, Eleginus navaga, E. gracilis*)	

The case of Cod



Mislabeling
27 % [17-41]
(n=51)



Blue shark
(Prionace glauca)

RED LIST THE FIRST TIME

Butterfish
(*Pampus spp, Peprilus spp, Stromateus spp*)

Mislabeling
80 % [38-96]
(n=5)

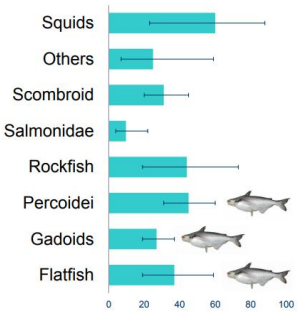
Escolar
(Lepidocybium flavobrunneum)

Indigestible wax esters can cause mild Keriorrhea; a condition characterized by excretion of an orange/brown oil

The most omnipresent species

Panga
(*Pangasius hypophthalmus*)

Pappalardo (2015); Wang (2016); Kappel (2015); Helyar (2014)



Isothermal Amplification ("RPA" Recombinase Polymerase Amplification)

Cotton swab

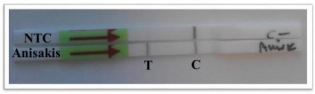
5-10 minutes

Lateral flow detection

eit Food

RPA: Recombinase Polymerase Amplification

- **Detection in 15-20 min:**
  - No initial denaturation step at 95ºC
  - Bsu polymerase requires short incubation time
- **Bsu polymerase maintains activity in inhib environments**
- **Operates at lower temperatures (37-42ºC)**
- **Two primers**
- **Can be multiplexed**
- **Extra functionality**
  - RPA-ELISA, RPA- LFD (Lateral Flow Device)
  - Fluorescent probes for Real Time PCR
- **Sensitivity (1 copy)**
- **Point of care applications** (pathogens detection kits)



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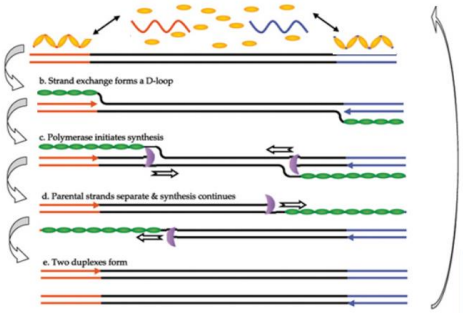
RPA: Recombinase Polymerase Amplification



RPA employs 3 core enzymes:
- Recombinase (T4 uvsX-primer)
- Single strand DNA binding protein
- Strand displacing Bsu polymerase

The 3 core RPA enzymes can be supplemented by other enzymes to provide extra functionality:
- **Exonuclease III** allows the use of an exo probe for real time
- **Endonuclease IV** means that a nfo probe can be used for lateral flow strip detection

SUMMARY

- This is the European **largest fish survey** focusing entirely on the restaurants
- **± 1 out of 3** establishments [31% (± 7%)] served mislabeled fish in the menu
- The higher % of fish mislabeling was detected in **caterings, canteens and takeaways**
- Remarkable **differences between countries**
- **Specific national surveys should be addressed**
- 72% (± 9%) of mislabeled fish samples were substituted **with cheaper fish species** suggesting economic motivation
- **Lack of care** in the manipulation of fish in the sector
- **Aquaculture species** (low optimal consumption) substituting wild-caught species (high optimal consumption)
- Some **sustainability** and **food safety issues** have been identified
- **Legislation should be improved** to include mandatory information (commercial designation and scientific name) in processed products (at restaurants etc…)

Technicians from AZTI (Xabi, Nagore, Mari and Amaia) **and MATIS labs**
Collectors of samples (FOODINTEGRITY and LABELFISH)

Disclaimer: The information expressed in this presentation reflects the authors' views; the European Commission is not liable for the information contained therein.

The project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement No. 613688.

The Authenticate workshop in Iceland

Jónas R. Viðarsson from Matís presented the main take-home messages from the Authenticate workshop that was held in Reykjavík on March 16th 2016. The workshop was attended by 44 stakeholders from different sectors of the Icelandic seafood industry. Lively discussions took place at the event and considerable media coverage was received following the workshop. Those attending the workshop agreed on the importance of raising the issue of food integrity for the Icelandic seafood sector. The biggest attention was given to preliminary results coming from a research that Matís was conducting, showing the 23% of samples collected at restaurants in Reykjavík proved to be mislabelled. This highlighted that mislabelling is also taking place in Iceland.

Nordic Co-operation

matís

Authenticate – The Reykjavík workshop

Jónas R. Viðarsson

Final meeting of the Authenticate project
November 14th 2017
Venue: Havstovan – Faroe Islands
Funding: AG-fisk

Nordic Co-operation

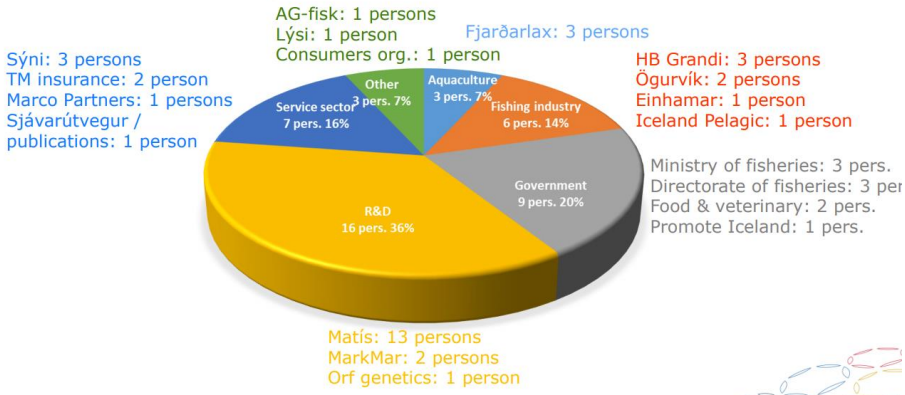
Workshop held in Reykjavik on March 16th 2016

- 3 hour workshop

- ✓ Welcome and introduction
- ✓ Introduction on AG-fisk
- ✓ Aquaculture feed quality and integrity issues and measurement
- ✓ Pathogens in seafood – detection
- ✓ Genetics as a method to detect species and origin
- ✓ Food fraud, market requirements and regulations

- **Discussions**

Attendance – 44 persons



Attendance – 44 persons

	Name	Company
1	Gunnar Dagur Darrason	Fjarðarlax
2	Höskuldur Steinarsson	Fjarðarlax
3	Ómar Grétarsson	Fjarðarlax
4	Jóhannes Gunnarsson	The Consumers Organization
5	Alda Agnes Gylfadóttir	Einhamar Seafood
6	Erlendur Stefánsson	HB Grandi
7	Sindri Már Atlason	HB Grandi
8	Guðrún A. Jónsdóttir	Iceland Pelagic
9	Halldóra Emilsdóttir	Ögurvík
10	Margrét Gíslagóttir	Ögurvík
11	Sigurjón Arason	AG-fisk
12	Áslaug Eir Hólmgeirsdóttir	Directorate of Fisheries
13	Hrannar Már Ásgeirsson	Directorate of Fisheries
14	Ingibergur Sigurðsson	Directorate of Fisheries
15	Björgvin Þór Björgvinsson	Íslandsstofa
16	Annas Sigmundsson	Ministry of Fisheries
17	Brynhildur Benediktsdóttir	Ministry of Fisheries
18	Grímur Valdimarsson	Ministry of Fisheries
19	Halldór Þorsteinsson	The Icelandic Food and Veterinary Authority (MAST)
20	Þór Gunnarsson	The Icelandic Food and Veterinary Authority (MAST)
21	Auður Ósk Emilsdóttir	Lysi
22	Hildigunnur Sigurðardóttir	MarkMar

	Name	Company
23	Sigurður Bogason	MarkMar
24	Anna Kristín Daníelsdóttir	Matís
25	Arnljótur Bjarki Bergsson	Matís
26	Ásbjörn Jónsson	Matís
27	Guðbjörg Ólafsdóttir	Matís
28	Guðmundur Stefánsson	Matís
29	Heiða Pálmadóttir	Matís
30	Jón Árnason	Matís
31	Jónas R. Viðarsson	Matís
32	Kristinn Ólafsson	Matís
33	Magnea Karlsdóttir	Matís
34	Oddur Már Gunnarsson	Matís
35	Valur N. Gunnlaugsson	Matís
36	Viggó Marteinsson	Matís
37	Sigríður Hjörleifsdóttir	Orf Genetics
38	Jón Stefánsson	Marko Partners
39	Valdimar Ingi Gunnarsson	Sjávarútvegur
40	Erna Jónsdóttir	Sýni
41	Hafrún Dögg Hilmarsdóttir	Sýni
42	Valgerður Ásta Guðmundsdóttir	Sýni
43	Aðalsteinn H. Jóhannsson	TM Insurance
44	Sveinn Ingvarsson	TM Insurance

Jonas R. Viðarsson ©Matís

Attendance – 44 persons

Jonas R. Viðarsson ©Matís

Attendance – 44 persons

Jonas R. Viðarsson ©Matís

Attendance – 44 persons





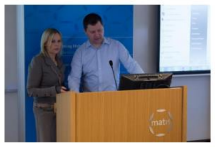






Jonas R. Viðarsson ©Matís

Attendance – 44 persons











Jonas R. Viðarsson ©Matís

What about Iceland?

