“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

D4.3.3. Report on Products’ Certification

WP4 - INNOVATING TOOLS AND PROCESSES FOR ADDED-VALUE ADRIATIC FISHERY PRODUCTS/ A 4.3. DEVELOPMENT AND QUALITY CONTROL OF ECO-INNOVATIVE FISHERY PRODUCTS

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Abstract

Due to the completion of piloting innovative products for each producer organization assigned to the project partnership, it is essential to introduce the possibilities of certification related to those products. Each producer has its specialty in catch and processing of the selected target species. This report relies on previous results achieved in WP4 deliverables, primarily: D4.3.1. *Report on new product analyses and description*, D4.3.2. *Report on Standards' qualification*, D4.4.1. *Guidelines for traceability implementation on new products* and D4.4.2. *Certification scheme for new innovative products and processes*, in line with the collaboration with WP3 and WP5 team.

The innovative products as project outcomes which will also serve as specific examples for the possibilities in ARFM certification are as following:

- **Sardine fillets** - treated with ozone and MAP (mixture of Argon gas and carbon dioxide in a ration 60:40), packed in standard MAP packs, plastic container sealed with plastic foil, 150 g (developed by PO "Omega 3");
- **Sea burgers** - treated with HPP, skin packed, 150 g (developed by PO "Istra");
- **Sea clams** - treated with HPP, with tomato sauce or natural (developed by PO "Bivalvia").

Product certification was tested in this report for targeted PRIZEFISH products, from the point of catch, to the first point of sale and into the marketplace. The economic, ecological and social sustainability and responsibility aspects were assessed, cross checking the compliance with relevant indicators of the proposed Standards (Chain of Custody and Processors' Standard, including Quality in terms of the Product Origin and Trademark).

The application of traceability system "from sea to plate" will assure responsible fishing (coupled with the assessment against the Fisheries Standard - work of WP3) and responsible operations (Production and Operational Efficiency Standard), assisted by another novel approach that gives additional value to the ARFM Certification Scheme - sustainable operations at supply and production to sales level. By adhering to all mentioned Standards and their principles, the applicants (producers, buyers, processors, wholesalers) will be able to verify compliance with claims of selling/buying/distributing certified products.

1. INTRODUCTION

1.1. BACKGROUND AND PURPOSE

Sustainability in fishing practices

In the last decade there has been a rising worldwide demand for seafood and other fishery products. This has caused a steady increase and growth in global fish production and world trade. According to the most recent report from the FAO (2018), the global total capture fishery production was 90.9 million tonnes in 2016, of which fisheries in marine waters provided 87.2 percent of the global total. This percentage shows a small decrease in comparison to the two previous years (of almost 2 million tonnes) that is explained by the substantially reduced catches of the Peruvian anchoveta (*Engraulis ringens*) between 2015 and 2016, due to El Niño influence (FAO, 2018).

Currently, 33.1 percent of global stocks is overfished, with a prognosis that restoring them to maximum sustainable yield (MSY)[1] levels will hardly be achievable in the near future. A fish stock is classified as biologically sustainable if its abundance is greater than the level which can produce MSY, and unsustainable if the abundance falls below that level. This threshold is used as an indicator for the sustainability of marine capture fisheries within the UN Sustainable Development Goals. The latest FAO report (2018) shows an overall decrease in the marine fish stock that has been fished within biologically sustainable levels, on the contrary to an increase of the stock fished at unsustainable levels. Among other major areas, the Mediterranean Sea had one of the highest percentages of the unsustainably fished stock.

Certain stocks are overexploited in some areas, while they are underfished in other areas. That is the case with some demersal species, such as sardines (*Sardina pilchardus*), which are overfished in the Mediterranean and Black Sea, in contrast with the recent assessment of the same species' catches in the Eastern Central Atlantic, where they are considered to be underfished (FAO, 2018).

With the ongoing trend in seafood consumption across the globe, mostly due to higher living standards and healthier dietary choices (STECF, 2013), both public and NGO sector started raising

[1] Maximum sustainable yield is defined as the largest yield/catch that can be taken from a fish stock under existing environmental conditions (Ricker, 1975).

concerns over sustainability of fishing practices (Kirby et al. 2014). Consumers were worried about the lasting impacts of wild capture and aquaculture production on marine habitats and resources. Their consciousness had shifted towards environmental sustainability, just and fair trade and social accountability in marine fisheries. This impacted the whole society and thus paved the way into preventing overfishing, directing good fishery management practices and promoting environmental protection.

Following the consumers' demand for the responsibilities in marine fishery production and trading, the business communities began to understand the importance of recognizing sustainable management of marine resources (Ramachandran, 2010). Retailers and processors succumbed to this green consumerism[2] and started developing various marketing strategies to influence consumers' choices.

In the 1990s, the concept of sustainability in fisheries broadened from solely representing maximum yield of harvesting resources and maintaining and restoring populations of economically important species (UNCLOS, 1982), to include human use of those resources, while maintaining ecosystem function and productivity (CBD, 1992). The development of international agreements followed as a response giving application to the new concept, particularly through the FAO Code of Conduct for Responsible Fisheries (FAO, 1995). But standards for sustainable fisheries had not been set until one major event took place in those years. It was the collapse of the Grand Banks cod (*Gadus morhua*) stocks that triggered one of the world's largest non-profit conservation organizations - WWF (World Wildlife Fund) to make partnership with Unilever in order to create the earliest globally recognised sustainable fisheries certification scheme (Howes, 2008). The Marine Stewardship Council (MSC) was the result of this unusual initiative.

The launch of the MSC opened the doors for the development of many other fishery certification schemes, some of which used their very own privately-defined standards. This ultimately leads to consumer confusion and loss of control over internationally set concept of sustainability. With a goal of harmonizing methods and advice among sustainability schemes, and providing a consistent approach for purchasing decisions, the ***FAO ecolabelling guidelines*** were created in 2009. Their goal was to cover minimum substantive requirements for the standard against which fisheries operations are assessed (Parkes et al. 2010). To be able to provide valid sustainability information, they also include procedural aspects, such as certification and accreditation procedure, as well as principles like governance, transparency and stakeholder engagement.

[2] Green consumerism refers to the consumer's environmental attitude and awareness of an eco-friendly product (Handayani & Prayogo, 2017).

These guidelines are applicable to ecolabelling and certification schemes that promote sustainable use of fisheries resources and well-managed marine capture fisheries (FAO, 2009). It is important to note that the guidelines are voluntary instruments that can help in establishing legitimacy of ecolabelling, thus assuring retailers and buyers that a specific product comes from a sustainable fishery which conforms to the established certification standard (Willmann et al. 2008).

Challenges and opportunities of certifying fisheries products in Croatia and Italy

Estimated as the sixth-largest market for seafood suppliers in the world, Italy is at the forefront of fishery products import and consumption (Bonanomi et al. 2017; Chen, 2016). The Italian seafood market has followed the international levels of increase in the total demand of these products. However, there is a noted lack of interest in fisheries sustainability among all Southern European countries in general (Washington & Ababouch, 2011). In these countries (Spain, France, Italy etc), consumers usually buy fresh products and are not concerned with ecolabelling and certification, unlike in other Member States, such as Germany and Norway (European Commission, 2016).

Actually, the Friend of the Sea (FOS) organization is registered in Italy, and it certifies products from both capture fisheries and aquaculture (Parkes et al. 2010). Although some of the most consumed seafood products in Italy (such as canned tuna, sardines, and anchovies) are labelled by the FOS, some major Italian retailers choose to sell products bearing the MSC label instead (Bonanomi et al. 2017). The MSC logo is perceived as a more recognizable and reliable eco-label, while the FOS label is identifiedby some as *semi-compliant*, since it rather focuses on target stock without providing information on fishery management sustainability (WWF, 2012).

Some studies have shown that Croatian consumers' behavior towards certified products is mostly influenced by product price and brand, and the economic status of purchasers (Cerjak et al. 2015). In Croatia, likewise in Italy, there is a growing interest in consuming fresh fish, but it is still perceived as an expensive food product (Tomić et al. 2016). From a statement given by the Croatian Chamber of Commerce (HGK) only 16% of Croatian citizens consume sea fish, mostly tinned[3]. The same source commented that the food industry in this country in the years to come should follow the global food market by increasing innovation and investment. Although ecolabelling in Croatia still plays a marginal role, the fact is that the main markets for certified

[3] https://www.total-croatia-news.com/lifestyle/29635-croats-at-eu-bottom-by-meat-and-fish-consumption

products are in Europe (Parkes et al. 2010), so there is a potential for future market diffusion and new markets' access for the Mediterranean countries as well.

Market demand, seafood consumption and attitude towards innovative products

The total EU market for fishery products in 2006 amounted to 10.2 million tons, or 10% of world consumption of fishery products, while in 2017 consumption increased to 12.45 million tons. In general, the five largest consumption markets in the EU are Spain, France, Italy, Germany and the United Kingdom, accounting for more than 70% of total consumption. Consumption per capita in 2006 was 21 kg, while today it is 24 kg. The largest consumers are generally the Mediterranean and Scandinavian countries. Central European countries and new members do not have a strong tradition of eating seafood, but in some countries, there is an increase in consumption due to rising incomes and increased trade.

In the long run, consumption of fishery products in the EU is increasing. Consumers have an increased interest in special products, culinary delicacies, premium and value-added products, fish fillet and sustainable fishery products.

But on the other hand, European consumers are also switching to the consumption of products produced outside the EU, such as African catfish, tilapia, Nile perch. These products are prized for their neutral taste and low price. Fishery products are increasing their market share both because of their health image and the benefits of preparation in equal measure.

Consumption of fishery products varies considerably between EU Member States. The highest consumption per capita is in Portugal - 56.8 kg, whereas in Hungary amounts to only 5.6 kg. The five largest consumer markets in the EU account for more than 70% of the EU consumption.

In general, the Mediterranean and Scandinavian countries are large consumers of fishery products. France has the largest market for fishery products, although per capita consumption is not the highest. Consumption per capita in Italy and the UK revolves around the EU average, but due to their large population they are as important market such as Germany.

Central European countries do not have a strong tradition of consuming fishery products and are at the lowest level of consumption. Most of these countries are surrounded by land and lack a significant marine production sector, although freshwater species consumption prevails. However, in these countries there is an increase in the consumption of marine fishery products with the expansion of the market as well as an increase in personal income.

Predictions are that total consumer volume will grow modestly, but prices and value are expected to increase through delivery of high-value products. *FAO predicts that demand for frozen fish will decline. Consumption of crustaceans and molluscs is expected to increase*. Markets in newer EU Member States such as Romania and Bulgaria, together with Latvia and Slovenia, show the highest growth rates in consumption. High growth rates are also present in Austria. Their growth values are above the EU average. Germany, Portugal and Slovakia also show good growth rates, while the markets of Poland, Ireland and the Netherlands are growing below the EU average.

The new EU members of Eastern Europe are a growing market for Western European countries. As income in these countries slowly increases, so does the demand for fishery products. Some countries that have a tradition of wild fish catch and aquaculture, such as Poland, are also developing into a strong supplier to other EU member states. Trade relations between the surrounding EU countries are generally strong.

Growing market demands for fish and other seafood products are partly met by increased processing capacity and adjustments to the final consumer. Namely, processed fishery products open up more opportunities and more sales channels. This momentum is due to the growing needs of the world market for this type of production, although gradual growth can be expected due to strict rules within the application and meeting strict standards in food production.

An active role in conservation of resources as well as exceptional food quality and market requirements related to full traceability and transparency of fisheries production, put the fisheries sector in the model of continuous innovation related to operational processes and techniques on-board and innovation in the processing industry of value-added products.

