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STRUCTURAL AND COHESION POLICIES **B**



Agriculture and Rural Development



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**THE OBLIGATION TO
LAND ALL CATCHES -
CONSEQUENCES
FOR THE MEDITERRANEAN**

IN-DEPTH ANALYSIS





DIRECTORATE-GENERAL FOR INTERNAL POLICIES
POLICY DEPARTMENT B: STRUCTURAL AND COHESION POLICIES

FISHERIES

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

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DIRECTORATE-GENERAL FOR INTERNAL POLICIES
POLICY DEPARTMENT B: STRUCTURAL AND COHESION POLICIES

FISHERIES

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Abstract

The Landing obligation of regulated species in the EU Mediterranean is raising some concerns about its effective implementation. This report provides a state-of-the-art of fishery discards in the Mediterranean, discussing consequences of the discards ban and finally providing some recommendations on how to tackle the problem of juvenile catches.

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LIST OF ABBREVIATIONS

EC	European Commission
EU	European Union
EUROSTAT	Statistical Office of the European Union
CFP	Common Fishery Policy
DCF	Data Collection Framework
FAO	Food and Agriculture Organization of the United Nations
GFCM	General Fisheries Commission for the Mediterranean
GSA	Geographical Sub-Area
ICCAT	International Commission for the Conservation of Atlantic Tuna
IUU	Illegal, Unregulated and Unreported catches
MLS	Minimum Legal Size
MPA	Marine Protected Area
MRAG	Marine Resources and Fisheries Consultants
MS	Member State
OTB_DEF	Bottom otter trawl for demersal species
OTB_DWS	Bottom otter trawl for deep water species
PS_SPF	Purse seine for small pelagic fish
PTM_SPF	Pelagic pair trawl for small pelagic fish
STECF	Scientific Technical Economic Committee for Fisheries
SWOT	Strengths, Weaknesses, Opportunities and Threats analysis
TAC	Total Allowable Catch
TL	Total Length
VMS	Vessel Monitoring System

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EXECUTIVE SUMMARY

Background

The high level of discards in Europe was identified by the European Commission, through the Green Paper on the CFP, as one of the structural weaknesses of the CFP (European Commission, 2009b). According to the Council of the European Union (2013), an obligation to land discards is necessary and the new CFP introduces this obligation gradually, following a schedule adapted to different areas, fisheries and species. Once the regulation comes into force all catches of species managed by quotas/catch limits and minimum landing sizes should be landed (article 15 of the CFP). Except bluefin tuna, in the Mediterranean there are no quotas and this regulation affect all regulated species with minimum landing sizes listed in Annex III of Regulation (EC) No 1967/2006. The landed discards will be limited to purposes other than human consumption (meals and fish oils, animal feed, cosmetics, pharmaceuticals and food additives). Exceptions (minimis) from the obligation to land (Council of the European Union, 2013) are also introduced. Member States may carry out pilot projects to avoid, minimize and eliminate unwanted catches (Council of the European Union, 2013).

Under these circumstances, the discard ban may lead to an increase in catching juvenile fish, because catches of juveniles are not counted against a given quota as is the case in the Atlantic fisheries, and thus there is no incentive to avoid fishing them. On the contrary, the obligation to bring to port the juveniles that are now discarded and their transformation into fishmeal might even become commercially attractive.

There is also a great concern about the possible increase of the black market for juveniles in some Mediterranean countries.

Aim

The aim of the present study is to provide a comprehensive qualitative analysis of the discards in the EU Mediterranean fisheries as well as to assess effects of the discard ban in the Mediterranean, with a particular focus on the discards on juveniles. The approach is focused on five main aspects, comprising a global view for the successful implementation of the new CFP, particularly in the aspects related to the discard ban and landing obligation. These are:

- European Mediterranean fisheries.
- Discards in EU Mediterranean fisheries.
- Discards mitigation measures.
- Use of un-wanted catches, commercialization and black market.
- Obligation to land all catches – implementation of the new CFP.

The methodology used comprised a twofold methodological approach:

- provision of a general overview about the Mediterranean fisheries and discards, based on the collection of recent information from academic publications, studies and reports of European Institutions, authorities of the Members States, and any other relevant sources;
- analysis of primary data collected from fieldwork and case studies. In some cases the IEO fishery database was used to provide useful Spanish examples to be extrapolated for different European fisheries.

Main findings

Mediterranean fisheries represent an important and vital sector of European Union fisheries, accounting for 46% of total EU fishing vessels. They comprise up to 22% of the EU fleet in terms of tonnage and 34% in terms of engine power. Landings in the Mediterranean represent a relatively small proportion, around 12 % of total EU landings. Overall, the Mediterranean fleet lands an average of 500,000 t per year , of which 48 % are in Italy, 20% in Spain , 16% in Greece, 8% in Croatia, 6% in France and Slovenia, Malta and Cyprus contributing each with less than 1 %. The main fisheries in the Mediterranean are bottom otter trawlers, pelagic trawlers and purse seines, drifting longlines and small-scale fisheries (also named artisanal fisheries). Bottom trawl is the fishing gear with higher discard rates. Because of the high diversity of species in the Mediterranean, there is a great diversity of discards in the bottom trawl fisheries. From 300 species caught in the Mediterranean, only around 10% are consistently marketed and 30% are occasionally retained (depending on the sizes and market demands) whereas up to 60% are always discarded.

Discards in the Mediterranean are estimated at around 18% of the total catch. Discards differ depending on the country. For regulated species, countries with the highest discard rates are Italy (more than 40% of landings), then Spain (5%) and Slovenia (5%). Reasons for discarding are variable. Data suggests that much of the discarding was not only associated to undersized fish but also to high-grading and market issues rather than other legal constraints. In fact, a very important driving factor for discards is the existence or absence of market. In some cases even a portion of the valuable catch is discarded to maintain price stability if supply exceeds demand. Table 1 shows estimates of total and undersized discards of several species, using Spanish data as example. It can be shown that discards of target species in the Mediterranean are generally low.

Some discards mitigation measures are suggested, mainly based on fishing selectivity, spatio-temporal closures and protection of vulnerable sizes and vulnerable species. Also better involvement of fishermen into management to comply in a better manner with mitigation measures is suggested. Given the characteristics and peculiarities of each region, local action plans are needed as solutions for management need to be set up in a regional context. Regarding use of unwanted catches, the lack of information concerning availability and types of raw material to apply valorization on an industrial scale is a handicap to overcome. Specific protocols for safety and preservation of raw material are also needed. A well-defined logistic and management network adapted to each area and type of industry does not currently exist. Delivering specific amounts of discard required by a given transformation can diminish industrial efficiency.

Unreported landings in the Mediterranean for demersal fisheries are estimated at 30~35% of total landings. The black market is mainly related to traditional consumption habits, the economic crisis and illegal catches, and it is benefited by a soft (lacking in some cases) enforcement and control by countries and regional organizations of fishing activities, due to inappropriate or insufficient operational plans and disciplinary measures for those not following the rules. Summarising the information of unreported fishery data in Spain by the late 2000s, the most important sources of unreported landings were recreational fishing (36%), followed by black market sales (32%), subsistence fishing (17%), unreported artisanal fishing (12%) and illegal catches (2%).

One possible consequence of the new regulation may be the increase in illegal marketing of fish below the minimum size. Landing, storage and transportation of juveniles will be legal and this can simplify commercialization via black market

A SWOT analysis reports the overall balance was detrimental to the implementation of the new CFP, with 72.6% of negative aspects (Weaknesses and Threats) and 27.4% of positive aspects (Strengths and Opportunities).

The landing obligation will prompt a different way of processing and storing fish material, which may also produce a cascade effect in other steps of the fishing and commercialization process. The discard ban and landing obligation should be accompanied by other measures for its successful implementation. Some of these measures are improvements of control of fishing effort, better fishing selectivity, spatio-temporal fishing restrictions for vulnerable sizes and/or areas, effective enforcement and finally an agreement of the fishing sector to comply with the rules and regulations.

Table 1: Yearly estimates of undersized discards of species minimum landing size. Spanish Mediterranean Fisheries.

