

**“Piloting of eco-innovative fishery supply–chains to market added–value Adriatic fish products”**

Priority Axis: Blue innovation

1.1 - Enhance the framework conditions for innovation in the relevant sectors of the blue economy within the cooperation area

## **D4.4.1. Guidelines for traceability implementation on new products**

WP4 - INNOVATING TOOLS AND PROCESSES FOR ADDED-VALUE ADRIATIC FISHERY PRODUCTS/ ACT 4.4 CAPITALIZING BLUE INNOVATION: TRACEABILITY AND CERTIFICATION OF ECO-INNOVATIVE FISHERY PRODUCTS/

MAY 2020

PARTNER IN CHARGE: PP1  
PARTNERS INVOLVED: LP UNIBO

Final Version  
Public document

<b>ORDER</b>	<b>ZADAR COUNTY</b>	
<b>TYPE OF DOCUMENT</b>	<b>PROJECT PRIZE FISH-</b> Piloting of eco-innovative fishery supply-chains to market added-value Adriatic fish product <b>REPORT D4.4.1.</b>	
<b>DELIVERY PERIOD</b>	M18	
<b>REPORT EVALUATION</b>	mr.sc. Mario Lovrinov	
<b>MEMBERS OF EXPERT TEAM</b>	mr.sc. Mario Lovrinov	MARIBU d.o.o
	Nikola Matović, Eva Merloni	University of Bologna
	MBA Ivan Matijašević, dipl. ing. Ana Brala Gospić, bacc. oec. Lovre Vidov	Omega 3
<b>CONSULTATION</b>	mag.ing. Valentina Andrić	Ministry of Agriculture- Fishery department
<b>PRODUCTION</b>	MARIBU d.o.o. Marine consultancy company	

## GLOSSARY

ARF	Adriatic Responsible Fisheries
ASC	Aquaculture Stewardship Council
BRC	British Retail Consortium
CAB	Conformity Assessment Body
DNA	Deoxyribonucleic Acid
EC	European Commission
EU	European Union
FAO	Food and Agriculture Organisation of the United Nations
FOS	Friend of the Sea
FSC	Forest Stewardship Council
HACCP	Hazard Analysis Critical Control Point
IFS	International Food Standard
ISCC	International Sustainability & Carbon Certification
ISEAL	International Social and Environmental Accreditation and Labeling
ISO	International Organization for Standardization
ISSF	International Seafood Sustainability Foundation
IUU	Illegal, Unreported and Unregulated Fishing
MSC	Marine Stewardship Council

RFMO Regional Fisheries Management Organizations

SSCI Sustainable Supply Chain Initiative

UN United Nations

USA United States of America

USDA United States Department of Agriculture

WWF World Wildlife Fund

## 1. Contents

---

2. INTRODUCTION .....	6
2.1. BACKGROUND AND PURPOSE .....	6
2.2. INTERNATIONAL GUIDELINES AND LEGISLATION .....	7
3. TRACEABILITY SYSTEMS IN FISHERY SUPPLY CHAINS - TERMS, DEFINITIONS AND USE .....	9
3.1. PRODUCT TRACEABILITY .....	12
3.2. TRANSPARENCY .....	12
3.3. CHAIN OF CUSTODY .....	13
3.4. OTHER TERMS .....	13
4. ORGANIZATION AND IMPLEMENTATION OF TRACEABILITY IN THE FISH PROCESSING INDUSTRY .....	14
5. DESCRIPTION OF STEPS AND PLAN IN THE TRACEABILITY PROCEDURE OF CERTIFIED FISH PRODUCTS .....	18
6.1. BEST PRACTICES AND REGULATORY MECHANISMS .....	19
6.2. TRACEABILITY TOOLS AND KEY-ENABLING TECHNOLOGIES .....	21
7. QUALITY ASSURANCE SYSTEMS .....	25
7.1. ISO 9001 STANDARD - QUALITY MANAGEMENT .....	25
7.2. ISO 22000 STANDARD - FOOD CHAIN MANAGEMENT .....	25
7.3. OTHER ISO CERTIFICATIONS .....	25
7.4. IFS FOOD (INTERNATIONAL FOOD STANDARD) .....	26
7.5. OTHER FOOD SAFETY STANDARDS .....	26
8. QUALITY STANDARDS AND LABELS WITH TRACEABILITY IMPLICATIONS .....	27
8.2. CROATIAN PRODUCT QUALITY LABELS AND CERTIFICATION AGENCIES .....	31
8.2.1. Croatian certification agencies .....	31
8.2.2. Geographical indications and origin labels .....	31
8.2.3. Branding and indication of origin .....	33
8.2.4. Possibilities of co-financing certificates .....	36

9.2. MSC CHAIN OF CUSTODY.....	39
13. ANNEXES.....	54
10.4. ANNEX I .....	54

## 2. INTRODUCTION

### 2.1. BACKGROUND AND PURPOSE

*“This document reflects the author’s views; the Programme authorities are not liable for any use that may be made of the information contained therein.”*

The global fish market has witnessed significant growth over the past decades. This rapid increase in seafood production and trade has been mostly notable in the aquaculture sector, with an increase from 5 million to 63 million tons in just thirty years, accounting it for 42% of global seafood production (Leal et al. 2015; World Bank, 2013). Along with rising consumption of such products, there has also been a distinct alignment between consumer demand and the industry’s offer. As seafood is becoming more available through various trade channels, the ambiguity of the market signals driving this demand is slowly starting to unfold.

In 2016, around 35 percent of fish produced in the world entered the trade, with 60 million tonnes of total fish products exported in this year alone. High percentage of this international trade was driven by export growth from developing states, which direct their products to developed country markets. Due to this fact, global fish trade value in exports in 2017 was estimated at USD 152 billion (FAO, 2018). Rapid internationalization in the seafood industry resulted in an interconnected system with complex relationships.

In the environment with such evident food supply chain complexity, the related products are susceptible to increased mislabeling and other fraudulent events<sup>1</sup> (Lewis & Boyle, 2017). A report by Oceana<sup>2</sup> concluded that in 2016, on average 20% of all fish from the retail and catering sector was mislabelled (Reilly, 2018). These products not only put public health at risk, but associated criminal activity also brings revenue losses measured in millions of U.S. dollars.

After series of some major international food incidents and scandals (eg. bovine spongiform encephalopathy; Leal et al. 2015), it was clear that there was an urgent need for stringent implementation of tools for tracing food items within the supply chains. The food fraud is not just the matter of species substitution and product quality, but also a matter of safety risks for

---

<sup>1</sup> Seafood fraud is the case where a product is mislabelled (wrongly labelled) with respect to its quality or quantity, a species name, country of origin etc. (NOAA, 2014)

<sup>2</sup> See: <https://oceana.org/>

consumers (Yasuda & Bowen, 2006). Public can be deceived with regard to concealed geographic origin, illegally harvested protected species or, in the case of marine fisheries, products from illegal, unreported, and unregulated fishing (IUU-fishing) (Reilly, 2018).

Therefore, the objective of this report is to analyze current state of the traceability systems in fisheries and to elaborate on recommendations/guidelines for their implementation on eco-innovative fishery products with a specific focus on the Chain of Custody (CoC) in the supply chains at the at the production (processing and sales) level.

In the following sections of this report, the main characteristics of the traceability systems will be presented, along with the principles and tracking solutions in fishery supply chains. Furthermore, the chain of custody certification requirements will be separately introduced, with examples of leading certification schemes. The CoC models relevant for the fishery supply chains will be explained, with a given view of their benefits and drawbacks. Also, we will include a list of recommendations with the specificities related to the PRIZEFISH objectives. In the end, the conclusions will be drawn from the presented analyses and discussion.

## 2.2. INTERNATIONAL GUIDELINES AND LEGISLATION

Growing concerns among the end-users in complex fishery supply chains, that want to know how and where their food was sourced, have been drivers for change of regulatory procedures and safety requirements in the industry development. One of the turning points for rigorously defining food chains in the EU happened in 2002, by implementation of the European Union's General Food Law (Regulation (EC) No 178/2002), which was in part a result of the outbreaks like that of foot-and-mouth disease (FishWise, 2018). It lays down general requirements and principles of food law and food safety. In the same year, a very important article came into effect (EU Article 4, Council Regulation 104/2000), requiring that all fishery products need to be labeled with species commercial designation name, the production method and the catch area. Moreover, by passing of the new Control Regulation in 2009 (EU Regulation 1224/2009), it was stipulated that the seafood products need to be *put into lots prior to the first sale* (Articles 56 and 58, Regulation (EC) No 1224/2009). But tracing food production throughout the supply chains was not limited to the EU only. In the aftermath of global market development, food scandals and potential acts of bioterrorism (Petersen & Green, 2007; Leal et al. 2015), the USA initiated important acts in an effort to reduce supply chain risks. With the Farm Security and Rural



Investment Act (USDA, 2012) and the Bioterrorism and Response Act<sup>3</sup>, strict regulatory requirements were in force. The issued rulings mandated the use of “country of origin” labeling (COOL) for certain food items and maintaining records to trace and track different links in the supply chains (Petersen & Green, 2007; FishWise, 2018). Other countries soon followed the footsteps of the EU and US, and passed similar legislation.

To make sure that the specified product conforms to the requirements for the quality and food safety aspects granted by a certification process in place, a product traceability system that considers standards like ISO 9001, ISO 22000 or BRC, took place over the next few years. It should be underlined that this kind of traceability system has not just aided in consumers’ trust and protection, but through creating higher product value it subsequently increased the chain value. By collecting different kinds of information that is transferred through the system, more precise quality assessment of the seafood can be derived and better production optimization can be performed.

The mandated requirements of the aforementioned regulations and standards, specify minimum amount of information to be associated with the fishery products. These include: commercial species name, catch area and production method. If the main characteristics are missing, then the covered products may not be offered for sale to the final consumer, in the case of the Regulation (EC) No 104/2000 and No 2065/2001. In addition, these characteristics shall be available to the authorities either as a label on package or in an accompanying commercial document (Rasmussen, 2012).

As we can infer from above, fish traceability resulted as a logical step in enforcing seafood safety regulations, combating fraud and ensuring high standards in seafood production and trade (FishWise, 2018; Reilly, 2018).

---

<sup>3</sup> FDA. (2002). The U.S. Bioterrorism Act of 2002. US FDA

### 3. TRACEABILITY SYSTEMS IN FISHERY SUPPLY CHAINS - TERMS, DEFINITIONS AND USE

Traceability systems refer to constructions that enable recording and following the product (including its parts or material) throughout the network of its production to final supply to consumers. The systems vary widely depending on their purpose. They can be paper-based or online (computer-based) tracking systems (Borit & Olsen, 2016). Usually linked to quality assurance, nowadays more frequently they tend to provide information on sustainability practices employed by organizations.

In order for traceability systems to be accurate and trustworthy, they have to be based on systematic recordings and good information sharing. There is a sense of collective responsibility for business actors in a supply chain, especially in the food sector, for providing information on the relevant features of the supply (Ploeger, 2014). Thus, it is crucial to recognize the importance of connectivity in this networking context and apply it to secure product supply integrity.