In 2016 Matís took 56 samples from 22 HoReCa outlets.
13 samples (23%) turned out to be mislabelled

1. **Tusk sold as monkfish**
2. **Yellowfin tuna sold as Bluefin**
3. **Bigeye sold as Bluefin**
4. **Ling sold as cod**
5. **Ling sold as cod**
6. **Ling sold as cod**
7. Bigeye tuna sold as yellowfin
8. Bigeye tuna sold as yellowfin
9. Bigeye tuna sold as yellowfin
10. Wolffish sold as tusk
11. Haddock sold as cod
12. Wolffish sold as spotted wolffish
13. Spotted wolffish sold as wolffish

Jonas R. Viðarsson ©Matís

Discussions: take-home messages

- **Not entirely clear who is responsible for monitoring food fraud / integrity**
  MAST (Food & Wet.), the health authorities (municipal level), directorate of fisheries, customs.....
- **Integrity of products exported from Iceland vs. products sold in Iceland**
  People seam to think that products produced in Iceland are okay and therefore little need for monitoring.
- **Our products need to be protected against competing products**
  Pangasius, double frozen, refreshed/chilled, Icelandic bacalao (boxes), label of origin
- **What about additives?**
  Phosphates, citric acid

Jonas R. Viðarsson ©Matís

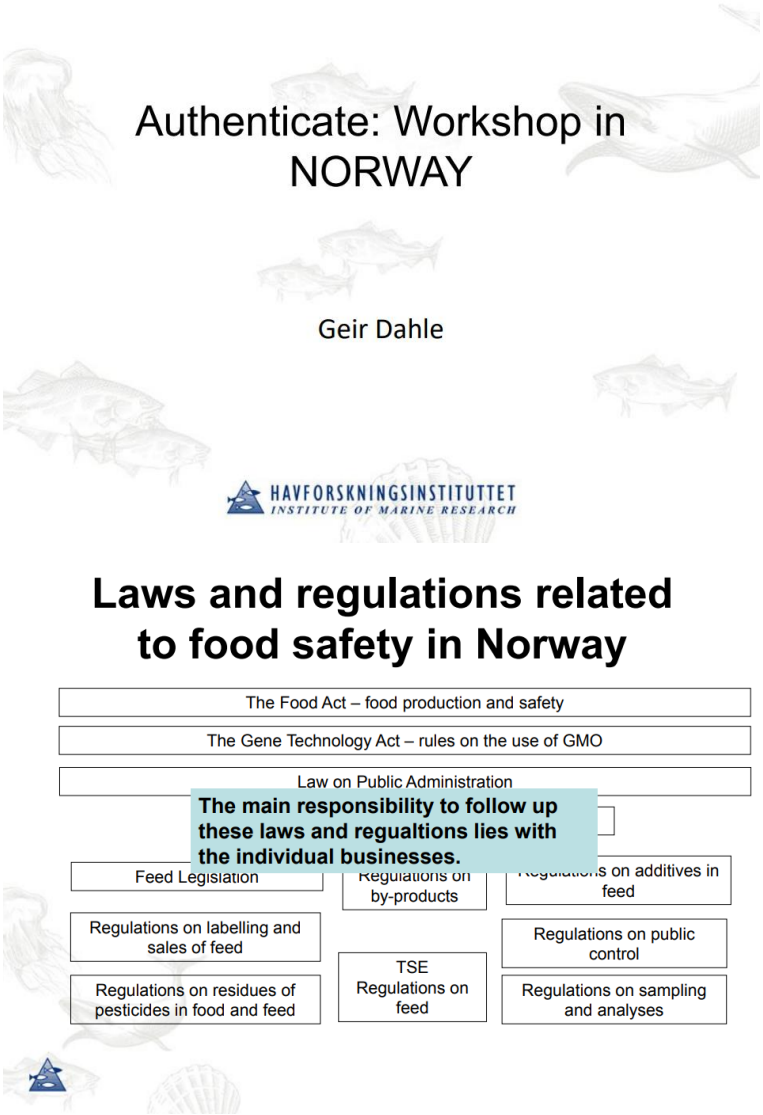
Discussions: take-home messages

- **What about regulations?**
  EU, National, Traceability legislations, labelling laws etc.....
- **We should look at this as an opportunity for Nordic seafood**
  We have the opportunity to be the suppliers of seafood of the highest (verifiable) integrity
  We should cooperate
  Need for success stories (collaboration between research and industry)
- **Available methods for detection and verification should be easily available for industry**
  What, how and where can stakeholders get verification?
  FoodIntegrity project and Authent-Net project
- **R&D needs to be careful about publicising information on food fraud ?**
  Meet pies (IS), Wild boar (NO), FoodIntegrity study (IS)

Jonas R. Viðarsson ©Matís

Report on the Authenticate workshop in Norway

Geir Dahle from the Institute of Marine Research (Havforskningsinstituttet) in Norway presented the main outcomes from the Authenticate workshop that was held in Bergen on October 26th 2016. The workshop was primarily attended by professionals in the field of genetics and served as such an interesting role in bringing together leading Norwegian experts in that field. The workshop attendees generally agreed that the regulatory and monitoring system in Norway is capable of dealing with food fraud and food integrity issues. The competent institutions, such as NIFES, make sure that regulations are followed. The National Reference Laboratories are set up to monitor food safety and related regulations, which are important part of ensuring food integrity in Norway.



Norwegian Food and Safety Authority (fish related activities)

- Governmental body, whose aim is, through regulations and controls, to ensure that food are as safe and healthy as possible for consumers and to promote fish and animal health.
- Role: to monitor food safety as well as fish health

The mission of the NFSA is to promote (fish related):

- Safe, healthy food and water
- Healthy fish and animals
- Ethical farming of fish and animals

NFAS (Continued)

- Participates in different international fora:
  - Codex Alimentarius (Food Safety, under WHO/FAO)
  - Standing committees and working groups under the auspices of the EU
  - Nordic Council Executive Committee for Fish and Aquaculture, Agriculture and Forestry

NFSA control

- Control of imported foods (different rules apply for food from EU/EEA and import from third countries

Program	Comments	Provider of analyse	Legislater
1. Foreign substances in feed components produced from fish	Fish flour/fish oil Establish limits for dioxin/PCB	NIFES	EEA
2.Genetic modification in food components and in feed to fish	Imported corn, soya, raps, rice 3. country (removed)	VI	Matlov Gentekn
4.Foreign substance program for fish	Farmed fish	NIFES w/ contractors	EEA
5. National audit program for mussel production	Classified production areas, End product control.	NMBU, NIFES, and more	853/04 854/04
6.Program - imported products HC/NHC from 3. country	Fish, marine mammals, flour and oil. Risk-based	NIFES	EEA
7. Fish feed	Risk assessment farming and food	NIFES	EEA
8. Pollutants in fish	Fish oils, beaked redfish	NIFES	project
9.Poluted harbours and fjords		NIFES	project
10.Foreign substances in wild fish	Mapping pollack and flatfish	NIFES	St. prp. 1 - 2008
11.Radioactivity in seafood	Map level in farmed fish	NIFES	project
12.Authenticaton of seafood products (2015)	Pilot project Coordinated control program	HI	EEA

Foreign substances in fish

- Program for surveillance of pharmaceuticals, prohibited and polluting substances in fish feed of animal origin and fish used for food.

Farmed fish

- EU- initiated surveillance and control program for food of animal origin. Norway have an obligation through the EEA treaty.