Species	Scientific name	Fishery	Legal size	Landings tons	Total discard tons	Total discard %	Undersized discard tons	Undersized discards %
Hake	<i>Merluccius merluccius</i>	Bottom trawl	20 cm	3298	250	7.6	151	4.6
Rose shrimp	<i>Parapenaeus longirostris</i>	Bottom trawl	20 mm	250	3	1.3	0	0.1
Norway lobster	<i>Nephrops norvegicus</i>	Bottom trawl	20 mm	411	21	5.1	0	0.0
Red mullet	<i>Mullus barbatus</i>	Bottom trawl	11 cm	898	20	2.2	2	0.2
Surmullet	<i>Mullus surmuletus</i>	Bottom trawl	11 cm	534	6	1.0	0	0.0
Axillary seabream	<i>Pagellus acarne</i>	Bottom trawl	17 cm	305	513	168.1	234	76.7
Black spot seabream	<i>Pagellus bogaraveo</i>	Bottom trawl	33 cm	58	347	592.8	211	361.2
Common pandora	<i>Pagellus erythrinus</i>	Bottom trawl	15 cm	344	375	108.8	29	8.4
Atlantic horse mackerel	<i>Trachurus trachurus</i>	Bottom trawl	15 cm	1780	605	34.0	313	17.6
Mediterranean horse mackerel	<i>Trachurus mediterraneus</i>	Bottom trawl	15 cm	816	585	71.7	353	43.2
Red mullet	<i>Mullus barbatus</i>	Trammel nets	11 cm	81	1	1.8	0	0.0
Surmullet	<i>Mullus surmuletus</i>	Trammel nets	11 cm	149	5	3.0	0	0.0
Anchovy	<i>Engraulis encrasicolus</i>	Purse seine	9 cm	10359	0	0.0	0	0.0
Sardine	<i>Sardina pulchardus</i>	Purse seine	11 cm	15656	539	3.4	1	0.0
Mackerels	<i>Scomber spp</i>	Purse seine	18 cm	3429	376	11.0	57	1.7
Atlantic horse mackerel	<i>Trachurus trachurus</i>	Purse seine	15 cm	1731	102	5.9	5	0.3
Mediterranean horse mackerel	<i>Trachurus mediterraneus</i>	Purse seine	15 cm	1377	9	0.7	10	0.7

Source: Authors

GENERAL INFORMATION

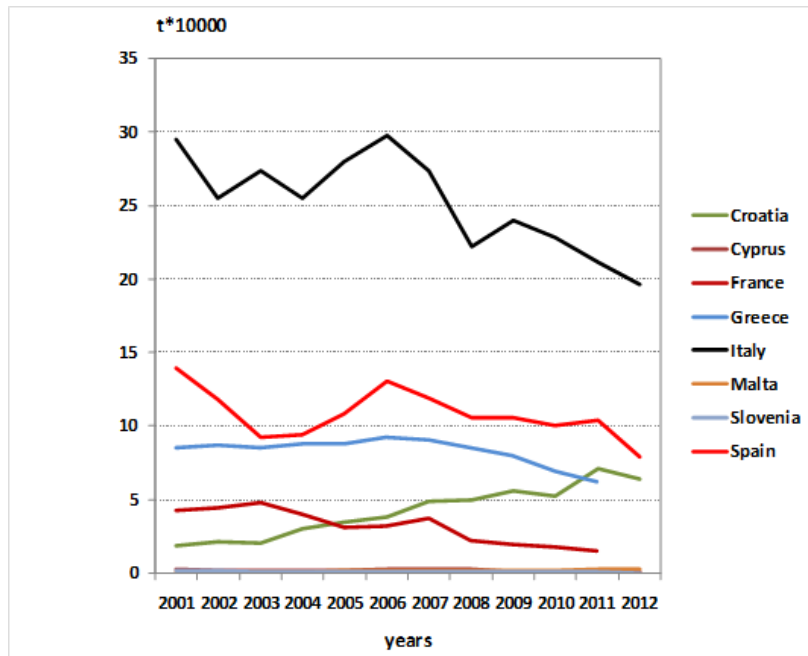
KEY FINDINGS

- **Mediterranean fisheries** represent an important and vital sector of European Union fisheries, **accounting for 46% of total EU fishing vessels** and 34% in terms of engine power.
- Landings in the Mediterranean represent a relatively small proportion, around 12 % of total EU landings by weight. Overall, **the Mediterranean fleet lands an average of 500 000 t per year** , of which 48 % are in Italy , 20% Spain , 16% Greece, 8% Croatia, 6% France, and Slovenia, Malta and Cyprus contributing each with less than 1 %.
- **Reasons for discarding are highly variable and they can be driven by economic, sociological, environmental or biological factors.** These factors often act together, it is quite difficult to separate them, especially in multispecies fisheries.
- The high level of discards in Europe is one of the structural weaknesses of the CFP. The new CFP introduces a gradual obligation to land discards, according to a schedule based in different areas, fisheries and species.
- **Given the characteristics and peculiarities of each region, solutions for management have to be applied on a regional basis.**

European Mediterranean fisheries

Mediterranean fisheries represent an important and vital sector of European Union fisheries, accounting for 46% of total EU fishing vessels. They comprise up to 22% of the EU fleet in terms of tonnage and 34% in terms on engine power. On average, fishing vessels in the Mediterranean are smaller than the rest of the Community. Almost 33,000 vessels are smaller than 12m length, i.e. about 80% of Mediterranean boats are small-scale boats, giving the Mediterranean fleet many characteristics of artisanal fisheries.

Landings in the Mediterranean represent a relatively small proportion, around 12 % of total EU landings. Overall, the Mediterranean fleet lands an average of 500,000 t per year , of which 48 % are in Italy , 20% in Spain , 16% in Greece, 8% in Croatia, 6% in France and Slovenia , Malta and Cyprus contributing each one with less than 1 % (Fig. 1).

Figure 1. Landings by Mediterranean country (in Tons) during the last decade.

Source: Statistical Office of the European Union: EUROSTAT.

A general trend of declining catches has been observed in the last 10 years, except Croatia. In general, both catch rates and the total amount of daily catches in the Mediterranean are low in comparison with those from other seas. However, the economic value of landings is much higher. This may be explained by the fact that most of the Mediterranean catches are fresh market used for human consumption, generating high market values.

Fishery discards in the Mediterranean

Discards exist since man began consistently fishing. Initially species that were not consumed were dumped overboard and, eventually some species have become consumable and more valuable (Mallol, 2005). Reasons for discarding are highly variable and they can be driven by economic, sociological, environmental or biological factors (Bellido et al, 2012). These factors often act together, and it is quite difficult to separate them, especially in multispecies fisheries (Bellido et al, 2012; Tsagarakis et al., 2013).

Both natural conditions and biology and distribution of marine species impede selectivity in fisheries (Johnsen and Eliassen, 2011). The level of discards changes if the fishery is directed at homogeneous or mixed fishing grounds, According Eliassen and Christensen (2012). There are also seasonal and interannual variations in fisheries discards (Moranta et al, 2000; Tsagarakis et al., 2013), and some others related to the cycles of life of the species (Tsagarakis et al., 2013), depth (Machias et al., 2001; Sánchez et al., 2004; Mallol, 2005) or differences in the composition of the catch and relative biomass of target species (Tsagarakis et al., 2013).

A very important driving factor for discards is the existence or absence of a market (Vassilopoulou et al., 2012). in some cases Even a portion of the valuable catch is discarded to maintain price stability if supply exceeds demand (Mallol, 2005).

Discarding can generate changes in the ecosystem, for instances changes for the disruption of food webs (Tudela, 2004). The discarded biomass favours the proliferation of opportunistic scavengers and primary production by re-input of nutrients in seabed and water columns (Saila, 1983). At the community level, a continuous supply of discards can

alter the diversity and abundance of benthic species (Bozzano and Sarda, 2002), affecting the functionality and distribution of ecological niches.

Discards are also a source of unaccounted fishing mortality, as they are usually not recorded in the statistics of abundance (Johnsen and Eliassen, 2011), which may affect the quality of scientific advice and therefore fisheries management. This can even contribute to problems of overfishing, both growth overfishing and recruitment overfishing (Mallol, 2005)

However, some authors consider that discards also have a positive effect by increasing the productivity of ecosystems and pelagic-benthic ratio (Tsagarakis et al., 2013) as well as creating other trophic interactions and increasing secondary production (Groenewold and Fonds, 2000). Also, discards are food for several species of seabirds (Camphuysen et al., 1995; Martínez-Abraín et al., 2002). In oligotrophic areas such as the Mediterranean, perhaps any residual input could produce positive effects in certain populations, as demonstrated with the nutrients derived from aquaculture (Machias et al., 2004).

The new CFP and the ban of discards

Management of discards is carried out in many different ways in different countries worldwide. New Zealand, Iceland and Norway are perhaps countries with a more advanced regulation, where different measures of quotas and fishing effort are in place (Jakupsstovu et al, 2007, Gezelius, 2008; Icelandic Directorate of Fisheries, 2012; Popescu and Poulsen, 2012). These measures include the discard ban, which has performed relatively well (Catchpole et al, 2005) and a reduction discard rates is apparent in some of these fisheries (Pálsson et al., 2006; Icelandic Directorate of Fisheries, 2012).

