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THE FUTURE OF THE ALMADRABA SECTOR – TRADITIONAL TUNA FISHING METHODS IN THE EU

STUDY

EN

2015

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This document was requested by the European Parliament's Committee on Fisheries.

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LINGUISTIC VERSIONS

Original: EN

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Manuscript completed in April 2015.
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This document is available on the Internet at:
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Abstract

Bluefin tuna is one of the most important fish species in terms of value and source of employment in the EU. Eastern Bluefin Tuna trap set ("Almadraba") harvesting is currently only practiced in Italy, Morocco, Portugal and Spain, though such fishing method was widely used throughout the Mediterranean Sea, and is of socio-economic and cultural relevance. Almadraba are more labour-intensive than any other fishing method and their production is increasingly appreciated by a high-end consumer market, either internal or international. Almadrabas must be considered as one key-tool of the EBFT stock management because of their available historic biometric datasets.

IP/B/PECH/IC/2014-081 09/02/2015

PE 540.367 EN

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LIST OF ABBREVIATIONS

BOE "Boletín Oficial del Estado" (Spain).

BFT Bluefin tuna Thunnus thynnus thynnus.

CITES Convention on International Trade in Endangered Species of Wild Fauna and Flora. (www.cites.org)

CPUE The amount of catch that is taken per unit of fishing effort (e.g., number of fish per longline hookmonths). Nominal CPUE is often used as a measure of the economic efficiency of a type of gear. StandardizedCPUE is normally used as an abundance index for "tuning" or fitting assessment models.

DPM Departement de la Pêche Maritime (Morroco).

EBFT Eastern Bluefin Tuna.

HL Hand Line (sport fishing).

ICCAT International Commision for the Conservation of Atlantic Tuna.

ITQ Individual Transferable Quota. A type of quota management system which typically entails the allocation of a part of the TAC to individual fishermen or vessel owners. The quota, once distributed, can be sold to others.

IUU Illegal, Unregulated and Unreported fishing vessels.

FAO Food and Agriculture Organization of the United Nations.

GBYP: Grande Bluefin Tuna Year Programme. The Atlantic-wide research programme for bluefin tuna.

MAD Legal currency in Maroc (Dirham).

MAGRAMA **"**Ministerio de Agrcultura, Alimentación y Medio Ambiente" (Spain).

MARPOL (73/78) The International Convention for the Prevention of Pollution from Ships (MARPOL) is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes. The MARPOL Convention was adopted on 2 November 1973 at IMO. The Protocol of 1978 was adopted in response to a spate of tanker accidents in 1976-1977. As the 1973 MARPOL Convention had not yet entered into force, the 1978 MARPOL Protocol absorbed the parent Convention.

MSY Maximum Sustainable Yield. The largest average yield (catch) that can be taken in the long-term from a stock, which corresponds to the yield expected from fishing at FMSY. ICCAT´s overarching objective is to make sure that stocks will be maintained at levels that permit harvest levels of MSY.

NAO North Atlantic Oscillation index. An index of climatic conditions given by the differences in winter sea level pressures between Lisbon, Portugal, and Stykkisholmar, Iceland. Several studies have looked for correlations between NAO anomalies (deviations from the mean) and recruitment strength of tunas or swordfish. (Mejuto 1999).

OPP51 The OPP 51 or the Almadraba Fish Producers Organisation in Spain.

RR Rod-and-reel. Rod and line fishing (sports fishing).

SCRS Standing Committee on Research and Statistics in ICCAT.

TIR The internal rate of return (IRR) or economic rate of return (ERR) is a rate of return used in capital budgeting to measure and compare the profitability of investments.

TAC Total Allowable Catch. Total catch allowed to be taken from a resource in a specified period (usually a year), as defined in the management plan. The TAC may be allocated to the stakeholders in the form of quotas as specific quantities or proportions.

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EXECUTIVE SUMMARY

The traditional fishing method called almadraba is one of the oldest recorded fishing systems, and is currently the object of study by anthropologists, sociologists and economist as a clear example of human activity developed to follow recurring migration cycles - specifically those of the Atlantic bluefin tuna (Thunnus thynnus). The almadrabas catch tuna as they swim across the Gibraltar strait, the Atlantic Ocean and the Mediterranean Sea when they go to spawn, and until recently, on their return ("al revés") journey when they return to the Atlantic Ocean. Besides this species, they also catch bullet tuna (Auxis rochei), little tunny (Euthynnus alletteratus), Atlantic bonito (Sarda sarda), bigeye tuna (Thunnus obesus) and swordfish (Xiphias gladius). The almadrabas that are used to catch tunas during their seasonal migration from the Atlantic Ocean to the Mediterranean Sea are called "di corsa" in Italian and "al derecho" or "de paso" (all these words translate to mean 'forward' in English) in Spanish. In Italian these are called "di ritorno" and "retorno" or "revés" ('going back', 'the return' in English). These traps catch the tuna when they are moving towards the Atlantic Ocean (trophic migration), with the outside net orientated towards the east (levante). The basis of this fishing method is that the schools of tuna, upon encountering the nets (called "raberas"), do not try to go through them, but instead they follow them, enter inside the labyrinth of nets and continue through the diverse chambers of nets, finally trapping themselves inside the final chamber, called the "buche". The fishing season for the "paso" almadraba traps begins in the spring and ends at the start of summer, and the season for the "retorno" almadrabas begins at the end of summer and ends in the autumn.

The long story of the almadraba traps has given us a series of data that is of important scientific value. These days, by performing a multivariable analysis, it is possible to specify how different factors have influenced the fishing of tuna. At this time, environmental factors could have a greater influence on the population than the fishing catches themselves. The almadraba technique used for Atlantic bluefin tuna fishing is respectful to the environment and to resources, due to several characteristical factors of this fishing system including: seasonality, location, structure, low energy consumption because of its working system, lack of waste generation, there is a limited stay time for the tuna within the structure of the almadraba, it creates a very reduced "bycatch", because the structure uses large mesh nets, and the small percentage of caught tuna correspond to adult specimens that have already bred and have spawned on several occasions, and the size and flexibility of the nets mean that there is no damage to the cetacean or dolphin populations and it doesn't have any influence on the local hydrological dynamics.

Nowadays there are 4 countries that practice fishing using the almadraba technique: Spain, Italy, Morocco and Portugal. The working system in all countries is similar. The number of jobs per almadraba is an average of 43 people, compared to 10 jobs on a purse-seiner dedicated to the fishing of bluefin tuna in the Mediterranean Sea, 10 jobs on a surface longliner fishing in international waters, or just 6 jobs on other longliners.

Spain

Almadrabas don't have great significance on the Spanish fishing sector. In the province of Cádiz there are currently four almadrabas dedicated to the fishery of Atlantic bluefin tuna. From these, the four of them (Tarifa, Conil, Zahara de los Atunes and Barbate) are on "de paso", and until very recently the almadraba in Barbate "de retorno". During 2013 in Spain

1,369.98t of tuna were caught using almadraba, which means an increase of 67% against the 819.76t in 2006. This increase is due to the purchase of quota from other sectors of fleet, as this has been kept fixed at 657t. It is one of the few fishing systems that generates stable employment, regulated by a labour agreement.

Italy

Currently there are three licenses for the almadraba fishing method in Sardinia: Isola Piana, Portoscuso and traps Porto Paglia. But due to the small quota, only two of these are set up, and it creates employment for 105 people. The break-even point estimated for each almadraba is 100,000 kg per season/almadraba, and now there is a quota of 165t for all the Italian almadraba traps, which catch 222t (2013). In 2010 approximately 40% of the production of the almadrabas in Sardinia was designated for the local market, 30% was for the European market, 20% for canning products and only 10% was exported to Japan.

Portugal

Currently there are 3 almadraba traps in Portugal, located in the Algarve region, mainly focused on catching Atlantic bluefin tuna. The only legally allowed technique in Portugal for the fishing of bluefin tuna is the almadraba, and using this technique the catches generated 233.19t of fish in 2013. There is the possibility, with the supervision of the fishing administration, of using them for tuna fattening.

Morocco

In 2013 there were 10 almadraba traps installed in Morocco, all of them in the Atlantic Ocean waters, and these caught 960.47 t (2013). The period of activity has generally been from April to July, but with the reduction of quotas, the period of activity has been mainly confined to May.

Consultations with companies in this sector show that staff costs in Morocco are 20% lower than in Spain, which as consequence has meant that European companies have chosen to base themselves in this country.

The trend is to organise into cooperatives and to vertically integrate the almadraba traps concession holders, in order to improve the appreciation of fishing products, and to establish a unit of industrial processing to decrease the amount of tuna exports in a raw state, taking better advantage of the periods when the tuna catches take place, as well as in looking for mechanisms like the sustainability certification of the fishery to provide the products with greater added value.

The results highlight that the almadraba traps provide valuable scientific information about the population of bluefin tuna across time, and the scientific community agrees to use them as observation points of bluefin tuna populations. After the last CCAT meeting held in Genoa, increments of 20% to the annual quota until 2017, were passed, leaving the possibility open for upward revisions. The catches reflect an increase in volume and average weight. The sector of almadrabas suffered greatly from the reduction in quotas in 2008 and expects to get compensation for that effort, as well as to avoid mistakes in the future that were made in the past.

"Almadraba" must be considered as a useful tool for the management of the BFT fishery. Some of the best EBFT size/age-at-catch historical datasets are to be found in the archives of coastal Mediterranean trap set-net. No other fishing gear in the history of mankind has proven itself to be as sound, efficient, selective and yet so sustainable and environmental-friendly; moreover and for the purpose of this study, so well documented and almost fully traceable. Also, the "almadrabas" have remained for the past four centuries and still today, an invaluable 'data gold mine', while, on the other hand, fishing mortality due to them remains low and the sizes of EBFT caught by such traps is close to the optimum, in terms of yield per recruit.

The data of the traps provides high-quality age-specific biometrics of stock biomass, for both the sedentary and migrating fraction of the EBFT stock, as well as a wide range of biological data that constitutes an invaluable component in the EBFT stock assessment models.

In reference to stock status, the analysis on the status of EBFT populations carried out by the ICCAT-SCRS in 2006 and 2009 (ICCAT, 2007; SCRS, 2009) pointed out to a rapid deterioration of the Eastern Atlantic stock.

Because of this situation, was established a EBFT Recovery-Plan (enacted by ICCAT Recommendations: 06-05-BFT to 13-07-BFT), which evolved around a number of stringent management measures: Fishing-fleet reduction, the banning of aerial tuna-spotting, real-time reporting, the BCD scheme, onboard observers, the contraction of fishing seasons, quota-slashes, fisheries policing both at port and at fishing grounds, war against IUU EBFT trade, etc.

After this and according to ICCAT-SCRS latest 2014 updated EBFT stock assessment, results indicated that the spawning stock biomass (SSB) showed clear signs of sharp increase in all the runs that have been investigated by the SCRS-ICCAT accepted a general scientific precautionary approach to sound fisheries management that would rely on trustworthy accurate and comprehensive EBFT size/age-at-catch historical datasets.

GENERAL INFORMATION

KEY FINDINGS

- Fixed tuna traps – because of their large physical size – are not considered to be small-scale. This is consistent with Di Natale et al. (2009) who affirm that the first industrial fishery in the Mediterranean used this type of system.
- Bluefin tuna has been fished using the almadraba traps since the time of the Phoenicians, taking advantage of their migratory path, but new research reveals that a part of the stock neither comes in nor leaves the Mediterranean Sea.

The oldest mention of the word «almadraba» dates back to the end of the 14th century. The diverse proposals about its etymological origin agree that it derives from the Hispanic Arab term "*al-mah-draba"*, which can be translated as «place where to hit». The word is applied indistinctly to the fishing gear and to the place where it is performed.

Almadraba fishing is the oldest industrial fishing system known, and it is now the object of study by anthropologists, sociologists and economists as a clear example of human activity developed following recurring migration cycles, those of the Atlantic bluefin tuna (*Thunnus thynnus*) (Florido del Corral, 2005). According to some authors[1] who state that the use of this type of gear was the first industrial fishing method in the Mediterranean. This fishing method is now considered as artisanal fishery due to the size of the installation it uses.

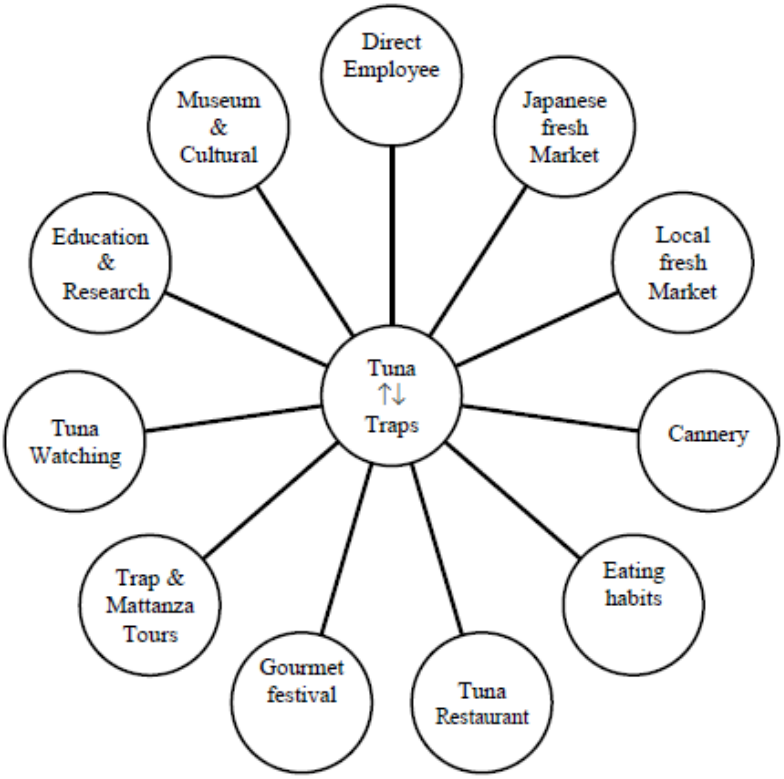
This species has been fished on the Atlantic coast of mainland Spain and Portugal since Phoenician times, between the months of May and July, and although the belief was that it was the whole stock which migrated, new research has shown that part of the stock neither goes into the Mediterranean Sea nor leaves it[2] There are records from the time of the Ottoman Empire proving that there were more than 100 traps spread across the Mediterranean Sea.

The almadrabas catch the tuna when there are crossing the strait, on their way to spawn and until recently, on its return journey, ("al revés") when they come back into the Atlantic Ocean. Besides this species, they also catch: bullet tuna (Auxis rochei), little tunny (Euthynnus alletteratus), Atlantic bonito (Sarda sarda), bigeye tuna (Thunnus obesus) and swordfish (Xiphias gladius).

The economic sector of the almadraba has produced by-products from the tuna and from the "bycatch" that is of a high commercial value, and is very appreciated in Japan, and growingly moreso on the European market too. The sector suffered greatly with the reduction of quotas in the year 2008. After the last CCAT meeting held in Genoa (10 - 17 November 2014), increments of 20% to the annual quota, until 2017, were passed, leaving the possibility open for upward revisions, with the scientific community optimistic with regards to the recovery of the Atlantic bluefin tuna, which was 6 years ago about to be included in CITES. This recovery could also mean the recovery of the almadrabas sector.

[1] Di Natale, The Eastern Atlantic Bluefin Tuna: entangled in a big mess, possibly far from conservation red alert. Some comments after the proposal to include the bluefin tuna in CITES appendix I, 2009.
[2] Florido del Corral, La almadraba amenazada: conflictos y paradoja socioambientales en la crisis del atún rojo, 2-5 Sept. 2014). (The almadraba threatened: conflicts and socio-environmental paradoxes in the bluefin tuna crisis.

Figure 1. The trap fishery network and subsectors that it engenders



Source: Social, cultural and basic economic analysis of the trap fishery of Sardinia: first step towards parameterization, 2012.

1. FUNCTIONING OF THE ALMADRABA TRAP

KEY FINDINGS

- There are two types of almadraba traps, classified depending on the time of the catch:
- **Almadraba traps of *paso***, *ida* or *derecho* (moving forward) type, in Italian these are called "di corsa": Those that catch the bluefin tuna and other species of tuna on its migration journey (genetic migration) towards the Mediterranean waters.
- **Almadraba traps for *retorno***, *revés* or *vuelta* (going back, the return) in Italian "di ritorno" .The almadraba traps that catch tuna on their migration return journey to the Atlantic Ocean
- The almadraba traps are big nets anchored or held by pegs, open on the surface and provided with different systems to direct and trap the fish. They are usually divided into different chambers, which have nets at the bottom.
- The fishing season for the *paso* type of almadraba traps takes place in spring and ends at the beginning of summer, and for the "return" type almadrabas, it begins at the end of summer and ends in autumn. **All almadraba traps currently belong to the *paso* type, because the quota is reached within the first few months.**
- Currently the almadraba season begins in February and ends in July. The crew for the almadraba is made up of 40-45 people hired during this period.

An almadraba fishery is the name received by those areas of the coast where almadrabas are set up, perpendicular to the coast. It is a series of nets called an almadraba whose objective is to intercept tuna schools on their journey, without any of its parts exceeding a distance of six nautical miles to the coast.

The fishing structure is kept in the water for 6 months of the year, of which only two months are used to catch the tuna, coinciding with the migration period of the bluefin tuna from the cold Atlantic Ocean waters to the warmer waters of the Mediterranean Sea.

There are two types of almadraba traps, classified depending on the time of the catch:

a) Almadraba traps of the *paso, ida* or *derecho* (moving forward) type:
Those that catch the bluefin and other species of tuna on it migratory journey (genetic migration) towards the Mediterranean waters. In Italian these are called "di corsa".

b) Almadraba traps of the *retorno, revés* or *vuelta* (going back- the return) type:
The almadraba traps that catch tuna on their migratory journey from the Mediterranean Sea to the Atlantic Ocean are called "retorno" o "revés" ('return-going back') in Spanish. In Italian these are called "*di ritorno*" y "*retorno*" o "*revés*". These are the traps that catch the tuna when they are travelling towards the Atlantic Ocean (trophica migration). In the Spanish province of Cadiz there are currently four almadraba fisheries dedicated to the catching of bluefin tuna. From these, all four of them are of the *paso* type: Tarifa (playa de Los Lances), Conil (Punta Atalaya), Zahara de los Atunes (Cabo Plata) and Barbate (Ensenada). The later, Barbate, is also an almadraba of the *return* type, achieving this by changing the position of the outside net.

In older times there were also other types of almadraba traps, called "tiro or de vista", and the "monteleva" almadraba, which are no longer used. These were made of mobile nets or with

just a fixed structure that wrapped up the tuna as they went through them. A system of watchtowers was built to let fishermen go to circle the tuna. From the 18th century, the only almadraba traps used have been the "buche" almadraba traps, and this type is the one described here. On the other hand, the traps called *almadrabillas* or *almadrabetas* also exist, which are trap structures oriented towards catching other smaller species of tuna, such as the bullet tuna (*Auxis rochei*) or the skipjack Tuna (Katsuwonus pelamis).

Almadraba trap *(buche* type). The basis of this fishing method is that the schools of tuna, upon encountering the nets (called "raberas"), do not try to go through them, but instead follow them, enter inside the laberynth of nets and continue through diverse chambers of nets, to then find themselves in front the "cuadrillo" and the "boca" through which they enter into the next chamber, finally trapping themselves inside the final chamber called the "buche" (See Annex II). They are, generally, big nets anchored or held by pegs, open on the surface and provided with different systems to direct and trap the fish. They are usually divided into chambers, which have nets at the bottom. In Japan, this fishing gear is called "gillnetting", but the almadraba trap system must not be mistaken with a gillnet. The almadraba trap operation system is based on the interception of the tuna specimens to later gather them in a space enclosed by nets, where they are caught on mass. It is for this reason that they are set at the time when tuna schools are migrating and, because this is a journey in both directions, the almadraba traps can belong to either the type *de paso or de derecho (moving forward)*, when the tuna caught are those going to spawn, or to the type *de venida o de revés (going back)*, when the tuna are heading back to the Atlantic Ocean. The bigger specimens are obviously *de paso* (*moving forward)* specimens, as the tuna stops eating when it starts the reproductive period, so by autumn they may have lost up to 35% of their weight.

The raising of the "copo" or final net or chamber, is usually done in the morning, between 6 and 7 am, when it is supposed that the tuna are already grouped together there. The operation starts with the raising of the bottom of the net, driving the fish towards the surface with the objective of catching them at that time. The caught tuna is carried in special vessels that take the tuna to the dock, for the handling and distribution (Rodriguez Roda, 1980). The fishing season for the *paso* almadraba traps takes place in spring and ends at the beginning of summer, and for "return" almadrabas, it begins at the end of summer and ends in autumn. Nowadays the almadraba season begins in February and ends in July, and a crew for the almadraba is made up of around 40-45 workers that are hired for this period. It is usual for the crew to be made up of the same people, with the knowledge, functions and job role being passed down through the generations. (Crespo, 2014).

Table 1. List of job roles on an almadraba trap

Professional category	Sailor *(Marinero)*
Captain *(Capitán primero)*	Boat Skipper (*Patrón de falucho*)
Second Officer *(Capitán segundo)*	Boat Engineer *(Motorista)*
Third Officer *(Capitán tercero)*	Boat Sailor (*Marinero de falucho*)
Catch Controller (*Administrador de mar*)	Boat Pilots *(Conductores)*
Almandraba Manager *(Patrón de almadraba)*	Net Technician *(Velamen)*
Assistant to Manager *(Proel)*	Divers (Buceadores)
Fisherman *(Copejeador)*	Official Guard *(Guarda real)*

Source: List of jobs according to the Sector's collective agreement (2014). The English translation is approximate, as these jobs are very specific to the almandraba method.

2. HISTORIC REVIEW OF THE ALMADRABA FISHING METHOD

KEY FINDINGS

- Phoenicians must have known about tuna fishing and the industrialisation of the process in the Far East, especially in the Bosphorus, and transferred their knowledge to the whole of the Mediterranean region.
- There is a lack of specific data since the periods from the classic and late antiquity until practically the end of the Middle Ages. Arab scholars, who left us numerous amounts of terminology, left hardly any records about this.
- It is in the 16th century, with the work by Father Sarmiento *"About tuna and its migrations and hypotheses about the decline of the almadrabas and the means to recover them"*) when this fishing system was first researched.
- For the 19th century we have to base our data on the "*Report on the fisheries from the east coasts of Spain",* written by Father Mirabent in 1835
- For the first half of the 20th century the records of catch in almadrabas are sporadical, and it has not been possible to establish a long and continuous series of records
- Between 1928 and 1971 a Consortium between the State and the almadraba companies was established, constituted as a National Union for Almadraba, with the objective to explode the fishing of tuna and other fish with passive fishing gear in the Gulf of Cadiz in a monopoly
- Based on the analysis of tuna catches of the 20th century on one hand, and of the five previous centuries on the other hand, we can assume that the low figures of catches in the second half of 20th century, can only be compared to those of the crisis in the final years of the 17th century and the first half of the 18th century, when other fishing methods were used, **i.e., there is a continuous and gradual decrease in the number of catches, in spite of improvements in fishing methods and technology.**
- **It must be taken into account that during the last few years (from 2008), the catch figures are conditioned by the imposed quotas,** which have limited the number of tuna specimens in almadraba traps in Andalusia, with an annual average catch of 1550 tuna specimens per almadraba.

Phoenicians must have known about tuna fishing and the industrialisation of the process in the Far East, especially in the Bosphorus, and imparted their knowledge to the entire Mediterranean region. The oldest references to the fishing and salting of tuna along the Spanish coasts can be found in fragments by the Greek comedy authors Eupolis (446 BC-411 BC) and Antiphaness (408 BC-334 BC) (López González & Ruiz Acevedo, 2012).