In order to balance innovative food production and resources sustainability, and achieve competitiveness of Adriatic seafood in the wider European market, it is necessary to recognize and appropriately valorize the place and role of new opportunities for catch and processing in the sector of healthy food production. The way to reach the mentioned strategic goals should take place through the improvement and modernization of the fisheries sector, i.e. catch and processing through:

- improving the balance of the catch process with conservation of resources, achieved high quality of catch and better price;

- modernization of production at existing processing capacities, improvement of existing and introduction of new processing technologies;

- introduction of new products in industrial processing;

- investing in new techniques and technologies, favoring new technological processes and innovative products;

- integrating new processes into rural development.

A lasting strategic commitment is to rank Adriatic fish among the leading countries in selected high-value fishery products with internationally recognizable quality and with respect for the highest environmental standards in production, quality and resource management.

Producer organizations seek to optimize their business and strengthen their market position by launching new production lines that are recognized by end consumers, based on innovations in catching, processing, new recipes for fish and seafood and their possible certification. Innovative techniques and technologies in catch have been proved as successful in raising the quality of input raw materials in the processing plants of PO "Omega 3"and PO "Bivalvia". On the other hand, PO "Istra" has successfully calibrated and upgraded the machine for automatic removal of shrimp shells, separating the shell from the meat, which is automatically used as one of the ingredients of the new product. Based on the guidelines obtained from WP3 - D3.1.1. *Report of the mapped fisheries in Italy*, D3.1.2. *Report of the mapped fisheries in Croatia*, D3.2.3. *Sustainability guidelines*, D3.3.1. *Report on the standardized approach in the pre-assessment process in Italy and Croatia*, D3.3.2. and D3.3.3. *Report of the pre-assessment of relevant fisheries in Italy and Croatia* and D3.3.4. *Standardized action plans in Italy and Croatia*, producer organizations have met criteria in relation to the catch of defined target species, having in mind the positive impacts on ecological (stock status through lower catch), economic (higher quality and price) and social parameters (benefits for fishermen through less operational work, more free time and safety at work).

Categories of high value-added products or fishery products ready for consumption in the category of semi-finished and ready meals in the form of appetizers and main meals are a growing demand of today's households with special emphasis on the geographical origin of catches as described in WP5 reports - D5.1.2. *Best practice guide*, D5.2.1. *Consumer analysis report* and D5.3.1. *Eco-innovative value chains design recommendations*. The market analysis focused on examining potentially new markets, mainly in Central and Eastern European countries, as well as consumer preferences, and it was determined that there is a possible increase in demand. New products created through this project in WP4 have successfully entered the segment of chilled and fresh products with higher quality and shelf-life extension.

This report covers the possibilities of certification of these new products, in accordance with the national legislation of Croatia and Italy, which were described in the guidelines of the D4.3.2. *Report on Standards'qualification* and guidelines for environmental accountability, quality

assurance systems and socio-economic sustainability of the D4.4.2. *Certification scheme for new innovative products and processes*.

1.2. SCOPE OF THE WORK

Objectives of this deliverable, as previously stated, are aimed at exploring the certification possibilities of the pilot fishery products within the newly developed ARFM scheme. An overview and the synthesis of the whole certification system for the eco-innovative products developed within the PRIZEFISH project will be presented, along with the strategies for these products to reach market place, position and recognition. One of the crucial considerations will be an alignment between fishery production and sales and marketing of ecolabelled products from responsible and sustainable production.

Previously, within the development of other deliverables of the WP4, the evaluation of the certification methodology was conducted, primarily operational and administrative aspects of the production and sales part of the chain (supply part has been covered by the work of the WP3); then the provision of the guidelines of the Chain of Custody and Processors' Standard, as well as control of procedures "from sea to plate" to follow up high quality and safety requirements. All this was supported by evaluating legal requirements of the concerned standards, covering compliance with the control procedures for the introduction of new products within new and existing markets.

One of the outcomes of the previous project activities done within the scope of WP4 was creation of a certification diagram, specifically designed as a graphical and conceptual representation of the ARFM certification framework, done in collaboration with the WP3 team (Figure 1).

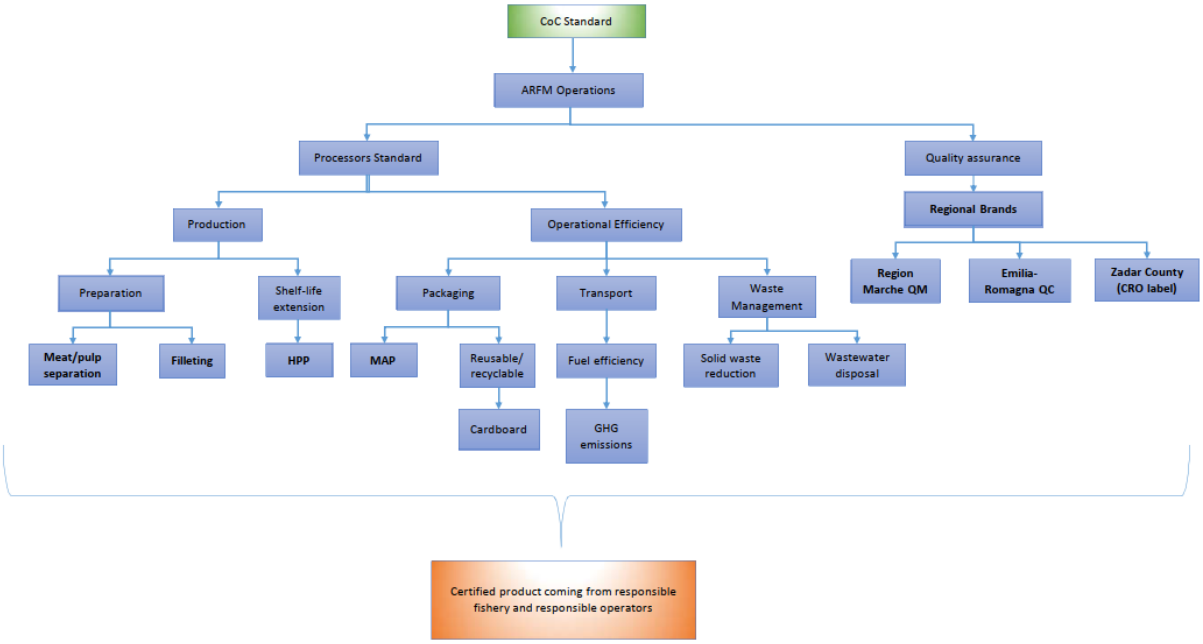


Figure 1. Certification framework of the Adriatic Responsible Fisheries Management scheme

In this report, we will present the certification possibilities for the three fishery products developed by producer organizations involved in PRIZEFISH project, fished in socially- and environmentally-responsible ways. This will be manifested by firstly describing mentioned innovative products, followed by information on the catch of raw materials, their processing, distribution and marketing. Representation of the new products will include important features, such as indication of origin, packaging-related quality preservation and environmental impact issues, with a review of the ecolabelling properties. Section on sales and marketing of the innovative products will describe branding strategies and consumer-facing marketing initiatives. Basic certification scheme rules and supervision, among other procedural principles were already described in previous deliverables, but here an overview will be given, with specificities of the Adriatic responsible certificate management. Regarding traceability system of the new scheme - specific Chain of Custody guidelines that were provided in D4.4.1. *Guidelines for traceability implementation on new products*, will be implemented here and showcasted for the three innovative products. Special attention will be given to emerging blockchain technology use in products' traceability. The same applies to quality and safety, as well as to production and

operational efficiency standard guidelines, which will here cover transport, packaging and waste procedures concerning handling of the new products, and human rights and labor ethics in the line of production.

2. PRODUCTS DESCRIPTION AND CHARACTERISTICS

Producer organizations have piloted selected options for innovative products of target species of marine organisms, and conducted all necessary tests and analyzes to demonstrate added value, in order to meet the needs of end consumers and expand market reach. Given the possibility of expanding the market reach, special emphasis was placed on extending the shelf life in the refrigerated/fresh category.

2.1. PO "OMEGA 3" – SARDINE FILLETS IN MAP

The nutritional characteristics of sardines are exceptional. In addition to a high protein ratio, this product also has an excellent unsaturated fat content. The nutritional values of the product are shown in Table 1.

Table 1. Nutritional characteristics of sardines (Source: *MedicAir Food*)

Nutrient	Value per 100 g
Water (g)	62,7
Energy (kcal)	225
Energy (kJ)	943
Proteins (g)	20,3
Lipids (g)	15,4
Cholesterol (mg)	65
Carbs (g)	1,5
Sugars (g)	1,5

The innovative product is a product washed with ozonated drinking water, packed in containers with a Modified Atmosphere Packaging (MAP) Mix (60 % Argon: 40 % Carbon dioxide), in a package of 150 g (Figure 2). This method of packaging has successfully increased the shelf life of the product from standard 9 days to 14 days, nominal value being 5 additional days. A more detailed piloting procedure can be found in document D4.3.1. *Report on new product analyses and description*.

Figure 2. Sardine fillets in MAP (ozone+Ar:CO_2) on 13th day (Source: *MedicAir Food*)

2.2. PO "ISTRA" - SEA BURGERS[4], HPP

The producer organization piloted burgers that make up a mixture of shrimp and mullet meat, with good nutritional values. From a nutritional point of view, mullet meat is firm and easily digestible with a protein content of 19.35 % and a fat content of 3.79 %. Shrimp on the other hand has a very low lipid content (0.6%) and a high protein intake of about 13.6%. Exact ingredients of these burgers are shown in Table 2.

[4] The name of the PO's product has been changed here from „shrimp burgers" to „sea burgers" (unlike in previous technical deliverables) as a suggestion for better representation of the product containing more mullet than shrimp meat and due to having two different seafood ingredients.

Table 2. Innovative burger ingredients in grams per kilogram

Ingredient	*Quantity [g per kg]*
Mullet meat	547,5
Shrimp meat	347,5
FAST FH 67002 thickener	50
MIX DRY FH 67001 thickener	50
NAT FIT 44751 aroma	5

Thickener characteristics: The product Fast FH 67002 is a creamy white semi-finished product for food, which contains dietary fiber (peas), starch, and natural flavors (aromatic preparations). Fast Dry FH 67001 is a creamy white semi-finished product for food, which contains dietary plant fibers (peas; chicory), potato starch, natural flavors (aromatic preparations), dehydrated potato flakes.

Table 3. Nutritional value of shrimp and mullet burgers (Source: *MedicAir Food*)

Nutrient	Value per 100 g
Water (g)	69,4
Energy (kcal)	127,4
Energy (kJ)	532,2
Proteins (g)	14,5
Lipids (g)	4,0
Cholesterol (mg)	81,1
Carbs (g)	8,3
Sugars	2,0

After the formation of the burger, the cryogenic freezing process at a temperature of -90°C follows. Finally, burgers are treated with high hydrostatic pressure - HPP (High Pressure Processing) technology that is able to microbiologically stabilize food with a liquid, semicircular and solid matrix, extending its shelf life. The packaging has a net weight of 150 g. With this

treatment, the shelf life was extended to 30 days. Once again, a more detailed piloting procedure can be found in document D4.3.1. *Report on new product analyses and description*.

Figure 3. Shrimp and mullet burger, cryogenic freezing+HPP+150g package (Source: *MedicAir Food*)

2.3. PO "BIVALVIA" – SEA CLAMS IN TOMATO SAUCE OR NATURAL CLAMS, HPP

PO "Bivalvia" piloted two sea clams' products - in a tomato sauce and as an alternative - natural clams, using HPP treatment. For the first product, tomato sauce completely filled the plastic tray and the product was then vacuum skin packed. The second had striped venus only packed in the same type of tray and vacuum skin packed.

