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THE CHAIN OF CONFISCATED CAUGHT FISH: STATE-OF-THE-ART ANALYSIS AND OPPORTUNITIES FOR SOCIAL REDISTRIBUTION IN ITALY

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Abstract

This study was born by the necessity to understand and analyse a phenomenon that Italy has been facing for years: the confiscation of fish products. Banco Alimentare Onlus, a non-profit organization engaged in surplus food recovery and redistribution for people in need in all the Italian regions, has been called in recent years to intervene in the recovery of huge quantities of fish products, which have been object of confiscation measures by the Competent Authorities.

The purpose of this thesis is to have a first photography of what happens in Italy, to analyse the confiscation process and to build possible recovery chains, considering the main barriers and opportunities faced and the main operational implications present in the recovery process.

Over time, many authors analysed the phenomenon of food waste and surplus food redistribution, however there are still very few studies about the recovery of fish products, and consequently on the recovery of confiscated fish products. Therefore, after a first literature review about these themes and the analysis of the main European and National Regulations and Directives on the topic, gaps are identified and research questions are formulated. Interviews are made to find out qualitative and quantitative information about the phenomenon of the confiscation of fish products.

The contribution of this study is the creation of a general framework which describes the variables to consider and the different processes and scenarios that can occur in the recovery and redistribution of confiscated fish, which can be generalized and applied to other geographical contexts within the European Union.

Keywords: Food waste, Surplus food, Surplus food redistribution, Surplus food donation, Confiscation of fish products, Fish supply chain

Sommario

Questo studio è nato dalla necessità di approfondire e analizzare un fenomeno che l'Italia sta affrontando da diversi anni: la confisca dei prodotti ittici. Banco Alimentare Onlus, un'organizzazione impegnata nel recupero e nella redistribuzione delle eccedenze alimentari per le persone più bisognose in tutte le regioni italiane, è stata contattata negli ultimi anni per intervenire nel ricovero di grandi quantità di prodotto ittico, oggetto di misure di confisca da parte delle Autorità Competenti.

Lo scopo di questa tesi è di avere una prima fotografia di cosa sta avvenendo in Italia, di analizzare il processo della confisca e di costruire possibili catene del recupero, considerando le principali barriere e opportunità incontrate e le implicazioni di carattere operativo maggiormente presenti nel processo di recupero.

Negli anni, diversi autori hanno analizzato il fenomeno dello spreco alimentare e della redistribuzione delle eccedenze alimentari, tuttavia ci sono ancora pochi studi riguardo al recupero dei prodotti ittici, e di conseguenza sul recupero dei prodotti ittici confiscati. Pertanto, dopo una prima revisione della letteratura su questi temi e un'analisi dei principali Regolamenti e delle Direttive sui diversi argomenti, sono state identificate delle lacune e formulate le domande di ricerca. Sono state poi svolte interviste per ricercare informazioni qualitative e quantitative sul fenomeno dei prodotti ittici confiscati.

Il contributo di questo studio è la creazione di un quadro generale che descrive le variabili da considerare e i diversi processi e scenari che possono realizzarsi nel recupero e la redistribuzione dei prodotti ittici confiscati, i quali possono essere generalizzati e applicati ad altri contesti geografici dell'Unione Europea.

Keywords: Spreco alimentare, Eccedenza alimentare, Ridistribuzione delle eccedenze alimentari, Donazione delle eccedenze alimentari, Confisca dei prodotti ittici, Catena di approvvigionamento del pesce

Executive Summary

Introduction

Nowadays the world is facing a great challenge: eradicate hunger, fight and solve food insecurity, assuring that everyone can afford a sufficient, safe and nutritious food which meets their dietary needs. The number of undernourished (NoU) people in the world has reached more than 820 million in 2018, as reported by the Food and Agricultural Organization of the United Nations (FAO) (*FAO et al., 2019*). Paradoxically, another problem is the phenomenon of food waste, estimated by FAO to be equal to 1,3 billion tonnes, corresponding to 1/3 of the total world food production.

The redistribution of food for social purposes, specifically donation, can solve both problems: alleviate food poverty and reduce food waste. A network of food banks and other charitable organizations are engaged in the recovery of surplus food, the food produced, that for various reasons is not purchased or consumed, from all stages of the supply chain and from different distribution channels. Their aim is to redistribute it and donate it to most needy people.

In this scenario, the current study focuses on the analysis of a specific challenge experienced by Banco Alimentare Onlus, the organization engaged in surplus food redistribution for people in need in Italy, which has been called in recent years to intervene in the recovery of huge quantities of fish products, object of confiscation measures by the Competent Authorities. The difficulties faced in the recovery of this type of products and the urgency of this issue lead to the need of understanding and analysing the phenomenon of confiscation of fish products: how the process of the seizure and consequent confiscation happens, the main causes, the players involved and the main locations where confiscation activities take place. The aim is to have a first photography of what happens in Italy, and to build possible recovery chains, considering the main barriers and opportunities faced and the main operational implications present in the recovery process. The contribution of this study is also to try to generalize the framework of the Italian process to make it suitable also in other geographical areas within the European context.

Literary Review

The starting point of the work has been a preliminary review of scientific literature articles with the aim to gain knowledge about food insecurity, food waste and surplus food management, with a focus on food donation. Many authors underline the issue of “scarcity within abundance” (Campiglio & Rovati, 2009) that happens in high-income countries: many people are suffering food insecurity even if the overall quantity of available food should be sufficient to fulfil everybody’s needs. The phenomenon of food waste, a huge problem spread worldwide, emphasizes this paradox: while a lot of people cannot afford a sufficient and nutritious diet, tonnes of food are lost and wasted every year (Galli et al., 2019; Garrone et al., 2013). The estimates of food waste levels are uncertain and different because, in the last years, there were several and ambiguous definitions of the different terms, such as food waste, food losses, food scrap and surplus food. This issue was underlined by many authors over the years (Arcuri et al., 2017; European Court of Auditors, 2016; Garrone et al., 2014b). This ambiguity and non-uniformity of definitions may have led to wrong evaluations and, consequently, to resistances towards measures and plans in order to act on it (Foti et al., 2018; Stenmarck et al., 2016).

A great contribution was given by Garrone et al. (2013), who developed a conceptual model, called ASRW (Availability, Surplus, Recoverability, Waste) in order to describe surplus food and food waste at individual stages in the food supply chain. Surplus food is defined as “*edible food that is produced, processed, distributed or served but for a variety of reasons is not purchased or consumed*”. Food waste can be defined in different ways, depending on the primary destination and use of surplus food (Figure 1): waste from social perspective (surplus food not recovered for human consumption), waste from social and zoo-technical perspective (not recovered for humans or animals) and waste from general system perspective (surplus food not considered of beneficial use in any form).

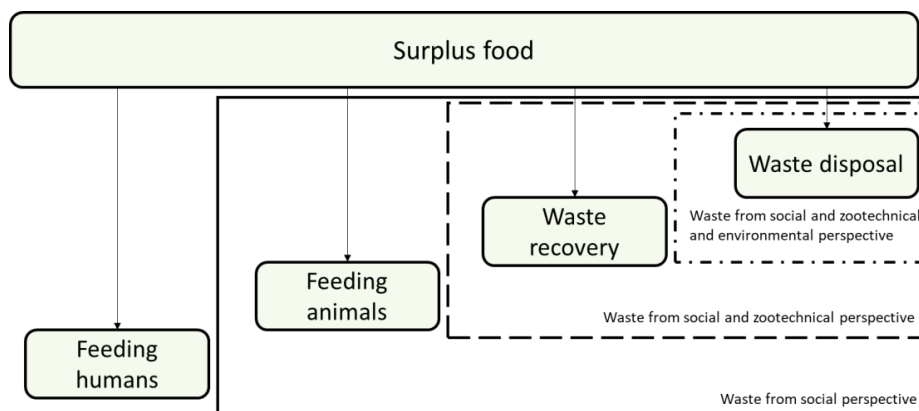


Figure 1 – The definition of food waste from different perspectives

Another important contribution was given by the European Commission, which in the Directive 2008/98/EC established the Waste Hierarchy, a framework for the management of waste that gives a priority order from the best environmental option to the worst: Prevention, Preparing for re-use, Recycling, Other recovery and Disposal. Papargyropoulou et al. (2014) gave an important contribution in the study of Waste Hierarchy and food waste: they introduced the framework of the Food Waste Hierarchy, based on the options of the Waste Hierarchy, on the difference between food waste and surplus food and on the distinction between avoidable and unavoidable food waste.

In the Circular Economy Package established in 2015, the European Commission affirmed that there is neither a harmonized definition of food waste nor a method to measure it and therefore it is hard to quantify the extent of the phenomenon and find its origins. Within this report, the Commission committed itself to take some actions to solve this problem and to meet the UN targets, called Sustainable Development Goals (SDGs), specifically the Goal 2 “*End hunger, achieve food security and improved nutrition and promote sustainable agriculture*”, and the Goal 12 “*Ensure sustainable consumption and production patterns*”, with the creation of the “EU Platform on Food Losses and Food Waste” and the introduction of a “food waste” definition in the revised Waste Framework Directive 2018/851.

The purpose of this study focuses on food donation which answers the two relevant aspects analysed before: the growing food insecurity in the world and the prevention of food waste, defined following the social perspective. The redistribution is therefore the

re-use of food for its primary function: in this way, food waste can be seen as a problem that becomes a resource, reaffirming the meaning of the Circular Economy paradigm.

The probability to recover a certain type of product is related to its Degree of Recoverability (DoR), studied by Garrone et al. (2013): the relative ease of recovering surplus food for human consumption. For the realization of surplus food donation, the work of food banks and other organizations and associations which recover it for social purposes is essential (Foti et al., 2018; Garrone et al., 2014b). There are two different type of non-profit organizations: front-line and back-line organizations, and in addition a hybrid model (Garrone et al., 2015). The contribution of the public sector is also fundamental.

An important contribution in the study of the surplus food donation has been given by the European Commission with the “EU guidelines on food donation” adopted on 17 October 2017. These guidelines aim to clarify the provisions given by European legislation and to remove barriers in the food donation process, facilitating the compliance of the players involved in the redistribution activities (regarding food safety, food hygiene, traceability and VAT) and clarifying roles and responsibilities.

Regarding the donation of fish products, even if the Common Organisation of the Markets in fishery and aquaculture products (CMO) does not promote and encourage it, it does not exclude this option.

Focusing on the situation in Italy, over the last years a series of policy actions towards the adoption of Circular Economy strategies have been approved. Italy has even been the first State in Europe which decided to realize a regulatory instrument, the Law n. 166 of 19th August 2016, the so-called Gadda Law, to fight food waste and to incentivize the reuse and redistribution of surplus food and pharmaceutical products for social solidarity purposes. One of the main innovations introduced in this Law is the one included in Article 6, which allows the reuse and donation to private entities which must pursue civic and solidarity purposes of the goods which are object of confiscation, when they are suitable for human or animal consumption.

Focusing on the fishing sector, the main Regulations established by the European Commission are investigated, as well as the problems incurred, their possible solutions, the possibility of recovery and redistribution of this type of product.

The European Union represents one the main seafood market in the world and the 5th largest producers of fishery and aquaculture products (*EUMOFA, 2019*). Therefore, it needs to establish on one side a sustainable use of the resources, since for decades the European fish stocks have been overfished and, on the other side, policies and regulations to ensure to the large number of European fishermen a stable and profitable market, while assuring reasonable prices for consumers. The major problems incurred among the others are: overfishing, unwanted catches and discards and Illegal, Unreported and Unregulated (IUU) fishing.

Overfishing is a worldwide problem: to solve it, the European Commission sets catch limits on several fish species. Total Allowable Catches (TACs) are set annually based on scientific advice on the stock status from expert advisory bodies and then divided into national quotas, which set limits on the amount of fish that can be caught.

Then the Common Fisheries Policy (CFP) shall act on the current high levels of unwanted catches and discards, being a substantial waste, which negatively affects the sustainable exploitation of marine biological resources. To reduce them, the European Commission decided to introduce the Landing Obligation (LO): all catches which are subject to catch limits or which are subject to minimum conservation reference sizes shall be brought and retained on board the fishing vessels, recorded, landed and counted against the quotas where applicable.

Illegal, Unreported and Unregulated (IUU) fishing is considered one of the major threats to global marine resources, having both environmental and socio-economic impacts: the direct consequence is the depletion of fish stocks which contributes to the decrease in size and quality of catches, with the consequent reduction in the fishing industry profitability. The Council Regulation (EC) No 1005/2008 established a Community system to prevent, deter and eliminate Illegal, Unreported and Unregulated (IUU) fishing, defining what is included in IUU fishing activities and the different violations performed by fishing vessels engaged in them.

Fish product is identified also by the European Parliament as the second-most likely category of food traded internationally at risk of fraud: the act of illegally placing food on the market with the intention of deceiving the customer, usually for financial gain.

Regarding the possibility to recover and redistribute fish product, the literature provides very few insights and studies about the donation of this kind of product. Garrone et al. (2013) classified it with a low Degree of Recoverability. The difficulties and the necessary intensity in the management of this type of products are due to the several risks related to its wrong handling and management. Fish has a high perishability nature: the cold chain needs to be maintained. The importance of recovering it lies on its high nutritional value: this product is indeed a source of high-quality protein, amino acids essential for human health as well as essential minerals and vitamins (*FAO, 2018b*).

Like all the type of product, also fish has its own Waste Hierarchy, deepened by Uhlmann et al. (2019). The options are the same: Prevention (reduction of bycatches), Re-use for human consumption (kept as fresh fish, transformed products or by the production of food ingredients), if it is not suitable, it can be used as bio-products, feed for aquaculture, pet-food and other animal feed, then there is the option of Industrial use (e.g. leather, fish oil and minerals), the Production of energy (i.e. biogas and biodiesel), Composting and, as last option, Incineration through landfills.

Research Questions and Methodology

The topic of the recovery of fish product is not deepened by many authors in the literature, probably for the several difficulties related to the obstacles in the recovery and redistribution activities and the low Degree of Recoverability that this product has. Therefore, there is a gap in the literature on the recovery of confiscated fish for other uses, especially redistribution activities. The Research Questions of this study are therefore formulated.

RQ1. What is the state of the art about confiscated fish in Italy and Europe?

The aim of this research question is to analyse the phenomenon in all its parts and considering the different points of view of the players involved. The focus of the analysis is mainly related to the Italian case, considering also the broader European context.

RQ2. What are the main barriers and opportunities for the recovery and redistribution of the confiscated fish in Italy?

The aim of this research question is to find what hinders and what facilitates the redistribution for social purposes of fish products. Relying on them and finding the main operational and logistical implications in the process, the scope is also to design possible recovery chains of confiscated fish products.

The research process followed to answer the research questions is here reported (Figure 2): after a first analysis of the literature on the general topic described before, interviews are made to investigate the possibility to recover the confiscated fish products. Several interviews are made at national level (Ministero delle Politiche Agricole Alimentari e Forestali - MIPAAF, Banco Alimentare della Sicilia, Euroittica Srl, Coldiretti Impresa Pesca, Federcoopesca-Confcooperative, Azienda Sanitaria Locale and Mercato Ittico di Milano), while two of them belonging to the European and International context: Directorate-General for Maritime Affairs and Fisheries (DG MARE) at European level and FAO (Fisheries and Aquaculture Department) at global level.

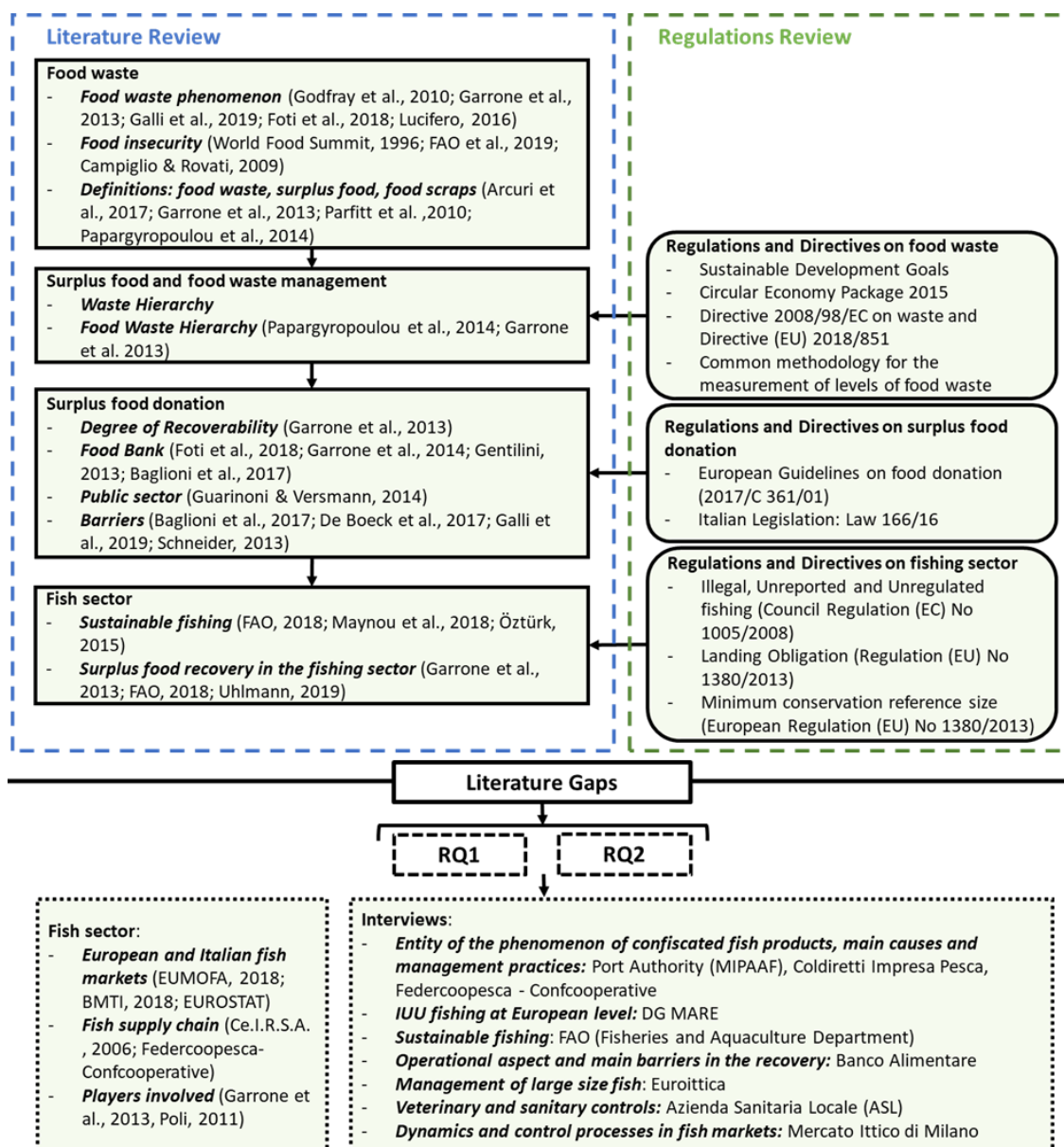


Figure 2 – Methodology steps

Findings

Before deepening the topic of the confiscation of fish products, a first analysis of the European and the Italian fish market was done, to provide a contextualization to the main issue of this study, and understand how the fish supply chain is composed and which are the main players involved.

Focusing on Italy, as reported by the European Market Observatory for Fisheries and Aquaculture (EUMOFA), it is the 6th main consumer between European countries (above

the European average) and the 3rd net importer. It has also the highest level of total expenditure for fish products (*EUMOFA, 2019*). According to EUROSTAT catches data¹ for the year 2018 and FAO division of Italian seas and coasts, the one which registered the highest level of catches is the Adriatic Sea, (43,38% of the total catches), followed by Ionian Sea (31,75%) and Tyrrhenian Sea and Sardinia (24,87%). Analysing the typologies of products caught in 2018, fish products account for 66,42% of the total amount of catches, then there are bivalve molluscs and gastropods together with cephalopod molluscs (21,41%) and crustaceans (12,17%).

The fish supply chain is then explored (Figure 3). The first step is fishing operations, which can include also handling activities on board, followed by landing of the fish products with the transport on refrigerated vehicles, the first sale to a market or to a wholesale production market, in which daily auctions occur. Then, after the storage, eventual transformation activities take place, and the last steps are the wholesale distribution and the retail distribution, with the sale to the end customer (*Ce.I.R.S.A., 2006*). The players involved are fishermen, Producer Organisations (POs), wholesaler “production” markets, wholesaler “distribution” markets, small and large-scale retailers, food service companies as catering and restaurants, fish shops and peddlers (*Garrone et al., 2013*).

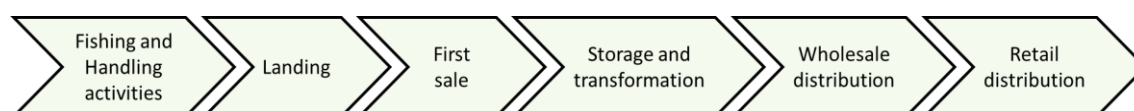


Figure 3 – Fish supply chain

The first finding emerged from the interviews performed is related to the need of defining and distinguishing between the meaning of seizure and confiscation: while the seizure is a temporary detention of the goods waiting for the final decision of the Judge in charge of validation of it, the confiscation is a sanctioning measure through which the ownership of the goods passes from the original owner to the Public Administration. In the Italian

¹ <https://ec.europa.eu/eurostat/web/fisheries/data/database>

law, the seizure could derive from two different types of offences ending into two different sanctions: penal and administrative.

The first step in order to understand the real entity of the phenomenon of the fish products confiscation is the analysis of the aggregated data about seizures and confiscations: from the data given by Port Authority, it can be observed a peak in 2016 in the amounts of kilograms of fish products confiscated, then the number has a rapid decrease in the following year (2017), with a revert in 2018, reaching almost 500 thousand kilograms in 2019.

Some variables are then identified and later considered crucial for the study because they help to describe the different processes and scenarios:

1. **Origin:** the fish product consumed in Italy is composed by local fish (20%), considering as local the European market, and imported one (80%);
2. **Fish Species:** the main species of fish object of seizure activities are Bluefin Tuna, Swordfish, Hake, Mullet (both Red mullet and Surmullet), Shrimp, Sole, Octopus. There are also some protected species for which the catch and consequently sale is almost always prohibited in Italy: Sea Urchins, Sea Dates, Sea Cucumbers, Chinese Crabs;
3. **Size:** fish species can be classified in small size species or large size one; products included in the latter need further operations to make them more manageable and to facilitate the consumption;
4. **Conservation Mode:** another categorization that can be made is the distinction between fresh and frozen products; when caught, the former are put on ice, maintaining the temperature between 0° C and 4° C, while the latter must be stored at a temperature not exceeding - 18° C in all their parts;
5. **Seizure Location:** the locations mainly characterized by controls of Competent Authorities are on board of the fishing boat, ports (on docks), fish markets, restaurants and supermarkets, logistic platforms, ports and airports (related to import activities) and roads;
6. **Seizure Cause:** the causes that occur the most are prohibited catch/prohibited sale, lack of traceability, undersized product, out of quota product or caught

during fishing stops and commercial food fraud. Each of them is linked to a certain violation, to the reference to the Italian Regulation and to the type of sanction;

7. **Recovery Place:** the fish products object of seizure can be put in different storage place while the Competent Authority waits for the final decision of the Judge to proceed with the confiscation of the goods; refrigeration cell for fish markets, restaurants, supermarkets and logistic platforms, refrigerated vehicle used for the transport of the goods, moved to the nearest Port Authority office for roads and European Community (EC) authorized warehouse for ports or airports;
8. **Suitability for Human Consumption:** after the confiscation there is a veterinary control by the doctors of the Local Health Units (Azienda Sanitaria Locale - ASL) who decide if the fish products are suitable for human consumption or not;
9. **Final Destination:** it indicates disposal if the confiscated products are not suitable for human consumption, while if they are suitable, auction or donation to charities.

The Competent Authority in charge of the controls is the Port Authority Corps. Controls over health, customs and tax aspects can be also performed by Finance Guards, Local Police, Carabinieri NAS, Forestry Carabinieri and the Ispettorato Centrale della tutela della Qualità e della Repressione Frodi dei prodotti agroalimentari (ICQRF).

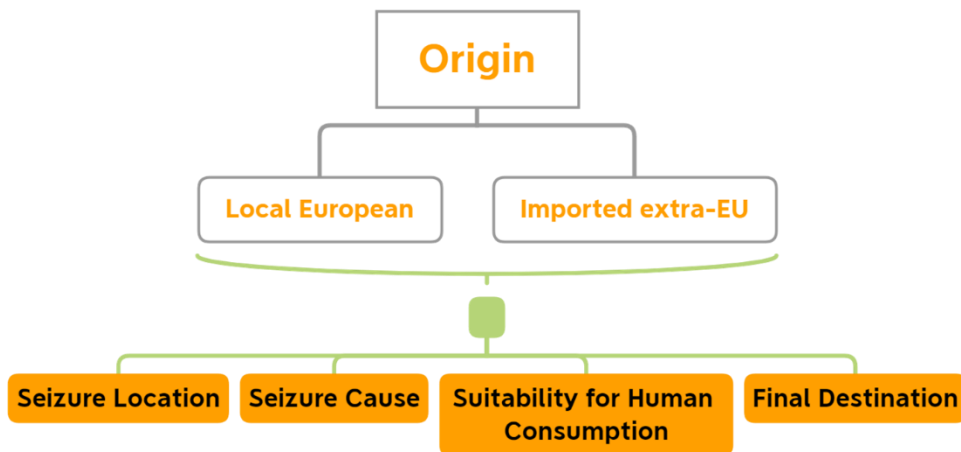


Figure 4 – Variables to consider in the seizure and confiscation process

The first identified variable, the Origin of the fish products, gives rise to two processes different in some parts. All the imported products from Extra-EU countries should pass through the Customs Office, localized at borders where there are the first controls over customs documents. There are also additional veterinary controls carried out by Border

Inspection Posts (Posti di Ispezione Frontaliera - PIF). When there is a problem with the batch of fish products, it is sent back to the country of origin. Therefore, concerning imported fish products, the potentially interested cases for recovery and redistribution are those for which batches of fish products manage to elude customs controls entering the Italian market through illegal channels. The main violations related to the imported products are lack of traceability, sale of undersized products, prohibited sale and commercial food fraud. Regarding the national catch, the first controls happen on board of fishing vessels or on docks of the ports. The main violations reported in the interviews are prohibited catch, lack of traceability, undersized product and out of quota products or catches during fishing stops. If they do not go under controls or manage to elude them, they enter the market through different distribution channels. If the good is caught by European vessels, it can pass through Veterinary Offices for Community Fulfillments (Uffici Veterinari per gli Adempimenti Comunitari - UVAC). As it happens for PIF, if a product is not compliant with regulations, it is sent back to the country of origin. In the case controls happen in fish markets, logistic platforms, restaurants, supermarkets, roads or airports (in case of European products), the main causes of seizure remain the lack of traceability and the undersized product, together with the prohibited sale and the commercial food fraud.

So, if one of the violations listed above happens, the seizure occurs as well, and while the legal process starts, the products are seized and put in different places, as written before. In the meantime, within 24 hours, the Judge in charge of the legal process decides if the confiscation of the products has to take place. After the decision of confiscation, there are veterinary controls made by doctors of the Local Health Units (ASL) to assess if the goods are suitable for human consumption. Then, the final destination is decided by the Port Authority who organizes within 24 to 48 hours what is necessary for the realization of one of the alternatives. If the Port Authority decides to donate the confiscated fish, it can call both front-line organizations such as soup kitchens or housing communities and shelters, and food banks to recover the products with its own means.

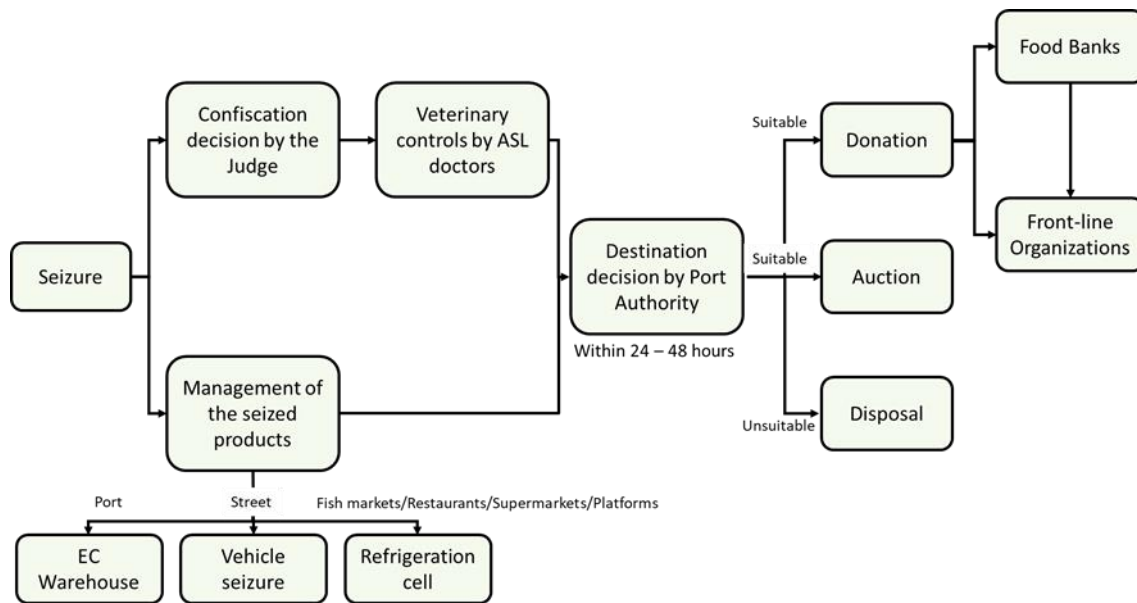


Figure 5 – Activities after seizure

The three alternatives of Final Destinations are then evaluated, with their barriers and opportunities.

1. **Disposal:** the disposal is the least preferable option in terms of food waste and thus social and environmental impact. Its cost is entirely up to the author of the violation, therefore the State does not have to pay or organize anything;
2. **Auction:** there are various reasons why this solution is also not preferred and convenient. A scenario which is luckily to happen is that products are mainly sold to merchants who create a mix of legal product and illegal one in order to have less expenses, earnings collected from the action by the Income Revenue Agency (Agenzia delle Entrate) are very limited due to very low selling prices, time may be longer due to non-responses of the subjects participating to the action with consequent risk of additional costs, and there is an additional work for the Authorities who have to prepare and manage auction organization;
3. **Donation:** this alternative seems to be the most preferable one for different reasons. It turns out to be the best one in terms of environment and sustainable exploitation of resources, with the recovery of products for social purposes fighting against food insecurity and it is also beneficial for other players involved, both Port Authorities who do not take over the management of the fish products

with the organization of auctions and companies owner of a EC authorized warehouses who must submit to the procedure and times of auctions (they must keep the product till the auction is performed). There are also some barriers which make the recovery and redistribution of confiscated products difficult to perform. From the point of view of the controlling Authority, the main problems encountered in the decision to donate the goods are two: large distances for the recovery and unsuitable structures (refrigeration cells and freezers) of the charities. From the point of view of non-profit organizations, the main problems are related to inadequate structures and competences of the front-line organizations contacted, and the insufficient capacity to contain confiscated goods, since they are already saturated. They can own some insulated means which maintains the cold chain, but they do not possess dedicated structures for this typology of product, and they do not have yet the knowledge to deal with it. Finally, the seizure activities take place at night or during weekends, times in which the recovery is more difficult to perform for lack of operating volunteers and personnel.

The operational implications of the recovery process are then studied. The Conservation Mode is the first variable to consider: if the product is maintained at a fresh status in ice between 0° C and 4° C, the average shelf life of products is between 6 and 8 days. Regarding the frozen product, it has to be maintained at temperature not above - 18° C. Depending on the type of fish, the conservation period varies: for fat fish 2-3 months, for lean fish 4-6 months (up to 9 if they are fillet), for crustaceans 2 months (lobster and crab) and 6 months (shrimp) and for molluscs 3-4 months (*Torry Research Station, 2001*). The cold chain has to be preserved in all the phases of the recovery activities: one of the most critical part of the process is the transportation from the recovery place to the charity organization, appropriated means of transport need to be used. The vehicles used for the transport of fish products have to be isothermal insulated to respect the right temperatures during all the transport. Other logistical implications to take into account are the geographical distances between the recovery place and the location of the charity organization.

To build recovery chains, products must be suitable for human consumption and destined to donation; the variables analysed before to take into consideration are Fish Species, with its related Size and Conservation Mode and the Seizure Location with consequent Recovery Place, where charitable organizations can collect the product (Figure 6).

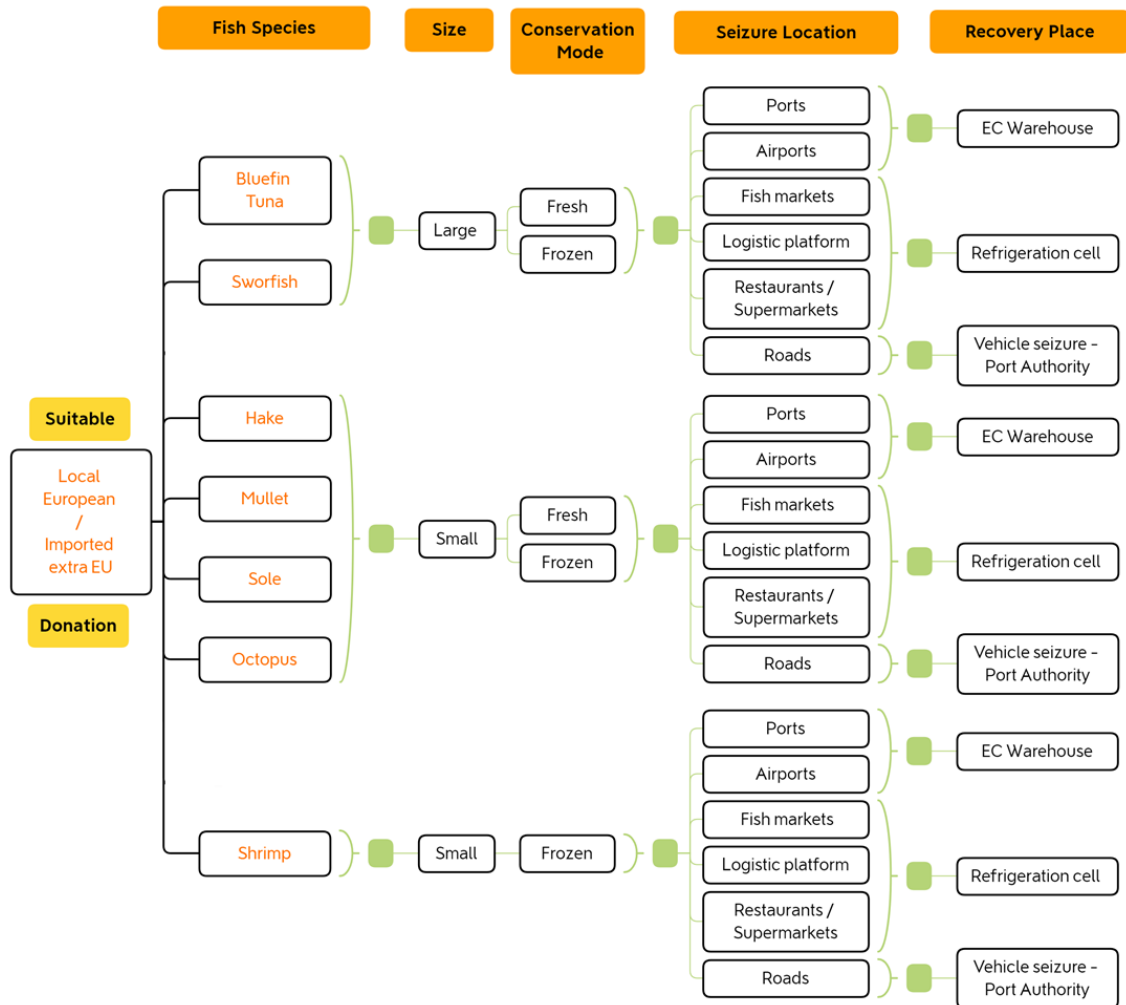


Figure 6 – Variables of different recovery scenarios

After the analysis of the process and the evaluation of the possible alternatives for the confiscated products, all the schemes done are then reviewed to establish if the elements included in them can be generalized and applied to other European countries. Some guidelines are provided in order to allow another country to deep the phenomenon of confiscated fish products and to build recovery chains, as described here below in a step-by-step process.

