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Management and regulations of the Atlantic Bluefin tuna fisheries: the case of Spain

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LIST OF ABBREVIATIONS

BTSD – Bluefin tuna Statistical Documents

CFP – Common Fisheries Policy

CITES – Convention on International Trade in Endangered Species

CPR – Common-pool resource

eBCD – Electronic Bluefin tuna catch document

EBM – Ecosystem-based fisheries management model

EU – Europe Union

FAO – Food and Agriculture Organization of the United Nations

ICCAT – International Commission for the Conservation of Atlantic Tunas

IUU – Illegal, unreported and unregulated fishing

JFO – Joint fishing operations

MAPMA – Ministery of agriculture, fisheries, food and environment (Spain)

MSY – Maximum sustainable yield

RFMO – Regional Fishing Management Organizations

SCRS – Standing Committee on Research and Statistics

TAC –Total Allowable Catch

WWF – World Wildlife Fund

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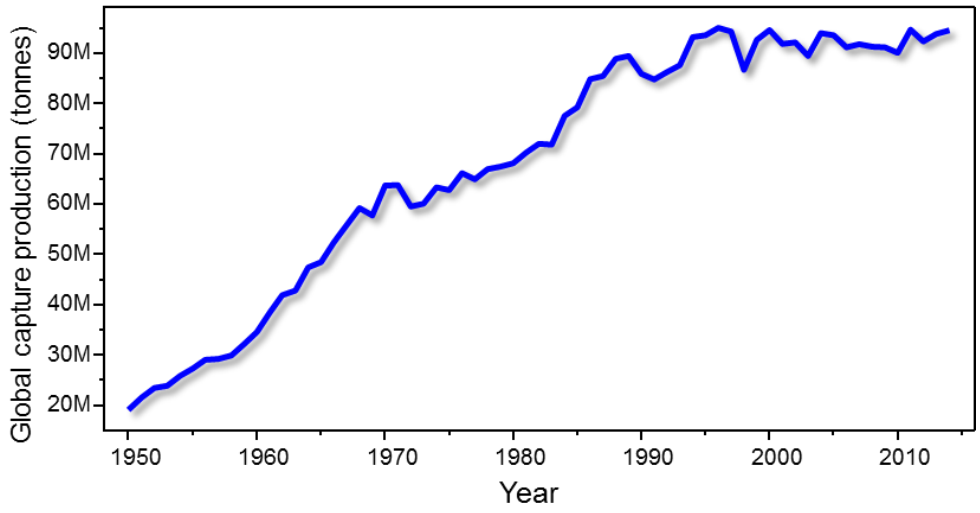
1. INTRODUCTION

Until the mid 20th century, the abundant fish stock was hardly threatened by people's catching abilities. The lack of advanced technologies in combination with a smaller human population was the factors that made the fish stock recovery consistently possible. However, the situation changed when the research and technological development achieved by the World War II industry were transferred to improve fish-finding and fish-capturing efficiency. Notably, the advancements in fresh product storage and transport, and the innovations in commercial marketing, simultaneously led to a fast growth of both global fish production and fish demand in the Western Countries and Japan. The Food and Agriculture Organization of the United Nations (FAO) has estimated that, for the last sixty years, the global supply of fish production for human consumption has outpaced the human population growth (FAO, 2016). The dramatic increase in fish capture during the last couple of decades is well illustrated in ***Fig. 1***, which shows the global capture production during the 1950-2014 period. In 1950, the capture accounted only for 19.2 million tonnes globally while, in 2014, it surpassed the 94 million tonnes (corresponding to an increase of 392% in less than 70 years).

Fig. 1 *Global Ocean capture production, 1950 – 2014*



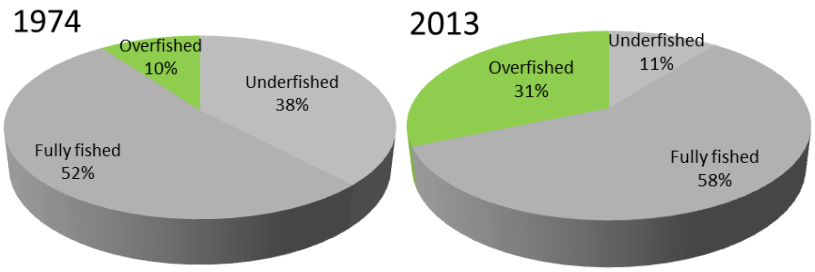
Source: (FAO, 2016)

The roots of the problem with high-seas fishing can be mainly associated with the fact that the ocean has been historically opened with unrestricted access. This implicates that there was neither any ownership assigned, nor specific rules that would govern the exploitation of fishing resources. Hardin (Hardin, 1968) argued that in an open access economy any natural resource will always eventually be overexploited. In the specific case of fishing, this will result in a scenario where each fisherman will aim to catch as much of fish at the earliest

possible time with a fishing gear that is more effective than those of the competitors. The outcome of such race for the last fish will bring the resource to be progressively exhausted, leading to a specular increase of prices and a decrease of everyone's welfare.

For many years, governments were managing fisheries on the basis of output restrictions in terms of Total Allowable Catch (TAC) supplemented by technical measures. Focusing on a single species approach, maximum sustainable yield (MSY) was set. MSY is estimated as the largest long-term average catch or yield that can be taken from a stock (or stock complex) under prevailing ecological and environmental conditions (OECD, 2001). However, it has been shown that MSY has been often set at levels that could not guarantee a complete stock recovery. In fact, the single species management of fishing did not provide an efficient tool to either preserve fish populations or improve the economic profits of fishing sectors. As a countermeasure, governments started injecting public money into the fishing industry in the form of subsidies (Iudicello *et al.*, 1999). The majority of subsidies were used to modernize the fishing fleets, enabling the vessels to catch the larger amount of fish in a shorter period of time. This action, while improving the economical profits in the short term, had a negative impact on the state of global fish stocks over the years. A FAO analysis on an assessed commercial fish stock during the 1974-2013 period is illustrated in ***Fig. 2***. In the graph, grey shaded area reflects fish stock within sustainable levels, both in the fully fished state or underfished state. It can be seen that, in 1974, the fish stock within sustainable levels accounted for the 90% of all fish stock (i.e., only the 10% was captured at an unsustainable degree) while, in 2013, the extent of overfished species reached the 31.4% of all fish stock.

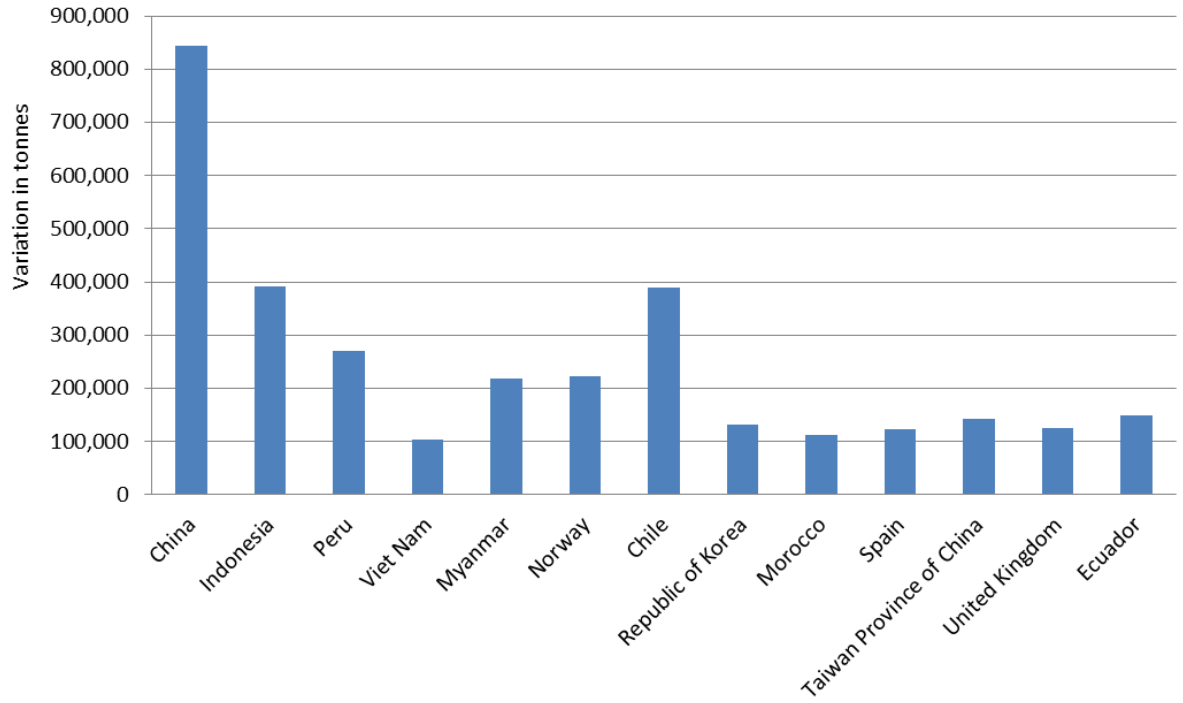
Fig. 2 *Global trend in world marine fish stock: the year 1974 and 2013.*



Source*:* (FAO, 2016)

Furthermore, the overall fishing volume keeps increasing worldwide. In this regard, 13 out of 25 major fishing countries have increased their catches by more than 100,000 tonnes in 2014 compared to 2013 (**Fig. 3**).

Fig. 3 *Marine capture production. Countries with highest annual increases in catches.*



Source: (FAO, 2016)

All data indicate that a change in fishing policy was required to address the issues associated with the overexploitation of marine resources. Since the mid-1990s, the global community started acknowledging the need to shift the fisheries management from short-term single stock assessments to long-term multi-species recovery plans (Frost, 2010). In this regard, a new "ecosystem" approach was designed to manage the fisheries with the goal of establishing healthy seas and oceans, and not merely the targeted species. (Ramirez-Monsalve *et al.*, 2016). In this approach, while the single-species assessment methods remain important tools for its implementation, all interactions in the marine world caused by the stock level variations of particular species are taken into considerations.

A paradigmatic example of a problem associated with overfishing is represented by the case of tuna. The tuna stocks have long been under the radar of conservation biologists due to the high exploitation levels. As per 2013 data, 41% of the tuna stocks were estimated to be overfished, while the remaining 59% were either fully fished or underfished. Most of the tuna species are highly valued in the market. In particular, the Bluefin tuna has been exceptionally in demand for the last 20 years. This led the Bluefin tuna stock to the border of collapse (ICCAT, 2016). Further, catches of the Bluefin tuna from the eastern Atlantic and Mediterranean were substantially under-reported due to illegal activities, mostly between 1998 and 2007. In general, it was impossible to have the stock monitored with confidence due to the lack of reliable historical information from most fishing countries. As a result, scientists have estimated that, under existing fishing patterns, Bluefin tuna mortality in 2003-

2004 could have reached up to three times the level that permits the stock to stabilize at the estimated MSY level (ICCAT, 2007). Fortunately, a set of strict measures were then implemented by major fishing states and, a decade later, government officials, scientists and environmentalists agreed that Bluefin tuna stock is currently recovering (EU, 2015).

Overall, in this study, I will analyze how a vulnerable species as Bluefin tuna has been affected by the fishing industry over time and the resulting measures taken by the government authorities to preserve the species will be examined. All discussion is based on previously published academic literature as well as reports of non-governmental and governmental organizations.

In order to understand the origins of the problems associated with the Bluefin tuna preservation, I will provide first in Chapter 2 an overview of the global situation of the fishing industry. Here, the Hardin's economic theory regarding the overexploitation of common resources in an open access scenario will be discussed within the frame of fishing. To avoid the collapse of the of fish stocks as predicted by Hardin's model, European authorities introduced Common Fisheries Policy. Chapter 2 will review the trajectory of different policies and management tools, as well as their overall beneficial or negative impact on fish stocks. In particular, I will discuss in detail major topics such as subsidies to the fishing industries, and the issues of illegal, unreported and unregulated fishing activities. The discussion on key aspects of the latest ecosystem-based European fisheries reform will conclude this section.

Chapter 3 will provide a historical overview of the origin of Bluefin tuna fisheries and the evolution of the demand for such product from the time of Phoenicians and Romans, to the boom of Bluefin tuna global demand triggered by the Japanese market from the 1970s which has eventually expanded to the Western countries. The impact of such increasing demand on the overfishing problem of Bluefin tuna will be also discussed.

In Chapter 4, I will present the creation of the International Commission for the Conservation of Atlantic Tunas (ICCAT) governance system and the implementation of the Bluefin tuna management rules into EU legislation. In particular, the foundation, functioning and impact of ICCAT will be discussed based on the common-pool resource governance model (Ostrom, 1990). I will describe the implementation of ICCAT rules in the European Union, with a special focus on their major aspects such as: (i) the quota allocation and management, (ii) the management of the fishing fleet capacity, and (iii) the technical and legal enforcement measures implemented into fishing management.