The Greek and Roman authors, who created a mythical image of the waters and coasts located on the other side of the Gibraltar strait (at the time known as the "Pillars of Hercules"), informed us of the fame of Tartasian bronze. Tuna fishing has been known about since then, although it is difficult to know how they were caught. It is unknown what the figures are for the catches back then, although it is possible they were very abundant. Authors like Oppiano and Eliano, from the 2nd and 3rd century respectively, described the method used to catch them, leaving no doubts about the use of almadraba traps.

There is a lack of specific data since the periods from the classic and late antiquity until practically the end of the Middle Ages. Arab scholars, who left us numerous amounts of terminology and works, hardly left any records about them. To this regard, the geographer from Almeria (Spain) from the 12th century, Al-Mahali, mentions the great abundance of tuna.
It is in the 16th century, in the work by Father Sarmiento *"De los atunes y de sus transmigraciones y conjeturas sobre la decadencia de las almadrabas y sobre los medios para restituirlas"* (*"About tuna and its migrations and hypotheses about the decline of the almadrabas and the means to recover them"*), where the technique is best described, as well as the location of the traps, which at that time belonged to the Casa de Medina Sidonia, which was the only one with the legal right to set the traps from the Guadiana River to the Kingdom of Granada. Although there was a notable decrease in catches during the final years of the century, the annual average across the 16th century for the 64 years for which we have data for Conil's trap, was 27,271 tuna specimens, and for the 51 years of Zahara's trap, 35,268 specimens, both Conil and Zahara being of the *tiro* type. There are variations in the catches, with years during which the nets were not even set up, forcing the Casa de Medina Sidonia to make very large investments to be able to keep fishing tuna, and it is for this reason that the Duke ordered the report. Studying the data obtained from the Medina Sidonia files, that date from 1757 to 1816, a gradual increase in the number of catches in the second half of 18th century can be seen, especially in the first years of the 19th century, which coincided with the instalment of the Conil almadraba ("de buche").

For the 19th century we have to base our data on the report "Memoria sobre las Pescas que se cultivan en las costas meridionales de España"("*Report on the fisheries from the east coasts of Spain"*) written by Father Mirabent in 1835. Analysing the figures of 50,000 tuna specimens per year for the almadrabas from Cadiz, and the same number for those from Algarve, it would mean catching 10,000 tuna specimens per year for each of these almadraba traps. In the opinion of Father Miranbent, the decline of the fishing of tuna was due to the change of winds or to water turbidness, and as he considered the unorderly proliferation of almadraba traps to have a negative effect, he proposed a unique association be created to be in charge of its exploitation. The improvements in the second half of 18th and 19th century can be partially attributed to the introduction of changes in the setting up of the traps.

For the 20th century the records of catches in almadrabas for the first half of this century are sporadical, and it has not been possible to establish a long and continuous series of records, but calculations indicate 5500 tuna specimens per almadraba per year. In 1928 a Consortium between the State and the almadraba companies was established, that was in force between 1929 and 1971. There are complete statistics for this period, which shows that 1936, 1937, 1938 and 1939 were extraordinary years. In 1937 more than 25000 tuna were caught. The closing of some almadrabas during the last years of the Consortium and its dissolution however didn't mean the suspension of the use of the almadraba traps. In 1975 the almadraba Barbate was again set up, and then followed the almadraba in Zahara in 1977 Tarifa's trap in 1981, and Conil's almadraba in 1986.

Based on the analysis of the tuna caught during the 20th century on one hand, and of the five previous centuries on the other hand, we can suppose that the low figures of catches in the second half of 20th century, can only be compared to those of the crisis in the final years of the 17th century and the first half of the 18th century, when other fishing methods were in place, i.e., there is a continuous and gradual decrease of the catches, in spite of improvements in fishing methods and technology. It must be taken into account that from 2008, imposed quotas condition the catch figures.

3. AN ECOFRIENDLY FISHING METHOD

KEY FINDINGS

- The Almadraba technique used to fish Atlantic bluefin tuna is an eco-friendly method, respectful of the environment and resources.
- **Its "bycatch" has high commercial value, with less than 1% being discarded.**
- The size and flexibility of the nets means: it doesn't harm the dolphin or cetacean populations, and doesn't have any influence on the local hydrological dynamics.
- The almadraba technique, as with any other fishing activity generates a certain amount of residues from vessels, whose control is regulated by the Marpol International Convention 73/78.
- **The almadraba fishing technique is an activity that generates hardly any organic waste**.
- **Energy consumption** generated by the structure of the almadraba **is very minimal.**

We can affirm that the Almadraba trap technique used to catch Atlantic bluefin tuna is respectful to the environment and to resources, due to several factor that characterise this type of fishing, including:

- Its seasonality.
- Its location.
- Its structure.
- Its function.
- The short time that the tuna remains within the almadraba's structure.

Currently the fishing season is concentrated into only 2 months, although the trap can be set for up to 6 months. Nowadays all the almadraba traps are of the *paso* type, because the fishing quota is reached within the first few months.

The seasonality and location, together with the fact that the visible part of the structure is very small, means that the visual impact to landscape is minimum, and as such the coastal landscape is not altered. With regards to the set up, as it is close to the coast and set parallel to it, it is a system that is respectful to the population of Thunnus thynnus, as only a small percentage of the total population that goes through the strait is caught.

The almadrabas are focus on Atlantic bluefin tuna, and the other small species of tuna that are caught are considered to be "bycatch". This is not the case for traps called *almadrabillas or almadrabetas*, whose objective catches are smaller species of tuna. Any "bycatch" in the almadrabas have a high commercial value, they are not discarded. One part is even given to the crew's fishermen as a part of their salary, as specified in the Labour Agreement in force (Article 14): "the companies will give to their workers four melvas or bonitos per week".

In studies performed about the "bycatch" in Portugal (Neves dos Santos, Saldanha, & Garcia, 2002) but whose results can be transposed to this art in all its locations, the "bycatch" is much lower than with other fishing gears, like for example the hake gill net fishery, with a bycatch in Italy ranging from 48% to 68% and around 15% in Portugal respectively with observed bycatch ranging from between 23% and 30% for the Algarve hake semi-pelagic longline. It is important to highlight from the scientific works that have been studied (Neves dos Santos, Saldanha, & Garcia, 2002) that the almadrabas produce a discard lower than 1% in weight,

and this value is significantly lower compared to other fishing methods. In fact Van Beek (1998) and Ymin et al (2000) reported discards of 25% and 98% for the Dutch beam trawl and Kuwaiti shrimp trawl, respectively. In Portugal, studies realised by Erzini (1998) showed discard ranging from 26% to 49% and from 9% to 12% for gill nets and long lines, respectively (Neves dos Santos, Saldanha, & Garcia, 2002).

On the other hand, as the structure of the traps consist of large scale mesh nets, the small percentage of caught tuna, compared to the total biomass, correspond to adult specimens that have already bred and have previously spawned on several occasions.

The size and flexibility of the nets means that:
- It doesn't harm populations of dolphins or cetacean
- It doesn't have an impact on local hydrologic dynamics

This fishing technique doesn't alter the seabed either. With regards to the seabed and benthic communities, as the traps are set in the area of the Gibraltar strait at a minimum distance from the coast, and it is made up of soft seabed soil, there are no problems of interaction with these communities, as there are for example from those that derive from fixed and permanent installations in other marine areas. Neither does it generate notable incidences on the local hydrodynamics. The almadrabas don't generate waste, don’t release polluting organic waste into the environment, as the tuna remain inside the net for only a few hours and are not fed. Also, as the fish are not handled on-board, there is no risk of organic matter discharged into the marine environment. Besides, the energy waste generated by the structure of the almadraba is very low, as the only consumption of energy is from the maritime signalling elements required by regulations.

Finally, we should point out that the emissions of polluting gases that can be produced by the fuel used for the vessels is perhaps higher than that produced by more modern motors, as the fleets used are older, but considering the amount of times these are used, the overall emission is low, as the vessels required to perform the catching of the specimens only move when there is the certainty that there are tuna inside the "*cuadro*" (death chamber).

Taking all these definitions into account, the fishing activity of almadraba traps, generate, as any other fishing activity, certain residues from the vessels, whose control is regulated by the Marpol International Convention 73/78, the international agreement that regulates the control process of discharge and waste generated on board a vessel, when they get to port. The dangerous waste, that is, the remainder of used motor oil and oil residues in general, are subject to specific legislation in each country.

As previously mentioned, with regards to waste production, the almadraba fishing method is an activity that generates hardly any organic waste. In the marine environment, large tuna are savage specimens that get trapped by the labyrinth of nets that create the structure of the almadraba, and the tuna remain in water for no more than a few hours, so the caught specimens are not fed, and therefore the production of organic waste is practically negligible in the sense of its influence on the marine environment.

Therefore, the greater volume of organic material that this activity produces is the production of organic by-products from the handling (fin removal, tail, head, gutting and slaughtering) of each specimen. The management of these by-products is assigned to a company managing this type of product.

4. GEOGRAPHICAL SCOPE FOR THE ALMADRABA FISHING METHOD

KEY FINDINGS

- I**n Portugal** there are currently three almadrabas with a license to fish Atlantic bluefin tuna. Other gears are not allowed to actively fish for this species.
- The great quantity of historical data about the activity of the almadrabas in Algarve (Portugal) proves the importance that tuna fishing has had in the past.
- Historically there has been a trade commerce of tuna catches from Morocco to Portugal.
- **In Spain**, the workforce of almadraba companies have traditionally been very extensive, and in 2005 the figure reached 344 workers. After an initial adjustment, the **almadraba fisheries from Andalusia** currently **employ a total of 292 workers.**
- In Spain the way of recruiting staff is with seasonal permanent contracts (6 months), creating 400 indirect jobs.
- **The structure of expenses generated by this activity is characterised as being clearly dominated by laboral expenses**, which amount to almost 70% of the total overall expenses.
- **External factors influence the broad range of variation in the income for catch** (environmental conditions, stock state, influence of other fishing techniques, market situation, etc.).
- The almadraba sector is one of the few fishing sectors that has a **Collective Bargaining Agreement**, with the first agreement being passed back in 1980.
- It is worth highlighting that the number of jobs per almadraba is an average of **43, compared to 10 jobs on a purse-seiner dedicated to bluefin tuna fishing in the Mediterranean Sea, 10 jobs on a surface longliner fishing in international waters, or just 6 on other longliners.**
- **The fishing industry is becoming vertically integrated** with the building of factories for the processing (quartering and freezing) and canning, to the commercialisation. The destination of those products, which started as being 100% destined for the Japanese market in the beginning of the 1980s, has changed, and now 50% is destined for the national market as gourmet products.
- In 2010 approximately **40% of the production of the almadrabas in Sardinia was designated for the local market, 30% for the European market, 20% for canning products and only 10%** was exported to Japan. This trend was very different to what took place during the period from 2003-2007, when exports to Japan reached 50% of the total production, and the trend was also followed for productions from Spain.
- The population of Sardinia is seriously concerned about the possible disappearance of the "almadraba", fearing the damage it would cost to the local economy in general, the uncertainty of tuna supply in the future, and for the lost of a deep-rooted tradition.
- The almadraba traps from Corcega generate 70 direct jobs (divided between fishermen, dock stevedores, canning factory staff and temporary staff). Indirect jobs can reach upwards of 100 staff (transport, maintenance, sellers, etc.).

- According to producers, the break-even point for each almadraba trap is 100 t per season/almadraba. Currently there is a quota of 165 t/ for all Italian traps.
- In Morocco, the first almadraba traps for tuna fishing were installed on the coast of Morocco almost 95 years ago. Currently there are 10 almadraba traps on the Atlantic coast.
- The analysis of catch shows that these have decreased since the 1960s. This trend may be related to the development of fishing vessels like tuna seiners and longliners in Mediterranean waters.
- The average capital invested per almadraba is 3.26 million euros. This investment is recovered in the short-medium term, as the annual profits per almadraba fluctuate from 90,000 Euros to more than 1 million Euros. The rate of return (ROI) of the almadraba is 8% over a 9-year period.
- The consultations with companies within this sector show that staff costs in Morocco are 20% lower than in Spain.

4.1. Italy

Currently there are three licenses for almadraba fishing methods in Sardinia (Addis, Secci, & Cau, Harvesting, handling practices and processing of bluefin tuna captured in the trap fishery: possible effects on the flesh quality, 2012): Isola Piana, Portoscuso and Porto Paglia. In 2011, due to the small quota assigned to almadraba fishing by the Ministry of Agriculture of Italy (82.2 tonnes), only two of the three traps were set.

In 2010 approximately 40% of the production of the almadrabas in Sardinia was destined for the local market, 30% was for the European market, 20% for canning products and only 10% was exported to Japan. This trend was very different to what happened during the 2003-2007 period, when exports to Japan reached 50% of the total production. During the 2008-2010 period, as a consequence of the crisis in the world markets, because of the increase in the cost of fuel and transport costs, exports seem to have been stabilised at 9%. Currently, the majority of the production designated to the local and Italian markets lists it as fresh produce, a high quality product for catering.

The bluefin tuna from the almadraba traps in Sardinia is regularly sold at the Tsukiji Japanese market at auction (90%). The price paid for the bluefin tuna from Sardinia is very variable, ranging from €5 to €45 per kg, depending on factors such as quality and daily quantity sold on the Japanese market. The most usual price of reference is 10€/Kg (PIAM, 2012). The price of the majority of bluefin tuna sold on the local market (Sardinia and the rest of Italy) varies, ranging from 7-9 €/kg. In the case of local restaurants (the specimens are sold without intermediaries) it is around 10 €/kg.

The sale price of the tuna in the shops varies ranging from 20 to 25 €/kg for the flesh known as "Tarantello" (between the dorsal area and the belly, adhered to the spine) and the "ventresca" (the fatty part and soft belly, called “toro” on the Japanese and international markets).

The fishing techniques, the handling and the processing play an important role when trying to get the highest price on the market[3].

Historically a great part of the production of the almadraba traps from Sardinia was stored in barrels filled with olive oil.

From 1860, the use of cans to pack the tuna started to become the general technique used, thanks to the technique developed by the French artisan Nicolas Appert (Appert, 1810). Since the beginnings of the 1900s, large investments were made in the building of factories for the canning of food in Sardinia. Since 1950 there were already registered brands that used diverse labels: Pasquale Pastorino, Marchese di Villamarina and Tonno di Carloforte for the South tuna district, and the brand Tonnara Salinas in the North (now closed down).

In the case of a great offer of fresh tuna, the alternative to the manager lowering the price is to limit the supply of fresh tuna available on the market, favouring the storage of the fish for the canning industry. In this sense, with the objective to better diversify the markets, a small canning factory was built in 2009 on the almandraba Isola Piana (Carloforte).

The total production was 5,000 cans (18 t) in 2009 and in 2010 the production grew, to hit 80,000 cans (50 t). The production has been diversified by producing three types of presentations of the tuna: "tuna in oil" (40,000 cans in 2010), "Tarantello in oil" (25,000 cans) and "ventresca (toro) in oil" (15,000 cans). Retail process for canned tuna is 12 €/kg for tuna (18 €/kg wholesale), 14 €/kg for Tarantello (22.50 €/kg) and 16 €/kg (25 €/kg) for "ventresca". The price difference for the canned products is apparently due to the quality of the canned product.

According to the latest population census (2010), the residential population in Carloforte was 6465 (3210 males, 3255 females) and 5280 (1423 males and 1496 females) in Portoscuso. The population surveyed (100 people per town, Carloforte and Portoscuso) consists of 63% men and 37% women. More than 50% of the sample population have relatives who work or have worked in the trap fishery, including previous generations (grandfathers and great-grandfathers). Only 50% of the population know what ICCAT is and about its programs of conservation for the bluefin tuna, and only 12% know details of regulations. The training level is basic (PIAM, 2012).

The entire sample population is seriously concerned with the possible disappearance of the "almadraba", fearing the damage it would mean to the local economy in general, the uncertainty of future tuna supply, and for the loss of a deep-rooted tradition.

Historical data facilitated by Angotzi (1901), Maurandi (1989) and Conte (1985), highlight the separation classification of the almadraba staff into two groups: fishing crew (tonnarotti), whose figures vary between 70 and 100, depending on the importance of the almadraba, and a land crew, made up of 20 permanent staff and at least another 20 seasonal staff. Until 1960 the entire workforce lived in the almadraba plant itself, constituting a small town of fishermen. Data about the staff directly employed on the trap fishery for the period between 2007-2010 is shown in Table 2.

[3] Addis, Secci, & Cau, Harvesting, handling practices and processing of bluefin tuna captured in the trap fishery: possible effects on the flesh quality, 2012

In 2010, the direct employees constituted 45 fishermen, and an addition of the following should be added to this figure: 10 employees on the dock, the staff of the canning factory, 4-6 divers and 10-17occasssional personnel. Indirect employment can reach the figure of 100 people (transport, maintenance, sellers…etc.).

Temporary staff (Tables 2-3). Indirect employment identified by the management adds up to approximately 100 people (including: transport companies, maintenance artisans, local auction seller, etc.).

The management of the traps is performed by three independent companies: Almadraba Isola Piana, managed by Carloforte Tonnare PIAM Srl; Almadraba Portoscuso, managed by Tonnara Su Pratt Portoscuso Srl. These jointly formed the "Associated Consortium of Sardinia Traps" (Consociazione Consortile delle Tonnare Sardes). And finally, the Porto Paglia trap is managed by Tonnare Sulcitani Srl. Since 2010, with the objective of sharing the operational costs, these traps have been jointly operating, using the same logistical organisation and fleet, dock landing areas, buildings for the processing (quartering and cleaning, freezing and packaging for the delivery) and storage space for the supplies from the traps.

Currently there are 3 operative traps in the southwest of Sardinia. These were the traps working in Sardinia from the end of the 17th century: Carlofonte, Isola Piana, Portoscuso-Capo Altano, Gonnesa-Porto-Paglia, and the structure of the traps consisted of 5 chambers (*grande, bordonaro, bastardo, chamber* and the *death chamber*). The Department of Biology and Environment of the University of Calgari has developed a research piece on this fishing method. During the last 10 years the situation in Italy has changed, from two active almadrabas in 2004 (Isola Piana and Portoscuso) to the current three, moving from 4 active in the 2008/2009 season.

Now, the number of direct jobs is 45, but with the established quota only 35 of these people are paid (the total number of jobs is 105). According to the producers, the break-even point for each almadraba is 100 t per season/almadraba, and currently there is 165 t/all the Italian almadrabas. Indirect employment has decreased to only 6 people per almadraba.

If we compare the catch by almadraba with that of other fishing techniques 100% of the 2014 quotas (around 1950 tonnes) would be divided as follows: the seiner fleets were assigned 74.4%, (1451 t), the longliners 13.58% (265 t, which was sold to fleets using other techniques), almadraba 8.46% (165 plus 66 tonnes purchased from the longliners). Sport fishing amounts to 0.51%. There is an undivided quota considered a revolving fund of around 60 tonnes (3.03%).

At the end of the 2013 season approximately 300,000 tonnes of tuna were freed from the traps during the last year, and in previous seasons this figure was higher (around 400,000 in 2012).

Regarding the number of job positions involved in the different systems of fishing, we know that the fishing vessels (seiners, longliners) have an average of 8.12 people per vessel, for a shorter period of catch than the almadraba, and with less crew. The number of vessels is:

a) 12 seiner fleets authorised in 2014;
b) 30 longliners in 2014.

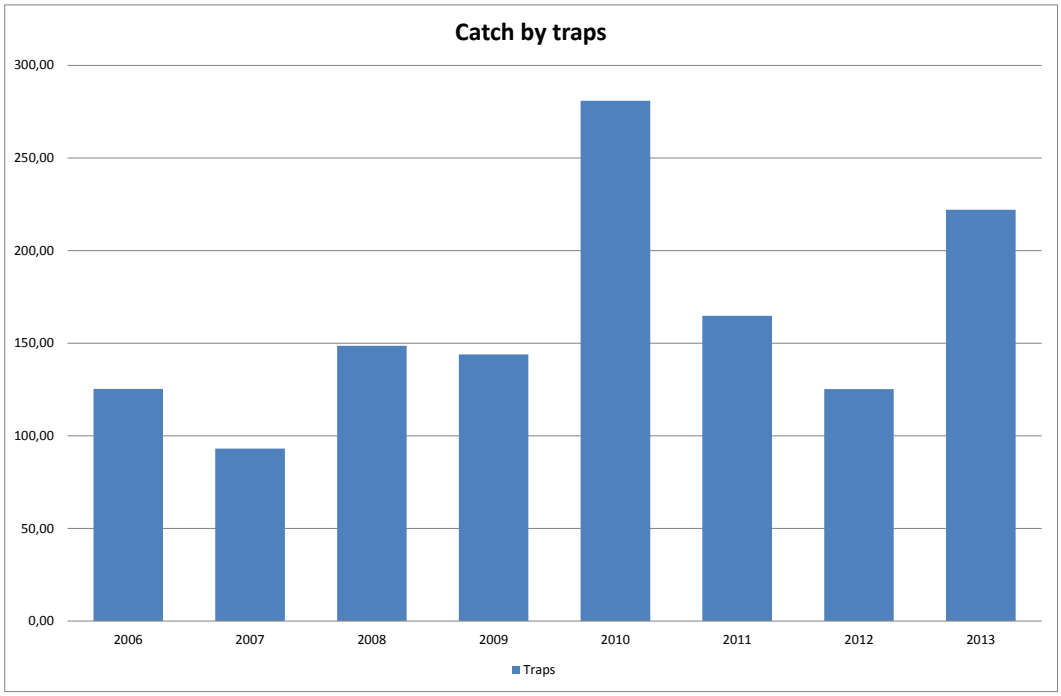
The Italian sector of almadraba fishing has advised us of their dissatisfaction, because they don't have individual quotas, but only an amount for the fishery as a whole, unlike the others, who have individual specified amounts, that is, each vessel has its own quota. Their demand is for that quota to be divided between individual capacities, according to the historic volume of fishing.

Another demand is regarding the existing annual delay for the assigning of the quota by the government, which apparently as consequence has meant that they have had to have the fish kept for up to a month inside the traps, waiting for the permit to "raise" them. Also the covering of the cost of the National Guard, and lastly, but not of least importance, the frequent and strict controls by the Italian Coast Guard.

It was communicated to us that during the 2013 season, until the 16th of May, they weren't told how much tuna corresponded to their quota, when the almadrabas had been ready since the middle April. The decree wasn't published until that date, which meant having to keep the tuna inside the net, paying workers who couldn't yet work and who had to stay on land for more than one month, besides the risk of damages produced in the traps.