The results were as follows:

- The shelf life of the products with tomato sauce was extended, to 14 days;
- Samples submitted for processing must be immersed in liquid and without air;
- After a week, the smell and taste of seashells with sauce matches the original;
- Disadvantages to deal with: several broken shells, and separate edible parts;
- Current treatment shows encouraging improvements that need to be refined for this type of product to make it suitable for consumers;
- Positive indications require further studies.

The net weight of the product pack (with clams and tomato sauce) is 500 g (330 g of clams + 170 g of tomato sauce). Exact ingredients of this type of product are shown in Table 4.

Table 4. Innovative sea clams with tomato sauce product's ingredients in grams per pack*

Ingredient	*Quantity [g per pack]*
Clams	330
Extra virgin olive oil	63
Tomato purée Mutti	63
Water	34
Ground black pepper	4
Guar gum	3
Citric acid	3

**Remark: This product has so far only been tested for HPP treatment without satisfactory results, but the conclusions suggested further analyses before eventual production and commercialization. Thus, further certification assessments for the sea clam's product presented in this deliverable will be treated with caution.*

Figure 4. Sea clams in tomato sauce, HPP (Source: *PO "Bivalvia"*)

3. STOCK STATUS OF THE TARGET SPECIES SELECTED FOR ECO-INNOVATIVE PRODUCTS

The status of stock of species that have been processed by piloting innovative products through the PRIZEFISH project is important for the connection of fishing technologies, techniques and processing in the plants, with requirements of the newly developed ARFM certificate. It is important to mention that although stock status is unavoidable criteria when talking about environmental sustainability in fishery certification, in the ARFM *Sustainability guidelines* (D3.2.3) it is addressed through effective data collection and data deficiency risk assessment and precautionary approach.

Utilization of the target stock through structured management system is one of the first objectives of the ARFM assessment, and this chapter will provide insight into currently available data (Main sources: *General Fisheries Commission for the Mediterranean (GFCM)*[5], *DNV GL-Business Assurance* and *Scientific, Technical and Economic Committee for Fisheries (STECF)*).

Target species selected by producing organizations are presented in Table 5, with listed information regarding their stock and conservation status, fishing gear and coverage by leading certification schemes.

Table 5. The list of marine species selected by POs, with information about their IUCN conservation status, FAO Major Fishing Area and stock status (*retrieved and modified from Bonanomi et al. 2017*), and gear type (only the gear used for catch by POs) and certification coverage by the MSC and FOS.

Species name	IUCN status	FAO area	Gear*	Stock status	MSC certified	FOS certified
European pilchard *Sardina pilchardus*	Least concern (Near Threatened: Europe)	27, 34, 37	PS	Overexploited in the eastern central Atlantic, although certain conservation measures are in place. Overexploited in GSA 6, 9, 16 and **17**. Long-term environmental changes might cause fluctuations.	YES	YES
Red mullet *Mullus barbatus*	Least concern	27, 34, 37	GNS, TB	Considered as overexploited in GSA 7, 9, 11 and overexploited in GSA 3, 6, 24 and 25. Also unsustainably fished in west African countries. Juveniles are frequently taken	NO	NO

[5] http://www.fao.org/gfcm/activities/fisheries/stock-assessment/sharedstocks/en/

				as bycatch by trawlers.		
Striped red mullet *Mullus surmuletus*	Least Concern (Data Deficient: Europe)	27, 34, 37	GNS, TB	Overfished in parts of the Mediterranean Sea (GSA 5, 9, 15 and 16). Juveniles are often taken as bycatch by trawlers.	NO	NO
Flathead grey mullet *Mugil cephalus*	Least Concern	27, 34, 37 (Atl+Med only)	GNS, TB	Considered as stable all over its geographic range.	YES	NO
Deep-water rose shrimp *Parapenaeus longirostris*	Not Evaluated	27, 34, 37 (Atl+Med only)	TB	In overexploitation in parts of the Mediterranean, but annual fluctuations depend heavily on recruitment.	NO	YES
Striped venus clam *Chamelea gallina*	Not Evaluated	27, 37	DRX	No existing stock assessment, considered overexploited in the Adriatic Sea.	YES	YES

* Gear type acronyms adapted and defined according to FAO code list (Sparre, 2000): DRX = dredges; GNS = set gillnets; PS = purse seines; TB = bottom trawls.

Out of 6 presented species, 2 of them are classified as *Not Evaluated*, according to the ***IUCN Red List of Threatened Species***[6]. As those species (Deep-water rose shrimp and Striped venus) are of specific interest for Croatian and Italian fisheries, this might present a potential challenge for stock status assessment. All other species are listed as *Least Concern*, with populations of some species in certain regions classified as *Data Deficient*. Rigorous data collection and assessments should be in place for all species in the Adriatic region to clarify their status for certification.

Although European pilchard (*Sardina pilchardus*) has the *Least Concern* status, populations in Europe are considered as *Near Threatened* (Cataudella & Spagnolo, 2011). This small pelagic

[6] https://www.iucnredlist.org/

species is of major commercial interest in the Mediterranean Sea, and together with the European anchovy it is subjected to the most intensive landings and exploitation in the Adriatic Sea (Bonanomi et al. 2017). Actually, the Northern Adriatic Sea European anchovy and European pilchard pelagic pair trawl fishery (*Consorzio Mare Adriatico*) was the first Italian fishery to apply for the MSC label in 2015, but decided to suspend the certification process two years later[7].

According to Bonanomi et al. (2017), the striped Venus clam (*Chamelea gallina*) is another species heavily exploited in the Adriatic Sea, for which the adoption of management measures is being evaluated.

When compared against the ***MSC and FOS certifications***, four species shared the same status - two of them were certified by both organizations, while other two species were not certified at all. Of the remaining species, one was only certified by the MSC (Flathead grey mullet), while the other one (Deep-water rose shrimp) was certified by the FOS only. In total, three species were certified by the MSC and three species by the FOS scheme.

Regarding the ***stock status***, there is either lack of assessment data for current status or species are fished at unsustainable levels. Exception is Flathead grey mullet, considered stable over its range, due its common occurrence. In the Adriatic Sea (including North-Central Adriatic area), European pilchard is generally considered as overfished, likewise Striped venus clam which is overexploited. However, some experts claim that since the 1950's there has been an increase in catch of European pilchard.

According to the GFCM, European pilchard livestock estimates have not yet been made, but according to all available sources, estimates are that biomass is close to minimum, and for this reason it can be considered that the stock is depleted.

In the past years, fish sustainability information schemes happened to certify certain overexploited stocks (Parkes et al. 2010). For example, recommendation lists tend to lack information on individual stocks, and usually do not assess data related to stock under

[7] https://fisheries.msc.org/en/fisheries/northern-adriatic-sea-european-anchovy-and-european-pilchard-pelagic-pair-trawl/

consideration. FAO guidelines undoubtedly define the use of stock-specific reference points, peer-review process, data validation, and imply the rightful applicability and quality of such data.

Certification of a clearly defined unit, such as the fish stock, has to implicitly on a stock-by-stock basis and reliable and adequate data in accordance with international standards.

In the case of overfished stock, suggestions imply certification of individual fishers who implement sustainable fishing practices. Such products would need to be traced back to those same fishers and tracked throughout supply chains to meet the criterion of sustainability (Kaiser & Edwards-Jones, 2005). This correlates with the proposed approach of the pre-assessment by the ARFM scheme.

Rose shrimp stocks in GSAs 17-19 show an increasing catch from 2014 to 2019, stable in previous years. Recruitment and Spawning Stock Biomass (SSB) initially fluctuated and then increased from 2014 to 2019. F increased over a time series with a very slight decrease in the last 3 years. (Source: STECF, p. 106)

Fishing gear used by vessels associated with POs in Italy and Croatia include: purse seines, bottom trawls and hydraulic dredges. Fishing methods comprising trawling and dredging have been severely criticized by environmental NGOs, especially concerning bottom trawls, considered as the most destructive gear type (Selden et al. 2016). Intense trawling activity performed by multi-species fisheries can jeopardize the recovery of vulnerable species. Moreover, undersized commercial species (juveniles) and non-target species are usually discarded as a bycatch (Bonanomi et al. 2017). Negative effects of bottom trawling on sensitive habitats and marine organisms can be reduced by spatiotemporal restriction and gear modification[8].

The MSC does not specifically exclude types of gear that may be used by the fishery seeking certification. Regarding environmental impact, it states in one of its principles that fisheries should not cause *serious or irreversible harm to habitats*.

[8] https://www.seafoodwatch.org/ocean-issues/fishing-and-farming-methods

Similarly, the FOS states in its *Sustainable fishing requirements* that the fishing vessels shall not use the gear that affects seabed *unless such impact is negligible*[9]. It also prohibits the use of explosives, chemical substances and other gear forbidden by the law.

Monitoring of Chamelea gallina makes it possible to obtain an estimate of the total adult biomass (≥20 mm individuals), which in the period from 2003 to 2019 in Veneto was 6.727 tons. 2018 was characterized by fatal events, and the extreme hydrometeorological situation occurred in the fall, while in 2019 a high catch rate was observed, which was confirmed by monitoring in 2020 as well (AGRITECO, 2020). The catch trend makes it possible to obtain an average value of about 3.000 tons per year, with peaks of almost 5.000 tons and minimum values of just under 1.000 tons. The ratio between catches and biomass of C. gallina in suitable areas, determined by monitoring activities, shows that on average the quantities extracted from the environment are about 45% of those naturally present larger than 20 mm, with the exception of the year in which the death phenomena occurred, to which this ratio is higher.

Monitoring showed a low biomass value at the end of 2019, so Cogevo and PO Bivalvia decided to modify CROMAC to protect the shellfish population. The main fishing area is located from Cavallino to Sottomarine (Chioggia). Historically, this was an area with higher production, with 80 active vessels, representing 66% of the entire Veneto fleet for shellfish fishing. In 2018, the VAIA storm, along with the phenomena of natural death, affected the value recorded in 2019. In 2019, the consortia decided to reduce fishing days (after biological cessation/seasonal closure) from 4 to 3 days a week, modifying their CROMAC, which was carried out by order of the Coast Guard. Therefore, the fishing effort in 2019 was less than in 2018.

Therefore, as for the RBF, which made the inventory estimate, the CA scoring would remain unchanged. Moreover, the data available during the site visit confirmed that the productivity and sensitivity results of PSA would be equal, given that the species did not show specific changes in its biology and the fishery did not increase its shift and effort in improvement. Therefore, the scoring of principle 1 is still above 80.

[9] https://friendofthesea.org/wp-content/uploads/FOS_Wild_Caught_rev3.1_18102017_en.pdf

4. INNOVATIVE PRODUCTS' REPRESENTATION

4.1. INDICATION OF ORIGIN

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

Origin mark is a more specific form of protection and 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. In the case of *designation of origin*, it is generally required that the production, preparation and processing of products and services take place entirely in the designated 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.

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, registration of the user of the mark with the appropriate competent authority is also required.

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

Another mark used to distinguish the products and/or services of one (or more) persons from other persons in commercial transactions is a *trademark*. In most countries, a trademark is acquired by registration on the basis of a test performed by the appropriate competent authority. For example, in the case of the Republic of Croatia that 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 the marked products and/or services on the market.

Trademark protection in Croatia and Italy, as in many countries, is valid for 10 years, starting from the date of application. The period of protection may be extended indefinitely after this initial period, with timely submission of applications (usually before the expiry of the previous 10 years) and payment of appropriate fees and reimbursement costs.