Finally, in Chapter 5, I will analyze in depth the state of Bluefin tuna fishing production structure and management in Spain, which is the country holding the biggest fleet in Europe and having the highest share of Bluefin tuna fishing quota assigned by ICCAT. To complete

this part, I examined legal Europe Union documents, EUROSTAT and ICCAT statistics, as well as Spanish government documents, and various academic articles. This section will be concluded by reporting the opinions about key and controversial aspects of the Bluefin tuna fishing industries, management and environmental impact, provided by Mr. Juan Navarro, the Deputy Manager of the Balfegó Group, one of the biggest Bluefin tuna fishing company in Spain.

2. GLOBAL FISHERIES

2.1. The inevitable overfishing problem for open access fisheries

Hardin's idea about the vulnerability of common-pool resources in the famous *"Tragedy of the Commons"* (Hardin, 1968) was a starting point of discussions related to fisheries exploitation and preservation. The author explained what happens to grazing land when there are no rules agreed upon by all users. In such a situation, the pasture belongs to everyone in the village and its value is exploited by whoever grazes cattle inside of it. Since the pasture is open access, each herdsman has incentives to graze as many animals as possible since this does not cause additional costs. Over time, the number of livestock eventually exceeds the capacity of the land and the overexploited pasture loses its value.

Out of this parabola, we can identify marine fisheries to be a clear common-pool resource. The captured fish creates a value for the fishermen just as the grass generates value for the herdsman and, similarly, fishermen have the incentive of extracting as much fish as possible. In both situations, it is expected that the value of the resource that has not been exploited by one individual, will eventually be obtained by the other.

2.2. First implementation of fisheries management in Europe

To avoid the tragic destiny of common resource and its perpetuating consequences, Hardin (Hardin, 1968) proposed two solutions to the open access problem. The first one was to transfer the resource to the private property. The second one was for the State to take over the management of the common resource and control the access and levels of exploitation.

The European Union fisheries management (partly) embraced the Hardin's model and the idea for the government to control the fisheries. The management of the fisheries in Europe has first started within the Treaty of Rome in 1957. At that time, the fisheries management was a part of the agricultural policy and did not have its own independent body (Frost, 2010). After years of negotiations, the Common Fisheries Policy (CFP) was created in 1983 aiming to *"protect the marine environment, ensure the economic viability of European fleets and provide consumers with quality food"* (Martí, 2016). In addition to that, it was provided that

any law or rule must comply with Treaty of the European Union and the rights of the citizens need to be taken into account when ratifying new rules (Frost, 2010). As it was declared by the EU itself, it holds exclusive competence over *"the conservation and management of sea resources and the corresponding right to adopt the relevant rules and regulations… and, within its competence, to enter into external undertakings with third States or competent international organisations"* (Antonova, 2015).

From the very beginning, the EU fisheries management was based on a single sector approach for marine resource management (Ramirez-Monsalve *et al.*, 2016). Only after the 1992 Rio Summit, the EU started drawing a connection between fisheries and environmental protection. However, the fisheries policy had to undergo various reforms to improve its functioning. The first reform was presented in 1992 and introduced the licensing system. Unfortunately, such reform failed to address the problem of uncontrolled fishing, likely because the effort management was not employed. As a result, a further decrease of the fish stocks was observed.

The second reform took place in 2002. Up until then, the main management of the CFP was based on TACs, quotas allocated to member states and technical measures. During the 2002 CFP reform, much more attention was paid to the over expanded fleet capacity while vessel decommissioning plans were introduced to cut down the fishing effort (Martí, 2016). Despite the increased attention to preserving the marine ecosystem balance, this reform failed to stop the decline of the fish stock.

2.3. Subsidies to the fishing industries: type and impact

In a short-term vision approach, the counteraction of the fisheries to the diminishing of the fish stock was to enhance the fishing efficiency by implementing better technologies. Many governments played also an ambiguous role in this race for the last fish by supporting the expansion of the fishing fleets and the fish processing facilities. Government management regimes aim to maintain an efficient allocation of resources and sustain profits. This implies that the incentives to the fishing industry must also be in line with the biological productivity and ecological viability of fish populations (Iudicello *et al.*, 1999).

Unfortunately, the goals of sustainability of the fish populations have long clashed with the major interest to increase the wealth at no-matter-what-cost, and government policies appeared to favor the rapid increase of the economic development over the sustainability aspect. The most common form of such policies was through subsidies which have actually offset the overfishing control efforts previously realized by the governments.

Subsidies can be broadly classified into three major groups (Sumaila *et al.*, 2016):

a) Ambiguous subsidies. These subsidies include, among others, vessel buyback programs, fisher assistance programs, and artisanal communities expansion. Some of the economic supports can lead to investments while others can result in disinvestments in the fishery sector. Thus, such class of subsidies are the most controversial ones due to the contradictory effects.
b) Beneficial subsidies. These subsidies can be generally defined as the ones that preserve the species and encourage the conservation of the stock. Also, they promote programs for improving the management of the fisheries, although not all the authors agree that the support for management should be regarded as subsidies (Sumaila *et al.*, 2016). Beneficial subsidies aim to reinforce the growth of the fish through preservation of the species and intensify the control of catching rates. The pivotal point in this type of support is the maximization of economical use while sustaining the ecological health of the species.
c) Capital-enhancing subsidies. This class summarizes a set of different types of subsidies which can be classified depending on the beneficiary (Iudicello *et al.*, 1999). For instance, governments introduced direct price supports and grants that encourage fishermen to stay in the industry. Another type of subsidies includes fuel tax exemptions that reduce variable costs of the firm. Furthermore, low borrowing costs and tax concessions make the sector more attractive, especially in situations when private banks are not prone to provide affordable loans. Overall, these subsidies mostly focus on elevating margins and, thus, favoring the entry of new investors. Also, the government can subsidize other industries such as vessel building or modernization industries that are indirectly tied to fisheries. Independently of the subsidies category, they tend to decrease the costs and therefore increase the revenues. Subsidies appear to have positive effects, such as securing food supplies, increasing employment and promoting economic development. However, they fail in general to combine the economic goals with the ecological ones. In this regard, several authors discussed the direct or indirect negative impacts of government financial support to the fisheries. Firstly, government subsidies have been seen as an instrument that distorts the market by granting some parties with more benefits than their competitors. Consequently, the parties that do not receive any subsidies in the sector of their interest, seek for support in other markets creating a problem about the traceability of the effect of the subsidies. Moreover, those subsidies devoted to the innovations of the fishing technologies, such as global positioning systems or detailed maps of the sea bottom (Pauly *et al.*, 2002), and construction of more powerful and faster vessels (Iudicello *et al.*, 1999), fuelled a dramatic increase of capturing efficiency and fish consumption over few years. Overall,

capital-enhancing subsidies have been classified as harmful, contributing to overexploitation and destruction of natural resources (Sumaila *et al.*, 2016).

It is worth noting that, as discussed by Sumaila (Sumaila, 2013) a certain ambiguity and vagueness in the definitions of the subsidies existed, which was further followed by a lack of reliable and complete data resources of the fishing countries. Also, in the absence of comprehensive information and consistency, it has been difficult to determine the exact amount of money that has been paid in the form of subsidies. However, some estimations about the magnitude of the subsidies to the global fisheries have been provided by different organizations. For example, World Wildlife Fund compiled the data from the subsidies reported by APEC, OECD and WTO members to provide a conservative estimation of ca. 15 billion US dollars a year spent globally in subsidies (WWF, 2001).

2.4. The problem of illegal, unreported and unregulated fishing

It has been argued that the subsidies and the overcapacity of fishing fleets have contributed to illegal, unreported and unregulated (IUU) fishing (Watson and Pauly, 2001). As per OECD study (Schmidt, 2004), the illegal fishing can be described as "*conducted by vessels of countries that are parties to a regional fisheries management organisation (RFMO) but operate in violation of its rules, or operate in a country's waters without permission*". Unreported catches refer to caches that have been either not reported at all, or misreported providing false data about real landings. Unregulated fishing is defined as "*conducted by vessels without nationality or flying the flag of States not parties of relevant fisheries organizations and who therefore consider themselves not bound by their rules".* Under these circumstances, the IUU fishing directly contributes to overfishing and depletion of fish stocks with little perspectives to the recovery. For instance, the failure of EU to control unreported and illegal catches has contributed to the decline of the stock of North Sea cod which has only recently begun to show signs of the recovery (Agnew *et al.*, 2009).

Furthermore, Agnew and co-workers (Agnew *et al.*, 2009) argued that the IUU fishing is responsible for the loss of annual economic benefits, an environmental damage and negative consequences to the food supply. Other authors pointed out that IUU fishing "*distorts competition, harms honest fishermen, weakens coastal communities, promotes tax evasion, and is frequently associated with a transnational crime such as narcotraffic and slavery at sea*" (Pramod *et al.*, 2014).

Even though it is difficult to collect a reliable and precise data of landings classifiable as IUU due to high mobility of fishing vessels (Agnew *et al.*, 2009), it has been estimated that worldwide IUU captures fluctuate between 13% and 31% of the total fishing, with peaks up to 50% in some regions (Pramod *et al.*, 2014). The IUU fishing trade is also responsible for

predating developing country economies by approximately 9 billion dollars a year, out of which 1 billion of dollars is lost by African countries (Petrossian, 2015). Other studies estimated that the total loss of some African countries caused by IUU captures accounted for 19 % of the total annual catches while in Asia Pacific region this value reaches the 16 % of total reported annual catches, equivalent to 5.8 billion dollars (Palma *et al.*, 2010).

Areas of poor fisheries management, and scarce enforcement and control, are much more prone to illegal fishing. Therefore, one might guess that high fish price, governance and the indicators of control problems are the factors that lead to the IUU. It has been argued (Agnew *et al.*, 2009) that higher or lower governance indices (government effectiveness, regulatory quality, rule of law and control of corruption) obtained from World Bank, are significantly related to the levels of illegal fishing levels. This discovery showed that improved governance is needed to combat the IUU fishing. Even though it cannot become a rule of thumb that the developing countries are the ones to conduct most of IUU fishing, they are much more vulnerable to it compared to developed countries with established and well-functioning governance systems. The introduction of Regional Fishing Management Organizations (RFMO) can be an efficient way to deal with IUU (Agnew *et al.*, 2009). The RFMOs are directly interested in having a complete and thorough understanding of the IUU activities since the illegal landings reduce the capture possibilities for the members of RFMOs (Schmidt, 2004). The most common methods implemented by RFMOs to fight the IUU fishing are catch-and-trade data registration, catch documentation and stock assessments. Even though exact statistics cannot be provided regarding the IUU fishing in the area of their competence, approximate suggestions can be given. For example, during 1997-2000, almost 90,000 tonnes of toothfish have been captured by IUU fishing. This amount is twice the level of all catches that are made in the area regulated by the RFMO. As per reports of the North North East Atlantic Fisheries Commission (NEAFC), RFMO of redfish, 20% of the fish traded internationally came from IUU sources in 2001.

2.5. The latest reform in the European fisheries management

As per FAO definition (FAO, 2016), the stocks are overfished when they are fished *at "biological unsustainable levels"* since they have an "*abundance lower than the level that can produce the maximum sustainable yield (MSY)."* Thus, it has been argued (Pikitch, 2012) that an individual species approach, such as total allowable catch (TAC) setting at MSY, should be seen as an upper limit target rather than the final goal. In fact, due to the uncertainty and lack of specific information about fishing, fishing levels set in such way are too high for realistic situations, and therefore intrinsically result in overfishing.

In this regard, many authors agreed that it is necessary to move away from the single species model and start analysing and understanding the "whole picture" of a marine ecosystem (Pauly *et al.*, 2002, Zhou *et al.*, 2010, Pikitch, 2012, Collie *et al.*, 2016). Pikitch argued (Pikitch, 2012) that a reduction in one fishery has cascading effects to other parts of the marine ecosystem. For instance, depletion of lower trophic level species such as sardines, anchovies, herring, krill etc. leads to a significant reduction in the stock of predators such as seabirds, large fishes and marine mammals, especially when these species are highly connected in the food web. Based on a 2006 report by Worm and co-workers (Worm *et al.*, 2006), the majority of large predatory species will collapse by 2048 provided there are no changes in current stock reduction rates.

Apart from overvaluing sustainable levels of the particular species, there are significant turbulences that appear in the total integrity of all marine systems. In this regard, it was highlighted that it is pivotal to reduce the practices of overexploitation of shallow seas due to their impact towards deep-sea species (Roberts, 2002). The majority of deep-water fish are not marketable due to its unappealing characteristics to the consumer. Remarkably, the species brought up from high depths of the sea are discarded with a 100% mortality rate. Overfishing of commercially valued species directly affects the increase of discards of deep-waters fish stocks. This exploitation contributes to the failure of sustainability of the deep-seas fisheries. A vast amount of stock in the deep-waters grows slowly and has an extremely long age, reaching up to 200 years old. The species mature late and they do not start their reproductive cycle fast enough to recover from experienced stock decline. For example, the orange roughy, a deep-waters species, has been heavily exploited during the 1970s and the 1980s. Very profitable fishing practices, allowing capturing over sixty tonnes of fish in less than a half an hour, led the fishery to a 20% collapse its pre-exploitation stock levels. Another species, pelagic armourhead, has been fished at unsustainable levels in the north-west of Hawaii in the 1960s-1970s leading to a collapse of the fishery with no recovery observed so far (Roberts, 2002).