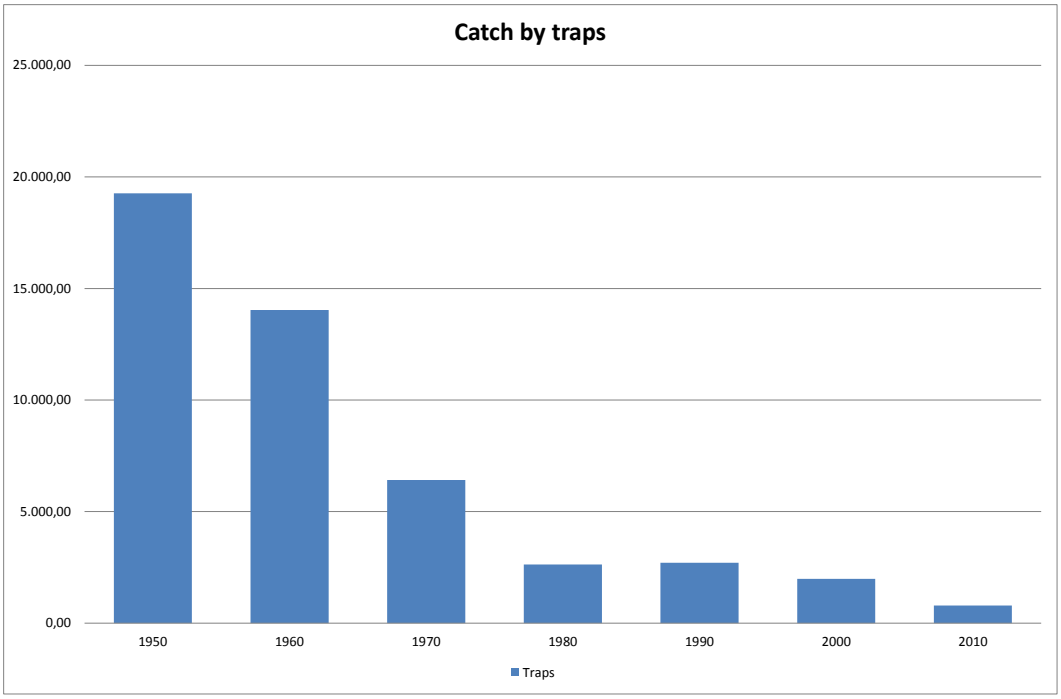
A study of the catch data from 1993 – 2010 and of the standardised CPUE of the almadraba fisheries in Sardinia (Occidental Mediterranean, Italy) has been performed. An important increment of the standardised CPUE has been noted, together with an important decrease of the average weight. There has been a significant increase of catches since 2007, along with a slight increase to the average weight. This trend could be a consequence of the regulation measures. The results highlight that the almadrabas provide valuable scientific information about the tuna population. The frequency of weights shows a gradual reduction in the biggest specimens as a consequence of the fishing, although it looks like it increases slightly from 2007.

Figure 2. Evolution of tuna catch in Italy



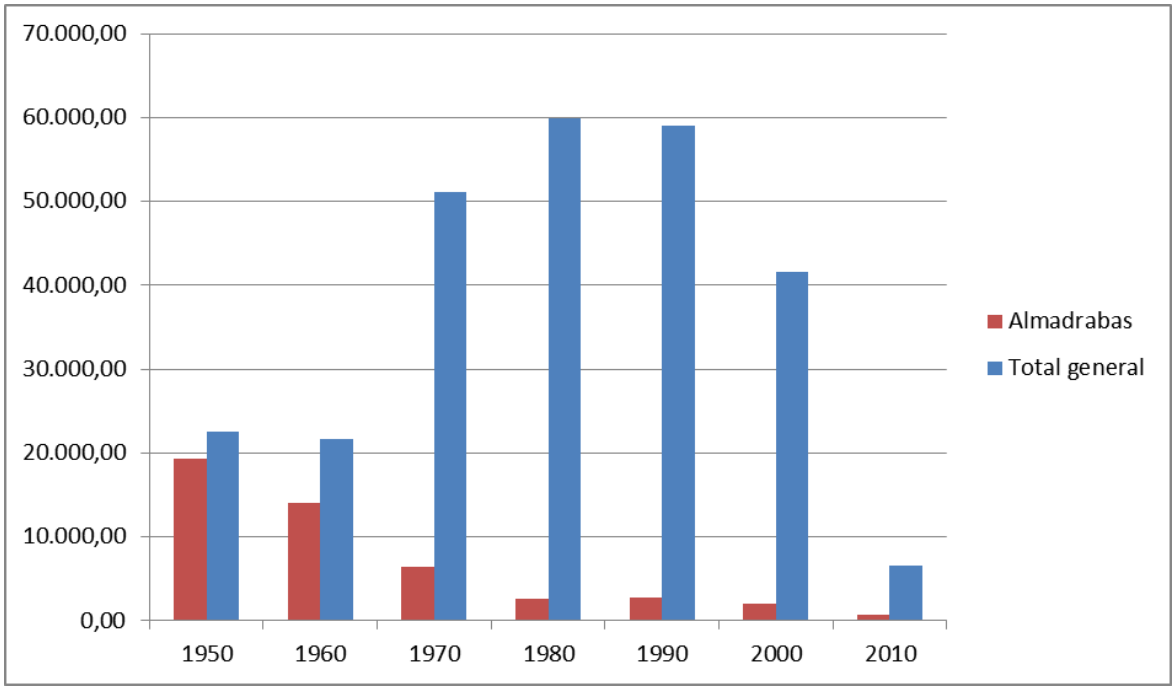
Source: ICCAT 2014

Figure 3. Evolution of tuna catch by traps in Italy by decades



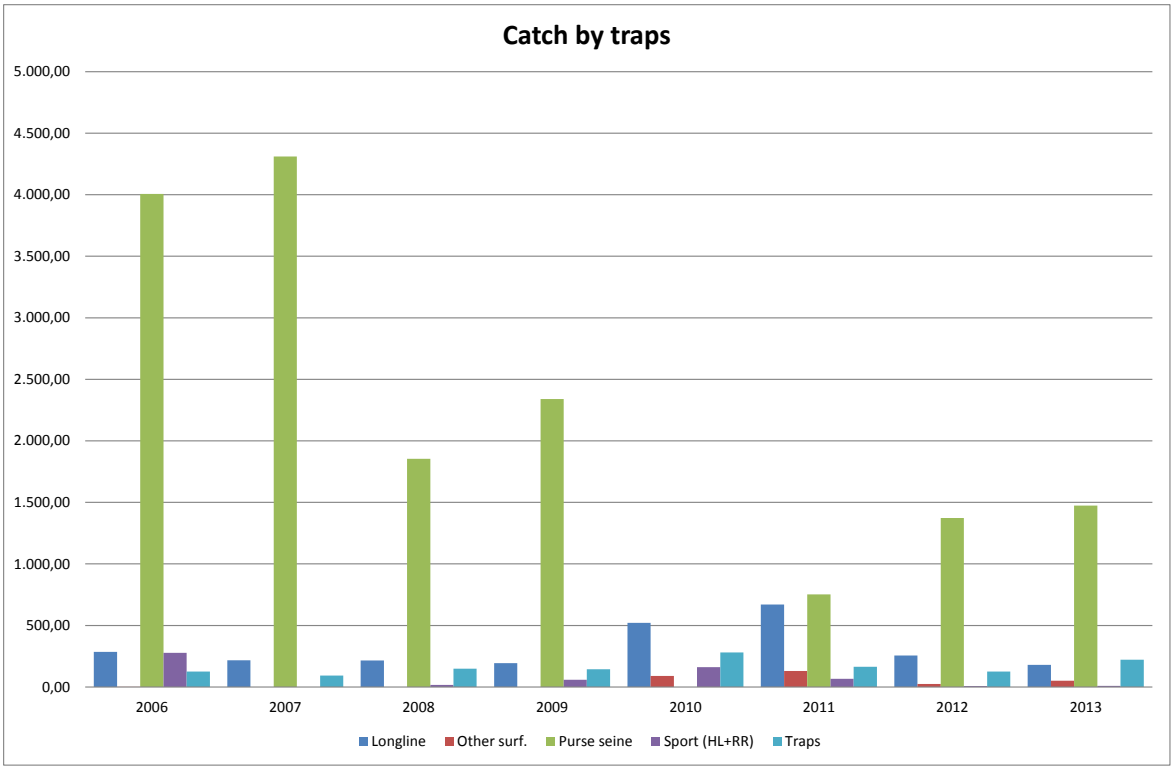
Source: ICCAT 2014

Figure 4. Evolution of the percentage of catch in almadraba versus total catch in Italy



Source: ICCAT 2014

Figure 5. Evolution of tuna catch by type of fishing system in Italy since 2006



Source: ICCAT 2014

Table 2. . Evolution of tuna catch by type of fishing technique in Italy

	Longline	Other surf.	Purse seine	Sport (HL+RR)	Traps	Total general
2006	286.06	0.10	4,006.14	277.45	125.32	4,695.07
2007	217.14		4,310.85		93.05	4,621.04
2008	215.62		1,853.51	16.58	148.56	2,234.28
2009	193,20		2,339.38	58.21	143,94	2,734.73
2010	520,54	89.92		161.26	280.83	1,052.56
2011	669,52	130.04	752.15	66.05	164.75	1,782.51
2012	256,35	24.61	1,373.83	7.57	125.22	1,787.58
2013	180,38	51.14	1,474.50	9.71	222.00	1,937.73
Total general	**2,538,81**	**295.81**	**16,110.38**	**596.82**	**1,303.68**	**20,845.50**

Source: ICCAT 2014

4.2. Portugal

Nowadays there are 3 almadrabas in Portugal with authorisation to fish Atlantic bluefin tuna. The evolution of the number of almadrabas in the last 10 years has been of 1 installation until 2011, and from this date 2 more have been installed. The employment on each of these is 135 direct jobs, and the figure for indirect jobs is around 300 people.

Portugal doesn't allow the use of other fishing gear to actively fish bluefin tuna. Only accidental catches are allowed (this means 5% of catch on-board, under the ICCAT REC 13-07) surface longliners and "bait boats". There are hardly any catches of bluefin tuna in Portugal using any technique other than almadraba traps, which are diversifying in species caught and in activities (tourism). It is important to highlight that in Portugal there is no any fattening "farms" (*alevamento*) authorised by ICCAT, but fattening is performed in the almadrabas themselves, and this must be specifically authorised, and listed on the page of ICCAT as a fattening facility. If the tuna is fattened in an almadraba (which is a fishing technique) without authorisation for "fattening", the weight of the fish measured is the weight when slaughtered and it is considered as catch weight, and this practice can give problems to clients that later buy the tuna, due to the lack of consistency regarding the weight.

The large amount of historical data concerning the activity of the almadraba traps in Algarve (Portugal) shows the importance that tuna fishing has had in the past. Records of daily catches, including information that details the number of tuna specimens with their respective weights, have been analysed, and thanks to this it has been possible to achieve a better understanding of the long-term fluctuations of bluefin tuna (Gil Pereira, 2012).

Historically there has been a commerce of tuna catch from Morocco to Portugal, from 1948 to 1965 that has been found (Gil Pereira, Bluefin Tuna imported to Portugal from Moroccan Traps, 2011) imports of 56,500 tuna specimens have been verified, even with peaks of 7900 tuna specimens in 1960, and it has been verified that the average weight has been growing, reaching an average weight of almost 220 kg in 1963, with a catch of 1,277 tuna specimens.

There are currently 3 almadraba traps in Portugal, which caught 233.19 t during the last year registered by ICCAT (2013). The evolution since 2006 shows a growth of almost 850%.

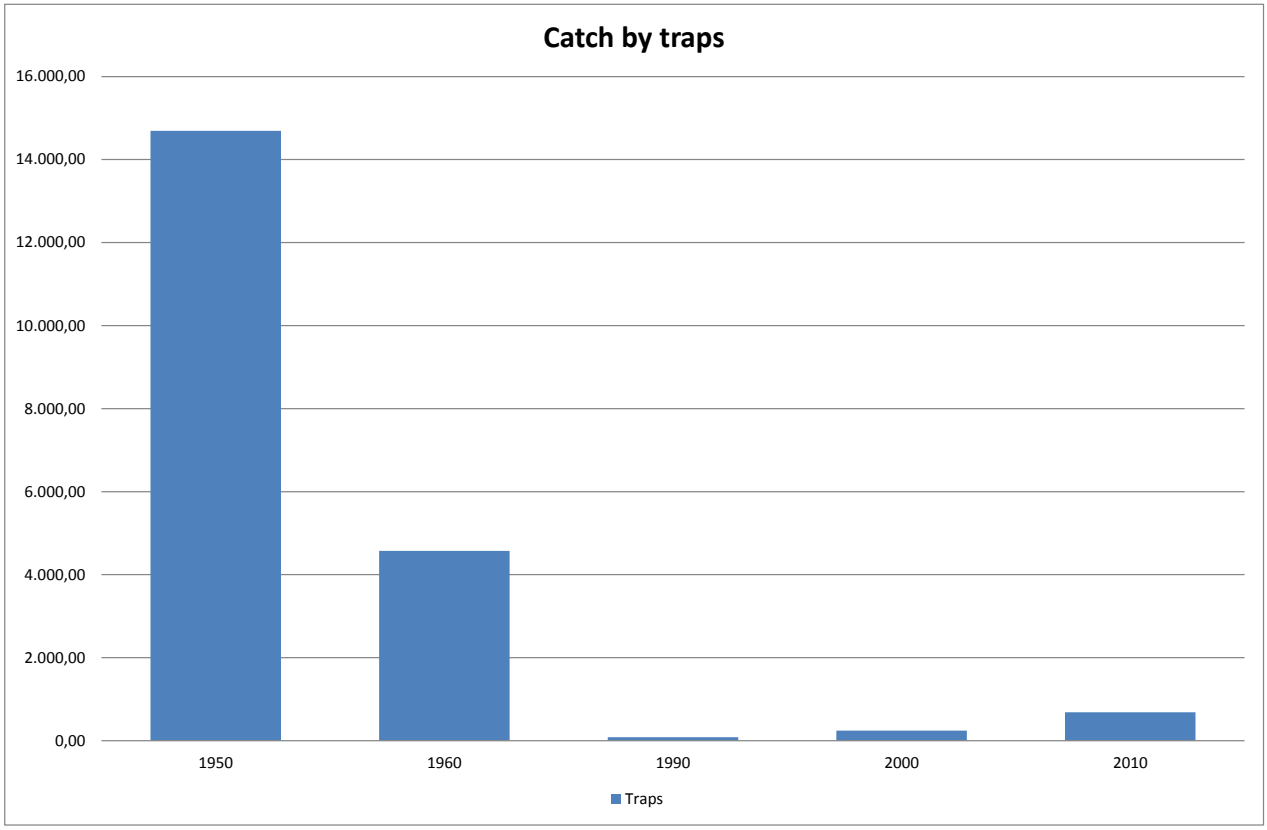
Table 3. Evolution of catches by "almadrabas" in Portugal

Years	"almadrabas"	Total general	Percentage of total
2006	24.56	107.43	22.86
2007	22.6	29.29	77.15
2008	24.39	36.48	66.85
2009	46.19	53.39	86.51
2010	57.1	57.8	98.78
2011	179.92	180.25	99.81
2012	215.38	223.05	96.56
2013	233.19	235	99.22
Total	**803.33**	**922.67**	**87.06**

Source: ICCAT 2014

Although catches by the "almadraba" fishing gear have risen in relative weight in the period of 2006-2013 (Table 5), if analyzed by decades the ICCAT data on captures (since those data exist -1950), it is observed a large decrease, from 14,690 tonnes to 244.25 tonnes in the last full decade (Fig. 10).

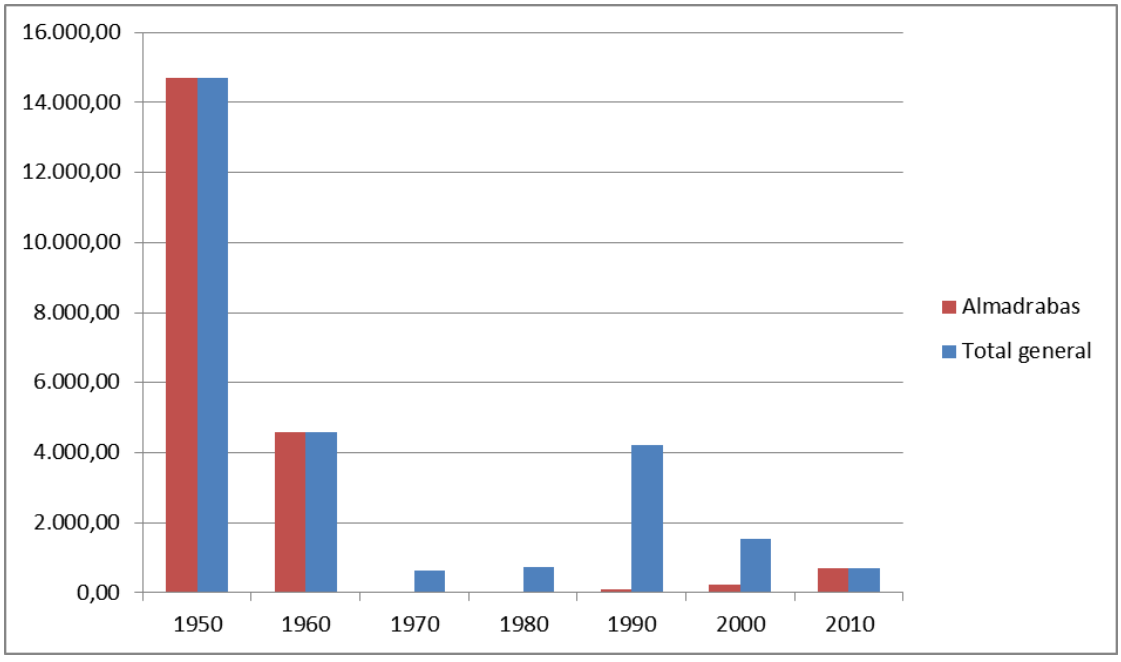
Figure 6. Evolution of catches by "almadraba" in Portugal for decades



Source: ICCAT 2014

Comparing since 1950 looks like in the last decade there is a revival of "almadrabas"

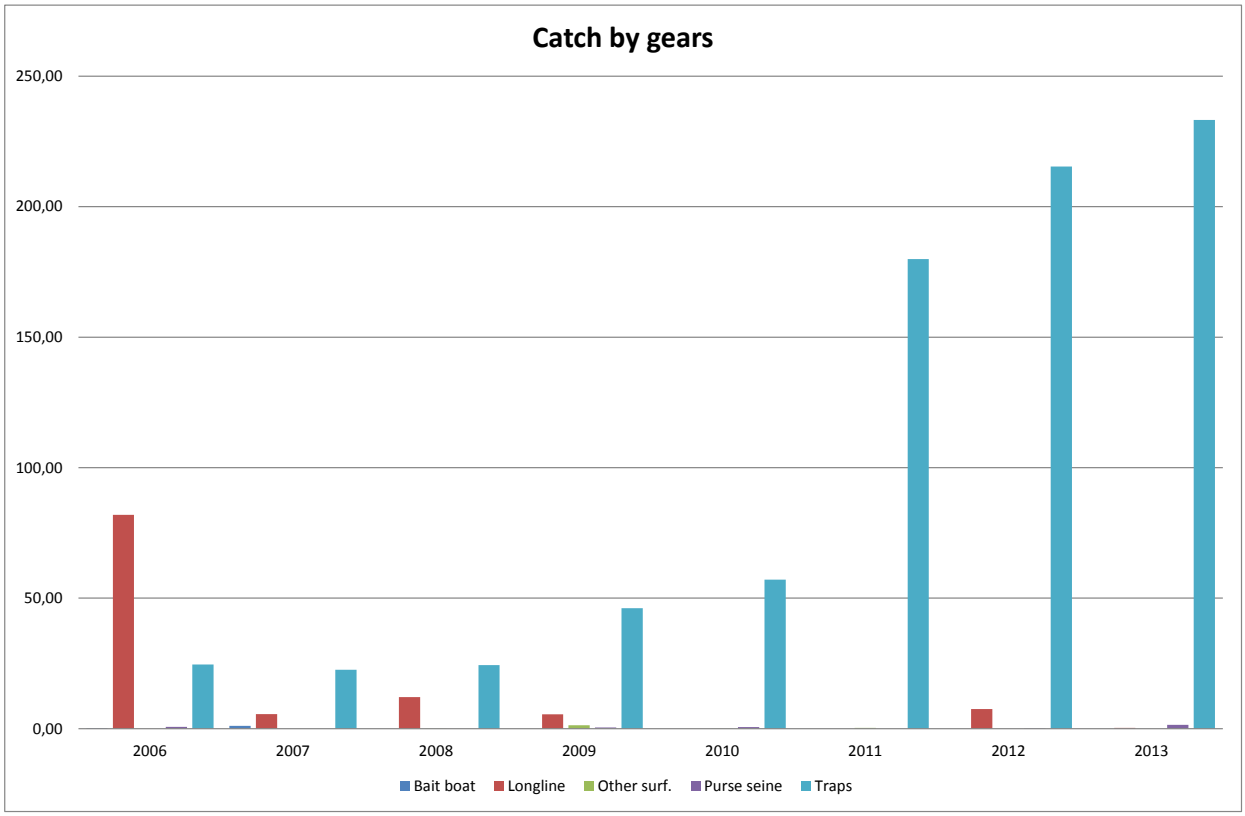
Figure 7. Evolution of the percentage of catch of bluefin tuna per almadraba trap against the total catch in Portugal per decade



Source:ICCAT 2014

Comparing the amount caught by the diverse types of fishing methods we see that the catch by almadraba trap has evolved positively whilst other fishing methods like longliners, with which previously caught more tuna, has decreased. Currently, of the total of 235 t, 233.19 t was caught using the almadraba method.

Figure 8. Evolution of catch by type of fishing method in Portugal from 2006



Source: ICCAT 2014

Looking at data since 2006, we notice the significant amount of tuna catches in the almadraba versus from other fishing methods. Only longline fishing in 2006-2008 shows significant values.

Table 4. Evolution of catch by fishing method

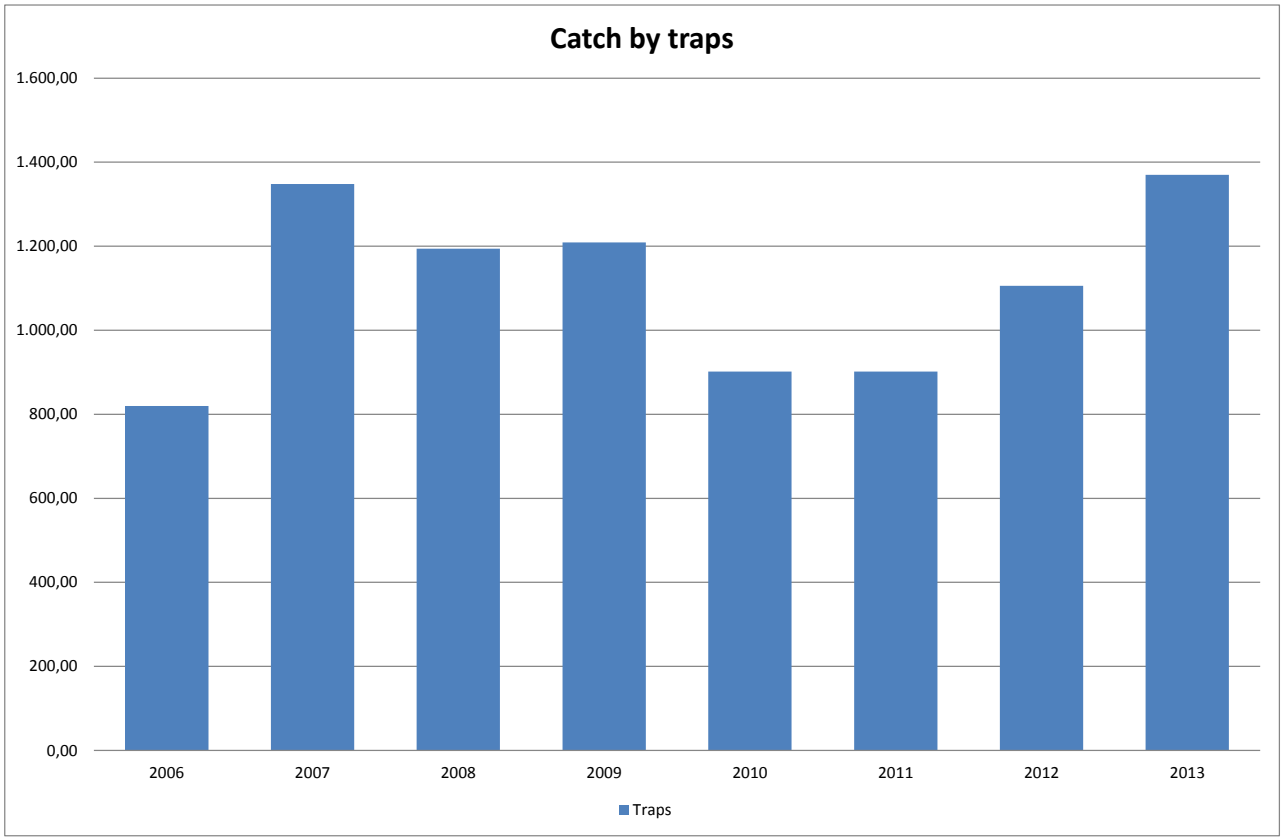
	Bait boat	Longline	Other surf.	Purse seine	Traps	Total
2006	0.22	81.95		0.69	24.56	107.43
2007	1.09	5.60			22.60	29.29
2008	0.00	12.07	0.02		24.39	36.48
2009	0.00	5.48	1.28	0.44	46.19	53.39
2010			0.08	0.62	57.10	57.80
2011			0.33		179.92	180.25
2012		7.53		0.14	215.38	223.05
2013	0.00	0.34		1.46	233.19	235.00
Total	**1.31**	**112.97**	**1.71**	**3.36**	**803.33**	**922.67**

Source: ICCAT 2014

4.3. Spain

Almadraba traps don't have great significance on the Spanish fishing sector. In the Andalusian Autonomous Region, where the 4 almadrabas are located, together, in the year 2010, they represent a GVA of €9,788,000, which is 0.01% of the total GVA in Andalusia, and 5.2% of the fishing sector GVA. In the year 2012 the participation of the almadraba traps on the production at base prices in the fishing sector from Andalucía was 2.3%, and through time this amount has been quite stable. There are no indicators for female employment, according to the data for the total employment for extractive operations, with 99.5% being male (Consejeria de Agricultura, Pesca y Desarrollo Rural, 2013). This seems to be common for all almadraba traps due to the physical work that this type of fishing technique requires.