It is up to competent national authorities to take the necessary measures to protect the registered names within their territory.

Note here that next to the planned ARFM label, an EU mark of the PDO (Protected designation of Origin) or PGI (Protected Geographic Origin) could additionally be used for enhancing claims of the quality guarantee. In this case, the preference would go to the PDO, because it recognizes agricultural products and foodstuffs which are produced, processed and prepared in a given geographical area recognizing production methods, unlike PGI where at least one of the stages of production, processing or preparation takes place in the area[10]. Until this date, for the class *Fresh fish, molluscs, and crustaceans and products derived therefrom* in Italy there are 3 PDO registered products and 3 PGI registered products (plus one applied). In Croatia there is one PDO registered (*Malostonska kamenica*) and one PGI applied product (*Novigradska dagnja*).

PDO or PGI selected PRIZEFISH products would need to enter names in the registers of protected designations of origin and protected geographical indications, having regard to the Treaty on the Functioning of the European Union, and to appropriate EU Regulation of the European Parliament and of the Council on quality schemes for agricultural products and foodstuffs. Application to register the name(s) should be published in the Official Journal of the European Union.

[10] https://www.italianmade.com/usa/pdo-pgi/

In case of producer organizations' decision to pursue this kind of certification, we present here the representation of one selected product by PO „Bivalvia“. This way, producer organizations can get a glimpse and understanding of the whole process and its final presentation. If successfully applied and approved, the products become origin-protected and registered across the EU, at the eAmbrosia[11] legal register of the names of agricultural products and foodstuffs, besides other products.

For other PRIZEFISH products, only the stock (mullets, shrimp) which would be hypothetically caught in a specific and distinct geographical area (eg. within 7 km of the Istrian coast or similar) may be considered as a basis of the products to be registered as PDO or PGI.

Hypothetical name of the PRIZEFISH sea clam product would be: *Vongole del Veneto*

Vongole del Veneto

Country authorities

✉ Ministero delle Politiche Agricole Alimentari e Forestali

Via XX Settembre, 20
00187 Roma
Italy
+39 06 46655104

Country/ies of origin		Type	
Italy		Protected Designation of Origin (PDO)	
Priority date	**File number**	**Product type**	**Basis of protection**
XX/XX/XXXX	*PDO-HR-XXXXX*	Food	EU register
Status		**Product category**	

[11] https://ec.europa.eu/info/food-farming-fisheries/food-safety-and-quality/certification/quality-labels/geographical-indications-register/

Applied OR *Registered*

Class 1.7. Fresh fish, molluscs, and crustaceans and products derived there from

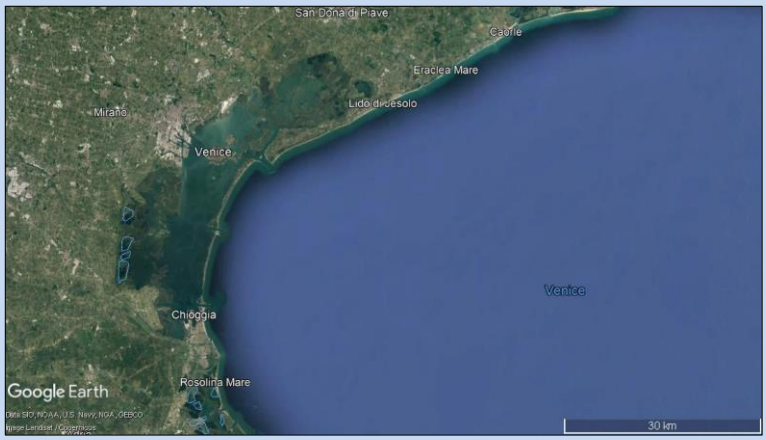
Legal instrument of protection at EU level

Official Journal X XXX, XX.XX.XXXX

Publications

Official Journal X XXX, XX.XX.XXXX

Map of the geographical area



NUTS code

ITH - Northeast Italy, ITH3 - Veneto

Products class

CLASSIFICATION SYSTEM	DESCRIPTION
HS/CN	0307 - Molluscs, fit for human consumption, even smoked, whether in shell or not, live, fresh, chilled, frozen, dried, salted or in brine;

flours, meals and pellets of molluscs, fit for human consumption

Product description

Vongole del Veneto is a moderatly large bivalve that grows up to 4 cm. The shell is thick and broadly triangular in shape with numerous fine concentric ridges. The umbones are conspicuous with the contour of the shell sloping steeply on one side of the umbone and concave on the other. The shell is off-white or cream in colour and often tinted pale yellow. There may be numerous, very fine chestnut or pinkish streaks. There are typically three broad bands of deep chestnut or reddish-brown radiating from the umbones. The coating of the shell (periostracum) is thin (Carter, 2008).

Taxonomically, *Vongole del Veneto* belongs to the species of Striped venus clam *Chamelea gallina* (Linnaeus, 1758).

Definition of the geographical area

The geographical area in which all production phases of *Vongole del Veneto* take place encompasses the waters of Veneto region that belong to the Italian Republic. The target species is harvested with hydraulic dredges in inshore shallow waters by fishing operators in the Veneto region, managed through the consortia of Venezia and Chioggia.

The vast stretch of sea involved in fishing is divided into 19 areas/lots, where the mollusc collection areas are granted with variable duration and rotation, with parts temporarily closed for use. With this type of management, the resource natural growth time is allowed and the entire marine habitat has optimal biological recovery. In addition, if necessary, operations to restock schools of juveniles are carried out, collecting molluscs from areas with a high density of specimens and then redistributing them to less populated areas, for the stock enhancement.

Causal link between the product and its origin

The flow of minerals from the mainland rivers; powerful sea currents; ancient flavors and traditions of the territory; all these factors combine to produce the high quality and specific, recognisable organoleptic characteristics of *Vongole del Veneto*.

**Applicants (in this case producer organizations/groups) decide themselves how they will lay down the product's specifications and link to the geographical area. This is just one example of key information provided for a hypothetical registered product with geographical indication.*

4.1.1. Rules of the ARFM trademark use

From the results of the analysis of the D5.2.1. *Consumer analysis report*, it can be concluded that the customers highly rank the aspect of *the origin of the product*. Thus, we extracted ground rules for the use of the "Adriatic Responsible Fisheries Management" (hereinafter: "ARFM" label), with compliance attestation and supervision for the product with specification.

Subject of the Rules

Article 1

This Ordinance prescribes:

- procedure for submitting and resolving requests;
- the content of the Request for recognition of the "ARFM" label (hereinafter: The Request);
- content of the Product Specification (hereinafter: The Specification);
- the procedure for confirming compliance with the Specification - acquisition and revocation of the right to use the mark;
- content of the Certificate of Compliance of the Product with the Specification (hereinafter: Certificate of Compliance);
- the content of the request for extension of the powers of the control bodies and the obligations of the authorized control bodies;
- appearance and manner of using the ARFM sign;
- keeping records of users of the ARFM sign.

Article 2

The "ARFM" mark is a graphic mark intended to mark fishery products with special characteristics in the sectors of catching and processing marine fish, bivalve molluscs, crustaceans and cephalopods produced in accordance with the Product Specifications for which the "ARFM" mark is recognized.

Article 3

Certificate of Compliance

The mark is registered as a guarantee trademark with the State Intellectual Property Office for the Republic of Croatia and the Italian Patents and Trademarks Office (Ufficio Italiano Brevetti e Marchi) for the Italian Republic.

The specification is a document that defines the special characteristics of the product and is an integral part of the Application for recognition of the mark from the national quality system.

The "ARFM" label is intended to encourage the development of product quality and production technologies and their promotion on the market. The mark guarantees a higher level of quality than that established by law, and a higher level of quality must be measurable.

Article 4

Notification procedure

This Ordinance is adopted having regard to the notification procedure under Directive (EU) 2015/1535 of the European Parliament and of the Council of 9 September 2015 laying down a procedure for the provision of information in the field of technical regulations and rules on information society services (OJ L 241/1, September 17, 2015).

Procedure for recognizing the label ARFM

Article 5

Applicant for recognition of the "ARFM" label

(1) The candidate for the recognition of the designation "ARFM" (hereinafter: The Applicant) for a product may be a producer or group of producers representing producers and processors of fishery products.

Article 6

Request for recognition of the "ARFM" label

(1) The request shall be submitted to the Technical Council/Management Board on the form set out in Annex III*, which is an integral part of this Ordinance and is accompanied by:

- specification / technical documentation with detailed product description and production process;
- copies of other certificates if any (ISO certificates, etc.);
- a brief description of the applicant's activities, history and other information;
- confirmation of payment of the costs of resolving the request.

Article 7

Product specification

1. The specification must contain:
    a. the sector and type of fishery products for which recognition of the "ARFM" label is sought;
    b. a description of the production process;
    c. specific characteristics of the product based on objective, measurable and other criteria which include:
        i. product composition
        ii. method of production of the main ingredient
        iii. the quality of the main ingredient
        iv. animal welfare
        v. length of transport
        vi. processing speed of the main ingredient
        vii. treatment during storage and transport
        viii. the origin of the main ingredient

ix. environmental protection;

d. a description of the traceability system throughout the production and/or processing of the product.

Compliance attestation and supervision

Article 8

Confirmation of compliance

(1) The procedure for confirming the compliance of a product with the Specification is carried out by an authorized control body according to the Control Plan for a specific Specification.

Article 9

1. The Certificate of Compliance shall contain the following information:
    a. name of the authorized control body
    b. ordinal number of the Certificate of Compliance
    c. name and address of the food business operator who is label user
    d. production facility address
    e. the type of product for which conformity has been confirmed
    f. the quantity of the product for which conformity has been confirmed
    g. date of issue and period of validity of the Certificate of Compliance
    h. signature of the responsible person
2. The Annex* to the Certificate of Compliance shall contain information on batches (lots) and quantities of products where applicable.

Article 10

Revocation of the Certificate of Compliance of the product with the Specification

In the event that deviations from the requirements of the Specification, Control Plan or content of the issued Certificate of Compliance are found during the official controls, the person authorized to perform official controls shall notify the authorized control body, which shall consider the identified deviations and initiate the narrowing procedure in the part relating to the

batch of the product to which the product belongs which has been found to deviate or withdraw in its entirety the Certificate of Compliance.

Article 11

Obligations of the authorized control body

The authorized control body has the following obligations:

- keep a list of users of the mark and all entities participating in the product production chain and data on product quantities that comply with the Specification;
- keep records of issued and annulled Certificate of Compliance;
- submit semi-annual reports on performed controls.

Article 12

Manner of keeping records of users of the "ARFM" label

(1) The Management Board / authorized body shall keep records of users of the "ARFM" label in electronic form and publish it on its website.

(2) The name and address of the food business operator that is the user of the label, the type of product bearing the label and the date of issue and the period of validity of the Certificate of Compliance shall be entered in the records referred to in paragraph 1 of this *Article*.

The ARFM sign

Article 13

The appearance of the sign

(1) The "ARFM" sign consists of: [*insert here*]

(2) The background of the "ARFM" sign consists of: [*insert here*]

(3) The sign referred to in paragraph 2 of this *Article* is shown in Annex I*, which is an integral part of this Ordinance.

Article 14

Right acquisition to use the mark

The right to use the mark is acquired by a contract on the right to use the mark concluded by the Authorized Body as the holder of the mark and the legal/natural person as the user of the mark, for a period of two years. By signing the contract on the right to use the mark, the user assumes all rights and obligations arising from this rulebook.