- NFAS responsible for the implementation

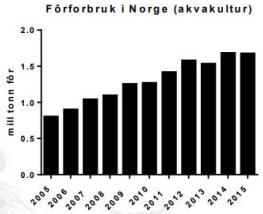
- NIFES (National Institute of Nutrition and Seafood Research) responsible for the analyses and reporting

NIFES (National Institute of Nutrition and Seafood Research)

- NIFES conducts research on feed for fish and fish as food
- NIFES is the National Reference Laboratory on PCR identification in animal feed
- Also works on genetic methods in addition to peptidomics to identify species and origin of species in sea food

Why monitor fish feed feed ingredients?

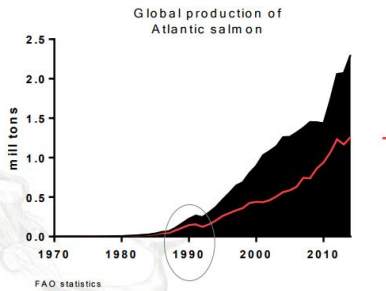
I 2015 over 1,6 million tonnes of fish feed in Norway
(Source: Norwegian Directorate of Fisheries)



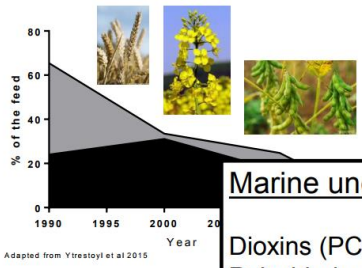
"Feed Legislation" of 7th Nov 2002; To secure safe feed, and thereby not presenting any harm to humans or animals, or make food from animals unfit for consumption. In addition the feed should not have an adverse effect on the environment.

Many regulations on feed

- Atlantic salmon diets were mainly composed of marine ingredients



Today - a blend of marine and plant feed ingredients



Marine undesirable substances

Dioxins (PCDF/PCDD),
Polychlorinated biphenyls (PCBs),
Organochlorine pesticides

Fish oil has been identified as one of the most important contributors to marine undesirable substances in salmon feed and farmed salmon

Main objective

To evaluate time trends of levels of marine undesirable substances

1) Marine feed ingredients
2) Norwegian fish feed
3) Farmed Atlantic salmon

Norwegian surveillance programs

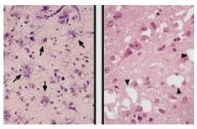
- Collected from Norwegian fish feed factories and fish farms
- Fish feed and feed ingredients: more than 5000 samples analyzed
- Farmed fish: Number is regulated by the EU Directive 96/23 (In 2014: 13 180 farmed fish were collected)

Surveillance program - fish feed

- Microbiology
- Heavy metals
- PCBs
- Dioxins and dioxin-like PCBs
- PAP
- Mycotoxins
- Polybrominated flame retardants (BFR)
- Antioxidants
- Selected vitamins and trace elements
- Pesticides

Detection of undesirable microorganisms in seafood

- Prions (TSE)
- Virus
- Bacteria
- Microscopic fungus
- Microscopic parasites



From: Bjørn Tore Lunestad, NIFES

Most important bacteria in seafood: *Listeria monocytogenes*

- May cause serious illness in pre-weakened consumers, e.g. the «cheese case» from 2007
- 15 -25 cases annually of listeriosis in humans in Norway
- Mortality is approx 30 %

Baseline study *L. monocytogenes* RTE-foods European Food Safety Authority, 2010 and 2011

3 053 packaged (not frozen) hot/cold smoked or cured fish
3 530 packaged heat-treated meat products
3 452 soft or semi-soft cheeses

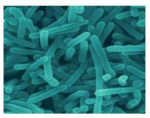
From 3 632 retail outlets in 26 EU Member States and Norway.

Samples exceeding 100 cfu/g at the end of shelf-life was 1.7 %, 0.43 % and 0.06 % for fish, meat and cheese samples, respectively, while for fish at the time of sampling it was 1 %.

EFSA Journal 2013;11(6):3241 [75 pp.]

Continues programs for the Food Authorities including microbiology

- *E. coli* og *Salmonella in* mussels and scallops
- Fish feed and the ingredients used
- Control of imported sea food from 3. country



National reference laboratories (NRL)

Appointed by the Food Authorities and linked to the NRL's in EU

National Reference Laboratories for Feed and Food in accordance with Regulation (EC) No 882/2004
Latest update: 19.04.2016

Matrix / parameter	EURL	NRL/DK Contact	NRL/FI Contact	NRL/IS Contact	NRL/NO Contact	NRL/SE Contact
4. Monitoring the viral and bacteriological contamination of bivalve molluscs	The laboratory of the Centre for Environment, Fisheries and Aquaculture Science (CEFAS) Weymouth United Kingdom	NFI-DTU-1 Department of Microbiology and Risk Assessment Anna Charlotte Schultz. acsc@food.dtu.dk +45 25477012 www.food.dtu.dk	Tullaboratoriet/ Custom Laboratory Teknikantie 13 FIN-02150 Espoo, Finland Elina Vatunen Elina.vatunen@tulli.fi +358 40 33 23 236	Matis Franklin Georgsson franklin@matis.is +354 4225040 +354 8585040	www.nmbu.no Mette Myrmel Mette.myrmel@nmbu.no +47 22 96 47 71 +47 22 96 48 18 Monitoring the viral and bacteriological contamination of bivalve molluscs: www.nifes.no Bjørn Tore Lunestad btu@nifes.no Tel +47 97596245 Fax+47 55905299	SLV Magnus Simonsson magnus.simonsson@slv.se +46 18 17 14 64 +46 18 10 58 48
5. *Listeria monocytogenes*	ANSES Laboratoire d'études et de recherches sur la qualité des aliments et sur les procédés agroalimentaires (LERQAP) F-94700 Maisons-Alfort France	NFI-DTU-1 Department of Microbiology and Risk Assessment Jens Kirk Andersen jkja@food.dtu.dk +45 35 88 72 13 +45 35 88 70 01 www.food.dtu.dk	Evira Tuula Johansson Tuula.Johansson@evira.fi +358 50 43 51 714		Food and feed VI www.vetinst.no Taran Skjerdal Taran.skjerdal@vetinst.no Tel +47 23216268 Fax +47 23216202 Seafood: NIFES www.nifes.no Bjørn Tore Lunestad btu@nifes.no Tel +47 97596245 Fax +47 55905299	*In food: SLV* Susanne Thisted-Lambertz susanne.thisted.lambertz@slv.se +46 18 17 55 62 +46 18 10 58 48 *In animals and feed: SVA* Elisabeth Bagge elisabeth.bagge@sva.se +46 18 67 42 61 +46 18 30 91 62

EU's recommondations

ANNEXES

to the
COMMISSION RECOMMENDATION

on a coordinated control plan with a view to establishing the prevalence of fraudulent practices in the marketing of certain foods

Coordinated control plan for fish species substitution

ACTIONS AND SCOPE OF THE COORDINATED CONTROL PLAN

A. Objective

Competent authorities should carry out official controls in order to establish whether fish species found in unprocessed or processed fishery and aquaculture products complies with the species that is declared on the label or in other means of information accompanying the food product.

In case of non-compliance, Competent Authorities should try to identify the actual species, to the extent possible.

The **methods or combination of methods used should allow**, to the maximum extent possible, the identification of the real species in the case of noncompliance with the declaration accompanying the product.