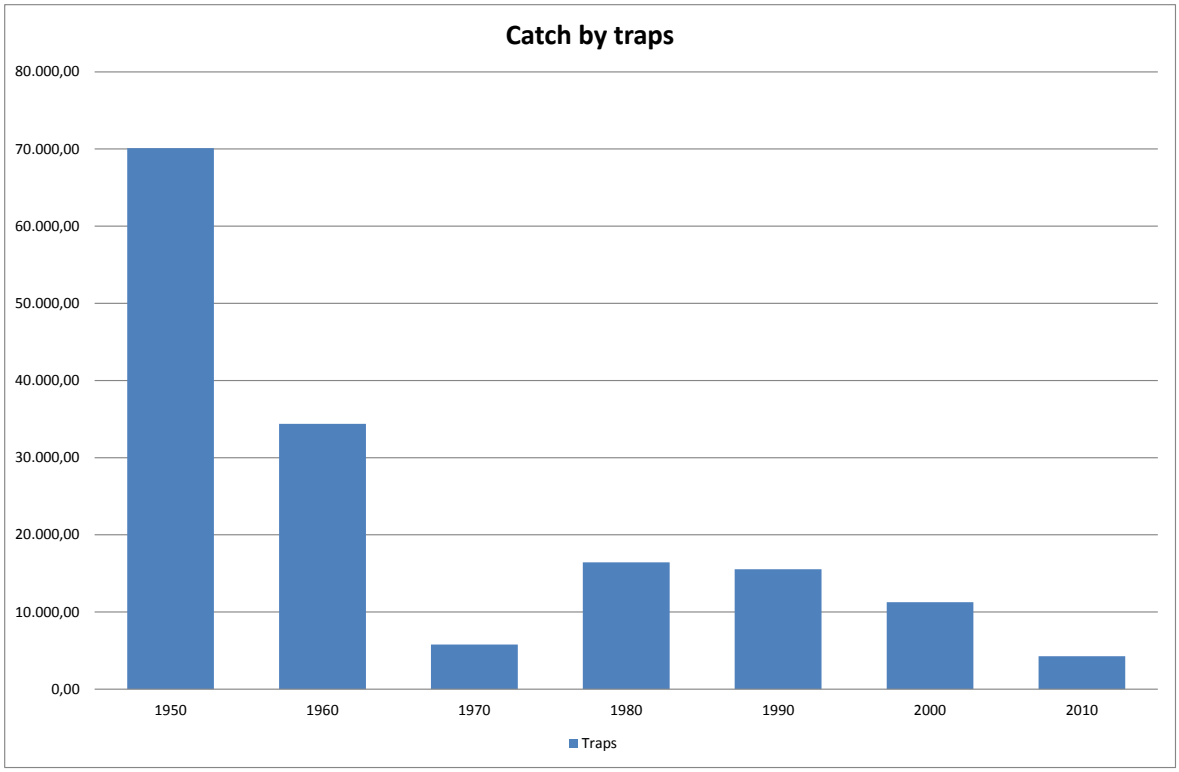
Figure 9 Evolution of tuna caught using almadraba traps in Spain



Source: ICCAT 2014

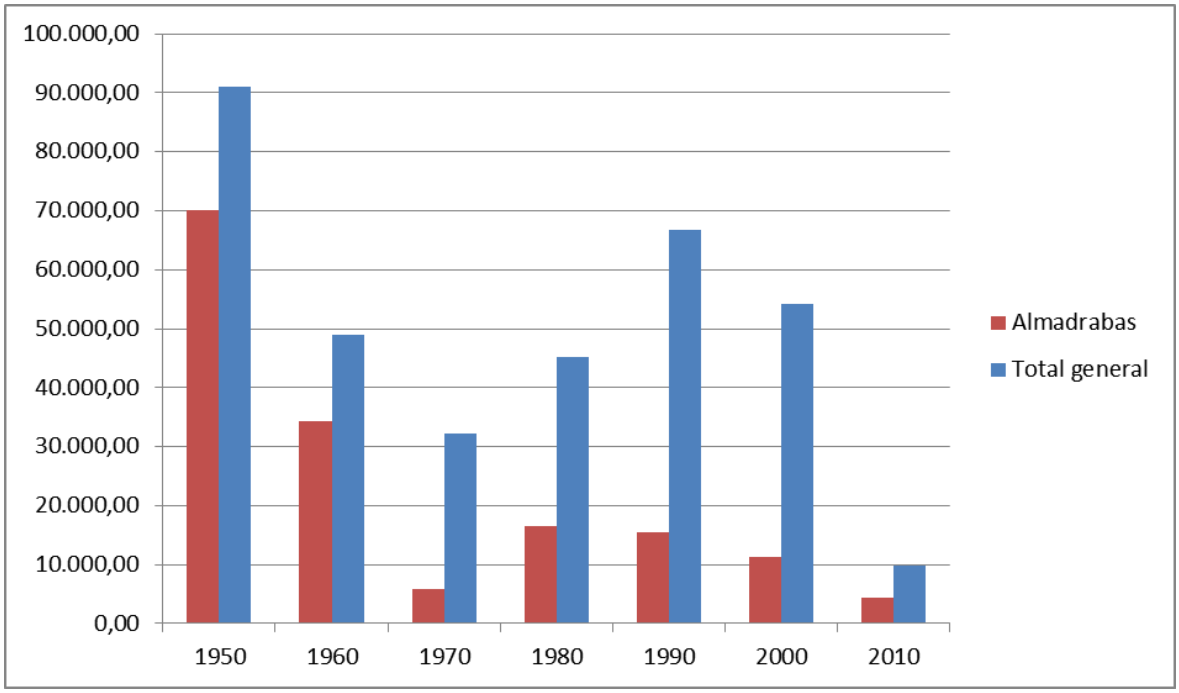
Comparing the catches of bluefin tuna caught using almadrabas since 1959, a strong decrease in the total amounts can be seen, and it is only with the data of the first half of the decade from 2000 - 2010 can some recovery be seen. During the year 2013 1,369.98 t of tuna was caught using almadraba, which means an increase of 67% against the 819.76 t in 2006. This increase is due to the purchase of quota from other fleet sectors, as this has been kept fixed at 657 t.

Figure 10. Evolution of tuna caught using almadraba traps in Spain per decade



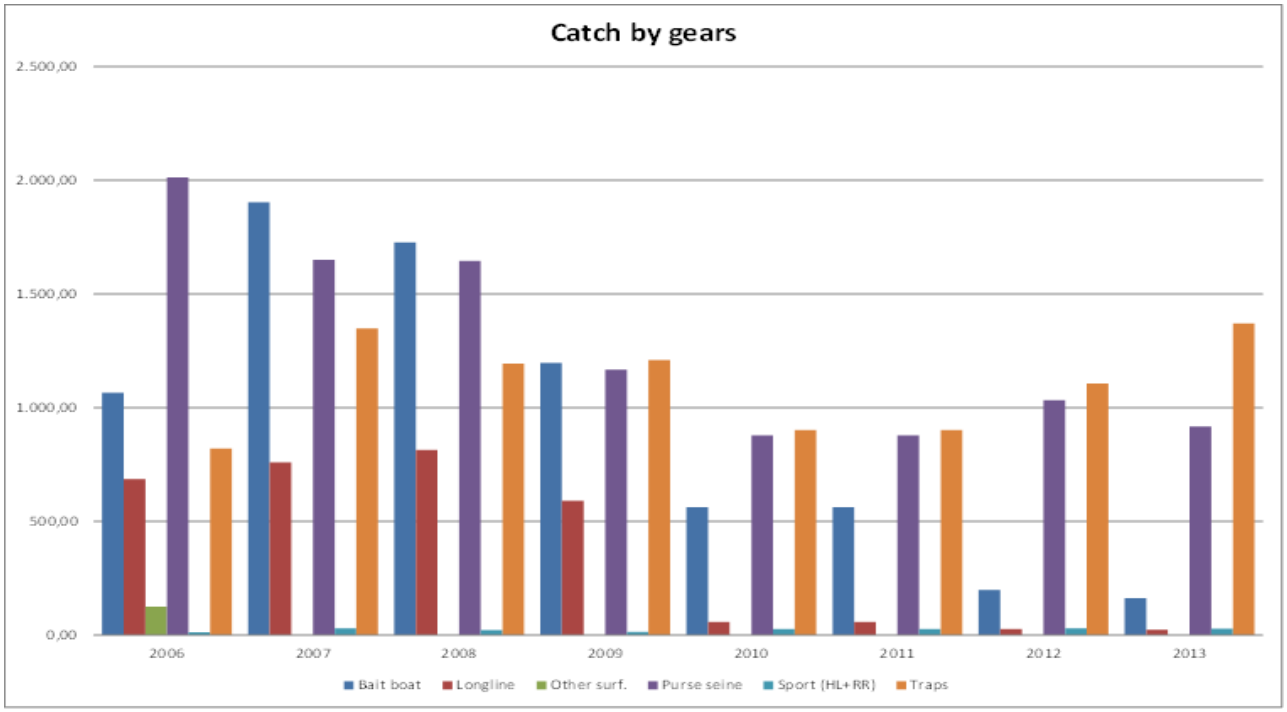
Source: ICCAT 2014

Figure 11. Evolution of percentage of bluefin tuna caught using almadraba traps against the total caught in Spain per decade



Source: ICCAT 2014

Figure 12. Evolution of tuna caught by type of fishing technique in Spain since 2006



Source: ICCAT 2014

Table 5. Evolution of tuna caught by type of fishing technique in Spain

	Bait boat	Longline	Other surf.	Purse seine	Sport (HL+RR)	Traps	Total general
2006	1,065.13	686.89	124.92	2,012.80	12.01	819.76	4,721.50
2007	1,902.81	758.65	40.00	1,649.40	30.41	1,348.32	5,690.00
2008	1,726.91	814.03	0.60	1,645.13	21.38	1,194.26	5,402.30
2009	1,197.42	590.42	0.00	1,166.69	14.07	1,209.17	4,177.76
2010	562.41	57.81	0.00	877.05	26.43	901.91	2,425.60
2011	562.41	57.81	0.00	877.05	26.43	901.91	2,425.60
2012	197.39	26.33	0.00	1,033.75	29.32	1,105.98	2,392.76
2013	162.72	23.98	0.00	917.43	27.75	1,369.98	2,501.85
Total	**7,377.20**	**3,015.90**	**125.92**	**10,179.29**	**187.80**	**8,851.27**	**29,737.39**

Source: ICCAT 2014

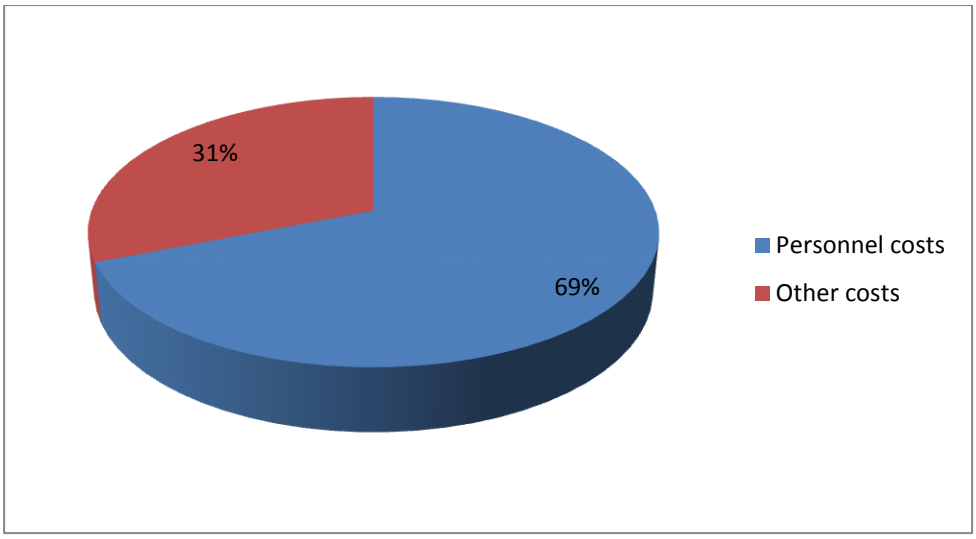
During the last year for which it has been possible to gather data (2011), the distribution of the sold catches amongst the four almadraba traps from Andalusia shows that three of them got 92% of the overall tonnage, with the almadraba "Ensenada de Barbate" being left out of these three, with the remaining 8% and with a catch of only 276 tuna specimens. The decrease of market production from this almadraba from Barbate is partly due to a percentage of the specimens caught being designated to fattening in cages. The company kept tuna specimens in its pools in the sea until mid October. In this way it was able to take the product to market out of season, with the subsequent profitability advantages that this implies. At the end of the year the result of fattening the tuna has been 499 tons of high quality Atlantic bluefin tuna, sold at a price of 11 euros per kilo, a price 17.4% higher than the price reached in origen and before the fattening. (Consejería de Agricultura y Pesca, 2012).

According to a report from the sector itself (Crespo, 2014), the workforce of the almadraba companies have traditionally been very extensive and in 2005 it amounted to 344 workers. This figure has been reduced over the last few years due to the pressure that cuts to the fishing quota within the sector have meant. After an initial adjustment, it is reported that the almadrabas from Andalusia employ a total of 292 workers (direct jobs). That is, the workforce has been reduced by an average of 15 %. This high number of jobs is because the fishing system is based on traditional techniques, barely mechanised, which requires the participation of a high number of workers.

The contract types of the workers are generally seasonal permanent (6 months), creating 400 indirect jobs in the sectors for the construction and maintenance of vessels (bankside carpentry), and processing and commercialisation of fish. According to statistical data from the Andalucian Government (2012) the figure is lower (185), but this refers exclusively to members of the vessel's crew, dividing this as follows: 111 in Barbate (where there are 2 almadrabas), 41 in Conil de la Frontera, and 33 in Tarifa.

However, the structure of the activity's expenses is characterised as being clearly dominated by the labour cost, which represents almost 70% of the total expenses, as can be seen in Figure 9.

Figure 13. Primary distribution of expenses for the Spanish almadrabas

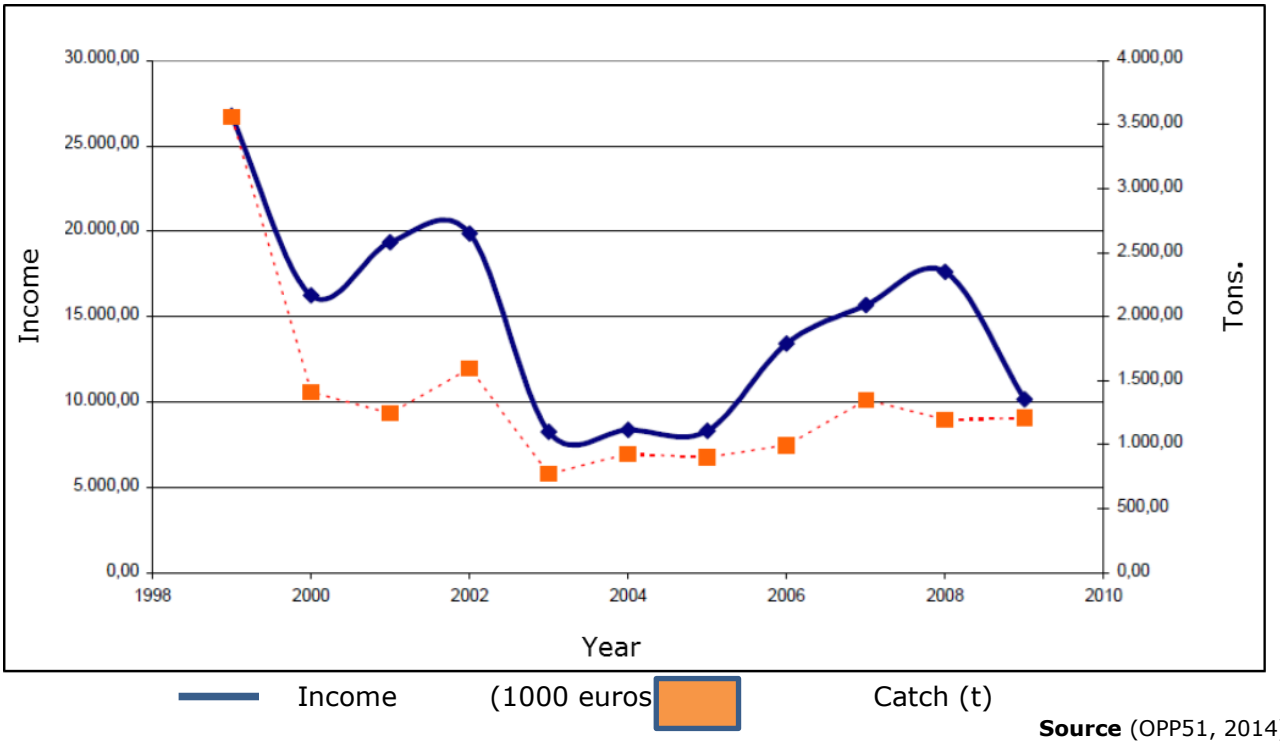


Source: com. Pers. Familia Crespo, 2014

Whilst the expenses of the activity can be considered as constant, the income depends mainly on the catches of bluefin tuna, as well as on the price marked by the local and international markets.

There are broad ranges of variation in the income for catches, influenced by external factors (environmental conditions, state of the stock, influence of other fisheries, situation of the market, etc.) established in the section 'DETERMINING FACTORS FOR THE CATCH IN THE ALMANDRABA TRAPS**Error! Reference source not found.**. All these variations are reflected on the lmadrabas annual income, although we again insist that the tuna catches are the variable that more directly correlates with the income, as shown in the following graph (OPP51, 2014).

Figure 14. Evolution of income and catches of the almadraba sector in Spain



Source (OPP51, 2014)

According to reports from the OPP51, "in the years when the income didn't reach the necessary minimum amount to cover expenses (which as we have previously shown can be almost considered as fixed amounts), they should use the reserves of profits that companies obtained during thriving seasons, which is normal in businesses with the existence of cycles associated mainly to biological and environmental factors". Continuing with the information obtained from the analysis undertaken by the OPP51, "in this way, and even with said cycles, the sector obtained an annual joint profit of approximately 2.5 million euros in the 10 years prior to 2009. During this period (the 10 years prior to 2009, the normal operation scheme of the almadrabas generated contributions to the State as corporate tax of more than 14 million euros and, due to the activity being developed in Maritime-Terrestrial Public Domain (DPMT) and the Public Port Domain, have also been paid more than 4 million euros to the government in the concept of taxes and royalties. The contributions paid to the Social Security system in the said period were approximately 20 million euros. As a consequence of the decrease in quotas from the year 2008 all of this has changed. Analysing the significance and evolution of total employment, it is seen that it is hardly significant compared to the total number of jobs in the fishing sector (60,580, MAGRAMA 2013). Employment on the almadrabas is stable, and it is regulated every year by a Collective Bargaining Agreement (2014), passed on the 17 September 2014, where the working day and job contract, hourly pay and bonus pays, compensation for illness and accident, the wage table and other issues related to the laboral activity were established.

Currently there are 400 employees in the almadrabas if we take into account the shipyards and the processing plants (quartering, processing and commercialisation).

Table 6. Employment in the fishing sector in Andalusia (Spain)

Year	Jobs on the almadrabas	Total fishermen	Number of almadrabas
1985	152	22,062	5
1986	152	20,826	5
1987	152	18,097	5
1988	163	18,644	6
1989	163	18,772	6
1990	163	18,438	6
1991	163	18,335	6
1992	152	17,307	5
1993	152	16,563	5
1994	137	15,797	4
1995	137	15,306	4
1996	137	14,634	4
1997	137	14,011	4
1998	137	13,187	4
1999	137	12,413	4
2009	300	7698	4
2010	170	6745	4
2011	170	6 217	4

Source: Junta de Andalucía. Memorias de Producción Pesquera

It is worth noting that the number of jobs per almadraba is an average of 43 people, compared to 10 jobs on a purse-seiner dedicated to bluefin tuna fishing in the Mediterranean Sea, 10 jobs on a surface longliner fishing in international waters, or just 6 positions on other longliners.

The fishing industry is becoming vertically-integrated with the building of factories for the processing (quartering and freezing) and canning, to the commercialisation. The destination of those products, that started by being 100% designated to the Japanese market at the beginning of the 1980s, has changed, and now 50% is destined for the national market as gourmet products. The average price of the different products of the percentage that is exported to Japan ranges from 11.31 €/kg for the exports of fresh tuna, 19.70 €/Kg for frozen tuna and 8.65 €/Kg for tuna fillets. We understand that the higher price of frozen tuna is due to the delivery costs of fresh tuna not being paid for by the supplier.

The Spanish almadraba sector, represented in its majority by the OPP 51, has just presented a production and commercialisation plan to the Fishing Secretariat General.

Currently the almadraba traps are making a purchase of quota, an example of this is the 2014 purchase of the whole quota (450 t) of the Basque fishermen ("arranchales"). It must be taken into account that almadraba traps catch tuna specimens that are more than 14 years old, which weigh an average 150-200 kg, whilst Basque fishermen catch younger tuna, which weigh 40-50 kg.

Barbate is going to become the first fish farming town in Andalusia, because there almost 1000 t of tuna that are going to be fattened, and also another 500 t of gilt-head bream and seabass.

4.4. Morocco

In 2013 there were 10 almadrabas installed in Morocco, all of them in the waters of the Atlantic Ocean. The period of activity has been from April to July, but with the reduction of quotas, the period of activity has been mainly contained to May. The freeing of 35,500 bluefin tuna specimens in 2013 after the quota of 7,455 t had been reached must be highlighted.

The first traps for tuna were installed on the Moroccan coast almost 95 years ago. This fishery in Morocco is the most important one, as its catches amount to 55% of the total tuna caught using this technique (Abid, Benchoucha, Belcaid, Lamtai, & El Fanichi, 2012). For it to function properly a workforce of approximately 50 fishermen, 6 divers, 2 mechanics, 2 vessel captains and one almadraba captain is required.