**The Annexes are not an integral part of the set of the Rules presented here.*

4.2. PACKAGING GUIDELINES

In terms of rules for hygiene and safety procedures related to products' processing and packaging - these were already outlined in D4.3.2. *Report on Standards'qualification* (legal requirements), and guidelines of the D4.4.2. *Certification scheme for new innovative products and processes* (fishing vessels and production facilities protocols and requirements). The summary and recommendations for selected PRIZEFISH products will be presented in the sub-chapter *Production and Operational Efficiency Standard* of this deliverable. In the present chapter 4.2, we will look at specific packaging guidelines for the three targeted products in regard to quality preservation and environmental impact (waste production and carbon footprint).

4.2.1. Quality preservation

As already presented in the D4.4.2, seafood and fish are highly perishable food items, so packaging should in the first-place preserve the quality and freshness of such products. At the same time, it has to withstand humid and cold conditions, be compatible for storage and distribution and preferably sustainable. The design and quality of the packaging may itself prolong the shelf lives of the targeted products, which is recognized as an innovative goal of the PRIZEFISH WP4.

To avoid spoilage possibilities and quality reduction of the products sensitive to temperature fluctuations, it is necessary to look at all features of packaging.

Product	Packaging features
Sardine fillets	• MAP packs, plastic container sealed with plastic foil • *shelf-life extension*
Sea burgers	• plastic film (skin packaging), plastic tray • *shelf-life extension*
Sea clams	• plastic tray, vaccum-skin packaging • *shelf-life extension*

The **MAP packs**' use in the EU is governed by regulations connected to HACCP (Hazard Analysis and Critical Control Point) implementation at the processing units, with traceability requirements of the European Regulation on "principles and requirements of food law" (Regulation No 178/2002) and MAP gasses requirements of the European Directive on "food additives other than colours and sweeteners" (Directive No 95/2/EC). Critical points in Modified Atmosphere Packaging quality control for the processors are:

- ensuring correct gas mixture and prevention of package leaking;
- setting up critical control points regarding both the gas content and the seal integrity;
- ensuring that the packaging process is always under control.

To avoid manual testing and substantial amount of waste and hours spent on quality control system, quality assurance methods is highly recommended, using on-line gas analyser for a continuous monitoring of the gas mixture and residual oxygen in a non-destructive way.

Skin packaging is actually derived from **vacuum packaging**, as a relatively newer technique. Studies showed that the skin packaging may improve quality of fresh seafood, by prolonging shelf-life and improving the stability of products concerned. This kind of innovation in packaging protects raw food from surface drying and external atmosphere. The tight adherence of the plastic film to the product in the plastic tray has also the ability to improve all sensorial aspects, such as odor and color.

Besides physical characteristics, important aspect of microbiological and chemical parameters are taken into account, such as inhibition of microbial growth and protein and lipid oxidation prevention. It has been already mentioned in past technical deliverables by the POs that the substrate where there is less exposed surface of the fish and crustacean meat to air - there is less exposure to oxidative reactions and microbial growth, and as a result prevention of food spoilage.

4.2.2. Environmental impact

Packaging is a very important component of any product, not only in terms of quality and protection, but also its overall environmental impact. Thus, it is necessary to assess the environmental footprint of the product packaging in order to make sustainability claims of products' sourcing and production. These are not strictly limited to waste and GHG emission analysis - assessments can also include disposability, littering and other environmental considerations.

The best solution for packaging optimization is the ***minimization of packaging*** - it simply reduces overall costs and use of material and other resources. Nevertheless, for extremely perishable commodities prone to spoilage such as the seafood - product stability should be of essential concern. Switching to materials, systems and processes for sustainable packaging performances may inadvertently lead to undesired outcomes of having higher carbon footprints or compromised food security.

Optimizing transportation in relation to packaging reduces the product's environmental footprint, and proposed solution would be the *square packaging* as it is mostly space efficient.

Use of ***recyclable materials*** is in case of seafood often reduced to secondary packaging made of cardboard (eg. PPB code 23) or primary for plastic trays where the food is layed (eg. polypropylene - resin identification code 5 or PET - resin identification code 1). When choosing materials that can be recycled, for instance cardboard, producers should always have in mind that customers' demand for sustainable solutions is only gaining momentum and if possible, should strive for materials with sustainable claims (at least FSC certified Mix paper/cardboard-based packaging).

Although ***biodegradable and edible packaging materials*** (such as starch, cellulose, chitosan, poly(lactic acid) (PLA), polycaprolactone (PCL), and polyhydroxybutyrate (PHB)) are considered as the future of food packaging trends, they are still in the research stage. Further testing and development is needed before this type of films and coatings become commercially available. Future predictions also announce wider use of packaging derived from renewable sources.

When it comes to specific issues of ***plastic use*** in seafood packaging, less is not more. Using monoplastic (and thin) layers (such as Low-Density Polyethylene (LDPE) or cellophane) is not recommended as it often causes oxidation and/or leaking, ultimately leading to contamination and wastage. Contrarily, multi-layer plastic barrier offers resistance to atmospheric and moisture influence. It ultimately comes to protecting food security, extending product's shelf-life and minimizing waste.

As all three selected PRIZEFISH products use plastics as their packaging: *MAP*, *skin packaging* and *vaccum-skin packaging*, it is only applicable to apply developmental novelties in technology of such packaging. There are packaging solutions which can keep the high levels of recyclability and lower levels of material usage.

Performance evaluation

Product	Packaging features	Performance improvements
Sardine fillets 	**MAP** plastic container sealed with plastic foil (PP - polypropilene)	- As the use of MAP is identified as optimal for the type of seafood product in question, improvements of its sustainability category could be achieved through use of polyolefin-based film or other type of composite materials (for eg. from the brands like *FlexiClose(re)* or *CRYOVAC*). This results in usage of less plastic (up to 25%) and recycled or highly recyclable PET.

Sea burgers 	**skin packaging** plastic film and plastic tray	- Due to product's characteristics and benefits of the skin packaging, improvements should be in place likewise for MAP, but also in terms of using high-grade recyclate and high-barrier films, and reducing the thickness of the tray while not jeopardizing integrity of the product.
Sea clams 	**vaccum-skin packaging** plastic tray with plastic film	- The previous improvement statement may apply to the film of this type of skin packaging too. In addition, recycled content shoud be used as polymers of the tray, while also applying reduced packaging weight if possible.

A lifecycle view of products and their whole supply chains are necessary to properly determine the environmental impact of the product's packaging. Detrimental analysis of all processes in LCA is needed in order to fully understand this impact and how carbon footprint and waste management should be handled. Extending product's shelf-life and food quality and security is not separated from sustainability performance of packaging but is its integral part.

4.3. ECO-LABELLING

Based on ISO Guide 2 (15.1.2) and Principles for Food Import and Export Certification and Inspection (CAC/GL 20), **certification** is defined as a *procedure by which a third party gives written or equivalent assurance that a product, process or service conforms to specified requirements*. It is subjected to continuous inspection in the production chain and later on to regular audits, in order to check if the activities in question comply with the overall set objectives.

Agnew (2019) states that in the fisheries field - certification is *a market-based mechanism seeking to reward sustainable fisheries by allowing retailers to sell fish distinguished by an eco-label*. On the contrary, Willmann et al. (2008) point out that although product certification and environmental labelling are inter-connected and related tools in fisheries' sustainability

verification, they exhibit important differences. **Certification does not necessarily lead to product labelling**. These authors also suggest that certification is mostly directed towards governmental authorities as a measure for legal harvesting and trading operations.

If certification comes with a label for conveying information - it can affect consumers choices. Third-party ecolabelling schemes entitle certain fishery products which are in compliance with standards to bear a distinctive logo, thus giving purchasers an option to buy a product from a sustainable source. Eco-labels can be found on retail packaging, supermarket deli counters or restaurant menus.

Finally, certification schemes may operate at business-to-business (B2B) level - supermarket, wholesaler or processing business is the intended final recipient of the information, in which case they can use certified seal. As previously mentioned, eco-label seal is not the same as certified seal but at business-to-consumers (B2C) level can be used as an advantage.

Using ARFM eco-label

As a novel certification label entering the market, ARFM seal should be distinctive but recognizable in order to compete with already existing labels. As already mentioned in D4.4.2, a label is a statement which certifies that the Adriatic seafood has been harvested in compliance with certification standards. The logo is intended to make provision for informed decisions of buyers who wish to promote or stimulate sustainable and responsibly managed fishery production.

The elements which certification mark/logo visually represents should include geographical origin and sustainability indication, but also be visually appealing to customers. The logo designs produced only as hypothetical pilot models for future accreditation are presented in Figure 5.

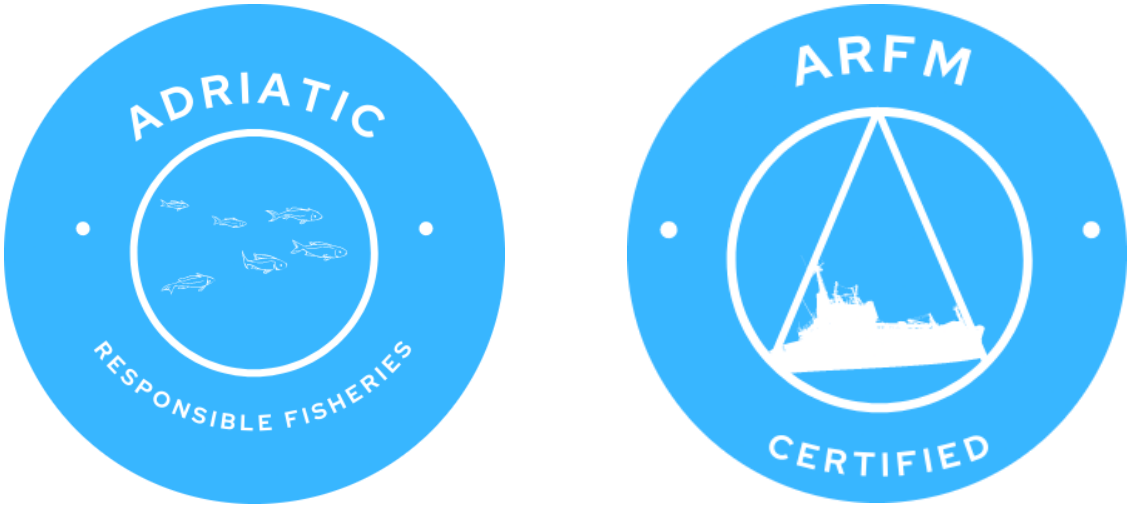


Figure 5. Two examples of a hypothetical ARFM logo

Besides elements such as the *name* of the certification scheme ("Adriatic Responsible Fisheries Management") or an *acronym* ("ARFM"), certification marks can also include: *website address*, *TM* letters (for trademark) etc.

Customers are usually attracted by the logo and its design, so the meaning of the text and symbols used should accurately represent the meaning behind it. In this case, we would like consumers to know that we are *promoting certified products coming from sustainable fisheries and processing plants with responsible practices, dedicated to respecting the Adriatic Sea*.

Besides the eco-label, product labelling on packaging must contain the ***Chain of Custody (CoC) code*** (eg. ARFM-C-xxxxx), that refers to the producer. The code will be provided by a certifier or supplier. It has to be properly displayed on the product and readable.

The ARFM Certification Claims[12]

Each company that takes ownership of the seafood products from the ARFM certified fisheries and would like to use certification claims and/or logo, needs to especially adhere to the Chain of Custody Standard. In addition, labelling guidelines should be set by the certification body for the

[12] A sustainability claim is a message used to promote a product with reference to three pillars of sustainability.

proper usage of the logo. If the logo licensing fees are charged, then the CB also sets the rules of the license agreement.

The objective of the CoC certification is to provide an assurance to a labeled claim on a seafood product or on marketing materials, based on standards not just behind the CoC itself, but all standards that are integral part of the voluntary ARFM certification scheme.