Fisheries supply chains play a big role in addressing seafood risks and sustainability issues, and reliable traceability systems are a key component to improved management and decision making within the supply chains. The weaknesses related to poor fisheries management, lack of transparency/traceability, unsustainable fishing practices etc., are not necessarily the result of ineffective internal control systems, but can be the legacy of the evolving systems that over time intended to move perishable items from one region to another<sup>4</sup>. In situations where complexities in supply chains prevail, seafood chain actors can only operate within legal framework capacities.

A typical *supply chain* can be defined as a network of distribution entities and facilities that performs function of procurement of raw materials, their transformation and distribution of final products to consumers (Islam & Habib, 2013). It can consist of mid-chain players, such as primary and secondary producers, wholesalers, dealers, transporters. The more of these players are present in the chain, the more they bring to its complexity and the harder it gets to trace and monitor products from a producer to a consumer. Even in the case of a shorter physical distance from a primary producer to final consumer, the risk of fraud and losing data remains, as a processor can purchase the catch from multiple fishers and sell it to more than one retailer.

---

<sup>4</sup> <https://reefresilience.org/coral-reef-fisheries-module/making-sense-of-wild-seafood-supply-chains/challenges-in-fishery-supply-chains/>

Besides, adding value to fish products can extend the supply chain, despite local product destinations (UNEP, 2009).

The flow of information at product' level within supply chains determines which strategies will be followed for promotion and incentivization of responsible and sustainable fishing practices and fish production. Thus, the recorded chain of events is essential for connecting the dots up and down-stream and tracing the product at each stage of its production, processing and distribution (UNEP, 2009). The traceability systems cover all these aspects and are able to convey crucial information along with the product, on different aspects (e.g. social, environmental) to the end user.

Each wild-caught seafood supply chain usually starts from the production/capture stage (1). That is where the harvesting occurs and where the fishermen collect fish (seafood) at sea. It is worth noting that this is also a point where the transshipment<sup>5</sup> might happen. This is important because misconceived and false data can make their way into the supply chain right through this point, making it therefore one of the weakest links of the chain (He, 2018). Next stage is the landing and collection from the first producer, where the purchase or trading (auction/broker) often occurs at the docks (2). Subsequently, the product goes to a processing plant or to a primary buyer (3). Here, the added-value products can be prepared, packaged and kept in cold storage, or the product is taken by the secondary processor/buyer. In the next stage, seafood products are transported and distributed to customers - restaurants, retailers and markets/fishmongers (4). From there, the final products reach plates of the end consumers (5) (Figure 1).

In this report, we will generally focus on the analysis of supply chains originating at the processors and sales' level, with a reference to the producers' level where appropriate.

---

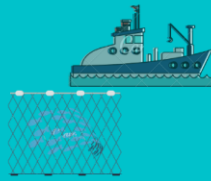
<sup>5</sup> Transshipment is a fishing operation where refrigerated transport vessels fetch and carry the catch from at-sea vessels. It can happen at port or at sea (See: <https://stopillegalfishing.com/issues/transshipment/>).

## Fishery Supply Chain

### Capture

Fishing vessels operate at sea and return with a catch, or hand it over via transshipment to other vessels.

POINT  
01



POINT  
02

### Landing

At docks, trucks transport the catch to processing plant or to a primary buyer.

Processing  
Sorting, filleting, canning added-value fish, packaging and storage.

POINT  
03



POINT  
04

### Distribution

The products are shipped to the customers - retailers, markets, restaurants etc.

### Sales

Final products reach the plate of the end consumer.

POINT  
05



Figure 1. Summary of a simplified general wild-catch fishery supply chain

### 3.1. PRODUCT TRACEABILITY

There are many different definitions of *traceability*, proposed by the European Union, Codex Alimentarius or International Organization of Standardization (ISO), among others. Essentially, they describe traceability as the ability to trace or follow the food movement through part or all stages of its production, processing and distribution (Petersen & Green, 2007). However, one of the most recent and complete definitions phrased it as *the systematic ability to access any or all information relating to an item under consideration, throughout its entire life cycle, by means of recorded identifications* (Olsen & Borit, 2013).

Traceability forms a crucial element in fishery supply chains. In order to mitigate risks throughout the chain, including food safety, IUU-fishing, human rights abuses, mislabeling and fraud (FishWise, 2018), it is imperative to have interoperable traceability. *Interoperability* refers to the ability of software systems to share information with different members of the supply chain (Future of Fish, 2016). It can be syntactic (utilizing common data format) and semantic (interpreting information based on shared definitions). Without it, the information cannot be shared efficiently.

Traceability information should be shared *end-to-end*. In fishery supply chains this means that the consumer unit of seafood at a restaurant or retailer can be traced back to its point of harvest by a vessel/farm<sup>6</sup>. The benefits of end-to-end traceability include: improved operations, facilitations of inventory management and product information preservation.

Traceability is very important for companies with seafood sustainability commitments. These companies can actively promote benefits of their products (e.g. social and fair-trade compliance) and improve their competitive advantage in the industry (FishWise, 2018).

### 3.2. TRANSPARENCY

Traceability is not to be confused with *transparency*. The latter term refers to the extent of shared understanding and access to product-related information that all stakeholders in the supply chain can request, without loss, noise, delay or distortion (Hofstede, 2004). The transparency cannot exist without traceability, but for transparency alone additional components are needed. While traceability has more generic function, transparency is specifically applied and aimed at target

---

<sup>6</sup> <http://futureoffish.org/content/t101-videos-end-end-traceability-supply-chain-decision>

audience (Borit & Olsen, 2016), and as a critical element in risk communication, it leans on the framework set by traceability. The very foundation for tracing products lies in the information connectivity between actors in the product supply chain.

### 3.3. CHAIN OF CUSTODY

Another system used for securing credibility, consumer trust and for mitigating companies' reputation risk, is known as the *Chain of Custody* (CoC). It is closely tied to traceability and it represents a documented set of measures for obtaining and conveying information about the products (and their parts and components), as well as their transformation throughout the supply chain (Borit & Olsen, 2016; ISEAL, 2016).

Borit & Olsen (2012) consider traceability and chain of custody as being two different processes in fishery certification practice. According to them, traceability is generic and non-discriminatory, while chain of custody has more specific meaning. More precisely, CoC certification is a necessary approach in claiming eco-label use and follows strict rules (eg. not mixing certain products), while traceability has only requirements in terms of documenting actions and keeping recordings. But in some cases, traceability requirements can be stricter than the ones of the CoC. For example, if the two products are coming from the same certified supplier, traceability requires them to have different identification codes as this should separate their properties; whereas CoC sees them as the units of the same category as long as they are not mixed contrary to eco-labelling rules.

### 3.4. OTHER TERMS

There are few other common terms often used in traceability systems for describing levels of packaged certified products at the various stages in the supply chains:

#### ***Batch***

A *batch* is a quantity produced at a certain time and placed in a uniform manner (Petersen & Green, 2007). It can be an incoming packaged load of materials for processing, or a production unit undergoing the same conditions in the processing plant. The term also describes a specific amount of material with the same sustainability characteristics (Borit & Olsen, 2016).

Some authors also use a term *lot*, while others differentiate this term as a subset of a production batch, meaning that there can be a few lots coming from a single batch (Ploeger, 2014). Sometimes these lots alone can move through the supply chain and mixed with other lots, thus forming new batches (Hosch & Blaha, 2017).

A *consignment* describes quantities of certified products also being referred to as a batch (ISCC, 2016). According to the ISSF (International Seafood Sustainability Foundation), the term is used for the shipment covered by a single transport document sent from the exporter to the buyer or consignee<sup>7</sup>.

## 4. ORGANIZATION AND IMPLEMENTATION OF TRACEABILITY IN THE FISH PROCESSING INDUSTRY

According to Council Regulation (EC) No. 1224/2009, all batches of fishery and aquaculture products must be traceable at all stages of production, processing and distribution, from catch or collection to retail, and all fishery and aquaculture products placed or likely to be placed on the market in the Community must be appropriately labeled to ensure the traceability of each batch. Lots of fishery and aquaculture products may be pooled or divided after the first sale only if they can be followed up to the catch or collection stage. Member States shall ensure that economic operators have systems and procedures in place to identify each economic operator who has supplied them with batches of fishery and aquaculture products as well as to whom those products have been supplied. This information shall be made available to the competent authorities upon request.

For all batches of fishery and aquaculture products, the minimum labeling and data requirements include:

- (a) the identification number of each batch;
- (b) the external identification number and name of the fishing vessel or the name of the aquaculture production unit;

---

<sup>7</sup> <https://iss-foundation.org/glossary/consignment/>

- (c) the FAO three-letter code for each species;
- (d) date of catch or date of production;
- (e) the quantities of each species, expressed in kilograms net weight or, where applicable, the number of individuals;
- (f) the name and address of the supplier;
- (g) consumer information provided for in Article 8 of Regulation (EC) No 1234/2007. 2065/2001: trade name, scientific name, relevant geographical area and method of production;
- (h) information on whether fishery products have been previously frozen.

The information referred to in points (g) and (h) must be available to consumers at the retail stage.

Annex II to Regulation (EC) No. 853/2004 lays down requirements for identification marks related to products of animal origin.

The identification mark must be affixed before the product leaves the facility. The mark must be legible and indelible and the letters on it need to be easy to understand. It must be placed so that it is clearly visible to the competent authority. The label must state the name of the country in which the object is located, whereby this name can be written in full or in the form of a two-letter code according to the appropriate ISO standard.

Depending on the way in which different products of animal origin are presented, the label may be affixed directly to the product/packaging, or may be printed on a label affixed to the product/packaging. The mark can also be in the form of a non-removable pendant made of resistant material. For products of animal origin placed in transport containers or large packages and intended for further handling, processing and packaging in another facility, the label may be affixed to the outer surface of the container or packaging. In the case of products of animal origin in the form of liquid, granules or powder transported in bulk, and fishery products transported in bulk, an identification mark is not required if the supporting documents contain the necessary information.



If products of animal origin are placed in packaging in which they will be offered directly to the end user, it is sufficient to place the label only on the outside of the packaging.

If the label is applied directly to products of animal origin, the colors used must be approved in accordance with Community rules relating to the use of colors in foodstuffs.

Regulation (EC) No. 1379/2013 prescribes mandatory data for informing consumers.

Fishery and aquaculture products placed on the market in the Union may be sold to the final consumer or wholesale supplier only if the appropriate markings indicate:

- (a) the trade name of the species and its scientific name;
- (b) the method of production, in particular by the words "... caught..." or "... caught in fresh water..." or "... farmed...";
- (c) the area where the product was caught or farmed and the category of fishing gear used in the fishery, as set out in the first column of Annex III of this Regulation;
- (d) whether the product has been thawed;
- (e) the date of minimum durability, as appropriate.