Drawing closer to the next cycle of the ten-year plan, in 2012 the EU community highlighted the need to reform the CFP from the core. This reform intended to beat the issues of overfishing, fleet overcapacity and subsidies to the fishing sector (Antonova, 2015).

As a result, in 2013 the CFP governance shifted to ecosystem-based management focusing not on single-species plans, but rather on multispecies and fisheries plans. Further, after long public consultation, the following important agreements were reached in the Council and European Parliament (Martí, 2016):

a) The maximum sustainable yield (MSY) will be set as a target for all fisheries.

b) Member states are bound to implement schemes for reduction of the capacity if it appears in any sector of the fleet.
c) Small-scale fisheries need to be given an exclusion zone which is larger than 12 nautical miles. Member states are encouraged to increase their share of quotas.
d) National governments are obliged to improve the collection and sharing of fisheries data.
e) All the catches will be landed, thus implementing a discard ban.
f) The governance of the fisheries should get more decentralised by allowing the Member States to develop and implement the required measures.

It is worth mentioning that, while the main concepts of the ecosystem-based fisheries management were introduced by the European CFP only in 2012, the roots of the ecosystem-based model (EBM) reach back in the 1950s and several different EBM were proposed since then. Each EBM represents distinctive technological and ecological measures that influence not a single but various species in the ecosystem. 18 definitions of EBM were reviewed that generated a summary describing this type of management (Arkema *et al.*, 2006). Nonetheless, all EBMs share the key concept of sustainability, which emphasizes the preservation of multispecies, the ecological health and the inclusion of humans in the ecosystem. Other criteria in this approach cover the use of the precautionary approach, management of target and non-target species, bycatch, discarding, habitat destruction (Grafton *et al.*, 2006).

3. ATLANTIC BLUEFIN TUNA FISHERIES

3.1. The growing demand for Bluefin tuna

The Bluefin tuna fishery dates back to the 7th century BC (Desse and Desse-Berset, 1994). Archaeological excavations show that the species has been harvested by Phoenicians and Romains. Also, philosophers such as Aristotle, Pline the Elder, Oppien and Alelien wrote about Bluefin tuna and the exploitation of its fishery (Fromentin and Powers, 2005). Over the centuries, the exploitation of this species kept a normal pace since its commercial values fish was limited. In fact, Bluefin tuna was often caught only for the production of pet food, poor people meals or used as an entertainment in recreational fishing (Longo, 2015).

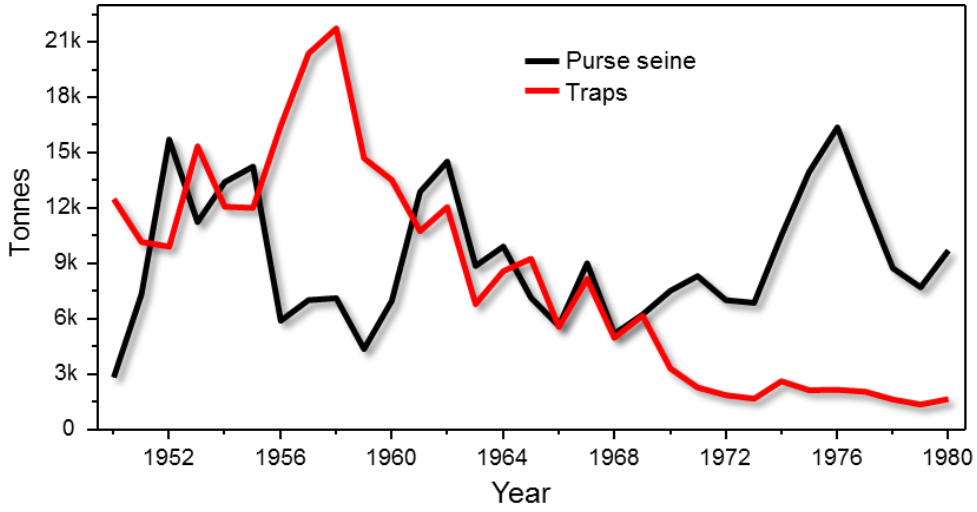
For the last five centuries, the main method of capturing the Bluefin tuna in Mediterranean was based on traps (in Spain known as *almadrabas*). The traps have been considered as the most environmentally friendly and the least damage-causing method for the Bluefin tuna massive fishing (Ambrosio and Xandri, 2015). Up until the late 1950s, the majority of the

Bluefin caught in Mediterranean came from the trap fishery. There was no purse seine Bluefin tuna catching in the Mediterranean at that time, differently to the North Sea, the Norwegian Sea and Kattegat regions (Fromentin and Powers, 2005).

The years from the late 1950s to the early 1960s experienced a key transition period for Bluefin tuna fishery in the Atlantic and Mediterranean area mainly due to the following reasons. Firstly, we witnessed a remarkable increase in human population, which in turn prompted an increment in global demand for food. Throughout the 1950s and 1960s, the global marine resources expanded so rapidly that fish catches exceeded human population growth (Pauly *et al.*, 2002). Secondly, around the 1970s, Japanese cuisine changed its attitude towards the fatty "*toro",* the highly valued Bluefin tuna belly. During this period, an attitude has formed that this part of the fish addresses Japanese upper-class people, and together with the post-second world war burgeoning Japanese elite, the demand for the Bluefin tuna exploded (Weber, 2002). The Japanese appetite for prime quality Bluefin tuna initiated a global gold-rush mentality, including in the Mediterranean area. In fact, the high price of the fish made economically viable the transport by air. By offering a 24 hours delivery to the most Japanese customers, Atlantic Bluefin triumphed against the local Pacific Bluefin tuna species that were preferred in Japan but could not offer high-speed delivery (Longo, 2015). Further, developing technologies, such as maintaining constant proper temperatures, fast freezing to low temperatures and advanced techniques in thawing allowed the tuna to be delivered in its superior quality. Longo (Longo, 2015) also highlighted the fact that new methods to capture, store and fatten the fish in the tuna ranches led Bluefin to become more accessible even for a medium quality sushi market. Finally, expanding and prospering middle-class in Japan was then able to afford this delicacy which resulted in the arrival of sushi as a version of local 'fast food'. Since both Europe and North America has recently shown a preference for healthier cuisine and the markets were open in trying new foods, the sashimi had all the conditions to spread rapidly in the following years (Miyake *et al.*, 2010).

Therefore, alongside with the growing global fish consumption per capita in the second half of the 20th century, the increasing demand from Japan and the industrialisation of agriculture, Bluefin tuna fishery started to convert into highly mechanised and capital-intensive production (Longo, 2015). Clearly, such a high demand for Bluefin tuna could not have been satisfied by the artisanal fishery anymore. Thus, the trap fishery was slowly overcome by purse seine vessels (***Fig. 4***). However, with an increase of purse seine effort, environmental and sustainability concerns started to become more relevant.

Fig. 4 *Bluefin tuna catches by traps and purse seine vessels (1950-1980).*



Source: (ICCAT, 2016)

3.2. Overfishing of Atlantic Bluefin tuna

Even though the Bluefin tuna has been exposed to overfishing since the mid-20th century, the negative impact of this practice peaked in the period from 1997 to 2008 (Agnew *et al.*, 2009). High technologies for fish location (such as Doppler radar, spotter planes, bird locating radars, omni-scan sonars, and satellite-derived sea surface temperature information devices) have started being extensively integrated into modernized purse seine fleets with more powerful engines, improved communication systems, faster auxiliary vessels as well as bigger sinking nets (Longo, 2015). The resulting larger-scale fishing brought increased benefits, and the exploiting countries started building up their fleet capacity (Fromentin and Powers, 2005).

In detail, between 1997 and 2008, a total of 229 new purse seiners were employed in the Mediterranean sea (WWF, 2008). A significant share of European purse seine fleet redevelopment was subsidised by public funds with an estimation of 35 million euros being distributed by the European Union between 2000 and 2008 (Pope, 2009). As a consequence, the fishing fleets were over-expanded, followed by the increased efficiency of the fishing gears. Fromentin and Powers (Fromentin and Powers, 2005) highlighted that a standard French purse seine in 1998 was double of the length and four times more powerful than its predecessor in 1970. By 2008, the fleet of 11 coastal states that was targeting Bluefin tuna comprised 617 vessels with a capacity of more than 54,000 Mt of potential yearly catch. This figure was three and half times higher than the safe threshold value suggested by scientific studies to avoid a complete stock collapse (WWF, 2008).

In addition to this, there has been significant noncompliance to quotas by most of the parties involved in Bluefin tuna fishing. The quantities of landings reported to local governments fell significantly shorter than both the overall export reports of the exporting countries and the total imports reports of importing countries, indicating that tuna catches must have been higher than the reported ones (WWF, 2008).

Furthermore, the IUU fishing remained a significant problem to the sustainability of the Bluefin tuna fisheries. It has been estimated that 10% of all Atlantic Bluefin tuna catches is captured by IUU (Schmidt, 2004). As per ICCAT data, which was provided by Japanese calculations, the total IUU catches during 2001-2002 fishing season reached around 18% of all tuna fishing activities (ca 25,000 tonnes). In 2006, such estimations were even more impressive. The ICCAT has made a rational calculation multiplying the total number of Bluefin tuna catch vessels per their average annual catches (WWF, 2007). The results indicated that, 200 – tonne estimate of the average annual catch per vessel equated to a total Bluefin tuna fleet catch of 50,000 tonnes. Since the legal quota for the same period (2006) was only 32,000 tonnes, the remaining 18,000 tonnes must have come from IUU fishing.

Even more, the same study estimated that fixed costs for a Bluefin tuna-targeting purse seine vessel reach about 800,000 €/yr (the capitalization of the mortgage). A vessel, capturing 200 tonnes of Bluefin tuna a year and selling it for about 4.5 €/Kg, can still make net profits of around 100,000 €/yr. However, if the legal catch limits were followed, which was 128 tonnes per vessel (on average) in 2006, the activity would have yielded a net loss of 224,000 €/yr.

Additionally, studies based on sources such as Japanese custom services and imports of farmed tuna through the Bluefin tuna Statistical Documents (BTSD) revealed some significant findings (Greenpeace, 2007). Here, the declared Bluefin tuna catches have been compared to the estimated tuna that entered the farms plus those which had been exported to Japan for the period from 1997 to 2004. The data showed that, while declared catches were supposedly decreasing in that given period, the estimated farmed imports followed an opposite and increasing tendency. The explanation for this mismatch was believed to be due to unreported and illegal catches.

3.3. The establishment of ICCAT

All these events urged the international community to raise questions about the sustainability of tuna fisheries and the Bluefin tuna population itself. A governance system that would regulate and coordinate the fishery was needed, and as a consequence of those concerns, the ICCAT was signed in 1966 (Heffernan, 2014). ICCAT is one of the RFMOs whose

principal function is the conservation of tunas and tuna-like species in the Atlantic Ocean and its adjacent seas. At that time, 17 national governments signed the Convention, with another 34 countries joining in later (ICCAT, 2016). The idea was that any government that was a member of the United Nations, or a specialised UN agency or intergovernmental organisation accepted the competence of ICCAT over the declared matters upon joining the Commission.

Even though the ICCAT did not have any direct regulatory power or capabilities of enforcement, it was delegated with collecting statistical data, generating reports, creating the space for discussions among contracting parties and bringing about management recommendations (Epstein *et al.*, 2014). ICCAT further created a special organism, the Standing Committee on Research and Statistics (SCRS), that has been responsible for providing complete and current statistics concerning fishing activities as well as for advising the Commission on the need for specific conservation and management measures (ICCAT, 2016). The combination of scientific and socio-economic information obtained from the SCRS has been used to set the annual total allowable catch (TAC) for Bluefin tuna (Sumaila and Huang, 2012). It was decided that the priority when allocating quotas should be given to the stock recovery measures (Spagnolo, 2010). According to those recommendations, the ICCAT has set the annual quota, which has been then distributed to the contracting parties. The criteria used for setting quotas have been the historical catches, followed by spatial distribution of the stock and proximity to coastal countries, among others (Sumaila and Huang, 2012).

3.3.1. Evaluation of ICCAT: the common-pool resource governance

Some authors (Epstein *et al.*, 2014, Fleischman *et al.*, 2014) used a common-pool resource (CPR) governance model to explain the creation and functioning of ICCAT. This model has been introduced by Ostrom (Ostrom, 1990) in the beginning of the 1990s and provided a complementary view to Hardin's "Tragedy of the commons". In Ostrom's academic work, the author focused on the prisoner's dilemma found in Hardin's example of herdsmen and pasture. It was argued that people will remain trapped in this dilemma only if they treat themselves as prisoners. However, if they try to seek collaboration with each other, the zero-sums game can be won. Ostrom believed that the issue of population dependence on the resource has two outcomes: (i) the overconsumption of the resource and failure to restore it, or (ii) the community constructs an institution to carry out a collective action that helps to preserve the natural resource.