Historically, the Mediterranean almadraba traps have intercepted the Atlantic bluefin tuna during the migration transit in search of food from the Mediterranean Sea to the Atlantic Ocean. On the other hand, the Atlantic almadraba traps have caught the tuna during their reproductive migration, with a much shorter catch period.

The analysis of the catches prove that these have decreased since the 1960s. This trend can be related to the development of purse seiners and longliners in the Mediterranean sea. The Atlantic bluefin tuna migrate following a hierarchical order, depending on the size of the fish (the first to migrate are the bigger ones). (Abid, Benchoucha, Belcaid, Lamtai, & El Fanichi, 2012).

The tuna catches were of a 3200 tonnes average during the period from 1958-1968, and from that date went on to decline until the final years of the 1980s. Since then, they have fluctuated between 300 and 2600 t, with an upward trend. The analysis of tuna catches for the period running from 1956-2000 proves that there is no correlation between catches and fishing efforts. This means that the increase in the number of almadrabas doesn't always mean an increase in the amount of catches. These catches seem to correlate with the abundance of the species, which is strongly affected by environmental factors.

The reduction in the tuna TAC since 2008 has caused the fishing season to shorten, lasting until the end of May instead of June. As a consequence this reduction has meant the disappearance of up to 7 almadrabas.

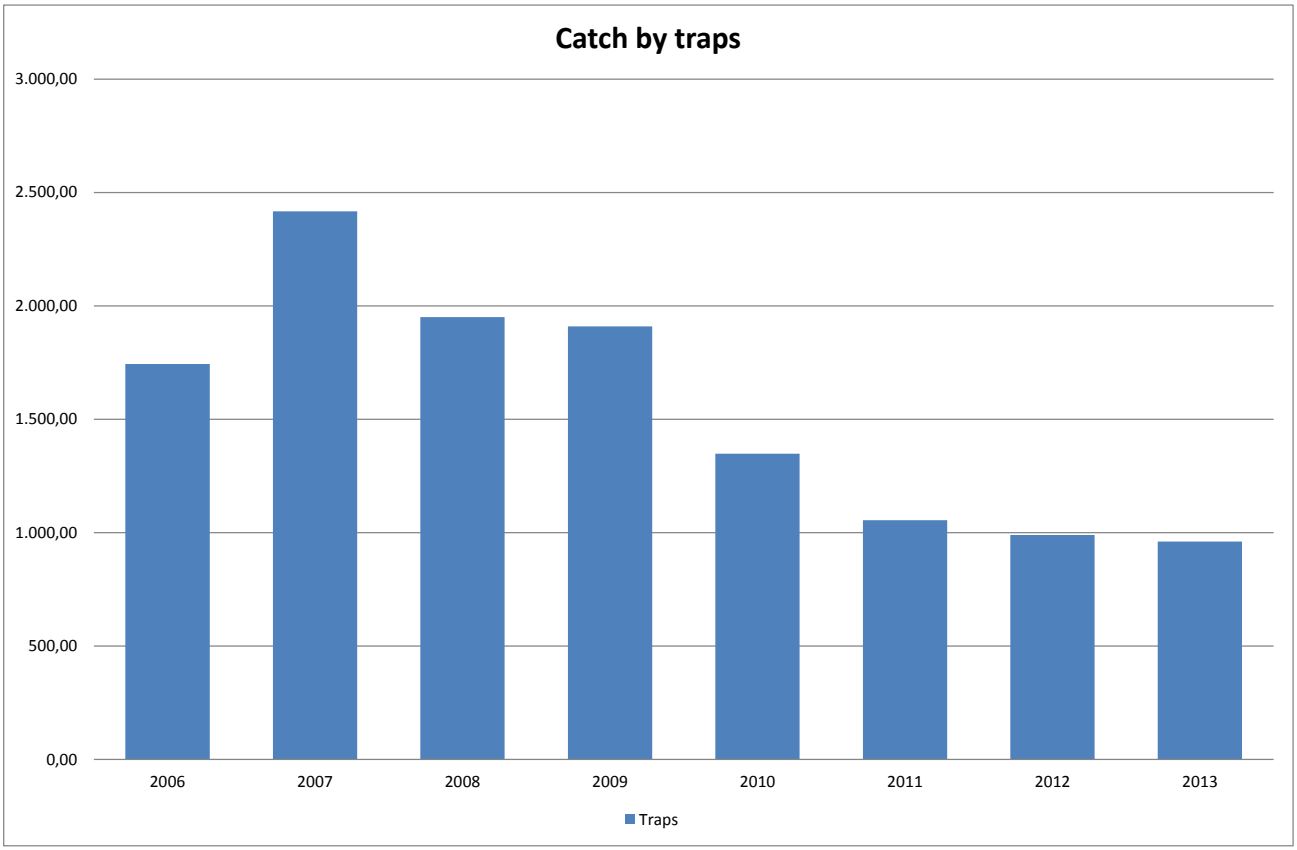
In 2008 the turnover amounted to more than 200 million MAD (18 million Euros), and almost all the produce was designated for exportation. Morocco is, after Spain, the second highest producer of bluefin tuna, and the almadraba catches amount to more than 80% of the tuna production from this country. In studies performed concerning the Moroccan traps (Malouli Idrissi, Zahraoui, & Nhhala, 2012) it is observed that the average capital invested per almadraba is 36 million MAD (3.26 million euros), this investment is recovered in the short-medium term, as the annual profits per almadraba range from 1-12 million MAD (from 90,000 to more than 1 million Euros), which is very important. The rate of return (ROI) of the almadraba is 8% for a 9-year period. It can be inferred from the previously mentioned economic reports that the figures for the business are strongly influenced by the price of tuna and the amount of catches.

The consultations with companies in this sector show that staff costs in Morocco are 20% lower than in Spain, Approximately €200,000 (from February to June, considering the first three months are at 50%).

The conclusions reached analysing the previous economic report, express that these profits are a consequence of the strategy of the regrouping of the almadrabas performed by the "Department de la Pêche Maritime" (DPM) in 2010 and of the support to companies that have started this process. This has allowed the catches to lessen and the costs of the operation to lower. In spite of the management measures performed with the objective of reducing the quota of the bluefin tuna, the economic results of the almadraba traps are positive.

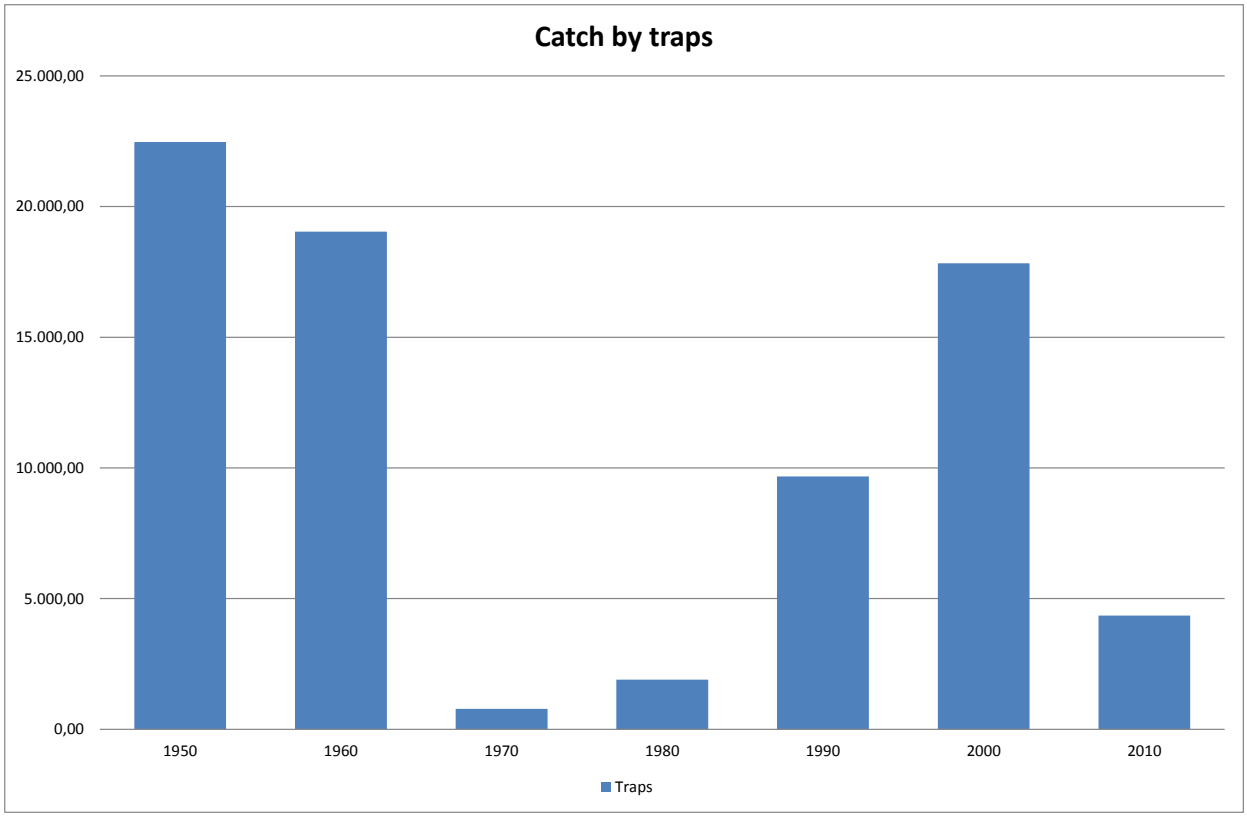
The experts in the sector pledge to create cooperatives for the almadrabas concession holders, in order to improve the appreciation of fishing products, and to establish a unit of industrial processing to decrease the amount of exports of the tuna in a raw state, taking better advantage of the periods when the catches of tuna take place. In order to achieve this there is a project of cooperation with Japan, whose objective is to get a better appreciation of the value of the catches. It is really fundamental to research the socio-economic value of the almadraba traps in much more depth, in the country that has the highest number of them.

Figure 15. Evolution of catch using almadraba traps in Morocco



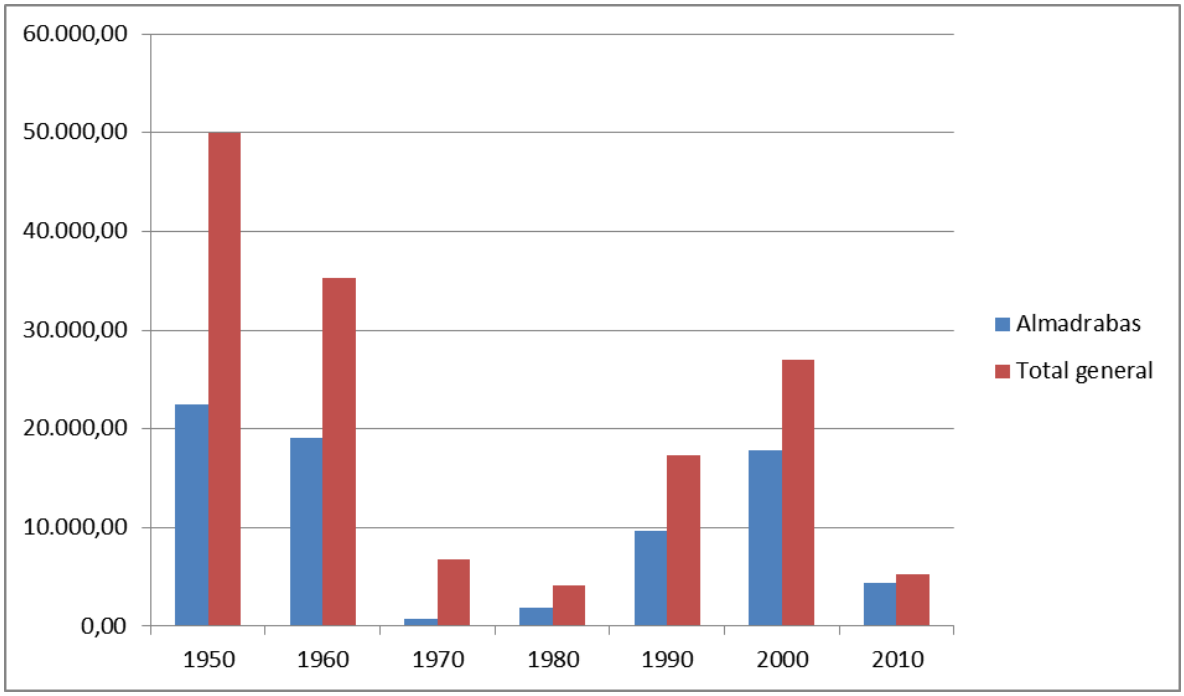
Source: ICCAT, 2014

Figure 16. Evolution of catch using almadrabas in Morocco by decade



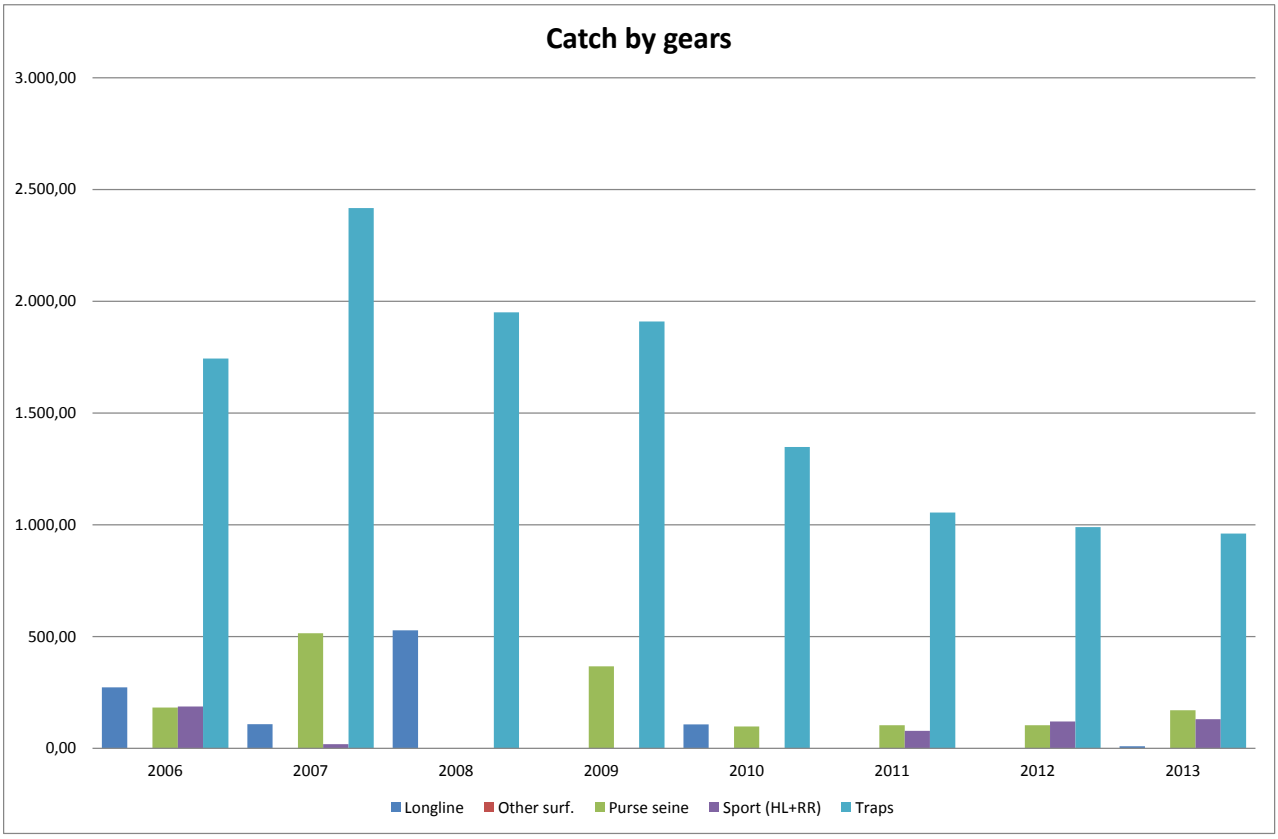
Source: ICCAT, 2014

Figure 17. Evolution of the percentage of catch per almadraba trap versus the total catch in Morocco, by decade



Source: ICCAT, 2014

Figure 18. Evolution of tuna catch by type of fishing system in Morocco since 2006



Source: ICCAT, 2014

Table 7. Evolution of catch by type of fishing technique in Morocco

	Longline	Other surf.	Purse seine	Sport (HL+RR)	Traps	Total general
2006	273,00		182,00	187,00	1,744,00	2,386,00
2007	107,89	0,00	514,94	19,00	2,417,00	3,058,83
2008	528,00				1,950,00	2,478,00
2009	0,00	0,00	367,00	2,00	1,909,00	2,278,00
2010	107,00		98,00		1,348,00	1,553,00
2011	1,00	0,00	103,00	78,00	1,055,00	1,237,00
2012	0,00	0,00	103,00	120,00	990,00	1,213,00
2013	9,43		169,98	130,00	960,47	1,269,88
Total	**1,026,32**	**0,00**	**1,537,93**	**536,00**	**12,373,47**	**15,473,71**

Source: ICCAT, 2014

5. DETERMINING FACTORS FOR THE CATCH IN ALMANDRABA TRAPS

KEY FINDINGS

- The most relevant factors able to affect the output of the almadraba traps are:
- **Environmental factors and natural variables**: oceanographic abnormalities, climate change, meteorological and hydrographical factors, dramatic changes to the marine environment, changes in the trophic chain, attacks of predators like orca, false killer whale , natural turbidity.
- **Human variables**: errors in the location of the almadraba traps, early or late setting up of the almadraba trap, pollution, anthropogenic noise, light condition changes, impact caused by the fishing of juvenile tuna in the same area, conflict between fishing methods, labour issues, lack of qualified staff.
- **Variables ip Position**
- **Impact of the regulations measures**
- Other factors to be consider in terms of output is **the minimum size (24 to 30 kg) approved by ICCAT, which in part limits the output of these traps,** hampering the complete collection of the bluefin tuna in the death chamber if the almadraba's crew is not able to separate these small sized tuna specimens from the bigger tuna.

The long story of the almadraba traps has given us a series of data of important scientific value (Di Natale & Idrissi, 2012). Nowadays, by performing a multivariable analysis it is possible to specify how different factors have influenced the fishing of tuna.

Next we review some of the more relevant factors that are able to affect the performance of the almadrabas. Not all factors can be easily detected or identified, as some of this data is extremely difficult to find, whilst very complex research is required to find other data.

The data should possibly be analysed looking at each almadraba individually, with a follow up of their history to better detect the factors whose consideration is more relevant. This will require a significant amount of time and effort, but the catching of tuna with an almadraba possibly deserves it, because it is the only opportunity we have to understand the fluctuations of bluefin tuna.

a) Environmental factors and natural variables

1. Oceanographic abnormalities: the NAO (*North Atlantic Obscillation*) is included here, and the changes in the marine streams due to the building of infrastructures that can have a local or broader influence would also be included here.
2. Climate change: this can modify the distribution of the tuna on a large scale (Di Natale 2007 on Di Natale &Idrissi, 2012). The research performed by ICCAT-GBYP confirms the variability of the tuna spawning in Mediterranean waters due to climate factors.
3. Meteorological and hydrographic actors: especially winds, both on a local level and on a greater level, which induce movements on the surface of the mass of water.

4. Dramatic changes in the marine environment. This is what happened in the Black Sea at the start of the 20th century, when a series of events (pollution, alteration of chemical conditions) caused the extinction of tuna in this sea.
5. Changes in the trophic (food) chain: this can make the shoals of tuna move to different areas.
6. Attacks by predators, like orca or false killer whale. The changes of the migration habits of sperm whales and great white sharks (*Carcharodon carcharias*) are not clear.
7. Natural turbidity: caused by clouds of mud and discharge of the rivers. It seems proven that this can alter the course of the migration offshore, preventing the tuna from going into the almadraba trap.
8. Other causes like earthquakes, submarine eruptions or changes in terrestrial electromagnetic fields.

b) Human variables

1. Errors when choosing the location of almadraba traps. This can happen due to lack of knowledge or ability in setting up the almadraba.
2. Early or late setting up of the almadraba trap: caused by a lack of success interpreting oceanographic and environmental conditions. If it is late, then part of the tuna will have already passed through, and if it is early then the damage culminates in a higher labour cost.
3. Pollution: there is considerable documented evidence on the effects of environmental pollution on almadraba traps (for example: Portoscuso and Isola Piana in Sardinia, Santa Panagia and Magnisi in Sicilia). In the case of Sardinia pollution affected the migration of tuna (extensively documented across the whole 20th century).
4. Anthropogenic noise: The changes that have occurred since the industrial revolution may have affected the migration of the pelagic species. Nowadays ultrafast ferries, explosions or the construction machinery at the docks seem to have a direct impact on the amount of tuna fished in the almadraba traps.
5. Alteration of light conditions. This factor doesn't seem clear, although it has been reported by fishermen that use attraction methods for small pelagic fish species, and it may be contradictory, as in some cases tuna are attracted by light, and in other cases repelled.
6. Impact caused by the fishery of juvenile tuna in the same area: This has been an issue broadly discussed since the 18th century. It is not easy to establish a correlation, or to establish an amount of juveniles must have been caught for it to have an impact on the tuna catch.
7. Conflict among fishing techniques: this problem is broadly referenced in the biography (for example with the artisanal fishermen or the longliners) and it is especially identified with those seiners that fish small pelagic species.
8. Laboral issues: there are also historic reports about these problems: strikes, conflicts between the owners and the captains of the almadraba traps, etc. These conflicts happened when the almadraba traps of the "tiro" type were replaced by the "buche" type almadraba, which require much fewer staff (referenced by Sarmiento Martin 1757 on Dinatale & Idrissi, 2012)
9. Lack of qualified staff: this can happen when the owners are forced to hire staff from other sectors (Gangemi, 2011 en Di Natale &Idrissi 2012)

c) Variables by position

When the almadraba traps were numerous and were spread along the coastline, the position was also very important. There are three main variables that must be taken into account:

position in relation to the movements of the tuna (going backward or forward), position in relation to the objective (big or small tuna) and position of the almadraba trap in reference to other almadraba traps- if one almadraba trap was set before or after another trap along the same route of the bluefin tuna, this possibly impacted the almadraba output.

d) Impact of the regulation measures.

After the approval of the Multiannual Plan of Recovery of the CICAA for the Atlantic bluefin tuna by the ICCAT, who established a quota (Recommendation of ICCAT 98-05 and later (Rec.00-09, Rec.02-08; Rec.06-05, Rec.08-05, Rec.09-06 and Rec.10-04), some CPC from ICCAT established limits for the catches that were specific to the almadrabas which, of course, limited their annual output. This is a very important factor to consider in the analysis of the annual CPUE for the almadraba.

Another factor to consider in terms of output is the minimum size approved by ICCAT, which in part limits the performance in those traps (24 to 30 kg), hampering the complete collection of the bluefin tuna in the death chamber if the crew of the trap can not separate these tuna specimens of insufficient size from the bigger tuna specimens (in Italy, until recently, all the catch could be seized if the crew didn't manage to separate the tuna that were under the minimum weight of 30 kg).

6. ANALYSIS OF THE TUNA TRAPS AS A TOOL

KEY FINDINGS

- Some of the best EBFT size/age-at-catch historical datasets are to be found in the archives of coastal Mediterranean trap set-net
- No other fishing gear in the history of mankind has proven itself to be as sound, efficient, selective and yet so sustainable and environmental-friendly; moreover and for the purpose of this study, so well documented and almost fully traceable
- Various results of major interest have been obtained by the analysis of historical yearly catches of EBFT by Mediterranean traps, showing well the effect of environmental variability (temperature and sun radiance) on EBFT abundance
- '"almadrabas"' have remained for the past four centuries and still today, an invaluable 'data gold mine', while, on the other hand, fishing mortality due to them remains low and the sizes of EBFT caught by such traps is close to the optimum, in terms of yield per recruit.
- trap data provides high-quality age-specific biometrics of stock biomass, for both the sedentary and migrating fraction of the EBFT stock, as well as a wide range of biological data that constitutes an invaluable component in the EBFT stock assessment models

Some of the best EBFT size/age-at-catch historical datasets, are to be found in the archives of coastal Mediterranean trap set-net ('"almadrabas"') past and present operators, namely those of Spain's Duchy of Guzmán-Medina Sidonia dating back to the end of the XIVth Century, as well as today's heirs: the 'Organización de Productores Pesqueros de Almadrabas' (OPP/51) and the 'Consorcio Nacional Almadrabero'.