The requirement in point (d) shall not apply to:

- (a) ingredients present in the final product;
- (b) food for which freezing is a necessary technological step in the production process;
- (c) fishery and aquaculture products previously frozen for health safety purposes, in accordance with Annex III, Section VIII. Regulation (EC) No. 853/2004;
- (d) fishery and aquaculture products thawed before the process of smoking, salting, cooking, pickling, drying or a combination of any of these processes.

For non-prepacked fishery and aquaculture products, mandatory information is provided for retail via commercial information such as billboards or posters.

Where a mixed product offered for sale to the final consumer or wholesale supplier consists of the same type obtained by different production methods, the method for each batch shall be stated. Where a mixed product offered for sale to the final consumer or wholesale supplier consists of the same species but is obtained from catches from different fisheries or farmed in different countries, at least the area of the largest catch shall be indicated and the products shall come from different fisheries or different breeding areas.

In addition to the mandatory information required, the following information may be provided on a voluntary basis, provided that it is clearly and unambiguously stated:

- (a) the date of the catch of the fishery product or the catch of the aquaculture product;
- (b) the date of unloading of the fishery product or information on the port where the products were landed;
- (c) more detailed information on the type of fishing gear, as indicated in the second column of Annex III;
- (d) in the case of fishery products caught at sea, details of the flag State of the vessel that caught those products;
- (e) environmental data;
- (f) ethical or social information;
- (g) information on production techniques and methods;
- (h) information on the nutrients of the product.

A quick response code (QR) can be used to identify some or all of the product information.

Voluntary information will not be displayed on a label if it would take up space for mandatory information. No unverifiable voluntary data is included.

## 5. DESCRIPTION OF STEPS AND PLAN IN THE TRACEABILITY PROCEDURE OF CERTIFIED FISH PRODUCTS

Council Regulation (EC) No. 1224/2009 states that all batches of fishery products must be traceable at all stages of production, processing and distribution, from capture or collection to retail, which includes identification marks on cassettes or boxes during transport. Lots of fishery and aquaculture products may be pooled (or split) after the first sale only if they can be followed up to the catch or collection stage. The minimum required data is the identification number of each batch; external identification number and name of fishing vessel; FAO three-letter code for each species; date of catch; the quantity of each species, expressed in kilograms net weight or, where appropriate, the number of individuals; name and address of the supplier; consumer information provided for in Article 8 of Regulation (EC) No 2065/2001: trade name, scientific name, relevant geographical area and method of production and information on whether fishery products have been previously frozen.

**Ordinance on traceability records for fishery products and live bivalve molluscs** (Narodne novine No. 68/2018) implements European regulations.

All batches of fishery products from farming or catching must be traceable at all stages of production, processing and distribution, from catch or collection to retail, and traceability data must provide at least the information as prescribed:

- Article 3 of Commission Implementing Regulation (EC) No. 931/2011 of 19 September 2011, on traceability requirements set out in Regulation (EC) No. 178/2002 of the European Parliament and of the Council on food of animal origin;
- Article 35 of Regulation (EC) No. 1379/2013 of the European Parliament and of the Council of 11 December 2013, on the common organization of the markets in fishery and aquaculture products, amending Council Regulation (EC) No. 184/2006 and (EC) No. 1224/2009 and repealing Council Regulation (EC) No. 104/2000
- Article 58 (5) of Council Regulation (EC) No. 1224/2009 of 20 November 2009 establishing a Community control system to ensure compliance with the rules of the Common Fisheries Policy.

## 6. SEAFOOD TRACKING AND TRACEABILITY SOLUTIONS

### 6.1. BEST PRACTICES AND REGULATORY MECHANISMS

As the global seafood trade grows and the supply chains get more and more complex, it becomes increasingly difficult to track fishery products throughout the entire production. From their origin (place of catch) on the route to processing and delivering to the final consumer, fish products go from hands to hands of many actors, including fishers, wholesalers, retailers. In order to obtain relevant and reliable information about a product's characteristics at harvest level, robust systems are necessary. Such systems are represented by the **MCS** (Monitoring, Control and Surveillance Systems). Their enforcement in the fisheries management can be a principal element next to effective traceability, to deter illegal operations, such as aforementioned IUU-fishing (WWF, 2015).

**Monitoring** = measurement and analysis of information on the fishing activity

**Control** = terms and conditions under which resources can be harvested

**Surveillance** = regulate and supervise fishing activity (to adhere to regulations)

Robust MCS is dependent upon good coordination between flag States (jurisdiction under whose flag fishing vessel operates), coastal States and RFMOs (in whose water fishing occurs), port States (where fish is landed) and market States (where fish is processed or sold). These bodies should verify the accuracy of claims made by traceability systems, which consequently brings to fulfilling legal requirements and validate origin of wild-caught fishery products (WWF, 2015).

Other supply chain tools include chain risk analyses, certified chains of custody, DNA testing, radio-frequency identification, record-keeping documentation and other regulatory mechanisms.

The systems that are subjected to third-party certification, due to for example making sustainability claims for their products, need to be regularly oversighted and monitored. Certified products are often traced<sup>8</sup> through the supply chain by monitoring and tracking<sup>9</sup> chain of custody.

WWF (2015) states that many certification schemes do not collect enough data on catch and landings from the vessels where the seafood is caught, which brings to difficulty of verifying claims on sustainability issues. Thus, the WWF suggests meeting its traceability principles which can serve organizations as a benchmark in avoiding illegal and fraudulent activities and events from occurring:

***Traceability principles*** (WWF, 2015):

A. Essential information (collecting first landing information)

- Vessel identity and registration
- Vessel owner/operator identity
- Catch location (e.g. GPS coordinates)
- Authorization to fish (permits, licenses, etc.)
- Species/product name
- Fishing method used
- Fishing date and time
- Quantities of target/non target catch and discards
- Habitat impacts (if relevant) (e.g. bottom-trawl)
- Location, date, time and specifics of any at sea transfer
- Transformation of fish prior to landing (at-sea processing, co-mingling, segregation, aggregation etc.)
- Location, date, time of landing and volumes
- Person/enterprise with custody and ownership after transfer
- Other compliance data (catch documentation, monitoring techniques, employed practices...)

B. Full chain traceability

---

<sup>8</sup> Tracing (traceback) - the capability to identify the origin of a particular unit located within the supply chain by reference to records held upstream in the supply chain (Petersen & Green, 2007).

<sup>9</sup> Tracking (trace forward) - the capability to follow the path of a specified unit or batch of trade items downstream through the supply chain, as it moves between trading partners (Petersen & Green, 2007).

- Fishing activity information - should be readily accessible and transparent
- “in-fishery” traceability (for at-sea transfers and multiple fishing methods)

C. Effective tracking of product transformations

- fish product properties, lot codes, packaging dates
- minimum industry standards (e.g. ISO)

D. Digital information and standardized data formats

- electronic - recording of data, labelling and tracking (small-scale fishery product-tracking is challenging)
- end-to-end, interoperable traceability systems

E. Verification

- external verification mechanisms, independent audits, governmental oversight and enforcement, third-party verification

F. Transparency and public access to information

- maximum (possible) public accessibility to detailed information

## 6.2. TRACEABILITY TOOLS AND KEY-ENABLING TECHNOLOGIES

In order to improve and potentially transform current practices and policies in the seafood industry, especially regarding tracing products back to their source, new technological solutions have lately emerged. These can include a range of diverse methods and devices such as: DNA testing, boat hardware (GPS devices, video monitors), mobile phone applications and others (Fish 2.0, 2015). The application of various hardware solutions (e.g., bar code scanners, radio-frequency identification tags) has subsequently led to growing design of new electronic traceability software (Badia-Melisa et al. 2015).

With the development of traceability systems based on information technology, the costs of tracking are decreasing with an increase in information quality and usability. Although such systems are described as still *too costly* and demanding for the small business units in the fishing

industry, there are few of the solutions that can be implemented at lower costs and at the same time solve some of the challenges facing efficient traceability. These possible solutions are presented in the continuation.

**TRACES** - TRAdE Control and Expert System<sup>10</sup> is the European Commission's multilingual online management tool that ensures traceability, information exchange and risk management. It is used for tracking movements of animals (back and forth), products of animal origin and plants from both outside and within the European Union. The main aims include: improving relationship between the public and private sectors, strengthening cooperation between EU parties and trade facilitation, in order to enhance food safety and animal welfare.

**FollowFood Movement**<sup>11</sup> - Started in 2007, the company successfully implemented the tracking code system that focuses on sustainable, transparent and traceable food. The initial vision came from creation of the FollowFish, a brand for the frozen fish products tracing (Figure 2). There are now over 90 sustainable frozen, canned and fresh products as well as numerous ecological projects and activities. Through the system, customers are able to learn about the source and production of their chosen product (fishing area, producer information, transport route). Moreover, the company developed their own quality criteria for agricultural products over the years, that include: promotion of traditional varieties, banned use of additives, requirements for transparency beyond the law (with the mentioned tracking code), etc. In addition, the FollowFish applies their own stringent fisheries guidelines. Recently, they announced their work on a satellite-based tracking system, with a goal to equip the vessels of all of their fishing partners with a radar system that shows where their vessels have traveled<sup>12</sup>.

---

<sup>10</sup> [https://ec.europa.eu/food/animals/traces\\_en](https://ec.europa.eu/food/animals/traces_en)

<sup>11</sup> <https://followfood.de/>

<sup>12</sup> <https://followfood.de/magazin/beitrag/volle-transparenz-bis-zum-ursprung.html>



Figure 2. Packaging of tuna fillets with a visible tracking code and the follow fish logo  
(Photo: Nikola Matovic)



**TraSiPesc** - The artificial-intelligence (AI) based traceability systems in the fishery supply chains have been developing rapidly during the last decade. They have shown remarkable importance in terms of data record keeping for fish products along the production chain. Specifically, the information procured by the stakeholders from the upstream to the downstream level,

can be gathered and available on a platform with a given access on the entire distribution chain (Nicolae et al. 2017). In order to comply with the European requirements and increasing consumer's demands, the experts from Romania have developed a unique cloud-computing based traceability information system for fisheries<sup>13</sup>. The system is designed to track the traceability of fish products using Computing Cloud and matrix barcodes (or two-dimensional barcodes). The main objectives are said to be: *to improve the management of risks related to food safety and animal health issues, to guarantee products' authenticity and to give reliable information to customers, and, eventually, to improve the quality of the products.*



**BIG EYE Smart Fishing** - The novel blockchain technology seemingly has not bypassed the sector of seafood traceability. Also known as the Public Ledger Technology, it powers the End-to-end transparency through B2B Fish Procurement. Through the so called smart procurement, the buyers can now base their purchasing decisions on their suppliers' trust ability level, by being

<sup>13</sup> <https://www.msp-platform.eu/projects/trasipesc-cloud-computing-based-traceability-information-system-fishery>



automatically notified when they place the orders. That way, the AI works to ensure fraud-free information and supply chain transparency<sup>14</sup>.