Besides the already mentioned logo and eco-labels above, which are the most recognizable forms of sustainability claims, in wide use are ***text claims***, which can be placed inside or alongside the logo. Text claim within logo is given in the example of Figure 5.

Claims can be made on products, off product (eg. promotional poster), on site, online (web page) etc. It is very important to follow the context and to create a truthful impression, in order to avoid misperceptions over claims.

Percentage-based claims are important to consider for the products that are not made from a single ingredient or where the source of the same ingredient (eg. fish meat) differs. This would be the case with the PRIZEFISH innovative product *sea burger*, as a multi-ingredient product. Here, minimum percentage considerations should be taken into account and set by the eco-labelling rules. If in this example, for instance - shrimp species used as the main ingredient is certified, and mullet species used in another percentage is not, then the claim can be qualified so that it reads for eg.: *The seafood ingredients in this product are sourced XX% from sustainable sources...*

It might be decided that all products and raw materials as constituents must be sourced from certified fisheries in order to use the ARFM certification claim. Or that at least 30-50% of the components are certified. This should be clearly stated.

Examples of possible ARFM text claims:

The Adriatic Responsible Fisheries™ seal ensures that a product comes from a vessel or production unit that meets comprehensive standards which respect the environment and take care of fishermen and other workers.

This product comes from a fishery that has been independently certified to the ARFM's standards for sustainable and responsibly managed fishing industry.

Sustainably and responsibly sourced.

This product has met the ARFM's standards for responsible practices and sustainability in Adriatic fishing industry.

Another example of the certification claim that would be made by a processing unit which accepts the certified raw material and then passes the ownership down to the next actor in supply chain could look like this:

We are certified to provide [insert raw material name] from ARFM certified sources.

At the supply chain stage, for example in a retail, assured claims can entitle following text:

This product comes from ARFM certified sources, which shows that the [insert product name] has been responsibly and sustainably produced.

<u>On-product and product related use</u>

Product-related claims represent a label or a statement printed or otherwise physically attached to a product or its packaging. This can be a label, a sticker, description etc. On the other hand, an off-product claim is referring to the product but is not physically attached to it or its packaging. A good example of the latter is an invoice or a product-specific advertising (eg. billboard). In reality, certification schemes will refer to more than one location of claims, so it is important to have different rules in place for each.

Display requirements for on-product labelling of the ARFM certified products should include:

- minimum size of the label

- location of claim (placement of logo should also be included)
- background colors and logo format
- distance from other claims/text
- examples of incorrect uses of logo

This shall also apply to uses other than on packaging, namely: restaurant menu use, fish counter, use of fish tags etc.

4.4. PRODUCT BRANDING

In order to sell value-added seafood products, such as the innovative products new to the market, food marketing is essential. Products that are at the same time labelled with a novel certification scheme might get drowned in the market overflowed with different seafood products (some of them carrying recognizable certification marks).

To start, it is of utmost importance to know the needs and attitudes of your customers. Within the deliverable D5.2.1 of the WP5, the customer analysis results have shown that Italian and Croatian respondents reacted to price signals and product quality as the major drivers for choosing product from the shelves. In the same analysis Spanish consumers showed greater preference for certified products. On the other hand, according to the Eurobarometer survey, the main reasons for buying fishery products in Italy were the appearance and freshness (63%) and the country of origin (56%) of the product. However, WP5 findings suggest that there is a possible increase in demand of the new products within mentioned markets, thus innovative chilled/fresh products with higher quality and shelf-life extension developed within the PRIZEFISH project should find their buyers.

One of the best approaches to successful branding and marketing plans for the new products in the market is the famous ***Four Ps*** approach.

1. **P**roduct - needs to meet customers' expectations for the things they care about. Think about your target groups (who is attracted to seafood, why do they eat it, is it because it is considered healthy, is it because it is rich in omega 3 and high in protein etc). Also

consider green consumers - how will your claims on sustainability satisfy this "though crowd", do they find consistency in your efforts for minimizing environmental impact and similar.

2. **P**rice - needs to reflect the product's value and level of quality. Always take into account your target customers' sensitivity to cost. Think about stores where your products will be sold (discount stores vs high-end market stores). Remember that there are consumers willing to pay higher prices of the certified products - caring for the environment, originating from a specific geographical location, and so on.

3. **P**romotion - product advertising. As your product is "fresh from the oven" you will need to grab consumers' attention so you can persuade them to choose your product. Think about its added value - what it is that you are selling, where you can purchase it, how it is different from other products, and why it is worth buying.

4. **P**lace - a strategic and very challenging part. Create a business model and try to identify future chain of events within the product distribution. Will your product be served at the restaurants? Are retail seafood markets your primary targets? A well-defined distribution strategy may give all the answers you will need.

A ***brand*** is anything that a company or an organisation uses to provide an identity for itself and that distinguishes its product from the competition. There are three important elements of a brand: name, logo and tagline.

A ***brand name*** is your brand's greatest form of identity. A good example of a brand name is given above in the description of the *Indication of origin* for the sea clams - *Vongole del Veneto*. As Italian buyers do care for the locally caught seafood, this kind of protected name indicates designation of origin and can create more public visibility for this product. Product benefits are clearly suggested if the Veneto area is already known for its fresh local seafood.

Brand names should also be distinctive, memorable and positive. Choose the words to enhance concepts tied to product's quality, freshness, sustainability, traceability, responsible sourcing.

A ***logo*** is a symbol or image that is unique to your product, as well as for the ARFM certification scheme in the example above. Here, the rule of simplicity applies - less is more. Use clever but

simple design to attract attention. Think about its usability, in terms of colors and surface areas of its application. Imagery always makes a greater impression than the words. Consider hiring or consulting a professional graphic designer to create your logo.

A ***tagline*** is a phrase that compliments logo and brand name. It is similar to a text claim in eco-labelling. It should provide additional information that differentiates your product from other similar products. For example, logo of the product *Vongole del Veneto* might focus on its appearance and freshness, while the tag line can talk more about the local origin, seasonal nature or certification characteristics of your product. Choose the wording wisely - inserting catch phrases, such as a simple word "Select" (eg. ***Select*** *Veneto seafood from the fishermen of the Adriatic...*) can express an image of a premium or quality product.

Creating materials that support marketing of your new products in the next important step. Take your time to specifically design product packaging that will bear your brand name, tag line and logo. Labelling your product on a packaging is related to branding. If you are advertising certified and sustainable products - create a strategy of designing packaging (shape, colors, size etc.) so that you fulfill all expectations of the product representation (including that packaging).

A good example of a seafood packaging that compliments the product brand is given in Figure 6.

Figure 6. Packaging example of the Chesil Smokery's Mackerel product (Source: *ateriet.com*)

The packaging is kept rather simple, but this kind of skin packaging does go well with less use of materials - paper wrapping (looks more *natural* and *sustainable*), but the color of the foil is golden and design is cleverly thought out so it gives it a modern look.

Another example that can be used as a guiding idea for the three piloted PRIZEFISH innovative products is shown below, in Figure 7.

(a) (b)

Figure 7. Packaging solutions for Kefalonia (a) and The Saucy Fish Co (b) products (Source: *ateriet.com*)

From the looks of the packaging shown in Figure 7b, it can be inferred that it is made for a product placed into a plastic tray skin or vacuum-skin packed and wrapped in plastic (with a sauce intelligently attached onto it). On the left side (Figure 7a) a photo shows different kinds of primary packaging, but the design on the label reveals a clever idea of designing secondary packaging. It actually depicts the image of the cooked fish with seasoning, ready-to-eat. This is in contrast with the fresh fish offered as a product, which gives customers a glimpse of a nicely thought-out serving suggestion.

As a conclusion, besides the classic go-to approach for the MAP, skin or vacuum-skin products' secondary packaging - a cardbox, there are other concept opportunities which can be seized. A clean and modern look, minimalistic design, smart and creative elements, coupled with unique typography, will attract consumers' attention and add to the message you want to convey to them. Aesthetics of seafood packaging can have a powerful effect in the retail environment, differentiating your brand from the others.

5. CERTIFICATION FRAMEWORK

"Adriatic Responsible Fisheries Management" (hereinafter: "ARFM") is a system intended for certifying fishery products with special characteristics in sectors of catching and processing of wild caught sea fish, shellfish, crustaceans and cephalopods, which are produced in accordance with the Specifications.

The Applicant for recognition of the "ARFM" mark (hereinafter: the Applicant) for a particular product may be a producer or a group of producers representing producers and processors of fishery products.

The request shall be submitted to the Technical Council/Management Board on the form set out in Annex *XX**, which is an integral part of this Ordinance and is accompanied by:

- Specification/technical documentation with detailed product description and production process;

- Copies of other certificates if any (ISO certificates, etc.);

- A brief description of the Applicant's activities, history and other information;

- Confirmation of payment of the costs for resolving the request.

**Annexes and other accompanying documentation will not be presented here, as they are to be developed by the Certification Body.*

5.1. SCHEME RULES

The Specification must contain:

a) the sector and type of fishery products for which recognition of the "ARFM" label is sought;

b) a description of the production process;

c) specific characteristics of the product based on objective, measurable and other criteria which include:

- product composition

- method of production of the main ingredient

- the quality of the main ingredient

- animal welfare

- animal nutrition

- length of transport

- processing speed of the main ingredient

- treatment during storage and transport

- the origin of the main ingredient

- environmental protection;

d) a description of the traceability system throughout the production and processing of the product.

Confirmation of conformity

The procedure of confirming the conformity of the product with the Specification is carried out by the authorized Control Body according to the Control Plan for a specific Specification.

The certificate of conformity contains the following information:

- name of the authorized control body

- ordinal number of the Certificate of Conformity

- name and address of the food business operator who is the user of the mark

- address of the location of the production facility

- the type of product for which conformity has been confirmed

- the quantity of the product for which conformity has been confirmed

- date of issue and period of validity of the Certificate of Conformity

- signature of the responsible person

The certificate of conformity shall contain information on batches (lots) and quantities of products where applicable.

In the event that deviations from the requirements of the Specification, Control Plan or the content of the issued Certificate of Conformity are found during the official controls, the person authorized to perform official controls shall notify the authorized Control Body, which shall consider the identified deviations and initiate the narrowing procedure in the part relating to the batch of the product to which the product belongs, which has been found to deviate or withdraw in its entirety the Certificate of Conformity.

Obligations of the authorized Control Body

- keeps a list of users of the mark and all entities participating in the product supply chain and data on product quantities that comply with the Specification;

- keeps records of issued and annulled Certificates of Conformity;

- submits semi-annual reports on performed controls.

Method of keeping records of users of the "Adriatic responsible" label

(1) The Management Board/Authorized Body shall keep records of users of the "ARFM" mark in electronic form and publish it on its website;

(2) The name and address of the food business operator that is the user of the label, the type of product bearing the label and the date of issue and the period of validity of the Certificate of Conformity shall be entered in the records referred to in paragraph 1 of this Article.

6. TRACEABILITY AND CHAIN OF CUSTODY GUIDELINES FOR THE ARFM PRODUCTS

6.1. CHAIN OF CUSTODY OF THE INNOVATIVE PRODUCTS

In this sub-chapter we will perform an assessment of the hypothetical chain of custody events in the case of three eco-innovative fishery products: *sardine fillets* from Croatian PO "Omega3", *sea burgers* from Croatian PO "Istra" and *sea clams with tomato sauce* from Italian PO "Bivalvia". These products were differentiated from the assortment of mentioned fishing cooperatives for selected target species (European pilchard, Striped venus clam, Flathead grey mullet and Deep-water rose shrimp) during the development of the deliverables D3.2.1. and D3.2.2.