EBFT harvesting throughout the region, using '"almadrabas"', dates back to the Middle Ages (Garcia Vargas & Florido del Corral 2010).

No other fishing gear in the history of mankind has proven itself to be as sound, efficient, selective and yet so sustainable and environmental-friendly; moreover and for the purpose of this study, so well documented and almost fully traceable.

With the mushrooming of the species' industrial long-line harvesting during the 70-80's followed by its massive purse-seining and ranching as of the late 90's, 'almadraba' EBFT fishing was however, doomed to almost disappear.

The use of a number of smaller '"almadrabas"' in Turkish, Libyan and Tunisian waters, has now been discontinued in certain cases, for over decades.

Though nowadays, only a few large '"almadrabas"' remain in use in Morocco, Spain and Portugal in the Eastern Atlantic, and only in Sardinia (Italy) in the whole Mediterranean. (Addis et al. 2008; ICCAT 2011) their contribution to the species' salvation, is yet to be acknowledged.

Indeed, it may be said that 'History has absolved '"almadrabas"'' as they have also become, probably, the most reliable ICCAT scientific observatory for the EBFT stock.

An extensive range of scientific results have been obtained from '"almadrabas"' on EBFT during the last centuries and especially in recent years.

For instance, various results of major interest have been obtained by the analysis of historical yearly catches of EBFT by Mediterranean traps, showing well the effect of environmental variability (temperature and sun radiance) on EBFT abundance.

The environmental variability explains well the long-term cycles of biomass in the Mediterranean Sea, and the subsequent 'natural' variability of the EBFT stock and its MSY.

This type of long series and the multiple results obtained from the analysis of trap data are indeed, unique worldwide.

Based on the historical series on catches, mainly those of the 16th-19th centuries from the Medina Sidonia traps and the 20th century from the 'Consorcio Nacional Almadrabero', the causes responsible for the gradual decline in the number of tunas caught in the '"almadrabas"' of the Gulf of Cadiz traps was described by J. A. López González and J. M. Ruiz Acevedo (SCRS/2011/031).

More recent analysis of these multiple biological data (on spawning, condition factors, detailed catch at size, CPUEs by age, etc.) recently obtained from Sardinian and Spanish traps are also of high scientific value.

Such data tends to confirm the potential heterogeneity between various groups of EBFT harvested in the central and the western Mediterranean.

This heterogeneity may well correspond to the existence of genetically distinct sub-populations of EBFT, that have been hypothesized for centuries in the Mediterranean by many scientists: having a sub-population of EBFT doing yearly migrations in and out the Mediterranean Sea, when the other sub-population would be highly 'viscous' and possibly predominantly resident in the eastern Mediterranean Sea.

Such biological heterogeneity has seldom been envisaged by SCRS, but it could have serious implication in the assessment and conservation of EBFT, as the harvesting rate and stock status of these sub-populations may differ.

Present genetic studies do not fully confirm this heterogeneity, but further studies are necessary, using various techniques such as electronic 'pop-up' tagging, genetics and biochemistry of bone and tissues.

Furthermore, a comparative analysis presented to the 2011 ICCAT-GBYP EBFT Trap Fisheries Symposium, on CPUEs and average sizes of EBFT by Moroccan traps and by Japanese longliners (both gears targeting the migratory fraction of the stock) shows a good agreement between CPUEs and sizes obtained from these two gears.

Such results may only confirm the interest of "almadraba" data in ICCAT-SCRS stock assessment analysis.

Indeed, it is the consensus among ICCAT's scientific community, that contrary to limited, biased and uncertain statistical, biological and other scientific information obtained from modern and recent gears, such as purseiners, particularly for the period during which such gears were the major source of excessive fishing mortality suffered by the EBFT stock; '"almadrabas"' have remained for the past four centuries and still today, an invaluable 'data gold mine', while, on the other hand, fishing mortality due to them remains low and the sizes of EBFT caught by such traps is close to the optimum, in terms of yield per recruit.

In this context, such 'almadraba' data is essential, today as in the past for ICCAT SCRS's EBFT stock assessments. In such context, historical data of the EBFT catches in the Portuguese '"almadrabas"' was recovered under the GBYP Data Recovery Plan on Historical EBFT. The data recovered includes the Task I and Task II data of the Portuguese trap fishery on EBFT between 1896 and 1972. Complementary information recovered, included daily catches for several traps, in number of fish and corresponding weights for a large number of years, between 1885 and 1972.

Such trap data provides high-quality age-specific biometrics of stock biomass, for both the sedentary and migrating fraction of the EBFT stock, as well as a wide range of biological data that constitutes an invaluable component in the EBFT stock assessment models.

Moreover, direct socio-economic and cultural aspects of '"almadrabas"' are also of vital importance and should therefore not be minimized.

Political and economic decision-makers would therefore be well advised to carefully ponder whatever legislative initiative they may implement with regards to an activity deeply rooted in the social and cultural fabric of many coastal communities around the Mediterranean Sea.

All in all, the general consensus among ICCAT' scientific community is that it would be very negative to stop now, after 400 years of continuous data, the unique statistical series the EBFT 'almadraba' fisheries have to offer.The biometrics that have been recovered in the last six years provide an important improvement of the ICCAT data base.

Further details be made available by national scientists, for a better understanding of the natural fluctuations of the stock, and to improve the standardised CPUEs taking into account the most relevant variables. It is therefore recommended that:

- Records of landed fish as well as released fish from the '"almadrabas"' be safely kept.
- Records be kept of size and/or age information of the fish caught, and indices be developed by age or age groups if there are changes in the size distribution of fish caught in the traps.
- Regional-wide studies be promoted on the trends of catch rates at size-age from different tuna traps.

Moreover, the enactment and implementation of the following summarized recommendations, would indubitably ease the uncomfortable situation this fishery has been going through for the past two decades:

- The national governments concerned to take the necessary steps to promote the urgent conservation of the few remaining tuna traps, by considering, among others, the possibility to ask for their inclusion within the "World Cultural Heritage" by UNESCO.

- The considerable historical and cultural importance of the tuna trap fishery and industry shall be preserved.
- Maintaining the Almadraba fisheries operational at all cost, inter alia because of their high value for scientific research and EBFT stock assessment.
- "almadrabas" should be kept open for a period that allows the consistency of their long-term statistical series.
- The opportunity to effectively use '"almadrabas"' as 'Tuna Scientific Observatories', by increasing their full cooperation with ICCAT and its scientific programs, by providing a full access to their detailed catch and effort data, giving access to biological sampling and allowing to tag and release EBFT and furthermore the allocation of a scientific quota for the ICCAT Atlantic-Wide Research Program on BFT (GBYP).

This allocation should not be under the restrictions of current size regulations and should include all size fish ranges.

7. SCIENTIFIC FOLLOW-UP OF THE BLUEFIN TUNA POPULATION

KEY FINDINGS

- Analysis on the status of EBFT populations carried out by the ICCAT-SCRS in 2006 and 2009 (ICCAT, 2007; SCRS, 2009) pointed out to a rapid deterioration of the Eastern Atlantic stock
- Because of this situation, was established a EBFT Recovery-Plan (enacted by ICCAT Recommendations: 06-05-BFT to 13-07-BFT), which evolved around a number of stringent management measures: Fishing-fleet reduction, the banning of aerial tuna-spotting, real-time reporting, the BCD scheme, onboard observers, the contraction of fishing seasons, quota-slashes, fisheries policing both at port and at fishing grounds, war against IUU EBFT trade, etc
- According to ICCAT-SCRS latest 2014 updated EBFT stock assessment, results indicated that the spawning stock biomass (SSB) showed clear signs of sharp increase in all the runs that have been investigated by the SCRS
- ICCAT accepted a general scientific precautionary approach to sound fisheries management that would rely on trustworthy accurate and comprehensive EBFT size/age-at-catch historical datasets.

Significant changes have occurred in the Mediterranean marine ecosystem since the mid-50's of the XXth Century.

It is our view that such changes are particularly due to, among others, four main indicators at a regional scale during the last eight decades:

- The over expansion of human activity (agriculture, industry, tourism, habitation, etc...) all over the coastal Mediterranean Basin and their direct impact on coastal water-column quality, as well as offshore gas & oil exploration and extraction, underwater pipelining and cabling on high seas areas;
- The over-expansion of commercial and leisure maritime traffic as the Mediterranean Sea (the Suez-Gibraltar route, etc...) has become one of the most transited waterways in the World,
- The evident warming of the Western Mediterranean Basin (Marullo et al. 2007; Vargas-Yañez et al. 2010) and the colonizing of thermophilic species (Bianchi 2007)
- Finally, but not the least, the over-expansion of fisheries (both artisanal and industrial) and their direct impact on an important number of species' populations.

The Mediterranean is one of the major marine and coastal biodiversity hotspots worldwide. Representing less than 1% of the global ocean surface, it is home for almost 20% of global marine biodiversity with a high level of endemism (up to nearly 50% for some taxonomic groups). Notwithstanding, the state of most fish stocks inside the Mediterranean Sea is no less than worrying.

According to two assessments by Expert Working Groups (EWG 12-10 & 12-19) of EU's Scientific, Technical and Economic Committee for Fisheries (STECF), 95% of scientifically assessed demersal species (incl. shrimps) and small pelagic stocks inside the Mediterranean,

were subject to overfishing and thus were classified as being exploited unsustainably outside safe biological limits, namely Bluefin Tuna - Thunnus Thynnus thynnus, L. 1758 eastern stock (EBFT).

Both the over-fishing of this species during the decade 1998-2008 as well as the level of catch underreporting, misreporting and/or un-reporting (SCRS/2012/127) and the dwindling weight/size structure of its population (SCRS/2014/042), spiralled out of control to such magnitudes, that the immediate commercial future of this particular fishery as well as the prospect of a proper scientific-based management, relying on pertinent size/age-at-catch datasets, became all but too seriously compromised.

This much was duly pointed-out at the time, by ICCAT's Scientific Committee (SCRS).

Analysis on the status of EBFT populations carried out by the ICCAT-SCRS in 2006 and 2009 (ICCAT, 2007; SCRS, 2009) pointed out to a rapid deterioration of the Eastern Atlantic stock. In particular, the analysis described a sharp increase of fishing mortality over the large spawner fraction of the population (age 8+) in recent past years, which was attributed to the high purse seiners catches driven by the increasing demand for large live-fish by Mediterranean tuna farms (ICCAT, 2007).

Scientists involved in past assessments of the East Atlantic Bluefin tuna stock, repeatedly expressed concerns on the reliability of the size and catch-effort data records available, making reference to the complex biology of the species and the poor quality of fisheries dependent data, among other factors.

Faced with the alarming scenario of an irremediable EBFT population collapse, voiced by an overwhelming outcry from the scientific community and the public opinion at large as of 2006, ICCAT itself, had no other alternative than but to take urgent and robust action.

It did so by adopting and enforcing in no flimsy-manner, an EBFT Recovery-Plan (enacted by ICCAT Recommendations: 06-05-BFT to 13-07-BFT), which evolved around a number of stringent management measures: Fishing-fleet reduction, the banning of aerial tuna-spotting, real-time reporting, the BCD scheme, onboard observers, the contraction of fishing seasons, quota-slashes, fisheries policing both at port and at fishing grounds, war against IUU EBFT trade, etc.

On the other hand, Nature and the resilience of the EBFT population seem to have played their part in what may be cautiously described as a happy-ending story.

It is now scientifically accepted that EBFT recruitment for a number of years (specially 2003) has been exceptionally important in all of the species' distribution areas, as well as in marginal regions such as waters around Norway and Greenland. (Doc. No. PA2-606A/2014). According to ICCAT-SCRS latest 2014 updated EBFT stock assessment, results indicated that the spawning stock biomass (SSB) showed clear signs of sharp increase in all the runs that have been investigated by the SCRS, up to almost 585,000 t in 2013 for the update of the 2012 Base Case which corresponds to the maximum estimated SSB over the period.

However, the magnitude and the speed of the SSB increase vary substantially among the runs (an SSB between 439,000 t and 647,000 t in 2013) and are, therefore, still rather uncertain.

This increase corresponds to a 4-fold increase in SSB over the past decade and ranges from 3 to 4.5-fold across the sensitivities examined. Trends in fishing mortality (F) for the younger ages (ages 2-5) displayed a continuous increase until recent years. Since 2008, F at ages 2-5 decreased sharply to reach the lowest historical values. For oldest fish (ages 10+), F had been decreasing during the first 2 decades and then rapidly increased since the 1980s and finally declined since the late 2000s.

Indeed and most importantly, ICCAT decision-makers at the time, took the novel step to give proper-science a chance.

It thus accepted a general scientific precautionary approach to sound fisheries management that would rely on trustworthy accurate and comprehensive EBFT size/age-at-catch historical datasets. (incl. EBFT baitboat fishery in the Gulf of Biscay, Japanese longline, as well as the recently released, based on Japanese fresh tuna daily auction market reports).

Such biometric datasets were therefore to support the improvement of future assessment's modelling and analytical work on demographic trends of the EBFT population inhabiting the North-eastern Atlantic Ocean and the Mediterranean Sea during its spawning season.

8. HOW THE FUTURE INCREASE IN QUOTAS WILL AFFECT THE VIABILITY OF ALMADRABAS?

The economic survival of almadrabas currently depends on the quota of tuna – a figure is assigned to each almadraba each fishing season, and therefore the fluctuations in these quotas along with the tuna's selling price determine the profitability of this fishing technique.

According to enquiries made to relevant figures within the sector and to existing bibliographic research, for almadrabas in Spain to be profitable the fishing quota should be 400 t/almadraba/year (reports from within the sector) whereas in Italy the figure is 100 t/almadraba/ year (reports from within the sector). The data for Morocco has been calculated using a detailed study on the profitability of almadrabas (Idrissi, M.; Zhahraoui, M.; Nhhala, H. Les Almadrabas au maroc: aspects economiques. 2012), and the net profit per almadraba is approximately 12 MDHS (€ 1,106,692). The internal rate of return (IRR) is 8%, so for the year in which the study took place, when there were 10 almadraba traps with a recorded catch of 1348 t, it can be inferred that the amount needed for them to be profitable is much lower than the required amount indicated for Spain and Italy (under 100 t/almadraba year), this partly due to the cost of wages in Morocco being 20% lower than in the EU.

The current recovery plan for Bluefin Tuna has set an objective – using adopted management measures - to achieve, with at least 60% probability, the maximum sustainable yield by 2022, which means that 50,000 tonnes can be fished without affecting the tuna population. According to scenarios based on three levels of recruiting and 2 different catch scenarios proposed in the last evaluation undertaken by the SCRS belonging to the ICCAT, 4 of these are already over the MSY so the future goals have been met 9 years ahead of schedule, and this way are in compliance with Article 2 of the European Common Fisheries Policies, which states that European fisheries must reach the MSY by 2015 if possible, and if not, then progressively, by 2020 for all stocks. Fishing mortality estimated for the two proposed scenarios in the evaluation does not exceed 0.40 of the fishing mortality target for the fishery. Besides this, and according to the SCRS report, Kobe's matrixes show that the probability is always 100% for the case where fishing mortality is lower than the fishing mortality for MSY, from the years 2014 to 2022, with quotas ranging from between 0 to 30,000 tonnes.

With the recovery plan, the European fleet has been able to avoid catching one million juvenile tuna specimen per year, and this change in the exploitation pattern seems to have had a huge impact. This will mean a higher BFT fishing capacity in the future for all fishing techniques, including almadrabas. According to ICCAT recommendations a Multiannual Recovery Plan for BFT in the Eastern Atlantic and the Mediterranean was established, (Doc. No. PA2-606A / 2014) and approved at the annual CCAT meeting held in Genoa (2014), with the quota projections for 2015, 2016 and 2017 shown in the table below. This means that almadrabas in Spain could start to be profitable from 2017, with Italy netting a profit by the same year. Although it must be taken into account that currently, in the case of Spanish almadrabas, profitability was higher in 2014 due to the acquisition of the quota that belonged to live bait boats from the Cantabrian Sea.

Also listed in this table are two future scenarios that have been integrated, in which the BFTE tuna quota is 32,000 and 50,000 tonnes respectively. In the case of Spain, who has 4 almadrabas, the lowest profitability point would be at a total quota of 32,000t, according to

the current percentages of distribution of quotas per country and fishing technique. (400t/year/almadraba).

Table 8 Distribution of quotas according to historic proportions (t)

	2014	2015	2016	2017	20XX*	20XX*
Quota BFTE	13,5	16,142	19,296	23,155	32	50
UE	7,938.00	9,372.92	11,203.54	13,451.36	19,159.80	29,030.00
Spain	2,504.00	2,956.64	3,534.10	4,243.16	6,043.85	9,157.35
Almadraba	650.00	804.60	961.75	1,154.71	1,644.74	2,492.03
Italy	1,788.00	2,213.27	2,645.55	3,176.34	4,524.30	6,855.01
Almadraba	165.00	204.25	244.14	293.12	417.51	632.60
Portugal	226.00	279.75	334.39	401.48	571.86	866.45
Almadraba	226.00	279.75	334.39	401.48	571.86	866.45

*Calculations made using hypothetical quotas of 32,000 and 50,000t/year.
Source: Own elaboration using data from ICCAT (2014)

9. POTENTIAL OF ALMADRABA TO BE CERTIFIED AS A SUSTAINABLE TUNA FISHING METHOD.

Although there are diverse standards of measurement for a fishery's level of sustainability from an environmental point of view, we consider that the MSC, because of its trajectory and the high number of certified fisheries, is a good reference point in the understanding of the situation of the almadraba technique with regards to good practices, both in its management as well as its environmental impact and the state of the stock catch.

As it has already been pointed out, the MSC standard is based on three principles - below is a summary of how the almadraba fishing levels fit in with these standards, broken down by principle:

Principle1
According to the last evaluation of the Eastern Atlantic Bluefin Tuna, it can be said that it is in a healthy enough position to ensure that, should current management circumstances continue, there is no risk of overfishing and that biomass levels and the exploitation pattern guarantee that catches remain under the Maximum Sustainable Yield level.

There is a management system that establishes Reference Points and Harvest Control Rules for this fishing method.

Therefore, it can be stated that BFTE fishery is compatible with the MSC standard for Principle 1.

Principle 2
According to the MSC standard requirements, it can be considered that Principle 2 is the greatest obstacle to the certification of Bluefin Tuna almadraba fishery. However, it is not considered an insurmountable issue given that the impact that an almadraba trap can produce on retained species, by-catch, ETP species, ecosystems and habitats cannot be considered significant and, in any case, by implementing specific strategies and actions the issues that may appear during the certification process can be solved.

The retained species are, in general, other species of tuna or a similar fish, swordfish or different carangidae species. All of these have a commercial value and are commercialised. Other small sized species are usually freed in the process of taking the fish from the net during the final stage of the fishing process.

The presence of by-catch, as well as the presence of other ETP species is minimal. The presence of turtles or sharks in the almadraba is not usual, much less the presence of cetaceans. In any case, an alert system to set free any possible specimens that have been trapped in the nets, and an exhaustive set of statistics would provide the basis for overcoming the hypothetical conditions that a complete evaluation would impose.

Regarding the habitat, the almadraba cannot be considered a fishing method that causes irreversible damage to either the seabed or to the pelagic ecosystem. Any impact on the ecosystem should also consider the amount of tuna that is extracted from the marine environment and how this affects it. In this sense it can be said that the almadraba extracts

only a small percentage of the stock when considering the entire global management plan, and therefore its impact is minimal.

Principle 3

This principle evaluates, as has already been commented, the analysis of the fishery management system. The management of BFTE fishery, within the ICCAT framework and the European Union framework, should not present any difficulties when measuring it using the MSC standard. According to this standard, the fishery must be managed under parameters that ensure that what is established in Principles 1 and 2 are adhered to - the fishery management plan must be designed to comply with these 2 principles. Besides this, MCS (Monitoring, Control and Surveillance) mechanisms must be clear and their implementation must be effective.

In this sense, the Common Fishery Policies and the ICCAT management mechanisms guarantee this point. There is also a clear and complete research plan that provides enough data for the best possible management of the stock. Finally, it should be highlighted that the management procedures are constantly evaluated and therefore there is technical and scientific feedback to aid the elaboration of new management measures and their implementation.

For all these reasons, we believe that Bluefin Tuna almadraba fisheries could enter into a complete evaluation process for the MSC standard, with a high probability that it will be approved.

10. RECOMMENDATIONS TO PARLIAMENT

- Almadrabas should be assigned an additional scientific quota for the next 3 years to measure the effects of the recovery plan for Bluefin Tuna.

- The almadraba technique has been a fishing technique that has been excluded from any type of subsidy over the previous European Funding period and we consider that the time has come for this technique to be prioritised for access to new subsidies - for owners and crews as much as for the technique itself and the associated industry.

- The Fishery Administrations of the Member States must comply with Article 17 of the new European Common Fisheries Policy with regards to the criteria that must be taken into account when establishing fishing quotas.

- Protection of the inlets where the almadrabas are set up against possible threats of all types of installations (offshore wind farms, offshore drilling platforms, aquaculture platforms, etc.) that avoid, prevent or disturb the normal migration route of tuna when they enter the almadrabas. As the almadrabas are placed in a fixed location, any physical obstacle that tuna find on route or that may cause noise or water turbidity affects the entry of tuna into the almadrabas.

- The almadrabas are an indicator of the state of the tuna population, and therefore they should be assigned a quota that will allow them to be profitable.

- Favour the start up and consolidation of projects that improve the generation of value and the creation of employment, taking the tuna captured using an almadraba as a reference point.

- Subsidise the sustainability certification, using European funds, as a mechanism to promote the sustainability of a traditional fishing method.

- Support the initiative currently in process that will decide whether the Almadraba fishing technique will be included on the UNESCO`s World Heritage list.

11. GLOSARY

Artisanal fisheries: Traditional fisheries involving fishing households (as opposed to commercial companies), using relatively small amount of capital and energy, relatively small fishing vessels (if any), making short fishing trips, close to shore, mainly for local consumption. In practice, definition varies between countries, e.g. from gleaning or a one-man canoe in poor developing countries, to more than 20 m trawlers, seiners, or long-liners in developed ones. Artisanal fisheries can be subsistence or commercial fisheries, providing for local consumption or export. Sometimes referred to as small-scale fisheries (FAO).

Bigeye (Thunnus obesus), Thon obese, Patudo: A widely-distributed species of tuna, ranging between 50o N and 45o S. This species dwells in deeper water than other tunas and shows extensive vertical movements. Spawning occurs in tropical waters when the environment is favorable. From the spawning area bigeye migrate into temperate waters as they grow. Young fish form schools mostly mixed with other tunas such as yellowfin and skipjack. These schools are often associated with drifting objects, whale shark and sea mounts. This association weakens as they grow larger. Circumstantial evidence suggests a single Atlantic-wide single stock (ICCAT).