**SeaTouch™** - Developed by Ridium Technologies<sup>15</sup>, this seafood software utilizes touch-screen applications that replaces paper-based traceability for a productive and low-cost technological solution. The processes such as purchasing, production, sales, inventory and accounting are automated and streamlined. The system is designed to include lot control and traceability functions, providing the ability *to track each item from receipt to sale*.

**PCAA** - One of the systems that allows the IT traceability of the fishery products was previously developed for the region of northern Adriatic as an objective of a past Interreg (Italy-Croatia) project called Adri.Fish<sup>16</sup>. One of its purposes was to implement coordinated and transnational initiatives for the qualification, promotion and marketing of fishery products, through the implementation of the traceability of the supply chain for certain fish products, together with the analysis and the elaboration of disciplinary acts, to achieve a unique quality mark for the fish products of the Upper Adriatic. The traceability of certified products is possible through an **online verification service**. If the consumer has purchased a PCAA product (Certified Product of the Upper Adriatic), it is possible to carry out a product traceability check by entering the batch number found on the label in a special field on the application website (Figure 3).



Figure 3. Screenshot of the PCAA product traceability research (Source: <http://www.jdd.it/trace/search.html>)

<sup>14</sup> <http://www.bitcliq.com/bigeye/#>

<sup>15</sup> <http://www.ridium.com/>

<sup>16</sup> <http://www.altoadriatico.com/altoadriatico.com/docbbab.html?iddoc=131&idarea=11>

## 7. QUALITY ASSURANCE SYSTEMS

ISO is the world's largest organization for the development and publication of standards. The International Organization for Standardization (ISO) is an international standard-setting body composed of representatives of various national standardization bodies and has 162 members, each representing one country. Founded in 1947, the organization issues industrial and commercial standards. Although ISO is defined as a non-governmental organization, its ability to enact norms that often-become laws, either through international treaties or through national norms, makes it more powerful than most non-governmental organizations. ISO certification is carried out by certification bodies and they issue a certificate.

### 7.1. ISO 9001 STANDARD - QUALITY MANAGEMENT

ISO 9000 describes the basics of a quality management system, and ISO 9001 additionally lists the requirements related to the regulations in force and aims to improve customer satisfaction. ISO 9001 requires document control, records control, internal audits, product and service compliance control, corrective measures and preventive actions. These procedures must be recorded in the quality manual.

### 7.2. ISO 22000 STANDARD - FOOD CHAIN MANAGEMENT

ISO 22000 refers to food safety in the food chain. A special chapter deals with food production and is based on the steps of the HACCP system and the Codex Alimentarius.

ISO 22000 is a standard based on a management system and contains the following elements: guidelines, planning, implementation, performance evaluation, improvement and management evaluation. Since ISO 22000 includes the principles of the HACCP system, every organization that is certified with ISO 22000 also has a satisfied HACCP system. ISO 22000 is designed specifically for food safety, while ISO 9001 refers to product quality and can be applied to any organization.

### 7.3. OTHER ISO CERTIFICATIONS

In addition to the two most important management systems, we can also mention ISO 14000, which is an international standard for environmental protection. ISO 14000 represents a set of standards that introduce an environmental management system to companies. Certification is performed according to ISO 14001: 2004. With the environmental management system, we

ensure that all environmental impacts in the company are identified, monitored and harmonized with legal regulations. Through various mechanisms over time, the negative effects are mitigated or completely eliminated.

International standards are important for the global market because they provide common definitions for products and processes, which makes it easier to meet customer expectations and needs. International food standards are being developed by two organizations - Codex and ISO.

The Codex publishes standards in a format that can be used to develop national laws and regulations and they are less frequently revised.

ISO develops standards according to market needs and they change and develop much faster.

#### 7.4. IFS FOOD (INTERNATIONAL FOOD STANDARD)

This is the German norm that is most accepted in the countries of northern Europe. It is applied in companies that package or process food, and serves to audit the quality and safety of food.

The IFS<sup>17</sup> has its own logo, and the certification review is conducted by independent companies.



Figure 4. IFS food logo (Source: <https://www.ifs-certification.com/index.php/en/standards/251-ifs-food-en>)

#### 7.5. OTHER FOOD SAFETY STANDARDS

**BRCS**<sup>18</sup>

---

<sup>17</sup> <https://www.ifs-certification.com/index.php/en/standards>

<sup>18</sup> <https://www.brcgs.com/brcgs/food-safety/>

This standard was formed by the British Retail Consortium (BRC) in 1996. It is used mostly in the UK and northern European countries, and is accepted by 70% of the world's supermarket chains.

### **FSSC 22000<sup>19</sup>**

The owner of the standard is the Danish Foundation FSSC 22000, and the standard deals with food safety and management systems. It is used mostly in the countries of northern Europe.

## **8. QUALITY STANDARDS AND LABELS WITH TRACEABILITY IMPLICATIONS**

The quality assurance procedures at different steps of the supply chain are established to optimize the use of information on characteristics of a product (or a raw material), its proper handling and storage and to improve the overall confidence among the chain actors. The issues surrounding supply chains, such as safety, quality and logistics management are addressed by the traceability and quality assurance, with regular auditing and inspection present to verify application of the vast range of national and international food safety and regulatory requirements.

There is an obvious difference between the obligatory quality standards set by the government of an EU country for import/export purposes in terms of legislations, and the standards of voluntary certification schemes set by private organizations and preferred by a certain customer group.

The food safety management systems, already mentioned in the first chapters of this report, are intended to ensure safety of raw materials and products along the supply chain. A newly confirmed ISO 22005:2007 standard for instance, describes principles and specifies the requirements for the traceability in the feed and food chain. It is worth noting that the distinctions between different quality management standards in terms of the main traceability requirements exist, and these are analyzed for the most prominent systems, i.e. ISO 22000, BRC

---

<sup>19</sup> <https://www.fssc22000.com/>

(British Retail Consortium) Global Standard and IFS (International Food Standard), in the Table 1 below.

Table 1. Comparison of the main food management standards (*modified from Rasmussen, 2012*)

<b>Standards</b>	<b>Main Requirements</b>
<b>ISO 22000</b>	The company shall establish and apply traceability systems that ensure the connection of product lots with the batches of raw material and accompanying records, and that shall be able to identify incoming material from the suppliers with its distribution route to the end consumer.
<b>BRC</b>	The company shall establish a system in place to trace and track all raw materials from the source to the end product. This also includes primary packaging materials.
<b>IFS</b>	The company shall have traceability systems to identify the relationship between product lots and batches of source material in all stages of processing. In addition, they shall trace primary and consumer unit packaging materials.

The requirements that encompass primary packaging materials are set forth by the BRC and IFS, while they are not mentioned by the ISO 22000. Furthermore, the IFS includes tracing consumer unit packaging in case it is not used as the primary packaging material (Rasmussen, 2012). Together with some other requests (eg. storing samples of raw material; fulfilling legal requirements in regard to records, required regular testing of the traceability systems etc.), IFS apparently has the most stringent requirements with regards to traceability (Rasmussen, 2012).

Tracing products and processing operations through the production chain is required for complying with the quality assurance, and risk assessments may span from the origin of raw materials to processing history and product distribution (Frederiksen & Gram, 2003). Majority of food processing companies already have internal record-keeping systems in place, which are known to be required for implementation of the HACCP based quality assurance system. This mostly relates to safety grading – maintaining the system under control, undertaking corrective actions for exceeding critical limits and revoking unsafe products (Caporale et al., 2001). But

within the external or chain traceability, attached information on quality of the products is transferred among chain actors, which can remarkably facilitate the effort and inspection of the incoming products.

Fully implemented traceability system that goes beyond the product safety covers a broader spectrum of aspects. For example, there are special quality schemes linked to geographical origin of the specific products and traditional know-how, aimed at showcasing their unique characteristics. The geographical indication (GI) distinguishes these quality products from the others, enabling consumers' trust and also creating better market opportunities for the producers.

## 8.1 ITALIAN PRODUCT QUALITY LABELS

In Italy, local products can carry different quality labels complying with specific requirements, such as: protected designation of origin (PDO), protected geographical indication (PGI), organic farming label (BIO) etc.<sup>20</sup> They either represent labels at national or at European level.

In some regions (e.g. Tuscany), aquaculture and capture fisheries companies have successfully adopted a number of private labels in addition to regional brands, for a range of quality perspectives, like: organoleptic quality, nutritional aspects, environmental impact, origin, market potential, to name a few. These enterprises are supplying big customers (i.e., retailers) with labels and brands covered by local, regional or international quality-labelling schemes. For example, the sustainable production in the region that values and supports traditional small-scale practices and use of native and local resources has been branded by the Slow Food Presidia foundation<sup>21</sup>. This label does not only represent a good marketing tool, but a tangible benchmark that connects different actors of the supply chain, from primary producers, NGO representatives to the retailers (Prosperi et al. 2020).

---

<sup>20</sup> See more: <http://www.parks.it/prodotti.tipici/Emarchiquailita.php>

<sup>21</sup> <https://www.fondazioneSlowFood.com/en/what-we-do/slow-food-presidia/italian-presidia/>

The already existing Italian agri-food schemes in the regions of the PRIZEFISH program area, that could potentially be used for controlling and tracing certified Adriatic fishery products' quality are the following two:



The Region Emilia-Romagna has registered **Controlled Quality Mark** or **QC** (*Marchio Qualità Controllata*). It serves as a collective enhancement trademark, so far intended to be used by the farms that decide to produce according to the integrated production regulations, respectful of human health and the environment<sup>22</sup>. It can be granted to companies working at production, processing and marketing level, that commit to respecting specific production regulations able to guarantee the quality of the product from sourcing to final consumption, along the entire supply chain. The control system is entrusted to accredited bodies that have the task of verifying the correct application of the specifications. To obtain the trademark concession, companies apply to the Region, using specific forms.



The Region Marche has recently approved a new version of the “Quality Specification” (*Disciplinare di Qualità*) for fisheries products, as a result of a cooperation between this region and the ASSAM (Agency for Agrofood Sector Services), and the collaboration with other institutions. The released version of the label **Marche Guaranteed Quality** or **QM** (*Qualità Garantita dalle Marche*) now includes fish products<sup>23</sup>. This is a collective quality label of the Marche Region certifying the compliance with the regional products specifications and technical regulations, aimed at guaranteeing customers the authenticity of the product caught and consumed. Particular attention is paid to the valorization of artisanal fisheries that play a significant role for the maritime communities, from a cultural and social point of view.

<sup>22</sup> <https://agricoltura.regione.emilia-romagna.it/dop-igp/temi/marchio-qc/marchio-qc>

<sup>23</sup> <http://www.qm.marche.it/>

## 8.2. CROATIAN PRODUCT QUALITY LABELS AND CERTIFICATION AGENCIES

### 8.2.1. Croatian certification agencies

**The Croatian Standards Institute (HZN)** is an independent and non-profit public institution established as a national standardization body of the Republic of Croatia in order to, among other things, increase product and process safety, protect human health and life and protect the environment, promote product, process and service quality, and all for the purpose of removing technical barriers to international trade. The Croatian Standards Institution is a member of the International Organization for Standardization (ISO) and the European Committee for Standardization (CEN) (*Source: <https://www.hzn.hr/>*).