- Review National Regulations about fishing activity to understand the violations and the sanctions provided;
- Identify the Competent Authorities involved in seizure and confiscation activities and collect data about seizure and confiscation measures at national level to understand the overall extent of the phenomenon;
- Review the National Regulations about food redistribution to understand if the donation of products object of confiscation is embedded or not;
- Conduct interviews to Competent Authorities and players of fish sector to understand how the process of controls over the legality of fish products happen and who are the main players involved, using the generalizable schemes proposed: Figure 4 for the variables to consider in the seizure and confiscation process, Figure 5 for the activities performed after seizure and Figure 6 for the variables of different recovery scenarios;
- Measure each variable with quantitative data and fill the proposed schemes in order to identify the most frequent confiscation paths and possible recovery scenarios.

Overall, the synthesis of the process shows that regarding the first scheme analysed, the one represented in Figure 4, the first three variables (Origin, Seizure Location and Seizure Cause) can be generalized while the last two, Suitability for Human Consumption and Final Destination, can be generalized only partially, due to the presence or the absence of a specific regulation on other uses of confiscated products. This scheme is the first to use to investigate the process of fish in a specific area. The process of seizure and confiscation activities (Figure 5) cannot be generalized: the phases of the juridical process and the management of the products may vary depending on the country. The other scheme which can be generalized is the one represented in Figure 6, regarding the variables considered in the recovery activities: it can only be generalized and applied to other European countries if the donation of confiscated fish products is possible.

Conclusions

This study aims at analysing a phenomenon which is a current challenge for Italy but that can be transformed into a source of new value through the recovery of fish suitable for human consumption. Before this research, there was not a comprehensive understanding

of what was going on over the topic of confiscated fish products. The aim of interviewing several players is to grasp their different points of views over the phenomenon, gathering information over the seizure process and the main destinations of the confiscated fish products in the Italian context. Therefore, this study answers the Research Questions defined at the beginning of this work; the gaps found about the surplus food redistribution for fish products and the recovery of confiscated fish products are filled, having a contribution also for the existing literature. The great contribution that this study brings is the following: from the analysis of the Italian case, variables which characterize the phenomenon are identified and described, and upon them frameworks that can be adapted to other European countries are created. Some guidelines are also developed for those countries that want to investigate this phenomenon and the possible recovery chains that can be built.

The results of this study can provide useful insights to the different players involved in the fish supply chain and in the recovery and redistribution activities, to deep this phenomenon and understand how they can deal with it.

First of all, food banks and front-line organizations can use the different information gathered, in particular the scheme of the variables related to the recovery activities (Figure 6), to build possible recovery chains, taking into account the operational implications and understanding where to concentrate the efforts for the maximization of the recovery interventions.

Local policy makers can use the results proposed to monitor and control the entire fish supply chain and to reach a more efficient management of it, valorising the confiscated fish product, and eliminating the burden that the public entity has in the management of it. Acting over this phenomenon can generate new values both in an economic and environmental terms: the creation of food waste is prevented, while a high value product is recovered. In collaboration with both food banks and front-line organizations, local policy makers can develop effective recovery chains of fish products collecting more specific data and enabling a more efficient management of redistribution activities. Also other companies of the fishing sector and organizations engaged in the sustainable exploitation of resources (e.g. FAO) can collaborate with policy makers and food banks,

giving their knowledge and their experience on this field to collect data and management strategies that can be then centralized.

For European policy makers, the frameworks and the guidelines proposed can be used to deepen the phenomenon in other European countries and verify if the recovery chains for confiscated fish products can be implemented.

This study has also some limitations: the quantitative data about the number of seizure and the amount of fish confiscated are aggregated, and they give only a first idea of the extent of this phenomenon. Further researches need to be done to find and analyse the specific data, in order to fill the proposed schemes with more specific data and calculate the probability of occurrence of each single path.

Further possible developments and steps are related to solving the problem of management and recovery of large size fish, resorting to the transformation of fish products: bringing the good to lower temperatures ($- 20^{\circ}\text{C}$ or $- 40^{\circ}\text{C}$) and divide it into more manageable portions.

Focusing on disposal alternative, further researches can be made on the other possible options used when the product is not suitable for human consumption: transformation into animal feed or feed for aquaculture, industrial uses (e.g. leather, fish oil and minerals), production of energy (i.e. biogas and biodiesel) or composting.

1. Introduction

Nowadays the world needs to face different threats and challenges: one of the most important is to eradicate hunger and solve and fight food insecurity, assuring that everyone can afford a sufficient, safe and nutritious food which meets their dietary needs. The number of undernourished (NoU) people in the world has reached more than 820 million in 2018, as reported by the Food and Agricultural Organization of the United Nations (FAO) (*FAO et al., 2019*). Both in developing and developed countries, there is another problem, related to the one already mentioned: the phenomenon of food waste. FAO estimated that every year 1/3 of the total food production is lost or wasted, equal to 1,3 billion tonnes. Many authors in the literature studied this phenomenon, underlining this paradox: while people suffer from food insecurity, tonnes of food are wasted every year.

One possible way to reduce food waste and alleviate food poverty is to recover and redistribute surplus food for human consumption through different possible channels: the one we are interested in is the donation. This activity is performed by a network of food banks and other charitable organizations, which recover and collect surplus food, the food produced but for various reasons is not purchased or consumed, from all the stage of the supply chain and from different distribution channels, and then donate it to most needy people.

In Italy, the Banco Alimentare Foundation, a non-profit organization for social utility which coordinates the Banco Alimentare Network, is engaged in the recovery and redistribution of surplus food, helping people in need who suffer from food insecurity and fighting against food waste, with the promotion of policies collaborating with European and National Institutions.

This study is born by the necessity to understand and analyse a phenomenon that Italy has been facing for years: the confiscation of fish products. The Banco Alimentare Onlus, the network of organizations engaged in surplus food redistribution working in all the Italian regions, has been called in recent years to intervene in the recovery of huge quantities of

fish products, which have been object of confiscation measures by the Competent Authorities. The donation of this kind of products is possible thanks to the promulgation of the Law 166 of 19th August 2016, containing "Provisions concerning the donation and distribution of food and pharmaceutical products for the purpose of social solidarity and for the limitation of waste". The Article 6 is related to the donation of confiscated products: therefore, from that time on, fish products object of seizure and confiscation, if judged suitable for human consumption, can be given for free to charitable organizations.

The characteristics of this type of product, source of high-quality protein, amino acids essential for human health, but also of minerals such as calcium, phosphorus, zinc, and vitamins A, D and B, make it a significant resource for the fight against food insecurity, for a possible improvement in the dietary habits. Therefore, it is extremely important try to understand how to recover it, and how to redistribute to people who cannot afford a sufficient nutritious meal otherwise.

Banco Alimentare worked in the last years in order to try to recover the great part of products confiscated, but they experienced lots of obstacles and difficulties. The urgency of this issue and the great importance that the recovery of this type of product has, as underlined before, lead to the need of deepening the phenomenon.

The scope of this work is to analyse and understand how the process of the seizure and consequent confiscation happens, the main causes, the players involved and the main locations where confiscation activities take place, in order to have a first photography of what happens in Italy, and to build possible recovery chains, taking into account the main barriers and opportunities faced and the main operational implications present in the recovery process. The contribution of this study is also to try to generalize the framework of the Italian process to make it suitable also in the European context.

In order to better understand and deepen the topic, a first literature review was made, summarized in the first section of this study. It has been deepened the food waste phenomenon, the surplus food and food waste management and the surplus food redistribution, with the focus on donation. A review of the main Regulations and Directives of the European Commission was also made, since its strong commitment towards this issue. Then, an in-depth analysis on fish sector, and of the main Directives which regulate it, is carried out to understand how this sector works, with the study of the

fish supply chain, the main players involved and the characteristics of the European and Italian fish markets, the production and the main trades, and the main actions taken by institutions and organizations towards a more sustainable use of marine resources.

The second part of the work is the deepening of the theme through interviews to several players involved in the fish product sector. The aim of these interviews is to find out qualitative and quantitative information about the phenomenon of the confiscation of fish products and the different point of view of the players. A large number of interviewees have to deal directly with this phenomenon, and their experience and knowledge over it helped us to understand better the entire process: this is the case of Port Authorities engaged in the seizure operations, veterinary doctors who perform the controls, cooperatives of fishermen, wholesalers of the fish market, a processing company working this type of product, and Banco Alimentare della Sicilia, the one most involved in the recovery operations. Other interviews were made to Institutional body as DG for Maritime Affairs and Fisheries (DG MARE), involved in the fight against Illegal, Unreported and Unregulated fishing, and to International organization such FAO (specifically the Fisheries and Aquaculture Department), to understand what studies and researches they are making in this field. All the information collected from the interviews and from further analysis have been re-elaborated and summarized in the section Findings. In the last section, the conclusions and further researches are deployed, underling the contribution of this study.

2. Literature Review

2.1 Food waste phenomenon

In recent years, the issue of food losses and waste has achieved more and more importance. Many studies and analysis have been done in order to try to answer to a worldwide problem that needs to be faced and solved: the paradox of food insecurity and food waste. By 2050 the world needs to feed a population of 9 billion people and so it has to face many challenges: it has to match the rapidly changing demand for food from a larger population in a way that is environmentally and socially sustainable and ensure that the world's poorest people are no longer hungry. These challenges need to be faced with a more sustainable production and consumption (Godfray *et al.*, 2010).

The issue of food insecurity was deepened in 1996 during the World Food Summit when the Food and Agricultural Organization of the United Nations (FAO) stated that “*food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life*” (World Food Summit, 1996a). At that time, a target has been set: “*eradicating hunger in all countries, with an immediate view to reducing the number of undernourished people to half their present level no later than 2015*” (World Food Summit, 1996b). In 2000, the United Nations Millennium Declaration, made by 147 heads of State and Government, and 189 nations in total, promoted to halve the proportion of people who suffer from hunger, expressed in the next year in target “*halve, between 1990 and 2015, the proportion of people who suffer from hunger*” (United Nations, 2001). From that time on, FAO continues to monitor the progress of these targets and level of food insecurity of the world. In the latest report of 2019 “The State of food security and nutrition in the world”, it is reported that more than 820 million people in the world were still suffering from hungry in 2018, expressed in number of undernourished (NoU) (FAO *et al.*, 2019). They do not analyse only the severe level of food insecurity, when people experience hunger, spending days without eating and putting their health and well-being at grave risk, but also moderate level, defined as uncertain access to food of sufficient quality and/or quantity, but not so extreme that it causes insufficient dietary energy intake (undernourishment) (FAO, 2019). The number of people who experienced food insecurity

at moderate level was 1,3 billion, which means 17,2% of the world population. The combination of moderate and severe levels of food insecurity brings the estimate to 26,4% of the world population, amounting to a total of about 2 billion people. In high-income countries, specifically in Europe and Northern America, 8% of the population is estimated to be food insecure, mainly at moderate levels: only in Europe in 2018, they amount to 57,9 million of people (from FAO Food security Index database)². EUROSTAT estimated that 110 million people were at risk of poverty or social exclusion in 2018 and 36 million people cannot afford a quality meal (including meat, chicken, fish or vegetarian equivalent) every second day³.

Many authors underline the issue of “*scarcity within abundance*” (Campiglio & Rovati, 2009) that happens in high-income countries: many people are suffering food insecurity even if the overall quantity of available food should be sufficient to fulfil everybody’s needs. The phenomenon of food waste, a huge problem spread worldwide, emphasizes this paradox: while a lot of people cannot afford a sufficient and nutritious diet, tonnes of food are lost and wasted every year (Galli et al., 2019; Garrone et al., 2013). In 2011, FAO estimated that 1/3 of the food produced, equal to 1,3 billion, is wasted every year (FAO, 2011). In new studies made in recent years, this estimate is replaced by two different indicators: the Food Loss Index (FLI) and the Food Waste Index (FWI). The FLI includes estimates of food losses from post-harvest up to, but not including, the retail stage: initial estimates of the FLI shows that around 14% of the world’s food is lost, excluding food waste by retailers and consumers. Estimates of FWI, which includes food wasted at the retail and consumption levels, are still been calculated. For what regards Europe, a study made in 2016 by FUSIONS (Food Use for Social Innovation by Optimising Waste Prevention Strategies), a project founded by the European Commission in order to make Europe a more resource efficient entity for what regards food waste, found that 88 million tonnes of food are wasted every year, equates to 173 kilograms of food waste per person in the EU-28. This estimate is made in 2012 and includes both edible food and inedible parts associated with food. The total amounts of food produced

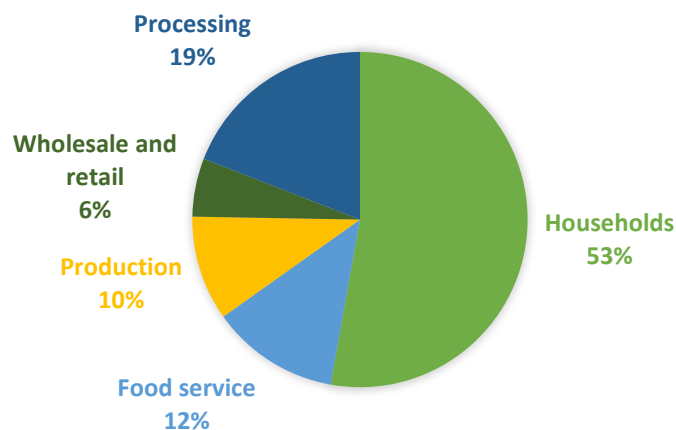
² <http://www.fao.org/economic/ess/ess-fs/ess-fadata/en/#.XgppzUdKjIV>

³ https://ec.europa.eu/eurostat/databrowser/view/t2020_50/default/table?lang=en

in Europe for 2011 were around 865 kg / person, meaning that Europe is wasting 20% of the total food produced (*Stenmarck et al., 2016*).

The main causes of food waste differ from developing and developed countries. In developing countries, food losses are mainly attributable to the absence of food-chain infrastructure and the lack of knowledge or investment in storage technologies. (*Garrone et al., 2014a; Godfray et al., 2010*), and to associated technical and managerial skills in food production and post-harvest processing (*FAO, 2011; Parfitt et al., 2010*). The situation is different in developed countries, where food is wasted mainly after the purchasing phase, driven by low prices of food relative to disposable income, consumers' high expectations of food cosmetic standards and the increasing disconnection between consumers and how food is produced. (*FAO, 2011; Lucifero, 2016*)

As a matter of fact, according to FUSIONS, in Europe the sector contributing the most to food waste is households (47 million tonnes \pm 4 million tonnes) followed by processing sector (17 million tonnes \pm 13 million tonnes). These two sectors account for 72% of EU food waste, although there is considerable uncertainty around the estimate for the processing sector. Of the remaining 28% of food waste, 11 million tonnes (12%) comes from food service, 9 million tonnes (10%) derives from production and 5 million tonnes (5%) from wholesale and retail. These estimates, made for 2012, have a confidence interval of 95%: this means an approximation of \pm 14 million tonnes (or \pm 16). Therefore, the range of results within this confidence interval is from 74 million tonnes to 101 million tonnes (*Stenmarck et al., 2016*). The Graph 2.1 summarizes FUSIONS results.



Graph 2.1 – Split of EU-28 food waste in 2012 by sector

The reason of this uncertainty in the estimates can be found in the difficulties in data gathering of food waste volumes because of the different and ambiguous definitions of the several terms, such as food waste, food losses, food scrap and at the end, surplus food. This issue was underlined by many authors over the years (*Arcuri et al., 2017; European Court of Auditors, 2016; Garrone et al., 2014b*). This ambiguity and non-uniformity of definitions may have led to wrong evaluations and, consequently, a resistance towards measures and plans in order to act on it. (*Foti et al., 2018; Stenmarck et al., 2016*). A lot of studies and analysis has been done in the last decade, with different perceptions and point of view of many scholars and professionals.

Parfitt et al. (2010) and Papargyropoulou et al. (2014) listed three main definitions of food waste from the literature they analysed: the first one from FAO (1981) as the wholesome edible material intended for human consumption, arising at any point in the FSC (Food Supply Chain) that is instead discarded, lost, degraded or consumed by pests, the second from Stuart (2009) who added from the previous definition edible material that is intentionally fed to animals or is a by-product of food processing diverted away from the human food and the last one from Smil (2004) same as the first and the second but including over-nutrition, the gap between the energy value of consumed food per capita and the energy value of food needed per capita.

In 2011 in its report “Global food losses and food waste – Extent, causes and prevention”, FAO gave its own definitions, distinguishing food waste from food losses. (*FAO, 2011*). They improved their definitions over the years, and here it is reported only the latest version of 2019. “*Food losses is the decrease in the quantity or quality of food resulting from decisions and actions by food suppliers in the chain, excluding retail, food service providers and consumers*”. “*Food waste is the decrease in the quantity or quality of food resulting from decisions and actions by retailers, food services and consumers*”. (*FAO, 2019*). Therefore, the main difference is that food losses refer to the first stages of the supply chain until the purchasing phase and food waste is the result of purchasing decisions: this may help to differentiate interventions from policymakers because on one hand they cope with suppliers and on the other act on retailers and consumers behaviour. In the last report “The State of Food and Agriculture 2019. Moving forward on food loss and waste reduction”, the organization presented also a framework they developed to

evaluate what can be considered waste. The Figure 2.1 shows a graphical representation of it. The framework distinguishes between the intended use of plants and animals produced (both food and non-food economic uses); their fragmentation into food, inedible parts, feed and non-feed parts; and, their destination (as food, productive non-food use, or food loss and waste). The intended use refers to the original purpose of the product in the chain: to be eaten by humans (food), fed to animals (feed), used as seeds, or for industrial or other purposes. If a product is not intended to be used as food and it is wasted, it is not considered food loss or waste even if this may have implications for food security and nutrition or the environment. Animal and plant products that are diverted to a non-food economic use (such as animal feed) are also not considered loss and waste. The fragmentation is the divisions of the product intended for human consumption in different uses: food, inedible parts, or other economic/productive uses. The destination refers to the actual use of the amount of edible food destined for human consumption: it can be eaten by people, diverted to economically productive use, or can be considered waste and be incinerated, composted or anaerobically digested (FAO, 2019).

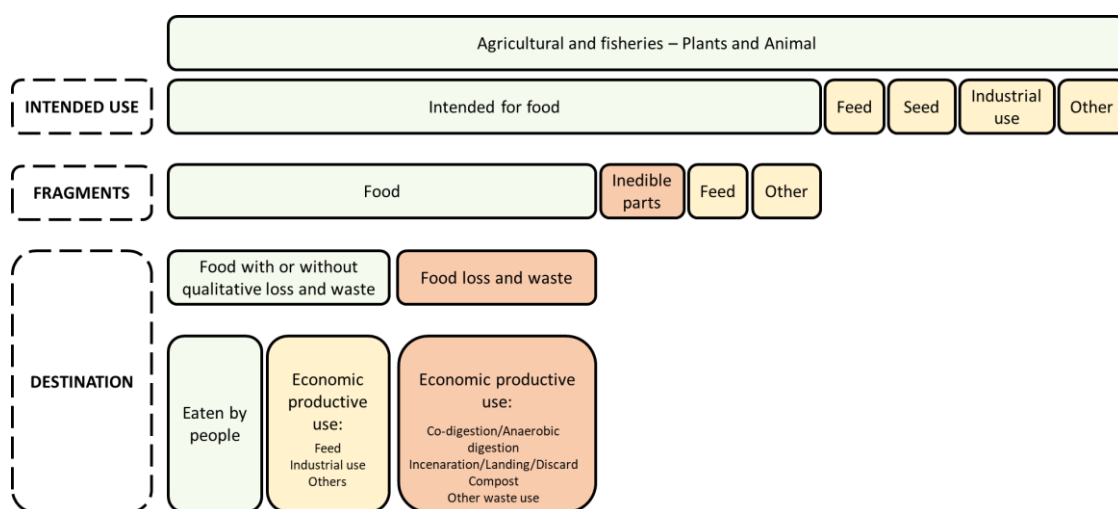


Figure 2.1 – FAO Conceptual Framework for Food Loss and Waste

According to FUSIONS, “Food waste is any food, and inedible parts of food, removed from the food supply chain to be recovered or disposed (including composted, crops ploughed in/not harvested, anaerobic digestion, bio-energy production, co-generation, incineration, disposal to sewer, landfill or discarded to sea)”. This definition is different

from the one gave by FAO because it includes inedible parts of food and also “*Drink and liquid waste, fish discarded to sea and waste of any materials that are ready for harvest, but which are not harvested*” are included. FUSIONS includes inedible part because it wants to underline the necessity to create a more sustainable and efficient food system at European level, as written before.

An important contribution for the research on food waste phenomenon was given by Garrone et al. (2013) in the study “Feed the hungry: the potential of surplus food recovery”. They want to deepen the issue of food waste and its recovery, analysing the Italian food supply chain and giving the definition of surplus food. First of all they analysed some definitions from the literature until the period of publication of their study, like the ones from Griffin et al. (2009) and Kantor et al. (1997); the first defined food waste as food products that are “discarded” at the various stages in the supply chain with no distinction between edible and inedible product, while the second one affirmed that food losses are the edible products that get “lost” at different stages in the supply chain, meaning that they are not sold or consumed by those for whom they were produced. After that, they developed a conceptual model, called ASRW (Availability, Surplus, Recoverability, Waste) in order to describe surplus food and food waste at individual stages in the food supply chain. Explaining the model, they first needed to give definitions of surplus food and food availability. Food availability is defined as “*all food produced throughout the food supply chain*”. It includes food products at individual stages in the supply chain. The food availability can have three different destinations: human consumption, surplus food and food scraps. The first is the edible food that is delivered through traditional market channels and is consumed by people to satisfy their food needs. Food scraps are the inedible food that is no longer suitable for human consumption. Surplus food is then defined as “*edible food that is produced, processed, distributed or served but for a variety of reasons is not purchased or consumed*”. Food waste can be defined in different ways, depending on the primary destination and use of surplus food. From a social perspective, it is the surplus food that is not recovered for human consumption through sales to secondary markets or donations to food banks and charitable organisations. This definition includes only the “edible” component which is surplus food, and not all the food availability. As regards the social and zoo-technical perspective, in the definition of food waste is included the surplus food that is not

recovered to feed either humans or animals. At last, in the general system perspective, the definition of food waste includes only disposed waste, that is, surplus food disposed of in landfills because it considers the beneficial use of surplus food in any form. The Figure 2.2 shows a scheme of what just explained.

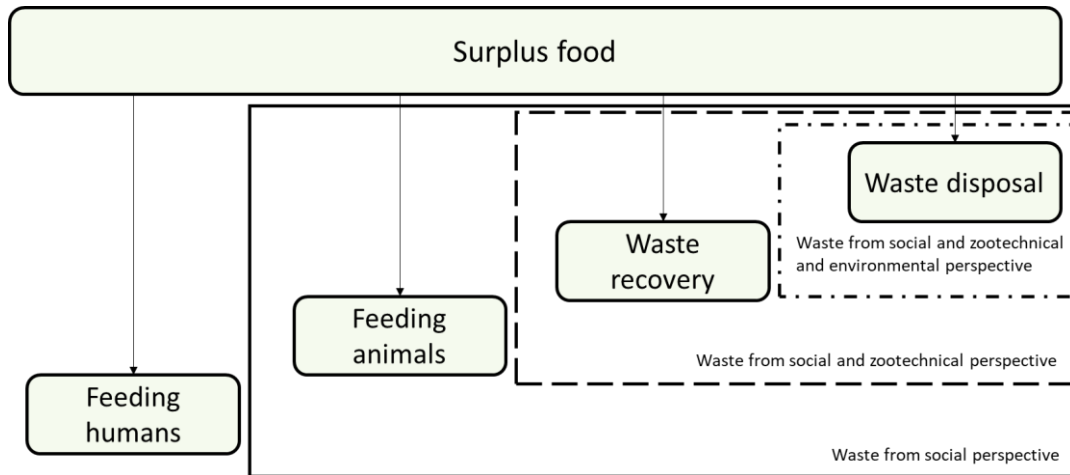


Figure 2.2 – The definition of food waste from different perspectives

We can notice that, having such various and divergent definitions, it can be difficult to have a consistent measure of the extent of the food waste phenomenon, and compare the evaluations of different studies of food waste management (Garrone et al., 2014a). In order to overcome this problem, the European Commission in the Directive (EU) 2018/851 of the European parliament and of the council of 30th May 2018 amending Directive 2008/98/EC on waste, stated that “*food waste means all food as defined in Article 2 of Regulation (EC) No 178/2002 of the European Parliament and of the Council that has become waste*”. From Article 2 of Regulation (EC) no 178/2002 of the European Parliament and of the Council, “*food (or foodstuff) means any substance or product, whether processed, partially processed or unprocessed, intended to be, or reasonably expected to be ingested by humans*”. This definition includes also inedible parts, when they are not be separated from the edible parts when the food was produced. Following this definition, food waste can comprise products that include parts of food intended for human consumption and parts that are not intended for that use. The definition of food waste from the European Commission takes into account only products that have already become food: in this way, does not include for example edible plants which have not been

harvested or by-products from the production of food, since they are defined as “*A substance or object, resulting from a production process, the primary aim of which is not the production of that item*” and consequently they are not a waste.

2.2 Surplus food and food waste management: Waste Hierarchy and Food Waste Hierarchy

In order to better understand the phenomenon of food loss and waste and to have the right tools to manage and overcome it, we can begin to look at how authors and legal entities had replied.

Regarding the European Commission, in 2008 in the Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives, it laid down “*measures to protect the environment and human health by preventing or reducing the adverse impacts of the generation and management of waste and by reducing overall impacts of resource use and improving the efficiency of such use*”. In order to do that, it established the Waste Hierarchy, a framework for the management of waste that gives a priority order, from the best environmental option to the worst. It also defined waste as “*any substance or object which the holder discards or intends or is required to discard*”.

In Article 4, the Waste Hierarchy is presented: the first option is Prevention, defined as measures taken before a substance, material or product has become waste. With Prevention measures the quantity of waste, the adverse impact on the environment and human health and the content of harmful substances in materials and products are reduced. The second option is Preparing for re-use and includes all the operations that are developed in order to use again for the same initial purpose a product or a component that are not wasted. The third, Recycling, means any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. Other recovery is any operation which leads waste to a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function. The last and less preferred one is

Disposal, defined as “any operation which is not recovery even where the operation has as a secondary consequence the reclamation of substances or energy”. Figure 2.3 shows a representation of the Waste Hierarchy.

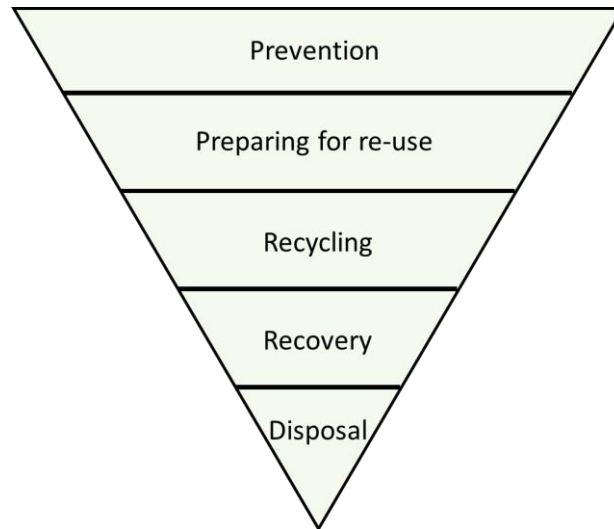


Figure 2.3 – Waste Hierarchy

For what regards surplus food management strategies, Garrone et al. (2013) in the book “Feed the hungry: the potential of surplus food recovery”, after giving the definition of surplus food, waste and scraps, identified and analysed four main management options for surplus food: feeding humans, through sales to secondary markets or donations to charitable organisations or food banks, feeding animals, giving or selling it to kennels or zoos for example, or by conferring it to manufacturing companies specialised in the production of animal feed, waste recovery where the surplus food is used by companies (public or private) for the production of fertilisers (especially when food products are “wet”) or energy (especially for dry food products) and, if all these options are not feasible, the surplus food is disposed in landfills (Garrone et al., 2013)

Papargyropoulou et al. (2014) gave an important contribution in the study of Waste Hierarchy and food waste: they introduced the framework of the Food Waste Hierarchy. They founded their study on the concepts of Waste Hierarchy and Sustainable Production and Consumption (SCP). The United Nations Environmental Program (UNEP, 2008) defines Sustainable Consumption and Production (SCP) as the “production and use of

goods and services that respond to basic needs and bring a better quality of life, while minimizing the use of natural resources, toxic materials and emissions of waste and pollutants over the life cycle, so as not to jeopardize the needs of future generations”. With a considerable number of interviews, the authors collected data which brought to the distinction of three main themes: the distinction between surplus food and food waste, between avoidable and unavoidable waste, and between waste prevention and waste management. After identifying the relationships between the first two themes, the options for prevention and management were identified and prioritized according to the principles of the Waste Hierarchy. At the end the surplus food and waste framework was developed, synthesizing the three themes.

The surplus food is defined as food produced beyond our nutritional needs, and in the moment it becomes unfit for human consumption it is called food waste (Papargyropoulou *et al.*, 2014). The difference between avoidable and unavoidable food waste is the possibility of the food which becomes waste of being edible. WRAP (Waste and Resources Action Programme), a charity which helps governments, businesses and communities to become more resource efficient in United Kingdom, defined unavoidable food waste as “*waste arising from food that is not, and has not been, edible under normal circumstances*”, while avoidable food waste as “*food thrown away because it is no longer wanted or has been allowed to go past its best*” (WRAP, 2009).

Regarding the Food Waste Hierarchy, the first option remains the Prevention one: it is environmentally recommended to prevent overproduction and oversupply of food beyond human nutritional needs at all the stages of the Food Supply Chain (Papargyropoulou *et al.*, 2014). The second option is Re-use for human consumption, so the possibility to redistribute the surplus food through a network of food banks and pantries to the people who are suffering from food insecurity. For the other three measures, the distinction between avoidable and unavoidable is essential. For both avoidable and unavoidable food waste there is the Recycling method. Recycling is first used for animal feed, then for composting. When Recycling is not possible, there is the Recovery option, the treatment of food waste with energy recovery, such as with anaerobic digestion. The last option for unavoidable food waste, and the least favourable option, is the Disposal in landfills. The framework is presented in Figure 2.4.

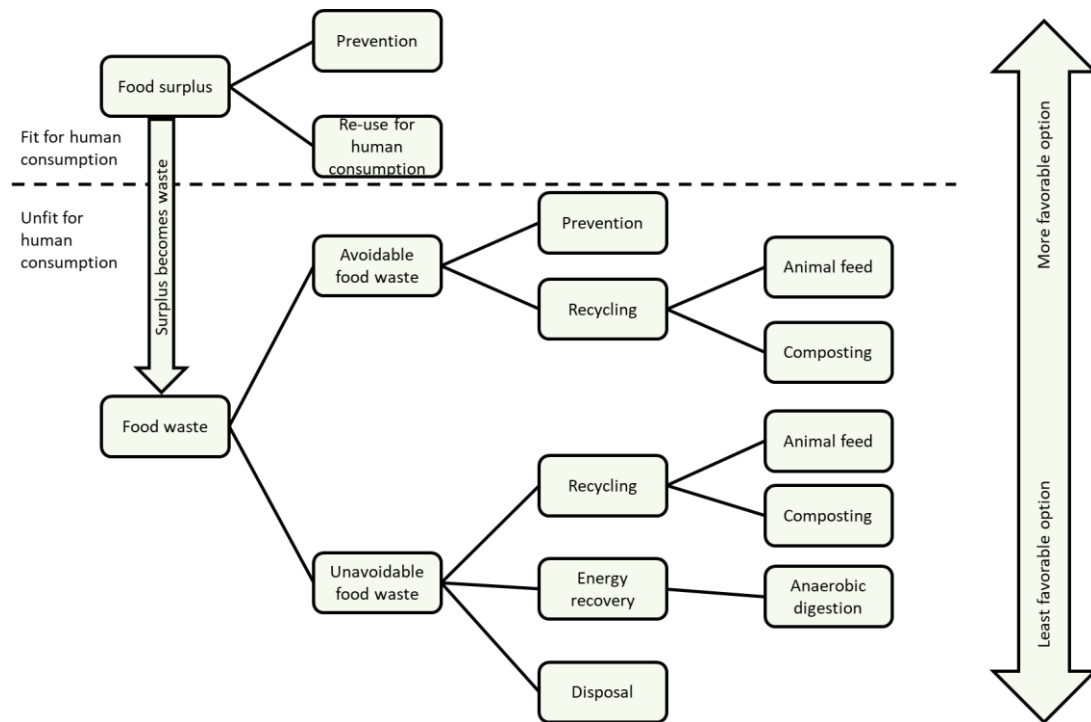


Figure 2.4 – Food surplus and waste framework

WRAP in 2011 developed the “Waste Hierarchy for food and drink businesses”⁴. It is slightly different from the one of Papargyropoulou et al. (2014), because in the Prevention option it includes also the redistribution to people and sending to animal feed. We can notice that, in this way, it underlines the difference between surplus food and food waste, following the zoo-technical perspective defined in study of Garrone et al. (2013), as surplus food becomes food waste when it is not recovered to feed either humans or animals.

Another Food Waste Hierarchy is proposed by EPA (United States Environmental Protection Agency) in 2013, named Food Recovery Hierarchy (EPA, 2013). It lists the actions that organizations can take in order to prevent and divert wasted food: Source reduction, Feed hungry people, Feed animals, Industrial uses, Composting and Landfill/Incineration. Being an agency of the United States federal government for environmental protection, this hierarchy has the same content of the one of Papargyropoulou et al. (2014), but it does not follow the names of the options defined in the Waste Hierarchy of the Directive 2008/98/EC of the European Parliament.