IEF

PCR-RFLP

DNA-barcoding

RT-PCR

Member State Recommended number of samples

Germany, Spain, France, Italy, United Kingdom	250
Czech Republic, Greece, Poland, Romania	160
Belgium, Denmark, Ireland, Croatia, Hungary, Netherlands, Austria, Portugal, Finland, Sweden	100
Bulgaria, Estonia, Latvia, Lithuania, Slovenia, Slovakia	70
Cyprus, Luxembourg, Malta	30
Total	3400

Pilot-study

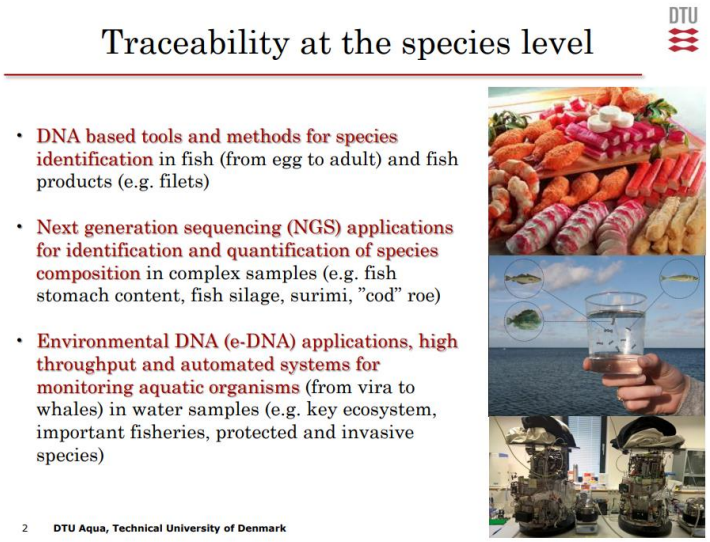
- Samples of sea food productes
  - frozen, filet, dried, salted, fish burgers and - cakes
- DNA – "barcoding" (COI)
  - Started with several analyse setups, but ended with two as a "standard"
- Blasted the resulting sequences against the NCBI database

		Result 1. run		Result 3. run, DNA isolated again			
				COI2		FDA	
Product	Labelled as	COI2	Comments	F	R	F	R
Fish soup	Unknown	-	No label, no analyses	-	-	-	-
Shellfish salad - shrimps, crayfish tails, crabstick	Shrimp, crayfish tails	-	Mixture of species, no analyses	-	-	-	-
Filets of cod	Cod	-	Similar product previously analyzed, no analyses.	-	-	-	-
Breaded fillets of fish	Unknown	Gadus chalcogrammus	?	-	-	-	-
Saith	Saith	Pollachius virens	Ok,	-	-	-	-
Fish balls in dillsauce – cod, saithe, haddock, and greater argentine	Various species	No hit	Mixture of products – bad quality	-	-	-	-
Fish cakes	Various species	Argentina silus	one of the species identified.	-	-	-	-
Pankopanert nuggets av cod	Cod	Salmo salar	Bad sequence. Need to control	-	-	-	-
Loins of arctic cod	Cod	No hit	Inexplicable result, New isolation needed.	Gadus morhua	Gadus morhua	Gadus morhua	Gadus morhua
Scallop	Scallop	No hit	Species could not be identified in NCBI database	No hit	No hit	-	-
Smoked filets of cod with skin	Cod	Oncorhynchus mykiss	Bad sequences –need to redo analyses	Oncorhynchus mykiss	Oncorhynchus mykiss	No hit	No hit
Breaded cod	Cod	Theragra finnmarchica/ gadus chalcogrammus	Deviating species. Control	Gadus chalcogrammus	Gadus chalcogrammus	Gadus chalcogrammus	Gadus chalcogrammus

Latinsk navn – labeled as	Positiv identification	No identification	Deviant identification	Comments
Anarhichas	**6**	0	0	
Brosme brosme	**2**	0	0	
Gadus morhua	**55**	**0**	**1**	**Identified as *Gadus chalcogrammus (Theragra/ Alaskan pollock)***
Gadus macrocephalus	**9**	0	0	
Gadus chalcogrammus	**1**	0	0	
Hippoglossus sp.	**3**	0	0	
Homarus americanus	**2**	0	0	
Pecten maximus	0	**1**	0	**Scallop – not white fish**
Lophius piscatorius	**1**	0	0	
Melanogrammus aeglefinus	**4**	0	0	
Molva molva	**4**	0	0	
Nemipterus bathybius	**1**	0	0	
Oncorhynchus mykiss	**1**	0	0	**Rainbow trout – not white fish**
Penaeus monodon	0	**1**	0	**Tiger prawns – not white fish**
Pagrus major	**1**	0	0	
Pleuronectes platessa	0	0	**1**	**Identified as *Pandalus borealis, probably* from the shrimp sauce declared on the label**
Pangasianodon hypophthalmus	**1**	0	0	
Pollachius virens	**12**	0	0	
Reinhardtius hippoglossoides	**1**	0	0	
Sebastes sp.	**2**	0	0	
Seriola sp.	**3**	0	0	
Thunnus sp.	**4**	0	0	**Tuna – not white fish**
Totalt	**113**	**2**	**2**	

Report on the Authenticate workshop in Denmark

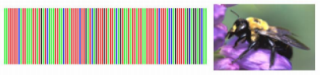
Jakob Hemmer-Hansen from DTU in Denmark presented the main outcomes from the Authenticate workshop that was held at the DanFish International fisheries exhibition in Aalborg on October 12th 2017. The workshop was attended by researchers, managers and the fishing industry; and really good discussions were initiated at the workshop. The meeting was primarily aimed in explaining to the industry which methods for detecting fraud are available, in particular genetic methods. The use of Genetics to trace stock populations were also explained. The emerging technology of using portable devices for DNA species identification/authentications did get attention among the industry, which saw potentials in implementing such technology in the sector.



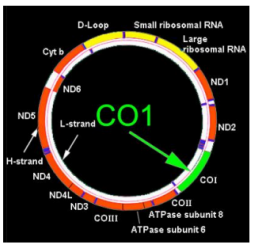
Traceability at the species level

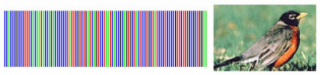
Barcoding

The unambiguous identification of a species through a specific gene sequence



Cytochrome c oxidase I (COI) in animals





- High copy number in each cell (mtDNA)
- Suitable rate of evolution
  - Fast enough to accumulate differences
  - Slow enough to allow universal primers to bind
- Notable differences between species, few within
- Simple gene structure
  - No introns

Barcoding of Life database: > 18.000 fish species

Traceability at the species level


Ministry of Environment and Food of Denmark
Danish Veterinary and Food Administration

Traceability at the species level

Results

26 cans

- 10 different brands (some brands sampled more than once)
- 2 cans per sampling event

2 analysis replicates per can

52 samples for testing

⇩

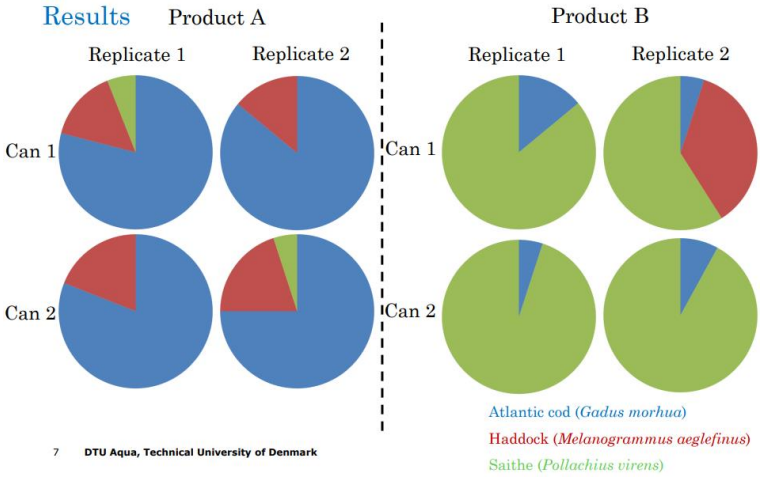
-> 26 samples: only Atlantic cod (*Gadus morhua*) detected

-> 4 samples: no Atlantic cod detected

All reads were *Gadus macrocephalus*, Pacific cod

-> 22 samples: Atlantic cod and other species detected

Traceability at the species level



7 DTU Aqua, Technical University of Denmark

Traceability at the population level

- **Identification of separate populations /stocks** of aquatic organisms and their genomic characteristics, for identification of management units, aquaculture development and biodiversity conservation
- **Tools (e.g. SNP chips) for determining the geographical or farmed/wild origin** of fish and fish products (e.g. North Sea, Baltic or aquaculture cod), for fisheries management, environmental protection and for (food) forensic purposes
- **Long term monitoring of the effects of exploitation and environmental change** on important fish species through genomic analysis af DNA from archived material (e.g. scales and bones)