The presented full product traceability and CoC system will be based on three individual cases of probable supply chains. The selected products for this study are fresh sardine fillets, fresh/frozen shrimp and mullet burger and fresh clams (with tomato sauce). The whole chains of these products will be analyzed in regard to CoC certification, from the harvester to the final customer level. Through these examples we will show how all steps in product life should be properly recorded and controlled, while assuming that the products will carry the label of the ARFM. For all ARFM certified products we demonstrated cases of domestic market supply chains. In two cases, our hypothetical supply chains end with the retailer stage - unlike one case where we opted for a shorter domestic supply chain that includes a mobile fish shop sale of prepared products to the end consumer.

As it was mentioned in the deliverable D4.4.1. - the CoC models are not exclusive, meaning that different models can be used at different stages of certified production. For example, we can use the identity preservation model at the start of the product's life and then switch to the segregation model through later stages of the supply chain.

Products flow through the chain from hands to hands of various actors. The documented track records need to show each purchase, sale and physical handling of certified species. This serves as another measure for identification from point of sale back to supplier and for differentiation

between certified and non-certified seafood. Specifically, the receipts and sale invoices of suppliers should include the acronym "ARFM" and the CoC code for identifying certified seafood.

The certification audits represent an important part of the CoC program. The audits should take place at all premises of a certified company where it handles all species certified by the ARFM. The company can have its own on-site check prior to the certification body conducting an official audit, in order to try to prevent any non-conformities. The auditor looks into the audit plan, scope of the certificate, company's and subcontractor's eligibility etc. It is worth mentioning that the staff employed by a certificate holding company needs to be trained to understand their role in maintaining certified product integrity and to be prepared and competent for the CoC audits.

Fully elaborated requirements and indicators of the ARFM CoC Standard can be found in the deliverable D4.4.2. *Certification scheme for new innovative products and processes*.

SARDINE FILLETS

Fisher/On the vessel

- "Omega3" PO's purse-seiners need to be certified suppliers of harvested fish.
- The catch is transferred directly from the net to thermocouples with chilled seawater. On board, vessels use the electronic system as a catch database and logbook - *e-Register* ("e-očevidnik") which collects information on date of catch, species name, fishing method, catch effort, discard and more. The catch is not separated on-board, but at Omega3's processing plant.
- A modern GPS system is used from leaving the harbour up to landing, with maps and zones and sub-zones entered into electronic register. All collected information is saved on the server.

Landing

- Upon first landing, the information collected from the vessels should be associated with the certified catch and should include compliance data such as: vessel identity, catch location, species name, fishing method, date and time etc. These data are transferred via identifier which also helps in targeting the vessel with hydraulic pumps which harvested the specific catch.
- Invoices, receipts, bill of lading or other documentation has to explicitly state identification of certified status of the sardines.

Processor

- The catch arrives chilled in the processing factory in Šopot. In the facility, the catch is sorted or frozen and subsequently sorted by species. A batch of sardines has been identified as certified and separated from other catches.
- The production line of these products shall be physically or temporally separated from other products. During processing, justifiable conversion rates shall be calculated.
- After weighing (accompanied by a unique LOT number with contained catch data) and preparation (including filleting), sardines are MAP packed and ready for distribution.

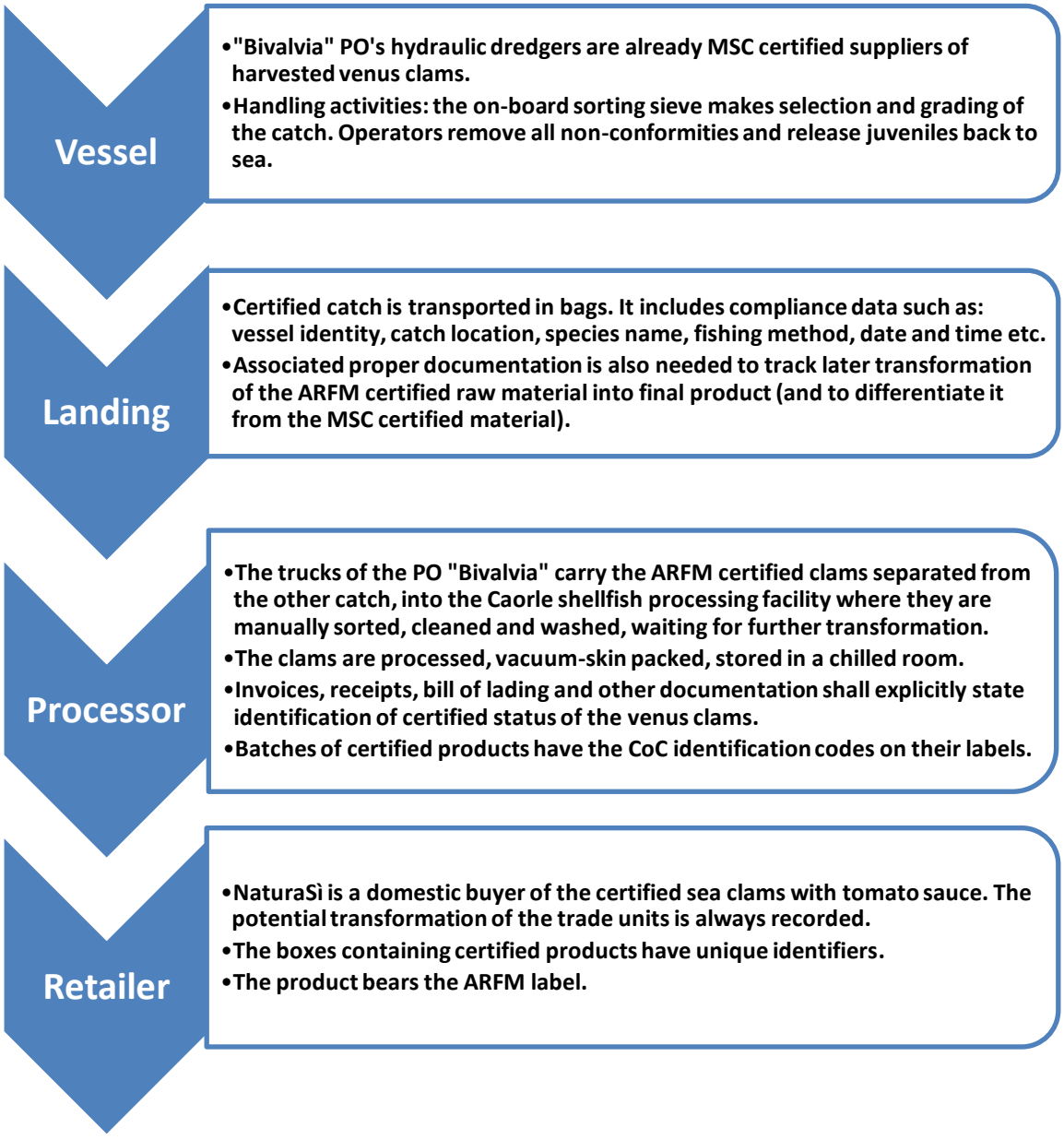
Distribution

- Fresh raw material is getting distributed by the Omega3's refrigerated trucks with records kept of the volumes of certified inputs.
- At this point, the products retain their properties, and are associated with production documentation clearly indicating their certification status.

Retailer

- Packaged sardines sold as final products to a domestic customer shall be associated with proper documentation from the upstream chain, stating line items as certified on a related sales invoice.
- Final product may have a claim on the pack, in form of a label (ex. ARFM label) to claim that it comes from a sustainable and/or responsible fishery production.

SEA CLAMS WITH TOMATO SAUCE



SEA BURGERS

Vessel 	**- Certified "Istra" PO's seiners catch the mullets with PO's own vessels, while frozen shrimps are sold to them by the S.I.C. doo company which buys certified shrimps from the ARFM-certified Dalmatian trawlers.** **- The catch on PO's seiners is separated on-board, and mullets are inserted into the cassettes, covered with a layer of ice.**
Landing 	**- Preliminary weighing and sorting are performed at the unloading point, with associated transport documentation (date, source, destination, volume etc).** **- The transporter receives the transport documentation (paper-based or electronic) with LOT number from the fishermen.** **- Transport of mullets to the production plant is done by PO's refrigerated trucks.**
Processor 	**- Production plant Labinci receives the catch of mullets which is stored in a chilled room before meat separation.** **- The catch is sorted and weighed at production unit according to species and quantities. At the same time, frozen shrimps (which were not mixed or substituted with non-certified items) are being de-frosted, rinsed and ready for processing.** **- Before processing raw material (cleaning, filleting, grinding...) the unique LOT number is added to certified catch.** **- After grinding, mixing and shape formation, the burgers are packaged with with lot identification lasting on the new packaging.**
Mobile Fish Shop 	**- Ready products (with LOT identifiers) are taken by the customer's vehicle and sold locally to a mobile fish shop.** **- Products bear the ARFM label which is visible in front of the product at the window display.**

These were the examples of the shorter supply chains for selected three products. However, they could have included secondary processors, who might sell the certified products to a wholesaler, who then wishes to sell them on a foreign market, maybe to a large retailer and so on. Seafood could have traveled a longer route to reach the market destination. All of this would make the chains more complex and create more critical points for traceability. With shorter chains and avoidance of certain mid-chain players (eg. second processors), producer organizations have more quality and inventory control and are protected from price volatility.

The highest risks for mixing/substitution of non-certified and certified products within supply chains can happen during landing and processing. Not having auctions for sale at ports minimizes the traceability risks at the landing stage, but at the same time port state authorities can use this point to verify information claims made by the traceability system.

The consumer ready products - sardine fillets, sea clams and sea burgers packed for the final consumer and put on the market, if certified by the ARFM CoC Standard, may bear the ARFM label confirming that they really are products of designated origin coming from the certified sources.

6.2. BLOCKCHAIN TECHNOLOGY USE IN PRODUCTS' TRACEABILITY

Although Croatia and Italy do implement modern electronic catch documentation and traceability systems in fisheries supply chains, there are emerging technologies that can enhance fisheries management and blue growth. One of the most prominent is the so-called "blockchain" technology, which is already revolutionizing the way in which data is managed and recorded at a more decentralized level. Other solutions include computing cloud and AI.

These key-enabling technologies were already introduced previously in D4.4.1. *Guidelines for traceability implementation on new products* and D3.3.1. *Report on the standardized approach in the pre-assessment process in Italy and Croatia*, as recommendations for future use in improving product traceability, since the moment of landing. For instance, suggestions included use of *TraSiPesc* (cloud-computing based traceability information system for fisheries) and *BIG EYE Smart Fishing* (Plate-to-Sea Fish Tracking, with fraud-free validation through Artificial Intelligence and Blockchain).

Although some of the systems (boat hardware: GPS devices, video monitors...) might be too costly for small-scale fishermen, 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. One such suggestion for small business units or artisanal fisheries of for instance Albania or Montenegro,

could be simple mobile messaging to the next actor in the supply chain, as the first level of identification of the seafood which is immediately transferred to the processing industry or distribution. All subsequent movements of that fish could be, in addition, recorded on a common platform based on the blockchain and contribute to enriching the wealth of information.

Fishers can install a small transponder in their fishing boats, which sends a signal to the gateway and to the platform about their whereabouts. Together with some forms of data exchange (for example, radio frequency cards), they form the link for the catch documentation traceability. Target cards or tags with stored information from the transponders can be associated with the catch, and their location is registered via tablet or phone at any time (through radio frequencies to the cloud). Fishers may also receive messages, for instance about sudden weather changes, which improves their safety and wellbeing at sea.