⁴ <https://www.wrap.org.uk/content/why-take-action-legalpolicy-case>

The commitment of European Commission towards the issue of food waste reduction increased with the publication of the Circular Economy Package in 2015, an action plan which includes measures to help the European transition towards a Circular Economy. The “EU Action Plan for the Circular Economy” established a concrete and ambitious programme of actions, that covers the whole economic cycle: from production and consumption to waste management and the market for secondary raw materials and a revised legislative proposal on waste.

This transition is essential nowadays, in a world that cannot handle a linear economy anymore, based on the paradigm "take-process-consume-discard", and so it is necessary to create a more efficient and sustainable system, maintaining the value of products and resources as long as possible in the economy and minimizing the generation of waste.

The involvement of the European Union towards the Circular Economy is essential for the achievements of the Sustainable Development Goals (SDGs), introduced by United Nations Member States in September 2015, in the U.N. 2030 Agenda for Sustainable Development (*United Nations, 2015*). The Agenda is based on 17 Sustainable Development Goals with 169 associated targets and its aim is to achieve sustainable development in its three dimensions, such as economic, social and environmental, building on the Millennium Development Goals, established in 2000 after the Millennium Summit of the United Nations, and trying to complete the work not achieved yet. SDGs touch a wide spectrum of themes: from ending poverty and hunger to combatting inequalities within and among countries, from building peaceful and inclusive societies to protecting human rights and promoting gender equalities, and from ensuring the protection of our planet to creating conditions for sustainable and inclusive economic growth.

The two targets fundamental for our study is the Goal 2 “*End hunger, achieve food security and improved nutrition and promote sustainable agriculture*”, and the Goal 12 “*Ensure sustainable consumption and production patterns*”. Another goal which it is important to mention for our research is the Goal 14 “*Conserve and sustainably use the oceans, seas and marine resources for sustainable development*”. Regarding food waste and food insecurity, the target that the European Commission is committed to meet are 2.1: “*By 2030, end hunger and ensure access by all people, in particular the poor and*

people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round” and 12.3: “By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses”.

In the Circular Economy Package established in 2015, the European Commission affirmed that there is neither a harmonized definition of food waste nor a method to measure it and therefore it is hard to quantify the extent of the phenomenon and find its origins. Within this report, the Commission committed itself to take some actions to solve this problem and to meet the UN targets.

From that time on, the European Commission has taken several steps: from the creation of the “EU Platform on Food Losses and Food Waste”⁵ in 2016, where Member State can share their knowledge and best practises in the fight against food waste, to the introduction of “food waste” definition in the revised Waste Framework Directive 2018/851 as written in 2.1.

The Directive (EU) 2018/851 is also an important step for the commitment of the European Commission towards food waste phenomenon because, after giving the definition of “food waste”, it also makes some adjustments to the previous Directive. For what regards the Waste Hierarchy it adds to the Article 4 the following graph: *“Member States shall make use of economic instruments and other measures to provide incentives for the application of the Waste Hierarchy, such as those indicated in Annex IVa or other appropriate instruments and measures”*. A noticeable measure listed in Annex IVa is the third: *“Fiscal incentives for donation of products, in particular food”*. We will deepen this issue in the next section.

Another fundamental outcome of this Directive is the decision to establish a common methodology and minimum quality requirements for the uniform measurement of levels of food waste. With this methodology, Member States shall measure levels of food waste on year base, and therefore monitor the achievements reached with food waste prevention measures. The objectives set by the Directive follows the UN Sustainable Development

⁵ https://ec.europa.eu/food/safety/food_waste/eu_actions/eu-platform_en

Goal, and it establishes a target of 30% reduction of food waste by 2025 and 50% by 2030. As a matter of fact, in the Article 9, Prevention of waste, in the point (g) it is established to: *“reduce the generation of food waste in primary production, in processing and manufacturing, in retail and other distribution of food, in restaurants and food services as well as in households as a contribution to the United Nations Sustainable Development Goal to reduce by 50 % the per capita global food waste at the retail and consumer levels and to reduce food losses along production and supply chains by 2030”*. Another remarkable point is (h): *“encourage food donation and other redistribution for human consumption, prioritising human use over animal feed and the reprocessing into non-food products”*.

On May 2019, the European Commission published the Commission Delegated Decision (EU) supplementing Directive 2008/98/EC of the European Parliament and of the Council as regards a common methodology and minimum quality requirements for the uniform measurement of levels of food waste. It is settled that Member States should carry out an in-depth measurement of the amounts of food waste on a regular basis for each stage of the food supply chain and at least once every four years. The five stages of the food supply chain are listed in Article 1: primary production, processing and manufacturing, retail and other distribution of food, restaurants and food services and households. For each stage, type of food waste differs, so in the Annex III a list of methodology that can be used for accessing the entity of food waste is proposed. When an entity has the direct (physical) access to food waste, it can use these methodologies in order to measure the food waste or to carry out an approximation: Direct measurement (weighing or volumetric assessment), Scanning/ Counting (assessment of the number of items that make up food waste, and use of the result to determine the mass), Waste composition analysis (physical separation of food waste from other fractions in order to determine the mass of the fractions sorted out) and/or Diaries (an individual or group of individuals keeps a record or log of food waste information on a regular basis). When there is no direct access to food waste or when direct measurement is not feasible, the other methodologies that can be used are Mass balance (Calculation of the amount of food waste on the basis of the mass of inputs and outputs of food into and out of the measured system, and processing and consumption of food within the system) or Coefficients (use of previously established food waste coefficients or percentages representative for a food industry sub-sector or for

an individual business operator). As written in Article 2, the amounts of food waste shall be measured in metric tonnes of fresh mass and in Article 4, the measurements need to be based on a representative sample of the population and on the best information available.

2.3 Surplus food redistribution: focus on surplus food donation

2.3.1 From problem to resource

As written in the section 2.2, the option of Re-use for human consumption (or redistribution) can happen in two different ways: through sales to secondary markets or donations to charitable organisations or food banks. For the purpose of this study we will focus on the second one, the surplus food donation.

Food donation answers the two relevant aspects analysed before: the growing food insecurity in the world and the prevention of food waste, defined following the social perspective. The redistribution is therefore the re-use of food for its primary function: in this way, food waste can be seen as a problem that becomes a resource, reaffirming the meaning of the Circular Economy paradigm.

In order to study the phenomenon of surplus food donation, we need first to introduce a concept developed by Garrone et al. (2013), which is a fundamental element for establishing plans and strategies in the management of surplus food: the Degree of Recoverability (DoR). This term means the relative ease of recovering surplus food for human consumption, and it differs from stage to stage in the food supply chain and for different kinds of products. The Degree of Recoverability is a function of the Intrinsic Recoverability (IR) and of the required Management Intensity (MI). The first one is defined as “*the facility with which a potential beneficiary could make use of the surplus food for human consumption in the absence of additional management efforts and/or intermediation*”. The higher is the IR, the greater the DoR of the food product. It depends on the type of product and the activities typically performed at a certain stage. The second variable represents the level of effort required by companies and intermediaries (e.g. charitable organisations) to maximise the usability of the surplus food by the final

beneficiary. This variable depends on two components, too: the effort needed to maintain products quality and nutritional properties and the enhancement effort required to increase the opportunities for using the surplus food. DoR decreases with increasing MI: therefore, the smaller is the MI, the greater is the Degree of Recoverability. The importance of analysing the DoR lies in the possible definition and implementation of feasible strategies in order to transform surplus food into a resource.

For the realization of surplus food donation, the work of food banks and other organizations and association which fight against food waste phenomenon recovering it for social purposes is essential (*Foti et al., 2018; Garrone et al., 2014b*). In his study, Gentilini (2013) reported that in 2011, 6% of European inhabitants (i.e. almost 19 million people) were reached by the EU food aid programme through food banks and other charitable organizations (*Gentilini, 2013*). The first food bank was created in the mid-Sixties by John Van Hengel in Phoenix, Arizona with the name of St. Mary's Food Bank. He was a volunteer in the local soup kitchen and after realizing the low annual budget given to it, he started to recover not harvested fruits and vegetables from the fields in order to use them for the kitchen meals. Additionally, Van Hengel and his colleagues soon began to recover surplus food from many supermarkets and redistribute it to other organizations: they gave structure to these operations and so the first food bank was created. This model has spread soon all over the world: a great example was the European Food Banks Federation (FEBA), which operates in 24 countries through a network of 421 Food Banks and branches. According to their Annual report of 2018, FEBA membership redistributed 781 thousand tonnes of food, equivalent to 4.3 million daily meals through 45.7 thousand charities assisting 9.3 million deprived people (*FEBA, 2018*).

In the recovery and redistribution phase there are different players involved and we can distinguish two types of non-profit organizations: front-line and back-line, and in addition a hybrid model (*Garrone et al., 2015*). They differ from each other by logistical capabilities, type of relationships established with beneficiaries and interaction capabilities with donor companies. The front-line organizations are deeply involved with the people in need, helping them with everyday problems. They are characterized by high commitment of the volunteers, who work for the rehabilitation of the person in need in their living place and who sensitize other people with initiatives and programs. They lack

logistical capabilities and relationships with policy makers and big donor companies, while they interact with small donor companies (Baglioni *et al.*, 2017). Examples of this type of organization are food pantries and soup kitchen. The back-line organizations, on the contrary, are characterized by strong logistics capabilities for the recovery and redistribution activities, but they do not have strong direct interaction with the people who suffer food insecurity. The food banks are an example of back-line non-profit organizations and they act as intermediaries between donors and front-line organizations. Finally, there is the hybrid model which combines logistical capabilities and management of supply channels with direct contact with the beneficiaries.

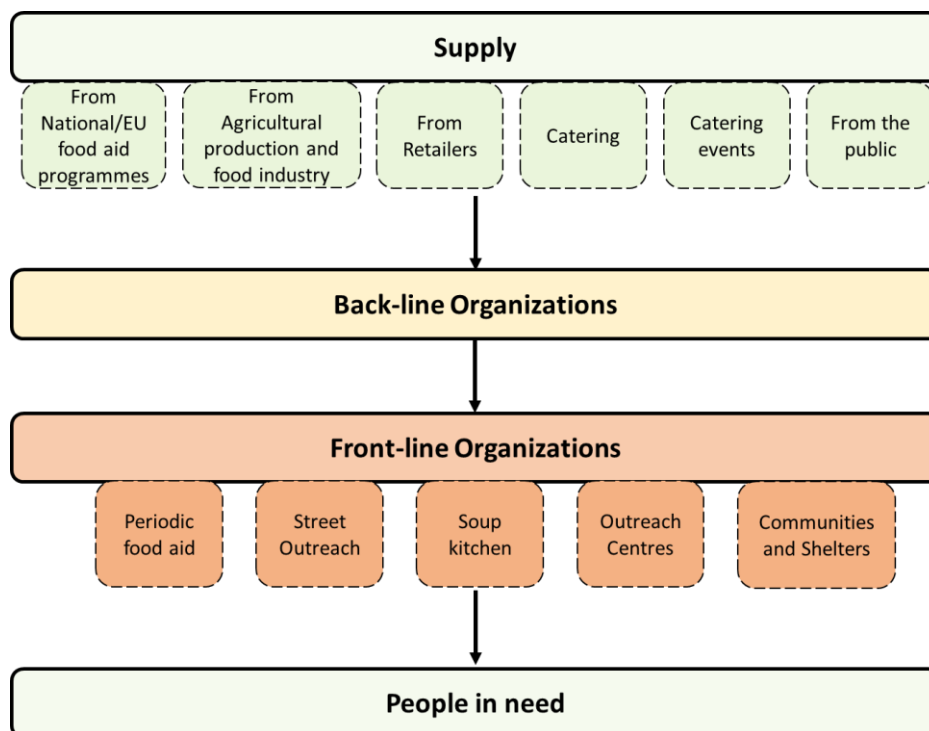


Figure 2.5 – Description of the “Recovery System” Chain

The contribution of the public sector is also essential. Only with the cooperation of the different players involved in the recovery chain (companies, non-profit organization and the public sector), the process will be efficient and the results of minimizing the food waste improved. On the side of the public authorities, it is fundamental to know how the process is developed and to discover the real necessities and limitations of the players involved in the chain (Garrone *et al.*, 2015). For what regards local entities, their aim is to favour the relationships and the shared knowledge between non-profit organizations and companies, while the national and international bodies need to contribute in the

development of new rules and incentives for the different players in the implementation of food waste reduction and surplus food management strategies. Another essential task that governments need to do is to raise awareness of the phenomenon and collect and disseminate scientific data on food waste in order to better understand it for taking the best strategic decisions (*Garrone et al., 2013*). A study developed by Deloitte in 2014 identified four main areas in which the public sector may work in order to favour surplus food donation and to increase redistribution: the definition of a common “Food Use Hierarchy”, the use of fiscal incentives for both donating companies and non-profit organisations, the liability legislation and the reform of food durability and ‘best before’ dates (*Guarinoni & Versmann, 2014*).

The main barriers to donation listed by many authors are related with this set of possible improvement areas just listed. As a matter of fact, the main legal areas impacting the quantity of food donated are: food safety, hygiene and tax legislation. In addition to them, lack of knowledge by donors on foodstuffs suitable for donation, insufficient logistical frameworks in place to facilitate large-scale donation, lack of storage capacity at the donor to set aside food losses if not immediately picked up by the food banks or lack of cooled transport capacity at the acceptor side and the burden on charities in managing surplus food recovery and redistribution create great barriers for food donation (*Baglioni et al., 2017; De Boeck et al., 2017; Galli et al., 2019; Schneider, 2013*).

Also the European Commission, specifically a sub-group on food donation of the EU Platform on Food Losses and Food Waste, analysed operational food redistribution models employed by Member States and listed several barriers and success factors. The main barriers are the following:

- lack of technical equipment and infrastructure
- lack of knowledge (of food business operators, beneficiaries etc.)
- higher demand than supply (food available in small volumes etc.)
- reduced human capacity (volunteers etc.) and financial resources
- absence of fiscal incentives
- limited availability of foods with short shelf life (e.g. high-quality protein sources such as meat, fish etc...)

- responsibility and liability issues
- geographical constraints
- absence of a coordinating body (i.e. multiple operators working independently)

While the main success factors found are:

- availability of EU wide guidelines for food donation, as well as national guidelines
- fiscal incentives
- inter-sectoral collaboration, including public/private, and development of networks (e.g. regional redistribution centres in NL)
- digital tools facilitating the donation process
- financial help for redistribution operators
- raising awareness about relevant measures laid down in EU/national legislation including the possibility of redistributing food past the 'best before' date
- legislation and/or guidance clarifying who is responsible for what at each stage of the redistribution process

For what regards the analysis of the main causes of surplus food creation, it is essential to identify the main stages of the food supply chain because every stage has different management strategy and different product characteristics. Therefore, there are different causes for each stage of the food supply chain.

There are five main stages: agriculture and fishing sector, manufacturing companies, retail trade, food services and household consumption. The first one includes crop farmers, livestock farmers and fishermen and other players like consortia and intermediaries. The outputs of this stage are raw food material, which are then sent to manufacturing companies (or sold directly to the final customer). After the production, the products are distributed through retail trade, which includes large-scale retailers, small-scale retailers and market stallholders. Then the fourth and the fifth stages are related to the consumption of food products in food service establishments or in households.

For the purpose of this study, we will focus on the first stage. Garrone et al. (2013) listed the main sources of generation of surplus food regarding this sector. The main source is the non-conformance with commercial standards of the products, as they do not meet the aesthetic level required. The second one is the over-production, so when the production exceeds the demand of the market. The generation of surplus food is also due to deterioration in storage. This can happen because of ineffective product management (e.g. unsuitable storage temperatures) or unsound management policies (e.g. storing larger quantities than required). Another source can be mishandling of the goods: a product may get damaged and lose the aesthetic quality required by the customer during handling operations or transportation (*Garrone et al., 2013*).

In 2015, the Banco Alimentare Foundation in collaboration with Caritas Italiana, the pastoral body set up by the Italian Episcopal Conference, developed the “Manual of Good Practices for charitable organisations” in order to systematize the activities and the correct hygiene practices which enable the recovery, collection, storage and redistribution of surplus food products by the hand of non-profit organizations from all the stages of the food supply chain. In this manual, the food recovery, collection and redistribution system for charitable purposes is described.

The first stage is the food supply and includes the recovery and collection of surplus food by different sources. The main ones are national and European food aid programmes, retailers, agricultural producers, the food industry, canteens and catering services, public services and other initiatives carried by members of public and individuals. After that there is the transport of recovered and collected food. Depending on the type of food collected, the means of transport may vary; non-profit organization may turn to intermodal freight services when they are dealing with large volumes or use small unrefrigerated lorry with insulated containers for smaller quantities. If the product is highly perishable, the back-line organization can transport the food directly to the front-line charitable organization. Then, in the storage and conservation phase, the products are stored by both back-line and front-line organizations (if there is the necessity). The fourth step is the preparation of food: the back-line organization prepares periodic packages to be distributed directly to those in need through front-line organizations. The last stage is the effective redistribution of food to people in need on the form of prepared food (e.g.

sandwiches, cooked meals and drinks) or non-perishable/perishable, prepacked /unpacked food.

There are also some risks specific for the recovery, collection and redistribution activities. The biological hazard is the first one to prevent and avoid and includes microorganisms and the related substances they may produce, parasites or pests. Then there is the chemical hazard derived from the presence of unwanted chemical substances and the physical hazard arisen from accidental foreign bodies in food products. (*Caritas Italiana & Fondazione Banco Alimentare ONLUS, 2015*)

2.3.2 European guidelines on food donation

An important contribution in the study of the surplus food donation has been given by the European Commission. As written in section 2.1, it put a lot of effort into this field, mainly after the publication of the Circular Economy Package in 2015, where the Commission committed itself to establish measures to clarify EU Regulations relating to waste and food and to facilitate food donation. Therefore, after the creation of the “EU Platform on Food Losses and Food Waste” in 2016, and the introduction of “food waste” definition in the revised Waste Framework Directive 2018/851, the “EU guidelines on food donation” were adopted on 17 October 2017. These guidelines aim to clarify the provisions given by European legislation and to remove barriers in the food donation process in the previous regulatory framework. This document was created for facilitating the compliance of the players involved in the redistribution activities with the different requirements: food safety, food hygiene, traceability, VAT. It also played an important role in clarifying roles and responsibilities of the players involved.

Food redistribution is then defined, following the definition of “recovery and redistribution for safe and nutritious food for human consumption” given by FAO: *“Recovery of safe and nutritious food for human consumption is to receive, with or without payment, food (processed, semi-processed or raw) which would otherwise be discarded or wasted from the agricultural, livestock and fisheries supply chains of the food system”*. *“Redistribution of safe and nutritious food for human consumption is to store or process and then distribute the received food pursuant to appropriate safety,*

quality and regulatory frameworks directly or through intermediaries, and with or without payment, to those having access to it for food intake” (FAO, 2015).

The guidelines list all the players who play an important role in the recovery and redistribution process. Donor organizations are food business operators which may provide surplus food from each stage of the food supply chain. Receiver organizations are the ones who get surplus food from donors. As written before, they can be classified as back-line or front-line. A particular kind of donor is the Private one, person who provides food in certain occasions at community or other charity events. The private people are exempt from the General Food Law obligations (because it does not apply to primary production for private domestic use) and consequently the charity organization who receives food from them are excluded too. Nevertheless, the guidelines recommend Member State to provide clarifications on rules and to give support to charity organizations in order to help them being compliant with the safety and hygiene requirements. The facilitator organizations are intermediary organizations which ease the collaboration between food donors and receivers, matching the supply of surplus food with the potential demand.

All the receiver organizations need to be considered as food business operators, defined in the General Food Law as *“the natural or legal persons responsible for ensuring that the requirements of food law are met within the food business under their control”*. So, they need to secure that food safety requirements are met at all stages of the food supply chain. One important requirement regards the traceability system. All the organizations which have a role in the redistribution of surplus food need to ensure the traceability of all the products they handle and keep records of their origins and, if they donate it to other businesses, they must document to whom it has been redistributed.

For what regards fiscal rules, the European Commission recommended to facilitate the donation for charitable purposes in adapting the rules applicable to goods handed out for free. This because the VAT legislation on surplus food redistributed can be seen as an obstacle to the transfer of surplus food between donors, food banks and other charitable organizations. Another solution is to offer tax reduction or tax credits in order to stimulate the choice of redistribute surplus food instead of resorting to disposal in landfills.

In the section 8, the European Commission lists three programmes developed at EU level. The first is the Fund for European Aid to the most Deprived (FEAD), the European fund to assist the Member State in the fight against food poverty, providing non-financial assistance to the people most in need. The FEAD is implemented with the help of different organization, such as public bodies or non-profit organisations which provide assistance activities. Then, there is the Common Organisation of the Markets in agricultural products and the Common Organisation of the Markets in fishery and aquaculture products. For the purpose of this study we will focus on this last one.

In the previous sections of the guidelines, some parts are dedicated to animal products and in particular meat and fish. Specifically, the two main issues are related to food hygiene and traceability. For the first one, there is additional rules adopted for food of animal origin: retailers who wish to deliver food of animal origin to redistribution organisations or charities need to comply with all provisions of Regulation (EC) No 853/2004 with related additional administrative requirements and burden including their approval by national authorities before the activity starts. Traceability is also a very important requirements when dealing with meat but above all fish products: for the latter, the guidelines underline the need to align with the specific traceability rules established in the Article 58 of Council Regulation (EC) No 1224/2009 (1) establishing a Union control system for ensuring compliance with the rules of the Common Fisheries Policy. Operators from all the supply chain phases have to carry all the specific information required for tracing fishery and aquaculture products in order to trace those products back to the catching or harvesting stage.

Taking into consideration only the fishery sector, the guidelines underline the contribution of the Common Organization of the Market (CMO) in fishery and aquaculture sector in working in sustainable exploitation of living marine biological resources. The first goal they want to achieve is the reduction of the unwanted catches and, in the case this is not possible, they want to find the best use of them. The EU Common Fishery Policy established minimum conservation reference sizes applied for certain species, in order to encourage fishermen to selective fishing practises. It also established that the catches that goes under minimum conservation size cannot be used for human consumption, but for other uses: the reason behind this is the necessity of not

creating secondary market of undersized fish products. Another important issue is the adjustment of production to market requirements: in this way, planning the catches in order to match the market demand, fishermen have certain earnings, and the food waste is limited.

Regarding the donation of fish products, even if the CMO does not promote and encourage it, it does not exclude this option. The guidelines underline the requirement of possible donated fish products: respecting the minimum conservation size and the common marketing standards.

An example of this is given by Peter van Dalen, Vice-Chair of the Committee on Fisheries on 25th March 2020 in a Joint Press Release by CU, CDA and SGP⁶ (three parliamentary list for the European Parliament). It regarded the possible helps to fisheries during the crisis of COVID-19, the virus which is spreading worldwide, causing a health crisis but also an economic one. After underling the decrease in the demand of fish products, with the consequent creation of surplus food, he pointed out the possibility to give this surplus to food banks, which are experiencing a decrease in the offer, with very low level of stocks. In this way, two problems can be solved: fishermen can receive a compensation for costs sustained by the European Maritime and Fisheries Fund (EMFF), while food banks can donate a very healthy food.

2.3.3 Italian environment

In this section we will analyse the involvement of Italy towards the issues of food waste and Circular Economy.

In the last years, Italy has approved a series of policy actions towards the adoption of Circular Economy strategies such as the Law 221 (28 December 2015) and other legislative decrees that define guidelines and criteria for the realization of this paradigm (e.g. the calculation of the rate of differentiated collection for municipal solid waste). (*Ghisellini & Ulgiati, 2020*)

⁶ <https://www.petervandalen.eu/blog/2020/03/25/Gezamenlijk-Persbericht-CU-CDA-en-SGP-corana-hulp-nodig-voor-de-Europese-Visserij?originNode=46177>

Italy is one of the most important economies within European countries, but it has not many natural resources, therefore it needs to rely on huge volumes of imports. According to the authors Ghisellini and Ulgiati (2020), this dependency can be mitigated with the transition towards Circular Economy, since it will make our country more sustainable, competitive and secure in the economic sphere. They underlined the fact that many companies (profit or non-profit), municipalities, foundations and associations (such as research centres and universities) are adopting the principles of CE in their organizations. Focusing on the distribution of organization's activities over the life cycle of the product, 40% of the sample deals with the stage of production, 20% in recycling stage, while 10% in reuse of goods. The companies included in the latter group are mainly non-profit organizations which collect and redistribute clothes and other objective, but also surplus food to poor people. The others are remanufacturing (9%) promotion of CE culture (7%), collection of post consumption waste (6%), design/research on CE (4%), distribution (2%) and consumption (2%). Regarding non-profit organization, they play an important role in the promotion of culture and dissemination of knowledge of CE, the recovery from citizens of used goods for their remanufacturing or their reuse and selling in second hand shops, the collection and redistribution of food to the indigent people.

Italy is one of 193 States of the United Nations who, since the approval of the 2030 Agenda for Sustainable Development in 2015, is working towards the achievements of the goals within 2030. In 2016, the Italian Alliance for Sustainable Development (ASviS) was born, on the initiative of the Unipolis Foundation and the University of Rome Tor Vergata. Its mission is to raise in the Italian society, in the economic players and in the institutions, the awareness of the importance towards the 2030 Agenda and to mobilize them in order to achieve the Sustainable Development Goals. Nowadays, the Alliance gathers over 220 institutions and networks of the civil society.

Now we will go deeper in the analysis of the evolution in Italy of the three SDGs which we are interested in: Goal 2 *“End hunger, achieve food security and improved nutrition and promote sustainable agriculture”*, the Goal 12 *“Ensure sustainable consumption and production patterns”* and Goal 14 *“Conserve and sustainably use the oceans, seas and marine resources for sustainable development”*.

In the last report of ASviS “Italy and the Goals for Sustainable Development”, published in 2019, each goal is analysed. For the Goal 2, it is reported that there was a significant improvement between 2010 and 2017, where the agricultural production and the extension of the areas destined for organic products have increased, while the use of pesticides and herbicides has decreased. For the fight against food poverty, the 2019 Budget Law added 1 million euros for years 2019, 2020 and 2021 to the Fund for the distribution of foodstuffs to destitute people (established by art. 58, section 1, of the Law decree n. 83 of 2012), which has already a budget of 5 million euros every year.

Even for Goal 12 there was a great progress during the period 2010-2017, thanks to the increasing of almost all the single indicator with a consequent improvement of the aggregated one. Particularly, the percentage of recycling of waste has reached a value of 49,4%, approaching the European Target for 2020 (50%), and also the index of circularity of material, defined as the percentage of material that is recovered and reintroduced into the economy over the total consumption, has reached important levels.

The Goal 14 is one of those targets that worsened in last years. In particular, the indicator of this target has shown a fluctuating trend: it had a positive trend until 2015, but during the following two years it reverts its tendency, worsening because of the increasing fishing activity and the phenomenon of overexploitation of fish stocks, which reaches a percentage of 83,3%, doubling the European average of 42%.

In the report, there was also a focus on the status of the food system in Italy. It identified points of strength and some areas of improvement for what regards sustainable agriculture, food loss and waste and nutritional challenges. Focusing on the theme of food loss and waste, they underlined as strengths the presence of innovative legislations (we will deep this issue later), positive initiatives by the third-party sector, public-private partnerships and a good level of scientific interest for the theme. Regarding the areas of improvement, they reported high level of food waste per capita, absence of monitoring system and absence of specific reduction target for food waste and loss. (*Alleanza Italiana per lo Sviluppo Sostenibile (Asvis), 2019*)

One of the first estimates of surplus food in Italy was made by Garrone et al. (2015) in the study “Surplus Food Management against Food Waste”. They analysed each stage of

the supply chain, measuring the amount of surplus food produced and the causes of the generation. The Table 2.1 summarizes the results.

<i>Stage</i>	<i>Surplus food [t]</i>	<i>Weight of the stage on surplus generated [%]</i>	<i>Annual flow [t]</i>	<i>Incidence of the surplus for every stage [%]</i>
<i>Primary</i>	2.045.000	37	71.975.000	2,8
<i>Transformation</i>	175.000	3	46.085.000	0,4
<i>Distribution</i>	755.000	13	29.810.000	2,5
<i>Food service</i>	210.000	4	3.280.000	6,4
<i>Consumption</i>	2.405.000	43	29.935.000	8,0
<i>Total</i>	5.590.000	100	181.085.000	

Table 2.1 – Amount of surplus food in the Italian agri-food supply chain

Most recent estimates of food waste level in Italy have been presented during the 6th National Food Waste Prevention Day (5th February 2019), established by the Ministry of the Environment in collaboration with the University of Bologna - Department of Agri-Food Sciences and Technologies and Zero Waste campaign of Last Minute Market, a social enterprise working on prevention and reduction of waste, by the project “60 Sei ZERO”. The estimate of food waste made for 2017 is equal to 15.034.347.348 €, which is the sum of food waste from the production and distribution stages (21,13% of the total amount) and the household food waste, which represents the great majority of it (78,87%).

The total amount of food waste weight 0,88% of the national gross domestic product (GDP)⁷.

In the Table 2.2, the exact estimates with the related percentages are presented for the different sectors of the food supply chain.

⁷ <https://www.sprecozero.it/2019/02/04/spreco-alimentare-in-italia-vale-quasi-16-miliardi-e-quasi-12-nelle-nostre-case-presentati-alla-fao-stamane-i-dati-waste-watcher-in-occasione-della-giornata-naz-di-prevenzione-dello-spreco-alimen/>

<i>Supply chain sector</i>	<i>Value of food waste (€)</i>	<i>%</i>
<i>Primary</i>	833.576.183	5,5
<i>Industry</i>	1.050.724.941	7,0
<i>Distribution</i>	1.291.731.289	8,6
<i>Household</i>	11.858.314.935	78,9
<i>Total</i>	15.034.347.348	100,0

Table 2.2 – Food waste estimates

The data reveal that actions need to be made to contrast the food waste coming from households, and this means increase the awareness of Italian citizens towards this issue, investing in food education projects to promote good practices and improve the sensitivity of consumers.

This issue is confirmed by the 2019 report of Waste Watcher, the national Observatory on waste, established by initiative of Last Minute Market, where it emerged the perception of Italian citizens over the food waste phenomenon: 4/5 of consumers do not believe that the great part of food waste comes from households. As a matter of fact, 20% of the interviewees affirms that the wastes derive from commercial activities and in the public sector, like school and hospitals, offices and barracks.

The project “REDUCE - research, education, communication: an integrated approach for the prevention of food waste” financed by the Ministry of the Environment and presented by University of Bologna, made in 2018 an analysis on quantification of food waste in Italy⁸. The analysis showed that in households 27,5 kg edible food waste/person are wasted every year, which means 1,6 million tons in Italy per year. Regarding the treatment plants, 89-111 (average 97) kg/person/year of total food waste and 14-38 (average 27) kg/person/year of avoidable food waste. In the food service, out of 534 g of prepared meal, 120 g are wasted, while in retail sector, 18,7 kg/m²/year are wasted in stores, which means 220.000 ton/year and 2,89 kg/person/year, with 35% of this food is perfectly edible when wasted.

⁸ <https://www.sprecozero.it/2019/07/16/lo-spreco-alimentare-in-italia-i-risultati-del-progetto-reduce/>

The paradox of scarcity within abundance is therefore a reality also in Italy, where in 2018 it was estimated that the families in absolute poverty were 1,8 million, with an incidence of 7% and an overall number of 5 million people⁹. The threshold of absolute poverty is an indicator established by ISTAT, the National Institute of Statistics of Italy, and it represents the monetary value of goods and services considered essential for each family, defined on the bases of components ages, geographical location and typology of city of residence. A family is absolutely poor if it sustains a monthly expenditure equal or lower than this monetary value. Another indicator is the relative poverty, which in Italy is estimated to involve 3 million families (11,8%), and an overall number of 9 million people¹⁰. The relative indicator is based on the use of the line of poverty, known as International Standard of Poverty Line (ISPL), which defines a family of two components poor with an expenditure equal or lower than the average expenditure per capita. For families of different sizes, corrective coefficients which take into account different needs and possible economies of scale due to the increasing number of family components are used.

The involvement of Italy in the issue of food waste and in particular food prevention and redistribution, began with the Law 155/2003, the so-called Good Samaritan Law. In 2014, the Ministry of the Environment presented the National Plan of Food Waste Prevention (Piano Nazionale di Prevenzione degli Sprechi Alimentari - PINPAS), which includes ten measures to fight food waste: from sale with lower prices of food that is about to expire to the donation of unsold products, from volunteer agreements with food services and distribution companies, to the introduction of rewarding criteria in public procurement of collective catering services for those who distribute food surplus for free. The PINPAS is one of the steps which bring to the promulgation of the Law 19th August 2016, n. 166, containing "Provisions concerning the donation and distribution of food and pharmaceutical products for the purpose of social solidarity and for the limitation of waste", the so-called Gadda Law, name of its first signatory.

Italy is the first state in Europe which decided to realize a regulatory instrument to fight food waste with a series of measures aimed at first reduce the production of waste, but

⁹ <https://www.istat.it/it/archivio/231263>

¹⁰ <https://www.istat.it/it/archivio/231263>

most important, to promote and incentivize the reuse and redistribution of surplus food and pharmaceutical products for social solidarity purposes, in order to reach the objectives established by the National Plan for waste prevention and by PINPAS. This new law harmonizes the different current regulations about tax reliefs, civil responsibility and procedures for sanitary safety and facilitates administrative issue for the donation procedures respect to the disposal: in this way, the food sector operators can give for free surplus food to donor subjects. It also introduces the possibility for municipalities to incentivize the donation of products to non-profit organizations with the reduction of the tax on wastes.

The Law touches different issues, the most important is the clear distinction between food waste and surplus food and the definitions of food sector operator, donor subjects, donation, minimum storage period and expiry date. All the definitions proposed are coherent with the Food Waste Hierarchy adopted at international levels.

The food sector operators are defined as public or private subjects, operating for profit or not, which carry out activities connected at the production, packaging, transformation, distribution or provision of food phase. The donors are then defined as public entities or private ones established for non-profit pursuits of civic and solidarity purposes and which, implementing the subsidiarity principle and in accordance with the respective statutes or articles of association, promote and realize activities of general interest also through the production and exchange of goods and services of social utility as well as through forms of mutuality, including third sector entities as referred to Third sector code, referred to in the legislative decree of 3 July 2017, n. 117.

Regarding the distinction between the term surplus food and food waste, the first is defined as food, agricultural and agri-food products which, notwithstanding the maintenance of product hygiene and safety requirements, are for illustrative, yet incomplete purposes: unsold or not administered due to lack of demand. Food waste is the set of food products discarded from the food supply chain for commercial or aesthetic reasons or for the proximity of the expire date, still edible and potentially destined to the human or animal consumption and which, in the absence of a possible alternative use, is intended to be disposed.