According to the Icelandic Government (2012), reducing discard rates is more associated with the combination of other measures than the prohibition itself. It should also be remarked that in these countries, the management of discards is less complex than in the European Union because they are smaller and there are no large mixed fisheries, unlike in the European Union (European Commission, 2009a). In addition, the European fishing sector is diverse, with significant differences between the regions of the North Atlantic and the Mediterranean (Uhlmann et al., 2013), and consequently in its fishing management.

Given the characteristics and peculiarities of each region (Uhlmann et al., 2013), the solutions that have been shown useful and effective in the Nordic countries maybe do not necessarily fit all fisheries in the European Union. However, it will be worthy to take into account the Nordic experience in developing and implementing management measures for discards and then tuning the management systems according the needs of each fishing area (Johnsen and Eliassen, 2011).

The high level of discards in Europe was identified by the European Commission, through the Green Paper on the CFP, as one of the structural weaknesses of the CFP (European Commission, 2009b). According to the Council of the European Union (2013), an obligation to land discards is necessary and the new CFP introduces this obligation gradually, according to a schedule based in different areas, fisheries and species.

Once the regulation comes into force, according to Article 15 of the CFP all catches of species managed by quotas/catch limits and minimum landing sizes should be landed. Except for bluefin tuna, there are no quotas in the Mediterranean and this regulation affects all regulated species with minimum landing size listed in Annex III of Regulation EC 1967/2006 (Council the European Union, 2006), except when used as live bait. However, there are some important gaps between national and European regulation, as in many cases national regulation is more restrictive than European regulation, having more species

regulated by minimum sizes. Hence, undersized individuals of regulated species with minimum size under national regulations are not covered under the European regulations, and must be returned to the sea. Therefore, the regulation is only applied to species listed in Annex III of Regulation (EC) No 1967/2006, no matter if other national regulation for minimum size exists for other species.

The landed discards will be limited to purposes other than human consumption (meals and fish oils, animal feed, cosmetics, pharmaceuticals and food additives). Exceptions (minimis) from the obligation landing (Council of the European Union, 2013) are also introduced. Member States may carry out pilot projects to avoid, minimize and eliminate unwanted catches (Council of the European Union, 2013).

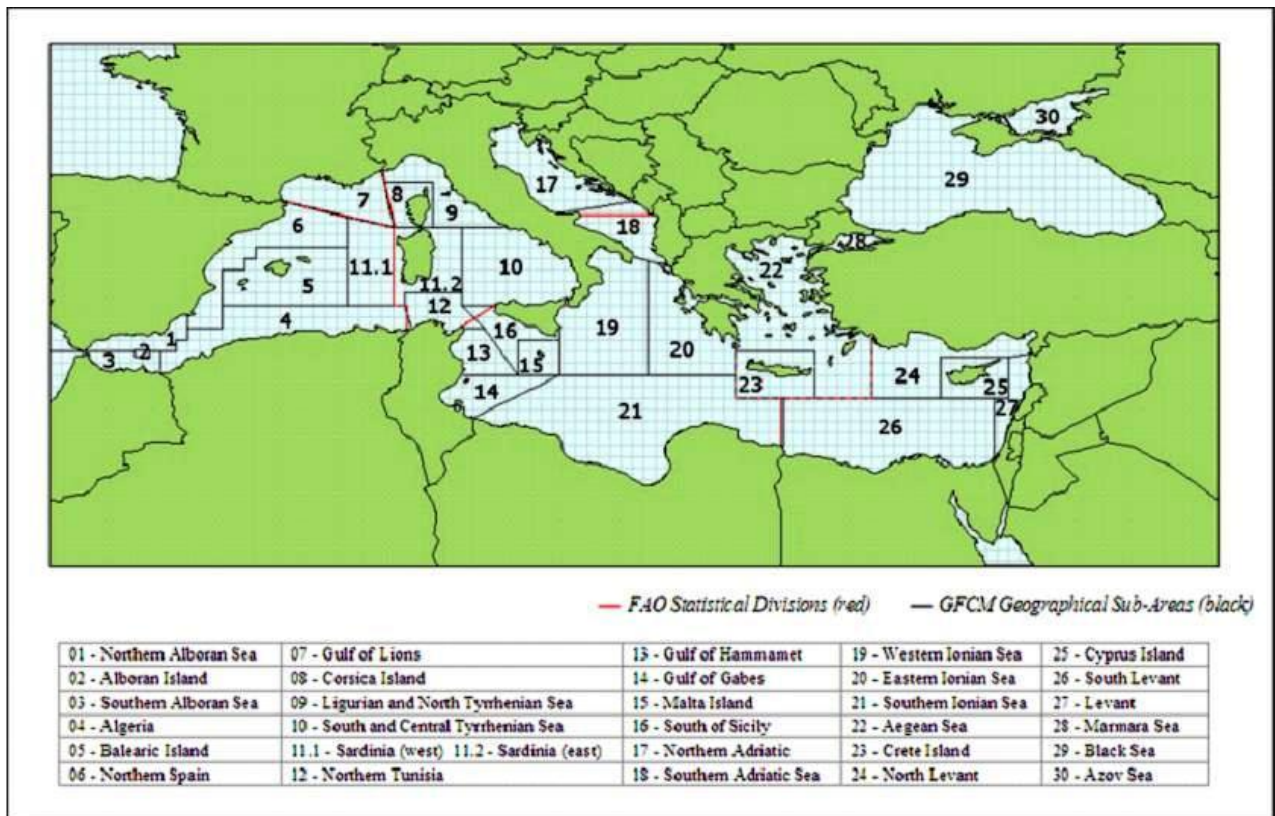
1. EUROPEAN MEDITERRANEAN FISHERIES

KEY FINDINGS

- The **European Mediterranean fisheries are monitored by** Member States following the **Data Collection Framework** rules (**EU Regulation 2010/93**).
- The **geographical stratification** used in the data collection is the **FAO GFCM Geographical Sub-Areas, and the sampling unit is the metier**.
- Mediterranean fisheries are **rather similar in their characteristics**, although in the Eastern basin there is a higher proportion of artisanal fleet.
- The main fisheries in the Mediterranean are bottom otter trawlers, pelagic trawlers and purse seines, drifting longlines and the artisanal fleet. **Bottom trawl is the fishing gear with higher discard rates**.
- Countries with **the highest landings are Italy and Spain**, but countries with **the highest number of boats are Greece and Italy**.

The Mediterranean Sea is usually divided into Geographical Sub-Areas in order to compile data, monitor and assess fisheries resources (GFCM, 2007). All Mediterranean countries collect fishery data and carry out statistics and stock assessment in a GSAs basis (Map 1).

Map 1. Geographical Sub-Areas (black) and FAO Statistical Divisions (red) in the Mediterranean



Source: Resolution GFCM/31/2007/2.

1.1. Data and Sampling

Since 2009 fisheries information is compiled gathered by metier (Fishing Unit). A metier is a group of fishing operations targeting a similar (assemblage of) species, using similar gear, during the same period of the year and within the same area. In other words, a metier is a group of vessels sharing the same fishing exploitation pattern. The use of "metier" allows a better identification of the actual effort exerted in a resource. It produces a better definition of the fleet, considering fishing strategies, uses and knowledge of fishermen. Also it allows more operational management units.

The EU Data Collection Framework (DCF, EC 2008a, EC 2008b, EC 2008c, EU 2010) establishes a framework for the collection of economic, biological and transversal data by Member States (MS). It was intended that this framework would provide the basic data needed to evaluate the state of fishery resources and the fisheries sector. According to EU Regulation 2010/93 (EU, 2010), the 7th Regional Coordination Meeting for the Mediterranean and Black seas 2010 established the métiers where MS have to collect discard data in the Mediterranean:

Table 2. List of métiers of the Mediterranean where there is an obligation for sampling

METIER CODING	METIER NAMING
LLD_LPF_0_0_0	Drifting longlines for large pelagic
OTB_DEF_>=40_0_0	Bottom otter trawl for demersal species
OTB_DWS_>=40_0_0	Bottom otter trawl for deep water species
OTB_MDD_>=40_0_0	Bottom otter trawl for mixed demersal and deep water species
OTM_MPD_>=13_19_0_0	Pelagic trawl according meshsize regulation
OTM_MPD_>=20_0_0	Midwater otter trawl for mixed demersal and pelagic species
PTM_SPF_>=20_0_0	Pelagic pair trawl for small pelagic species
TBB_DEF_0_0_0	Beam trawl for demersal trawling

Source: Report of 7th Regional Coordination Meeting for the Mediterranean and Black seas 2010.

1.2. Characteristics of main fisheries

In general, Mediterranean fisheries are rather similar in their characteristics. Western and Central basins are really similar to each other, while in the Eastern artisanal fleets are more prevalent, comprising a majority of small-scale boats. The target species vary between metiers. The same species can be targeted by one gear and also considered bycatch in others gears. The major fisheries in the Mediterranean in volume of landings are purse seine fisheries and demersal and pelagic trawl. However, small-scale fisheries are much larger in number of vessels and they usually use more selective gears (gillnets, longlines, traps).