The results from empirical approach showed that if people try to cooperate by creating contracts, agreeing on certain performance rules, incentives and required institutions,

obstacles for overconsuming the resource have been overcome in some populations. The author discovered basic principles of groups that settled collective actions, and therefore succeeded in the management of the commons:

a) Boundaries – the common-pool resource withdrawal rights were clearly defined.
b) The rules restricting time, place, technology, quantity of resource should match requiring labor, money and other resources.
c) Individuals are allowed to participate in the creation and modification of the rules.
d) Authorities do not question the rights to organize of the individuals.
e) The monitoring is undertaken by the community members.
f) The existence of graduated sanctions.
g) The existence of low costs of dispute resolution.

Ostrom argued that neither a complete government control nor privatization is needed for a successful management of a common resource as long as groups create institutions for collective actions. She defined main barriers that may prevent the achievement of such objective. Firstly, if people act individually, a lack of information about the system appears. Creating an institution that would gather the necessary data would most likely overcome a problem of missing information. The second problem is the free-riding issue associated with the bearing of policy costs. In addition to that, the groups must organize proper resources in order to create new institutions and to provide monitoring measures that would ensure the individual compliance with the arranged rules. According to the author, it is easy to verify whether the common resource governing institution failed or succeed in its function. If the resource survives, it can be seen that the institution has accomplished its main tasks (Ostrom, 1990).

Ostrom's principles were chosen to analyze the governance of ICCAT (Fleischman *et al.*, 2014). The scholars found out that, in general, ICCAT case was less successful than expected, but could not be either classified as a complete failure. Clear boundaries have been acknowledged to be one of the main principles for a successful collective action. The membership in ICCAT defines the withdrawal rights for the members; however such rights for non-member states are not well-defined. Also, the authors argued that enforcement of the rules within the states is often performed poorly. Furthermore, it was highlighted that in the ICCAT case, the congruence between the rules and local conditions is often uncertain. Also, the direct users of the resource (i.e., the fishermen) have limited opportunity to both participate in the establishment of principles and regulations, and functioning of the governance institutions (even though they do indeed organize to lobby their respective representatives) (Fleischman *et al.*, 2014). After all, the remaining principles were either

weak or absent in the ICCAT. At the present, such controversial conclusions prohibit a clear understanding of whether the ICCAT regime will eventually result in an overall failure or a significant success in the preservation of the Bluefin tuna stocks.

3.4. European Union participation in ICCAT

In regard to Atlantic Bluefin tuna, Europe Union joined the ICCAT in 1997 and since then it has incorporated the ICCAT recommended measures into its Common Fishery Policy. It is worth stressing that the EU has distinctive characteristics when participating in international institutions, including regional fisheries management organisations such as ICCAT. EU comprises 28 countries, each of them having its own political system and enforcement mechanisms. Therefore, its participation in ICCAT can be distinguished externally, that is, whether the Commission accepts supranational entities such as EU and, if so, to which extent such participation is allowed. On the other hand, the EU participation in the ICCAT is determined internally by the performance of its member states (Antonova, 2015). As one would expect, it is critical that member states comply with the EU regulation. The CFP regulates all EU vessels independently of the geographical area of activity; therefore the failure of a single country to comply with agreed measures would damage the reputation of the entire EU as a contracting party among international organisations. Such concern is even more relevant as, in the past, a weak enforcement and control measures endangered EU prestige in international fisheries management (Daw and Gray, 2005). As a consequence, since 2009 the EU has particularly stressed its internal compliance with all member states. Such shift to a stricter policy also affected the Bluefin tuna fishery. The 2009 multiannual recovery plan for Bluefin tuna in the eastern Atlantic and Mediterranean Regulation (EC) No 302/2009 (EU, 2009) has implemented ICCAT recommendation 08-05 which heavily stressed the internal compliance with member states. Since then, there have been several implementations to the Union law, further integrating ICCAT rules and strengthening the internal compliance (EU, 2016).

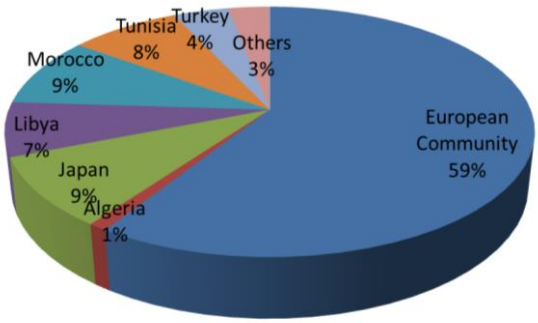
The EU regulations governing Atlantic Bluefin tuna, just as for any other fish species, are based on three pillars: (i) total allowable catches (TAC) allocation, quota distribution and management; (ii) the fishing fleet capacity management; and (iii) technical measures.

3.4.1. The TAC regime and management

The ICCAT assigns a share of TAC to EU and, subsequently, the EU Council allocates fishing possibilities among the member states. The historical catch records are used for allocating the quota to each state. ***Fig. 5*** shows countries that are entitled to catch Bluefin and their corresponding TAC. The EU received the biggest share of the total allowable catches, accounting an overall 59%. Among no-EU countries, Morocco receives the highest

share, 9% of total quota, followed by Japan, Tunisia, Libya and Turkey (9%, 8%, 7% and 4%, respectively).

Fig. 5. *Atlantic Bluefin tuna quota allocation by ICCAT*

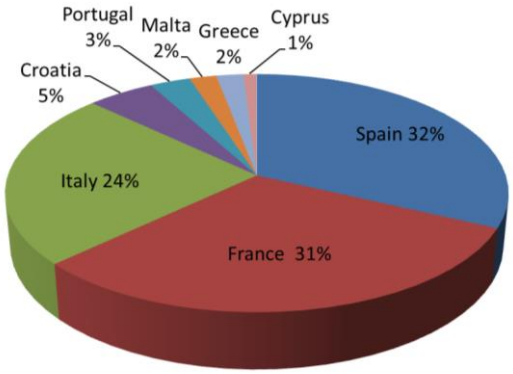


Source: (ICCAT, 2014)

In the EU, the management of member states quotas is the competence of national authorities (Frost, 2010). The transferability of quotas is allowed, but only among other EU member states (EU, 2016). In most European countries, individual transferable quotas are commonly used, and there are no restrictions on the management profile as long as the total catches do not violate the EU law. In addition, each country is obliged to prepare detailed annual fishing plans for the catching vessels and traps and send it over to the European Commission (Art. 4, COUNCIL REGULATION (EC) No 302/2009). This obligation also includes reports of quota exhaustion, if applicable, and yearly reporting of Bluefin tuna catches.

The EU distributes quota according to their own rules and systems, which is also based on historical catch records. As a result, Spain, France and Italy receive highest shares of the Bluefin quota (32%, 31% and 25%, respectively). The remaining countries which have been fishing Bluefin tuna in the past and, therefore have been assigned a part of European TAC, are Croatia, Portugal, Malta, Greece and Cyprus, having 5%, 3%, 2%, 2% and 1%, respectively (***Fig 6***).

Fig. 6 *European national quota allocated*



Source: (EU, 2015)

3.4.2. Economic theories for and against quota mechanisms

The TAC fisheries management systems have been both criticized and supported in the course of the time. Among those who were in favour of such models, it has been argued that incentive-based approaches lead to sustainable fisheries in the long-term perspective (Grafton *et al.*, 2006). The logic behind this approach is that by assigning secure and durable fishing rights, fishers protect "what is theirs" (even though legally they do not gain ownership of the resource stock). In this manner, the party that has the greatest impact on the fisheries are concerned about long-term conservation of the resource and a sustainable flow of benefits out of it. Another important aspect of this theory is that the provision of fishing rights, individual or communal, prevents the fishers from racing against each other for the last fish available in the total assigned quota. Furthermore, the transferability of the rights adds up to the prevention of the fleet overcapacity and overexploitation of the species. On the other hand, it has been highlighted that the results towards fishery sustainability could be worsened if interested parties tried to influence negatively the allocation mechanisms in order to achieve more convenient fishing rights (Grafton *et al.*, 2006). Among others, there is another issue with this model. There are plenty of cases where the fishers do not have equipment that would target only one species, therefore a mix of different type of fish is usually captured on a single trip. Then, assuming that the captured amount of fish exceed their individual quota or appear to have a lower commercial value than their trip landings, discards or misreporting are likely to happen. Finally, the authors conclude that this incentive-based approach inevitably requires a public oversight and a mechanism which would combine commercial and environmental aspects for restraining the abuse of the fishing.

To address these issues, multiple scholars discussed the opportunity to expand the scope of the fisheries management beyond the pure TAC model, in favour of a broader community-

based co-management approach (Jentoft, 2000, Gutierrez *et al.*, 2011). It was argued that co-management is a very potential tool to sustain the health of the fisheries and promote long-term benefits. The main findings of the empirical study revealed that quota assignation mechanisms, solid cooperation between the members of the community, the area protection and a strong leadership, are crucial for successful management of fisheries. The authors argued that self-enforcement mechanisms form a part of elements that add up to successful common resource management, just as the influence of exploiters, directed to local markets, can reduce the likelihood of overfishing. Leadership in this analysis played a significant role (Gutierrez *et al.*, 2011). The leader, according to Gutiérrez et al. (Gutierrez *et al.*, 2011) is ought to be a highly respected and motivated individual with entrepreneurial skills and personally committed to his role. This person should be *"guided by collective interests and not self-benefits, give resilience to changes in governance, influence users' compliance with regulation and enhance conflict resolutions in quota allocation"*. The authors argued that both individual and communal quotas are effective tools to prevent the evils of overfishing. Following the arguments made, it was believed that by using the suggested tools, the tragedy of the commons (Hardin, 1968) should be avoided.

Jentoft also stressed the pivotal importance of moral standards in the community, but he also argued that limited access mechanisms, such as licenses and quota rights, should not be used as a basis for fisheries management (Jentoft, 2000). The author highlighted that, before anything else, strong communities should be built in order to reach long-term sustainability in fisheries. He contradicted the common view stating that overfishing is a sign that markets failed to function properly. What the author held for is that fragile bonds within the community and poor values create disintegrated communities. As a consequence, such communities should be partly held reliable for the evils of overfishing. The author argued that by implementing individual rights mechanisms, some communities earn a chance to increase their wealth while other are cut out of it. The quota trading enables to *"depersonalize relationships between social agents"* since they see each other as objects to reap off some benefits from. Such systems were seen as destructive by dividing communities and making the individuals think only of their own interests that bring to the fulfillment of "Tragedy of the commons" prophecy.

Jentoft argued that the main downside of Hardin's model was the fact that the importance of community was completely left out. There was, however, an implicit concept of it, assuming that individual fishers represented different communities. Such communities were involved in "zero-sum" games; namely, when one community increases its welfare, the other one loses. Jentoft introduced another community model, which was indeed based on elements not included in Hardin's model: cooperation, support and trust. He described the concept of the

community by introducing hyperbole about the fishing net and its knots. When fishing net loses one of its knots, other knots carry an extra burden by having to catch the necessary amount of fish to fulfill the trip targets. Similarly, in the consolidated community, a loss of one member leaves other members worse off and the success of one individual means success for the entire community. A possible solution introduced by Jentoft was allowing communities to be involved in decision-making and introducing communal property rights rather than individual property rights (quotas). As one could expect, the author did not consider this co-management model to be the only solution to the problem of overfishing. Instead, it was suggested that a broader spectrum of decisions should be made in order to ensure the future of the fisheries.

3.4.3. Fleet Capacity Management in EU

In any type of fisheries management models, including the TAC-based ones, the maintenance of an adequate number of fishing vessels is the pivotal aspect of controlling the IUU fishing. Each country in EU is responsible for its fishing fleet and the consistency of its size with the assigned fishing quota (Art. 5 (EC) No 302/2009). The fleet size is calculated adding up the best catch rates for all vessels of the fishing fleet.

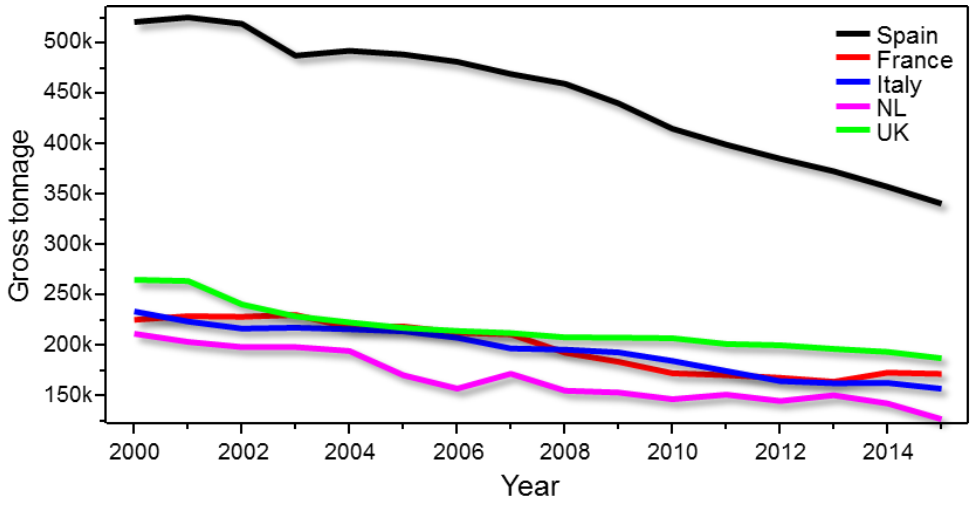
In order to maintain a determined fishing fleet, the regulation obliges to withdraw an equivalent amount of capacity in the case of new entries (Art. 9 (EU) 2016/1627). The countries which exceed the upper ceilings of the capacity or fail to report fleet capacity changes have all public aid frozen from EU. Member states that perform breaches on fleet capacity regulation risk having their annual quotas reduced or removed altogether (Frost, 2010).