One of the main innovations introduced in this regulation is the one included in Article 6, which is a modification of Article 15 of the Decree of 29th July 1982, n. 571, and provides specific rules to allow the reuse and donation of the goods which are object of confiscation, when they are suitable for the human or animal consumption. When a product is confiscated, the Authority engaged in the process arranges the free transfer to private entities which must pursue civic and solidarity purposes without the aim of profits, that means donors as defined before.

The donation of confiscated products for reason other than food safety is also taken into account in the European guidelines on food donation when the term surplus food is explained: “*Foods suitable for food donation may include, for instance, products which:[...] have been collected and/or confiscated by regulatory authorities for reasons other than food safety*”. From an analysis made by EU Platform on Food Losses and Food Waste in 2019 of the different examples of practices in the Member States, it emerges that only Italy and Greece and Lithuania have in their National Regulations the possibility to donate confiscated products. Regarding Italy and Greece, it is underlined that among the others, fish product can be donated if it is confiscated by the Competent Authorities. From now on, the focus of our research will be on this type of product.

2.4 The fishing sector: the phenomenon of confiscated fish products

In this section we will deepen the fishing sector from different parts: from the Regulations established by the European Commission, to the issue of sustainable fishing and the practice of Illegal, Unreported and Unregulated (IUU) fishing and the possibility of recovery and redistribution of this product.

2.4.1 European Commission Regulations on fishing sector

The European Union represents one the main seafood market in the world: according to the European Market Observatory for Fisheries and Aquaculture (EUMOFA), its apparent consumption for 2017 amounted to 12,45 million tonnes, which correspond to 24 kg per capita. The great part of the internal demand is covered by imports (60% of the

total supply in 2017). The EU is the 5th largest producer in the world of fishery and aquaculture products, representing 3% of the global production (5,6% for catches and 1,2% for aquaculture) (EUMOFA, 2019).

Being one of the biggest market and producer in the world leads to the need to establish on one side a sustainable use of the resources, since for decades the European fish stocks have been overfished and, on the other, policies and regulations to ensure to the large number of European fishermen a stable and profitable market, aligning the demand to the offer, and assuring reasonable prices for consumers.

In this context, the European Commission in 2013 updated the Common Fisheries Policy (CFP), already established in the 1970s and modified over the years. The CFP is a set of rules that enables the management of the European fishing fleets and aims at the conservation of fish stocks. In the Regulation (EU) No 1380/2013, the scope of the CFP is defined: it shall cover (a) the conservation of marine biological resources and the management of fisheries and fleets exploiting such resources and, (b) in relation to measures on markets and financial measures in support of the implementation of the CFP, fresh water biological resources, aquaculture, and the processing and marketing of fisheries and aquaculture products.

Regarding the objectives, they can be summarized as follows. First, the CFP shall ensure the sustainability in the long-term of fishing and aquaculture activities, with also the aim of achieving economic, social and employment benefits. It needs to assure that exploitation of living marine biological resources restores and maintains populations of harvested species above levels which can produce the maximum sustainable yield. The maximum sustainable yield (MSY) is *“the highest theoretical equilibrium yield that can be continuously taken on from a stock at existing environmental conditions without significantly affecting the reproduction process”*.

Overfishing is a worldwide problem: in its last report “The State of world fisheries and aquaculture” published in 2018, FAO reported that the percentage of stocks fished at biologically unsustainable levels increased from 10 percent in 1974 to 33.1 percent in 2015. (FAO, 2018b)

To overcome the problem of overfishing, the European Commission sets catch limits on several fish species: Total Allowable Catches (TACs) are set annually based on scientific advice on the stock status from expert advisory bodies. TACs are then divided into national quotas, which set limits on the amount of fish that can be caught.

Another important objective is the contribution on the collection of scientific data, necessary for the monitoring of the activities.

Then the CFP shall reduce the current high levels of unwanted catches: fish products are incidentally caught and due to the fact that they belong to a less desirable species fish (e.g. low value species) or do not respect the minimum conservation reference size or are subjected to catch limits, they are therefore thrown back to the sea, in most cases already dead. The objective of European Commission is to gradually eliminate the number of discards. Unwanted catches and discards constitute a substantial waste and negatively affect the sustainable exploitation of marine biological resources and marine ecosystem and the financial viability of fisheries. The Regulation underlines that when necessary, the best use for the unwanted catches has to be found, without creating a market for those catches that are below the minimum conservation reference size. This term means *“the size of a living marine aquatic species taking into account maturity, as established by Union law, below which restrictions or incentives apply that aim to avoid capture through fishing activity”* as defined in Article 4 of the Regulation (EU) No 1380/2013.

The phenomenon of discarding fish is not only a problem of European Union, but it is spread worldwide: from a study of FAO, the amount of annual discards from global marine capture fisheries between 2010 and 2014 was 9.1 million tonnes (95% CI: 6.7 – 16.1 million tonnes) which represent 10.8% (10.1% –11.5%) of the annual average catch of 2010 to 2014 (*Pérez-Roda et al., 2019*). The main causes of discarding identified by FAO are: undersized products, low value of fish caught, lack of market demand, high grading whereby the most valuable species or sizes are graded and kept for sale, limited storage space on board the vessel and quota system that determines the quantities of certain species that can be landed.

The European Commission decides to act over the phenomenon of discarding with the introduction of the Landing Obligation (LO): all catches which are subject to catch limits

and, in the Mediterranean, also catches of specimens which are subject to minimum sizes shall be brought and retained on board the fishing vessels, recorded, landed and counted against the quotas where applicable.

The aim of European Commission with the introduction of this obligation is to discourage the practise of discarding and to incentivize fishermen to move towards more selective fishing techniques in order to avoid and reduce unwanted catches. Another important goal that the European Commission wants to achieve is the assessment of the real amount of unwanted catches, which otherwise would be impossible to identify.

Maynou et al. (2018) in their study “Fishers’ perceptions of the European Union discards ban: perspective from south European fisheries” analysed the perception of the fishing industry in South European waters (Portugal and Mediterranean EU countries) with regards to the implementation of the Landing Obligation through structured interviews to 173 fisheries.

According to the interviews, the majority of fishermen (85%) were sceptical about the success of the LO and did not see any mid to long term benefits in this policy, as well as possibilities of utilization of former discards as a practical way to offset increased handling costs. As a matter of fact, 65% of them affirmed that fishing costs are expected to increase with the implementation of the LO. Regarding the cause of discarding, the majority of fishers (69%) declared that potentially commercial by-catch was discarded because of low price.

An interesting aspect to bring to the attention for the purpose of this study is the question to fishermen about possible types of utilization of former discards. The question asked to the fishermen was open, and the most frequent type of utilization cited was “Charity”, so using the discarded fish products for human consumption without creating a secondary market for producers. The second answer is “None”, therefore fishermen did not know or were sceptical about possible other use of discards. Other utilization types are cited: “fish meal / oil”, “pellets for farmed fish” or “pet food” (Maynou et al., 2018).

The Common Fisheries Policy is applied also to the measures related to the market of fishery and aquaculture products of the European Union. Since the revision of the CFP of

2013, also the Common Organisation of the Markets in fishery and aquaculture products (CMO) is modified with the Regulation (EU) No 1379/2013. Fishery producer organisations and aquaculture producer organisations ("producer organisations") play an important role in reaching the objectives of the CFP and of the CMO. In the Article 7 the different objectives of producers organizations are listed. These are aligned with the one of the Regulation No 1380/2013. First, they shall promote sustainable fishing activities in compliance with the conservation policy and respecting social policy. Then they should avoid and reduce unwanted catches of commercial stocks making the best use of such catches, without creating a market for those that are below the minimum conservation reference size. It is important also to assure the traceability of fishery products and clear and comprehensive information for consumers. Lastly, they should contribute to the elimination of Illegal, Unreported and Unregulated fishing, also called IUU fishing.

IUU fishing is a global problem: it was estimated between 11 and 26 million tonnes of fish are caught illegally each year, corresponding to at least 15 % of the world's catches. (*European Commission. Directorate-General for Maritime Affairs and Fisheries., 2018*). IUU fishing is considered one of the major threats to global marine resources, having both environmental and socio-economic impacts. IUU fishing activities damage the marine environment and biodiversity through overfishing and irresponsible fishing practices and techniques. The direct consequence of these illegal practices is the depletion of fish stocks which contributes to the decrease in size and quality of catches, with the consequent reduction in the fishing industry profitability and possible job losses. IUU fishing creates also unfair competition between honest fishermen and those who practise illegal activities. Focusing on Mediterranean Sea, which holds 4-18% of all known marine species (almost 17000) and known as a hotspot of biodiversity with its great variety of marine and coastal habitats (*Öztürk, 2015*), the impacts of IUU fishing are high, since the high level of overexploitation of fish stocks. A problem related to the fight against IUU fishing in Mediterranean Sea is the lack of data about by-catch and ghost fisheries (abandoned nets) and some gaps in fisheries management at regional level. An accurate identification of these gaps, and researches of IUU data, could enormously help in addressing IUU fishing in the short term. About the major impediments in some Mediterranean coastal countries, there are the insufficient information on fishing fleet and weak implementation of port states controls. (*Öztürk, 2015*)

Being one of the main importers of the world regarding the fishing sector, Europe adopted an innovative policy to fight against illegal fishing worldwide, by not allowing imported products to access the EU unless they are certified as compliant with the European Regulations.

The Council Regulation (EC) No 1005/2008 establishes a Community system to prevent, deter and eliminate Illegal, Unreported and Unregulated (IUU) fishing. It concerns all IUU fishing activities carried out within the territory of Member States, within Community waters, within maritime waters under the jurisdiction or sovereignty of third countries and on the high seas.

In Article 2, the different terms of IUU fishing are defined. 'Illegal fishing' means fishing activities: (a) conducted by national or foreign fishing vessels in maritime waters under the jurisdiction of a State, without the permission of that State, or in contravention of its laws and regulations; (b) conducted by fishing vessels flying the flag of States that are contracting parties to a relevant regional fisheries management organisation, but which operate in contravention of the conservation and management measures adopted by that organisation and by which those States are bound, or of relevant provisions of the applicable international law; or (c) conducted by fishing vessels in violation of national laws or international obligations, including those undertaken by cooperating States to a relevant regional fisheries management organisation.

'Unreported fishing' means fishing activities: (a) which have not been reported, or have been misreported, to the relevant national authority, in contravention of national laws and regulations; or (b) which have been undertaken in the area of competence of a relevant regional fisheries management organisation and have not been reported, or have been misreported, in contravention of the reporting procedures of that organisation.

'Unregulated fishing' means fishing activities: (a) conducted in the area of application of a relevant regional fisheries management organisation by fishing vessels without nationality, by fishing vessels flying the flag of a State not party to that organisation or by any other fishing entity, in a manner that is not consistent with or contravenes the conservation and management measures of that organisation; or (b) conducted in areas or for fish stocks in relation to which there are no applicable conservation or management

measures by fishing vessels in a manner that is not consistent with State responsibilities for the conservation of living marine resources under international law.

In Article 3 the fishing vessels engaged in IUU fishing are defined: the list contains different violations, from the absence of the licence or the lack of reporting catching data, to fishing in areas or period of fishing stops or from stock which is subject to a moratorium or for which fishing is prohibited, from non-compliant fishing gear to falsification of markings, identity or registration, from the obstruction of the work of officials engaged in inspecting activities, to the detention and transshipment of undersized fish, from the cooperation with other vessels engaged in IUU fishing activities, to the absence of a nationality, which means a stateless vessels.

In the other section of the regulation, the conditions for access to the port by third country fishing vessel and procedure of the inspection at ports and of the eventual infringement are described. An important part of the regulation is the introduction of the catch certificate, necessary for the import of all fish products. It shall be validated by the flag State of the fishing vessel or fishing vessels which made the catches from which the fishery products have been obtained. All the information that the catch certificate needs to include are examined in depth in the following section.

The phenomenon of IUU fishing is not the only one threats which the fishing sector and its players have to face and overcome. Another huge problem is the food fraud: this act is committed when food is illegally placed on the market with the intention of deceiving the customer, usually for financial gain.

The European Union is fighting against food fraud through the work of Europol, EU's law enforcement agency, whose aim is to assure security and safety to European Member State by assisting law enforcement authorities in EU member countries. The first Operation OPSON made in collaboration with INTERPOL on targeting counterfeit and substandard foodstuff and beverage was started in 2011 with 10 participating countries, exclusively European Member States. The operation OPSON VI developed in 2016 and early 2017 included 65 countries from all continents, and 20 private companies or associations. The participant countries carried out checks throughout their national territory, and when a violation happens, the products are seized and withdrawn from the

market. The seizure can happen at production sites, during the transport phase, or at the distribution and selling points of illicit foods and drinks (*Europol/INTERPOL, 2017*).

Focusing on fish product, the European Parliament in 2013 identified it as the second-most likely category of food traded internationally at risk of fraud. This is confirmed in the reports of Operations OPSON, where the fish chain appears to be particularly vulnerable to fraud. Most of the seizure were made in Italy and France, and in smaller quantities in the USA, Iraq, Belgium, Bulgaria, Greece, Czech Republic, Spain and Moldova. It was reported that the most common infringement category was deceiving consumers, especially with species substitution, where a low-value species is replaced by a more expensive variety for economic gain, or where a high-value species is presented as a lower-value species for tax evasion purposes. The second most common infringement was the food safety, therefore expired products or inaccurate storage or transport conditions which lead to contamination of harmful substances (*Europol/INTERPOL, 2017*).

The first infringement is also confirmed by the study of FAO “Overview of Food Fraud in the Fisheries Sector” made in 2018, where it is reported that the substitution of species and mislabelling are facing an increase trend in recent years at a global scale.

The study also reported some results of surveys made at national level: regarding Italy, Tantillo et al. (2015) conducted a study in southern Italy, where 42,8 % of fillets (sole, plaice, salmon and hake) were mislabelled. Another study made on imported fishery products carried out by Italian authorities found that 22,5 % of products were mislabelled. (*FAO, 2018a*)

FAO is engaged in the fight against IUU fishing, since its involvement and interest in working towards a more sustainable fishing, recognizing the importance of fish for what regards food security and nutrition, economic growth and poverty alleviation with the creation of employment opportunities in poor countries.

FAO’s engagement towards the fishing sector is wide and varied: among the others, it implemented the Code of Conduct for Responsible Fisheries and the Ecosystem Approach to Fisheries (EAF), compiled the global capture production database, including

fleet, fishers and trade-related data, and it works with Government for developing international guidelines relating to fisheries operations including bycatch management and reduction of discards, eco-labelling and traceability, reduction of fish loss and waste and supply chain efficiency.

Focusing on IUU fishing, FAO developed three tools to fight it and to help government to overcome it which are adopted globally¹¹. The first one is the Port State Measures Agreement (PSMA) which is an international agreement with the aim of detecting vessels engaged in IUU fishing and preventing them from using ports and landing their catches. The PSMA applies to fishing vessels seeking entry into a port other than those of their own State. With the implementation of this agreement, illegal fish products cannot enter national and international markets, and vessels engaged in IUU fishing are discouraged to continue to operate in such way.

The second tool is the Global Record of Fishing Vessels Refrigerated Transport Vessels and Supply Vessels (Global Record). The Global Record is a global initiative, created with the aim of providing certified information on vessels and their related fishing operations. Having real and rapid data about vessels helps in the identification of illegal, unreported and unregulated activities.

The last tool, which needs to be applied in synergy with the others two, is the Voluntary Guidelines for Catch Documentation Schemes (VGCDS). It is the first international policy document with comprehensive elaboration about catch documentation scheme. The CDS is a traceability system to determine and verify if the fish products have been caught following national and international regulations and conservation measures.

Regarding traceability, a lot of work has been done, since the importance of traceability system for the safety of products and the fight against IUU fishing and food fraud.

Another important contribution of FAO is the commitment towards the reconstruction of fish stocks, proposing good practices, regulations and incentives to the different players of the fish supply chain: from the governments to the fishermen. FAO is also involved in the International Commission for the Conservation of Atlantic Tunas (ICCAT), the body

¹¹ <http://www.fao.org/iuu-fishing/en/>

responsible for the conservation of tunas and tuna-like species in the Atlantic Ocean and adjacent seas. Through ICCAT, it established the yearly quotas of the tuna fishes, distributed to the different countries.

2.4.2 Surplus food recovery and redistribution in the fishing sector

In the literature, there are very few insights and studies about the recovery and donation of fish products. Garrone et al. (2013) after giving definition of Degree of Recoverability, identified the segments for each phase of the food supply chain and they set the Degree of Recoverability for each of them, based upon the interviews and case studies they developed. Regarding the fishing segment, they classified it with low DoR. This result is the combination of medium Intrinsic Recoverability (differentiating from the livestock farming which has a low IR) due to the fact that many species can be consumed without specific transformation, and a high level of Management Intensity.

The difficulties and the necessary intensity in the management of this type of products are related to the several risks related to its wrong handling and management. They are similar to the one written in section 2.3.1: there are the biological hazards, represented by bacteria (e.g. *Campylobacter*, *Salmonella*, *E.Coli*, etc...), from parasites (*Anisakis*) and viruses, and chemical hazards, such as Histamine, Environmental pollutants (Mercury, Cadmio and Pcb), or Algal biotoxins. The group of Molluscs has higher risks due to their characteristics (*Ce.I.R.S.A.*, 2006).

There are different general rules for the right management procedures of this product: it is necessary to check especially the refrigeration of the work area and containers for the transportation, the environment must always be clean and unpolluted, the type of container and the ice / fish ratio are important for the hygienic conditions and for the shelf life of fish products. (*Poli*, 2011). In fact, fish has a high perishability: the cold chain needs to be maintained.

Garrone et al. (2013) underlined that despite the high economic value of fish products, and so the great potential that the recovery of this type of food has, the Degree of Recoverability is low, so the effort needed for the redistribution of it is very intense, with

barriers to donation such as significant logistical and transaction costs (*Garrone et al., 2013*). Therefore, this segment is the least feasible for redistribution activities, but policymakers and company need to cooperate to assess the potentiality within it to reach the objective of reducing food waste. The quantitative assessment of surplus food for the fishing sector found by Garrone et al. (2013) with their study are reported in Table 2.3.

<i>Production [1000 t/year]</i>	475
<i>Surplus food [1000 t/year]</i>	10,5
<i>Percentage of production [%]</i>	2,2%
<i>Social waste [1000 t/anno]</i>	9,4
<i>Percentage of surplus [%]</i>	90%
<i>Recoverability</i>	Low

Table 2.3 – Summary of food waste in the fish sector

Another important issue brought to attention by Garrone et al. (2013) is the nutritional value of the surplus food. The nutritional value can be expressed as a function of nutritional content (how many nutritional characteristics a certain product has) and nutritional variety (how varied is the surplus food recovered). Effort shall be concentrated on high nutritional value products, in order to guarantee the best quality food to people in need. EUROSTAT calculated the percentage of people who are not able to afford a meal with meat, chicken, fish (or vegetarian equivalent) every second day by level of activity limitation, sex and age: for Europe and for the age class people of 16 years and over, the percentage is equal to 14.5% for 2018, while for Italy 15.7%¹². These data underline the fact that a considerable part of the population cannot assume the right quantity of proteins, an essential component of a healthy diet.

Fish products play an important role in the dietary habits of the world population. As stated by FAO (2018b), more than 3 billion people depend on fish for at least 20% of

¹² https://ec.europa.eu/eurostat/web/products-datasets/-/hlth_dm030

their total animal protein intake, percentage that rises to 50% in some less developed countries. This product is indeed a source of high-quality protein, amino acids essential for human health, such as lysine and methionine, and many species are also source of long-chain omega-3 fatty acids. Fish also provides essential minerals such as calcium, phosphorus, zinc, iron, selenium and iodine as well as vitamins A, D and B (FAO, 2018b). In the light of all these considerations, fish products can have a great importance in the fight against food insecurity, intended as lack of regular access to enough safe and nutritious food, and therefore new strategies can be developed for the recovery and redistribution of fish products to the people who cannot afford it.

FAO analysed the food loss and waste in the fish value chain: for each phase, it identified possible causes in order to act on them and reduce food waste. They focused on Capture Fisheries, Aquaculture, Processing and Storage, Wholesale, Transport, Retail and Consumption. It followed the definitions given for food loss and food waste and applied them to the fish sector: *“food loss includes fisheries and aquaculture products which are intended for human consumption but are ultimately not eaten or consumed by people, or that have incurred a reduction in quality. A reduction in quality usually leads to a reduction in nutritional value, economic value, or food safety issues”*. Food waste is *“the discarding or alternative (non-food) use of food that was fit for human consumption – by choice or after the food has been left to spoil or expire as a result of negligence”*: an example in fisheries is discards. The evaluation made by FAO over the phenomenon of discarding and its main causes was underlined in section 2.4.1. There are additional causes which can occur throughout the fish supply chain. In the first stage, some examples are: inefficient fishing gears which lead to the capture and consequent discarding of immature fish or unwanted catches, predation of fish in gear, and discarded fish gears which provokes “ghost fishing”. In all the other stages of the fish chain, the most frequent causes are: inefficient processing methods or fishing vessel design which does not favour a good handling and storage on board, with a consequent loss in quality of the products, lack of cold chain (due to low investments on it) and poor storage condition with a poor understanding of good handling and hygiene practices in some countries which leads to microbial contamination and insect infestation. Regarding the final stage, Consumption, the main causes are related to consumer habits, rejection of products which do not meet standards, improper storage or overbuying, confusion over date label.

Like all the type of product, also fish has its own Waste Hierarchy. In the book “The European Landing Obligation” written by Uhlmann et al. (2019), the main valorisation options are studied by the authors, following the Waste Hierarchy. The prevention phase is represented by the reduction of bycatches with the increase of gear selectivity and optimization of fishing strategies. Then, the fish products can be used for human consumption and kept in the food supply chain as fresh fish, transformed products or by the production of food ingredients. Examples listed are the fish pulp and surimi, intermediate products that can be good solutions beyond the fresh fish one. If the fish is not suitable for human consumption, it can be used as bio-products thanks to high-value biomolecules that fish products have, which can be used in food, pharmaceuticals and cosmetics sector. For the same reason above, fish products can be transformed into feed for aquaculture, pet-food and other animal feed. The last options are the industrial use (e.g. leather, fish oil and minerals), the production of energy (i.e. biogas and biodiesel), composting or incineration through landfills. (Uhlmann, 2019, pp. 333-342)

The authors defined specific criteria to consider in selecting the most suitable solution. The first ones are characteristics of raw material which determine logistics needs and potential end products: for example, variability, seasonality and geographic dispersion of landings or microbiological characteristics of the catches. The second criteria are technical parameters, such as maturity of the production process, ratio, quality and purity of the product obtained, availability of technology and equipment at an industrial scale, feasibility of modifications on board vessels and availability of shore-based facilities for storage, preservation, logistics, and processing. All these criteria are related to the technical feasibility of a solution. Then another aspect to take into consideration is related to the market characteristics that affect product peculiarity and their marketability: compliance with health, environmental and other regulations, existence of potential users, existence of a gap in the market or of demand for an existing product, presence of competitors and quality requirements and volume of available product to satisfy demand. The last criteria are the economic ones, which determine the economic feasibility of the solution. Examples of these are: minimum volume of raw material for viable production, final value of the product (price), expected cost-benefit ratio and efficient use of existing infrastructures.

3. Research Questions and Methodology

3.1 Research Questions

The topic of the recovery of fish product is not deepened by many authors in the literature, as underlined also in the section 2.4.2. The reason behind the choice of many authors who analyse the phenomenon of food waste in general not to study and analyse in depth this type of product may rely in the several difficulties related to the obstacles in the recovery and redistribution activities (procedures to maintain the cold chain and to avoid all the types of risks and hazards listed before), the characteristics (high perishability) and low Degree of Recoverability of the fish product (*Garrone et al., 2013*). Some authors underlined other valorisation solutions for what regards the fish by-products. Only Uhlmann et al. (2019) described the entire Food Waste Hierarchy for fish products, taking into account only the unwanted catches.

Therefore, there is a gap in the literature on the recovery of confiscated fish for other uses, especially redistribution activities. The Research Questions of this study are therefore formulated.

RQ1. What is the state of the art about confiscated fish in Italy and Europe?

As analysed in the Literary Review section, the issue of illegal fishing and food fraud is deepened by many institutional bodies, organizations and authors, but none of them investigate how the process of seizure and confiscation happens, its main players involved and the final destinations that this products can have. The aim of this research question is to analyse the phenomenon in all its parts and taking into account the different points of view of the players involved. The focus of the analysis is mainly related to the Italian case but trying to consider also the European context.

RQ2. What are the main barriers and opportunities for the recovery and redistribution of the confiscated fish in Italy?

Having understood the importance of fish products for human health and for the dietary needs of the people who suffer food insecurity, and since the recovery of confiscated fish products is not deepened in the literature, the aim of this research question is to find what hinders and what facilitates the redistribution for social purposes of this kind of product.

Relying on them and finding the main operational and logistical implications in the process, the scope is also to build recovery chains of confiscated fish products.

3.2 Methodology

In this section we will deepen the methodology used in this study, in order to examine the topic and to answer the research questions. After a first analysis of the literature on the general topic of food waste, surplus food and food waste management, surplus food donation and a focus on the fishing sector, with the related Regulations and Directives, interviews were made to investigate the possibility to recover the confiscated fish products. The Figure 3.1 is a graphical representation of the steps done.

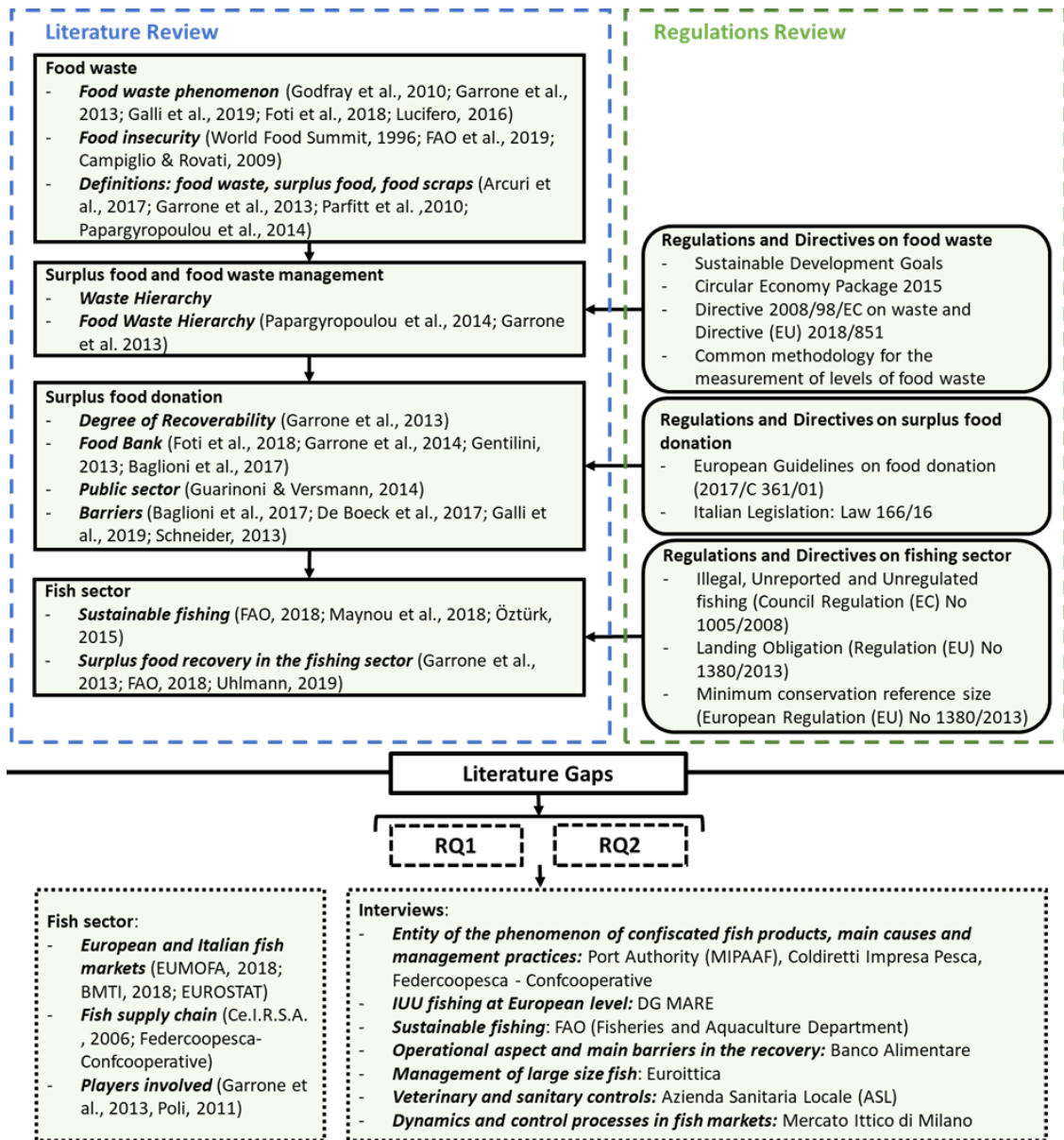


Figure 3.1 – Methodology steps

In order to answer to the first research question, a first literature review about food waste phenomenon and the paradox between this issue and the food insecurity existing in both developed and developing countries has been performed, focusing on definitions of food waste and losses made by different authors, to understand what can be considered food waste and surplus food and find ways to measure and assess it. The entity of the food waste and food insecurity phenomenon is studied from different sources: from scientific literature, to reports and websites from the organization and institutions mainly involved like FAO, WRAP, EPA and EUROSTAT.

Then, focusing on surplus food and food waste management, a review of the main European Regulations and Directives has been made, in order to frame the phenomenon and understand the different options which can be implemented. An insight on the 2030 Agenda for Sustainable Development was developed, focusing on Sustainable Development Goals 2 (End hunger, achieve food security and improved nutrition and promote sustainable agriculture), 12 (Ensure sustainable consumption and production patterns) and 14 (Conserve and sustainably use the oceans, seas and marine resources for sustainable development).

The third section of surplus food donation was explored with papers by different authors, reports from organizations like Banco Alimentare Foundation and Caritas Italiana, FEBA and Deloitte. The European guidelines on food donation are recalled with a general review and the focus on fish products. Then, the Italian Law on food donation is studied, with particular attention on the confiscated product.

Focusing on fish products, an analysis of the European Regulations on fisheries has been made, with insights from scientific literature for what regards the IUU (Illegal, Unreported and Unregulated) fishing. The Italian Regulations on fisheries and measures to fight illegal fishing have been deepened. The European fish market is also analysed through EUMOFA reports, while the Italian one through BMTI report and EUMOFA and EUROSTAT data.

In order to answer the second research question and investigate the real entity of the phenomenon of the confiscation of fish products in Italy, a series of interviews to the relevant players involved in the process have been made. It has been performed semi-

structured interviews with different questions with respect to the interviewee: this because the people involved in the fishing sector are several and various, so we want to gather different points of views regarding the phenomenon. The interviewed players are here listed:

1. Ministero delle Politiche Agricole Alimentari e Forestali (MIPAAF): Port Authority (Capitaneria di Porto)
2. DG for Maritime Affairs and Fisheries (DG MARE)
3. Banco Alimentare della Sicilia Occidentale e Orientale
4. Euroittica Srl
5. Coldiretti Impresa Pesca
6. Federcoopesca - Confcooperative
7. FAO (Fisheries and Aquaculture Department)
8. Azienda Sanitaria Locale (ASL)
9. Mercato Ittico di Milano

A discrete number of interviews were made at national level (MIPAAF, Banco Alimentare, Euroittica Srl, Coldiretti Impresa Pesca, Federcoopesca -Confcooperative, ASL and Mercato Ittico di Milano), while two of them belonging to the European and International context: DG MARE at European level and FAO at the global level.

1. Ministero delle Politiche Agricole Alimentari e Forestali (MIPAAF): Port Authority (Capitaneria di Porto)

The Ministero delle Politiche Agricole Alimentari e Forestali (MIPAAF) is a ministry of the Italian Government in charge on the elaboration and coordination of the agricultural, forestry, agri-food and fishing policies and regulations in the Italian environment and at European and international level, and it represents Italy in the European Commission for competence subjects¹³.

¹³ <https://www.politicheagricole.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/8>

According to the article 4 of the Legislative Decree of 27th May 2005 n.100, the Maritime Fishing Department (Reparto Pesca Marittima, RPM) of the Corps of Port authorities is established, and it is placed under the functional dependencies of the Ministry of Agricultural, Food and Forestry Policies. Its aim is to carry out coordination activities between MIPAAF and the General Command of the Port Authority Corps - Coast Guard, as the National Fisheries Control Centre (CCNP), in all matters involving the tasks performed by the Corps for what regards the supervision and control of sea fishing, aquaculture and related supply chain¹⁴.

The interview performed with MIPAAF, specifically with the Port Authority, is the first we made. The aim of the interview is to investigate the main causes and the entity (volumes, main affected areas, the typologies of fish objected of seizure) of the phenomenon of confiscated fish products, the management practices and the competent Authorities.

2. DG for Maritime Affairs and Fisheries (DG MARE)

The DG for Maritime Affairs and Fisheries (DG MARE) is the Commission's Directorate-General responsible for the policy area of fisheries, the Law of the Sea and Maritime Affairs. It has several duties: to guarantee sustainable exploitation of the marine resources, ensuring a profitable future for the players of the fishing sector, to promote maritime policies and stimulate a sustainable blue economy and promote ocean governance at international level¹⁵.

We interviewed them to grasp the point of view of the European Union, focusing on IUU fishing.

3. Banco Alimentare della Sicilia Occidentale e Orientale

Fondazione Banco Alimentare Onlus is a non-profit organization for social utility which coordinates the Banco Alimentare Network consisting of 21 organizations distributed throughout the Italian territory with the aim of the daily recovery of surplus food and the redistribution to people in need through affiliated Charitable Structures. It was born from the idea of replicating the Banco dos Alimentos of

¹⁴ <https://www.camera.it/parlam/leggi/deleghe/05100dl.htm>

¹⁵ https://ec.europa.eu/knowledge4policy/organisation/dg-mare-dg-maritime-affairs-fisheries_en

Barcellona. On 30th March 1989, the Banco Alimentare Foundation is founded by the meeting between Danilo Fossati (president of the company Star) and Father Luigi Giussani. It obtained the Onlus qualification in 1999. It's a member of the Fédération Européenne des Banques Alimentaires (FEBA), founded in 1986, that includes 253 food banks from 21 European countries.

The Foundation promotes the recovery of surplus food from agricultural production, industry, especially food, large-scale retail and organized catering, public institutions and food outlets. It also organizes the National Food Collection Day and it is the responsible of the collection of food at large distribution centres during this day and at other food collection events from different organizations during the whole year. Another aim of the Foundation is to promote initiatives to raise awareness of the public sector and the competent authorities to the problems of the right to food, food waste and food poverty. In 2018, the Banco Alimentare Network recovers 90.411 tonnes of food which, with the help of 7.569 charities, were redistributed to 1.506.332 people in need in Italy¹⁶.