1.2.1. Bottom otter trawlers

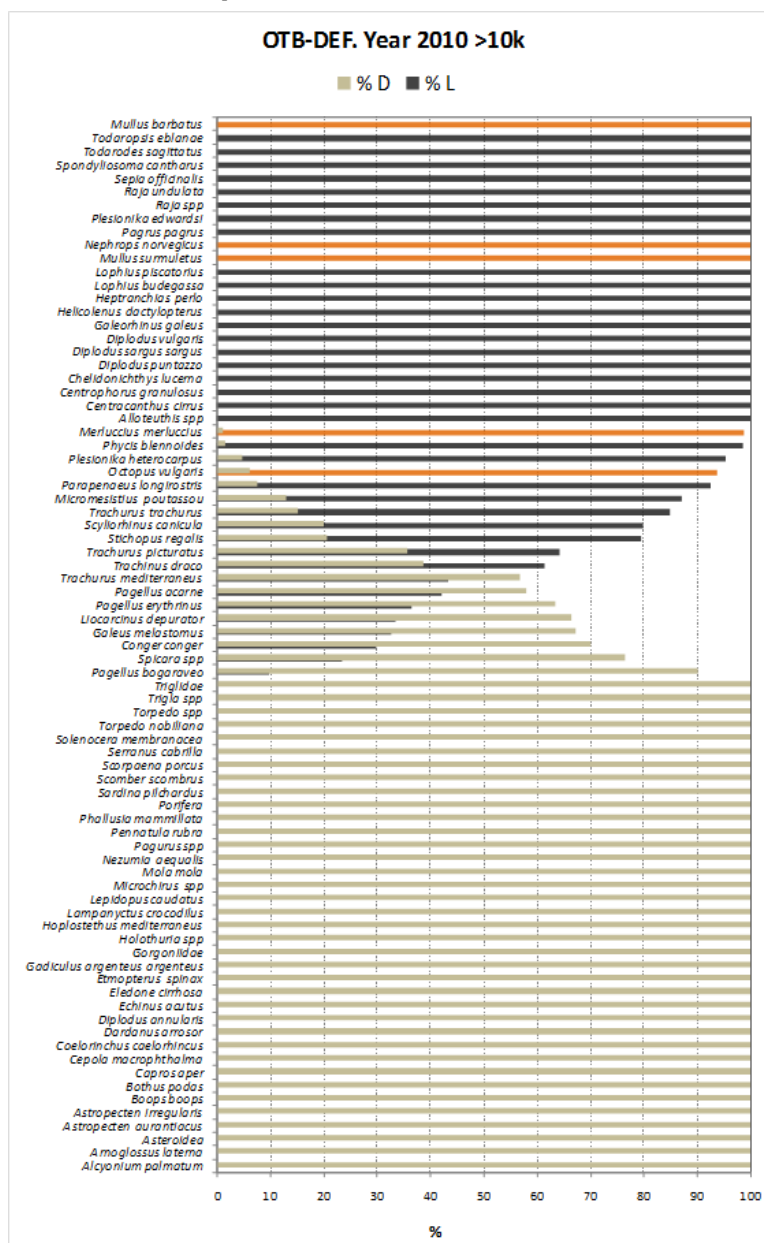
The trawl fishery is the second largest in landings in the Mediterranean, after small pelagic fisheries. A clear decreasing trend in number of trawlers is apparent over the last 20 years in the Mediterranean. However, the fishing capacity and fishing power do not follow the same decreasing trend (Leonart and Maynou, 2003). Fishing power is usually

underestimated in the entire region and fishing technology has improved greatly over the last decades (Anon, 2010).

The bottom trawl is the fishing gear with higher discard rates, while other more selective gears such as hooks, gill nets and trammel nets present lower discards rates (Stergiou et al., 1997a). The discarded fraction of otter-trawl catches ranges from 20 to 70% by weight, mainly depending on the area and the depth of trawling (Carbonell et al., 1998; Stergiou et al., 1997ab; Machias et al., 2001; D'Onghia et al., 2003; Kelleher, 2004).

Due to the high diversity of species in the Mediterranean, there is a great diversity of discards in the bottom trawl fisheries (Figure 2). Of the 300 species caught in the Mediterranean, only around 10% are consistently marketed and 30% are occasionally retained (depending on the sizes and market demands) whereas up to 60% are always discarded (Carbonell and Mallol, 2012; Machias et al., 2001).

Figure 2. Proportion of species in the commercial and discarded fraction of the métier OTB-DEF, Spanish waters GSA01.



Source: Authors.

The most important otter-trawlers metiers in the Mediterranean are OTB_DEF (targeting demersal species in the continental shelf) and OTB_DWS (targeting deepwater species in the slope). OTB_DEF is the most important metier in landings by economic value.

The target species of the OTB_DEF metier included hake, rose shrimp, nephrops, red mullet, and octopus. Discards consists of a number of species with low commercial value (Horse mackerel, blue whiting, bogue, pout, seabreams, etc) or without commercial value (fishes without value, invertebrates), target species under minimum legal size (MLS), damaged or in poor condition.

The target species of the metier OTB_DWS is the red shrimp. Economically, red shrimp is one of the most important species in the trawl fishery. For example, in Spain it contributes between 30 and 50% of the total incomes for the trawl fleet. However the contribution in weight is lower, between 5 and 20% depending on the area. This bottom trawl fisheries reported even lower rates of discarding. Iberian Peninsula crustacean bottom trawls fisheries targeting rose shrimp discarded only 5-10% of total catch.

1.2.2. Pelagic trawls and purse seines

Small pelagic fisheries are the most important in volume of landings across the Mediterranean Sea. The number of boats has ranged from 350-400 in the last ten years. While purse seines gears (PS_SPF) are allowed and operating in all Mediterranean countries, the use of pelagic trawl (PTM_SPF) is forbidden in Spain and Greece.

Purse seines are generally more targeted, "cleaner" fisheries with lower levels of discards than trawl fisheries. In the Mediterranean, they target predominantly anchovy and sardine, and sometimes horse mackerel and silver scabbards. Discards can be considered low, around 9% of total catch, including high-grading of target species and species of low commercial value.

Regarding pelagic trawls in the Adriatic Sea, Santojanni et al. (2005) reported discards up to 90% in the Ancona trawlers, being the mean discarded proportion 53% of the total catch. In the Strait of Sicily, paired mid-water pelagic trawls targeting anchovies have variable discard rates. They are higher in winter reaching 50% of total catch, and lower in summer, ranging from 10-15%. This difference is mainly due to the targeting of juvenile areas in winter, so discarded species are mainly undersize anchovies and sardines and other pelagics such as mackerel, discarded due to minimum landing sizes and low market value. Silver scabbardfish (*Lepidopus caudatus*) are similarly targeted by pelagic trawls and no minimum landing sizes are in place, so small fish are discarded due to low market value.

1.2.3. Drifting longlines for large pelagic species

The target species of drifting longlines in the mediterranean are the bluefin tuna (*Thunnus thynnus*), swordfish (*Xiphias gladius*), albacore (*Thunnus alalunga*) and bonito (*Euthynnus alletteratus*). Bluefin tuna is the only species in the Mediterranean under quota restrictions. Although it was reported that discards in the longline fleets fishing in the Mediterranean targeting albacore and swordfish were rare (EC, 2006), other reports from the Adriatic and the Strait of Sicily suggest 50% of swordfish caught are below the MLS and bycatch includes endangered species. Some of the notable discarded species are bluefin tuna which forms 20% of bycatch, the blue shark (*Prionace glauca*) which forms 7% of bycatch, the pelagic stingray (*Pteroplatytrygon violacea*) and other vertebrates such as sea turtles (*Caretta caretta*) and seabirds.

1.2.4. Artisanal fisheries

Artisanal fisheries include a range of gears such as gillnets, trammel nets, traps, pots and other small-scale gear. Discards in the small scale fishing fleet are generally due to low commercial value, damaged specimens and undersize individuals (STECF, 2011).

1.3. Fisheries by countries

The landings in volume in the Mediterranean represent a relatively modest 12% of total Community landings. Altogether, the Mediterranean fleet landed an average of 500 000 t per year, of which 48% belong to Italy, 20% to Spain, 16% to Greece, 8% to Croatia, 6% to France, with Slovenia, Malta and Cyprus each contributing less than 1% (Fig. 1). There is a general tendency, except Croatia, for a decline of catches in the last 10 years.