However, until 2008, EU failed to efficiently reduce the fishing capacity to the appropriate level (Belschner, 2015) In this regard, there has been much criticism of EU subsidies for fishing fleet that was related to the construction of new vessels and modernization of the old ones. As a consequence, the only possible subsidies that can be received nowadays are connected to fishers' safety and health onboard improvements. In that sense, EU has acknowledged that subsidised vessels not only increase the risk of extinction of fish stocks but also reduce the overall productivity in the fishing industry (Frost, 2010).

The indicator employed to measure the capacity of holding fish is the gross tonnage. In 2015, the total EU fishing fleet reached 1.59 million gross tonnes, and Spain has been the leading country keeping 21.4% of the total fishing fleet (341,000 gross tonnes) (***Fig. 7***). The second biggest fleet belongs to United Kingdom (187,000 gross tonnes), and the third to France (172,000 gross tonnes), while Italy maintains a fishing fleet of 157 thousand gross

tonnes, followed by Netherlands (127,000 gross tonnes) (Eurostat, 2016). As it can be seen, the gap between Spain and other countries fleets is very large.

Fig. 7 *EU fishing fleet by gross tonnage 2000-2015.*



Source: (Eurostat, 2016)

3.4.4. Technical Measures

Technical measures implemented into fishing management include multiple variables, such as the size of the Bluefin tuna that are allowed to be caught, open fishing seasons, authorised fishing means, among others. The EU regulation (EU) 2016/1627, Art. 11, provides that Bluefin tuna by large-scale long line vessels larger than 24 meters is allowed to be caught 5 months a year, from the 1 January to 31 May in the eastern Atlantic and the Mediterranean. However, the purse seine fishing which is used for capturing live tuna for tuna farms is only allowed from 26 May to 24 June in the eastern Atlantic and the Mediterranean. Pelagic trawlers are allowed to fish the eastern Atlantic from 16 June to 14 October, so are sport and recreational fishers. The regulation also provides that small environmental impact fishing methods, such as smaller boats and traps, are allowed to be used throughout the year as long as they fulfill the conditions of ICCAT rules.

Regarding the permitted catch size, the greater freedom is given to the coastal and artisanal fishery. Bait boats, long liners and hand lines are allowed to catch Bluefin of the reference size of 8 kg in the Mediterranean Sea. Fishing juvenile in eastern Atlantic is more restricted than in Mediterranean. In this area, only bait boats and trolling boats can be authorised to catch the 8 kg weighing Bluefin. The last exception for catching 8 kg, or 75 cm fork length, fish is provided for farming purposes in the Adriatic sea. Otherwise, the minimum conservation size is 30 kg, for the fish caught both in eastern Atlantic and Mediterranean (Art 14, (EU) 2016/1627).

An important legislation affecting Bluefin tuna fishery was introduced in the 2014 Common Fishery policy. This regulation provided that all catches should be landed, maintaining a 5% *minimis* rules (EU, 2015). The technicalities of this exception have been argued to be rather unclear (Borges, 2015). However, such an implementation made the discard ban to be possible in practical terms and has put an end to wasteful practices of throwing fish back to the sea, whether dead or still marketable.

3.5. Legal enforcement measures

EU obliges the member states to have a juridical system for taking enforcement measures that would be capable of dealing with violations of the EU Common Fishery Policy. However, it is left for national governments to implement CFP rules on their territory and waters. The Commission provides that the sanctions taken could be *"fines; seizure of illegal fishing gear and catches; sequestration of the vessel; suspension or withdrawal of authorization to fish; reduction or withdrawal of the fishing quota."* (Art 33. (EC) No 302/2009). Regulations referring to farming activities should be protected by introducing fines, limitations to fatten, store or market the tuna in case of failure of compliance. However, it is also left for member states to apply sanctions in cases of infringements in their area of jurisdiction.

The 2009 legislation also included improved internal control measures followed by modernised EU approach to fisheries control. The electronic reporting system (ERS), vessel monitoring system (VMS), autonomous vessel identification system (AIS) have been introduced in the current CFP policy (Ojamaa, 2016). Such measures have a goal to fight the IUU fishing and to ensure that no illegal caught Bluefin enters EU market. The EU legislation (EC) No 302/2009 included important measures that forbade to import, export, trade or process any Bluefin tuna catches that go against ICCAT rules (EU, 2009).

4. ATLANTIC BLUEFIN TUNA PRODUCTION STRUCTURE IN SPAIN

5.1. National quota assignment

In Spain, the Ministery of agriculture, fisheries, food and environment (MAPMA) assigns the national quota based on the history of fishing activity (BOE, 2001). Before allocating Bluefin tuna fishing possibilities, Spanish government retains 5% of quota, "*Fondo de Maniobra*", in case the catches exceed the assigned quota (MAPAMA, 2016). The quota is allocated to fishing methods and gears: bait boat fisheries, handlines, longliners, purse seine fleet, and the trap fishery. The quota allocation has been established at 21.7%, 6.3%, 13.8%, 28.3%

and 27.2%, respectively (MAPAMA, 2016). The assignation of each share to the specific fishing method is based on two factors: the historical catches, accounting for 60%, and the socioeconomic dependency (employment and fishing season), accounting for the remaining 40%. For the industrial fisheries (purse seines, bait boats, longlines and *almadrabas*), the base reference period for totalling official catch records was 10 years (1996-2006). The quota for remaining activities, often referred to as "artisanal fisheries", was allocated considering catch records of 5 years period, from 2001 to 2006. This allocation is done in the form of individual rights, which can be transferred within the same or different fishing technology. The transfer of the individual quota to different fishing technology (e.g., bait boat to trap fishery) often enables the producer organisations to avoid loss in case of unexpected price changes in the raw material or labour markets. On the other hand, it has been argued that transferability between different fishing gears can imply difficulties of controlling the impact to the environment (González, 2006, Aranda and Murillas, 2015, EU, 2015). The state has also established a concentration cap of 30% to prevent an excessive concentration on a single operator.

5.2. Legal enforcement measures in Spain

In Spain, the government has promoted the electronic Bluefin tuna catch document programme (eBCD) which has become mandatory for the contracting parties of ICCAT since 2016. In order to facilitate the fulfilment of this new obligation, the assistance service named SEDA was established and is available on an extended timetable for any queries related to eBCD (MAPAMA, 2016). In addition, the national government introduced the National Observation Program (*Programa nacional de observadores*) in order to control the activities of the Bluefin capture. 100% of trap and tug boat fishery has to be checked by observers, whereas only 20% of longline and purse seine fishing vessels are subjected to this observation program (MAPAMA, 2016).

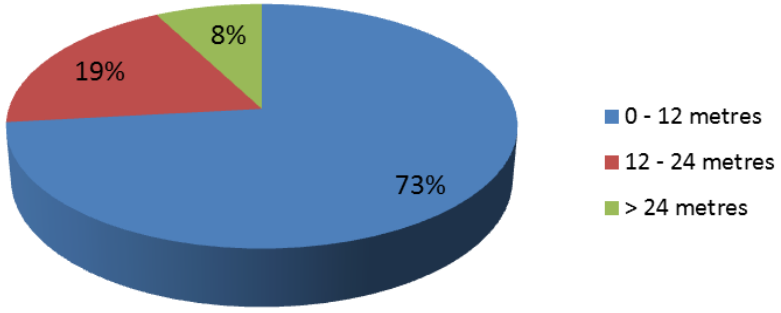
The Spanish government has classified all infringements related to capturing any kind of fish into 3 classes: minor, serious and very serious. Any conduct that goes against the Spanish regulation of conservation of Bluefin tuna (i.e., EU regulation which is based on ICCAT recommendation) will be fined according to its seriousness from 100 to 2,000,000 € (BOE, 2015).

5.3. Spanish fishing fleet

Spanish tuna fleet can be described as a small-scale fleet. In 2015, there were 9,396 vessels registered, out of which 73% was up to 12 meters length, which is normally being classified as a small-scale fleet segment (***Fig. 8***). On the other hand, 19% of all vessels are between 12 and 24 meters long whereas 8% are longer than 24 meters (Eurostat, 2016).

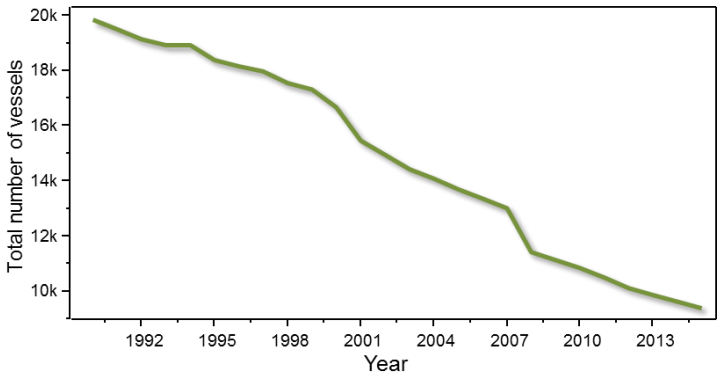
Fig. 9 illustrates the evolution of the overall fishing fleet in Spain since 1990. From this graph, we observe a clear tendency of the reduction of the size of the fishing fleet in terms of total numbers of vessels. On the other hand, ***Fig. 10*** reflects gross tonnage development in Spain and supports the fact that the country has been on a vessel decommissioning scheme in the last two decades.

Fig. 8 *Number of vessels by length 2015.*



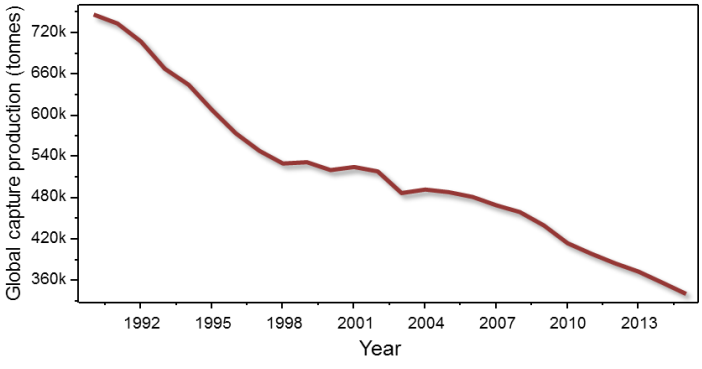
Source: (Eurostat, 2016)

Fig. 9 *Evolution of the fishing fleet Spain by number of vessels (1990 - 2014).*



Source: (Eurostat, 2016)

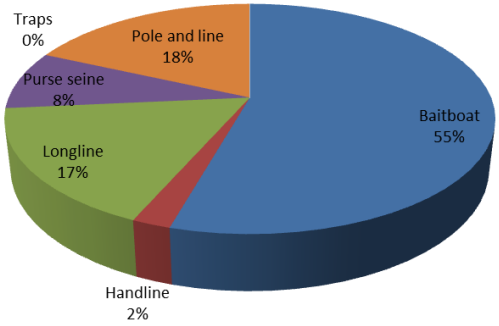
Fig. 10 *Evolution of the fishing fleet Spain by total gross tonnage (1990 – 2014).*



Source: (Eurostat, 2016)

For the specific case of Spanish Atlantic Bluefin tuna fishing fleet, which consists of 281 units for a total gross tonnage of 17,194 tonnes, we can identify 6 main sectors (***Fig. 11***). Here, it is represented the fishing gear distribution by total gross tonnage, authorised to capture Bluefin tuna by the Spanish government in 2016. 6 large purse seine vessels are targeting the Bluefin tuna in the Mediterranean Sea, with 55 bait boats targeting Bluefin tuna in North West Cantabrian Area, 22 boats with handline fishing, 55 longlines and 143 pole and line vessels, operating in the Canary Islands fleet (***Table 1***).

Fig. 11 *Total Gross Tonnage of Spain fleet targeting Bluefin tuna in 2016.*



Source: (MAPAMA, 2016)

Table 1. *Spanish fleet targeting Bluefin tuna in 2016.*

Fishing gear	***Total vessels***	***Total GT***	***Assigned quota per vessel***
Baitboat	55	9354	730
Handlines	22	373	211
Longline	55	2912	464
Mediterranean Purse seine	6	1418	951
Traps	0	0	914
Pole and line (Canary Islands)	143	3136	40
Total	**281**	**17,194**	**3,276**

Source: (MAPAMA, 2016)

5.4. Bluefin tuna fattening farms

In Spain, the main cultivation of Bluefin tuna is done in fattening farms. The fish for the farms is captured by purse seine vessels since this method allows for efficient transporting live tuna into the fattening cages. In 2016, the total maximum capacity of fattening farms in Spain reached 11,852 tonnes (ICCAT, 2016). In particular, 10 instalments were spread between

Murcia, Catalonia, Almeria and Cadiz. Further, ***Table 2*** describes the distribution of the farms capacity between commercial companies.