**The Croatian Accreditation Agency** performs the tasks of the national accreditation service in the Republic of Croatia. It was established to implement Croatian technical legislation that is in line with the *acquis communautaire*. Technical regulations regulate product safety and freedom of movement in the internal market, protection of citizens' health, consumer protection, environmental protection and other areas of public interest. (*Source: <https://akreditacija.hr/>*).

### 8.2.2. Geographical indications and origin labels

A geographical indication is the name of a geographical area or other sign indicating that a product or service originates in a particular geographical area and possesses a certain quality and characteristics attributed to that origin.

The designation of origin is a more specific form of protection and necessarily implies the essential or exclusive influence of special natural and human factors of a certain geographical environment and the resulting special quality and properties of products or services. Labels of origin generally require that the production, preparation and processing of products and services take place entirely in the specified area. The designation of origin may, in addition to the names of geographical areas or signs indicating that a product or service originates in a particular geographical area, protect traditional geographical and non-geographical names used to designate products or services originating in a region or place, provided that they comply with conditions.



Geographical indications and designations of origin are protected as intellectual property in order to prevent their misuse or unauthorized use, as they contribute to a higher market value of products and services corresponding to their specific characteristics and the reputation thus acquired. An effective system of protection of these labels benefits both consumers and the general public, by promoting fair competition and good business practices. The protection of these labels also helps economic development, especially in rural areas, by retaining the working age population and encouraging family farms in these areas, and by preserving and developing specific or traditional production and services. The protection of a geographical indication as intellectual property is achieved by carrying out the appropriate registration procedure for the designation carried out by that competent authority. Once registered, a geographical indication or designation of origin may be shared by all producers in the designated area who meet the prescribed conditions. As a rule, the registration of the user of the mark with the appropriate competent authority is also required.

On products, a geographical indication or a designation of origin is often used next to the manufacturer's mark or logo (which may be protected by a trademark), in order to emphasize both the individual character and the common feature of the product's affiliation<sup>24</sup>.

The protection of a geographical indication as intellectual property is achieved by carrying out the appropriate registration procedure for the designation carried out by that competent authority. In addition to defining the geographical area to which it relates, the application for registration must specify in detail the particular quality and characteristics deriving from the indicated origin.

The protection of geographical indications of origin and designations of origin in Croatia is prescribed by the Act on Geographical Indications and Indications of Origin of Products and Services, and the Act on Designations of Origin, Geographical Indications and Traditional Reputation of Agricultural and Food Products.

Procedures for the protection of geographical indications of origin and designations of origin for agricultural and food products (food), wines and spirits are carried out by the Ministry of Agriculture in accordance with the Law on Designations of Origin, Geographical Indications and

---

<sup>24</sup> <http://www.dziv.hr/hr/intelektualno-vlasnistvo/oznake/zemljopisnog-podrijetla-i-izvornosti/>

Traditional Reputation of Agricultural and Food Products and the Wine Act appropriate implementing regulations.

For other products and services, the procedure in accordance with the Law on Geographical Indications and Indications of Origin of Products and Services and the Ordinance on Geographical Indications and Indications of Origin of Products and Services is carried out by the **State Intellectual Property Office**<sup>25</sup>.

### **8.2.3. Branding and indication of origin**

Joint branding where several companies use the same logo is based on the promotion of quality that relies on strict control of production, the specificity of the technique or breeding area and geographical origin.

A trademark is an exclusive right recognized as a mark used to distinguish the products and/or services of one (or more) persons from other persons in commercial transactions.

The name, logo, emblem, label or other distinctive features of your product and/or service may be protected by a trademark.

In most countries, a trademark is acquired by registration on the basis of a test performed by the appropriate competent authority, and in the Republic of Croatia it is the State Intellectual Property Office.

The basic conditions that a sign must meet in order to become a trademark are that it is different and that it is not similar to an earlier trademark.

The trademark guarantees the owner the exclusive right to place on the market the products and/or services marked by him.

Trademark protection is an effective market tool by which manufacturers and service providers protect the funds they have invested in the promotion and marketing of their products and/or services. The protection of the very creation of a sign, logo or label may be a copyright work that is protected as copyright, thus protecting the interest of the author or creator.

---

<sup>25</sup> <http://www.dziv.hr/hr>

Trademark protection in Croatia, as in many countries, is valid for 10 years from the date of application. The term of protection may be extended indefinitely for periods of 10 years, with the timely submission of applications (usually before the expiry of the previous 10 years) and the payment of appropriate fees and reimbursements.

### **Food label of Croatian farms HPA**

In 2017, the **HPA** (Croatian Agricultural Agency) launched the labeling of Croatian farm products with signs. Six signs were designed: meat of Croatian farms, milk of Croatian farms, eggs of Croatian farms, honey of Croatian beehives, bread of Croatian farms and flour of Croatian fields.

The marks are registered with the State Intellectual Property Office of the Republic of Croatia as a guarantee mark. The holder of the right to a guarantee stamp is the Croatian Agricultural Agency.

The mark can be used for 2 years by signing a contract with the HPA with the submission of a report on production and sold quantities of products.



Figure 5. Sign Meat of Croatian farms, honey of Croatian beehives and bread of Croatian fields (Source: <http://hrana-hrvatskih-farmi.hpa.hr>)

### **Signs of Croatian Chamber of Commerce CCC quality**

Quality marks CCC “Croatian Quality” / “Croatian Quality” and “Originally Croatian” / “Croatian Creation” are the intellectual property of the Croatian Chamber of Commerce, registered with the State Intellectual Property Office, and the registration includes 43 classes of the international classification of products and services) and their protection in Croatian and English.

CCC quality marks are also protected on the European market in accordance with the Madrid Agreement and the protocol of the World Intellectual Property Organization (WIPO).



Figure 6. Labels Croatian quality (Hrvatska kvaliteta) i Originally Croatian (Izvorno hrvatsko) (Source: <https://znakovi.hgk.hr/o-znakovima/>)

The Croatian Quality Label is worn by products that are produced or services provided on the territory of the Republic of Croatia, and meet a higher level of quality than that established by the legislative framework and normative criteria for the type and category of products. The mark is a recognition of the Croatian manufacturer/service provider as well as the product/service, and at the same time it is a guarantee to the consumer that it is a product/service that meets the highest level of quality and represents the top quality in the world.

The Original Croatian logo is worn by high-quality products and services of the Republic of Croatia that were created as a result of research and development work, invention, innovation or a long tradition.

### **Project “Riba Hrvatske – Jedi što vrijedi”**

The project was initiated by the Ministry of Agriculture, Fisheries and Rural Development in 2011, by a decision of the Government of the Republic of Croatia in cooperation with the Croatian Chamber of Commerce and the Croatian Chamber of Trades and Crafts. In 2017, the project was restarted by the Croatian Chamber of Commerce, recognizing the needs of the sector and its members from the Fisheries Association of the Croatian Chamber of Commerce.

The project "Fish of Croatia - Eat what is worthwhile" was launched for the purpose of promoting fishery products of the Republic of Croatia, which includes products from catch, breeding and processing. The aim of the project is to contribute to increasing the consumption of local fishery

products, to achieve their appropriate evaluation, and to build/raise the culture of fish consumption in the Republic of Croatia.

The sign "Fish of Croatia - Eat what is worthwhile" testifies to consumers that the product it carries comes from a strictly controlled food safety system, that care is taken in production and a lot is invested in strict environmental conditions, that workers' rights and all other positive EU regulations are respected, and that such production provides local employment opportunities, especially in rural areas.

The project is funded by the European Maritime and Fisheries Fund, and is similar in content to similar projects launched by the European Commission: "Enjoy, it's from Europe!", MedFish4Ever Inseparable and Farmed in the EU, Italy Eataly.

The label can be obtained by fish producers, so for example the Fishermen's Cooperative Adria received the Croatian Fish label<sup>26</sup>.

#### **8.2.4. Possibilities of co-financing certificates**

In Croatia, currently Measure IV.3 "Placing on the market of fishery and aquaculture products" for the period 2017-2020 may be co-financed under certain circumstances. The aid beneficiary is a fisheries entity or a joint beneficiary.

##### Article 4

(1) Eligible activities must contribute to at least one of the following objectives:

b) promoting quality and added value either by registering products and adapting economic operators to the relevant compliance and certification requirements in accordance with Regulation (EU) No 182/2011. Regulation (EU) No 1151/2012 of the European Parliament and of the Council of 21 November 2012 on quality systems for agricultural products and foodstuffs (OJ L343, 14.2.2012)

The certification activities for sustainable fisheries and aquaculture products are eligible under the objective of promoting quality and added value referred to in Article 4 (1) (b) of the Ordinance

---

<sup>26</sup> <https://www.rzadria-tribunj.hr/hr/novosti/znak-riba-hrvatske>

(Article 68 (1) (c) (ii) of Regulation (EU) No 182/2011). 508/2014 on the European Maritime and Fisheries Fund).

Regulation (EU) no. 508/2014 - Article 68

Measures related to placing on the market

1. The ERDF may support measures relating to the placing on the market of fishery and aquaculture products aimed at:

(c) promoting quality and added value by facilitating:

ii. certification and promotion of sustainable fisheries and aquaculture products, including small-scale coastal fishing products and environmentally friendly processing methods;

## 9. CHAIN OF CUSTODY CERTIFICATION

### 9.1. CHAIN OF CUSTODY - TERMS, CONCEPTS, EXAMPLES

During each step of the supply chain, there is a possession or control over materials (products) that is passed from one custodian to the other (ISEAL, 2016). Documenting *chain of custody* means listing all actors that have ownership and control of the material supply (both physically and administratively) during its production, distribution, selling. Moreover, it refers to a connection between certain claims about raw materials and final products (ISCC, 2016).

On the other hand, *CoC certification* aims to provide a verification of issued certificates for chain of custody or traceability in the supply chain. Chain of custody is a key element of a certification scheme, as it links the products sold as certified in the market with practices from a certified site (Wingate & McFarlane, 2005). Besides preventing false claims and providing truthfulness, it is an important factor in addressing illegal and controversial activities in the sector.

The FAO (2009) defined the chain of custody in fishery supply chains as *the set of measures designed to guarantee that the seafood product put on the market and bearing the ecolabel seal is really a product of designated origin and coming from the certified fishery concerned*. Furthermore, those measures subsequently cover both the traceability of the product all along

the chain, as well as the documentation tracking and quantity control (IFFO RS, 2013). Another definition concerning certified fisheries is given by Albert (2010) and states that the chain of custody *assessment* verifies whether adequate measures are in place to identify fish from a certified fishery at all stages of the supply chain, i.e., during processing, distribution and marketing.