The interviews we made were addressed to Banco Alimentare della Sicilia Occidentale e Orientale (Western and Eastern Sicily). In these interviews we focused on the operational aspect of the phenomenon, exploiting their previous experience in the recovery and management of confiscated fish products, considering that they are facing this problem since the approval of the Law 166/2016. We explored the ways they manage the fish products and the problematics emerged.

4. Euroittica Srl

Euroittica Srl is a processing company for the fish sector working in the city of Marsala in the province of Trapani (Sicily). It is also an EC authorized warehouse listed in the Approved establishment of the Ministry of Health, used by the Port Authority for storing confiscated products when needed. The involvement of this company in our research was pushed by the need to understand what should be

¹⁶ https://cdn.bancoalimentare.it/sites/bancoalimentare.it/files/risultati_2018_compressed.pdf

done with large size fish species, like Tuna and Swordfish, and to deepen the issue related to the authorized warehouses.

5. Coldiretti Impresa Pesca

Coldiretti (Confederazione Nazionale Coldiretti) is the main agricultural organization at national level. Established in November 1944, it represents agricultural enterprises, direct farmers, professional agricultural entrepreneurs, agricultural companies, fish enterprises and entrepreneurs, consortia, cooperatives, associations and any other entity operating in the agricultural, fish sectors, agri-food, environmental and rural, at national, European and international level. In 2010 Coldiretti set up its own organizational structure for the fishing sector, called Coldiretti Impresa Pesca. It was established as a non-profit organization to represent, protect and defend - on a local, regional, national, European and international basis - the interests of fish producers such as companies in the fish sector, single and associated, also in the form of consortia between fishery producers, and aquaculture producers. Marketing companies managed by producers can also join, both as fish markets for production and as establishment compliant with the European Normative for the collection, storage and processing of national fish products¹⁷.

The interview with them helped us to understand the point of view of the operators of the fishing sector.

6. Federcoopescas - Confcooperative

Federcoopescas - Confcooperative was born on 25th April 1950 and is the federation of reference for the fishing and aquaculture sector that associates production, research, processing and marketing cooperatives. Its purpose is to exercise functions of representation and protection of fishing cooperatives and their members, carrying out its activity thanks to initiatives and projects realized in partnership with the national government, with local authorities and with the European Union. In recent years it has started to carry out further services for the economic development of associated companies: tax, legal, technical and

¹⁷ <http://impresapesca.it/sitonuovo/>

professional updating assistance for members. It is present throughout Italy, with headquarters in Rome and a branch in Brussels. In the international arena, it commits to protect the peculiarity of Italian fishing and encourage the preparation of specific rules for the Mediterranean, designed to ensure sustainable fishing from an economic, social and environmental point of view.

As Coldiretti Impresa Pesca, the aim of the interview with them is to have a glimpse of their experience in the fishing sector.

7. FAO (Fisheries and Aquaculture Department)

The Food and Agricultural Organization of the United Nations was established in 1945 in Canada. Since then, its aim is to work and fight against food insecurity and assure that people have regular access to enough high-quality food to lead healthy lives. With its effort and researches, the organization helps governments to improve agriculture, forestry, fisheries, land and water resources.

It works in over 130 countries worldwide and it is composed by over 194 member states. It is divided in several Departments, one of them being the Fisheries and Aquaculture Department. Its mission is “to strengthen global governance and the managerial and technical capacities of members and to lead consensus-building towards improved conservation and utilization of aquatic resources”¹⁸.

It promotes the implementation of the Code of Conduct for Responsible Fisheries and its related instruments and it provides scientific advice, strategic planning and training materials. Moreover, its position in the international context makes FAO a nerve centre for discussing issues related to international cooperation and multi-stakeholder approaches to fisheries and aquaculture management.

The interview was made to a group of experts belonging to the Product, Trade and Marketing Branch. This division focuses on the improved post-harvest utilization of fisheries and aquaculture resources and the reduction of food losses along the entire value chain. It develops codes of practice, guidelines and standards related to the safety of products, utilization, marketing and responsible trade. The issues deepened with them were the sustainable fishing and the main areas they are put their effort in.

¹⁸ <http://www.fao.org/fishery/about/en>

8. Azienda Sanitaria Locale (ASL)

A Local Health Unit (Azienda Sanitaria Locale - ASL) is a public body of the Italian public administration, responsible for the provision of health services. It fulfils the National Health Service tasks and duties, serving a specific territorial area, which can be a municipality, a province or a group of cities. The Local Health Units have a high degree of managerial, administrative, financial and technical autonomy. They are organized by health districts, prevention departments and hospitals. The Local Veterinary Services are part of the Department of Prevention, and have responsibility over animal health and welfare, food of animal origin and animal feed. In the interview with a veterinary doctor of ASL, we deepened some issue related to the veterinary and sanitary controls.

9. Mercato Ittico di Milano

The Mercato Ittico di Milano is one of the Wholesale Fish Market of the Italian territory. It represents the most important fish market in Italy in terms of quantity, quality and freshness of the products marketed: in 2019, it had a turnover of 80 million euros, corresponding to 10 thousand tonnes of fish products sold. It is also one of the most modern fish markets in Europe¹⁹. There are 25 wholesalers who operate in the market: 8 of them are of medium-high dimension (on average, 1,5 tonnes of fish products traded each year), and the others are smaller, with the half of the volumes of the formers. Each of them has specific clients and commercialize different type of products. The wide range of fish products available in the market consists in both local (30% of the total volume) and imported (70%) (the great part from countries of North Europe), in fresh (60%) and frozen (40%) and then farmed, processed, dried / salted / smoked products. The interview with them helped us to understand how the largest fish market in Italy works and which are dynamics and control processes which take place in it.

¹⁹ <https://www.sogemispa.it/mercati/mercato-ittico/>

4. Findings

In this section we will analyse the different results obtained by the analysis of the European and Italian fish markets and the interviews performed with the insights from the research of Italian Regulations. The chapter will be divided in five sections: first, there is a focus on the main characteristics of the European fish market and an analysis of the Italian environment, investigating the fish supply chain and its main players involved. Then, terms and definitions used and found during the interviews are explained. The aggregated data gathered are analysed: volumes and the main fish species object of confiscation activities are listed. The As-is situation of the process is then presented: different variables have been identified, as well as the main Competent Authorities involved, different scenarios deepen with barriers and opportunities and possible recovery chains investigated. The last section analyses the schemes done and how to make them suitable also in other geographical areas within the European context.

4.1 Fish in Europe and Italy

Before deepening the topic of the confiscation of fish products, a first analysis of the European and the Italian fish market was done, to provide a contextualization to the main issue of this study, and understand how the fish supply chain is composed and which are the main players involved. Re-elaborating the available data from EUMOFA, EUROSTAT and BMTI reports, the main characteristics analysed are the production and the amount of catches, the supply balance and the consumption, both household and out-of-home, and finally the trade balance with extra-EU countries.

The data about European fish market shown in this section was taken by the report “The Eu Fish Market 2019 Edition” published by the European Market Observatory for Fisheries and Aquaculture (EUMOFA). EUMOFA is an initiative of EU Commission - Directorate-General for Maritime Affairs and Fisheries (DG MARE) and it includes a team of experts and analysts who monitor volumes, values and prices from the first sale to retail stage, including imports and exports, of the European market daily. It aims to increase market transparency and efficiency, to analyse EU markets dynamics, and to

support business decisions and policy-making. The main sources of data are EUROSTAT and FAO for what regards catches, expenditure and import/export, while EUROPANEL and Euromonitor for what regard households consumption and out-of-home consumption respectively.

In 2017, the world catches and aquaculture production amounted 205.170 million of tonnes, with an increase of 3% compared to 2016. Both catches and aquaculture production grew: the first amounted 93.204 tonnes, while farmed production was equal to 111.966 tonnes. The European Union, the 5th main producers of fish products after China, Indonesia, India and Vietnam, reached these results for 2017: fishery production accounted 5.253 million tonnes, while aquaculture 1.372 million tonnes, with a total of 6.625 million tonnes, corresponding to the 3% of the world production.

The supply balance is a proxy that helps to follow the evolutions of internal supply and apparent consumption of fishery and aquaculture products. It is calculated in live weight equivalent and it is based on the following equation:

$$\begin{aligned} & \textit{Apparent consumption} \\ & = (\textit{Catches} + \textit{Aquaculture production} + \textit{Imports}) - \textit{Exports} \end{aligned}$$

The apparent consumption is the amount of fishery and aquaculture products consumed in the EU. The catches considered in the equation are only the one reserved for food use, so they are the result of the subtraction of the catches for industrial uses to the total amount of catches.

The results of 2017 showed a supply of Europe of fishery and aquaculture products equal to 14,61 million tonnes live weight, resulting from the sum of an internal production of 5,40 million tonnes and imports equal to 9,21 million tonnes. The exports were equal to 2,16 million tonnes, and, consequently, according to the equation written above, the European apparent consumption amounted 12,45 million tonnes.

Looking at the single results, regarding the fisheries products, the catches accounted 4,02 million tonnes with imports and exports equal to 7,11 million and 1,93 million tonnes respectively. The aquaculture sector has smaller results: the production was equal to 1,37

million tonnes, while the imports and exports 2,11 and 0,23 million tonnes respectively, with a result of 3,25 million tonnes of apparent consumption.

From the data of 2016, it can be observed a decrease in the supply of 48.640 tonnes in 2017 (-0,3%), mainly due to decrease in the amount of catches: the increases registered both in the aquaculture production and in the imports did not compensate the decrease of 3% in the catches. With the growth of the exports, also the apparent consumption decreased of 2% respect to the amount observed in 2016. The wild products, the one derived from fishing activities, represented 74% of the total amount of apparent consumption. On average, in 2017 the average consumption of fish products of European citizens was 24,35 kg, of which 18 kg originated from catches and 6,35 kg from aquaculture.

EUMOFA calculates also the self-sufficiency rate, which represents the capacity of EU Member States to meet demand from their own production: it is calculated as the ratio of domestic production over domestic consumption. In Table 4.1, the main commercial species are presented with the percentage of per capita consumption, the percentage of wild or farmed products (the one coming from aquaculture production) and the self-sufficiency rate.

<i>Products and share of total apparent consumption</i>	<i>Per capita consumption (kg)</i>	<i>Self-sufficiency rate</i>	<i>% Wild</i>	<i>% Farmed</i>
<i>Tuna (13%)</i>	3,07	27%	99,17%	0,83%
<i>Cod (9%)</i>	2,31	11%	99,97%	0,03%
<i>Salmon (9%)</i>	2,24	18%	0,05%	99,95%
<i>Alaska pollock (7%)</i>	1,59	0%	100%	0%
<i>Shrimps (6%)</i>	1,51	9%	50,87%	49,13%
<i>Mussel (5%)</i>	1,28	80%	8,44%	91,56%
<i>Herring (5%)</i>	1,18	95%	100%	0%
<i>Hake (4%)</i>	0,94	37%	100%	0%
<i>Squid (3%)</i>	0,67	13%	100%	0%
<i>Mackerel (3%)</i>	0,65	121%	100%	0%

<i>Sardine (2%)</i>	0,58	75%	100%	0%
<i>Surimi21 (2%)</i>	0,53	n/a	100%	0%
<i>Trout (2%)</i>	0,42	91%	0,21%	99,79%
<i>Sprat (2%)</i>	0,37	112%	100%	0%
<i>Freshwater catfish (1%)</i>	0,36	6%	0,30%	99,70%

Table 4.1 – Estimates of percentage of per capita consumption, self-sufficiency rate, the percentage of wild or farmed

On average, the EU self-sufficiency ratio is equal to 43%, in line with the 10-year average. This means that European Union internal demand is mainly fulfilled by imports. As a matter of fact, Europe represents the 1st world importer of fish products, with a value of 26,53 billion euros in 2018 and volume of 6,32 million tonnes. Compared with 2017, extra-EU imports increased by 4% in volume and by 2% in value in 2018, thus reaching a 10-year peak. The main supplier of European Union is Norway (26% of the total imports). Regarding exports, the European Union is the 3rd exporter in the world, with 5,75 billion euros in 2018, 2% more than 2017. In volume terms, it grew by 3%, or 70.122 tonnes, compared with 2017, thus reaching 2,20 million tonnes. The US and China are the main markets in value terms for European exports, but the highest volumes are actually destined for Nigeria and Norway.

Regarding the expenditure for fish products of the European families, it has a positive trend since 2009, reaching 59,3 billion euros in 2018, increasing of 3% respect to 2017. In none of the European countries the expenditure for fish products overcame the one for meat, but in 2018 households of all Member States, except Sweden, spent more for buying fish products than in 2017.

The consumption of food is analysed through two different levels: household and out-of-home consumption.

Focusing on the first, fish product is the one which is more affected by fluctuations in the purchasing power of families, since its high prices comparing to other sources of protein. In 2018, fish products suffered a significant drop, decreasing by more than 56.000 tonnes. This can be explained by the negative trends of the three main consumer countries, Spain, Italy and France, which represent 80% of the total volume of fish products consumed in

the 12 Member States analysed (Germany, Denmark, Spain, France, Hungary, Ireland, Italy, the Netherlands, Poland, Portugal, Sweden and the United Kingdom).

The out-of-home consumption includes several channels: retail, which includes fishmongers and large-scale retail, foodservice, like catering and restaurants and institutional channels, which includes schools, canteens, hospitals and prisons. EUMOFA analyses only foodservice and institutional channels of out-of-home consumption, based upon data of Euromonitor International, an independent provider of strategic market researches. For what regards the out-of-home consumption of unprocessed fish and seafood, they analysed only Germany, Spain, France, Italy and the UK, which represents alone 72% of total EU expenditure for fishery and aquaculture products. For all these countries, foodservice channel plays a major role in out-of-home consumption. Out-of-home consumption of processed fish and seafood is analysed for foodservice channels in all EU-28 countries. In 2018, the total amount of consumed processed fish products is 727.200 tonnes. Regarding the categories of processed food, in 2018 the shelf-stable products was 48% of total EU out-of-home consumption of processed products, followed by followed by frozen (36%) and chilled (16%) products.

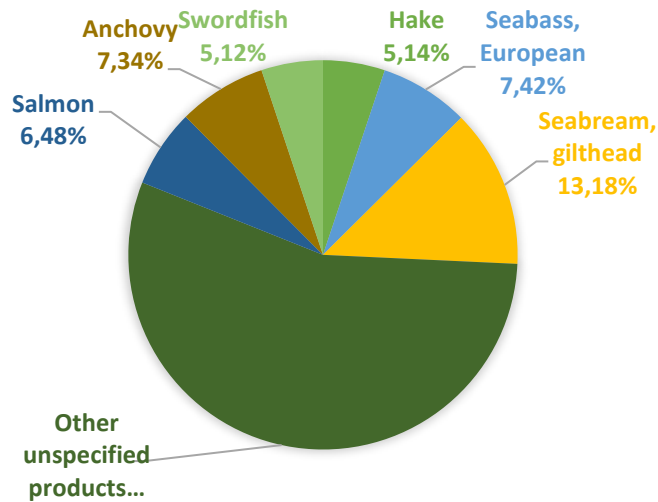
Focusing on the Italian fish market, the apparent consumption of our country is far above the European average, placing at 6th place after Portugal, Spain, Malta, Luxembourg and France: 30,9kg/per capita was the amount of per capita consumption of Italy in 2017, while the European one was 24,3 kg/per capita. Italy has the highest level of total expenditure for fish products (11.679 million euros in 2018), with 193 €/per capita, a higher value than the European average which amounts 115 €/per capita. Regarding the amount of consumed products by Italian families, it followed a volatile volume trend from 2014 to 2018, reaching a decrease of 11.334 tonnes between 2017 and 2018 (-3%), while in value terms, it had a decrease of 27 million euros in 2018 respect to the previous year (-1%). In the Table 4.2, the volumes of fish products are presented, divided by commodity group, for the years 2017 and 2018. The source of data is EUMOFA.

<i>Commodity Group</i>	<i>Main commercial species</i>	<i>Year 2017 [t]</i>	<i>Year 2018 [t]</i>	<i>% Variance 2017-2018</i>
<i>Bivalves and other molluscs and aquatic invertebrates</i>	Clam	11.806	11.751	-0,46
	Mussel Mytilus spp	29.650	28.649	-3,49
<i>Cephalopods</i>	Octopus	14.517	11.776	-23,28
	Squid	12.263	13.299	7,79
<i>Groundfish</i>	Hake	14.088	13.375	-5,33
<i>Miscellaneous aquatic products</i>	Other unspecified products	155.231	143.827	-7,93
<i>Other marine fish</i>	Seabass, European	18.243	19.287	5,41
	Seabream, gilthead	32.751	34.260	4,40
<i>Salmonids</i>	Salmon	15.229	16.855	9,64
<i>Small pelagics</i>	Anchovy	21.344	19.084	-11,84
<i>Tuna and tuna-like species</i>	Swordfish	11.677	13.302	12,22

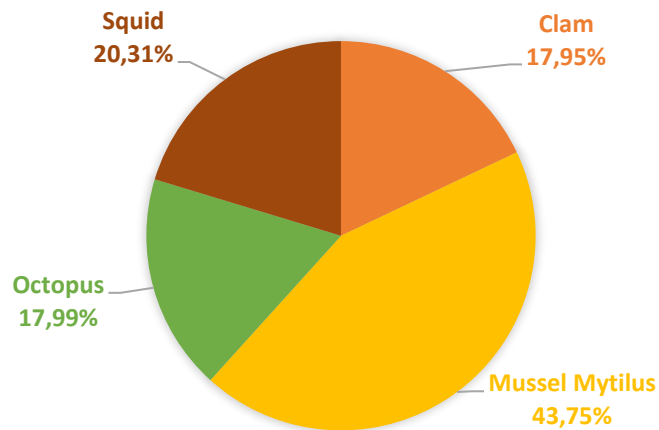
Table 4.2 – Estimates of Households consumption for 2017 and 2018

A lot of commercial species experienced a decrease in volume between 2017 and 2018: the highest level of variance is reached by Octopus (-23,28%) and Anchovy (-11,84%). There are some other species which otherwise experienced an increase: among others, Swordfish (12,22%), Salmon (9,64%) and Squid (7,79%).

Looking at Graph 4.1, an elaboration of EUMOFA data which represents the distribution of consumption of fish products in 2018, excluding Bivalves and other molluscs and Cephalopods, the most populated class is Other marine fish (55,32%), followed by gilthead Seabream (13,18%), and European Seabass (7,42%). After them there are: Anchovy (7,34%), Salmon (6,48%), Hake (5,14%) and Swordfish (5,12%). Graph 4.2 shows the distribution of Bivalves and other molluscs and Cephalopods: the highest percentage is reached by Mussel Mytilus (43,75%), followed by Squid (20,31%), Octopus (17,99%) and Clam (17,95%).



Graph 4.1 – Fish products consumption



Graph 4.2 – Bivalves and other molluscs and Cephalopods consumption

The 2018 report of the Borsa Merci Telematica Italiana (BMTI), the company of Italian Chamber System for the regulation, development and transparency of the market and for the dissemination of prices and economic information, established by the Minister of Agricultural and Forestry Policies (MIPAAF), analyses the Italian fleet catches over the years, as well as the consumption and import and export trades. Analysing the ISTAT data, it can be observed that the Italian catches from 2010 experienced a negative trend until 2013, with a partial recovery in the next year and a deceleration in 2017. The year

2018 saw a little increase (+3,86%), reaching 192 thousand tonnes (precisely 192.489,1 tonnes) (*BMTI S.c.p.A, 2018*).

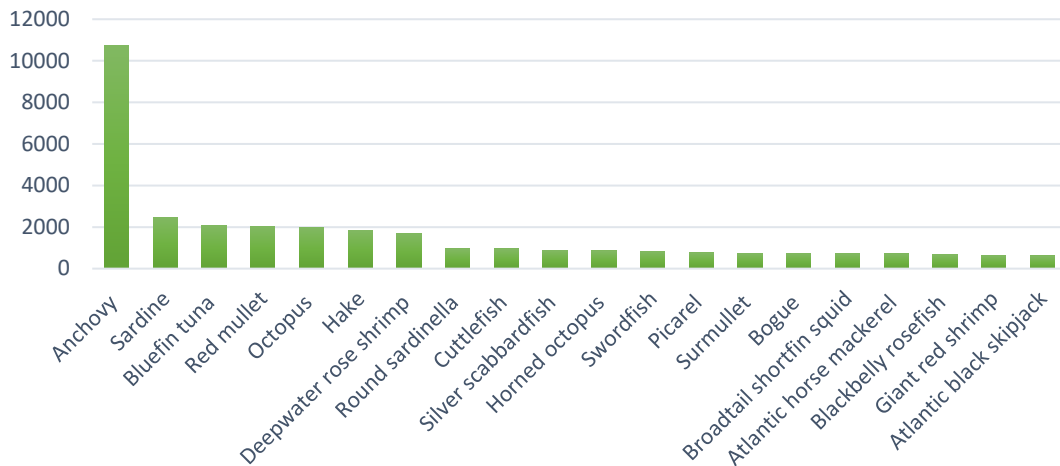
Italian coasts are divided in three FAO zones, as shown in Figure 4.1: 37_2_1 consisting in Adriatic Sea until the Gargano coasts, 37_2_2 Ionian Sea from the Gargano coasts to the northern coast of Sicily up to Trapani, and 37_1_3 the area from the coasts of Trapani to the Tyrrhenian Sea and Sardinia coasts.



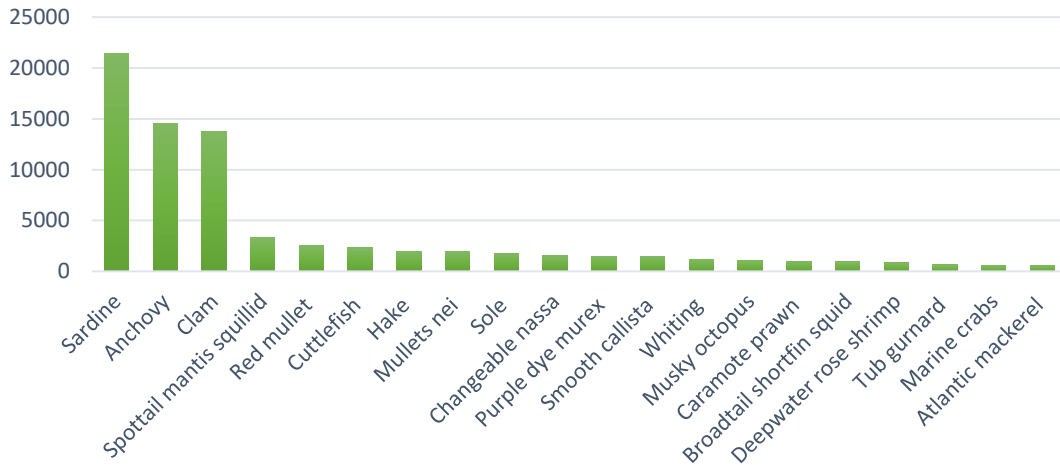
Figure 4.1 – FAO zones in Italy

According to EUROSTAT data²⁰ for the year 2018, the one which registered the highest level of catches is the Adriatic Sea, 43,38% of the total catches, following by Ionian Sea (31,75%) and Tyrrhenian Sea and Sardinia (24,87%). The following graphs show the main fish species caught in 2018 in the three different zones: Graph 4.3 for 37_2_1, Graph 4.4 for 37_2_2 and Graph 4.5 for 37_1_3.

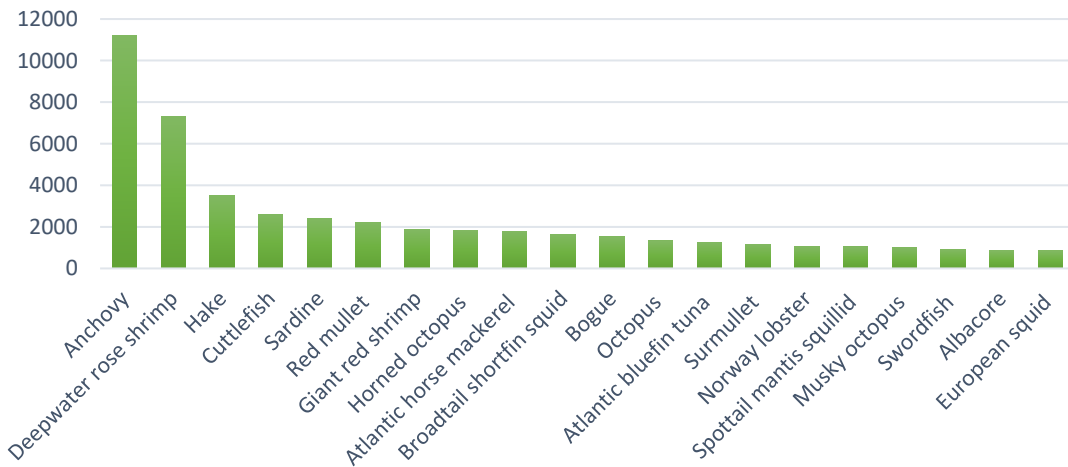
²⁰ <https://ec.europa.eu/eurostat/web/fisheries/data/database>



Graph 4.3 – 2018 Catches of the main species in 37_2_1

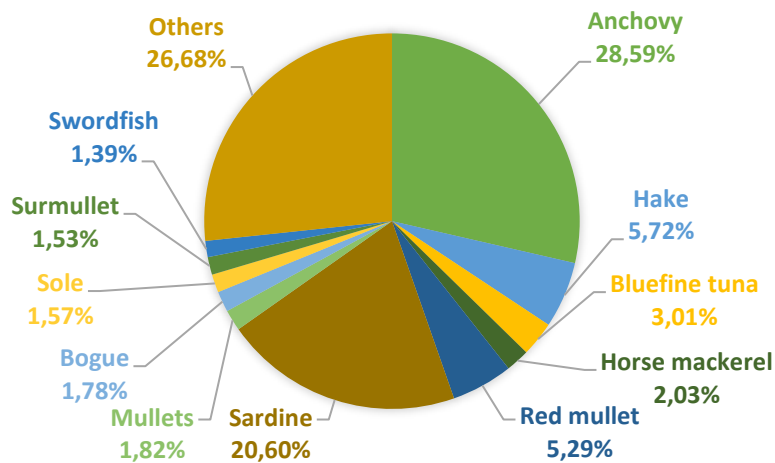


Graph 4.4 – 2018 Catches of the main species in 37_2_2

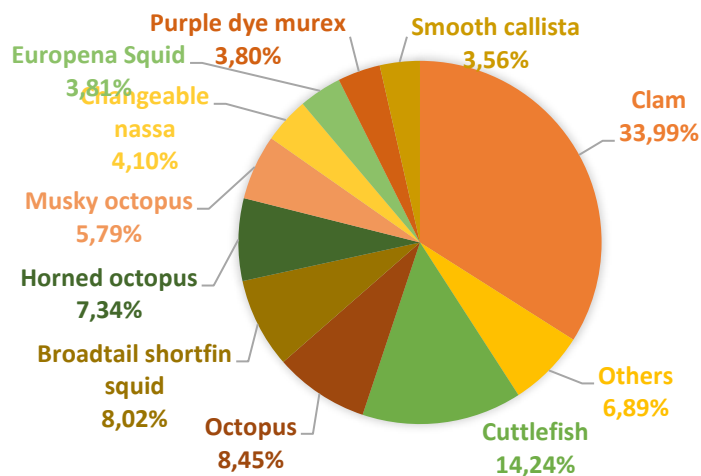


Graph 4.5 – 2018 Catches of the main species in 37_1_3

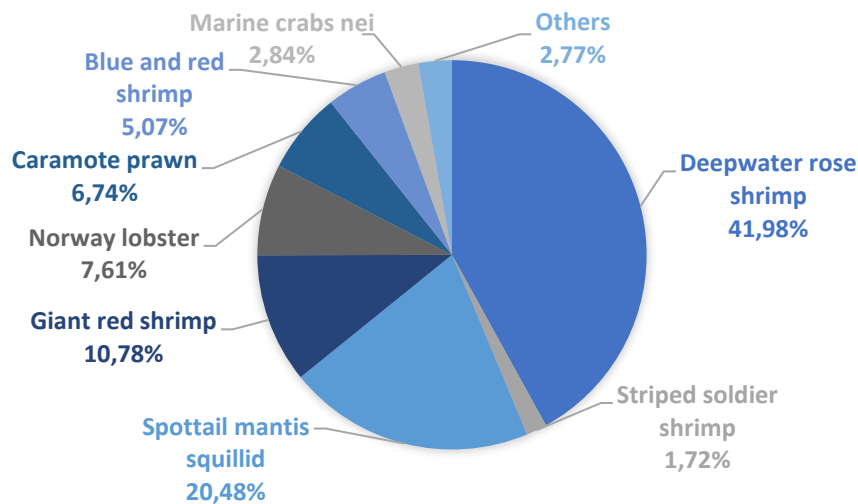
Analysing the typologies of products caught in 2018, fish products account for 66,42% of the total amount of catches, then there are bivalve molluscs and gastropods together with cephalopod molluscs (21,41%) and crustaceans (12,17%). The following graphs shows the percentage of the main products caught by the Italian fleet, divided by typology of product: Graph 4.6 for fish, Graph 4.7 for bivalve molluscs and gastropods and cephalopod molluscs and Graph 4.8 for crustaceans. The main fish species caught in 2018 are Anchovy (28,59%) and Sardine (20,60%). Clams and Cuttlefish have the highest percentages for molluscs, with 33,99% and 14,24% respectively, and regarding crustaceans, Deepwater rose shrimp and Spottail mantis squillid, with 41,98% and 20,48% percentages on the total amount.



Graph 4.6 – Main fish caught in 2018



Graph 4.7 – Main bivalve molluscs and gastropods and cephalopod molluscs caught in 2018



Graph 4.8 – Main crustaceans caught in 2018

Italy is the 3rd net importer among the European Member State, after Sweden and Spain. In 2018, the Italian imports reached 1 million tonnes, with an increase of 1,2% respect to 2017. Of this amount, 39% includes import from extra-EU countries (453.882 tonnes) and 61% from other European Member States (705.053 tonnes). From the analysis of BMTI, the main imported group of species is represented by the molluscs, which showed a decrease in volume in 2018 (-7,4%), followed by fresh or chilled fish and fish fillets, both scoring increases in volume, respectively +6,8% and +3,9%. From the analysis of EUMOFA data, the main species imported from extra-EU are: Yellowfin tuna, Squid, Skipjack tuna and Octopus. The main from European State Members are: Salmon, Other fish products, Squid and Skipjack tuna.

Regarding exports, the total amount of products traded from Italy to other countries (both intra-EU and extra-EU) in 2018 was equal to 180.232 tonnes. Of this amount, 156.957 tonnes were exported towards European State Member (87,09%), while 23.275 tonnes were traded to extra-EU countries (12,91%). From 2010, Italian exports registered a contraction in volumes until the result of 2018, which showed a decrease of 3,97% respect to 2017. The main groups affected by a decrease in volumes are molluscs, frozen fish, crustaceans and edible fish, while fresh or chilled fish showed a stability. The main species exported in extra-EU countries are Skipjack tuna, Other products, Anchovy and

Yellowfin tuna, while for the intra-EU countries are Other products, Sardine, Skipjack tuna and Clam.

After analysing the characteristics of the European and the Italian market, the fish supply chain is investigated, through the main stages and operations and the players involved.

The fish supply chain is the process which allows to bring on the market fish product, transferring it from the fisherman to the final consumer²¹. It is composed by several steps, as shown in Figure 4.2. The first one is fishing operations, which can include also handling activities on board: the products can be gutted, filleted and frozen. Then there is the landing of the fish products with the transport on refrigerated vehicles. The first sale can happen in different ways: in the majority of the cases, fishermen sell the product to a market or to a wholesale production market, in which daily auctions occur. After the storage, eventual transformation activities take place, such as Drying (air drying), Salting (dehydration by salt), Smoking (drying / cooking by wood smoke), Marinade (conservation in vinegar, oil, lemon, etc.), Breeding and Cooking. The last steps are the wholesale distribution and the retail distribution, with the sale to the end customer (Ce.I.R.S.A., 2006).



Figure 4.2 – Fish supply chain

There are several players involved in the fish supply chain including fishermen, Producer Organisations (POs), and wholesale markets located near either production or distribution centres. Fishermen may belong to a Producer Organization, which are cooperatives that sets out an annual operational programme and rules which each member should follow. As written before, fishermen sell their product to wholesale “production” markets, which are usually located in harbour cities, and they are the place where daily auctions take place. The main buyer of the auctions are restaurants, retailers and Wholesale

²¹ <http://www.federcoopesca.it/old/normative/1276178092.pdf>

“distribution” markets, which are located in the major Italian cities. They work in a similar way to wholesale produce markets and they sell products to small and large-scale retailers, food service companies as catering and restaurants, fish shops and peddlers. (Garrone *et al.*, 2013). Figure 4.3 shows all the players involved and their relationships.

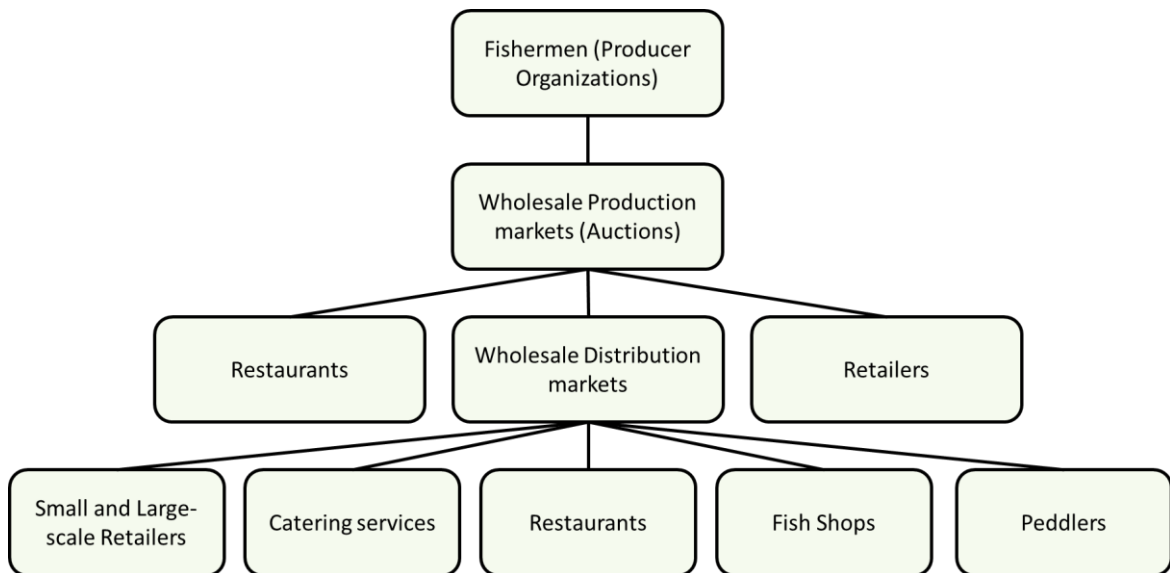


Figure 4.3 – Players of the fish supply chain

4.2 Terms and definitions

From the first interviews it emerged the need to define and distinguish between the meaning of seizure and confiscation. These two terms are often used interchangeably, but they are two different phases of a legal process, with different implications.