8 DTU Aqua, Technical University of Denmark 8

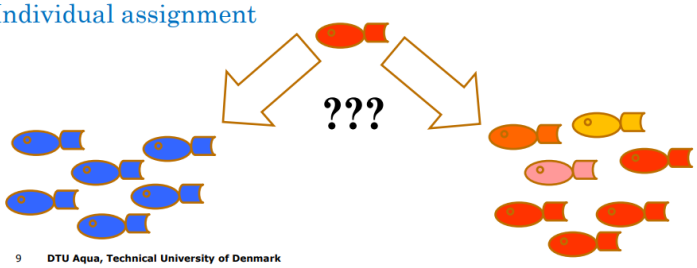
Traceability at the population level

Populations are genetically more similar than species

No categorial allocation, must identify most likely population of origin

-> Frequency differences

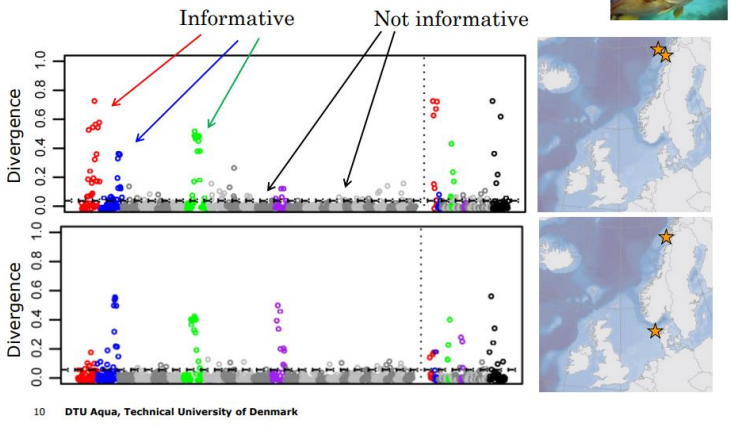
Individual assignment



9 DTU Aqua, Technical University of Denmark

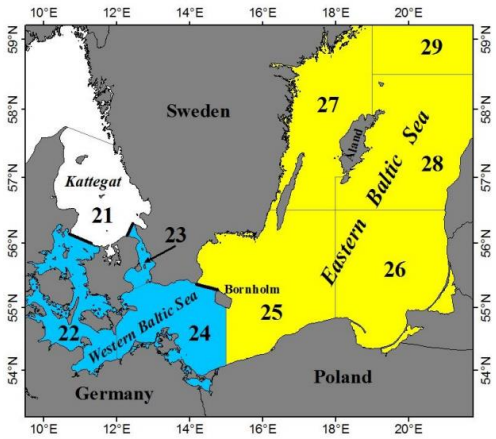
Traceability at the population level

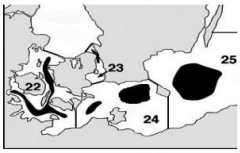
Population structure and assignment



Traceability at the population level

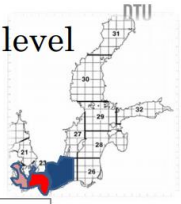
Cod in the Baltic Sea

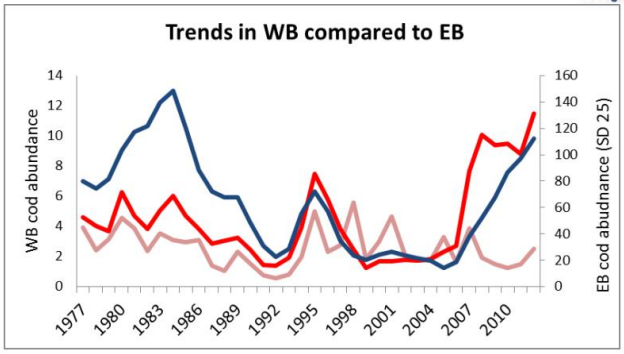




Traceability at the population level

Cod in the Baltic Sea





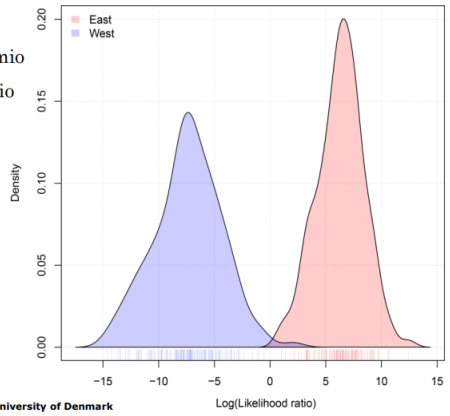
Traceability at the population level

Cod in the Baltic Sea – statistical power

39 loci (SNPs)

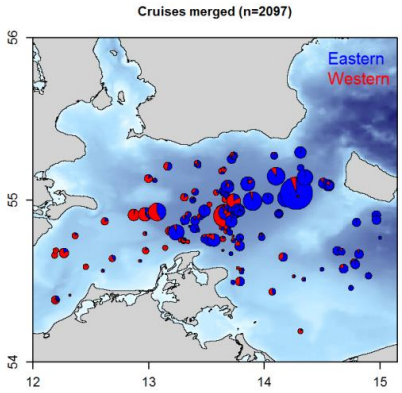
WB: P (WB/EB)~22 mio

EB: P (EB/WB) ~2 mio



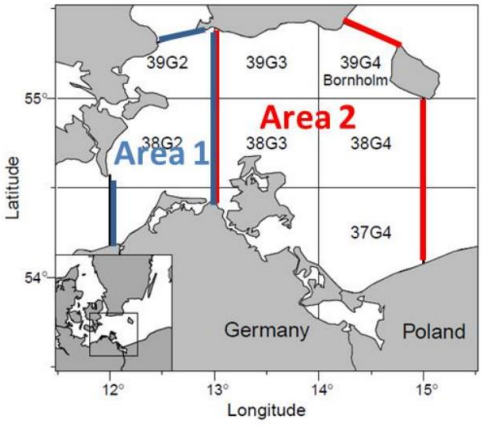
Traceability at the population level

Cod in the Baltic Sea – population mixing



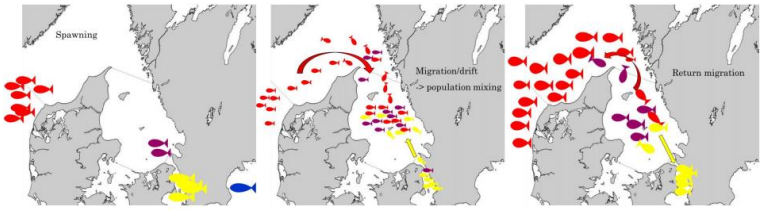
Traceability at the population level

Cod in the Baltic Sea – implications (split stock assessment)