The whole CoC *system* consist from the set of documentation and measures used to verify the claims from the unit of production to the final product (ISEAL, 2016). The system most often requires a standard mechanism for monitoring and associated online reporting system. There are three main principles which make an effective CoC system: identification, segregation and documentation (Dykstra et al. 2003).

According to ISEAL (2016) the system functions include:

- Identifying origin of final product or its components
- Ensuring recorded sequence of custody
- Ensuring confirmation of volumes of certified inputs and outputs
- Linking product sustainability claims at the end of the chain with practices at any certain stage
- Monitoring and ensuring the integrity of claims and of entities, respectively
- Increasing transparency throughout the supply chain
- Compiling life cycle analysis (LCA) data along the supply chain
- Improving the connection between the standard-setter and the members of the supply chain
- Allowing third party to back up implementation of the best practices

The CoC *standard* is the key element of the chain of custody system because it sets the criteria for the operators, which they need to fulfill in order to make certain claims about the product they want to offer. The requirements set by the standard should be in place if the claims pertain to the eco-labelled products originating from a sustainable source (Wingate & McFarlane, 2005).

For making sustainability claims, the data should be monitored and verified to comply with a sustainability standard, in order for a product to get certified against it. The standard itself can be composed of the set of component standards, covering different issues. To become certified against the CoC standard, the applicants need to comply with its requirements, through an

independent assessment, carried out by approved and competent *certification body*<sup>27</sup>. It is important to know that a certification body needs to be accredited to ISO 17065 by an Accreditation Body who is a member of the International Accreditation Forum (Alaska-RFM, 2012).

In the following section, the MSC Chain of Custody Standard will be presented as a good practice example of the principles that should be implemented in the CoC standard to control and record certified product movement throughout the supply chain.

## 9.2. MSC CHAIN OF CUSTODY

The CoC Standard ensures identification and segregation of the final products at each step of the chain, and those products need to be traced back to the certified source. This is a necessary approach to cover all steps from the time of harvest to the time of the final sale to the consumer (Willmann et al. 2008).

MSC has three types of standard options, according to the nature of the applicant - the Standard Default version and two variants: Consumer-facing Organization (CFO) Standard and CoC Group Version Standard. The CFO Standard applies to any organization (e.g., retail, foodservice, caterer) that sells or serves products to the final consumer. Organizations that are certified against the MSC CoC standard are subjected to periodic surveillance audits by a third-party accredited certification body (MSC, 2019a).

The CoC standard is consisted of five key principles for achieving certification (Marine Stewardship Council, 2019b):

### 1. Certified supply - both product and supplier need to be certified

There has to be a process in place to ensure that all certified products come from certified suppliers (fisheries). If a company buys a product from another supplier or directly from a fishery, it needs to present a proof of valid CoC certification. Documentation accompanying certified product (invoices, bill of lading etc.), has to explicitly state identification of certified status. The certified products that are identified using an internal system (e.g., barcodes), need to be

---

<sup>27</sup> A certification body is an independent and recognized body that conducts certification and oversees certification activities (Based on ISO Guide 2, 15.2; Willmann et al. 2008).



recognized as such by the receiving organization. At the time of initial certification, those products that are in stock have to be segregated, identifiable and traced back to certified suppliers.

## **2. Identifiability - products have to be clearly identifiable as certified at all stages of the supply chain, both physically as well as in traceability documentation**

This can be a sign or a label on the package, container etc. The internal system of identification needs to accompany certified products all the way from purchasing and receiving to storing, packing and selling. When an invoice is given, the certified product shall be identified on the line item using a product or CoC code (or just the acronym “MSC”). This requirement is not necessary in case of sales invoices to the final consumer.

The system has to be in place to ensure that only the certified products are identified as such, on menus, labels, food counters and similar. It is important that the certified products are not mislabelled by species name (scientific or common name) and catch area or origin (if specified).

## **3. Segregation - certified products have to be separated from non-certified products**

These products shall not be mixed together, except in the case when: non-certified seafood is used as an ingredient in a certified product. In that case the company has to follow the non-MSA seafood ingredients rule (5% non-certified seafood in the total seafood content; MSC, 2018).

If a company sells products that are certified against different certification schemes that share the chain of custody standard (e.g., ASC<sup>28</sup>) - those products cannot be mixed unless the organization has a permission from the Marine Stewardship Council International Ltd. They can be co-labelled, i.e., products can include both labels on the package, and thus contain different ingredients from different certification schemes.

## **4. Traceability - all certified products can be tracked “from ocean to plate” and volumes are recorded**

The companies are expected to trace back any product or batch from the sales or customers serving using a sales invoice. Also, any certified product should be tracked forward from point of

---

<sup>28</sup> Aquaculture Stewardship Council, see: <https://www.asc-aqua.org/>

purchase to the point of final serving or sale (even if in the end it is not sold as a certified product). Traceability records shall be complete and accurate and able to link certified products at all stages between purchase and sale to dispatch and/or serving. They also need to allow volume calculation of certified products.

Sites selling products that are served or sold to the final consumer have to maintain all records of volumes received and purchased. The records need to allow conversion rates<sup>29</sup> for the outputs if products have been repacked or processed at any given time. This can help prevent misuse and mislabelling of non-certified products.

#### 5. Management system - effective management based upon good practice that addresses Standard's requirements

The management system should include written documentation for procedures and policies, to the extent dependent upon the size of the company, the type of activities etc.

The responsible staff from the organization should be trained and competent to ensure conformity with the requirements of the CoC standard.

Records demonstrating conformity with this Standard (e.g., purchase, production or sale records) should be kept for a minimum of 3 years (or more if the product's shelf life exceeds those 3 years), in hard copy or digital format.

The organization is responsible for informing the assessment body of any changes regarding certified products and related supply. It should also ask for approval in certain situations, like for including new activities that are out of the scope of certification.

If an organization uses subcontractors, they need to comply with the requirements of the Standard for handling certified products. An agreement will be signed between the organization and the subcontractor, to make sure that the latter will have traceability systems in place and will allow access to its premises and records upon request of assessment bodies or the MSC. In addition, the organization will not use vessels engaged in IUU-fishing activity, or listed on RFMO blacklists.

---

<sup>29</sup> Conversion rate is a factor describing the change in quantity of a material that occurs at the processing site (ISCC, 2016).

The organization should have a process in place for managing non-conforming product<sup>30</sup>, including ceasing sale of any non-conforming product as a certified, notifying assessment body and customers (excluding final customers) and implementing measures to prevent future non-conforming scenarios. To assure conformity and authentication of certified products, the MSC or CAB (Conformity Assessment Body) should be allowed by the company to take samples from its sites, for identification of origin, catch area or species.

It is also important to highlight that only fisheries and fishery client groups undergoing assessment can purchase under-assessment product<sup>31</sup>, which needs to be clearly identified and segregated from other products. Until the fishery is certified, this product cannot bear the MSC label.

Concerning forced and child labor, an on-site labor audit needs to be completed with which the company agrees by signing the CoC Certificate Holder Statement of Understanding of Labor Requirements. Recognized third-party labor programs include: Consumer Goods Forum's Sustainable Supply Chain Initiative (SSCI) social standard, SEDEX Members' Ethical Trade Audit, among others. They are audit programs globally recognized and commonly used in the seafood industry (MSC, 2019). The organizations that are exempted from this requirement are the ones scoring as "*Lower Risk* for forced and child labor violations" according to the Country Labor Risk Scoring Tool. At their first audit control, companies do not need to complete a labor audit. Instead, they will sign a statement that they agree to complete it by their next audit. This means that the companies will have around 12 months from the date of their first audit against the new CoC Standard to complete the labor audit (MSC, 2019).

## 6. Additional requirements for Group CoC

The following requirements are applied only to the CoC Group Standard:

- Group control: the central office<sup>32</sup> ensures that all the sites on the group certificate conform with the Standard and abide by decisions made by the central office.

---

<sup>30</sup> Non-conforming product relates to any product that is identified as certified or labelled, but cannot be proven to come from a certified source (Marine Stewardship Council, 2019a).

<sup>31</sup> Under-assessment product refers to fish products harvested during the assessment process, but before the fishery is certified (Marine Stewardship Council, 2019b).

<sup>32</sup> The central office is the organization, legal entity or other function that will manage the group certificate (MSC, 2019a).

- Site register and adding sites: the central office maintains a register of all sites on the group certificate, and any new sites have to conform with the Standard.
- Use of the MSC label and other trademarks: all sites have license agreements covering the use of the MSC trademarks.
- Internal audits: on-site internal audits for each site (not required for handling products in sealed containers). Later, after initial certification, the organization should conduct annual audits of certified sites, except for sites handling only certified seafood.
- Internal group reviews: the sites should review records annually that show total volumes of certified product purchased and sold for all sites on the group certificate (excluding those sold to final consumer - only product purchases). An organization completes the internal group review to confirm that all sites conform with the requirements of the Standard.

### 9.3. AUDITING

At each step of the chain a company may undergo an *audit*. The audits represent a systematic and independent documentation process for evaluation of the extent to which the client meets the relevant standard (MSC, 2019b). Audit requirements often look at the records, input and output volumes, quantity bookkeeping and traceability documentation that need to be updated, complete and readily accessible upon request (ISCC, 2016). In certain cases, where there are sustainability claims, they also look at social and environmental issues.

The supporting assurance system, such as auditing, needs meticulous and detailed documentation of material flow, in order to be successful and to provide enough evidence of compliance with all relevant legal and other requirements.

Conducting internal audits is an important process to cover all the standard requirements and to potentially prevent the occurrence of corrective measures. This type of audit is usually conducted once a year and results in a periodical reporting, making sure that the outgoing certified material does not exceed the amount of incoming certified content. It normally includes on-site inspection, control of documents and staff interviews (FAO, 2010).

In the chain of custody process, company audits are useful for providing insight into a company's operations (Lewis & Boyle, 2017), which becomes important when assessing compliance with sustainability or certification claims. General audit requirements proposed by ISCC (2016) name

the following records for the entering and exiting certified materials: list and contracts of all suppliers and recipients of the certified products, sustainability declarations, mass balance calculation (or quantity bookkeeping) and other sustainability-related data. If a company uses more than one sustainability certification scheme, the names and scopes of those schemes need to be provided with aforementioned relevant CoC information.

For companies certified by the FOS and MSC schemes, CoC certification and corresponding audits are not necessary **only** in cases of handling, distributing and storing *tamper-proof* consumer-ready products (MSC, 2019a; FOS, 2020). These are the products that are sealed, packed and sold in the same form to final consumer (eg. can of tuna) (MSC, 2019a).

There are opinions that the system requirements for auditing CoC in certain industries are not well adapted for detecting fraud or errors in terms of volumes that are sold as certified<sup>33</sup>. Specifically, it concerns to intentions of some companies to sell volumes of certified products that exceed volumes of the certified material that they bought. For this reason, the Forest Stewardship Council (FSC)<sup>34</sup> had launched the Online Claims Platform (OCP) initiative, for buyers to report traded volumes of products so that the suppliers can check and confirm these claims online. The system expansion increases fraud potential and more robust solutions are needed to insure higher levels of supply chain integrity.