1.3.1. Italy

Italy is the most important Mediterranean country in volume of landings. The Italian fleet consists of 13 227 vessels, of which more than 9 300 are under 12 meters. Despite this, bottom trawlers, with 2 627 units, represent the most important segment of the Italian fleet in terms of production (32% of total landings). Other fisheries are purse seiners, pelagic trawlers, mid-water pair trawlers, dredges, polyvalent vessels, and vessels using passive gears (GFCM Task 1, Statistical Bulletin 2010). The Italian fleet operates in GSAs 9, 10, 11, 16, 17, 18, 19.

1.3.2. Spain

Spain is the second country in volume of landings in the European Mediterranean. The main métiers are trawlers, purse seines, drifting longlines, nets and bottom longlines. The fleet operates in GSAs 1, 2, 5, 6, and 7 (partially). In 2010 the Spanish fleet was composed of 1194 trawlers, 287 purse seine boats and about 2 800 artisanal small scale boats (with less than 12 meters length) (GFCM Task 1, Statistical Bulletin 2010). Bottom trawlers represent the most important segment of the Spanish fleet in terms of production.

1.3.3. Greece

Greece presents the largest fleet in number of vessels in the European Mediterranean, with around 16 600 vessels in 2011 (EUROSTAT). The fleet operates in GSAs 20, 22, and 23. However, Greece ranks third in volume of landings. The Greek fleet is composed of 16 280 polyvalent small fishing units with engine, 318 trawlers and 273 purse seiners (GFCM Task 1, Statistical Bulletin 2010).

1.3.4. France

The main métiers in France are bottom trawl and pelagic trawl, operating in the GSA 7 (Gulf of Lion) and 8 (Corsica). The otter trawl fleet is composed of 126 vessels working exclusively in the Gulf of Lion (GS7) and 8 bottom trawlers working in the coastal waters of Corsica (GS8). The rest of the fleet is composed of about 1 152 small fishing units, 28 purse seiners, 79 long liners and 18 tuna seiners. Trawlers (both bottom and pelagic) land about 27 000 tonnes by year, most of them small pelagic species.

1.3.5. Croatia

The EU welcomed Croatia in 2013. Fleet data for this new EU member State have not been found in the European bibliography or in the EU and GFCM databases. The Croatian fleet operates in GSA 17.

1.3.6. Slovenia

The total number of registered fishing vessels is 174. The fleet is mostly composed of small vessels, under 10 meters length overall, and only 18 vessels are bottom trawlers, all of them operating in GSA 17. The yearly landing of bottom trawlers was 120 tonnes in 2005 and 111 tonnes in 2006. The most important species are musky octopus (*Eledone moschata*), whiting (*Merlangius merlangus*) and cuttlefish (*Sepia officinalis*).

1.3.7. Cyprus

The Cyprus fleet consists of 565 vessels, of which 525 are polyvalent small fishing units with engine. the Bottom trawlers fleet is composed of only 4 vessels (GFCM Task 1, Statistical Bulletin 2008).

1.3.8. Malta

The Malta fleet consists 1 111 vessels, of which 1 015 are polyvalent small fishing units. The rest of the fleet is composed of 23 trawlers, 2 purse seiners and 71 long liners (GFCM Task 1, Statistical Bulletin 2010). The Malta fleet operates in GSA 15.

2. DISCARDS IN EU MEDITERRANEAN FISHERIES

KEY FINDINGS

- In the Mediterranean, **discards are characterised by extremely high species diversity with a high percentage of non-commercial catch** and high variability in total discard rate due to seasonality.
- **Total discards in the Mediterranean are estimated at 18.6% of the total catch.** Discards differ depending on the country. For regulated species, Italy with more than 40% of landings by weight, is followed by Spain (5%) and Slovenia (5%) as countries with the highest discard rates.
- Spanish data suggests that **much of the discarding was not only associated with undersized fish but also to high grading and market forces rather than any legal constraints.**

It is important to distinguish between by-catch and discards. By-catch is the unintended catch of organisms during fishing. It also refers to the catch of juveniles or undersize fish of the species targeted. By-catch can still hold economic value and may be kept on board to sell as a by-product. However, discards is a term specifically used for catch which is not kept but is thrown back the sea, often dead. This may be either unwanted by-catch or target fish. It may occur for a number of reasons, including poor quality, fish degradation, lack of value of fish compared to other species or sizes (high grading) and/or because landing or retention is prohibited by regulation. Globally, discarding is estimated to be 8% (6.8 million tonnes) of the total volume of fish caught annually (Kelleher 2005). Kelleher (2005) also noted that 1.3 million tonnes of this discarding occurs in FAO area 27 which includes much of the EU waters.

In the Mediterranean, fleet characteristics are very varied with multiple gear types and a wide range of vessel sizes fishing a variety of habitats such as seagrass beds and coral reefs. Discards are characterised by extremely high species diversity (there may be >100 species in a bottom otter trawl and of these >60 discarded) with a high percentage of non-commercial catch (commercial portion of catch may range from 30-80%) and high variability in total discard rate due to seasonality. Endangered species are frequently caught and benthic flora is often hauled up with catch, some of which is from vulnerable benthic habitats.

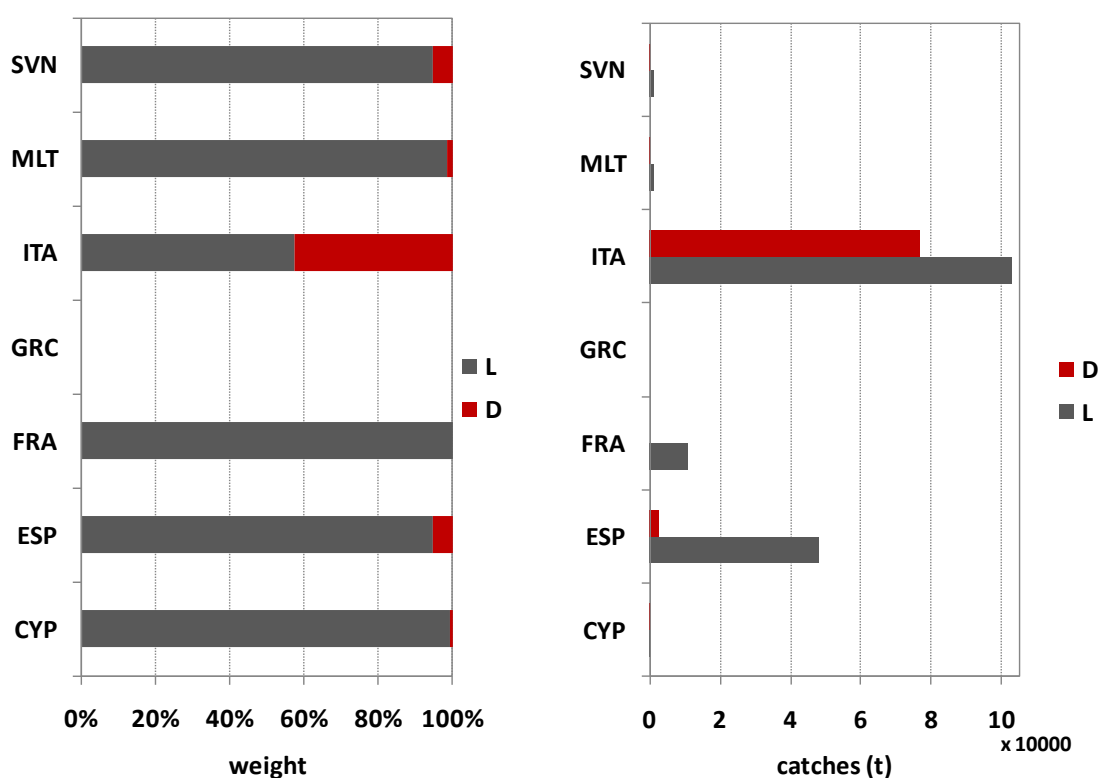
Due to the effort based management regime in force in the Mediterranean, with the exception of bluefin tuna, no over-quota discarding occurs. High-grading of small fish is a recent occurrence as traditionally smaller fish were eaten, but larger sized fish now fetch a higher market price, resulting in a high grading incentive (Fabio and Grati, 2005). In the Mediterranean discards include both species with no commercial value and marketable species (eg, those on Annex 3 of Council Regulation (EC) No 1967/2006). The latter are represented both by undersized specimens, considered unmarketable for their minimum landing sizes, and species discarded for their low market value, despite their legal size.

Discards include species which have no commercial value (even rare/ endangered/ protected species) as well as commercial and marketable species. The latter are represented by specimens smaller than the legal landing size and species/ sizes discarded for their low market value (Tsagarakis et al., 2008).

2.1. Total discards

"Total discards" refers to total volume discarded, considering both commercial and non-commercial species as well as undersized discards. Total discards in the Mediterranean are at 18.6% of the total catch (Tsagarakis et al., 2013). Discards differ depending on the country. Considering only regulated species, Italy with more than 40% of landings by weight, followed by Spain (5%) and Slovenia (5%) are countries with the highest discard rates (Fig. 3). However, as aforementioned these discard rates have to be analyzed by métier, as there are several métiers operating and behaving in a different manner in every country.