Seizure

The seizure is the first act managed by the Competent Authorities when an offence occurred. With the seizure of the goods, some of the powers that normally belong to the owner of a movable or immovable property are inhibited. The seizure is a temporary detention of the goods, waiting for the final decision of the judge in charge of the validation of the seizure.

Confiscation

After the Judge adjudication, the confiscation takes place. Confiscation is a sanctioning measure, through which the possession and the ownership of the good pass from the original owner to the Public Administration. Therefore, unlike the seizure, confiscation is a definitive act. It is dictated by the art. 240 of the Penal Procedure Code.

Then, from the interview to the Port Authorities emerged that the seizure could derive from two different types of offences in the Italian law: penal and administrative.

Penal seizure

For what regards the Penal procedure, there are two main type for what regards the food sector: probative seizure or preventive one. The probative seizure (art. 253 of the Penal Procedure Code) is ordered by the competent judicial authority (i.e. by the public prosecutor who conducts the investigation) with a reasoned decree and concerns the body of the crime and other things pertinent to the crime (things that constitute the product, the profit or the price). The aim of this type of seizure is to assure the things that constitute an evidence not to be lost or damaged. The preventive seizure (art. 321 of the Penal Procedure Code) is requested by the public prosecutor to the competent Judge on goods for which confiscation is permitted and those whose free availability could aggravate the consequences of the crime or facilitate the commission of other crimes.

Administrative seizure

The other type of seizure is the administrative one, measure of a precautionary nature and aimed at (administrative) confiscation. The procedure is dictated by art. 13 of Law 689/81 and it basically follows the one of the Penal Procedure Code. Unlike the penal seizure, the administrative does not need the validation of the Judge, but it is required only a report explaining the reasons that motivated it. The confiscation is considered as an accessory administrative sanction and impose the transfer of the ownership from the interested party already affected by seizure to the state.

4.3 Volumes and main species of confiscated fish products

After understanding the differences between the terms used, the first step is the analysis of the aggregated data about seizures and confiscations in order to understand the real entity of the phenomenon. The main species involved in confiscation measure are reported, with an analysis of their volumes of catches with the main fishing area, and the amounts of product imported and exported.

In the Table 4.3 the aggregated data about seizures in Italy during the period 2015-2019 are reported. During this time interval, the number of controls has increased until 2018, with a decrease in 2019, year in which also the numbers of both administrative and penal sanctions have diminished. Regarding the amount of fish products seized, there was a peak in 2016, then the number has a rapid decrease in the following year (2017), with a revert in 2018, reaching almost 500 thousand kilograms in 2019.

<i>Year</i>	<i>Number of controls</i>	<i>Number of administrative sanctions</i>	<i>Number of penal sanctions</i>	<i>Sanctions amount [€]</i>	<i>Number of confiscation</i>	<i>Seized fish products [kg]</i>
2015	63.379	4.610	993	7.556.695,00	2.256	602.721,17
2016	122.289	4.791	743	8.413.127,00	2.299	762.705,60
2017	127.002	5.789	622	12.105.895,20	4.100	378.394,27
2018	128.812	5.690	541	12.442.447,97	4.253	464.257,60
2019*	105.036	5.336	374	9.488.520,65	3.833	489.090,33

Table 4.3 – Seizure aggregated data during the period 2015-2019 in Italy

* Partial data (until 11th December 2019)

The main commercial species which are mainly object of seizure activities, as reported in the interviews, are the following:

- Bluefin Tuna
- Swordfish
- Hake
- Mullet (both Red mullet and Surmullet)
- Shrimp

- Sole
- Octopus

In Table 4.4, an elaboration of data about the main commercial species object of confiscation is reported. The source of data about household consumption (HC), import and export and aquaculture production (A) is EUMOFA, while the amount of catches (C) is taken from EUROSTAT database. Analysing Aquaculture data, only the Sole is produced. Regarding Mullet, data about imports and exports are not present in the EUMOFA database. For each species, the Apparent consumption (AC) is calculated, following the formula of EUMOFA, as written in section 4.1. For each species, it is reported also the main area where each product is caught, according to EUROSTAT database, which follows the division of FAO for catching zones. Several species are caught in all the Italian territory, in Table 4.4 it is reported only the area which registered the maximum volumes of catches in 2018. As reported in section 4.1, 37_2_1 consisting in Adriatic Sea until the Gargano coasts, 37_2_2 Ionian Sea from the Gargano coasts to the northern coast of Sicily up to Trapani, and 37_1_3 the area from the coasts of Trapani to the Tyrrhenian Sea and Sardinia coasts.

	<i>C</i> [t]	<i>FAO</i> <i>Zone</i>	<i>A</i> [t]	<i>Import</i> <i>extra</i> <i>EU</i> [t]	<i>Import</i> <i>intra</i> <i>EU</i> [t]	<i>Export</i> <i>extra</i> <i>EU</i> [t]	<i>Export</i> <i>intra</i> <i>EU</i> [t]	<i>AC</i> [t]
<i>Swordfish</i>	1.778,9	2_2		5.869,7	16.749,9	11	214,7	24.172,8
<i>Bluefin</i>	3.843,3	1_3			633,5	1,9	588,8	3.886,1
<i>Tuna</i>								
<i>Hake</i>	7.299,8	2_2		23.262,2	14.777,1	4,5	464,1	44.870,5
<i>Mullet*</i>	8.710,7	2_1/2_2						8.710,7
<i>Shrimp**</i>	9.827,1	2_2		1.134,1	518,4	8,5	478,4	10.992,7
<i>Sole</i>	1.999,3	2_1	4	261,8	3.743,4	0,6	173,3	5.834,6
<i>Octopus</i>	3.479,6	1_3		37.570,1	17.050,7	226,5	3.363,5	54.510,4

Table 4.4 – Elaboration of data about the main commercial species object of confiscation

* Both Red mullet and Surmullet

** Deepwater rose shrimp is the species considered

Focusing on catches, the highest amount of volumes is reached by Shrimp (9.827,1 tonnes), followed by Mullet (8.710,7 tonnes) and Hake (7.299,8 tonnes). The main species imported by extra-EU countries are Hake and Octopus, and by intra-EU countries Octopus and Swordfish. The main species exported (both intra-EU and extra-EU) is the Octopus. The highest level of apparent consumption is reached by Octopus and Hake. Table 4.4 does not report the Households consumption because a lot of data about it are missing, due to the fact that EUMOFA databases analyse only certain typologies of fish. There are reported only the tonnes of Swordfish (13.302,2 tonnes), of Hake (13.374,7 tonnes) and of Octopus (11.776,4 tonnes).

4.4 As-is situation

In this section the process of the confiscation will be described, as well as the players involved and the related regulations. Qualitative data of the different interviews made were gathered and re-elaborated to reconstruct a general framework which describes the variables to consider and the different processes and scenarios that can happen. Different barriers and the opportunities for the recovery and the redistribution of confiscated fish products are deepened.

4.4.1 Identified variables

We identified some variables that will help to describe the process and the different scenarios that can happen. Here, the list of the identified variables:

1. Origin
2. Fish Species
3. Size
4. Conservation Mode
5. Seizure Location
6. Seizure Cause
7. Recovery Place
8. Suitability for Human Consumption
9. Final Destination

1. Origin

The fish product consumed in Italy is composed by local fish and imported one. For the purpose of this study, we defined as local both the national catches and the one coming from European Member States, since the existence of the European Single Market which enables the free movement of goods and services. From the interviews it emerged the fact that the great majority of the consumed fish in Italy is imported: the percentage is equal to 80%, while the local one is only the 20%. This distribution is confirmed by the report made by Coldiretti “Sos pesce italiano” based upon ISTAT data of 2018, and by 2018 BMTI (Borsa Merci Telematica Italiana) report, which stated that 1 million of tonnes were imported in 2018, with an increase of 1,2% respect to 2017. This increase is related to both fresh product and transformed ones. (*BMTI S.c.p.A, 2018*)

2. Fish Species

As underlined in section 4.1, the Italian sea is populated by a wide range of different fish species. From the interviews, it was discovered that the main species of fish object of seizure activities are:

- Bluefin Tuna
- Swordfish
- Hake
- Mullet (both Red mullet and Surmullet)
- Shrimp
- Sole
- Octopus

The main protected species for which the catch and consequent sale are almost always prohibited in Italy are:

- Sea Urchins
- Sea Dates
- Sea Cucumbers
- Chinese Crabs

3. Size

Fish species can be classified in small size species or large size one. In case the fish has a large size, further operations to make it more manageable and to facilitate its consumption are needed. The preparation phase (needed also for small size species) includes different processes: removal of flakes, evisceration, stripping and filleting. Then, to decrease its perishable nature making it last several months, an additional transformation phase can be made: the freezing of the product, bringing it to lower temperatures (- 20° C or - 40° C).

4. Conservation Mode

Another categorization that can be made when dealing with fish products is the distinction between fresh and frozen products, two different modes used to handle the goods. The first can be defined as unprocessed, whole or prepared products which, for conservation purposes, have not undergone any other treatment than refrigeration, intended to ensure its conservation. This means that, when caught, the fish product is put on ice, maintaining the temperature between 0° C and 4° C. The frozen products, otherwise, need to be stored at a temperature not exceeding - 18° C in all their parts. (*Poli, 2011*). From the interviews, we found that only the Shrimp is frozen on board of the vessels. All the other species stay at a temperature between 0° C and 4° C when caught.

5. Seizure Location

There are different places where the controls and the consequent seizures can happen. The locations mainly involved and characterized by controls by the Competent Authorities are:

- On board of the fishing boat
- Ports (on docks)
- Fish markets
- Restaurants and Supermarkets
- Logistic platforms
- Ports and airports (related to import activities)

- Roads

Based on the interviews made, the regions where most of the seizures take place by sea are: Campania (from Castellabate to Naples), Lazio, Calabria (Crotona, Reggio Calabria and Vibo Valentia), Puglia (Manfredonia, Barletta, Gallipoli and Bari) and Sicily (areas near Catania and Trapani). The cities most impacted by confiscations, especially in fish markets, supermarkets and logistics platforms are Rome, Milan and Naples. While in the regions seizures are constant but of small quantities (on average about 1000 kg), confiscations of large quantities occur in cities. The real problems lie in the local markets rather than in the central ones, being the firsts less controlled areas. This aspect was confirmed in the interviews, where it was reported that very few seizures happen during the year, because of the presence of a consistent and frequent veterinary control. In the Mercato Ittico di Milano, the main market of Italy, there is a triple check of products that enter the market; this includes three veterinary doctors who every day of the week make controls on the new goods arrived, a veterinary consultant for self-control hired by the market governance and at last each operator has to follow HACCP (Hazard Analysis and Critical Control Points) procedures. All the controls are aimed to assure the good quality and safety of the products and the conformance of products labels. The few confiscations occurred in the market were mainly due to the detected presence of Anisakis, Histamine, the non-compliance with the minimum conservation reference size, and traceability problems (incorrect labelling). Seizure activities were conducted by Port Authority or Carabinieri NAS who make periodic controls (and also unscheduled ones) on specific parameters.

6. Seizure Cause

Several causes of seizure exist, but some of them are the ones that occur the most. Based on the interviews, the five main causes are:

- Prohibited catch/Prohibited sale
- Lack of traceability
- Undersized product
- Out of quota product or caught during fishing stops

- Commercial food fraud

All these causes are summarized in the Table 4.5, where each of them is linked to the related violation (taken from Italian Regulation and for this reason not translated), the reference to the Italian Regulation and the type of sanction.

<i>Cause</i>	<i>Violation</i>	<i>Regulation</i>	<i>Sanction</i>
<i>Prohibited catch / Prohibited sale</i>	Pescare, detenere, trasbordare, sbarcare, trasportare e commercializzare le specie di cui sia vietata la cattura in qualunque stadio di crescita, in violazione della normativa vigente.	Art. 7 c.1 lett. a), D.lgs. n. 4/12	Penal
<i>Lack of traceability</i>	- Violare gli obblighi previsti dalle pertinenti normative europea e nazionale vigenti in materia di etichettatura e tracciabilità nonché gli obblighi relativi alle corrette informazioni al consumatore finale, relativamente a tutte le partite di prodotti della pesca e dell'acquacoltura, in ogni fase della produzione, della trasformazione e della distribuzione, dalla cattura o raccolta alla vendita al dettaglio.	Art. 10 c.1 lett. z), D.lgs. n. 4/12	Administrative
<i>Undersized product</i>	- Detenere, sbarcare e trasbordare esemplari di specie ittiche di taglia inferiore alla taglia minima di riferimento per la conservazione, in violazione della normativa vigente - Trasportare, commercializzare e somministrare esemplari di specie ittiche di taglia inferiore alla taglia minima di riferimento per la conservazione, in violazione della normativa vigente.	- Art. 10 c.2 lett. a), D.lgs. n. 4/12 - Art. 10 c.2 lett. b), D.lgs. n. 4/12	Administrative Administrative
<i>Out of quota product</i>	- Pescare quantità superiori a quelle autorizzate, per ciascuna specie, dalle normative europea e nazionale vigenti	- Art. 10 c.1 lett. e), D.lgs. n. 4/12	Administrative Administrative

	- Pescare direttamente uno stock ittico per il quale è previsto un contingente di cattura, senza disporre di tale contingente ovvero dopo che il medesimo è andato esaurito.	- Art. 10 c.1 lett. g), D.lgs. n. 4/12	
<i>Product caught during fishing stops</i>	Pescare direttamente stock ittici per i quali la pesca è sospesa ai fini del ripopolamento per la ricostituzione degli stessi.	Art. 10 c.1 lett. d), D.lgs. n. 4/12	Administrative
<i>Commercial food fraud</i>	- Chiunque, nell'esercizio di una attività commerciale, ovvero in uno spaccio aperto al pubblico (1), consegna (2) all'acquirente (3) una cosa mobile per un'altra, ovvero una cosa mobile, per origine, provenienza, qualità o quantità, diversa da quella dichiarata o pattuita (4), è punito, qualora il fatto non costituisca un più grave delitto [440-445, 455-459], con la reclusione fino a due anni o con la multa fino a duemilasessantacinque euro.	Art. 515 Penal Code	Penal

Table 4.5 – Summary of the main seizure causes and related violations in the Italian Regulation

Prohibited catch/Prohibited sale

For what regards the first cause, there are some species for which the catch is forbidden at any time of the year and at any growth stage and, as a consequence, the sale of these species is also forbidden. Other species need to be protected for environmental issues because, due to their high value, they are often caught in huge quantities, debilitating the marine ecosystem: for this kind of species, sale is prohibited, too. The Authorities try to protect them with catch bans. This is the case of Sea Urchins, Sea Dates, Sea Cucumbers and Crabs.

Lack of traceability

The lack of traceability is one of the main causes of seizure of fish products in Italy. The Italian Regulation follows the European Council Regulation (EC) No

1224/2009 establishing a Community control system for ensuring compliance with the rules of the Common Fisheries Policy. The Art. 58 is dedicated to traceability, and it is stated that each lot of fisheries and aquaculture products shall be traceable at all stages of production, processing and distribution, from catching or harvesting to retail stage. Then, the main information that have to be put on labels for all fisheries and aquaculture products are:

- The identification number of each lot
- The external identification number and name of the fishing vessel or the name of the aquaculture production unit
- The FAO alpha-3 code of each species
- The date of catches or the date of production
- The quantities of each species in kilograms expressed in net weight or, where appropriate, the number of individuals
- The name and address of the suppliers
- The information to consumers provided for in Article 8 of Regulation (EC) No 2065/2001: the commercial designation, the scientific name, the relevant geographical area and the production method
- Whether the fisheries products have been previously frozen or not

Undersized product

The third cause, undersized product, is a great threat for the marine ecosystem: fishes are caught before they reach the minimum reference conservation size, a precise minimum measure identified according to scientific parameters, related to the achievement of the sexual maturity that allows their reproduction. The European Regulation (EU) No 1380/2013 on the Common Fisheries Policy, defined the minimum conservation reference size as *“the size of a living marine aquatic species taking into account maturity, as established by Union law, below which restrictions or incentives apply that aim to avoid capture through fishing activity; such size replaces, where relevant, the minimum landing size”*.

From the interviews, we discovered that there are some species which are particularly exposed to the catch in their juvenile period for cultural reasons: this

is the case of Bianchetti, the whitebait of Sardines and Anchovies, or Agostinelle, the juvenile status of Red Mullet, called in this way because caught during August, period in which they are too small.

Out of quota product or caught during fishing stops

Analysing the fourth cause, from the interviews we found that only Tuna is a species subjected to the quota system.

Every year the International Commission for the Conservation of Atlantic Tunas (ICCAT) of FAO, the entity responsible for the conservation of Tunas and Tuna-like species in the Atlantic Ocean and adjacent seas, divides the quantities of catches allowed for maintaining the fish stocks at their sustainable level to each to the different countries involved, called Total Allowable Catches (TACs).

The European Commission, with the Council Decision 86/238/EEC, became a Contracting Party to the ICCAT. Therefore, it committed itself to realize the conditions of ICCAT plans to replenish the considered tuna stocks with a progressive reduction of TACs. Therefore, the European Commission divides the quotas assigned by ICCAT to their Member States. In this way, every Italian fisherman has its own individual quota to manage on a year base. When it is finished, it is not possible to catch that species anymore.

From the interviews we discovered that in Sicily, the region where the majority of Tuna is caught, the phenomenon of seizure happens the most in the period between April and June, when the specimens reach very large sizes (increasing a lot their monetary value), and the quotas may be completed.

For some other species, in order to regulate and protect the reproductive periods of the main commercial marine resources, the Italian Government establishes fishing stop periods. It focuses on the most invasive fishing system (bottom trawls, divergent and flying nets) to ensure the protection of marine fauna. Each year the Ministry of Agricultural, Food and Forestry Policies issues a ministerial decree which specifies the dates on which the temporary stops of fishing are mandatory. These periods correspond to summer months till autumn. In the Appendix, the fish stops of the period 2015-2019 is presented, divided by fishing systems and gears

as bottom trawling, diver trawlers, twin divergent nets and by species like small pelagics (Anchovies and Sardines) caught in the Adriatic with specific fishing modes: purse seines, flying and flying in pairs.

Commercial food fraud

The last cause of seizure and subsequent confiscation is the commercial food fraud. In the fishing sector, there are several types of fraud. The main one is species substitution “aliud pro alio” in order to sale low commercial value species under the name of more valuable species. The Port Authority, in a report about fraud and sophistications drafted in 2017, listed the main commercial species substituted: European flying squid for Squid, Vietnamese Pangasius for “Plaice”, Juvenile fish of sardine (Bianchetto) for Ice fish, Zanchetta for Sole and Melù for Cod.

The other types of commercial fraud are: sales of an unfrozen product for a fresh one, sale of farm products for catch products at sea and other ones, mainly related to fraudulent practices to simulate freshness.

7. Recovery Place

The fish products object of seizure can be put in different storage place while the Competent Authority waits for the final decision of the Judge to proceed with the confiscation of the goods. The main places discovered through interviews are: refrigeration cell for fish markets, restaurants, supermarkets and logistic platforms; refrigerated vehicle used for the transport of the goods, moved to the nearest Port Authority office for roads and European Community (EC) authorized warehouse for what regards ports or airports.

8. Suitability for Human Consumption

Not all the confiscated fish products are then suitable for human consumption and as a consequence adequate for redistribution activities. After the confiscation, there is a veterinary control by the doctors of the Local Health Units (Azienda Sanitaria Locale - ASL) who decide if the fish products are suitable for human consumption or not.

9. Final Destination

There are three possible final destinations of the confiscated fish products: disposal, auction and donation to charities.

The disposal option is taken when the product is judged not suitable for human consumption for different reasons, mainly related to safety issue and health risks. The cost associated to dispose the confiscated product is entirely up to the author of the violation: based on the interviews made, it can reach 3 €/kg including incineration, transport and duties.

If the fish products prove to be suitable for human consumption, there are two possible alternatives for the recovery. The first one is the auction, announced and organized by Port Authority, with the aim of reselling the confiscated products to the best bidder.

In the auction solution the product is mainly sold to merchants who then resell to fishmongers, restaurants and markets. However, there might be the risk of incorrect behaviours, leading to the creation of a mix between legal product (which has a higher price) and illegal product returned to the circuit through the auction, bought at a much lower price.

The other solution that can be undertaken is the donation to non-profit food-aid organizations. As we said before, the donation of confiscated products is possible after the entry into force of the 166/2016 Law, known to all as Gadda Law.

4.4.2 Competent Authorities

Before analysing the process, we need first to define who are the Competent Authorities specialized in controls and, when needed, in seizure activities.

The Competent Authority in charge of the controls is defined Art. 22, c.2 of the Legislative Decree n. 4/12. The Ministry of Agricultural, Food and Forestry Policies - General Directorate of Maritime Fisheries and Aquaculture makes use of the Port Authority Corps, as the National Fisheries Control Centre in order to fulfil all the functions listed in the Regulations (EC) n. 1224/2009, in particular controls over fishing activities, transshipments, transfer of fish to cages or aquaculture installations, landing,

import, transport, processing, marketing and storage of fisheries and aquaculture products.

The control activities can be delegated to the civil and military personnel of the Central and Peripheral Maritime Authority, to the Finance Guards, the Carabinieri, the public security agents and the sworn agents, as written in the Art. 22, c.3 of the Legislative Decree n. 4/12. As a matter of fact, in the interviews, it emerged that the controls over health, customs and tax aspects are performed by Finance Guards, Local Police, Carabinieri NAS, Forestry Carabinieri and the Central Inspectorate for Quality Protection and Fraud Repression of Agri-Food Products (Ispettorato Centrale della tutela della Qualità e della Repressione Frodi dei prodotti agroalimentari, ICQRF).

The frequency of controls occurs periodically (daily or weekly), based on verified hypotheses. Campaigns are carried out especially in the periods preceding the holidays or during fishing stops.

Focusing on imported products, there are two additional entities that need to be introduced and presented: Customs Agency (Agenzia delle Dogane) and Border Inspection Posts (Posti di Ispezione Frontaliera, PIF). The first is a public entity in charge of the customs system and the controls on flows of goods. The Border Inspection Posts are peripheral veterinary offices of the Ministry of Health (Ministro della Salute) recognized and authorized, according to Union procedures, to carry out veterinary checks on live animals, animal products and feed from third countries and destined for the European market.

4.4.3 The process

In this section the process of the seizure and consequent confiscation is analysed in its different components, considering the variables identified before, which give rise to different scenarios. Figure 4.4 summarizes the variables considered in the description of the process. The first identified variable, the Origin of the fish products, gives rise to two processes different in some parts. Figure 4.5 is the representation of how the variables may change in the process, giving rise to different possible scenarios. The first to be analysed is the imported one.

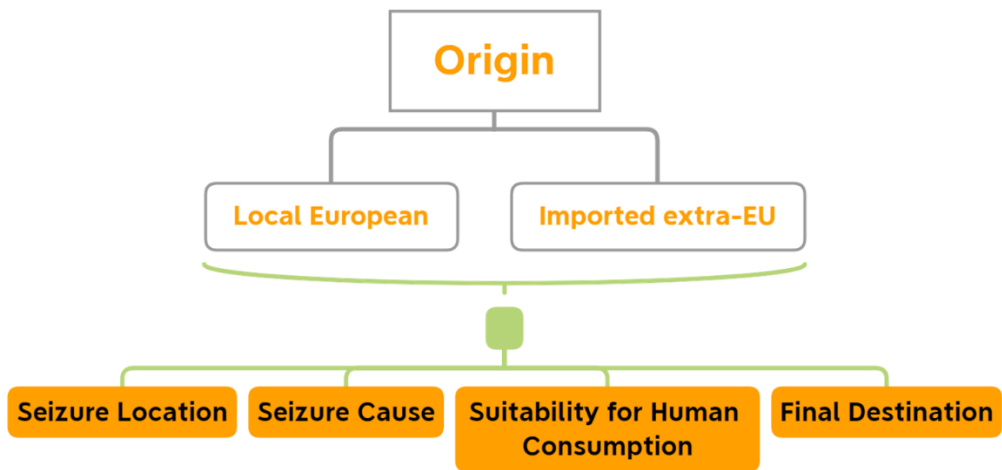


Figure 4.4 – Variables to consider in the seizure and confiscation process

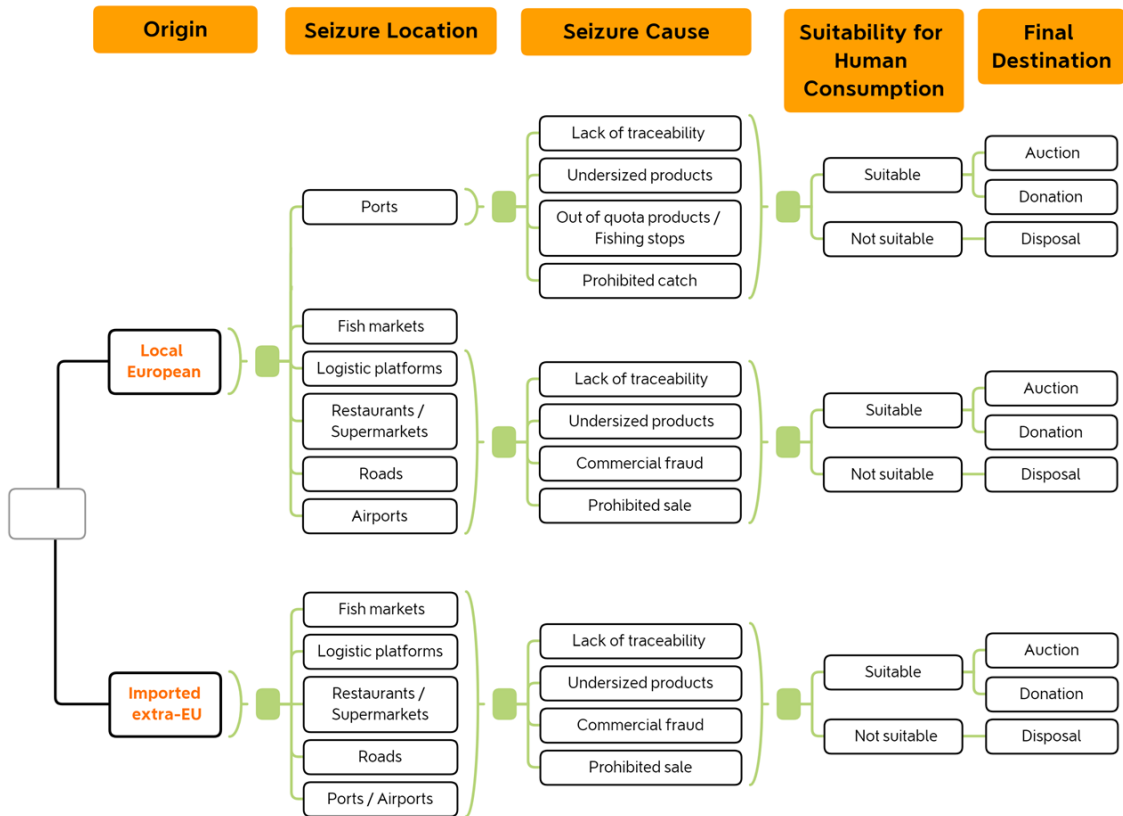


Figure 4.5 – Representation of different scenarios

The great difference between imported and local goods is the first stages of the process. Figure 4.6 summarizes the process of the first controls over the imported products (the overall process is reported in the Appendix).

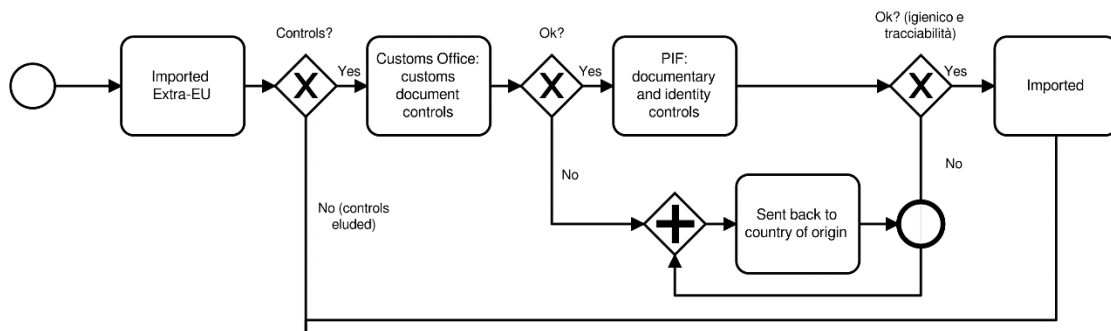


Figure 4.6 – First controls over imported products

All the imported products should pass through the Customs Office, localized at borders. In the case of fish, it can be imported in the Italian territory through ports and airports: according to what was reported in the interviews, the main arrival points of the imported fish products are Milan Malpensa and Venice for the airports, and Genoa, Livorno, Trieste and Naples for the ports. For what regards the Conservation Mode, the imported fish can be both frozen or fresh.

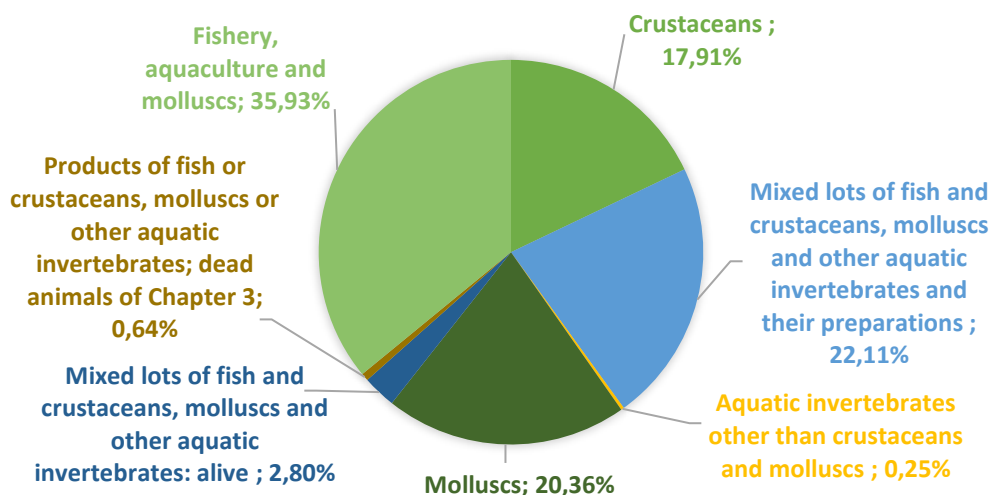
The first controls performed by the Customs Office are related to customs documents. Each batch of fish products must come with the catch certificate which, according to Council Regulation (EC) No 1005/2008 establishing a Community system to prevent, deter and eliminate Illegal, Unreported and Unregulated fishing, must contain a series of information, the most important listed here:

- Personal information about the fisherman
- Fishing vessel name and Flag
- Description of the product:
 - Species
 - Product code
 - Catch area and Dates
 - Estimated live weight (kg)

The Customs Agency carries out the control of admissibility (formal accuracy of the declaration) of the catch certificates, with the check of the mandatory indications. If documents are not compliant with the Regulations, the custom clearance operations are not performed, and the entire batch is sent back to the country of origin.

Otherwise, if documents respect all the mandatory indications, there are additional veterinary controls. They are carried out by Border Inspection Posts. They collaborate with the Customs Agency for the fight against illegal imports and the development of the Single Customs Office which main objective is to simplify the import and export of goods and to have a single hub for the exchange of informations. The veterinary controls carried out by PIF include both documentary and identity controls, made systematically on all lots and physical / material ones, made on a percentage of the total. When needed, they perform also laboratory controls. In Italy there are 24 PIF, 7 of them are collocated in airports and 17 in ports.

According to the last report of the Directorate General for Animal Health and Veterinary Medicines (Direzione Generale della Sanità Animale e dei Farmaci Veterinari) “L’attività dei Posti Di Ispezione Frontaliera e Uffici Veterinari per gli Adempimenti Comunitari 2018” the most imported product group in Italy is the fish, with 35.699 lots (72,8%) followed by meat with 3.754 lots (7,8%), live animals with 2.748 lots (5,7%), animal feeds and supplements with 2.157 lots (4,5%). The percentual distribution of fish product volumes divided by individual items commodities are reported in Graph 4.9. The great majority is composed by Fishery and Aquaculture and Molluscs lots (35,93%), followed by Mixed lots of fish and crustaceans, molluscs and other aquatic invertebrates and their preparations (22,11%) and Molluscs lots (20,36%).



Graph 4.9 – Fish product volumes divided by individual items commodities

The report also summarizes the amount of refusal for each category. It underlines that the fishing sector had a particular incidence in 2018 (22%) in the refusal for documental controls. The main causes were documental irregularities and non compliant certificates. Another cause of refusals are Identification problems (17%). In the Appendix, an elaboration of the data about controls activities of PIF included in the 2018 report is presented.

As it happens for the Customs Agency, when there is a problem with the batch of fish products, both regarding traceability and documentation and sanitary reasons, it is sent back to the country of origin. In 2018, the percentage of refusals of fish products on the total amount of lots intended for the import, was equal to 0,28%.

Therefore, all the imported products which for several reasons are not compliant with trade regulations, are not object of seizure, and as a consequence it can not recover for redistribution activities.

The cases we are interested in is when batches of fish products manage to elude customs controls entering the Italian market through illegal channels or when the product is imported in the European market through other Member States borders where there are fewer checks and then enters in Italy. The products are distributed through different

channels. Regarding the phenomenon of confiscated fish, the main location interested are here listed:

- Fish markets
- Restaurants and Supermarkets
- Logistic platforms
- Roads
- Ports and airports

As written in the previous section, the majority of controls with consequent seizures happens in cities, in fish markets, restaurants, supermarkets and logistic platforms. Regarding fish markets, the most critical are the local ones, due to the fewer entry controls. A great part of confiscations happens also on roads.

The main violations related to the imported products are lack of traceability, sale of undersized products, prohibited sale and commercial food fraud. In supermarkets and restaurants, the last cause listed is the one that occurs the most, while in the other places all the three violations happen.

The process of the local products is similar to the one described before, apart from how it begins.

Regarding the national catch, the first controls happen on board of fishing vessels or on docks of the ports. The main violations are prohibited catch, lack of traceability, undersized product and out of quota products or catches during fishing stops. If they do not go under controls or manage to elude them, they enter the market through different distribution channel, mainly wholesale production markets where auctions of the daily catch take place or wholesale distribution markets which sell products to small and large-scale retailers and companies in the food service industry.

If the good is caught by European vessels, it can pass through Veterinary Offices for Community Fulfillments (Uffici Veterinari per gli Adempimenti Comunitari, UVAC), which are peripheral offices of the Ministry of Health established with Legislative Decree 30 January 1993, n. 27, to ensure the correct application of veterinary and zootechnical legislation. They have the responsibility for controls at the state level of

Community origin goods. In the Italian territory 17 UVAC are present and they carry out coordination and verification of the controls carried out by the services veterinarians of ASL on goods of Community origin. Checks are carried out at sample and non-discriminatory base. In 2018, according to the report of the Directorate General for Animal Health and Veterinary Medicines on the activities of PIF and UVAC , the lots of fish products pre-notified to UVAC were equal to 956.814 (41,99% of the total) and the percentage of controls on them was on average 0,38%. In the Appendix, the list of controls made by UVAC in 2018 for fish products are presented.