Table 2. *Spain tuna farming facilities in 2016.*

Owner name	Total capacity (tonnes)	% Total capacity
Ricardo Fuentes e Hijos S.A.	7440	62.77
Balfegó Tuna S.L.	1500	12.66
Piscifactorias de Levante S.L.	800	6.75
Atunes de Mazarrón S.L.	777	6.56
Culmarex S.A.	500	4.22
Servicios atuneros del Mediterraneo S.L.	400	3.37
Tuna farms of Mediterraneo S.L.	435	3.67

Source: (ICCAT, 2016)

There are five companies having small share of the market: Piscifactorias de Levante S.L., Atunes de Mazarrón S.L., Culmarex S.A., Servicios atuneros del Mediterraneo S.L., Servicios atuneros del Mediterraneo S.L. and Tuna farms of Mediterraneo S.L., with farms capacity of 7%, 7%, 4%, 3%, 4%, respectively. Ricardo Fuentes e Hijos Group controls 63% of total farming capacity or 7,440 tonnes. The Balfegó Group has the second biggest Bluefin tuna fattening farms capacity of 1,500 tonnes or 13% of a total capacity.

5.5. Entry barriers

The entry barriers for the Bluefin tuna production can be divided into two broad categories. The first class includes government-introduced barriers such as fishing restrictions. Since European countries are obliged to keep the fishing fleet constant, only registered vessels are allowed to receive fishing possibilities. This means that the only legal entry for new members is the purchase of the vessels that has the authorization to capture Bluefin tuna (Aranda and Murillas, 2015). This type of fishery is also threatened by natural conditions. Scientific discoveries about stock declination usually leads to quota reduction which in turn provides less fishing possibilities for fishermen and less raw material for fattening farms. In such a scenario, the rivalry for the Bluefin increases dramatically. Furthermore, there still remains a potential risk that Bluefin tuna might be completely forbidden to be captured. In 1992, there were proposals to include this species into Convention on International Trade in Endangered Species (CITES) which would have meant restrictions on catches and trade of the Bluefin tuna (OECD, 2004). This resolution did not come into force due to lobbying and political

pressure by Japan, but it did force ICCAT to reduce quotas and implement a stricter monitoring process (Korman, 2011).

The second important restriction that impedes new entries is the necessity of capital. This type of barrier is very relevant to the Bluefin tuna fattening farms. In order to start up a new business, high investments are needed to acquire proper cages, feeding equipment, “tuna coffins” for fresh fish transportations, etc. Apart from that, the company needs to ensure it has the necessary know-how to guarantee the required quality of the final product (De Stefano and van der Heijden, 2007).

While there is a rivalry for the fish caused by quota restrictions, some companies might have better opportunities to access the raw material. One of the biggest producers in Spain, *Balfegó,* benefits from the fact that it owns two purse seine vessels. On the other hand, the Bluefin tuna production giant *Ricardo Fuentes group* has a strong vertical integration structure that comes to the aid of acquiring Bluefin tuna for its farms and accessing distribution channels through its Japanese co-owners.

5.6. Spain Bluefin tuna foreign trade

Net exports of live, fresh and frozen Bluefin tuna

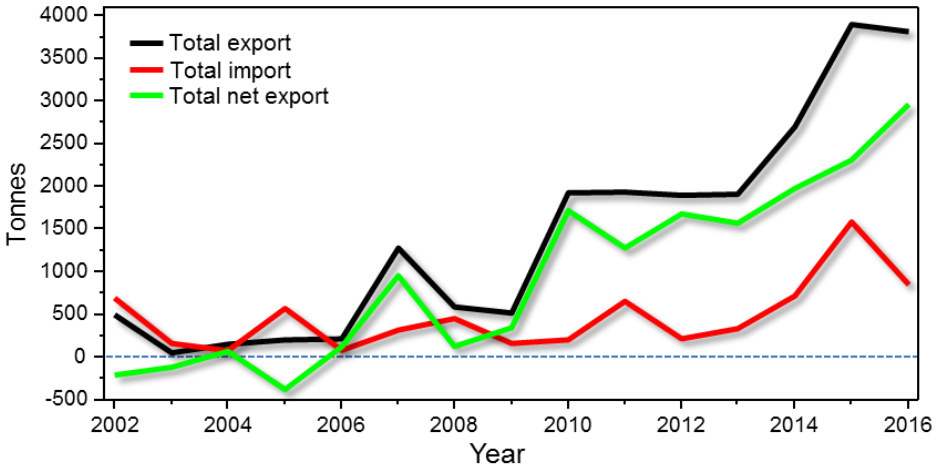
Figures from ***Fig. 12*** to ***Fig. 21*** illustrate different Bluefin tuna import/exports profiles (DataComex, 2017). Each of them shows the type of Bluefin tuna that has been traded (live Bluefin tuna, fresh Bluefin tuna and frozen Bluefin tuna). Fresh Bluefin tuna refers to the fish that has been killed after being caught and, then, directly presented to the market (without being frozen).

Fig. 12 shows the overall Spain Bluefin tuna exports/imports which have been calculated by adding up all live, fresh and frozen Bluefin tuna (i.e., the total Bluefin tuna) that has been traded in the given period. Between 2002 and 2006, the total Spain Bluefin tuna net exports were negative, with a punctual exception in 2004. Since 2006 the total Bluefin tuna exports were significantly larger than imports. In particular, there were three remarkable total exports escalations. In 2007 total exports rose from 219 tonnes to 1,284 tonnes then decreased in the following two years. In 2010 total exports expanded to 1,932 tonnes and remained relatively constant until 2013. In 2014 exports were remarked by another sharp rise of 2,704 tonnes.

The main non-EU importers of Spain-caught Bluefin tuna are Japan, United States and South Korea (***Fig. 13***). Japan has been an importer of Spanish Bluefin since Spain started exporting the Bluefin altogether. In the last 10 years (2007-2016) Japan has imported 8,248 tonnes of all types of Bluefin tuna from Spain, out of which 8,075 tonnes have been imported in the last 5 years. South Korea and the United States are still new markets, whose more

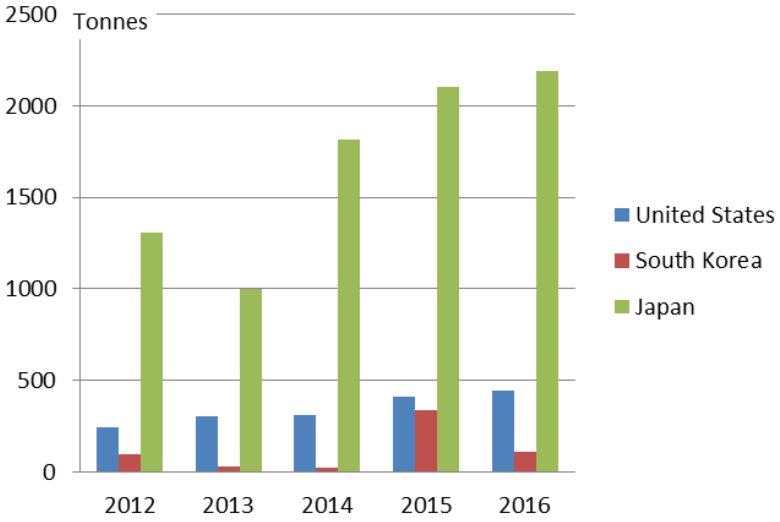
remarkable exports began in 2012. In the 2012-2016 period, the total amount of the Bluefin tuna imported by the United States and South Korea were 1,673 tonnes and 584 tonnes, respectively.

Fig. 12 *Total Spain Bluefin tuna exports/imports (2002-2016).*



Source: (DataComex, 2017)

Fig. 13 *Total Spain Bluefin tuna exports by non-EU importers (2012-2016).*

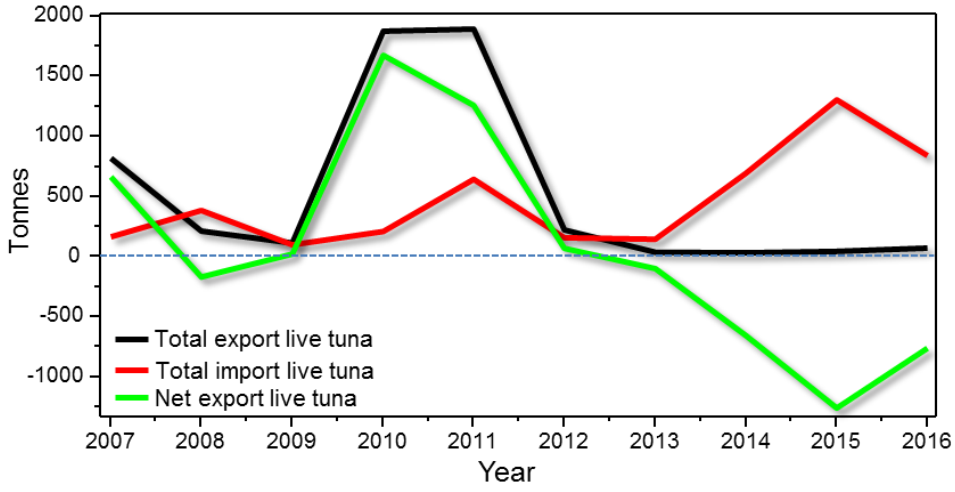


Source: (DataComex, 2017)

Live Bluefin tuna

The live Bluefin tuna trade in the 2007-2016 time range can be divided into two periods. The first one, from 2007 until 2012, is characterized by Spain exporting the live Bluefin (***Fig. 14***). From 2013 up until now, Spain has intensively been importing live Bluefin tuna, caught by purse seine vessels for farming purposes.

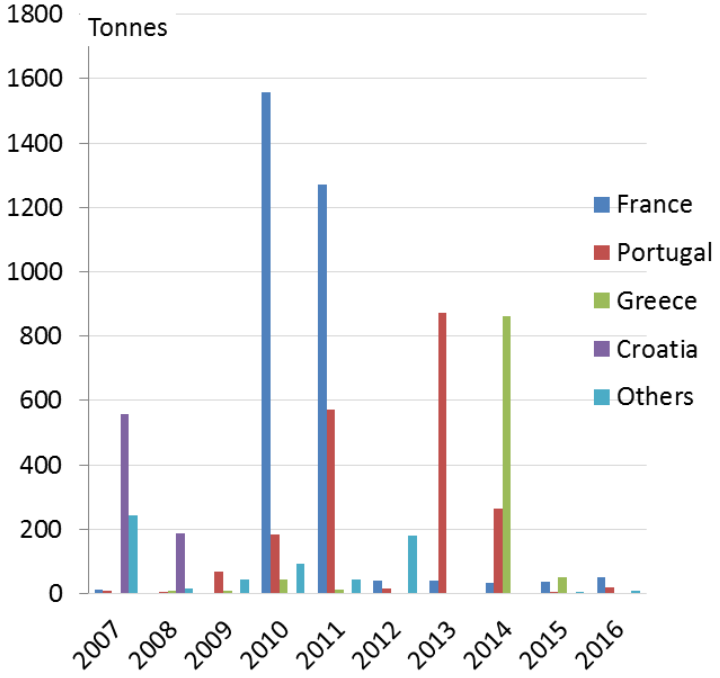
Fig. 14 *Spain live Bluefin tuna exports/ imports (2007-2016).*



Source: (DataComex, 2017)

Since 2007, the main partners in live Bluefin tuna trade have been France, Croatia, Greece and Portugal (***Fig. 15***). Even though Spain general tendency is importing Bluefin tuna from its neighbour countries, in 2010 and 2011, the country exported a huge amount of live Bluefin tuna to France (1,558 tonnes and 1,270, respectively). This exported Bluefin tuna sums up to almost 60% of Spain total allowable catch for 2010 and 53% for 2011. Larger quantities that have been exported during this period to Portugal, Greece and Croatia represented one-time trade deals rather than a continuous trend.