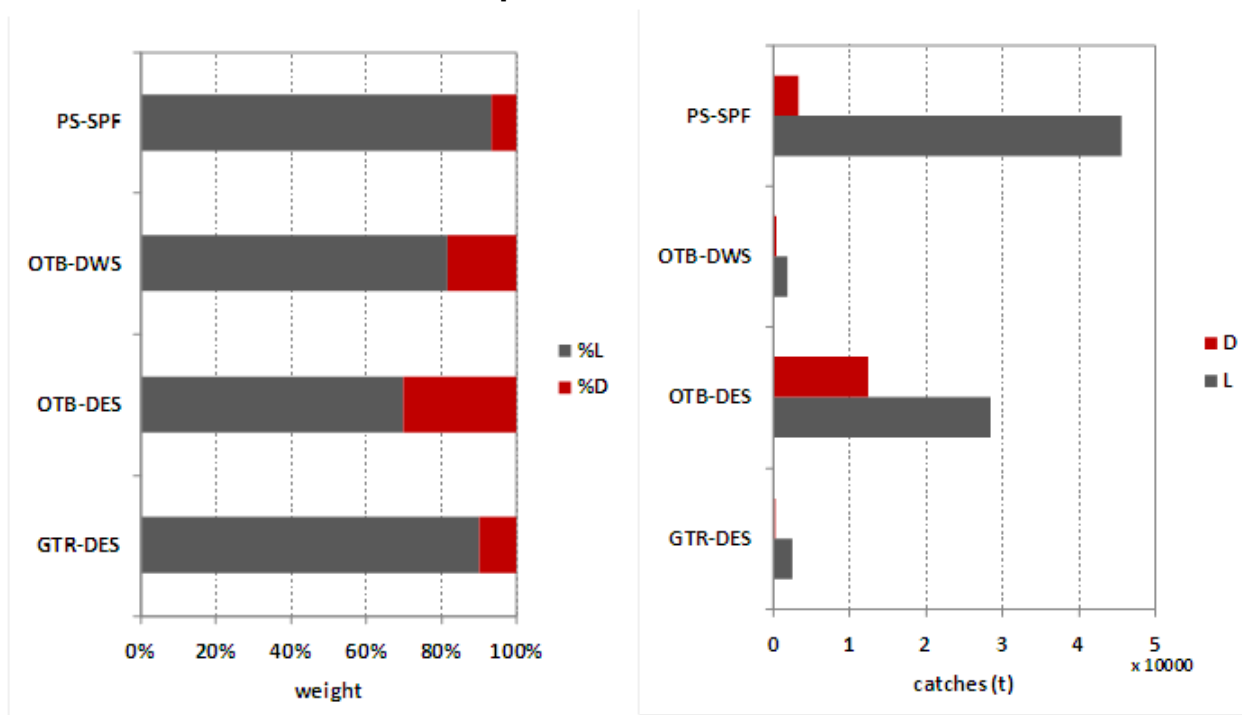
Figure 3. Proportion of commercial and discarded fractions by weight of the catches (a) and total catches (b) by principal species in Slovenia (SVN), Malta (MLT), Italy (ITA), Greece (GRC), France (FRA), Spain (ESP) and Cyprus (CYP)



Source: Authors based on data from STECF, July 2013)

Particularly in the Spanish Mediterranean, for 2009 to 2012 the mean discard rate was 18% grouping all gears and all species together, including regulated species and by-catch (fish, invertebrates and flora). This percentage represents around 18 000 tonnes per year. Figure 4 shows discards percentage in weight and catches by métiers (Spain only). OTB-DEF (mixed species shelf trawling) shows a discard rate of 30% total catch, accounting for 12 400 tonnes discarded yearly. OTB-DWS (deep water trawling) shows a discard rate of 18% total catch, accounting for 414 tonnes discarded yearly. PS-SPF (Purse seiners) shows a discard rate of 9% total catch, representing around 4 500 tonnes discarded every year. Trammel nets shows a discard rate of around 10% total catch, what rise up 250 tonnes discarded annually.

Figure 4. Proportion of commercial and discarded fractions by weight of the catches (a) and total catches (b) taken during the period from year 2009 to 2012 in the Spanish Mediterranean



Source: Authors.

2.2. Discards of juveniles

Undersized discards depend on the strength of recruitment and area. Very low discard rates are noted in some zones, while the opposite is true in other areas and are generally associated with high densities of juveniles.

The low level of discarding of MLS-regulated species among Mediterranean otter trawl fisheries may be a consequence of smaller MLS (e.g. hake), a lack of MLS compliance and the absence of over-quota discards in a quota-independent management system of demersal trawl fisheries (Catchpole et al., 2013; Damalas and Vassilopoulou, 2013). Although undersized hake, for example, are being caught by demersal otter trawlers, the proportion (in weight) of discarded individuals is small (Damalas and Vassilopoulou, 2013). The fast-growing, smaller, and highly diverse fish fauna (Stergiou et al., 1997) together with the existence of local markets for small fish and the low probability of prosecution for retaining undersized fish (Damalas and Vassilopoulou, 2013) may be further reasons why a tendency to retain most of the catch exists in the area.

2.2.1. Italy

In trawl fisheries, hake discarding is associated with the retention of fish below MLS. Undersized discards are notably more important in terms of number of specimens than in weight. The discarded fraction is made up by specimens ranging from 3.5 to 23 cm total length, even if most of discards are from 7 and 16 cm total length. This is due to the presence, in particular in some Italian GSAs, of important nursery areas of this species where juveniles are very abundant.

2.2.2. Greece

The modal length of the discarded hake was 12 cm whereas the landed hake was 16 cm. The MLS for hake in the Mediterranean is 20 cm. Market demand is the decisive factor for the discarding practice and above 70% of the fish is less than the MLS. A more detailed area, depth and season analysis could reveal more clearly the fishing grounds where there is segregation the juveniles.

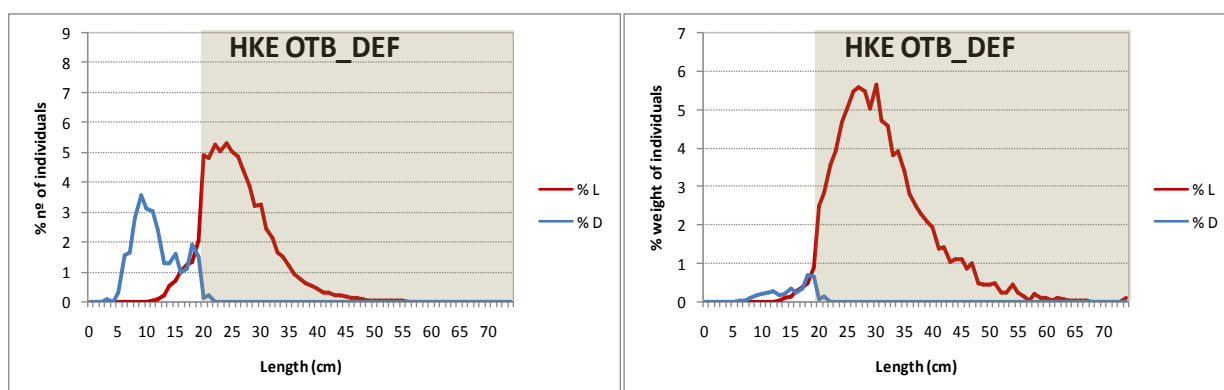
2.2.3. France

The mean discard rate was 41% by weight and 82 % by numbers. Globally the main discarded species are small pelagics. Hake is an important target species, whose mean discard rate is 9.4 % in weight. In the case of hake, discards are primarily associated with retention of fish below MLS and landings of fish below MLS seem to be significant

2.2.4. Spain

When studying undersized discarding, it is pretty more appropriate to analyse data on the number of individuals rather than weight. Regarding hake in otter-trawl, there are discards of juveniles below the minimum size (Figure 5; see also Fig. 5a, 5b and 5c in Annex for the different GSAs in Spanish Mediterranean).

Figure 5. Length of landings and discards for Hake in OTB-DEF in the GSA01. The data is presented as a percentage of the number of individuals (left) and a percentage of weight of individuals (right). The shadowed area represents legal landing sizes.



Source: Authors.

The percentage in weight of discards of hake juveniles is around 4.6%, which represents 151 t per year. Other target species for OTB-DEF such as red mullet's undersized discards are minimal (<0.3%), with catches over the minimum size (11 cm) at almost 100%. Crustaceans such as rose shrimp and Norway lobster (nephrops) are practically not discarded by size (<0.1%), and almost all of the catch is above the legal size. There are some nephrops discards in GSA05, but they are not related to length (Fig. 6b).