#### 9.4. COC MODELS

As the ISEAL (2016) simply puts it - traceability is the ability to demonstrate the chain of custody, and tracing information can be achieved by implementing different CoC models. Those are the approaches used for establishing the link *between the verified unit of production and the claim about the final product*.

Different industries and companies have different requirements regarding CoC standards in their schemes, so the models may show variations even if they are under the same name. The choice of the model use will depend on product type, traceability needs, industrial specificities and

---

<sup>33</sup> <https://www.nepcon.org/newsroom/chain-custody-certification-myth>

<sup>34</sup> <https://fsc.org/en>

legislative requirements. The models are fluid, which means that there can be more than one model in use throughout the complex supply chains.

In the following section we will present the standards for sustainability and chain of custody models from the global membership association for credible sustainability standards - ISEAL Alliance. Different CoC models presented here can provide a basis reference for future development of the ARF's chain of custody standard. Thus, after each model description there is a brief discussion about advantages and disadvantages of their use.

Let us take a look at ISEAL (2016) Chain of custody models (complementing ISEAL's Sustainability Claims Good Practice Guide):

- **Product segregation** - follows product through each part of the supply chain to know that this product actually came from the certified source

This model only permits mixing of the certified products if the standards against which they are certified are the same (i.e. equivalent). This physical mixing needs to be followed up by the associated documentation which specifies information on origin.

Segregation or *separation* can be temporal (by time), spatial (in terms of storage or production separation) or by permanent identification (Wingate & McFarlane, 2005). This model can support claims that 100% of the product material came from certified sources.

**Pros:** It allows physical mixing of combined volumes from several certified sources (which recognize equivalence). The information about individual volumes remains available in the traceability system of the chain.

**Cons:** It does not allow mixing of non-certified with certified material, which in some cases can become unavoidable.

- **Identity preservation** - does not allow physical mixing of the certified material with non-certified material

The identity preservation model is the strictest one and states that all batches or lots of certified physical products with associated documentation are treated separately from other sources

(certified and non-certified products/materials). This means that materials flow through the supply chain physically separated from other materials.

**Pros:** If a company uses this model throughout the entire production and distribution process, it can successfully trace a certified product from a production site to the final point (use of certain claim).

**Cons:** It does not allow any mixing of certified sources with other materials.

- **Mass balance** - certified and non-certified products can be physically mixed, but volumes leaving the operations need to have a claim of percentage of certified ingredients

This model is based on the system which balances percentage or volume mass from input to output. This means that the percentage of a certified material that enters the system should exit the operations as an equivalent in the final product. Volumes sold and bought within one year must match, with consideration of the conversion rate (e.g., 1 kg of raw fresh fish caught will not necessarily translate into 1 kg of final certified product).

It is important to emphasize that physical mixing can be absent from the supply chain. Secondly, related documentation associated with the product's claim of sustainability can get disassociated from the physical product. These instances concern the balance of volumes at three different levels: **batch**, **site** and **group** level.

#### Batch-level mass balance (batch blending)

The sub model where the segregation persists until the final point of mixing ingredients for a product containing both certified and non-certified components. Claims are allowed to be made for proportion of certified end-product, if the mixing is strictly monitored and recorded. There are two options for the end-use claim: either the proportion alone declares a claim of "fully certified", or a product bears a claim of percentage of the certified content, separating it from unlabelled (non-certified) content.

#### Site-level mass balance (controlled blending)

The segregation is maintained until the point of processing, where certified product can be mixed with non-certified product if the proportions are recorded. The difference from the other sub

models is that although the proportion entering and leaving the system is known, final content proportion may not be known. This sub model follows the reconciliation period (i.e. *trade-conversion-trade cycle*) within which 100% of the content volume for labelled products must be delivered to the factory if a certification claim is to be made.

#### Group-level mass balance (multi-site)

This sub model corresponds to multi-site organizations or just any group with more than one site for volume tracking. Here, the physical mixing of the certified and non-certified products is allowed at any stage with mandatory related documentation recording. If a certain quantity of certified content enters the system as "certified", the same amount should leave the group site and be sold as such. For example, if only a portion of certified content is used in the making of goods at multiple sites, with irregular mixing of the certified and non-certified sourced components, all sites will have the end-use claim of the percentage of product sourced from certified sources.

**Pros:** Any physical product can carry sustainability claims, as long as the volumes leaving the system are appropriately balanced and controlled.

**Cons:** It can result in the non-certified products unintentionally receiving a certification label. In addition, materials or products from certified sources might not be labelled as such and they can even lose their individual properties.

#### - **Certificate trading** (*book & claim*)

This model is characteristic for completely detaching sustainability claim documentation from the physical certified product. Here, a company receives sustainability certificate (credit) from an independent issuing body, for the volume of certified content that goes into the supply chain. From there the material flows freely through the chain along with non-certified material.

It should be noted that the sustainable certificates are bought through an online credit trading platform, and are used by many trading companies which might not be able to meet their sustainability targets in other ways. Claims can only use the words *supporting certification*, to describe the end-product.



**Pros:** Rewards enterprises for responsible production in the complex chains and allows sustainability claims to be detached from the certified products.

**Cons:** This is not a real model for controlling the volumes of certified material through the chain, as it lacks physical traceability and the end-product might not be certified. There is no link between the actual material flow and sustainability claims.

## 10. LIST OF RECOMMENDATIONS

- Internationally accepted and recognized CoC standards should comply with the ISEAL's rigorous codes.
- The potential ARF's CoC certification should include all organizational structures, namely single, multi-site (e.g., organizations that include wholesalers with more than one warehouse or a restaurant chain) and group organizations.
- The choice of the appropriate CoC models is dependent upon the nature and the characteristics of the particular supply chain, i.e., its complexity, magnitude, structure, to name a few.
- If batches or lots with different sustainability characteristics are physically mixed at some point in the chain, they should be kept separated in the quantity bookkeeping.
- When the materials are processed or the losses of material occur in the facilities, the conversion rates should be used for the correction of the batch size.
- High risks associated with the long and complex supply chains include: uncertified volumes sold as certified, accompanying documentation fraud and duplication, incorrect mass balance etc. (Van Dam & Ugarte, 2020). In order to avoid these risks, suggested preventative measures and mitigation should be: improving the accessibility and completeness of information at origin, using traceability tools and improving overall quality of supply chain management.
- To assist companies and organizations to implement and develop their sustainable seafood policies and standards, the Conservation Alliance for Seafood Solutions provided the guidance through its *Common Vision for Environmentally Sustainable Seafood*. The simple guidelines of this initiative can help PRIZEFISH partners in facilitation of their sustainable practices. They are summarized and listed in the Annex 1 of this report.

## 11 CONCLUDING REMARKS

Compliance with the voluntary norms and standards can be verified by means of certification systems. Certification of chain of custody and associated traceability enables organizations to improve their international credibility and access global markets. It also builds trust and confidence among their customers. Ultimately, CoC certification provides assurance that the sustainably sourced product conforms to the demands of the certification scheme.

Combining traceability with chain of custody methods can ensure that the material flow through the supply chain remains traced back and forth, resulting in supported sustainability claims. All the elements in the supply chain should comply with the sustainability criteria, but this has to be closely aligned with actions such as monitoring, control and surveillance, which require adequate traceability and chain of custody measures and cooperation between different actors.

Chain of custody systems need to be more transparent and effective enough to retain consumers' confidence and credibility, where CoC certification plays a major role. Naturally, over time, certification schemes will expand, resulting in higher occurrence of various types of risk for the chain of custody systems. Thus, it is crucial to be prepared for the constant evolvement of these systems providing more assurance and reducing possibility of fraudulent events.

Constant link should be maintained between improving CoC sustainability standards and providing customers with awareness and guarantees of the new practices (Crona et al. 2016). This will not only allow good publicity strategy and popular support, but will also influence better and stronger fisheries policies and pave the path to large-scale sustainability commitments in fisheries sector.

## 12. REFERENCES

1. Alaska-RFM. (2012). Chain of Custody Standard. *Medico-Legal Bulletin*, 39(2), 7.  
Retrieved from:  
[https://www.scsglobalservices.com/files/program\\_documents/rfm\\_std\\_chain\\_of\\_custody\\_standard\\_coc\\_v2.4\\_nov2014.pdf](https://www.scsglobalservices.com/files/program_documents/rfm_std_chain_of_custody_standard_coc_v2.4_nov2014.pdf)
2. Albert, J. (2010). Innovations in food labelling. The Food and Agriculture Organization of the United Nations and Woodhead Publishing Limited. CRC Press.

3. Badia-Melisa P, Mishrab L, Ruiz-Garcia R. (2015). Food traceability: new trends and recent advances. A review. *Food Control* 57, 393–401.
4. Borit, M., & Olsen, P. (2012). Evaluation framework for regulatory requirements related to data recording and traceability designed to prevent illegal, unreported and unregulated fishing. *Marine Policy*, 36(1), 96–102. doi:10.1016/j.marpol.2011.03.012
5. Borit, M., & Olsen, P. (2016). Seafood traceability systems: gap analysis of inconsistencies in standards and norms. *FAO Fisheries and Aquaculture Circular No. 1123, FIAM/C1123* (Vol. 1123).
6. Caporale, V., Giovannini, A., Di Francesco, C., & Calistri, P. (2001). Importance of the traceability of animals and animal products in epidemiology. *Revue Scientifique et technique de l'Office International des Epizooties* 20, 372-378.
7. Conservation Alliance for Seafood Solutions. (2017). A Common Vision for Sustainable Seafood. Retrieved from: <http://solutionsforseafood.org/wp-content/uploads/2014/10/A-Common-Vision-for-Sustainable-Seafood.pdf>
8. Crona, B. I., Daw, T. M., Swartz, W., Norström, A. V., Nyström, M., Thyresson, M., ... Troell, M. (2016). Masked, diluted and drowned out: how global seafood trade weakens signals from marine ecosystems. *Fish and Fisheries*, 17(4), 1175–1182. <https://doi.org/10.1111/faf.12109>
9. Dykstra, D.P., Kuru, G. and Nussbaum, R. (2003). Tool and methodologies for independent verification and monitoring - Technologies for wood tracking. *International Forestry Review*, 5(3): 262-267.
10. FAO. (2009). Guidelines for the Ecolabelling of Fish and Fishery Products from Marine Capture Fisheries. Revision 1. Rome/Roma, 97p.
11. FAO. (2010). Ecolabels and marine capture fisheries. Rome/Roma. Retrieved from: <http://www.fao.org/docrep/013/i1948e/i1948e04.pdf>
12. FAO. (2018). The State of World Fisheries and Aquaculture 2018 - Meeting the sustainable development goals. Rome. Licence: CC BY-NC-SA 3.0 IGO
13. Fish 2.0 (2015). Traceability - An Investor Update on Sustainable Seafood. *Market Report*. Retrieved from: [http://www.fish20.org/images/Fish2.0MarketReport\\_Traceability.pdf](http://www.fish20.org/images/Fish2.0MarketReport_Traceability.pdf)
14. FishWise. (2018). Advancing Traceability in the Seafood Industry: Assessing Challenges and Opportunities. February 2018. Retrieved from <https://fishwise.org/traceability/advancing-traceability-in-the-seafood-industry-assessing-challenges-and-opportunities/>