In the Republic of Croatia in use is a mobile application for the delivery of catch data where all catches are sold through a system of buyers that is in an electronic form.

Building company's own data-sharing ecosystem

One company's whole supply chain can be covered by its own data-sharing ecosystem. IBM has recently activated ***Transparent Supply*** - a blockchain platform solution that allows real-time visibility on flow of goods from origin to buyer, and that started to become the largest blockchain network for the seafood industry. It is a cloud-based open platform that allows industries to take basic components and customize them to suit their business needs.

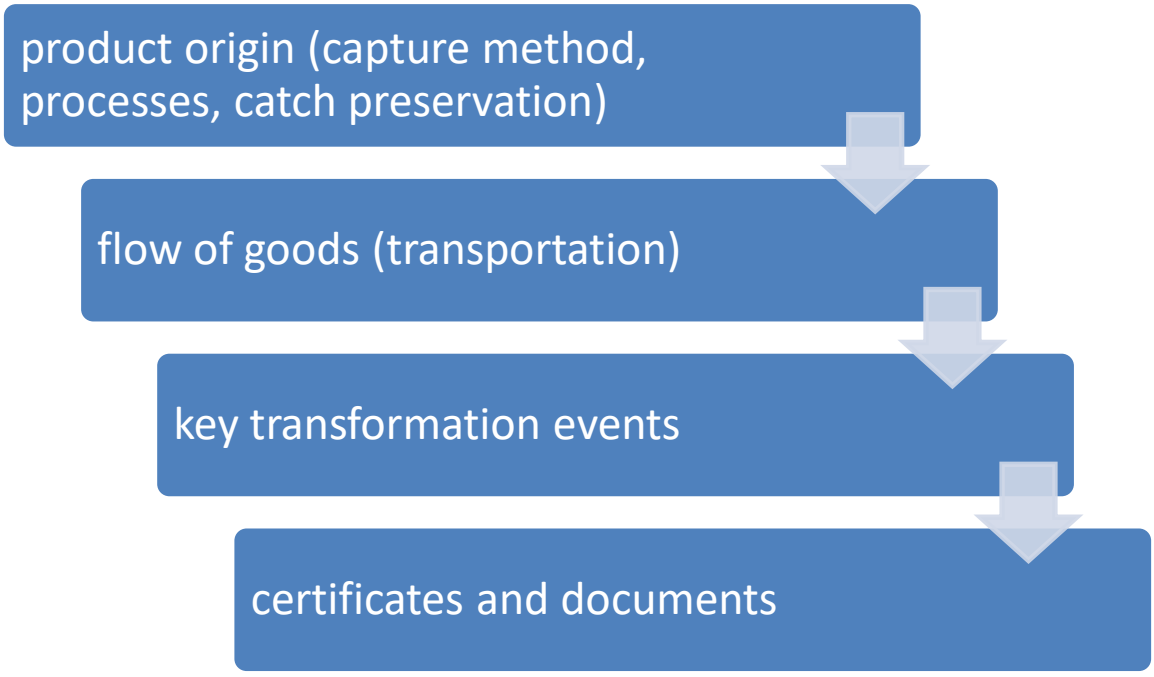
One of the benefits of uploading data to these networks is governance of data (ownership and access control) and the possibility of only sharing the encrypted data with the actors in the supply chain. Also, consumers are able to have a direct connection with the fishers who caught the seafood that is on their plates.

It is possible to use this technology within and between organizations, to optimize the flow between them and the total flow within the supply chain, with the aim to reduce inventory at various levels. Documentation actually flows with the product throughout the chain, along with financial transactions.

IBM Blockchain technology, based upon The Linux Foundation's Hyperledger Fabric, creates a permanent record of every entry into its ledger. By distributing the record-keeping functions of the ledger across several actors, no individual has complete control over the data, which assures its trustability[13].

Ultimately, the main aim of any blockchain technology is to exchange information safely and in a very short time. This technology is based on a shared register among all the subjects participating in the network in which the information is stored. All information, recorded as a block and linked to previous information, is certified - as foreseen by the "blockchain" system - and cannot be modified. A system like this is considered as an asset capable of attracting visibility and investments and, at the same time, as an element of driving and development of the local economy.

The Blockchain Process



[13] https://www.ibm.com/blogs/blockchain/category/blockchain-in-food-safety/food-supply-chain/

Data is sourced from the core production systems as automated. IBM uses Global Standard 1 (GS1) for ID structure which allows interoperability within the Seafood Trust Network. The *Trace module* enables end-to-end supply chain visibility.

From the SMS and radio-frequency identification codes on-board vessels, through the NFC devices (near field communication devices) at processing plants, up to the QR codes on mobile apps of consumers - packaging can reveal product's journey from "bait to plate".

7. SUSTAINABLE AND RESPONSIBLE PRACTICES IN PRODUCTION AND SALES

The Operational Efficiency requirements, as well as Quality Assurance recommendations, Food Safety and Sanitary procedures and guidelines for Human rights and working conditions, were covered in deliverable D4.4.2. *Certification scheme for new innovative products and processes*.

In the present chapter we will break down all customized criteria and principles, perform a synthesis of the certification process and prepare a pre-assessment checklist.

Outline of the ARFM certification process was produced in the deliverable D3.3.1: *Report on the standardized approach in the pre-assessment process in Italy and Croatia*, providing a summary of each step of the certification process and evaluation criteria for the fisheries pre-assessment, which covered the supply part of the chain. Having in mind that the Chain of Custody Standard criteria and indicators will be incorporated into the scheme (covering all steps from landing to final sale) along with Processors' Standard, these will become integrated with the Fisheries Standard into a conceptual procedural framework. If and when the ARFM certification program is formally registered, a Certification Body will be established and will decide on implementation of detailed procedures and performance indicators of the mandatory and recommended (self-selected) criteria within all standards.

As described in the mentioned deliverable D3.3.1, the goal of the pre-assessments is not to certify fishery of producing organization facilities under evaluation, but to present clear indications of the certification process potentiality.

Synthesis of the certification process

The Adriatic Responsible Fisheries Management is split into two constituent parts which basically work together to promote responsible fishing and sustainable practices - the Fisheries Standard and the Processors' Standard (Chain of Custody Standard is part of both pieces, as it envelops steps in supply chain covering stages at sea and on land). While the Fisheries Standard provides a framework for better fisheries performance, the Processors' Standard targets companies to promote both sustainable and responsible operations. Buyers, processors and traders in certified supply chains should provide fishers increased support through different mechanisms. This is envisioned not like a linear process, but a circular approach that supports all actors in the supply chain.

Besides more „traditional“ rules and approaches within certification programs, the ARFM already included significant innovations in both harvesting and production, which will enable certificate holders to grasp on more opportunities in the markets. These include requirements and pillars that are either not covered or which are left on the margins of many certification schemes for capture fisheries. That is why we developed guidelines for animal welfare, socially responsible practices in seafood processing and production, innovative options for GHG emissions reduction, packaging, and waste disposal. The components of such guidelines can be implemented and carefully integrated into ARFM Standards so that they are reflective of existing and potential mechanisms of the Adriatic fishing industry. Also, on an ongoing basis new approaches and improvements of the certification program must be adopted, to ensure it has the biggest impact and supports effective implementation.

The outline of the ARFM Certification process is shown in D3.3.1. The Applicants (eg. Producer Organizations) may submit a formal application for the assessment and fishery certification within the ARFM. If the Applicant is in possession of a processing plant within which the certified catch will be processed and from where will be distributed, then it needs to be assessed against the Processors' Standard, meaning the fulfillment of the: food safety and quality criteria, environmental and waste management criteria, human rights and working conditions criteria. All supply chain actors need to be certified against the CoC Standard, to assure claims of selling, buying and processing ARFM certified products.

In order to achieve full ARFM Certification to all mentioned Standards as its integral part, the Applicant must meet requirements of all components of the Standards.

Assessment checklist

The Quality and Safety standard recommendations and guidelines have been already extensively outlined in the D4.4.2. and will not be shown here, as they could be implemented through regional brands' quality control procedures as outlined in D4.3.2. *Report on Standards'*

qualification. Here, the sustainability indicators of the operational efficiency and production requirements are presented. Conformity Assessment Bodies ensure that the compliance criteria have been met. Assessment team analyzes all relevant information (reports, technical papers etc.) and uses it to complete the scoring of the performance according to the scoring system (which is set by the Certification Body).

Transport, Packaging and Waste Procedures
Transport
1. Fuel efficiency
☐ The records of vessel fuel consumption are kept. ☐ The manoeuvring techniques for fuel usage decrease are undertaken. ☐ Reductions in energy consumption are applied to cut carbon emissions. ☐ Catch is transported at short distances from the landing sites.
2. GHG emissions reduction
☐ High-efficiency and energy-smart systems are applied to reduce energy uses and costs. ☐ The equipment is regularly serviced and maintained to run more energy efficiently. ☐ The refrigeration units are regularly inspected, insulated with leak prevention in place. ☐ Carbon footprints are calculated on a monthly basis. ☐ GHG emissions plan exist and are updated regularly. ☐ On board the vessels, the use of LED lighting is existent and preferentially solar panels and photovoltaic cells are installed.
Packaging

☐ Easy-to-use and distribute compact packages are preferred. ☐ Effective package use is communicated to end consumers. ☐ If using external packaging services, preference is given to certified material. ☐ Unnecessary waste production and over-packaging is avoided. ☐ Renewable materials are sourced where possible. ☐ Light-weight material exists at least in part of the packaging. ☐ Chemically recycled products are encouraged. ☐ Packaging materials that improve product quality and for which the LCA was contucted are more favored than other materials. ☐ Packaging produced with biodegradable polymers or other forms of biopackaging are procured where possible. ☐ The initial steps are taken towards circular packaging.
Waste
1. Solid waste reduction

☐ There is a system in place for monitoring and preventing waste accummulation. ☐ The raw materials are monitored for identifying possible production inefficiencies. ☐ The employees are trained to perform better processing. ☐ Packaging is reduced by means of proper storage, rectifying faulty packing machines and similar actions. ☐ Biodegradable materials are favored over plastic. ☐ Certain discards (offal, scales etc.) shall be used if and where possible as secondary products. ☐ Waste is handled according to respected legal requirements and regulations. ☐ Circular economy principles are being introduced in factories.
2. Wastewater disposal
☐ Water consumption is reduced whenever possible. ☐ Wastewater leaving the processing system is treated not to possess negative impact to humans and environment. ☐ Wastewater is not discharged into aquatic system unless it meets industrial parameters of the nationally applied law. ☐ Wastewaters are not directly applied to the soil unless previously treated for reduction or removal of particulates or potential pollutants. ☐ The most innovative wastewater treatments are encouraged.
Human Rights and Labor Ethics
1. Discrimination, abuse, forced and child labor

☐ Forced and child labor is non-existent ☐ There is a system in place which prevents discrimination and workplace harassment. ☐ There is a staff person administered to address the above issues ☐ There is a monitoring and record assessment system for risk reduction in place.
2. Fair wages and employment conditions
☐ The employees are paid adequate salaries, above minimal wages. ☐ All workers are informed about their duties and payment-related rights. ☐ Legally binding contracts and national laws are fully respected. ☐ All payments are adequately documented.
3. Health and safety
☐ All personnel is enabled to work under safe conditions at their workplace. ☐ Workers are familiarized with safe usage instructions, warning signals and health and safety policy. ☐ Pregnant or nursing workers are not given tasks posing risk to either their's or infant/fetus' health. ☐ All workers have access to clean water and sanitations. ☐ First aid boxes exist and are available to all staff. ☐ The incident reports are submitted anually to relevant authorities.

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