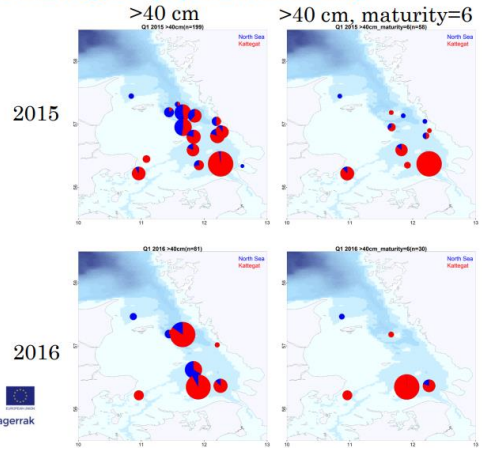
Traceability at the population level

Cod in the Kattegat



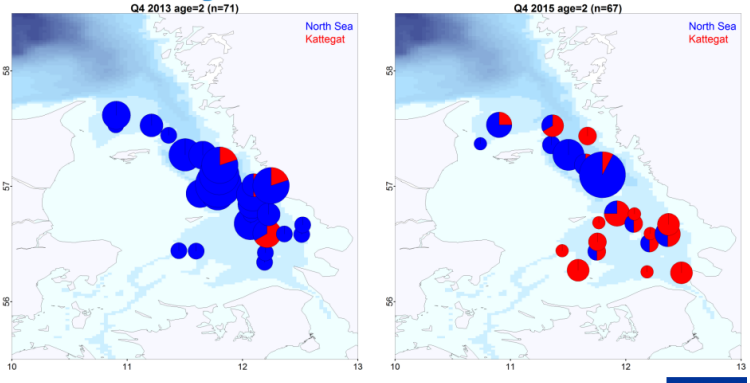
Traceability at the population level

Cod in the Kattegat – population mixing



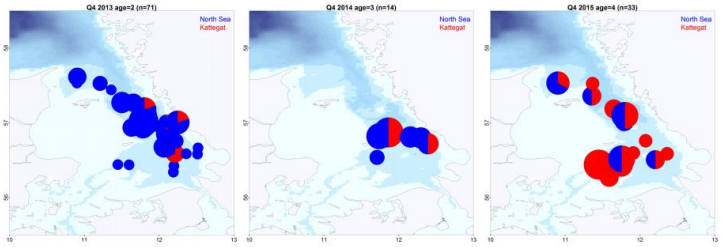
Traceability at the population level

Cod in the Kattegat – variation between cohorts



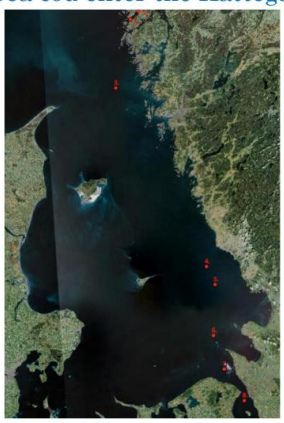
Traceability at the population level

Cod in the Kattegat – tracking of cohort proportions



Traceability at the population level

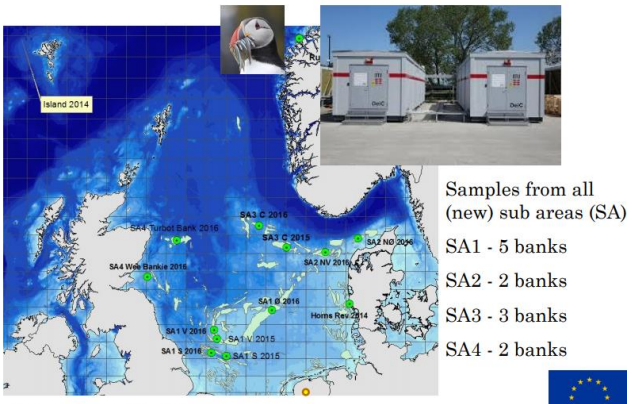
When do North Sea cod enter the Kattegat?



Per Moksnes/Per Jonsson, University of Gothenburg

Traceability at the population level

Sandeel in the North Sea



Samples from all (new) sub areas (SA)

SA1 - 5 banks

SA2 - 2 banks

SA3 - 3 banks

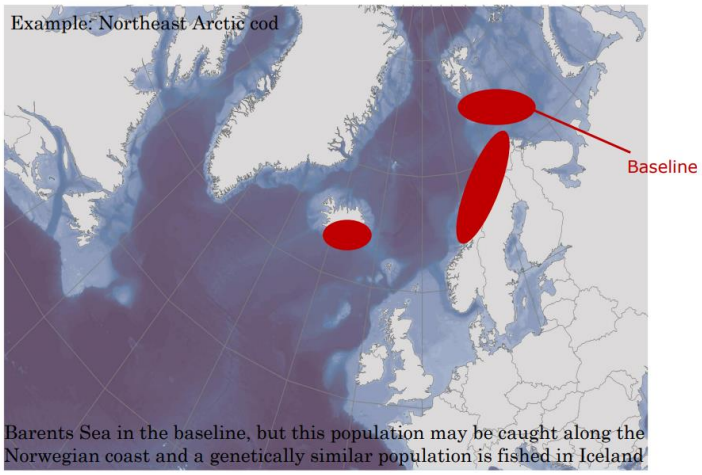
SA4 - 2 banks

Traceability at the population level

…can be complicated

- Specific scenarios are preferable
- We can only assign fish to populations included in the baseline
- Fish from an un-sampled baseline may still assign to one of the included baseline samples (the most likely of the possible baseline samples)

Traceability at the population level



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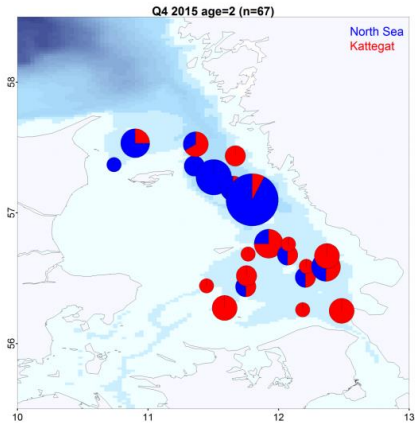

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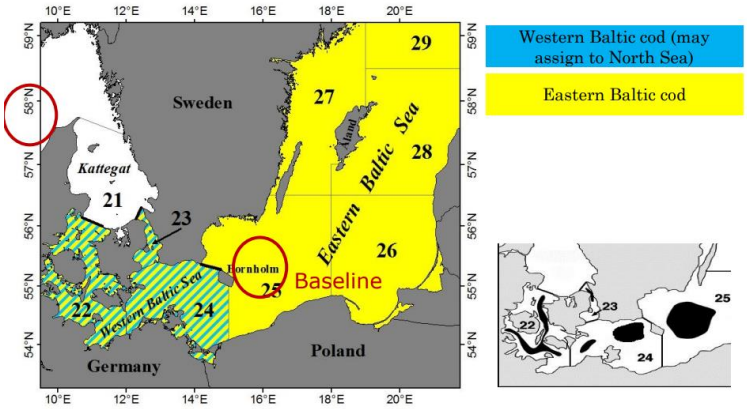

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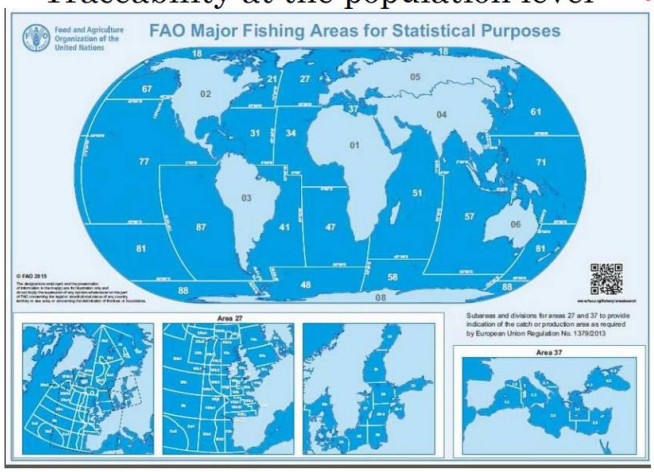

www.fao.org

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- Area definitions are not always specific (e.g. FAO27, "Northeast Atlantic")

…but definitely feasible

-> genomic technology facilitates major advances

-> target new species and areas

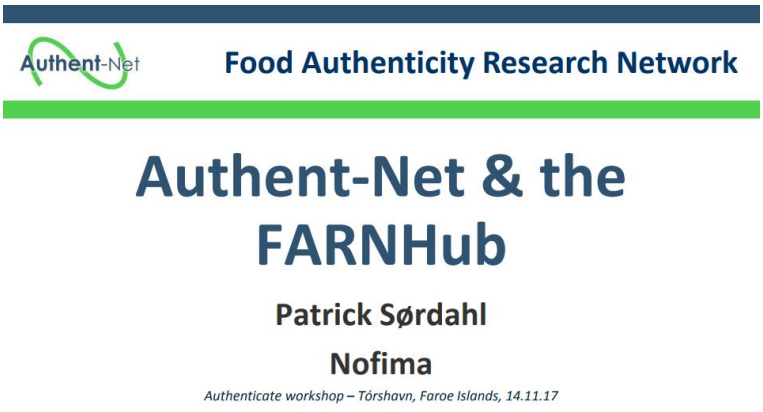
Next steps?

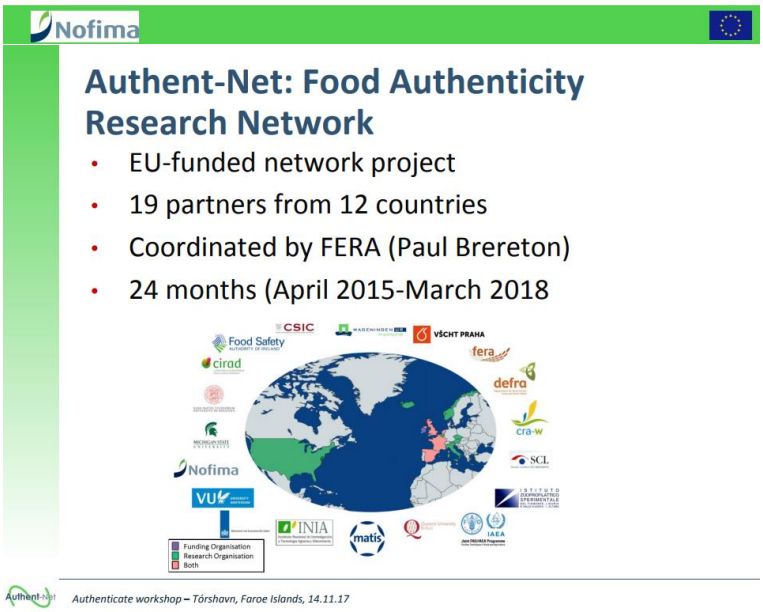
Portability

Oxford Nanopore Technologies
https://nanoporetech.com

Authent-Net & the FARNHub

Patrick Sørdahl from Norway introduced the H2020 project Authent-Net project and the FARNHub that is being developed within the project. Authent-Net is a Coordination and Support Actions (CSA) project that has the aim or bringing together R&D institutions in Europe that are working on food authenticity, collect information on national status on of research and food fraud incidents, collect information on food frauds and available methods for detections for selected food items (including seafood), bring together and network with funding bodies across Europe that are funding food authenticity projects, try to initiate ERA-Net projects and finally to divelop a web based portal where users can get an overview of currently available resources related to food authenticity. This web based portal is called the FARNHub (Food Authenticity Research Network Hub).