Fig. 15 *Net Spain exports of live Bluefin tuna by main trading partners (2007-2016).*



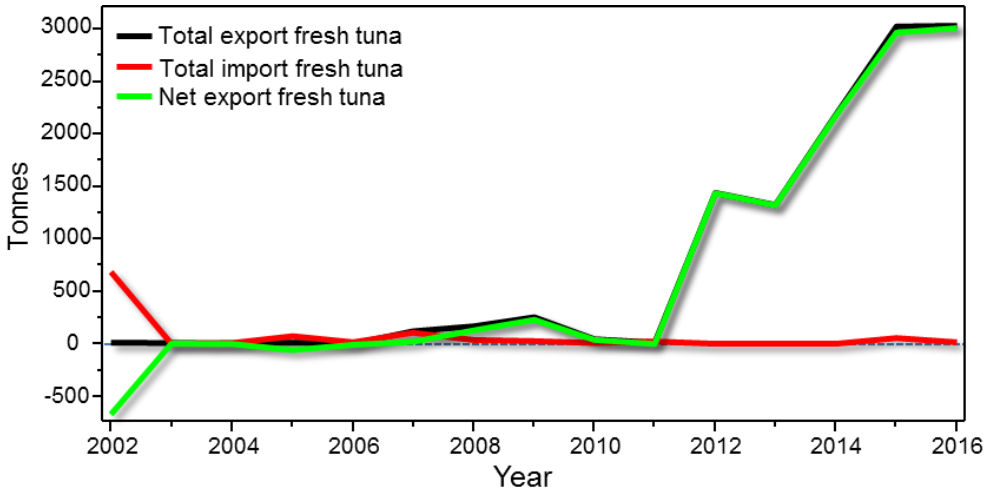
Source: (DataComex, 2017)

Fresh Bluefin tuna

Between 2002 and 2011, the fresh Bluefin tuna market exports and imports were fluctuating around similar values (***Fig. 16***). However, in 2012, the exports of fresh Bluefin tuna rose almost 9,000% (from 16 tonnes to 1,439 tonnes) and dropped slightly, by 8%, the year after. Fresh Bluefin tuna exports further rose 65%, 38% and 1.7% in 2014, 2015 and 2016, respectively. Comparing the live Bluefin and the fresh Bluefin import/export figures, we observe that a high increase in fresh Bluefin exports in 2014 equals the decrease of the live Bluefin tuna net exports. This could be explained by the increase in tuna fattening farms production which was made possible by importing live Bluefin from other countries.

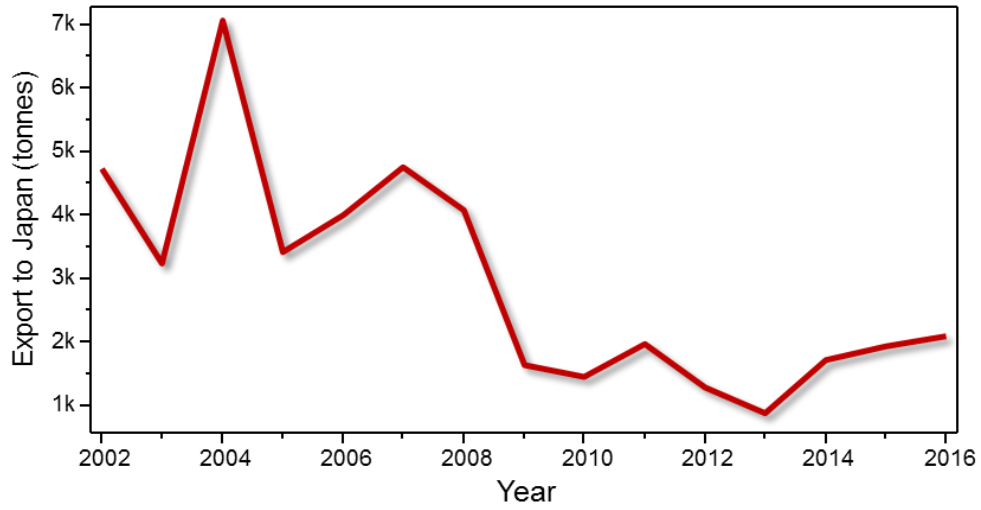
The main importer of fresh Bluefin tuna remains Japan, which imported 44,252 tonnes of fresh Bluefin tuna in the last 15 years (2002-2016) (***Fig. 17***). France, Italy, Germany and United Kingdom have been importing the fresh fish on a regular basis since the beginning of the 2000s, as depicted in ***Fig. 18***. There have been significant exports of fresh Bluefin tuna to France from 2002 to 2007, ascending to 1687 tonnes, 1070 tonnes, 1086 tonnes, 1655 tonnes, 1568 tonnes, 1753 tonnes in 2002, 2003, 2004, 2005, 2006 and 2007, respectively. Even though the imports by France dropped in 2008, the quantities exported to this country have maintained consistency. Other 3 countries, United Kingdom, Germany and Italy had more homogenous annual imports during the given period, giving reason to think that all three countries, and France, indicating that they offer well-established foreign markets. Another major observation indicates that Spain started exporting significant amounts into new markets, such as Thailand and South Korea, in the last 5 years (***Fig. 19***). The exports of fresh Bluefin tuna have been active since 2002, however, the tendency of growth is noticeable since 2010.

Fig. 16 *Fresh Spain Bluefin tuna exports/ imports (2002-2016).*



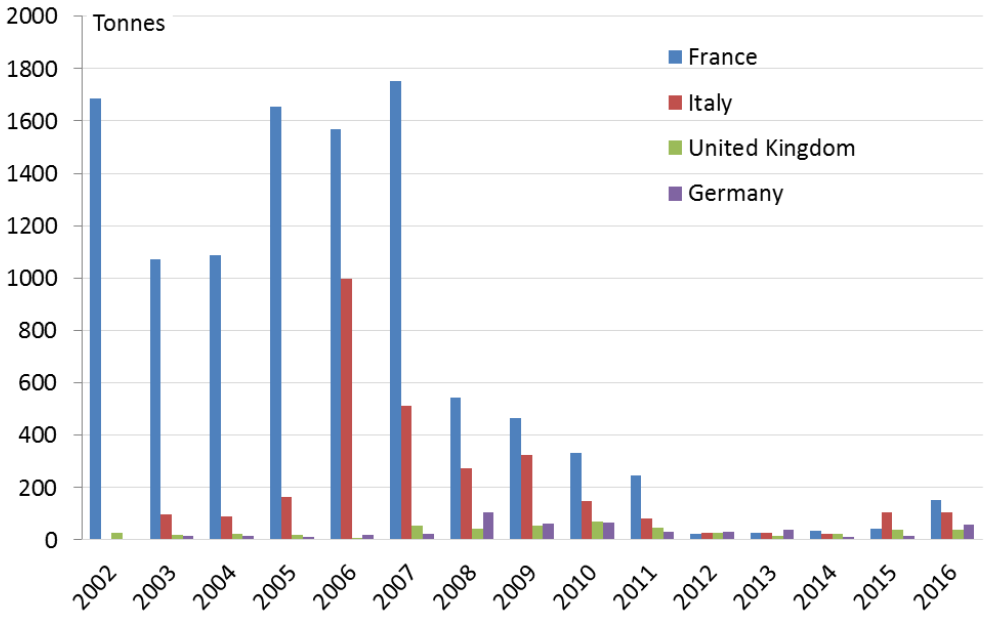
Source: (DataComex, 2017)

Fig 17. *Spain fresh Bluefin tuna exports to Japan (2002-2016).*



Source: (DataComex, 2017)

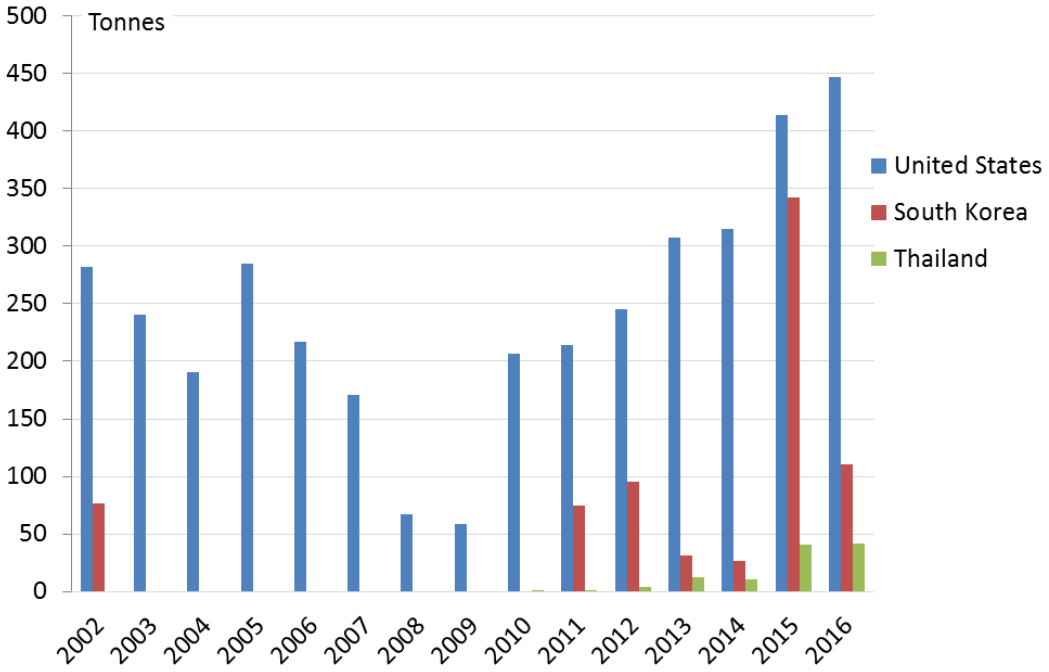
Fig. 18 *Spain fresh Bluefin tuna exports by main trading partners (2002-2016). Countries in EU*[1]*.*



Source: (DataComex, 2017)

[1] Countries that imported more than 500 tonnes during 2002-2016

Fig. 19 *Spain fresh Bluefin tuna exports to non-EU markets (2012-2016).*

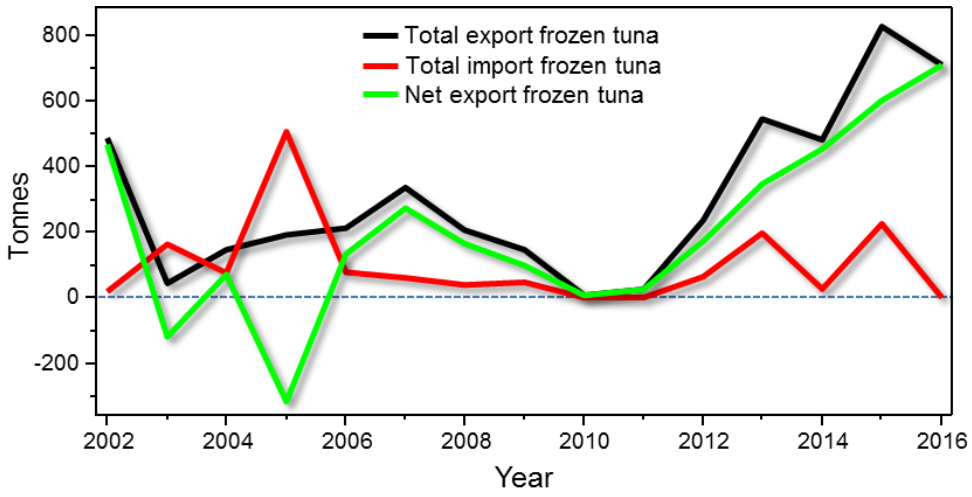


Source: (DataComex, 2017)

Frozen Bluefin tuna

Data of frozen Bluefin tuna market from 2002 to 2006 do not reveal a clear tendency (***Fig. 20***), as the net exports were fluctuating between positive and negative values. Nevertheless, since 2006, net exports gained a positive value. The net exports of 2016 comprise over 500% of 2006 net export figures (135 tonnes in 2006, and 712 tonnes in 2016).

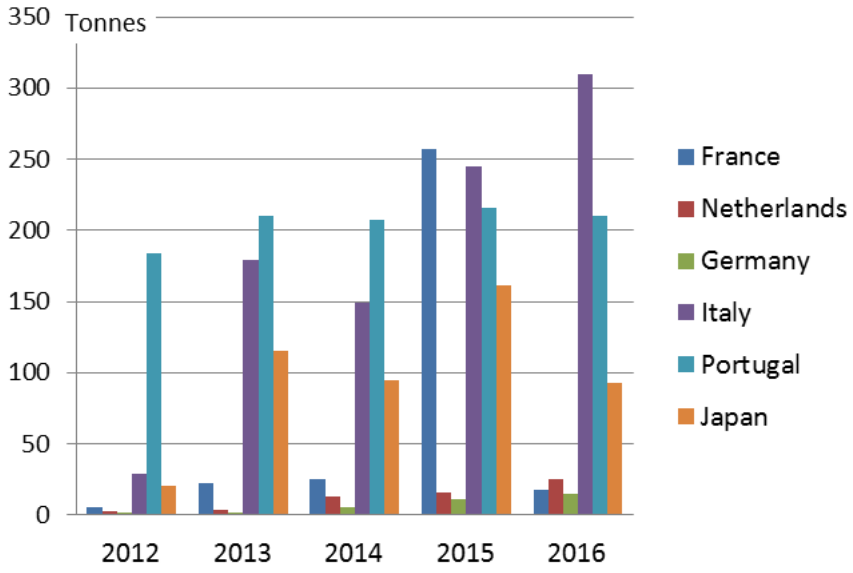
Fig. 20 *Frozen Bluefin tuna exports/imports (2002-2016).*



Source: (DataComex, 2017)

With regards to frozen Bluefin tuna importing countries, the tendency is rather different from the fresh Bluefin tuna market. The leading countries that have been importing frozen Bluefin tuna are mainly Portugal and Italy (***Fig. 21***). In the last 5 years, the amount imported by these two countries was 1,011 tonnes and 855 tonnes, respectively. Japan falls third in this category, with imports of 484 tonnes during the 2012-2016 window. Interestingly, the United States while maintaining its position in the fresh Bluefin market, completely missed out the frozen Bluefin tuna imports.