As it happens for PIF, if a product is not compliant with Regulations, it is sent back to the country of origin. If there are nor traceability or safety problems, the good enters the Italian market through distribution channel listed before.

Based on the interviews, the locations where seizures occur the most are:

- Fish markets
- Restaurants and Supermarkets,
- Logistic platforms
- Roads
- Airports (in the case of European products)

In this case, the main causes of seizure remain lack of traceability and undersized product, and in addition to these, the prohibited sale and the commercial food fraud are observed.

If the controls carried out by Competent Authorities listed in the previous section (Port Authority, Finance Guards, Local Police, Carabinieri NAS, Forestry Carabinieri and ICQRF) are positive to one of the violations written before, the seizure happens, otherwise the process ends.

In the Figure 4.7 the activities performed after the decision of the seizure are schematized: while the legal process starts, the products are seized and, depending on the location where it happens, they are put in different places.

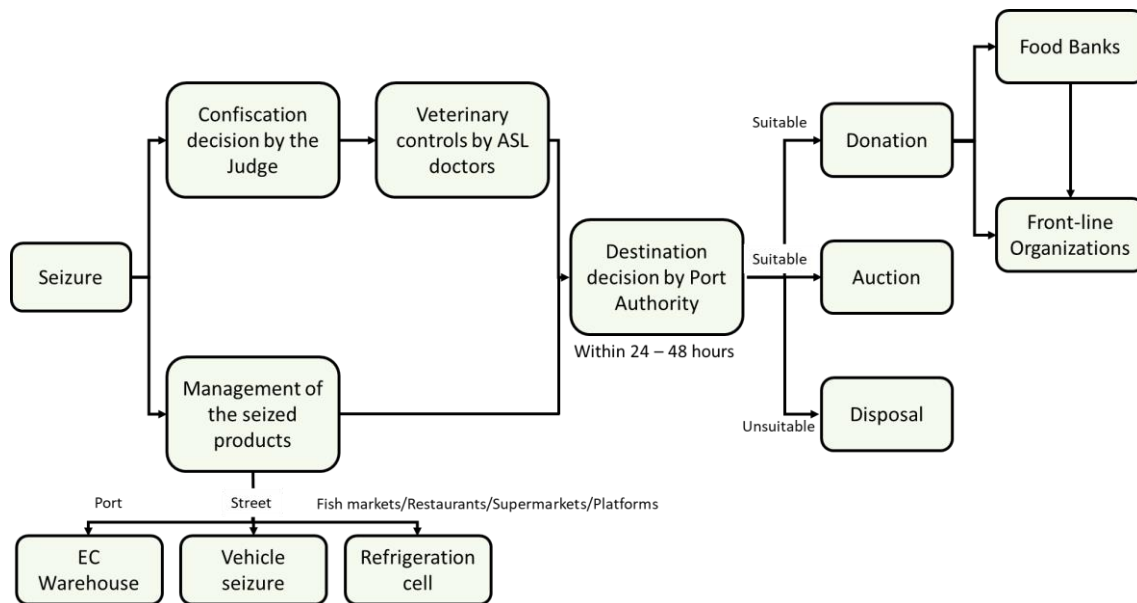


Figure 4.7 – Activities after seizure

Regarding fish markets, restaurants, supermarkets and logistic platforms, the fish products remain in the refrigeration cell of the owners of the goods. If the seizure takes place on roads, the entire refrigerated vehicle used to transport the products is also object of seizure, and it is taken to the nearest Port Authority office. Lastly, if the goods are seized in ports or airports, they are transported to the nearest and available EC authorized warehouse, a temporary depository listed in the Approved establishment of the Ministry of Health. This list contains 2478 establishments, they are dislocated all over the Italian territory, and they can be of different type: cold storage vessel, fresh fishery products plant, processing plant and others.

In the meantime, the Judge in charge of the legal process decides if the confiscation of the products have to take place, evaluating possible appeals of the person involved in the seizure. For fish products, the legal process needs to be accelerated for the perishable nature of the good: within 24 hours the Judge deliberates his/her decision.

After the decision of confiscation, there are veterinary controls made by doctors of the Local Health Units to assess if the goods are suitable for human consumption. As reported in the interviews, 90% of confiscated product is edible. As written in the previous section, there are three possible alternatives for the Final Destination of the products: disposal if

the product is not suitable for humans, or, otherwise, auction or donation. This decision is taken by the Port Authority who, within 24 - 48 hours, decides and organizes what is necessary for the realization of one of the alternatives. While the first alternative is totally up to the author of the violation (disposal activities and costs), the organization of the other two are entrusted to the Port Authority.

If the Port Authority decides to donate the confiscated fish, it can call both front-line organizations, such as soup kitchen and housing communities and shelters, and food banks, to advise them that a certain amount of fish product is available in a determined location. From here on, the recovery of the confiscated volumes is up to the structure with its own means. In Sicily, Banco Alimentare della Sicilia acts as a link between Port Authorities and front-line organizations: they are called by the first to recover the goods and they contact the charities where the products can be donated and distributed to most needy people. In the case of Banco Alimentare della Sicilia, at the time of the study, there are not structured procedures to follow for the recovery activities and there are not specific written agreements between them and charities.

Regarding the documentation necessary for the transfer of ownership and to ensure traceability of fish products lots, the document issued by the Judge at the time of the confiscation decision is sufficient. It must certify that the confiscated product is given as a donation. For the transport, the shipping note is needed.

A particular case of managing documentation is the one regarding the Bluefin Tuna species. It has a specific catch documentation called BCD (Bluefin Tuna Catch Documentation). It was established by the European Commission by Regulation (EU) No 640/2010, with the aim of ensuring traceability along all the supply chain, an important element of the conservation and recovery system of Bluefin Tuna stocks. The Article 3 reported that “each lot of Bluefin Tuna domestically traded, imported into, exported or re-exported from the territory of the Union shall be accompanied by a validated catch document – except in cases where Article 4(3)²² applies – and, where applicable, an ICCAT transfer declaration or a validated Bluefin Tuna reexport certificate. Any such

²² 3. Validation under paragraph 2 of this Article shall not be required where all the bluefin tuna available for sale are tagged, as referred to in Article 5, by the flag or trap Member State that fished them.

landing, transshipment, caging, harvest, domestic trade, import, export or re-export of Bluefin Tuna without a completed and validated catch document and, where applicable, a re-export certificate shall be prohibited.”

From the interviews we discovered that the document issued by the Judge regarding the confiscation should be enough for the transfer of the ownership of the tuna specimens.

4.4.4 Alternatives evaluation

In this section we will go deeper in the analysis of the barriers and opportunities related to the three alternatives for the confiscated fish products.

Disposal

As written before, the first alternative is entirely up to the author of the violation, who has to cover the costs. On the one hand, the State does not need to pay anything; on the other side, the disposal is the worst option in terms of food waste and social and environmental impact. This solution can be adopted in case the Competent Authorities cannot find any available organization to recover the confiscated product as donation or for bureaucratic reasons.

Auction

There are various reasons why this solution is the least preferred and convenient: a scenario which is luckily to happen is that products are mainly sold to merchants who create a mix of legal product and illegal one in order to have less expenses, the possible earnings to the Income Revenue Agency (Agenzia delle Entrate), the entity in charge of the functions relating to tax assessments and controls and to the management of taxes, are very limited, due to very low prices, and the time that passes from the decision to opt for the auction alternative and the effective success of it may be longer due to non-responses of the subjects participating with consequent risk of additional costs. The last reason is the additional work for the Authorities who have to prepare and manage it. Based on the interviews performed, the owners of EC authorized warehouses do not prefer this option, because they are obliged to take the confiscated products and to keep in custody till the auction is performed, and this means occupied storage capacity with no earning.

Donation

From different interviews, it emerged that there are several reasons why the alternative of the donation seems to be the most preferable one. This because on one side it turns out to be the best one in terms of environment and sustainable exploitation of resources, as fish products are not thrown away and food waste is not created, with the recovery of products for social purposes fighting against food insecurity, and on the other it is also beneficial for other players involved. In fact, as analysed before, respect to the auction alternative, the Port Authority needs to take over the management of the fish products with the organization of auctions, with all the obstacles that this alternative can bring, and also companies who are the owners of a EC authorized warehouses must submit to the procedure of the Competent Authorities, with all the consequences written before.

However, there are also some barriers which might make the recovery and redistribution of confiscated products difficult to perform. Now we will go deeper in the analysis of them focusing on the different points of view of the players interviewed.

From the point of view of the controlling Authority, the main problems encountered in the decision to donate the goods are two: acting on the whole territory, there are large distances for the recovery and unsuitable structures (refrigeration cells and freezers) of the charities they contact. The first problem is related to the fact that in Italy there are 55 Port Authority offices distributed throughout the Italian territory and this means an office every 50 km along the coast. Therefore, if the seizure happens on littorals, there is no problem of large distances, while there are more difficulties when it occurs in inland regions, where the coverage is not so extensive. Also, higher the distances, higher the transport cost to move the product.

Regarding the second problem, also from the point of view of the non-profit organizations, it often happens that they are called to redistribute the product to other entities, but they do not have suitable structures and competences to take the product, mainly because there are many food pantries which redistribute only long-life and pre-packaged products and there are not many local soup kitchens which can reuse fresh products.

Another problem is the fact that the front-line organizations contacted do not always have the necessary capacity to contain confiscated goods, since they are already saturated. This happens because first of all the charities have limited capacity. In the case of Sicily, there are peak seizure periods from May to mid-July, which make handling large volumes difficult.

The main difficulties encountered by non-profit organizations in the management of seized fish recovery are different. The fish is a commodity product which has a perishable nature and it has to be managed and distributed in very short time. They can own some insulated means which maintains the cold chain, but they often do not possess dedicated structures for this typology of product. They do not have yet the knowledge and manuals to deal with the fresh product (they usually works with pre-packaged ones), and finally the seizure activities take place at night or during weekends, times in which the recovery is more difficult since the activities are made by volunteers, therefore the success of the mission depends on their availability.

Another problem is related to the size of some species: in Sicily mainly Swordfish and Tuna are confiscated, where the former can weigh from 10 to 50 kg, while the latter up to 200/250 kg. As written before, very often the front-line organizations do not have the right structure to deal with this kind of specimens. Only in some soup kitchens there are specialized workers who are able to clean and use the fish products for dishes to donate to the most needy people. For small fish, such as Sardines, this problem does not exist, and the product is collected directly from the front-line organizations, or by the food bank.

4.4.5 Operational implications

In the recovery process of the different type of fish products involved in the phenomenon of confiscation, there are several operational and logistical implications, which a non-profit organization engaged in the recovery and redistribution of food, needs to consider.

The Conservation Mode is the first variable to take into consideration: if the product is maintained at a fresh status in ice between 0° C and 4° C, the average shelf life of products at this state is between 6 and 8 days, as reported in the interviews. This estimate is confirmed by a study of FAO, which stated that the shelf life of fish products depends on

different parameters, the main one being temperature, physical damage and intrinsic factors, therefore it can vary from one species to another. The intrinsic factors to consider are the shape of fish (flat or round), the size (large or small), the fat content in the flesh (lean species or fatty one) and skin characteristics (thick skin or thin) (*Shawyer, M. and Medina Pizzali, A.F., 2003*). In order not to incur in biological or chemical hazards, like the ones mentioned in section 2.4.2, the cold chain needs to be preserved. Regarding the frozen product, it has to be maintained at temperature not above - 18° C. Depending on the type of fish, the conservation period vary: for fat fish 2-3 months, lean fish 4-6 months (up to 9 if they are fillet), for crustaceans 2 months (lobster and crab) and 6 months (shrimp) and for molluscs 3-4 months (*Torry Research Station, 2001*)

The cold chain has to be preserved in all the phases of the recovery activities: one of the most critical part of the process is the transportation from the recovery place to the charity organization. As written before, transportation activities are up to the charity called for the recovery by the Competent Authority. In Italy, for the transport of fish products, reference should be made to the general regulations on the land transport of perishable goods, specifically to the Agreement on international carriage of perishable foodstuffs and on the special equipment to be used for such carriage (ATP). This agreement was concluded in Geneva on 1st September 1970 by the United Nations Economic Commission for Europe (ECE / UN), and entered into force on 21st November 1976. In Italy, it was made executive with law n.264 of 2nd May 1977, and its application regulation was launched with Presidential Decree n.404 of 29th May 1979. According to ATP Regulation, the vehicles used for the transport of fish products must be built and equipped in order to respect the right temperatures during all the transport. If the ice is used for the refrigeration of the goods, water of ice fusion must be evacuated to avoid that it remains in contact with fish products. The internal surfaces of the mean of transport must be finished not to damage the goods, smooth and easy to wash and disinfect. To maintain the temperature the mean has to be isothermal insulated (classified as Normal Insulated (IN) or Heavily Insulated (IR)). There are three main classes to which all the refrigerated means belong. The first is class A which includes all the means which reach minimum temperatures down to 0° C, class B involves all the commercial vehicles that manage to reach minimum temperatures down to - 10° C and class C down to - 20° C. The isothermal insulated (IN or IR) is suitable only for the transport of class A. The

vehicles may be Refrigerated (Normal (RN) or Reinforced (RR)), if, with the use of a source of cold such as natural ice, eutectic plates, dry ice or liquefied gases, they are able to low the temperature and to maintain it. If the vehicle is equipped with a refrigerating appliance which enables the lowering of the temperatures, it is classified as Mechanically refrigerated (Normal (FN) or Reinforced (FR)). The IN vehicle can be transformed only into a Refrigerated of class A, defined as FNA or to a Mechanically refrigerated one of class A-B-C, classified as FNA, FNB, FNC. The IR vehicle may be conformed for transport for all classes A-B-C, both Refrigerated and Mechanically refrigerated (FRA, RRA, FRB, RRB...).

Respect to the temperature needed to transport fish products, one of these vehicles has to be chosen: for the transport of fresh fish products, vehicles of class A are enough, while for the frozen one, class C vehicles are needed. The capacity of the mean is another parameter to take in consideration.

Other logistical implications to take into account are the geographical distances between the recovery place and the location of the charity organization. In the case the confiscation takes place in ports or airports, the products are sent to the nearest EC warehouse. These warehouses can be dislocated in several locations, very far apart from the site of the charity organization. The situation is better in the case of fish markets, restaurants, logistical platforms and supermarkets, because they are mainly located in cities and towns, therefore there are higher possibility that the distances can be lowered (also due to the fact that there are more charitable organizations which operate in inhabited centres). The last case, the roads, seems to be the most difficult one, because the confiscation activities can happen everywhere. However, in this case, the Competent Authorities often seize also the vehicles where the product is transported and bring it to the nearest Port Authority office, which can be more accessible for recovery activities.

4.4.6 Recovery chains

In this section we will try to reconstruct and describe two possible recovery chains, following the scheme made, trying to simulate the possible scenarios, which can then be tested in the real context.

The Figure 4.8 summarizes the variables to consider when dealing with recovery of confiscated fish products. It is taken into consideration only the products suitable for human consumption which are destined to donation and the species which are most involved in seizures are the one listed. Each species is characterized by a Size and a Conservation Mode; as written before, the Shrimp is the only one which is frozen directly on board, so its status is only the frozen one. Respect to the Seizure Location, a Recovery Place is established.

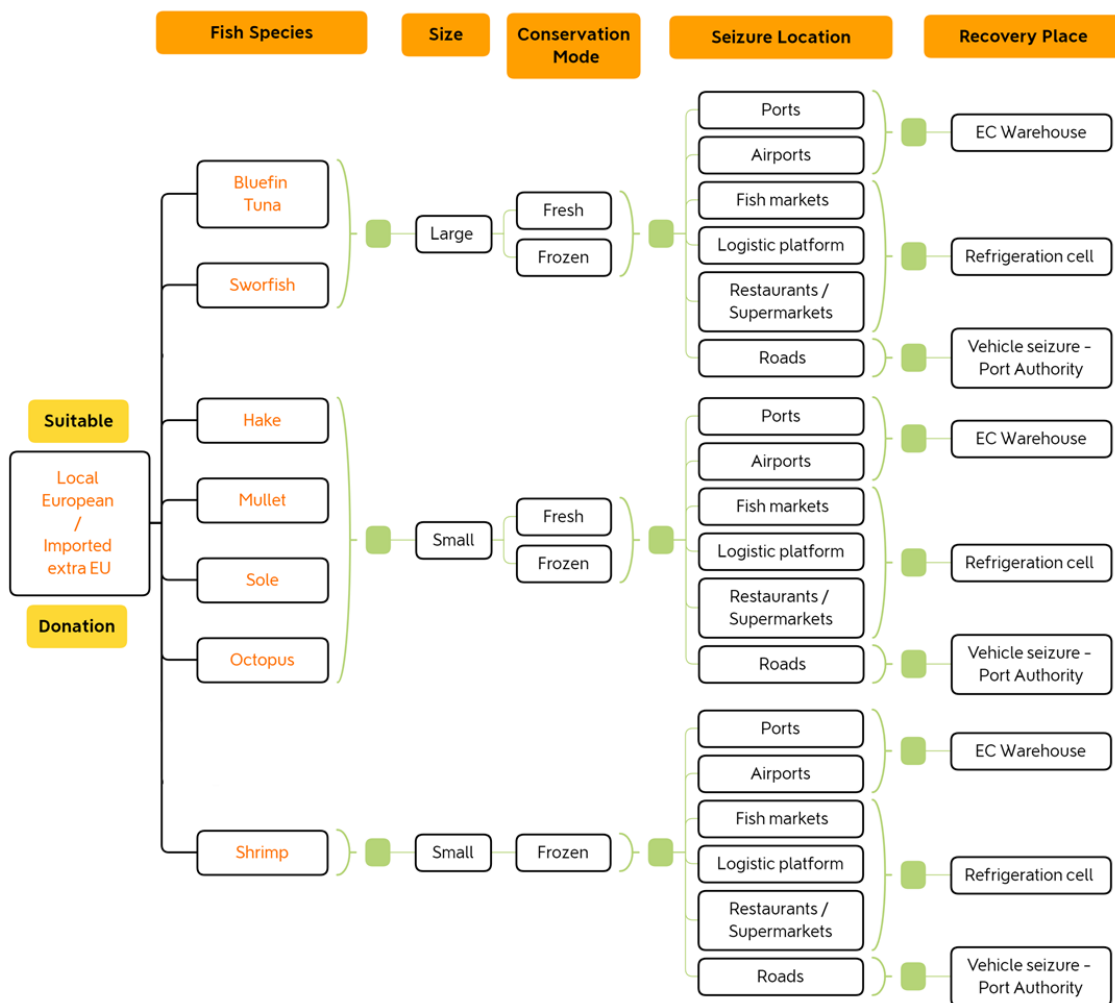


Figure 4.8 – Variables of different recovery scenarios

Bluefin Tuna

The first recovery chain described is the one of the Bluefin Tuna. The choice to describe it is lead to the peculiarities of this species: it is one of the two species mainly recovered by Banco Alimentare della Sicilia because, being object of the quota system, in some part

of the year is illegally caught and the controls of the Port Authorities are strengthened with consequent huge amount of products confiscated.

The first important characteristic that needs to be considered is the large size of this product: as written before, it can weigh up to 200/250 kg, making recovery activities very difficult to perform. A possible case that can happen very frequently is when Tuna fishes are object of Port Authorities controls at ports: as a consequence, seized product are brought to the nearest and available EC warehouse where it waits the decision of the Judge until a maximum of 24 hours. In parallel, within 24-48 hours, the Port Authority organizes the donation: the product can be picked up by the charitable organizations called for the recovery activities. This product is maintained at the fresh state until the transformation phase.

The operational implications for this type of recovery chain are first of all related to the Conservation Mode: as fresh product, it has to be maintained at a temperature between 0° C and 4° C, and at this status, its shelf-life is on average from 6 to 8 days. After this period, it is more likely the occurrence of alterations in the product which lead to an impossibility to consume the good. Tuna species are characterized by a risk of high concentration level of Histamine, an organic molecule belonging to the class of biogenic amines, which, if taken in large quantities, can provoke allergic reactions and intoxications. The mean used for the transport of this products needs to follow the ATP Regulation: it must have an isothermal insulation and belong to the Class A, reaching minimum temperatures down to 0° C: it can be Normally Insulated or Reinforced and both Refrigerated and Mechanically Refrigerated vehicles. The distances between the EC warehouse and the charity organization can be large: this is another aspect to take into account in choosing the vehicle. The large size of this product is also a parameter to consider when the recovery chain is going to be built. As a matter of fact, there are operational implications related to this characteristic because several front-line organizations do not have adequate structures and competences to deal with large size fish: the product needs to be worked and divided in more manageable portions.

Shrimp

This fish product is chosen because is the only species caught by the Italian fleet that is frozen on board. It has a small size and it can be confiscated in fish markets because of

lack of traceability. In fish markets it waits the decision of confiscation by the Judge in the refrigeration cell of the owner (up to a maximum of 24 hours). Within 24-48 hours Competent Authorities (Port Authority or Carabinieri NAS) organizes the donation. The recovery activities can occur in this place, with the right mean of transport: the refrigerator has to belong to ATP Class C, reaching temperatures down to - 20° C, in order to maintain the cold chain: it can be or Refrigerated or Mechanically Refrigerated. The charity who recovers this product needs to have suitable refrigeration cells to maintain the right temperature until the good is consumed. If the product is not subject to temperature changes, it can last up to 6 months.

4.5 Generalizable elements and Guidelines

After the analysis of the phenomenon of confiscated fish products in Italy, and after having identified the variables and the main steps of the process, we want to see if the Italian case can be generalized at a European level: all the schemes done are reviewed to establish if the elements included in them can be generalized and be applied to other European countries. Guidelines have been developed to follow if another country wants to deep the phenomenon of confiscated fish products and try to build recovery chains.

The first step that a European country needs to do is to review its National Regulations about fisheries, to understand the violations and the sanctions that the regulations dictate: the National Regulation should derive from the European one, therefore violations are expected to be similar in every European countries, while sanctions can be different. The Competent Authorities who are involved in seizure and confiscation activities need to be identified, too. The first quantitative information to gather is the aggregated data about seizure and confiscation measures in order to evaluate if the amounts of confiscated fish products and the potential recovery are significant, and the effort put in the study of the phenomenon can reach positive results. Then, the Regulations about food redistribution have to be deeply analysed and reviewed, to understand if the donation of products object of confiscation is embedded or not. As written in section 2.3.3, only in Italy, Greece and Lithuania it is reported to exist specific regulations on donation of confiscated products, with application to fish products for what regards the first two countries. Then the study

of how the process of controls over the legality of fish products happen and who are the main players involved can begin. This can be done with interviews to Competent Authorities and players of fish sector.

The first scheme analysed is the one which summarizes the main variables used for describing the process (Figure 4.4). Looking at the single variables, we can conclude that the Origin (local or imported) of fish products can be generalized: in all the countries (apart the landlocked ones) both imported and local products are consumed, and similar controls on imported products are performed at customs. The Seizure Location and Seizure Cause can be generalized because in the first case, the possible places where fish products can be controlled and eventually confiscated are the same (the only exception regards ports for those countries which do not overlook the sea), and in the second, possible violations are the same, due to the fact that National Regulations on fisheries must follow the European ones. The last two variables, Suitability for Human Consumption and Final Destination, can be generalized only partially: if in the country there is not a specific Regulation on other use of confiscated products, the Final Destination is only the disposal of the good, without establishing the suitability. However, if there is a Regulation, there is the establishment of the suitability and the choice of one of the Final Destinations.

This scheme is the first to use to investigate the process of fish in a specific geographic location. After understanding the percentage of local and imported fish consumed in the country, the following step is to understand how the controls over goods happen in the two different cases. Then, the main seizure locations and possible causes need to be investigated. The last step is to understand the possible alternatives of final destination for the products, considering the suitability for human consumption.

The process of seizure and confiscation activities (Figure 4.7) cannot be generalized: the phases of the juridical process and the management of the products are typical of the Italian case, and they may vary depending on the country. Each country needs to investigate how these operations are conducted by the Competent Authorities.

The other scheme which can be generalized is the one of the variables taken into account in the recovery activities (Figure 4.8). A premise needs to be done: this framework is done

keeping fixed the variables suitable for human consumption and donation as Final Destination. This means that it can only be generalized and applied to another European countries if the donation of confiscated fish products is possible.

The first variables, Fish Species, Size and Conservation Mode can be generalized as in all European countries the typologies of fish (with related sizes of goods) consumed are similar, with possible different mixes of species, as well as the mode used to preserve them. As written before, the Seizure Locations should be the same for all countries, while the Recovery Places may vary. In the case of refrigeration cells, it can be assumed that they can be used when seizure happens in fish markets, logistic platform, supermarkets or restaurants. Regarding the case of fish products confiscated in ports, airports and roads, hypothesis can be only made: as happens in the Italian case, they can be brought to the nearest EC warehouse or Port Authority office (with the seizure of the vehicle in case of roads), but there are no sufficient information for establishing it. In order to establish efficient recovery chains, all these variables must be taken into consideration: the fish species most affected by seizure activities, their related size and principal conservation mode after catch, and the main locations where fish are confiscated and then put until the recovery activities have to be identified.

The last step to follow is to measure each variable with quantitative data and fill the proposed schemes described above: this will help to identify which are the most frequent confiscation paths and possible recovery scenarios with their specific operational implications, in order to understand where to put the effort and act in the most efficient way. In addition, a map of the existing charities which act on a specific territory can be developed to build recovery activities.

5. Conclusions

In this last section, final conclusions and managerial implications are presented, as well as the main limitations and further research that can be done are explored.

5.1 Contributions, Managerial Implications and Limitations

This study aimed at analysing the phenomenon of confiscated fish products which is a real challenge for the Italian territory, but which can be transformed into a source of new value through the recovery and redistribution of fish suitable for human consumption. The first literary review and the study of the main European and National Regulations helped to deep the different aspects related to the main topic: food waste and surplus food redistribution with then the focus on the fish sector. Analysing the scientific literature, it was underlined the existing gap of scientific studies about surplus food redistribution for fish products and, consequently, the recovery of confiscated fish products.

With the multiple interviews made to the different players involved in the fish sector, engaged in controls and seizure activities as well as in the recovery and redistribution chains, relevant information was gathered and re-elaborated to develop a general framework which describes the key variables to consider and the different processes and scenarios that can happen.

The contributions brought by this work are different. First of all, before this research, there was not a comprehensive understanding of what was going on over the topic of confiscated fish products. The aim of interviewing several players is to grasp their different points of views over the phenomenon, gathering and connecting information over the seizure process and the main destinations of the confiscated fish products in the Italian context.

Therefore, this study answers the Research Questions defined at the beginning of this work: with the initial analysis of the scientific literature, the review of the main European and Italian Regulations, and the several interviews performed, it contributes to fill the existing gaps found in literature about the surplus food redistribution of fish products and the recovery of confiscated fish products. The identification of the variables to consider when dealing with this phenomenon, and the creation of the different schemes contribute

to better describe the process and possible recovery chains. As underlined in section 4.5, some of the schemes can be applied and adapted to the European context. This is the great contribution that this study brought: from the analysis of the Italian case, variables which characterize the phenomenon were identified and described and based on them frameworks were created, which can be adapted to other European countries. Some guidelines are also developed for those countries which want to investigate this phenomenon and the possible recovery chains that can be built.

The results of this study provide useful insights to the different players involved in the fish supply chain and in the recovery activities, to deep this phenomenon and understand how they can deal with it.

First of all, food banks and front-line organizations can use the different information gathered, and in particular the scheme of the variables related to the recovery activities (Figure 4.8), to build possible recovery chains, taking into account the operational implications that each chain could have and understanding where to concentrate the efforts for the maximization of the recovery interventions. The section 5.2 will deep also the practical implications encountered by Banco Alimentare della Sicilia, and the possible further steps that they can take.

Local policy makers can use the results proposed to monitor and control the entire fish supply chain and to reach a more efficient management of it, valorising the confiscated fish product, and eliminating the burden that the public entity has in the management of it. Acting over this phenomenon can generate new values both in an economic and environmental terms: the creation of food waste is prevented, while a high value product is recovered. In collaboration with both food banks and front-line organizations, local policy makers can develop effective recovery chains of fish products collecting more specific data and enabling a more efficient management of redistribution activities. Also other companies of the fishing sector and international organizations promoting the responsible use of resources and the shift towards more sustainable production and consumption systems (e.g. FAO) can be interested in the results obtained to collaborate with policy makers and food banks in this type of recovery activities, giving their knowledge and their experience on this field to collect data and develop management strategies that can be shared and widely adopted.

As written before, for European policy makers, the frameworks and the guidelines proposed can be used to deepen the phenomenon in other European countries and verify if the recovery chains for confiscated fish products can be implemented.

This study has also some limitations. The quantitative data about the number of seizure and the amount of fish confiscated are aggregated, and they gave only a first idea of the extent of this phenomenon. Further researches need to be done to find and analyse the specific data, in order to fill the schemes done with the real data and calculate the probability of occurrence of each single path. This will help charitable organizations, like Banco Alimentare, to focus the effort in locations where confiscations happen the most and to understand which are the most frequent types of fish to recover, with their specific operational implications. After identifying the recovery places where confiscated products are put most frequently, existing front-line organizations which act on that specific territory can be found, to assure the efficiency of recovery activities.

Another limitation is related to the focus of this study: the researches and analysis was made on the Italian case, therefore, as written in the section 4.5, some part of the process, specifically the ones related to the legal practices and the activities performed after the seizure, are specific for Italy, and they can vary between countries. To understand the practices followed by other countries, further analyses are necessary.

5.2 Further researches

In the section 4.4.4, the different alternatives of the possible destinations of confiscated products are listed, with their strengths and weaknesses. In this section, further possible development and steps which can be made are described.

Regarding the donation alternative, one of the difficulties analysed is the management of large size products. In order to make the fish more manageable, a further operation is needed. A possible solution discussed in the interviews is the transformation of fish products: this means bringing the good to lower temperatures (- 20° C or - 40° C) and divide it into more manageable portions. The product brought to - 40° C can last up to 8/9 months if the cold chain is maintained, while at - 20° C the months are reduced. The yield for tuna species is 60%.

These operations must take into account a series of parameters: the conditions of the working environment (walls, tables, knives, rounded corners and steel benches), the ambient temperature (between 8° C and 20° C), and critical bleeding and filleting operations. Another point to consider is the labelling operation; the company involved in the transformation procedures has to perform also this type of activities. As written in section 4.4.3, regarding the Tuna species, there is also a specific catch document (Bluefin Tuna Catch Documentation - BCD) whose code has to be included in the labels. The confiscation documentation should ensure the right transfer of ownership and conveyance of information.

Due to the critical nature of all these different parameters, it is better to entrust the processing and labelling activities to companies specialized in this sector, which have suitable structures and equipment.

With the involvement of third parties in the management of recovery activities, some necessary considerations have to be made. First, an evaluation of possible suppliers needs to be done: the company needs to follow all the Regulations regarding food safety and hygienic issues and works in an environment that satisfies the different requirements analysed before. An economic evaluation of the different proposals is necessary to find the supplier which executes the activities at the most convenient price, while assuring quality and safety, since the costs will be up to the structure which takes the responsibility to donate the product. Even the time needed by the company to perform the activities and to return the product portioned and frozen is a parameter to consider in the evaluation.

During the meeting with a consulting company which is working on a feasible study with Banco Alimentare della Sicilia about the recovery of confiscated fish on regional base with the aim of providing operative hypothesis to manage the next season of seizures, the alternative of involving a transformation company was also considered, according to the analysis of critical issues observed by the consulting company. These difficulties are the same we examined in depth.

As an alternative to disposal, the amount of fish products that go in landfills can be recovered in other ways, following the Food Waste Hierarchy applied to fish products, as we learned also from the literature: transformation into animal feed or feed for aquaculture, industrial uses (e.g. leather, fish oil and minerals), production of energy (i.e.

biogas and biodiesel) or composting. An example of reuse of illegal fish products was reported in the interviews: in Denmark a big portion of undersized fish goes to industry for making fish oil. This can be seen as a creation of a market for this type of illegal fishing, but the undersized fish is sold at such a low price that fishermen are not incentivized to catch and then sell this product. This is a possible option to avoid the disposal alternative, the least preferable option between the others of the Food Waste Hierarchy and which leads to the creation of food waste.