Authent-Net: Food Authenticity Research Network

- Anti-food fraud capabilities are poorly coordinated and not consolidated
- National research funding bodies need to be brought together

To facilitate sustainable cooperation between national and international research funding bodies in the area of food authenticity, to improve the competitiveness of the food supply chain and the consumer confidence in it, by means of better-coordinated, cost-effective R&D

Authent-Net will:

- *Bring together relevant member states R&D budget holders to coordinate inter-disciplinary research effort and build a cohesive and sustainable network*
- *Undertake stocktaking of existing national research and assess against the international landscape*
- *Establish transnational mechanisms and instruments for collating and exchanging information on food authenticity research*
- *Develop a high level research and innovation strategy for transnational research and a rationale for a potential ERA-NET on food authenticity*

Expected impact

- *Improved coordination and communication between relevant member states research budget holders*
- *Enhanced cognisance of existing national research*
- *Joint strategy for food fraud R&D*
- *Agreed priorities and capability to deliver transnational European research on food fraud*

Selected project outcomes

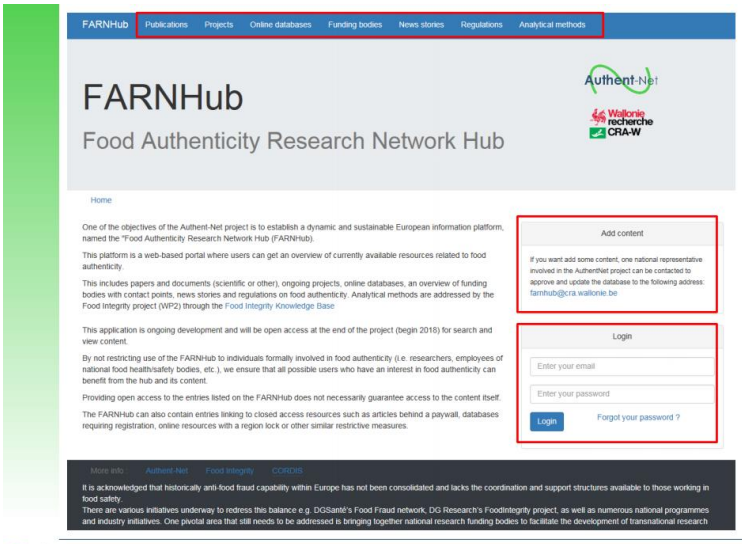
- Mapping and gap-analysis of todays status on food authenticity in Europe
- White-paper identifying the rationale for an ERA-NET on food authenticity
- Develop a low-level European Standard
  - CEN WS 86 – "*Authenticity in Feed and the Food Chain – General Principles and Basic Requirements*"
- Establish a dynamic and sustainable information platform
  - The Food Authenticity Research Network Hub

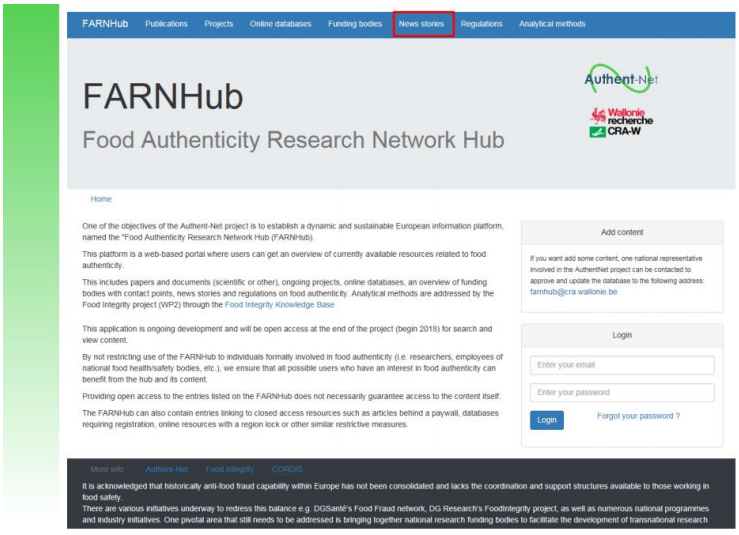
Low-level European standard

- CEN WS 86 – "*Authenticity in Feed and the Food Chain – General Principles and Basic Requirements*"
- Will develop "*consensus-based recommendations for definitions of key terms and concepts, and outline principles and basic requirements related to food authenticity*"
- Program ahead
  - Public hearing (late-November 2017 -> late-January 2018)
  - CEN Workshop Consensus meeting (March 2018)
    - In the context of the Authent-Net Final meeting
    - Time and date not set
  - Publication of CWA by CEN (May 1st 2018)

The FARNHub

- *"The Food Authenticity Research Network Hub"*
- Web-based portal where users can get an overview of currently available resources related to food authenticity
- Includes:
  - Publications (scientific or other)
  - Projects
  - Online databases
  - Funding body overview
  - News stories
  - Regulations
  - Analytical methods (through the "FoodIntegrity Knowledge Base")