15. FOS. (2020). Friend of the Sea Standard. FOS 0001 v9.3 2019; English version 2.  
Retrieved from: [https://friendofthesea.org/wp-content/uploads/10092019\\_FOTS\\_FOS-0001-ver.9.3.pdf](https://friendofthesea.org/wp-content/uploads/10092019_FOTS_FOS-0001-ver.9.3.pdf)
16. Frederiksen, M., & Gram, L. (2003). Traceability. In: Huss, H. H., Ababouch, L., & Gram, L. (2003). Assessment and Management of Seafood Safety and Quality. FAO Fisheries Technical Paper 444. Rome/Roma.
17. Future of Fish. (2016). Seafood Traceability Glossary: A guide to terms, technologies, and topics (Glossary). Future of Fish, FishWise, Global Food Traceability Center.  
Retrieved from: [http://futureoffish.org/sites/default/files/docs/resources/T101-Seafood%20Traceability%20Glossary%20WEB\\_0.pdf](http://futureoffish.org/sites/default/files/docs/resources/T101-Seafood%20Traceability%20Glossary%20WEB_0.pdf)
18. He, J. (2018). From country-of-origin labelling (COOL) to seafood import monitoring program (SIMP): How far can seafood traceability rules go? *Marine Policy*, 96(January), 163–174. <https://doi.org/10.1016/j.marpol.2018.08.003>
19. Hofstede, G.J. (2004). Hide or confide? The dilemma of transparency. 's-Gravenhage: *Reed Business Information*. 248 p.
20. Hosch, G., & Blaha, F. (2017). Seafood traceability for fisheries compliance: country-level support for catch documentation schemes. *FAO Fisheries and Aquaculture Technical Paper 619*. Retrieved from: <http://www.fao.org/3/a-i8183e.pdf>
21. IFFO RS. (2013). Responsible Supply of Fishmeal and Fish Oil Chain of Custody Standard. *The Marine Ingredients Organisation*. Retrieved from: <https://www.iffors.com/sites/iffors/files/2017-06/IFFO%20RS%20CoC%20V1.1%202013%20Eng.pdf>
22. ISCC. (2016). Traceability and Chain of Custody Version 3.0. ISCC 203. Retrieved from: [https://www.iscc-system.org/wp-content/uploads/2017/02/ISCC\\_203\\_Traceability\\_and\\_Chain-of-Custody\\_3.0.pdf](https://www.iscc-system.org/wp-content/uploads/2017/02/ISCC_203_Traceability_and_Chain-of-Custody_3.0.pdf)
23. ISEAL. (2016). Chain of custody models and definitions. Retrieved from: [https://www.isealalliance.org/sites/default/files/ISEAL\\_Chain\\_of\\_Custody\\_Models\\_Guidance\\_September\\_2016.pdf](https://www.isealalliance.org/sites/default/files/ISEAL_Chain_of_Custody_Models_Guidance_September_2016.pdf)
24. Islam, S. B., & Habib, M. (2013). Supply chain management in fishing industry: A case study. *International Journal of Supply Chain Management*, 2(2), 40–50.
25. Leal, M. C., Pimentel, T., Ricardo, F., Rosa, R., & Calado, R. (2015). Seafood traceability: Current needs, available tools, and biotechnological challenges for origin certification. *Trends in Biotechnology*, 33(6), 331–336. <https://doi.org/10.1016/j.tibtech.2015.03.003>
26. Lewis, S. G., & Boyle, M. (2017). The Expanding Role of Traceability in Seafood: Tools and Key Initiatives. *Journal of Food Science*, 82, A13–A21. <https://doi.org/10.1111/1750-3841.13743>

27. Marine Stewardship Council. (2019a). MSC Chain of Custody Standard: Consumer-Facing Organisation (CFO) Version 2.0. Retrieved from: [https://www.msc.org/docs/default-source/default-document-library/for-business/program-documents/chain-of-custody-program-documents/msc-chain-of-custody-standard\\_consumer-facing-organisation-version-v2-0.pdf?sfvrsn=e2b49c1b\\_10](https://www.msc.org/docs/default-source/default-document-library/for-business/program-documents/chain-of-custody-program-documents/msc-chain-of-custody-standard_consumer-facing-organisation-version-v2-0.pdf?sfvrsn=e2b49c1b_10)
28. Marine Stewardship Council. (2019b). MSC Chain of Custody Standard: Default Version 5.0. Retrieved from: [https://www.msc.org/docs/default-source/default-document-library/for-business/program-documents/chain-of-custody-program-documents/msc-chain-of-custody-standard\\_default-version-v5-0.pdf?sfvrsn=b832b260\\_10](https://www.msc.org/docs/default-source/default-document-library/for-business/program-documents/chain-of-custody-program-documents/msc-chain-of-custody-standard_default-version-v5-0.pdf?sfvrsn=b832b260_10)
29. MSC. (2018). MSC Ecolabel User Guide. Retrieved from: <https://www.msc.org/docs/default-source/default-document-library/for-business/use-the-msc-label/msc-ecolabel-user-guide.pdf>
30. MSC. (2019). Summary of Changes. Chain of Custody Standards: Program release 2019. Retrieved from: [https://www.msc.org/docs/default-source/default-document-library/for-business/program-documents/chain-of-custody-program-documents/chain\\_of\\_custody\\_summary\\_of\\_changes\\_2019.pdf?sfvrsn=69c6c195\\_24](https://www.msc.org/docs/default-source/default-document-library/for-business/program-documents/chain-of-custody-program-documents/chain_of_custody_summary_of_changes_2019.pdf?sfvrsn=69c6c195_24)
31. MSC. (2019a). MSC Chain of Custody Standard: Group Version. MSC. Scheme Documents, 1–23.
32. MSC. (2019b). MSC-MSCI Vocabulary, Version 1.2. Marine Stewardship Council. Retrieved from: [https://www.msc.org/docs/default-source/default-document-library/for-business/program-documents/chain-of-custody-supporting-documents/msc-msci\\_vocabulary\\_v1-2.pdf?sfvrsn=cef284dd\\_12](https://www.msc.org/docs/default-source/default-document-library/for-business/program-documents/chain-of-custody-supporting-documents/msc-msci_vocabulary_v1-2.pdf?sfvrsn=cef284dd_12)
33. Nicolae, C. G., Moga, L. M., Bahaciu, G. V., & Marin, M. P. (2017). Traceability System Structure Design for Fish and Fish Products Based on Supply Chain Actors Needs. *Scientific Papers-Series D-Animal Science*, 60, 353–358.
34. NOAA. (2014). Recommendations of the Presidential Task Force on Combating Illegal, Unreported and Unregulated Fishing and Seafood Fraud, RIN 0648-XD652, published on 18 December, p.4.
35. Olsen P., Borit M. (2013). How to define traceability. *Trends in Food Science and Technology*. Vol. 29, Issue 2. pp. 142-150.
36. Petersen, A., Green, D. (2007). Seafood Traceability: A Practical Guide for the U.S. Industry. Retrieved from <http://seafood.oregonstate.edu/.pdf> Links/Seafood Traceability - A Practical Guide.pdf
37. Ploeger, A. (2014). Traceability in the fish supply chain : Which problems occur in the fish supply chain with regard to traceability and how can companies handle these

- problems? Unpublished Bachelor thesis, Wageningen University. Retrieved from:  
<https://edepot.wur.nl/316938>
38. Prosperi, P., Vergamini, D., & Bartolini, F. (2020). Exploring institutional arrangements for local fish product labelling in Tuscany (Italy): a convention theory perspective. *Agricultural and Food Economics*, 8(1). <https://doi.org/10.1186/s40100-020-0151-7>
  39. Rasmussen, M. L. R. (2012). A study of traceability and quality assurance in fish supply chains. PhD thesis, DTU Food, National Food Institute, Technical University of Denmark.
  40. Reilly, A. (2018). Overview of food fraud in the fisheries sector. FAO Fisheries and Aquaculture Circular No. 1165. Rome.
  41. UNEP. (2009). The Role of Supply Chains in Addressing the Global Seafood Crisis. Retrieved from:  
<https://unep.ch/etb/publications/Fish%20Supply%20Chains/UNEP%20fish%20supply%20Ochains%20report.pdf>
  42. USDA. (2012). Agricultural Marketing Service, Country of Origin Labeling. Retrieved from: <https://www.ams.usda.gov/rules-regulations/cool>
  43. Van Dam, J., & Ugarte, S. (2020). Accessibility and traceability in sustainable biofuel supply-chains. Final Report. SQ Consult. Project: S/2019/USE/0041
  44. Willmann, R., Cochrane, K., Emerson, W. (2008). FAO Guidelines for Ecolabelling in Wild-Capture Fisheries. *Seafood Ecolabelling: Principles and Practice*, 58–80.  
<https://doi.org/10.1002/9781444301380.ch3>
  45. Wingate, K. G., & McFarlane, P. N. (2005). Chain of custody and eco-labelling of forest products: a review of the requirements of the major forest certification schemes. *International Forestry Review*, 7(4), 342–347. <https://doi.org/10.1505/ifor.2005.7.4.342>
  46. World Bank. (2013). FISH TO 2030. Prospects for Fisheries and Aquaculture. Agriculture and Environmental Services Discussion Paper 03. Retrieved from:  
<http://www.fao.org/3/i3640e/i3640e.pdf>
  47. WWF. (2015). Traceability Principles for Wild-Caught Fish Products. Retrieved from:  
<http://www.worldwildlife.org/publications/traceability-principles-for-wild-caught-fish-products>
  48. Yasuda, T., & Bowen, R. E. (2006). Chain of custody as an organizing framework in seafood risk reduction. *Marine Pollution Bulletin*, 53(10–12), 640–649.  
<https://doi.org/10.1016/j.marpolbul.2006.08.015>

## 13. ANNEXES

### 10.4. ANNEX I

- Implementing sustainable seafood commitments (by six-steps approach) (Conservation Alliance for Seafood Solutions, 2017):

- 1) *Make a public commitment* (if you developed your own company criteria - make them public)
- 2) *Collect data on seafood products* (make a detailed data collection and adopt relevant traceability and product information policies)
- 3) *Make responsible sourcing decisions* (make sure to buy and sell seafood that is certified, rated, or engaged in improvement projects)
- 4) *Be transparent* (track the progress you are making and provide public updates; use labels to inform about your sustainability commitments)
- 5) *Educate staff, customers and vendors* (train your employees, provide support and educate your vendors on environmental and social issues)
- 6) *Support improvements in fisheries and aquaculture* (improve practices, policies, management)