There are significant discards of bream (*Pagellus acarne*) below the minimum size (17 cm), which can represent up to 76% of the landing, reaching 230 t annual undersized discard. For seabream (*Pagellus bogaraveo*, MLS 33cm) undersized discards are greater, even exceeding landings, and they can be over 200 tonnes per year. Pandora (*Pagellus erythrinus*) also shows undersized discards, although less amount than the other *Pagellus* sp, reaching around 8% of the total catch.

Other fishing gears such as trammel nets show very low discarding rates mainly due to market reasons, not to undersized discards. In purse seiners, there are minimum discards for undersize reasons, in some case only under 2 % for some mackerels (*Scomber* sp.).

For France, Spain and Greece, the highest discard rates for commercial species were associated with 'low value' pelagic species such as sardine and horse mackerel. The length data supplied by Spain suggests that much of the discarding was not only associated with fish below minimum landing size (MLS) but also because of high grading, suggesting that only the larger specimens were retained for marketing purposes. Conversely, high value species such as hake, shrimp and monk/anglerfish all exhibited very low discard rates and examination of the length data suggests that a considerable proportion of the fish landed for sale were below MLS, suggesting that discarding was mainly induced by quality issues and market forces rather than any legal constraints.

3. DISCARDS MITIGATION MEASURES

KEY FINDINGS

- The **change in mesh size or mesh geometry** from 2010 in the demersal trawl fishery **have reduced discards under MLS for target species, in the case of European hake.**
- As a general rule, **discards of target species in the Mediterranean are very low.** Discards of bycatch species depend on the size range of each specific species, the fishing areas and seasons, and the size preferences of the market consumers.
- **Bycatch and discards in the Mediterranean present a high diversity of species and a wide size range, which makes discards mitigation by using only fishing gear selectivity difficult.**
- There is no EU Regulation to reduce captures of juveniles in the Mediterranean, as those in force in the Atlantic. **Local action plans are necessary** to reduce discards as well as to integrate stakeholders and the fishing sector in the discards management.

Currently, the mitigation of discards is a major concern to conservation bodies and the wider public (Catchpole and Gray, 2010). Many EU fisheries have put in place measures such as minimum mesh sizes, effort regulations including spatio-temporal fishery closures, days at sea quotas, daily hour restrictions, and landing quotas (STECF, 2008), in an effort to mitigate the capture of unwanted species/sizes. Certain countries (e.g. Iceland, Norway) have addressed the discards issue by banning discarding, which is also considered in the reform of the EU Common Fisheries Policy (EC, 2011, 2013). However, solutions to bycatch/discards need to be designed for specific fisheries and may differ between regions of the world (Hall and Mainprize, 2005; Johnsen and Eliassen, 2011), especially given the varying incentives for discarding.

Council Regulations (CE No 1967/2006) established a combination of technical regulation, including gear modifications and gear restrictions, fishing effort limitations, seasonal and spatial area closures and management regulations such as minimum landing legal sizes. These regulations in trawl fisheries were preceded by numerous studies carried out on fishing selectivity topic, analysing the effect of increasing the mesh size in the cod-end (e.g. Sardà et al., 1993; Mytileneou et al., 1998; Ragonese et al., 2001, 2002; Carlucci et al., 2006; Ragonese and Bianchi, 2006; Deval et al., 2007). Others studies have assessed the effect of changing the mesh geometry in the cod-end (Stergiou et al., 1997a, 1997b; Petrakis and Stergiou, 1997; García-Rodríguez and Fernández, 2005; Bahamon et al., 2006; Guijarro and Massutí, 2006; Ordines et al., 2006; Baro and Muñoz de los Reyes, 2006) and few studies have explored the efficiency of sorting grid systems (Sardà et al., 2004, 2006; Bahamon et al., 2007a). Changed size or geometry of trawl net come in force in 2010, and an improvement in the resource conservation state and reduction of discards in the EU Mediterranean trawl fisheries can be expected to follow.

Certain habitats are also protected from towed gears. Fishing with trawl nets, dredges, purse seines, boat seines, shore seines or similar nets above seagrass beds of, in particular, *Posidonia oceanica* or other marine phanerogams is prohibited. Furthermore, fishing with trawl nets, dredges, shore seines or similar nets above coralligenous habitats and maërl beds is also prohibited. Management and technical measures following the EU Regulations (CE No 1967/2006; 1380/ 2013) to reduce both captures of juveniles fish and unwanted catches are in force for the EU Mediterranean Sea areas since 2010 year. By

countries there are differences in regulations for bottom trawling fleets: in Italy, most fishing-vessel licenses allow the use of more than one fishing system (80% of the vessels are authorized to use several fishing gears), while in Spain, fishing licenses only allow use of one fishing system (STECF, 2007). There is additional local legislation to regulate the activity in different countries.

3.1. Regulation in force

3.1.1. Based on fishing selectivity

The minimum mesh size of bottom trawlers is 40 mm square or 50 mm diamond. Spain, Italy and Malta have used the derogation to maintain the old mesh size of 40 mm diamond up to June 2010. Pelagic trawl nets targeting sardine and anchovy, (where these species account for at least 80 % of the catch in live weight after sorting), have a minimum mesh size of 20 mm. For surrounding nets the minimum mesh size is 14 mm. Bottom-set gillnets can not have a mesh size opening smaller than 16 mm.

3.1.2. Based on temporal closures

Temporal closures have usually been implemented in several countries (Spain, France, Italy), during some period of the year (e.g. recruitment or spawning periods in spring or autumn), under local management plans. A decrease of the number of daily hours was also put in practice, which obliged the vessels return earlier to the harbours to rest at port during night time.

3.1.3. Based on spatial closures

Spatial closures are applied in coastal Mediterranean regions under local management plans of Marine Protected Areas MPA for coastal fisheries (artisanal fisheries). Certain habitats are also protected from towed gears (Fishing Marine Reserves) to protect both sensitive and essential fish habitats, with particular attention to juvenile phases of important commercial demersal species. Fishing with trawl nets, dredges, purse seines, boat seines, shore seines or similar nets above seagrass beds of, in particular, *Posidonia oceanica* or other marine phanerogams is prohibited. Fishing with trawl nets, dredges, shore seines or similar nets above coralligenous habitats and maerl beds is also prohibited. However, to come in force adequately, this measure will require to map these habitats (by projects mapping seabed habitats) in shelf and slope zones. For deep-water species, fishery legislation prohibits fishing below 1 000 m. In addition, trawling cannot take place within 3 miles of the coast or in area where the seabed is less than 50 m deep

3.1.4. Based on vulnerable sizes and vulnerable species

In support of management measures to mitigate bycatch and discards of vulnerable species, distributions and ranges of these species taken as bycatch, in particular rare, endangered, threatened or protected species should be mapped and their captures avoided.

3.1.5. Based on quotas

There is no quota management in the Mediterranean (with the exception of blue fin tuna).

3.2. Measures and tools to mitigate discards of juveniles and unwanted catches.

3.2.1. Measures of control of fishing effort.

Controls are needed on fishing capacity and effort in a fishery where bycatch and discards occur and cause significant problems. Excess capacity and effort excluded from one fishery/area/time should not lead to increased bycatch and discard problems in other fisheries/areas/times. Output control measures, such as individual or fleet-wide quotas, and/or limits on allowable bycatch could be developed and implemented within the framework of fishery management plans.

3.2.2. Improvement of the design and use of fishing gear and bycatch mitigation devices.

Technological measures to improve selectivity and reduce bycatch and discards should be considered, including: change of design, rigging and deployment of fishing gear (e.g. mesh size, hook size...); installation of bycatch reduction devices (e.g. turtle excluder devices, sorting grids, square mesh panels, tori lines on longlines); using operational techniques during fishing, to reduce encounters with bycatch (e.g. the backdown manoeuvre during purse-seining); using equipment, practices and handling techniques that increase the probability of survival of the released catches and the appropriate use of integrated vessel and fishing gear position monitoring and habitat mapping systems.

3.2.3. Spatial and/or temporal fishing restrictions and/or closures

Measures to reduce interactions with particularly vulnerable bycatch (e.g. juveniles and rare, endangered, threatened or protected species) should be considered through identifying and establishing areas where the use of all or certain gears is limited or prohibited, based on the best available scientific information. The use of adaptative spatial closures is necessary to reduce bycatch problems.

3.2.4. Limits and/or quotas on bycatches

As aforementioned, there are no TACs and quotas in Mediterranean fisheries, with the exception of the bluefin tuna. However MS as correspondents of fisheries national management plans should consider to setup a no-discard policy, when applicable, as well as limiting fleet size (number of vessels and Fishing Power/Capacity) in those fisheries where bycatch is unavoidable. Some suggested measures can be:

- a) Monitoring by camera devices to ensure the adequate compliance of limits of discards and quotas.
- b) Reduction of discards should be supported by technological development in the post harvest sector.
- c) States may develop long-term cooperative working relationships on management and discards reduction with stakeholders and authorities.