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Appendix

I. List of names and Italian translation

Border Inspection Post = Posti di Ispezione Frontaliera (PIF)
 Central Inspectorate for Quality Protection and Fraud Repression of Agri-Food Products = Ispettorato Centrale della tutela della Qualità e della Repressione Frodi dei prodotti agroalimentari (ICQRF)
 Customs Agency = Agenzia delle Dogane
 Directorate General for Animal Health and Veterinary Medicines = Direzione Generale della Sanità Animale e dei Farmaci Veterinari
 Finance Guard = Guardia di Finanza
 Forestry Carabinieri = Carabinieri Forestali
 Income Revenue Agency = Agenzia delle Entrate
 Local Health Units = Azienda Sanitaria Locale (ASL)
 Local Police = Polizia Locale
 Ministry of Agricultural, Food and Forestry Policies = Ministero delle Politiche Agricole Alimentari e Forestali (MIPAAF)
 Ministry of Health = Ministero della salute
 Port Authority = Capitaneria di Porto
 Veterinary Offices for Community Fulfillments = Uffici Veterinari per gli Adempimenti Comunitari (UVAC)

II. Fishing stops in the Italian territory during the period 2015-2019

Bottom trawls, divergent trawls, twin divergent nets

	2015	2016	2017	2018	2019
<i>Trieste - Rimini</i>	26/7 - 6/9	25/7 - 5/9	31/7 - 10/9		
<i>Pesaro - Bari</i>	16/8 - 27/9	16/8 - 26/9			
<i>Brindisi - Imperia</i>	19/9 - 18/10	17/9 - 16/10			
<i>Sardegna-Sicilia</i>	regional measure (30 days)	regional measure (30 days)	regional measure (30 days)	regional measure (30 days)	regional measure (30 days)
<i>Trieste - Ancona</i>			31/7 - 10/9	30/7 - 9/9	29/7 - 27/8

<i>San Benedetto del Tronto - Termoli</i>	28/8 - 8/10	13/8 - 23/9	15/8 - 13/9
<i>Manfredonia - Bari</i>	31/7 - 29/8 + 10 even not consecutive working days by 31/10		29/7 - 27/8
<i>Brindisi - Civitavecchia</i>	11/9 - 10/10		
<i>Livorno - Imperia</i>	2/10 - 31/10		
<i>Brindisi - Roma</i>		10/9 - 9/10	9/9 - 8/10
<i>Civitavecchia - Imperia</i>		1/10 - 30/10	16/9 - 15/10
Anchovies			
<i>Trieste - Ancona</i>	26/8 - 9/9	26/8 - 9/10	
<i>San Benedetto del Tronto - Gallipoli</i>	3/9 - 17/9	3/9 - 17/10	
<i>Trieste - Monfalcone (purse seines with mechanical closure and without closure)</i>			1/8 - 30/8
<i>Venezia - Gallipoli (purse seines with mechanical closure and without closure)</i>			15/5 - 13/6
<i>Trieste - Rimini (flying and flying in pairs)</i>			1/8 - 30/8
<i>Pesaro - Ancona (flying and flying in pairs)</i>			1/6 - 30/6
<i>San Benedetto del Tronto - Gallipoli (flying and flying in pairs)</i>			1/5 - 30/5
Sardines			
<i>Trieste - Rimini</i>	16/12 - 30/12	16/12 - 30/12	
<i>Pesaro - Ancona</i>	21/10 - 4/11	21/10 - 4/12	
<i>San Benedetto del Tronto - Gallipoli</i>	16/12 - 30/12	16/12 - 30/13	

<i>Trieste - Gallipoli (purse seines with mechanical closure and without closure)</i>	20/2 - 21/3
<i>Trieste - Rimini (flying and flying in pairs)</i>	15/12 - 13/1
<i>Pesaro - Ancona (flying and flying in pairs)</i>	1/10 - 30/10
<i>San Benedetto del Tronto - Gallipoli (flying and flying in pairs)</i>	1/11 - 30/11

III. PIF control activities during 2018, divided by fish species

<i>Product Description</i>	<i>Lots</i>		<i>Controls</i>				<i>Refusals*</i>		
	Lots	Quantity (Kg)	Physical	%	Lab	%	R	T	D
<i>Crustaceans</i>	6.395	61.327.371	3.448	53,90%	196	5,70%	4	-	4
<i>Aquatic invertebrates other than crustaceans and molluscs</i>	91	83.810	87	95,60%	1	1,10%	2	-	3
<i>Clams</i>	7.268	297.655.338	4.128	56,80%	287	7,00%	17	-	6
<i>Mixed lots of fish and crustaceans, molluscs and other aquatic invertebrates and their preparations</i>	7.892	44.025.249	4.011	50,80%	2	7,40%	10	-	17
<i>Mixed lots of fish and crustaceans, molluscs and other aquatic invertebrates: alive</i>	999	5.414.961	999	100,00%	-	0,00%	-	-	-
<i>Fishery, aquaculture and shellfish products</i>	12.827	179.007.752	5.217	40,70%	558	10,70%	17	1	17
<i>Products of fish or crustaceans, molluscs or other aquatic</i>	227	10.433.495	175	77,10%	7	4,00%	2	-	-

<i>invertebrates; dead animals</i>							
<i>Total</i>	35.699	597.947.976	18.065			52	1 47

*R=Refusals; T=Transfer; D=Destruction

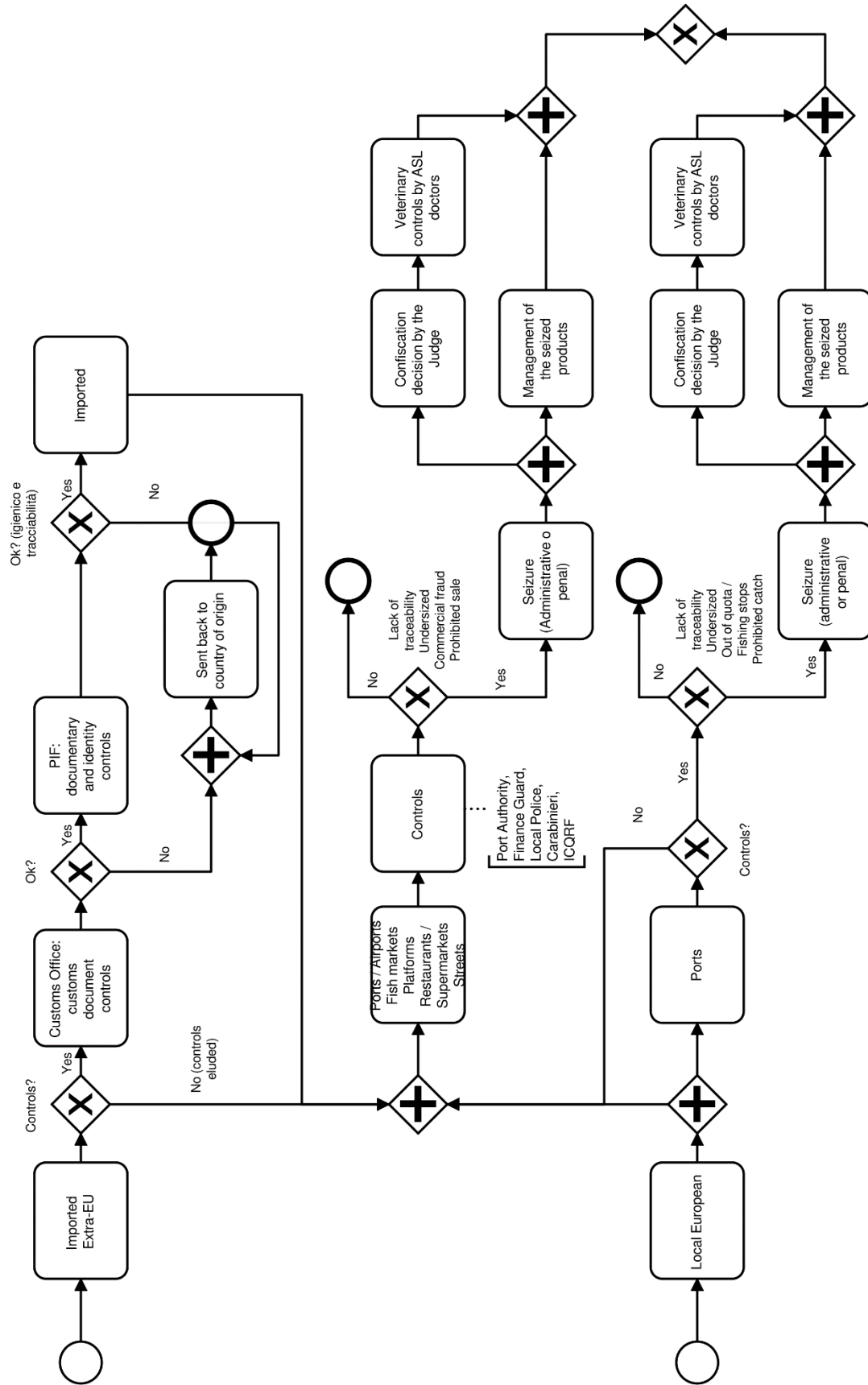
IV. PIF Refusals motivation, divided by fish species

<i>Product Description</i>	<i>Refusals Motivations</i>				
	<i>Documental</i>	<i>Identity</i>	<i>Laboratory</i>	<i>Physical Material</i>	<i>Others</i>
<i>Crustaceans</i>	2	2	-	-	4
<i>Aquatic invertebrates other than crustaceans and molluscs</i>	1	2	-	-	2
<i>Clams</i>	2	1	-	-	20
<i>Mixed lots of fish and crustaceans, molluscs and other aquatic invertebrates and their preparations</i>	4	9	-	2	12
<i>Mixed lots of fish and crustaceans, molluscs and other aquatic invertebrates: alive</i>	-	-	-	-	-
<i>Fishery, aquaculture and shellfish products</i>	11	3	-	-	21
<i>Products of fish or crustaceans, molluscs or other aquatic invertebrates; dead animals</i>	2	-	-	-	-
<i>Total</i>	22	17	0	2	59

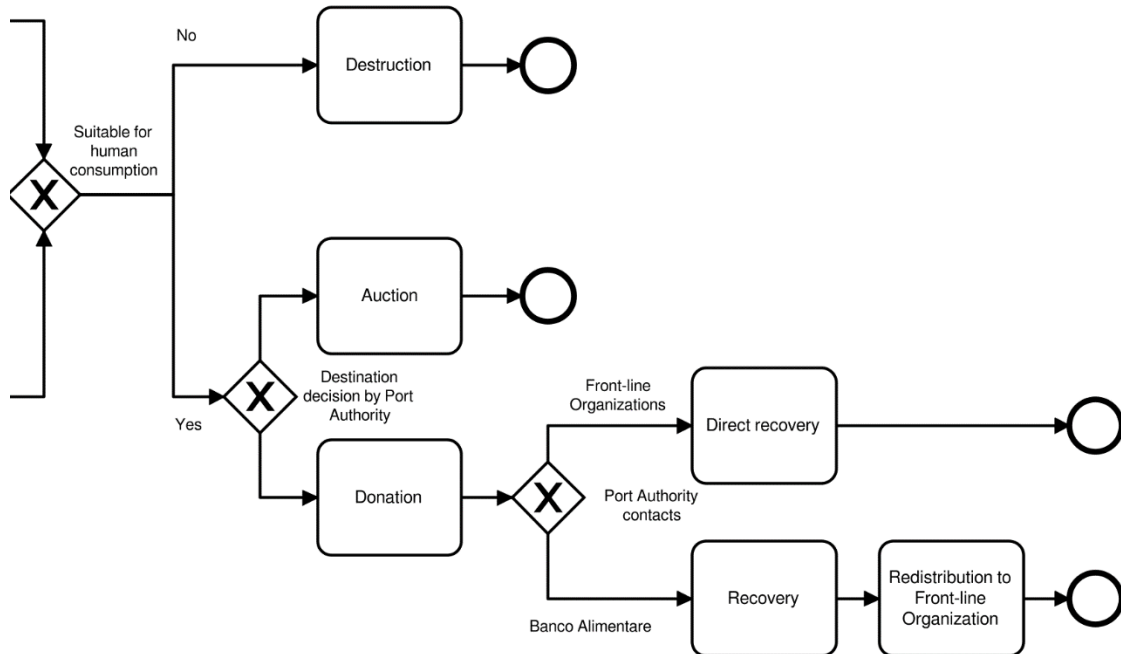
V. UVAC controls activities during 2018, divided by fish species

<i>Sector</i>	<i>Lots</i>	<i>Quantity (Kg)</i>	<i>Physical control</i>	<i>% Controls over lots</i>	<i>Laboratory controls</i>	<i>% Lab. Analysis over lots</i>
<i>Fish</i>	641.716	315.344.988	2.200	0,34%	1.168	53,09%
<i>Crustaceans</i>	64.537	37.118.078	281	0,44%	142	50,53%
<i>Clams</i>	197.563	125.066.080	873	0,44%	482	55,21%
<i>Prepared fish</i>	48.725	105.357.474	163	0,33%	75	46,01%
<i>Other fishery products</i>	4.273	1.417.090	15	0,35%	3	20,00%
<i>Total</i>	956.814	584.303.710	3.532		1.870	
<i>Average</i>				0,38%		44,97%

VI. BPMN of controls and seizure procedures



VII. BPMN of final destinations



VIII. Surveys

1. MIPAAF (Capitaneria di Porto)

- a. *Quali sono le cause del sequestro?*
- b. *Quali sono i luoghi dove avvengono i sequestri?*
- c. *In che fase del processo avvengono prevalentemente i sequestri?*
- d. *Come avviene il sequestro?*
- e. *La frequenza delle attività di controllo da cosa essa dipende?*
- f. *È possibile avere una tabella degli interventi effettuati negli anni dal 2015 al 2019?*
- g. *Calcolate la percentuale tra quantitativi controllati che viene controllata e il totale del pesce movimentato?*
- h. *Quali sono le tipologie di pesce maggiormente interessate?*
- i. *In base alla tipologia di pesce sequestrato è possibile costruire un calendario dei sequestri?*
- j. *È possibile definire l'entità (in peso) del pesce sequestrato negli anni dal 2015 al 2019?*
- k. *Quali sono le destinazioni del pesce sequestrato?*

- l. Sono presenti attività di recupero del pesce sequestrato?*
- m. Quali sono le fasi del processo di recupero e gli attori coinvolti?*
- n. Come si posiziona la normativa sul sequestro in Italia e più in generale sulla pesca illegale rispetto alla legislazione direttive europea?*
- o. A suo avviso, come è la situazione corrente in Italia rispetto all'Obiettivo di Sostenibilità 14.4 dell'Agenda 2030 delle Nazioni Unite: "Entro il 2020, regolare efficacemente la raccolta e porre fine alla pesca eccessiva, la pesca illegale, quella non dichiarata e non regolamentata e alle pratiche di pesca distruttive, e mettere in atto i piani di gestione su base scientifica, al fine di ricostituire gli stock ittici nel più breve tempo possibile, almeno a livelli in grado di produrre il rendimento massimo sostenibile come determinato dalle loro caratteristiche biologiche"?*

2. DG MARE

- a. How much fish has been confiscated in Europe between 2015 and 2019?*
- b. What are the main destinations of the confiscated fish?*
- c. At what percentage the confiscated fish is reuse for other purposes?*
- d. Where IUU fishing occurred the most?*
- e. What are the species mainly involved in the IUU fishing?*
- f. What is the frequency of the controls?*
- g. At which phase the controls occur?*
- h. What are the main actors involved?*
- i. Is it possible to have data about interventions carried out between 2015 and 2019?*
- j. Have the IUU fishing decreased with the implementation of the new European regulation?*
- k. Do you know other examples of redistribution to charitable organizations of seized fish? In which countries?*
- l. In your opinion, how is the current situation in Europe compared to the Sustainability Objective 14.4 of the United Nations Agenda 2030: "By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-*

based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics”?

3. Banco Alimentare Sicilia Occidentale e Orientale

- a. Dal momento in cui è stata applicata la legge Gadda, quante volte siete stati chiamati dalla Guardia costiera? Quanti kg di prodotti ittici siete riusciti a ridistribuire? Quali sono state le specie maggiormente interessate?*
- b. Avete notato dei periodi di picco del fenomeno?*
- c. Quali sono le principali barriere e difficoltà nel recupero? Avete a disposizione strumenti idonei per mantenere in sicurezza i prodotti?*
- d. Gestione del pesce sequestrato*
- e. Procedura di recupero: fasi e attori coinvolti*
- f. Ci sono differenze tra pesce di piccola e grossa taglia?*
- g. Dove e come viene conservato il pesce prima che venga ridistribuito*
- h. Entro quanto tempo il pesce sequestrato deve essere consumato/processato*
- i. Ci sono accordi con associazioni e/o aziende di trasformazione per redistribuire il pesce?*
- j. Pesce sottomisura: ci sono stati casi in cui non è stato possibile donarlo?*

4. Coldiretti Impresa Pesca, Federcoopescas-Confcooperative

- a. Quali sono le attuali opzioni di valorizzazione delle eccedenze di prodotti ittici, con particolare riferimento ai prodotti ittici oggetto di sequestro?*
- b. Sono in atto pratiche di recupero di prodotti ittici sequestrati per consumo umano? Se sì, in che fase (produzione, trasformazione...)?*
- c. I diversi attori della filiera ittica sono interessati a pratiche di valorizzazione delle eccedenze?*
- d. Quali sono le specie di pescato maggiormente idonee al recupero per consumo umano?*
- e. Sono presenti incentivi per i produttori o trasformatori per la valorizzazione dei prodotti ittici?*

- f. *Quali sono le principali barriere e i vincoli, per esempio inerenti alla normativa in materia di sicurezza e di igiene alimentare?*
- g. *Quali sono le operazioni necessarie per poter recuperare i prodotti ittici sequestrati?*
- h. *Quali sono le tipologie di pesce maggiormente pescate nei mari italiani?*
- i. *Quali sono e a quanto ammontano (kg) le specie più consumate in Italia?*
- j. *Quali sono e a quanto ammontano (kg) le specie importate ed esportate in Italia?*
- k. *A suo avviso, quanto è esteso il fenomeno della pesca fuori quota, della mancata tracciabilità e dei prodotti sottomisura, identificate come le maggiori cause di sequestro?*
- l. *A suo avviso, come è la situazione corrente in Italia rispetto all'Obiettivo di Sostenibilità 14.4 dell'Agenda 2030 delle Nazioni Unite: "Entro il 2020, regolare efficacemente la raccolta e porre fine alla pesca eccessiva, la pesca illegale, quella non dichiarata e non regolamentata e alle pratiche di pesca distruttive, e mettere in atto i piani di gestione su base scientifica, al fine di ricostituire gli stock ittici nel più breve tempo possibile, almeno a livelli in grado di produrre il rendimento massimo sostenibile come determinato dalle loro caratteristiche biologiche"*

5. FAO (Fisheries and Aquaculture Department - Product, Trade and Marketing Branch)

- a. *Regarding sustainable fishing, what are the main areas you are focusing on?*
- b. *Which type of initiatives are you pursuing?*
- c. *How is the current situation compared to the Sustainability Objective 14 of the United Nations Agenda 2030 "Conserve and sustainably use the oceans, seas and marine resources for Sustainable development", both at an international level and regarding the Italian context? What are the areas of major concern?*
- d. *Specifically, what about the Sustainability Objective 14.4: "By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at*

least to levels that can produce maximum sustainable yield as determined by their biological characteristics”?

- e. What are the measures that can be used to reduce fish losses and waste?*
- f. Fish has high nutritional qualities and is essential in human diet. Having this in mind, are you working on initiatives regarding the recovery of surplus of fish products for social purposes, in particular food donation, in order to achieve both the 12.3 Sustainability Target: “By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post - harvest losses” and the 2.1 one: “By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round”?*
- g. Are you dealing with the issue of recovery and valorisation of confiscated fish?*
- h. Do you know examples of redistribution of confiscated fish to charitable organizations? In which countries?*
- i. One of the causes of the phenomenon of confiscated fish is the lack of traceability: in which ways can it be improved? Is an area you are currently focusing on?*

6. Mercato Ittico di Milano - grossisti

- a. A quanto ammonta il flusso annuo dei prodotti distribuiti?*
- b. Di questo ammontare, quali sono le percentuali tra prodotto locale e di importazione da Paesi extra-UE?*
- c. Quali sono le percentuali tra prodotto fresco e congelato?*
- d. Chi sono i principali acquirenti?*
- e. Quali sono le principali specie vendute? E quali quelle più consumate dai privati?*
- f. Quali sono le procedure per introdurre i prodotti nel mercato ittico? Esse differiscono tra prodotto locale e importato?*
- g. Vengono eseguiti specifici controlli prima che il prodotto venga introdotto?*
- h. Vengono eseguiti controlli periodici da parte delle Autorità Competenti?*
- i. Sono avvenuti sequestri all'interno del mercato? Se sì, quali sono state le principali cause del sequestro?*

j. Quali sono state le specie più interessate e quali i quantitativi? E quale la destinazione del prodotto confiscato?

7. Mercato Ittico di Milano – Direttore generale

- a. A quanto ammonta il flusso annuo dei prodotti distribuiti?*
- b. Di questo ammontare, quali sono le percentuali tra prodotto locale e di importazione da Paesi extra-UE?*
- c. Quali sono le percentuali tra prodotto fresco e congelato?*
- d. Chi sono i principali acquirenti?*
- e. Quali sono le principali specie vendute? E quali quelle più consumate dai privati?*
- f. Quali sono le procedure per introdurre i prodotti nel mercato ittico? Esse differiscono tra prodotto locale e importato?*
- g. Vengono eseguiti specifici controlli prima che il prodotto venga introdotto?*
- h. Vengono eseguiti controlli periodici da parte delle Autorità Competenti?*
- i. Sono avvenuti sequestri all'interno del mercato? Se sì, quali sono state le principali cause del sequestro?*
- j. Quali sono state le specie più interessate e quali i quantitativi? E quale la destinazione del prodotto confiscato?*

References

- Alleanza Italiana per lo Sviluppo Sostenibile (Asvis). (2019). *L'Italia e gli Obiettivi di Sviluppo Sostenibile*.
- Arcuri, S., Brunori, G., & Galli, F. (2017). Insights on the role of private and public actors in food assistance provision: A literature review for High Income Countries. *Economia Agro-Alimentare*, 19(1), 119–150. <https://doi.org/10.3280/ECAG2017-001006>
- Baglioni, S., De Pieri, B., & Tallarico, T. (2017). Surplus Food Recovery and Food Aid: The Pivotal Role of Non-profit Organisations. Insights From Italy and Germany. *Voluntas*, 28(5), 2032–2052. <https://doi.org/10.1007/s11266-016-9746-8>
- BMTI S.c.p.A. (2018). *Report annuale sul mercato ittico - Anno 2018*. 93. <https://ittico.bmti.it/Prezzi/pages/DownloadDoc?id=975>
- Campiglio, L., & Rovati, G. (2009). Il paradosso della scarsità nell'abbondanza: il caso della povertà alimentare. In Campiglio L. and Rovati G. (editors). *La povertà alimentare in Italia Prima indagine quantitativa e qualitativa*. Milano: Guerini e Associati.
- Caritas Italiana, & Fondazione Banco Alimentare ONLUS (2015). *Recovery, Collection and REDISTRIBUTION of Food for charitable purposes*. 62.
- Ce.I.R.S.A. (2006). *La filiera dei prodotti ittici*. Accessed on the Internet on December 12, 2019. <https://www.ceirsa.org/>
- Coldiretti (2019). *Stranieri 8 pesci su 10 sulle tavole italiane*. Accessed on the Internet on February 14, 2020. <https://www.coldiretti.it/economia/stranieri-8-pesci-10-sulle-tavole-italiane>
- Comando Generale del Corpo delle Capitanerie di Porto (2017). *Frodi e Soffisticazioni*.

- Committee on the Environment, Public Health and Food Safety (2013). Report on the food crisis, fraud in the food chain and the control thereof (2013/2091(INI)). Accessed on the Internet on December 10, 2019. <https://www.europarl.europa.eu/sides/getDoc.do?pubRef=//EP//NONSGML+REPORT+A7-2013-0434+0+DOC+PDF+V0//EN>
- De Boeck, E., Jacxsens, L., Goubert, H., & Uyttendaele, M. (2017). Ensuring food safety in food donations: Case study of the Belgian donation/acceptation chain. *Food Research International*, 100(May), 137–149. <https://doi.org/10.1016/j.foodres.2017.08.046>
- Direzione Generale della Sanità Animale e dei Farmaci Veterinari (2018). *L'attività dei Posti Di Ispezione Frontaliera e Uffici Veterinari per gli Adempimenti Comunitari 2018*. Roma
- EPA (2013). Putting Surplus Food to Good Use. *Journal of Chemical Information and Modeling*, 53(9), 1689–1699. <https://doi.org/10.1017/CBO9781107415324.004>
- EU Platform on Food Losses and Food Waste (2019). *Redistribution of surplus food: Examples of practices in the Member States*. Accessed on the Internet on November 25, 2020, https://ec.europa.eu/food/sites/food/files/safety/docs/fw_eu-actions_food-donation_ms-practices-food-redis.pdf
- EUMOFA. (2019). *The Eu Fish Market 2019 Edition*. <https://doi.org/10.2771/168390>
- European Commission (2015). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Closing the loop - An EU action plan for the Circular Economy. COM (2015) 614 final. Brussels
- European Commission (2017). Commission Notice EU guidelines on food donation (2017/C 361/01). C 361/2. Brussels
- European Commission Directorate-General for Maritime Affairs and Fisheries. (2018). Facts and figures on the common fisheries policy : basic statistical data : 2018 edition. <https://doi.org/10.2771/060211>

- European Court of Auditors (2016). Combating Food Waste: an opportunity for the EU to improve the resource-efficiency of the food supply chain. In *European Union - European Court of Auditors* (Issue 34). <https://doi.org/10.2865/8374>
- European Parliament Council (2002). Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety. Brussels
- European Parliament Council (2008a). Directive 2008/98/EC of the European Parliament and of the council of 19 November 2008 on waste and repealing certain Directives. Brussels
- European Parliament Council (2008b). Council Regulation (EC) No 1005/2008 of 29 September 2008 establishing a Community system to prevent, deter and eliminate illegal, unreported and unregulated fishing, amending Regulations (EEC) No 2847/93, (EC) No 1936/2001 and (EC) No 601/2004 and repealing Regulations (EC) No 1093/94 and (EC) No 1447/1999. Brussels
- European Parliament Council (2009). Council Regulation (EC) No 1224/2009 of 20 November 2009 establishing a Community control system for ensuring compliance with the rules of the common fisheries policy, amending Regulations (EC) No 847/96, (EC) No 2371/2002, (EC) No 811/2004, (EC) No 768/2005, (EC) No 2115/2005, (EC) No 2166/2005, (EC) No 388/2006, (EC) No 509/2007, (EC) No 676/2007, (EC) No 1098/2007, (EC) No 1300/2008, (EC) No 1342/2008 and repealing Regulations (EEC) No 2847/93, (EC) No 1627/94 and (EC) No 1966/2006. Brussels
- European Parliament Council (2010). Regulation (EU) No 640/2010 of the European Parliament and of the Council of 7 July 2010 establishing a catch documentation programme for bluefin tuna *Thunnus thynnus* and amending Council Regulation (EC) No 1984/2003. Brussels
- European Parliament Council (2013a). Regulation (EU) No 1379/2013 of the European Parliament and of the Council of 11 December 2013 on the common organisation of the markets in fishery and aquaculture products, amending Council Regulations

(EC) No 1184/2006 and (EC) No 1224/2009 and repealing Council Regulation (EC) No 104/2000. Brussels

European Parliament Council (2013b). Regulation (EU) No 1380/2013 of the European Parliament and of the Council of 11 December 2013 on the Common Fisheries Policy, amending Council Regulations (EC) No 1954/2003 and (EC) No 1224/2009 and repealing Council Regulations (EC) No 2371/2002 and (EC) No 639/2004 and Council Decision 2004/585/EC. Brussels

European Parliament Council (2018a). Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste. Brussels

European Commission (2018b). Summary Report Eu Platform on Food Losses and Food Waste: Sub-Group on Food Donation DG Health and Food Safety (SANTE) 4th meeting. Brussels. Accessed on the Internet on February 25, 2020. https://ec.europa.eu/food/sites/food/files/safety/docs/fw_eu-platform_20181026_sub-fd_sum.pdf

European Commission (2019). Commission Delegated Decision (EU) of 3.5.2019 supplementing Directive 2008/98/EC of the European Parliament and of the Council as regards a common methodology and minimum quality requirements for the uniform measurement of levels of food waste. C(2019) 3211 final. Brussels

Europol / INTERPOL. (2017). *Operation OPSON VI - Targeting counterfeit and substandard foodstuff and beverage*. 1–52. https://ec.europa.eu/food/sites/food/files/safety/docs/official-controls-food-fraud_opson-vi-report.pdf

FAO (2011). Global food losses and food waste – Extent, causes and prevention. Rome

FAO (2015). Food Recovery and Redistribution Advocated by the Committee on World Food Security, FAO multi-disciplinary Team. Accessed on the Internet on February 7, 2020. <http://www.fao.org/save-food/news-and-multimedia/news/news-details/en/c/288692/>

FAO (2018a). Overview of food fraud in the fisheries sector, by Alan Reilly. Fisheries and Aquaculture Circular No. 1165. Rome, Italy.

- FAO (2018b). The State of World Fisheries and Aquaculture 2018 - Meeting the sustainable development goals. Rome. Licence: CC BY-NC-SA 3.0 IGO.
- FAO (2019). The State of Food and Agriculture 2019. Moving forward on food loss and waste reduction. Rome. Licence: CC BY-NC-SA 3.0 IGO.
- FAO, IFAD, UNICEF, WFP and WHO (2019). The State of Food Security and Nutrition in the World 2019. Safeguarding against economic slowdowns and downturns. Rome, FAO. Licence: CC BY-NC-SA 3.0 IGO
- FEBA (2018). *Annual report 2018*. Accessed on the Internet on January 26, 2020. https://www.eurofoodbank.org/images/cont/feba-annual-report-2018-final_file.pdf
- Foti, V. T., Sturiale, L., & Timpanaro, G. (2018). An overview of food waste phenomenon: By problem to resource. *Quality - Access to Success*, 19(S1), 232–240.
- Galli, F., Cavicchi, A., & Brunori, G. (2019). Food waste reduction and food poverty alleviation: a system dynamics conceptual model. *Agriculture and Human Values*, 36(2), 289–300. <https://doi.org/10.1007/s10460-019-09919-0>
- Garrone, P., Melacini, M., & Perego, A. (2013). *Feed the hungry: the potential of surplus food recovery*. Fondazione per la Sussidiarietà: Milano.
- Garrone, P., Melacini, M., & Perego, A. (2014a). Opening the black box of food waste reduction. *Food Policy*, 46, 129–139. <https://doi.org/10.1016/j.foodpol.2014.03.014>
- Garrone, P., Melacini, M., & Perego, A. (2014b). Surplus food recovery and donation in Italy: The upstream process. *British Food Journal*, 116(9), 1460–1477. <https://doi.org/10.1108/BFJ-02-2014-0076>
- Garrone, P., Melacini, M., & Perego, A. (2015). *Surplus Food Management Against Food Waste*. La Fabbrica: Milano

- Gentilini, U. (2013). Banking on Food: The State of Food Banks in High - income Countries. *IDS Working Papers*, 2013(415), 1–18. <https://doi.org/10.1111/j.2040-0209.2013.00415.x>
- Ghisellini, P., & Ulgiati, S. (2020). Circular economy transition in Italy. Achievements, perspectives and constraints. *Journal of Cleaner Production*, 243, 118360. <https://doi.org/10.1016/j.jclepro.2019.118360>
- Godfray, H. C. J., Beddington, J. R., Crute, I. R., Haddad, L., Lawrence, D., Muir, J. F., Pretty, J., Robinson, S., Thomas, S. M., & Toulmin, C. (2010). Food security: The challenge of feeding 9 billion people. *Science*, 327(5967), 812–818. <https://doi.org/10.1126/science.1185383>
- Guarinoni, M., & Versmann, A. (2014). *Comparative Study on EU Member States' legislation and practices on food donation Final report June 2014. June*, 78.
- Johnston W.A., Nicholson F.J., Roger A. & Stroud G.D. (1994). Freezing and refrigerated storage in fisheries. FAO Fisheries Technical Paper. No. 340. Rome, FAO.
- Legge del 19/08/2016 n. 166. Disposizioni concernenti la donazione e la distribuzione di prodotti alimentari e farmaceutici a fini di solidarietà sociale e per la limitazione degli sprechi. Pubblicato in Gazzetta Ufficiale n. 202 del 30 agosto 2016
- Lucifero, N. (2016). Food Loss and Waste in the EU Law between Sustainability of Well-being and the Implications on Food System and on Environment. *Agriculture and Agricultural Science Procedia*, 8, 282–289. <https://doi.org/10.1016/j.aaspro.2016.02.022>
- Maynou, F., Gil, M. del M., Vitale, S., Giusto, G. B., Foutsi, A., Rangel, M., Rainha, R., Erzini, K., Gonçalves, J. M. S., Bentes, L., Viva, C., Sartor, P., De Carlo, F., Rossetti, I., Christou, M., Stergiou, K., Maravelias, C. D., & Damalas, D. (2018). Fishers' perceptions of the European Union discards ban: perspective from south European fisheries. *Marine Policy*, 89(December 2017), 147–153. <https://doi.org/10.1016/j.marpol.2017.12.019>

- Öztürk, B. (2015). Nature and extent of the illegal, unreported and unregulated (IUU) fishing in the Mediterranean Sea. *Journal of Black Sea / Mediterranean Environment*, 21(1), 67–91.
- Papargyropoulou, E., Lozano, R., K. Steinberger, J., Wright, N., & Ujang, Z. Bin. (2014). The food waste hierarchy as a framework for the management of food surplus and food waste. *Journal of Cleaner Production*, 76, 106–115. <https://doi.org/10.1016/j.jclepro.2014.04.020>
- Parfitt, J., Barthel, M., & MacNaughton, S. (2010). Food waste within food supply chains: Quantification and potential for change to 2050. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 365(1554), 3065–3081. <https://doi.org/10.1098/rstb.2010.0126>
- Pérez Roda, M.A. (ed.), Gilman, E., Huntington, T., Kennelly, S.J., Suuronen, P., Chaloupka, M. and Medley, P. (2019). A third assessment of global marine fisheries discards. FAO Fisheries and Aquaculture Technical Paper No. 633. Rome, FAO. 78 pp. Licence: CC BY-NC-SA 3.0 IGO.
- Poli, M. B. (2011). *Qualità, igiene e sicurezza nella filiera ittica*. Ministero delle politiche agricole alimentari e forestali.
- Schneider, F. (2013). The evolution of food donation with respect to waste prevention. *Waste Management*, 33(3), 755–763. <https://doi.org/10.1016/j.wasman.2012.10.025>
- Shawyer, M.; Medina Pizzali, A.F. (2003). The use of ice on small fishing vessels. FAO Fisheries Technical Paper. No. 436. Rome, FAO. 108 pp
- Stenmarck, Å., Jensen, C., Quested, T., Moates, G., Buksti, M., Cseh, B., Juul, S., Parry, A., Politano, A., Redlingshofer, B., Scherhauser, S., Silvennoinen, K., Soethoudt, H., Zübert, C., & Östergren, K. (2016). Estimates of European food waste levels. Reducing food waste through social innovation. In *Fusions*. [https://www.eu-fusions.org/phocadownload/Publications/Estimates of European food waste levels.pdf%5Cnhttps://phys.org/news/2016-12-quarter-million-tonnes-food-logistics.html#nRlv](https://www.eu-fusions.org/phocadownload/Publications/Estimates%20of%20European%20food%20waste%20levels.pdf%5Cnhttps://phys.org/news/2016-12-quarter-million-tonnes-food-logistics.html#nRlv)

- Torry Research Station (2001). Cold Storage of Frozen Fish. Torry advisory note No. 28. FAO in partnership with Support unit for International Fisheries and Aquatic Research, SIFAR
- Uhlmann, S. S. (2019). The European Landing Obligation. In *The European Landing Obligation*. <https://doi.org/10.1007/978-3-030-03308-8>
- UNEP (2008). Planning for Change. Guidelines for National Programmes, Paris.
- United Nations (2001). *Road map towards the implementation of the United Nations Millennium Declaration*. Accessed on the Internet on January 8, 2020. http://mdgs.un.org/unsd/mdg/Resources/Static/Products/SGReports/56_326/a_56_326e.pdf
- United Nations (2015). Transforming Our World: The 2030 Agenda for Sustainable Development. *A New Era in Global Health*. <https://doi.org/10.1891/9780826190123.ap02>
- United Nations Economic Commission for Europe Inland Transport Committee (2017). Agreement on the International carriage of perishable foodstuffs and on the special equipment to be used for such carriage (ATP). New York and Geneva. Accessed on the Internet on February 18, 2020. https://www.unece.org/fileadmin/DAM/trans/main/wp11/ATP_publication/2017/ATP_E_ECE_TRANS_271_WEB.pdf
- World Food Summit (1996a). *World Food Summit Plan of Action*. Accessed on the Internet on January 8, 2020. <http://www.fao.org/3/w3613e/w3613e00.htm>
- World Food Summit (1996b). *Rome Declaration on World Food Security*. Accessed on the Internet on January 8, 2020. <http://www.fao.org/3/w3613e/w3613e00.htm>
- WRAP (2009). Household Food and Drink Waste in the UK. Report prepared by WRAP. Banbury.