Bluefin (Thunnus thynnus thynnus), Thon rouge, Atún rojo A temperate tuna distributed throughout the north Atlantic. For assessment purposes, two stocks are assumed, although some mixing is known to occur: Western (ATW) and Eastern (ATE) Atlantic (including the Mediterranean, MED). Atlantic bluefin can grow to over 300 cm and reach more than 650 kg and can live for over 20 years. In the western Atlantic, bluefin generally reach a larger maximum size, and mature later than eastern bluefin. Spawning occurs from April to June in the Gulf of Mexico and the Florida Straits, and from May to July around the Balearic Islands, Tyrrhenian Sea, and central Mediterranean. Large bluefin are adapted for migration to colder waters. (ICCAT).

By-catch: Catch of species other than the intended target species in a fishing operation. Bycatch can either be discarded or landed. (Alverson et al. 1994).

Catch: 1) Any activity that results in killing any fish or bringing any live fish on board a vessel. 2) The component of fish encountering fishing gear which is retained by the gear.

Fisher: A person (male or female) participating in a fishery (in preference to the previously used term 'fisherman'). An individual who takes part in fishing conducted from a fishing vessel, platform (whether fixed or floating) or from the shore.(FAO).

Fishery: 1) The sum (or range) of all fishing activities on a given resource (e.g. a hake fishery or shrimp fishery). It may also refer to the activities of a single type or style of fishing (e.g. beach seine fishery or trawl fishery). The fishery can be artisanal, or/and industrial, commercial, subsistence, and recreational, and can be annual or seasonal. 2) Activity of catching fish, from one or more stocks of fish, that can be treated as a unit for purposes of conservation and management and that is identified on the basis of geographic, scientific, technical, recreational, social or economic characteristics, and/or method of catch (FAO).

Fish stock: The living resources in the community or population from which catches are taken in a fishery. Use of the term fish stock usually implies that the particular population is more or less isolated from other stocks of the same species and hence self-sustaining.

Fishery management: The integrated process of information gathering, analysis, planning, decision-making, allocation of resources and formulation and enforcement of fishery regulations by which the fishery management authority controls the present and future behaviour of interested parties in the fisheries, in order to ensure the continued productivity of the living resources.

Fishing effort: 1) The amount of fishing gear of a specific type used on the fishing grounds over a given unit of time e.g. hours trawled per day, number of hooks set per day or number of hauls of a beach seine per day. 2) The overall amount of fishing (usually per unit of time) expressed in units such as: boat days on the fishing ground, number of traps, or trawl hauls, or (gillnet length x soaking time), etc. The effort may be *nominal*, reflecting the simple total of effort units exerted on a stock in a given time period. It may also be *standard* or *effective* when corrected to take account of differences in fishing power and efficiency and ensure direct proportionality with fishing mortality. Relates usually to a specific fishery and gear. If more than one gear is considered, standardization in relation to one of them is necessary. For biologists, a good measure of fishing effort should be proportional to fishing mortality. For economists it should be proportional to the cost of fishing.

Fishing industry: Includes both recreational, subsistence and commercial fishing, and the harvesting, processing, and marketing sectors.

Fishing vessel: Any vessel, boat, ship, or other craft that is used for, equipped to be used for, or of a type that is normally used for the exploitation of living aquatic resources or in support of such activity. This definition may include any vessel aiding or assisting one or more vessels at sea in the performance of any activity relating to fishing, including, but not limited to, preparation, supply, storage, refrigeration, transportation, or processing (e.g. mother ships).

Flag State: State having registered a vessel under the national flag.

Fleet: The aggregation of units of any discrete type of fishing activity utilising a specific resource. Hence, for example, a fleet may be all the purse seine vessels in a specific sardine fishery, or all the fishers setting nets from the shore in a tropical multispecies fishery.

Home port: Boat and gear activities are sampled from homeports or base ports, in contrast to catches and species composition, prices, etc. that are sampled at **landing sites.**

Precautionary approach: 1) Set of measures taken to implement the precautionary principle. 2) A set of agreed cost-effective measures and actions, including future courses of action, which ensures prudent foresight, reduces or avoids risk to the resource, the environment, and the people, to the extent possible, taking explicitly into account existing uncertainties and the potential consequences of being wrong.

Quota: A share of the allocated TAC to an operating unit such as a country, a vessel, a company or an individual fisherman (individual quota) depending on the system of allocation. Quotas may or may not be transferable, inheritable, and tradable. While generally used to allocate total allowable catch, quotas could be used also to allocate fishing effort or biomass.

Recreational fishing: Any fishing for which the primary motive is leisure rather than profit, the provision of food or the conduct of scientific research. and which may not involve the sale, barter, or trade of part or all of the catch.

Responsible fisheries: The concept "encompasses the sustainable utilisation of fishery resources in harmony with the environment; the use of capture and aquaculture practices which are not harmful to ecosystems, resources and their quality; the incorporation of added value to such products through transformation processes meeting the required sanitary standards; the conduct of commercial practices so as to provide consumers access to good quality products" (International Conference on Responsible Fishing, Cancun, Mexico, 1992).

Sustainable development: 1) "Development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987). 2) "Management and conservation of the natural resource base, and the orientation of technological and institutional change in such a manner as to ensure the attainment of continued satisfaction of human needs for present and future generations. Such sustainable development conserves (land) water, plants and (animal) genetic resources, is environmentally non-degrading, technologically appropriate, economically viable and socially acceptable" (FAO Council in 1991).

Sustainable use: The use of components of biological diversity in a way and at a rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations.

Sustainable yield: The number or weight of fish in a stock that can be taken by fishing while maintaining the stock's biomass at a steady level from year to year, assuming that environmental conditions remain the same. Sustainable yields can take all sorts of values from very low in underexploited or overexploited fisheries to very high in properly exploited ones. Difficult to achieve in practice due to environmental fluctuations.

Target species: Those species that are primarily sought by the fishermen in a particular fishery. The subject of directed fishing effort in a fishery. There may be primary as well as secondary target species.

Trap: Fixed gear anchored to the bottom, usually containing a guide net that leads fish into an enclosure. In this study trap is also synonymousis with “Almadraba” and “Madrague” due to its geographical scope.

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- Document SCRS/2011/042 makes a comparative analysis of EBFT caught by Mediterranean traps and by Japanese longliners in the North Atlantic, allowing a better estimate of EBFT migratory routes;
- Document SCRS/2011/080 discusses the results of recent work done on genetic heterogeneity of EBFT;
- Document SCRS/2011/029 describes the current research program on Spanish 'Madragues'.
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ANNEX I.- MAIN STATISTICS ABOUT TRAPS FOR BLUEFIN TUNA

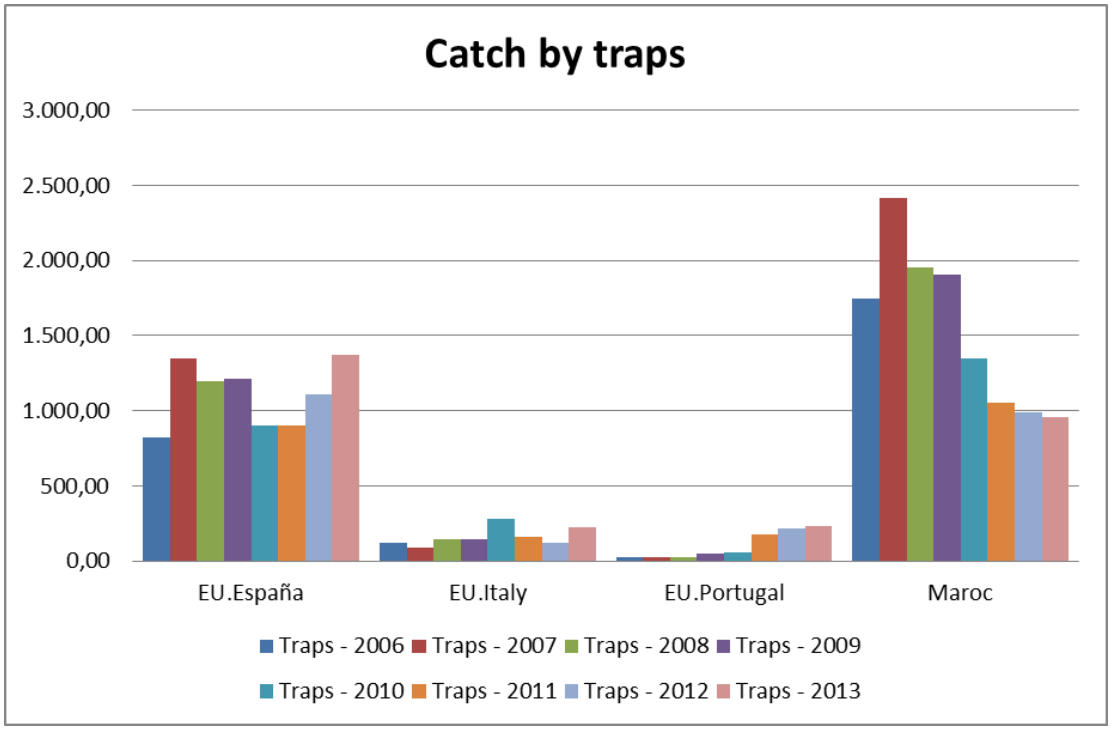
ICCAT Record of BFT "almadrabas"

ICCAT List Number	Reporting Flag	Trap	Reg.Number	Owner	Address	Operator	Location	Autho From	Autho To
ATEU2PRT00002	EU.Portugal	Armaçao Do Barril	2022	REAL ATUNARA, SA	Av República, Edfo. Guadiana Foz, Lote 2. r/c B 8900-201 VR de Sto António	REAL ATUNARA, SA	Tavira: 37°02'30''N 07°39'30''W	1/1/2014	31/12/2014
ATEU2PRT00003	EU.Portugal	Armação De Santa Maria	2023	REAL ATUNARA, SA	Av República, Edfo. Guadiana Foz, Lote 2. r/c B 8900-201 VR de Sto António	REAL ATUNARA, SA	Faro: 36°56'24''N 07°56'00''W	1/1/2014	31/12/2014
ATEU2ESP00001	EU.España	Cabo Plata	ESP AL1	ALMADRABA CABO PLATA S.A.	AVDA. CABO DIEGO PEREZ Nº 100	ALMADRABA CABO PLATA S.A.	BARBATE (ESPAÑA)	1/1/2014	31/12/2014
ATEU2ESP00002	EU.España	Ensenada de Barbate	ESP AL2	PESQUERIAS DE ALMADRABA SA	PUERTO DE BARBATE S/N-11160 BARBATE-CADIZ	PESQUERIAS DE ALMADRABA SA	BARBATE (ESPAÑA)	1/1/2014	31/12/2014
AT002MAR00011	Maroc	Es Sahel	MORTRAP-07	Société Maromadraba	Nouveau port de pêche BP 573, Larache	Société Maromadraba	35º18'10"N-06º11'40"W	28/2/2014	30/9/2014
AT002MAR00010	Maroc	Kénitra 2	MORTRAP-11	Société Al Madraba del Sur	Ave Mohamed V No. 66, Tanger	Société Al Madraba del Sur	34º51'00"N-06º21'00"W	28/2/2014	30/9/2014
ATEU2ESP00003	EU.España	La Azohía	ESP AL3	ALMADRABA LA AZOHÍA S.A.	C/ VALLE DEL LEÓN S/N	ALMADRABA LA AZOHÍA S.A.	CARTAGENA (ESPAÑA)	1/1/2014	31/12/2014
AT002MAR00003	Maroc	La Garifa	MORTRAP-04	Société Atuneros del Norte	3 Rue El Jarraoui 1er étage, appt No. 26, Tanger	Société Atuneros del Norte	35º32'51"N-06º05'07"W	28/2/2014	30/9/2014
ATEU2ESP00004	EU.España	Lances de Tarifa	ESP AL4	ALMADRABAS DE ESPAÑA S.A.	C/ PLAYA DE LOS LANCES S/N.	ALMADRABAS DE ESPAÑA S.A.	TARIFA (ESPAÑA)	1/1/2014	31/12/2014
AT002MAR00012	Maroc	Las Cuevas	MORTRAP-05	Société Congelay	Nouveau port de pêche BP 573, Larache	Société Maromadraba	35º27'24"N-06º06'54"W	28/2/2014	30/9/2014
AT002MAR00004	Maroc	Los Cenizosos	MORTRAP-06	Société Al Madrabas del Norte	Zone portuaire, Larache	Société Al Madrabas del Norte	35º23'05"N-06º09'45"W	28/2/2014	30/9/2014
AT002MAR00013	Maroc	Mansouria	MORTRAP-14	Société Les Madragues du Sud	23 Rue Moussa Ben Noussair 1er	Société Les Madragues du Sud	34º29'00"N-06º32'00"W	28/2/2014	30/9/2014

ICCAT List Number	Reporting Flag	Trap	Reg.Number	Owner	Address	Operator	Location	Autho From	Autho To
				SARL (par abréviation "Madrasud")	étage no. 1, Tanger	SARL (par abréviation "Madrasud")			
AT002MAR00014	Maroc	Mansouria 2	MORTRAP-13	Société Les Madragues du Sud SARL (par abréviation "Madrasud")	23 Rue Moussa Ben Noussair 1er étage no. 1, Tanger	Société Les Madragues du Sud SARL (par abréviation "Madrasud")	34º34'33"N-06º31'00"W	28/2/2014	30/9/2014
AT002MAR00002	Maroc	Principe	MORTRAP-01	Société Atuneros del Norte	3 Rue El Jarraoui 1er étage, appt No. 26, Tanger	Société Atuneros del Norte	35º03'25"N-06º15'49"W	28/2/2014	30/9/2014
ATEU2ESP00006	EU.España	Punta Atalaya	ESP AL6	ALMADRABA PUNTA ATALAYA S.A.	PUERTO PESQUERO DE CONIL S/N	ALMADRABA PUNTA ATALAYA S.A.	CONIL (ESPAÑA)	1/1/2014	31/12/2014
AT002MAR00005	Maroc	Punta Negra	MORTRAP-08	Société Al Madrabas del Norte	Zone portuaire, Larache	Société Al Madrabas del Norte	35º09'06"N-06º13'52"W	28/2/2014	30/9/2014
ATEU2PRT00001	EU.Portugal	TUNIPEX	1645	TUNIPEX-EMPRESA DE PESCA DE TUNIDEOS,S.A.	Porto de Pesca de Olhao, Armazem 2 Ap.456, 8700-914 TAVIRA	TUNIPEX - EMPRESA DE PESCA DE TUNÍDEOS, S.A	TAVIRA	1/1/2014	31/12/2014
AT002MAR00009	Maroc	Tahadart	MORTRAP-03	Société Tahadart	Port de pêche, Tanger	Société Tahadart	35º40'32"N-06º00'54"W	28/2/2014	30/9/2014
ATEU2ITA00009	EU.Italy	Tonnara Capo Altano	ITA02/FIS/2014	Tonnare Sulcitane srl	Via M. Polo n.1, 09010 Portoscuso (CA)	Tonnare Sulcitane srl	Sardinia	1/1/2014	31/12/2014
ATEU2ITA00003	EU.Italy	Tonnara Isola Piana	ITA01/FIS/2014	Soc. Carloforte Tonnare P.I.A.M. s.r.l.	Via Arezzo n.2, 09125 Cagliari (CA)	Soc. Carloforte Tonnare P.I.A.M. s.r.l.	Sardinia	1/1/2014	31/12/2014
ATEU2ITA00006	EU.Italy	Tonnara di Porto Paglia	ITA03/FIS/2014	Tonnare Sulcitane srl	Via M. Polo n.1, 09010 Portoscuso (CA)	Tonnare Sulcitane srl	Sardinia	1/1/2014	31/12/2014

Source: ICCAT (2014)

"Almadrabas" catches evolution in Italy, Morocco, Portugal and Spain

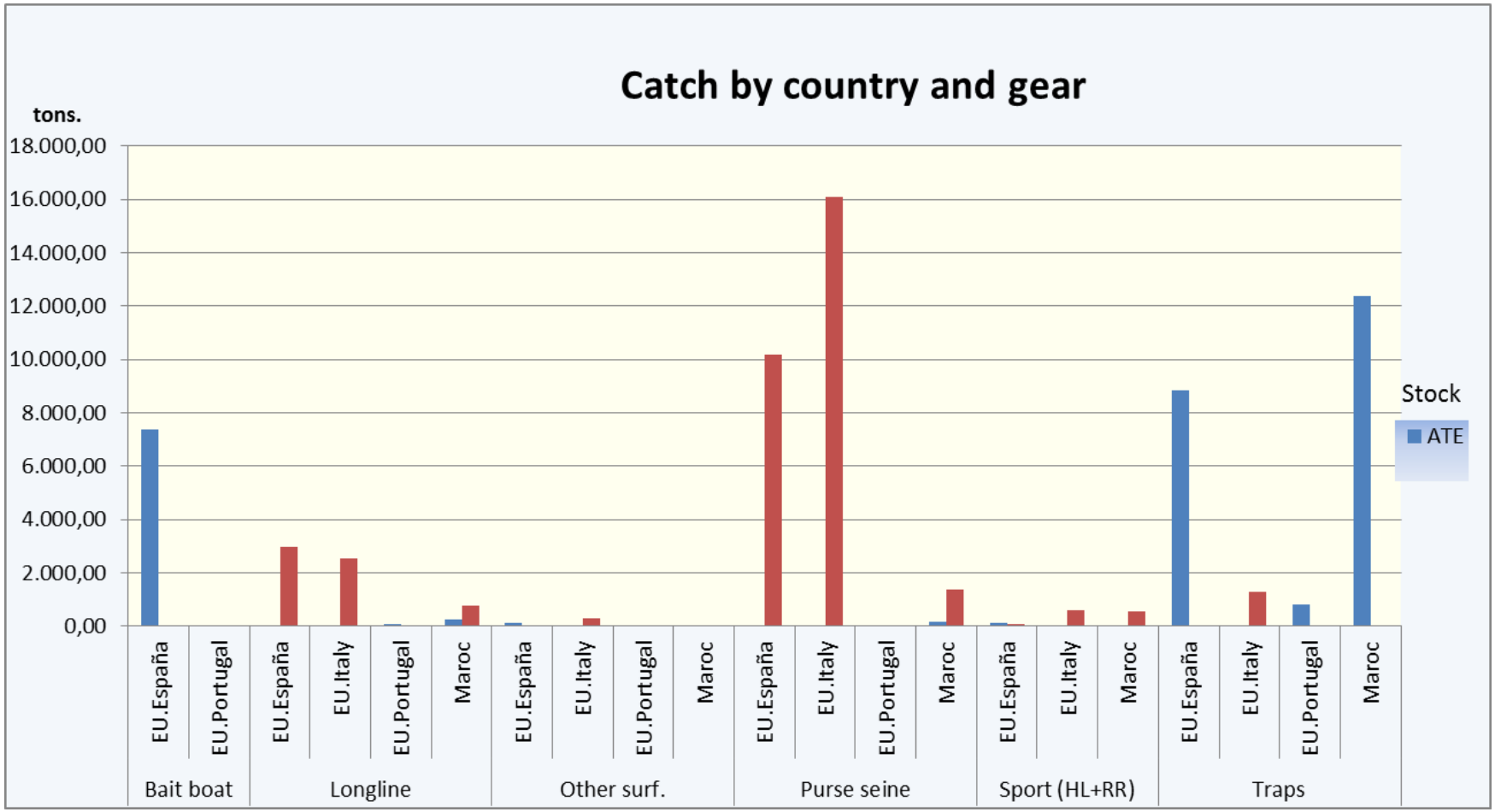


Graphic processed with data obtained from ICCAT (2014)

Countries	2006	2007	2008	2009	2010	2011	2012	2013	Total Traps
EU.España	819.76	1,348.32	1,194.26	1,209.17	901.91	901.91	1,105.98	1,369.98	8,851.27
EU.Italy	125.32	93.05	148.56	143.94	280.83	164.75	125.22	222.00	1,303.68
EU.Portugal	24.56	22.60	24.39	46.19	57.10	179.92	215.38	233.19	803.33
Maroc	1,744.00	2,417.00	1,950.00	1,909.00	1,348.00	1,055.00	990.00	960.47	12,373.47
Total general	**2,713.63**	**3,880.98**	**3,317.21**	**3,308.30**	**2,587.84**	**2,301.57**	**2,436.58**	**2,785.64**	**23,331.75**

Source: ICCAT (2014)

BFT catches in Italy, Morocco, Portugal and Spain (2013)

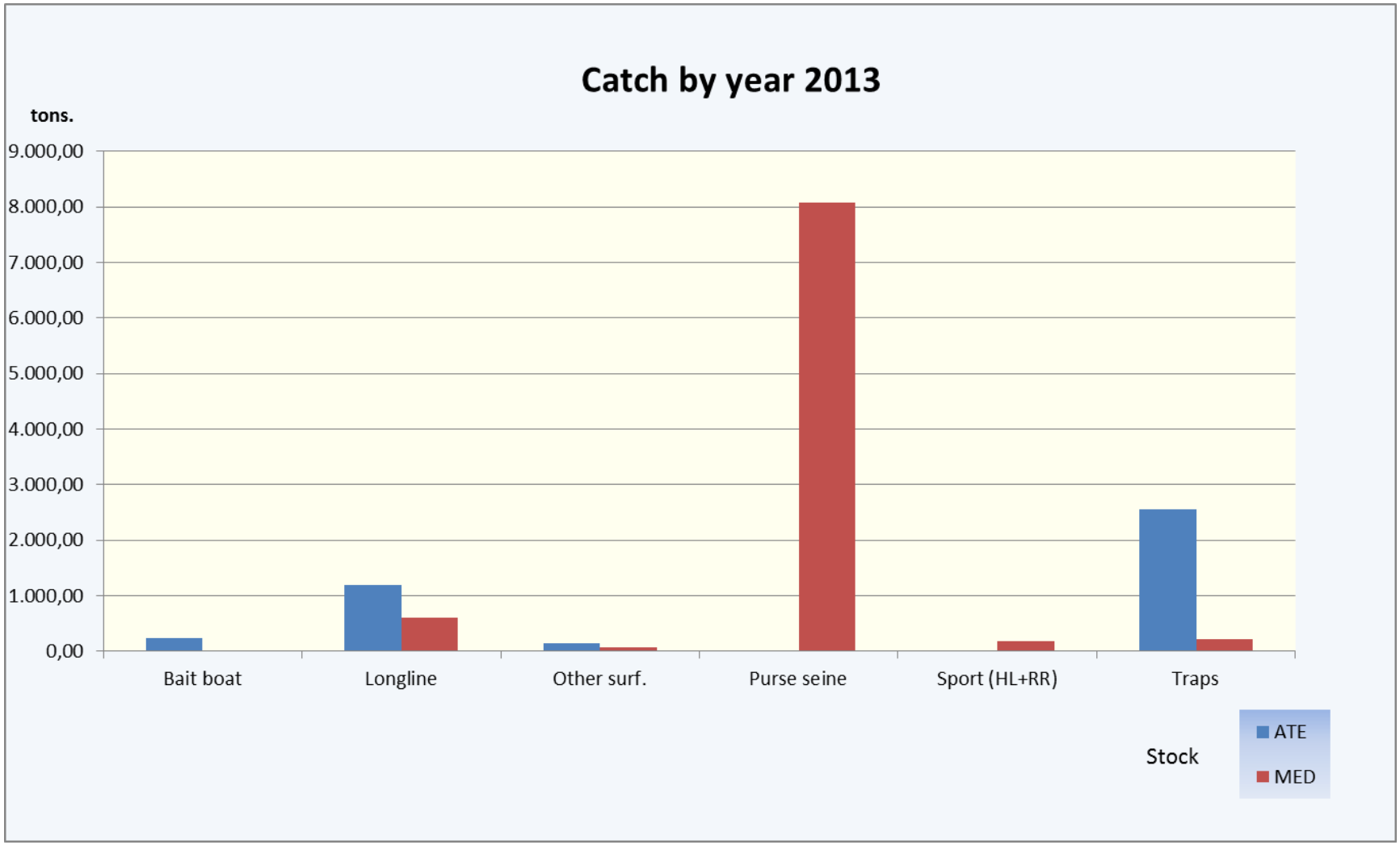


Graphic processed with data obtained from ICCAT (2014)