Fig. 21 *Frozen Bluefin tuna exports (2012-2016) by main trading partners*[2].



Source: (DataComex, 2017)

5.7. Balfegó group reflections on Bluefin tuna management

The scope of this final section was to directly discuss key and controversial aspects of the Bluefin tuna fishing industries, management and environmental impact presented in this study, with representatives of Balfegó Group, as a major Bluefin tuna fishing company, and Greenpeace, as a major non-governmental environmental organization. I had the opportunity to interview in person Mr. Joan Navarro, Deputy Manager in Balfegó, while Greenpeace declined to respond to specific questions due to lack of resources.

The *Balfegó Group* (Balfegó & Balfegó SL) is set at L'Ametlla de Mar (Tarragona) and currently employs over 180 people, while 2 of the 6 Spanish purse seine vessels, *La Frau Dos* and *Tío Gel Segon*, belong to the company. Contrary to the biggest Bluefin tuna producer in Spain, Fuentes Group, Balfegó Bluefin tuna activities were started without the

[2] Countries that imported more than 50 tonnes during 2007-2016

help of foreign capital. The key year for the development of the company was 2002 when the fifth generation fishermen, and cousins, Manel Balfegó and Pere-Vicent Balfegó decided to start an aquaculture of Bluefin tuna.

Until 2006, the company had a contract with one of the French purse seine vessels, which was selling its French quota part to the company. However, after the ICCAT restrictions on Bluefin tuna management in 2006, which also included the quota cut, Balfegó had to search for additional Bluefin tuna sources since the quota assigned to the three vessels (one contracted French vessel plus *La Frau Dos* and *Tío Gel Segon* vessels owned by the company) was not enough to secure the production and employment of its workers. That is when the French fleet (comprising 4 additional vessels) was subcontracted and sold the needed amount of Bluefin to Balfegó. Overall, there are currently 9 vessels fishing for Balfegó: 5 belong to the French fleet and 4 to the Spanish fleet (2 Spanish vessels were further subcontracted). These vessels capture the fish through joint fishing operations (JFO). Often larger Bluefin schools cannot be captured by a single vessel if the tonnage of the school exceeds the assigned vessel quota. By participating in JFO, the overall quotas of the 9 vessels are brought into the same pool which allows capturing large schools of the Bluefin with individual vessel. The company receives around 1500 tonnes of the fish per fishing season, which then enter the fattening facilities. The boats belonging to the Balfegó group, *Tio Gel Segon* and *la Frau Dos,* can catch up to 4,72% and 5,47% of the assigned Spanish quota, respectively (MAPAMA, 2016).

In the interview with Mr. Joan Navarro, Deputy Manager in Balfegó, major aspects of the Bluefin Tuna fishery management and regulations have been discussed.

Is current Bluefin tuna quota allocation fair?

Artisanal fishery representatives recently put pressure on Spain government asking for a higher share of quota allocation. However, according to Mr. Navarro, Spanish Bluefin tuna quota allocation is adequate and reflects well the reality. As mentioned earlier, the criteria used to allocate Spain Bluefin tuna quota is based on catch records (60%) and socio-economic aspects (40%). Interviewee reminded that Balfegó family has been fishing Bluefin tuna during periods, including the 1970s and the 1980s, when many fishermen ceased their activity on this fishery due to difficult fishing conditions. Therefore, according to Mr. Navarro it is more than fair that the sacrifice done in the past is being taken into account at the time of allocating the quota. He also highlighted that such quota allocation system protects those who have been consistently declaring legally their catches. In this regard, Mr. Navarro further argued that the requests of redistributing the quota allocation in favor of artisanal fisheries would go against the willingness to restore Bluefin tuna stocks. In his opinion, the

artisanal fishery was unable to prove the fisheries dependency to the Bluefin over the preceding years mainly due to the following reasons. There was either a lack of catch records due to undeclared (and therefore illegal) catches, or the fleet did not have the actual historical records required to be assigned with a larger quota but, despite that, does want to enter into the currently profitable sector of Bluefin tuna.

The environmental impact of purse seine activities vs. artisanal fishing fleets

Balfegó group has recently received accuses from the Canary artisanal fishing fleet of "*practising an industrial fishing that has put the species (Bluefin tuna) to the edge of the abyss*" (Expansión, 2017). The interviewee commented that one of the main obstacles for the company is the widespread assumption that all large-scale fisheries are harmful while the "artisanal" ones are intrinsically is "beneficial". He argued that, on the contrary, modernized purse seine vessels have significantly reduced exhausted fumes emission while maximizing considerably the fishing time, which reduces the impact on the environment. Moreover, these purse seines mainly target Bluefin in the high seas and in the South of Balearic Islands, where the Bluefin comes to spawn. Since these areas are literally other-species-free in order to avoid any disturbances during the spawning period, this implies that there are hardly any by-catches at the time when surrendering the Bluefin – an argument often used to attack the purse seine activities due to environmental impact. Mr. Navarro particularly stressed that Balfegó group has devoted major long-term investments in such activity which clearly made the long-term sustainability of the Bluefin tuna fishery a priority for the company.

The role of the Spanish authorities in the fishery management and the future of the artisanal fisheries

Mr. Navarro urges the Spanish authorities to request more responsibility from the different fishing gears. In his opinion, the fishing sector has become a "***begging sector"*** *(*"*sector pedidor"*). All other Bluefin tuna fishing gears, apart from the purse seine fleet, are assigned quotas to fish other species. The interviewee argued that when the assigned quotas are not managed properly and cease to bring benefits, the artisanal fishers start demanding the access to fish other species, as happened in the Bluefin tuna case. For this reason, according to Mr. Navarro, Spanish authorities should ask for more responsibility from the fishers regarding how they handle their assigned shares of quota before paying attention to the demands of additional quotas.

Further, he complained that productivity has not been often valued in this sector by Spanish government authorities which, on the other hand, continuously supported small-scale fishery industries even when there was neither economical nor environmental reason to do it. On

the contrary, the Bluefin tuna fishery, no matter by whom the fish is caught, is a plain commerce, and the artisanal fishermen are not capable of neither develop their activities nor sustain the fishery in the future. In this regard, Mr. Navarro claimed that artisanal fisheries in Bluefin tuna capture mostly consist of old fishermen while their descendants appear not to be necessarily willing to continue their fathers' activity due to the difficult working conditions and risks in the open sea. The interviewee solicits the authorities to step in not by involving direct subsidies, but by introducing business development projects, which he reckons are currently missing in today artisanal fisheries. These projects would bring economic viability into the small-scale fisheries and, in turn, directly benefit the whole economy.

EU role in the Bluefin tuna management

The EU position in the Bluefin tuna management seemed to be worrying too the representative of Balfegó. Theoretically, apart from implementing ICCAT rule into the EU legislation, the Europe Union does not play a weighty role in this issue. The impression received by the producer is that the EU authorities do not manage to guarantee that the Bluefin tuna circulating inside the Union is caught legally. The EU receives the highest share of Bluefin tuna quota, but other countries such as Egypt, Morocco, Turkey, among others, also fish Bluefin but do not have the adequate infrastructure system to provide a reliable fish traceability. For instance, in the last two years, Turkey, a member of ICCAT, neglected the official quotas and unilaterally increased their share of captures. This caused a float of critics from the Balfegó to the EU due to its inaction regarding the control of imports from this country. The interviewee also highlighted the fact that the requirements for Bluefin tuna management are very strict within EU whereas the government has rather loose politics when it comes to importing the same fish from other countries.

5. CONCLUSIONS

After the 1950s, the rapid increases in fish demand, major technological advancements and an open access economy have pushed the fish industry to overexploit this natural resource, bringing the several fish stocks to the border of collapse. A various set of fisheries management policies based on different models were progressively implemented to address the sustainability issues of the fishing industry. In this study, I have investigated in detail the case of Bluefin tuna fisheries and their management, with a special focus on those operating in Spain, one of the most important Bluefin tuna exploiting countries. Bluefin tuna is an extremely valued fish species and represents a paradigmatic example of a problem associated with overfishing and the measures taken to address this issue. The main conclusions of this work can be summarized as follows:

The overfishing problem is an unavoidable consequence of open access fisheries. Thus, implementation of fisheries management is necessary to protect the marine environment, ensure the economic viability and provide consumers with quality food. Since its foundation in 1957, EU fisheries management was based on a single sector approach for marine resource management. However, this approach largely failed and a further alarming decrease of the fish stocks took place. In a short-term vision approach, the counteraction of governments was to support the fishing industry via subsidies mostly aimed at improving the fishing efficiency by implementing better technologies. However, the implementation of subsidies and the overcapacity of fishing fleets have been linked to an increase of illegal, unreported and unregulated (IUU) fishing. The failure of the implemented policies to beat the issues of overfishing required a transition from single species models to ecosystem-based models, which were finally integrated into the latest reform in the 2013 European fisheries management. The key concepts of the ecosystem-based models are sustainability, which emphasizes the preservation of multispecies, the ecological health and the inclusion of humans in the ecosystem

The exploitation of the Bluefin tuna fishing rapidly increased from the late 1950s, rising progressively environmental and sustainability concerns that finally peaked in the 1997-2008 period, requiring immediate actions to preserve Bluefin tuna population. As a response, the ICCAT organization (EU joined the ICCAT in 1997), decided that the priority when allocating quotas should be given to the stock recovery measures. ICCAT set the annual quota and distribute it to the contracting parties. The criteria used for setting quotas have been the historical catches, followed by spatial distribution of the stock and proximity to coastal countries, among others. While positive impacts have been demonstrated, the ICCAT governance also displayed major flaws such as an uneven implementation of the enforcement rules and scarce influence over non-member states. In this regard, since 2009, the EU limited its subsidies to fishers' safety and health onboard improvements in order to reduce the fishing capacity to the appropriate level. Further, EU severely stressed its internal compliance with all member states. Such shift to a stricter policy also affected the Bluefin tuna fishery. In this regard, an important legislation affecting Bluefin tuna fishery was introduced in the 2013 Common Fishery policy to enhance the efficiency of discarding and the landing obligations. As for other fish species, the EU regulations governing Atlantic Bluefin tuna are based on three pillars: (i) total allowable catches (TAC) allocation, quota distribution and management; (ii) the fishing fleet capacity management; and (iii) technical measures. Such fisheries management systems did not address major issues such as fish discards, misreporting due to unspecific fishing techniques, or restraining illegal fishing.

Spain receives among the highest EU shares of the Bluefin quota and remains the country with the largest fishing fleet in the EU (even though it has been on a vessel decommissioning scheme for the last two decades). In Spain, the Ministery of Agriculture, Fisheries, Food and Environment assigns the national quota depending on the fishing method. The assignation of each share is based on the historical catches and the socioeconomic dependency (employment and fishing season). The state has also established a concentration cap of 30% to prevent an excessive concentration on a single operator.

The main cultivation of Bluefin tuna is Spain is performed in fattening farms. In fact, Spain is currently a large importer of *live* Bluefin tuna and a major exporter of *fresh* and, to a lesser extent, *frozen* Bluefin tuna. Overall, the *total* Bluefin tuna net export has been increasing in the last 10 years, with Japan being the major importer.

Key and controversial aspects of the Bluefin tuna fishing industries, management and environmental impact presented in this study were finally discussed with the Deputy Manager of a major Bluefin tuna fishing company (Balfegó Group), Mr Juan Navarro. Notably, artisanal fishery representatives recently put pressure on Spain government asking for a higher share of Bluefin tuna quota allocation. Mr. Navarro argued against a change in quota allocation, which he considers fair for historical, environmental and economic reasons. On the one hand, he argues that reduction of quotas for those established companies, like Balfegó, would go against the basic values that regulate the functioning of ICCAT. On the other hand, Mr. Navarro argued that modernized purse seines vessels mainly target Bluefin tuna in high seas with minimal by-catches and significantly reduce exhausted fumes emission, therefore reducing the overall environmental impact. Finally, Mr. Navarro claimed that, often, small-scale fishery industries often lack economic viability and only survive based on the support by the Spanish government.

The following major considerations arise from my extensive readings on global fishery and Bluefin tuna managements. In my opinion, European government should enhance their centralized enforcement activity of the Bluefin tuna management. A coherent control policy is particularly required on Bluefin tuna catching since this product currently combines high value and natural availability (Bluefin tuna population is on its way to recovery). Thus, lobbying at both the national and local levels for acquisition/redistribution of quota allocation as well as illegal fishing are expected to pose severe challenges in the near future. I believe it is crucial to tackling such a global challenge as Bluefin tuna management by applying a comprehensive and coherent approach that works beyond the individual regional specificities. At the same time, EU should apply stricter policies regarding the imports of Bluefin tuna originating from countries which cannot provide traceability documents or that are known to fish above the assigned Bluefin tuna quota levels.

On the other hand, I reckon that rights assignation method (quotas) still remains a reasonable way to manage Bluefin tuna exploitation. In general, fishermen are willing to protect the fish stocks they have been assigned quotas to, especially in the case of large investments being poured into the activity. In this regard, direct involvement of the producers into a governance driven by ecosystem-based policies may offer an opportunity to enhance the control over illegal fishing as well as ensuring the long-term sustainability of Bluefin tuna and other marine species.

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