FARNHub
Publications
Projects
Online databases
Funding bodies
News stories
Regulations
Analytical methods
FARNHub
Food Authenticity Research Network Hub
Home
One of the objectives of the Authent-Net project is to establish a dynamic and sustainable European information platform, named the "Food Authenticity Research Network Hub (FARNHub).
This platform is a web-based portal where users can get an overview of currently available resources related to food authenticity.
This includes papers and documents (scientific or other), ongoing projects, online databases, an overview of funding bodies with contact points, news stories and regulations on food authenticity. Analytical methods are addressed by the Food Integrity project (WP2) through the Food Integrity Knowledge Base
This application is ongoing development and will be open access at the end of the project (begin 2018) for search and view content.
By not restricting use of the FARNHub to individuals formally involved in food authenticity (i.e. researchers, employees of national food health/safety bodies, etc.), we ensure that all possible users who have an interest in food authenticity can benefit from the hub and its content.
Providing open access to the entries listed on the FARNHub does not necessarily guarantee access to the content itself.
The FARNHub can also contain entries linking to closed access resources such as articles behind a paywall, databases requiring registration, online resources with a region lock or other similar restrictive measures.
Add content
If you want add some content, one national representative involved in the AuthentNet project can be contacted to approve and update the database to the following address:
farnhub@cra.wallonie.be
Login
Enter your email
Enter your password
Login
Forgot your password ?
More info
Authent-Net
Food Integrity
CORDIS
It is acknowledged that historically anti-food fraud capability within Europe has not been consolidated and lacks the coordination and support structures available to those working in food safety.
There are various initiatives underway to redress this balance e.g. DGSanté's Food Fraud network, DG Research's FoodIntegrity project, as well as numerous national programmes and industry initiatives. One pivotal area that still needs to be addressed is bringing together national research funding bodies to facilitate the development of transnational research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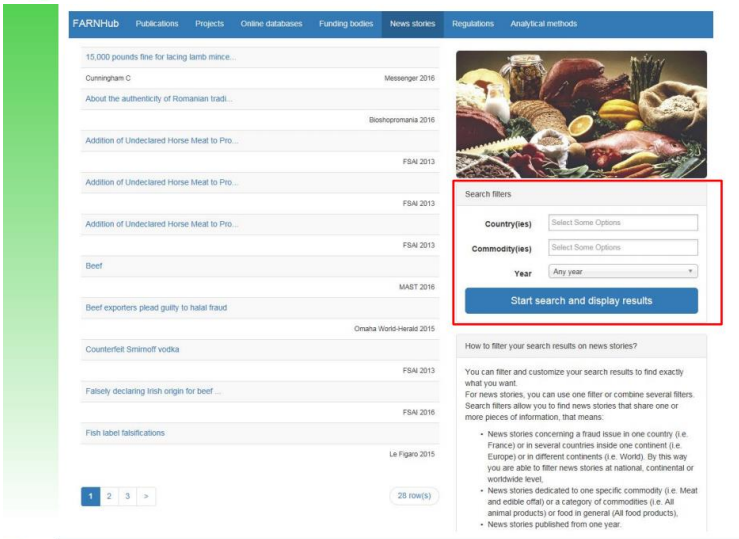
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Bioshopromania 2016
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Beef exporters plead guilty to halal fraud
Omaha World-Herald 2015
Counterfeit Smirnoff vodka
FSAI 2013
Falsely declaring Irish origin for beef ...
FSAI 2016
Fish label falsifications
Le Figaro 2015
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2
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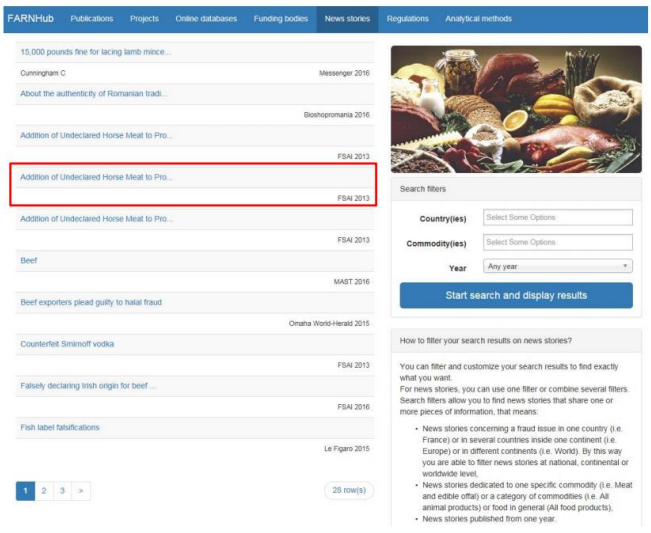
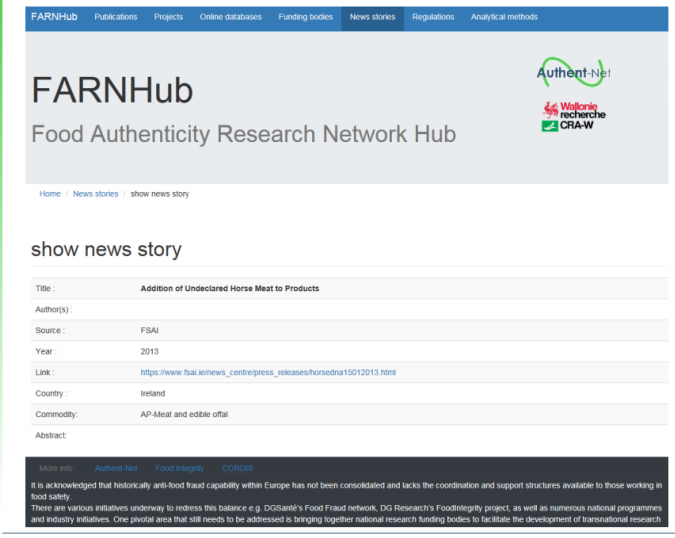
28 row(s)
Search filters
Country(ies)
Select Some Options
Commodity(ies)
Select Some Options
Year
Any year
Start search and display results
How to filter your search results on news stories?
You can filter and customize your search results to find exactly what you want.
For news stories, you can use one filter or combine several filters. Search filters allow you to find news stories that share one or more pieces of information, that means:
News stories concerning a fraud issue in one country (i.e. France) or in several countries inside one continent (i.e. Europe) or in different continents (i.e. World). By this way you are able to filter news stories at national, continental or worldwide level.
News stories dedicated to one specific commodity (i.e. Meat and edible offal) or a category of commodities (i.e. All animal products) or food in general (All food products).
News stories published from one year.





www.authent-net.eu

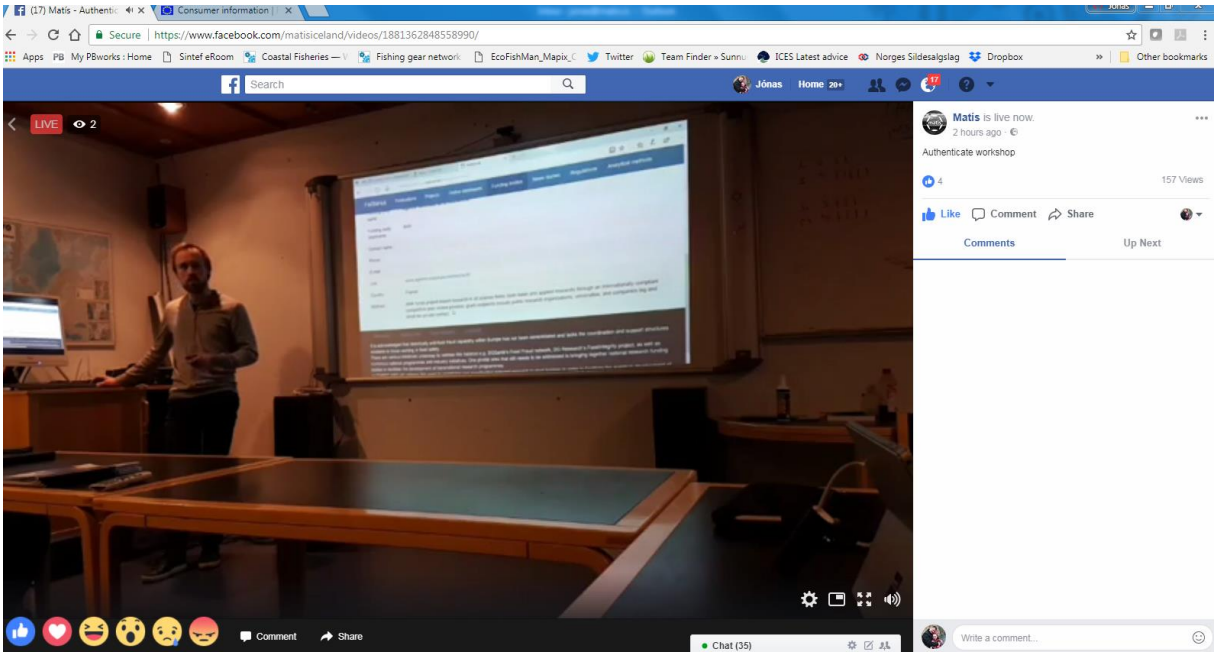
"This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 696371".

Discussions

Food fraud and food authenticity is apart of international seafood trade that is becoming increasingly noticed. Processors, retailers, food service sector, consumers and other stakeholders are aware of this problem, which seems to be growing. In some cases, food fraud is in many cases a part of what is considered organised crime and larger retail chains have reacted by setting up their own laboratories or contracting research institutions to authenticate their supplies. Large research projects have been initiated to address the issue and authorities have created task-forces to try to tackle the problem.

A growing societal demand for food authenticity, safety and broader food security is creating both new opportunities and increased challenges for Nordic seafood suppliers, manufacturers and retailers. Seafood from the Nordic countries have many favourable characteristics that provide competitive advantage on high paying markets, which is why their products are often subjected to fraud. This does however also create opportunities; if it is possible to ensure that Nordic products are traceable and if retailers & food service sector can fully trust their Nordic suppliers.

The Authenticate project has facilitated networking amongst Nordic stakeholders in the field of food authenticity and has served as important venue to raise awareness and understanding. The national workshops organised by the project gained considerable attention and the final workshop, which was broadcasted on Facebook, was viewed by around 200 persons. This highlights the growing attention that the issue is getting. The figure below shows a screenshot from Facebook during the broadcasting.



Patrick Sørdahl'spresentation on the FARNHub broadcasted on Facebook with 157 views

As follow-up on the Authenticate project are projects such as the Authent-Net project and facilitation of cooperation between researchers and industry to ensure authenticity of Nordic seafood products. There are available tools for detecting fraud, both analytical methods and other, which we have more understanding on as results of projects such as Authenticate. The Nordic seafood sector should therefore look at the issue as an opportunity to further highlight the many favourable characteristics of the fantastic seafood that the region has to offer.

Acknowledgements

Partners of the Authenticate project and the authors of this report would like to thank the Nordic Council of Ministers - Working Group for Fisheries (AG fisk) for contributing to the funding of the project. It is also acknowledged that the H2020 projects Authent-Net (project nr. 696371) and FoodIntegrity (project nr. 613688) have contributed to the progress of Authenticate and this report.

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