	ATE	MED	Total general
Bait boat	**162.72**	**0.00**	**162.72**
EU.España	162.72	0.00	162.72
EU.Portugal	0.00		0.00
Longline	**0.34**	**213.79**	**214.14**
EU.España	0.00	23.98	23.98
EU.Italy		180.38	180.38
EU.Portugal	0.34		0.34
Maroc		9.43	9.43
Other surf.	**0.00**	**51.14**	**51.14**
EU.España	0.00	0.00	0.00
EU.Italy		51.14	51.14
Purse seine	**1.46**	**2,561.91**	**2,563.37**
EU.España		917.43	917.43
EU.Italy		1,474.50	1,474.50
EU.Portugal	1.46		1.46
Maroc		169.98	169.98
Sport (HL+RR)	**20.69**	**146.77**	**167.46**
EU.España	20.69	7.06	27.75
EU.Italy		9.71	9.71
Maroc		130.00	130.00
Traps	**2,563.64**	**222.00**	**2,785.64**
EU.España	1,369.98	0.00	1,369.98
EU.Italy		222.00	222.00
EU.Portugal	233.19		233.19
Maroc	960.47		960.47
Total general	**2,748.86**	**3,195.61**	**5,944.46**

Source: ICCAT (2014)

Total catches for gear in the mediterranean an ATE (all ICCAT countries)

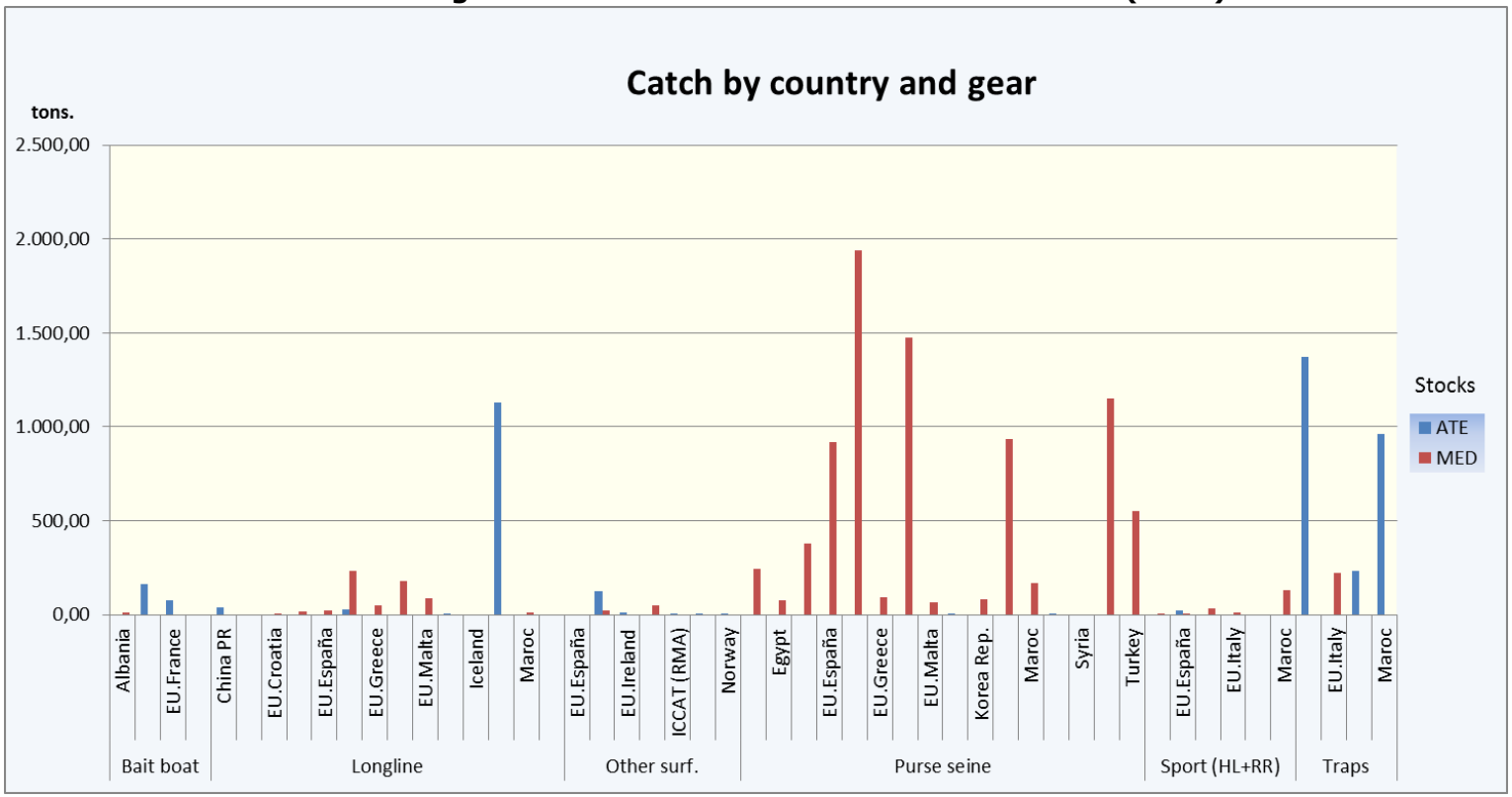


Graphic processed with data obtained from ICCAT (2014)

	ATE	MED	Total general
Bait boat	236.42	8.59	245.02
Longline	1,192.28	604.92	1,797.20
Other surf.	144.81	70.90	215.71
Purse seine	1.59	8,078.27	8,079.86
Sport (HL+RR)	20.69	188.73	209.42
Traps	2,563.64	222.00	2,785.64
Total general	**4,159.44**	**9,173.41**	**13,332.84**

Source: ICCAT (2014)

Detail catches of ICCAT countries and gear in Mediterraenean and Eastern Atlantic (2013)



Graphic processed with data obtained from ICCAT (2014)

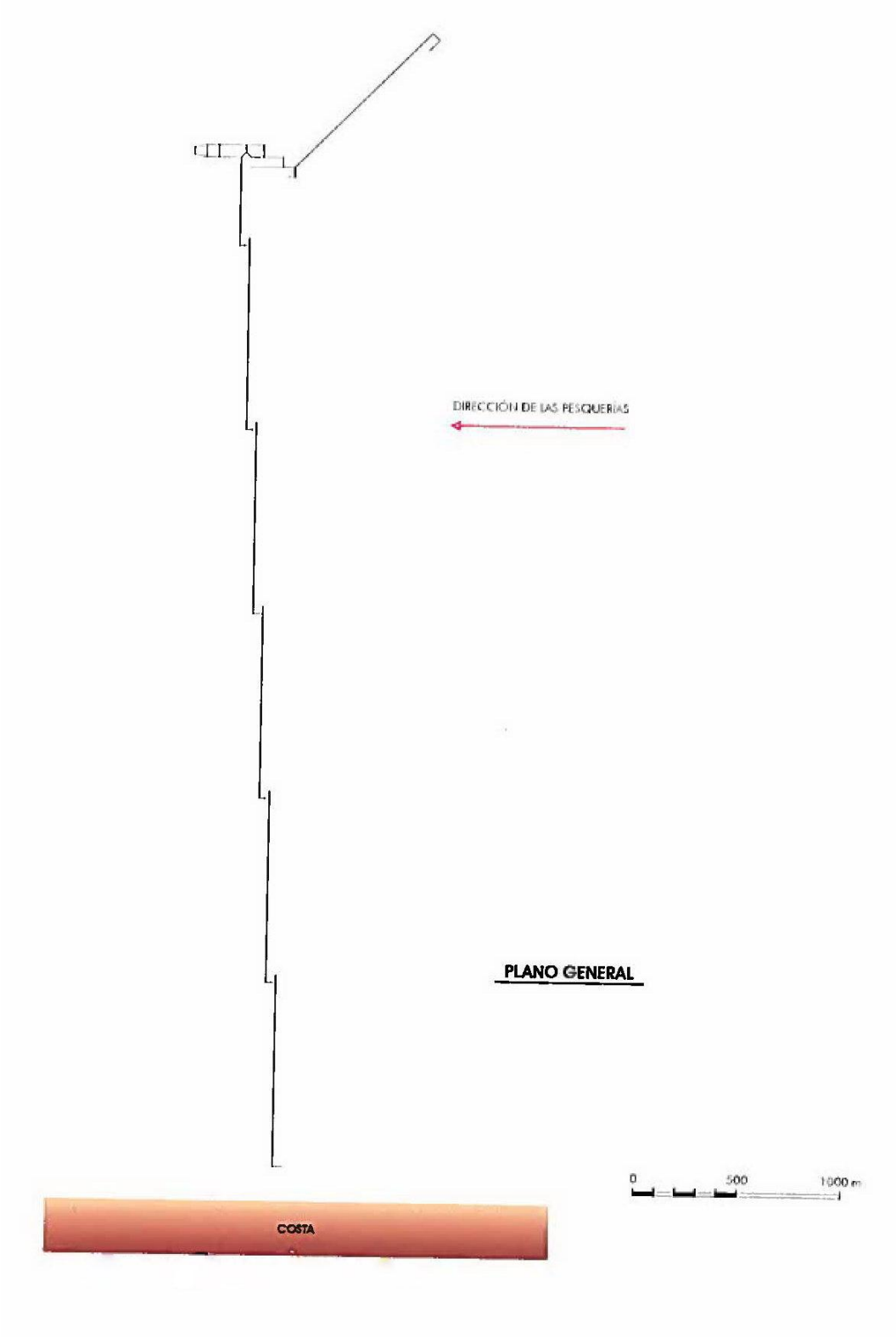
Gear/Country	ATE	MED	Total general
Bait boat	**236.42**	**8.59**	**245.02**
Albania		8.59	8.59
EU.España	162.72	0.00	162.72
EU.France	73.70		73.70
EU.Portugal	0.00		0.00
Longline	**1,192.28**	**604.92**	**1,797.20**
China PR	38.14		38.14
Chinese Taipei	0.00	0.00	0.00
EU.Croatia		1.67	1.67
EU.Cyprus		17.13	17.13
EU.España	0.00	23.98	23.98
EU.France	25.70	231.62	257.32
EU.Greece		51.26	51.26
EU.Italy		180.38	180.38
EU.Malta		89.45	89.45
EU.Portugal	0.34		0.34
Iceland	0.00		0.00
Japan	1,128.10		1,128.10
Maroc		9.43	9.43
Syria		0.00	0.00
Other surf.	**144.81**	**70.90**	**215.71**
EU.España	0.00	0.00	0.00
EU.France	123.56	19.76	143.32
EU.Ireland	13.10		13.10
EU.Italy		51.14	51.14
ICCAT (RMA)	4.17		4.17
Iceland	3.80		3.80
Norway	0.18		0.18
Purse seine	**1.59**	**8,078.27**	**8,079.86**
Algerie		243.83	243.83
Egypt		77.09	77.09
EU.Croatia		380.33	380.33
EU.España		917.43	917.43
EU.France		1,939.88	1,939.88
EU.Greece		91.33	91.33

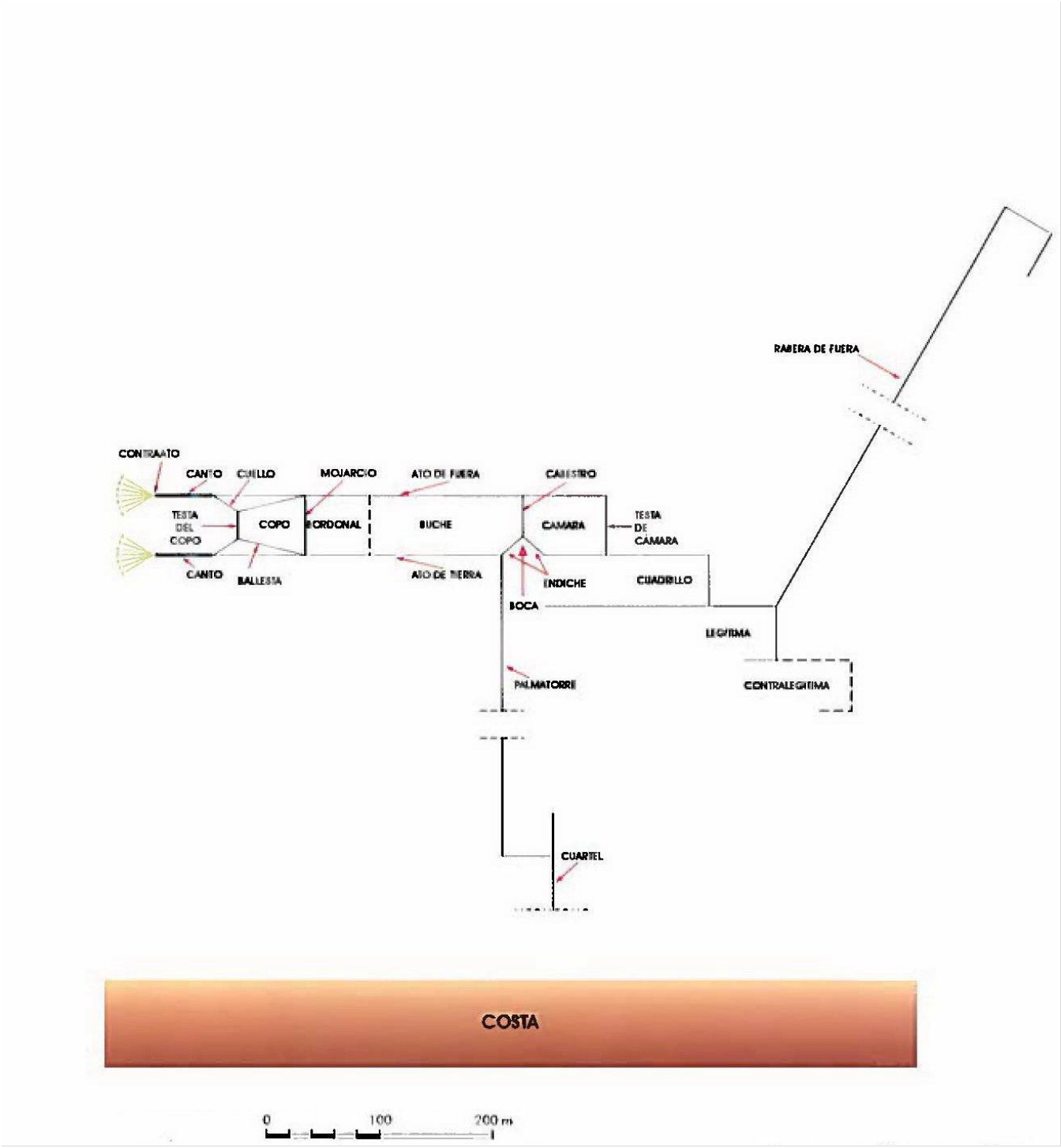
Gear/Country	ATE	MED	Total general
EU.Italy		1,474.50	1,474.50
EU.Malta		65.93	65.93
EU.Portugal	1.46		1.46
Korea Rep.		80.50	80.50
Libya		933.10	933.10
Maroc		169.98	169.98
Norway	0.13		0.13
Syria		0.00	0.00
Tunisie		1,153.02	1,153.02
Turkey		551.36	551.36
Sport (HL+RR)	**20.69**	**188.73**	**209.42**
EU.Croatia		6.99	6.99
EU.España	20.69	7.06	27.75
EU.Greece		34.97	34.97
EU.Italy		9.71	9.71
Iceland	0.00		0.00
Maroc		130.00	130.00
Traps	**2,563.64**	**222.00**	**2,785.64**
EU.España	1,369.98	0.00	1,369.98
EU.Italy		222.00	222.00
EU.Portugal	233.19		233.19
Maroc	960.47		960.47
Total general	**4,159.44**	**9,173.41**	**13,332.84**

Source: ICCAT (2014)

ANNEX 2.- DIFFERENT TYPES OF ALMADRABAS

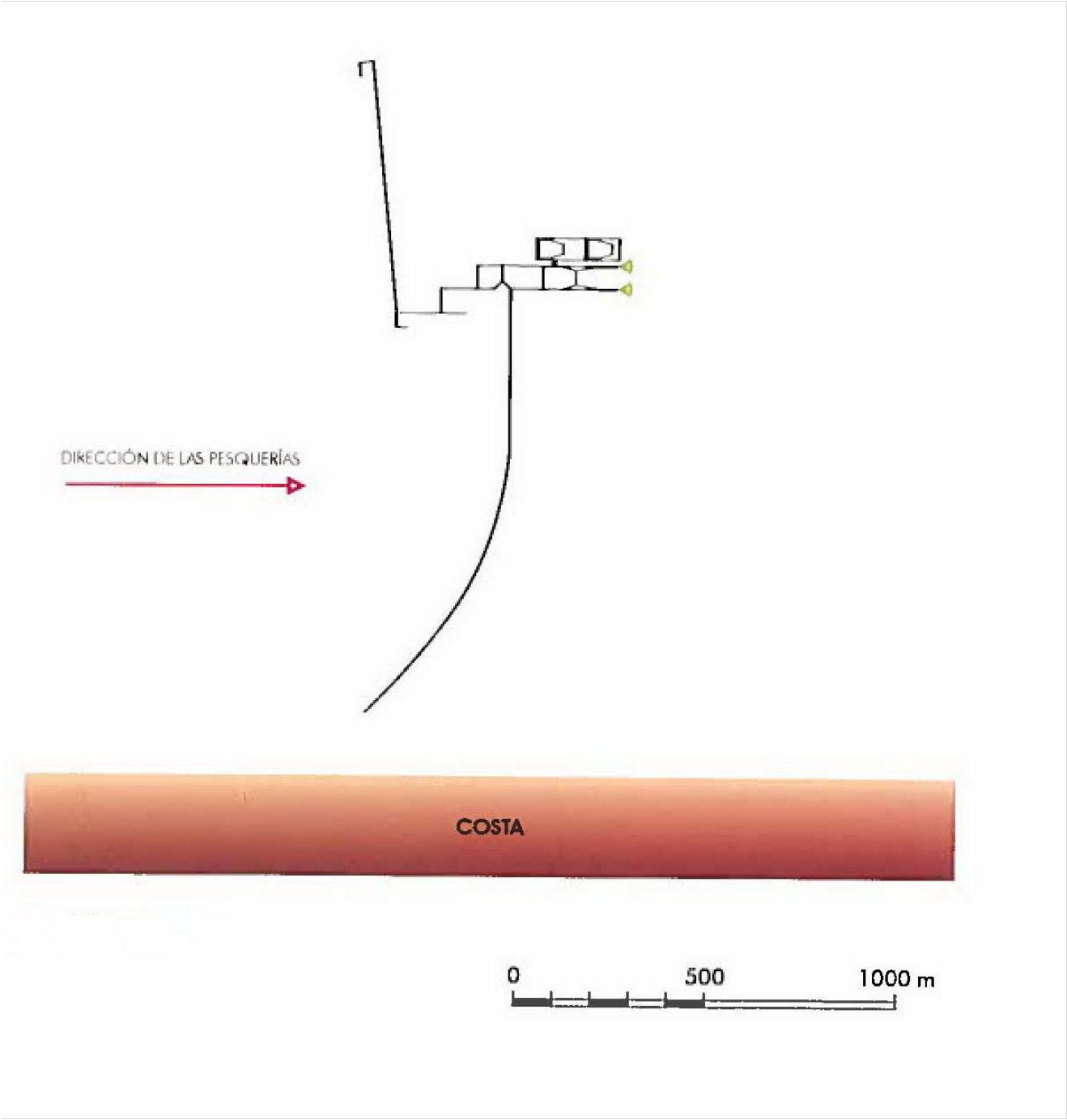
Parts and their situation in a forward "almadraba"

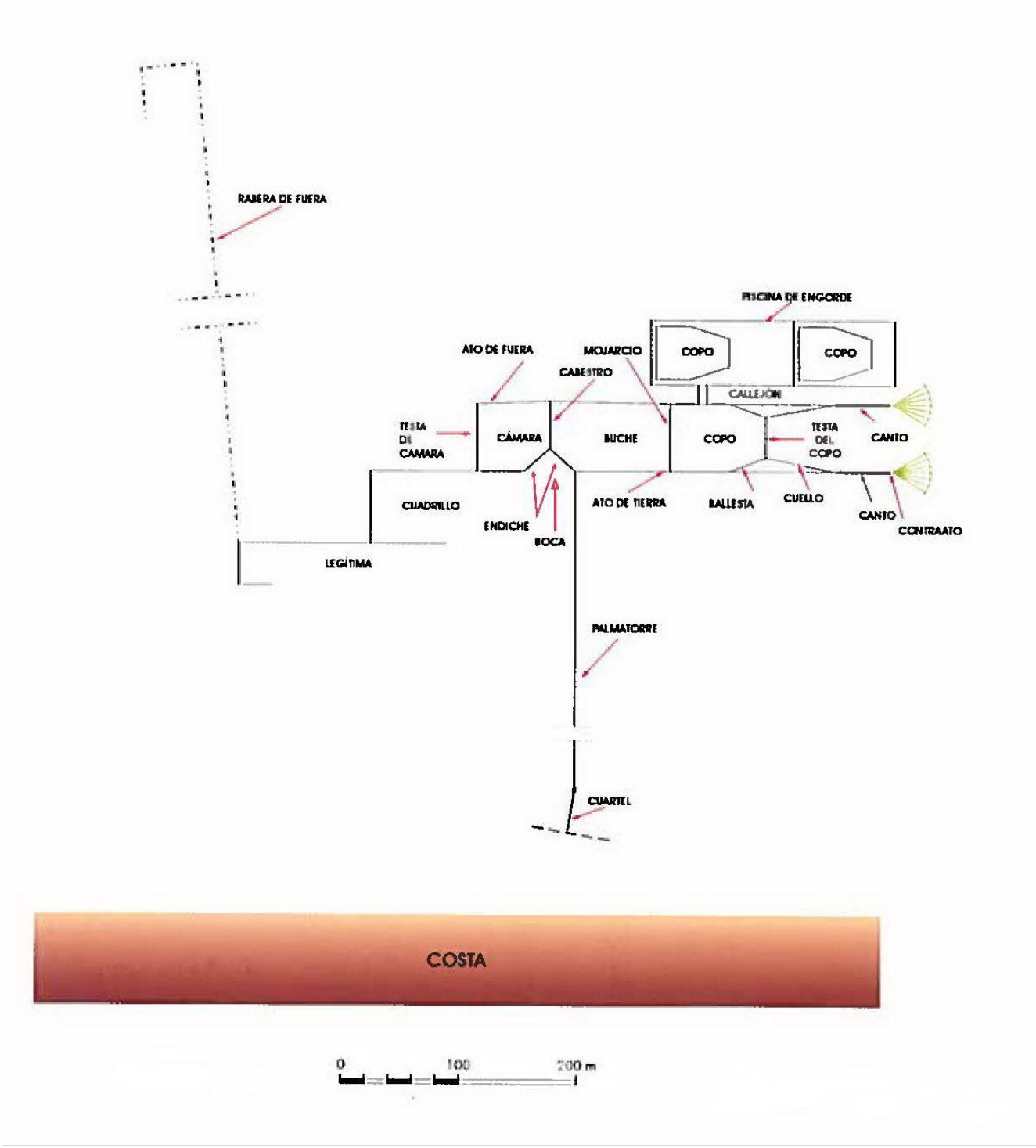




Source: Junta de Andalucia (2003). Catálogo de Artes, Aparejos y Utensilios de Pesca del Litoral Andaluz.

Parts and their situation in a reverse "almadraba"





Source: Junta de Andalucia (2003). Catálogo de Artes, Aparejos y Utensilios de Pesca del Litoral Andaluz.

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ISBN 978-92-823-6645-5
doi: 10.2861/605869

Publications Office