3.2.5. Incentives for fishers to comply with measures to manage bycatch and reduce discards

Fishermen are more likely to comply with management measures and adopt fishing techniques that are designed to manage bycatch and reduce discards if such measures improve their revenue, the quality of their catch, their operational efficiency and/or safety. The costs to fishermen for installation of bycatch mitigation technologies could be lowered,

where appropriate, through the application of grants/loans and preferential treatment on duties and taxes for investment in such technologies:

- a) Trade-related instruments, exercising jurisdiction over national competent fisheries management authorities to avoid under legal size commercialization.
- b) The use of effective controls, especially in fisheries where discards are a significant issue.
- c) The implementation of co-management and community-based management plans for fisheries reducing discards, based on the best scientific and technical information available taking into account fishermen's knowledge.
- d) Encouraging the involvement of fishermen in the development of measures to reduce discards, recognizing the value of their knowledge and experience
- e) Promoting the use of appropriate incentives to reduce discards and ensure they are sufficient to encourage the adoption of and compliance with management measures.
- f) Encouragement of innovation through the collaboration of fishermen, scientists, changing the design, rigging and deployment of fishing gear (e.g. mesh size, hook size, aimed trawling).

4. USE OF UN-WANTED CATCHES, COMMERCIALIZATION AND BLACK MARKET

KEY FINDINGS

- **Lack of information concerning availability and types of raw material to apply valorisation at an industrial scale** is a handicap to overcome as is establishing specific **protocols for safety and preservation** of raw material.
- **Unreported landings in the Mediterranean for demersal fisheries are estimated of 30~35% of total landings.**
- **The black market is mainly related to traditional consumption habits, the economic crisis and illegal catches** and it is caused by a **lack of enforcement and control** by countries and regional organizations of fishing activities, due to inappropriate or **insufficient operational plans and disciplinary measures** for those not following the rules.

4.1. Use of Un-Wanted Catches

The EU changes to the common fisheries policy include provisions for a ban on discarding in the Mediterranean from 2015 (Purse seiners), which will be fully met in 2019 for all fisheries, for the species of Annex III subjected to minimum landing sizes, according to EC Regulation 1967/2006. This means, that fishermen would be required to land all these species discards.

The main objective of the ban will be to avoid the capture of any unwanted catch. However, there is always some fish caught under the MLS, as well as catches without commercial value. Whether the discards could be valorised and utilised by the fishing transformation industry has not been explored for the Mediterranean fisheries until now. This information is needed in order to be better prepared to deal with the discards ban.

One of the main problems in applying valorisation and technologies to the discards for use at an industrial scale is the lack of information concerning availability and types of raw material, and specific protocols of safety and preservation of raw material. At the same time, another problem is related to the logistics of discards both on board and once they are landed. A well-defined logistic and management network adapted to each area and type of industry does not exist at present. It could allow to efficiently determine and deliver specific amounts discard required by a given transformation.

Suitable use of outlet catches (discards) for human and other consumption includes fish soups, fish paste (surimi), pet and aqua feed, feeding pellets, reduction to fishmeal, fish oil, anaerobic digestion with energy recovery, compost and organic fertilizer, frozen bait, and other products such as renewable energy generation. With the aid of research technologies and the fish transformation industry, it may be decided what species, size and quality could be used in which industrial process and product.

4.2. Commercialization and Black market

The non-reported catch was important in all fishing sectors, including industrial, artisanal and recreational fisheries. The Mediterranean fresh fishing industry generally receives a small share of the price the consumer pays for the fish at the counter. Overall, first sale prices of fish have been stagnating, even at times of extraordinary variations in fuel prices such as those in 2008. There are several reasons for this situation: first, Mediterranean fishing communities are very fragmented and they have not organised themselves in order to market their products so as to ensure that a higher part of the value returns to them. Second, consumers tend to turn increasingly towards processed or frozen products at the expense of fresh ones. These products do not factor in transport costs and carbon footprint. Estimates of actual catches were very imprecise and very inaccurate in the Mediterranean, and the reasons are partially market preferences and fishermen market strategies to increase or maintain best prices. Some illegal catches, like those of specimens under legal minimum landing size, are sold in the black market in areas where there is a tradition of consuming them.

FAO fishery landing statistics is the only regional dataset freely available in the GFCM Mediterranean areas where capture data referred to the commercial, industrial and small-scale inland, coastal and oceanic fisheries. FAO publishes the 'Yearbook of Fishery Statistics', which contains the annual landings of fish, crustaceans, molluscs and other aquatic animals/plants (excluding recreational or sport fishing) since the 1950s (<http://www.fao.org/fishery/statistics/software/fishstat>). FAO statistics do not include: (i) illegal, unreported, and unregulated catches (IUU catches), which may reach up to 50% of the total landings (Pitcher et al., 2002).(ii) and landings of small-scale fisheries (i.e., landings for boats with engines <19 HP or less than 12 m overall length).

FAO data often suffer from serious drawbacks and biases, thus in order to better reflect reality they must be complemented by specific evaluation studies at the national level. Access to data and information on the different fishing fleets operating in the Mediterranean region is difficult. In most cases, available data only covers official landing statistics, excluding catch that is sold on the black market or is used for consumption of fishers and relatives, and illegal catches, all components of IUU (Illegal, Unregulated and Unreported catches). These IUU catches are caused by a lack of control by countries and regional organizations on fishing activities, due to inappropriate or insufficient operational plans and disciplinary measures for those not following the rules, and due to lack of political will (Zeller and Pauly, 2007). IUU practices impair the correct assessment of exploited marine species, and complicate or even defeat the development of suitable management actions. They can also have important socio-economic impacts due to conflicts with legal activities, and especially with artisanal and subsistence fishing. This is a fundamental issue in the Mediterranean and Black Seas where IUU activities are prevalent (Tsikliraset al. 2007; Le Manach et al. 2011).

Artisanal fisheries, i.e., small-scale commercial fishing, represents around 10% of Mediterranean catches, followed by recreational (9%), and subsistence fisheries (6%). However, neither artisanal or recreational fisheries are accounted for in official statistics (Tudela 2004). In fact, most Mediterranean countries generally do not fully monitor these fisheries, as required for ecosystem-based management (Pikitch et al., 2004). For small-scale and recreational fisheries, catches are systematically underestimated (Pauly, 2006). The scale of this underestimation is usually not known, and alternatives to the national/FAO datasets are rarely available.

Different methodologies have been used in an attempt to quantify unreported catches, with the most frequent estimation obtained using information of existing auction sites, and on-board observer programmes although this type of information does not cover all of the existing ports and landings estimations may have not easily detectable bias. The knowledge of catch per unit of effort obtained from the operative Mediterranean fishing fleets throughout the catches recorded from the on board sampling programmes and the information from of the Vessel Monitoring System (VMS), may allow to assess the unreported captures. However, national authorities who have been collecting these high resolution fishing effort data (VMS) have not made them fully available to scientists (Hinz et al. 2012).

Some of the relevant information on unreported landing in the Mediterranean for demersal fisheries suggests an average underestimation by 35% (range: 10-65%) (Tsikliras et al., 2007) in Greek fisheries and between 25 and 30%, for the demersal deep water shrimps fishery in the Mediterranean (EU Study Contract DGXIV 018/98) and more recent estimations in the northern Mediterranean Spanish coast point at an unreported catches of around 30% of the total fish captures ("El Periodico" Newspaper, 21/08/2011).

Summarising the information of unreported fishery data by the late 2000s, recreational fishing was the most important sector for unreported landings (36%) in Spain, followed by black market sales (32%), subsistence fishing (17%), unreported artisanal fishing (12%) and illegal catches (2%). For France, in decreasing order of importance, the contribution of the different segments of the fishery to the unreported total was: artisanal catches (900 000 tonnes; 42%), industrial catches (500 000 tonnes; 23%), discards (415 000 tonnes; 20%), recreational catches (270 000 tonnes; 13%), and subsistence catches (36 000 tonnes; 2%). For Italy the contribution of the different segment of the fishery to the unreported total was: industrial catches (6.7 million tonnes; 63%), artisanal catches (970 000 tonnes; 9.5%), subsistence catches (282 000 tonnes; 3%), and recreational catches (137 000 tonnes; 1%). Finally, Turkey's contribution of the different segment of the fishery to the unreported total was: industrial catches (2.1 million tonnes; 54%), artisanal catches (1 million tonnes; 27%), recreational catches (133 000 tonnes; 3%) and subsistence catches (110 000 tonnes; 2%).

5. OBLIGATION TO LAND ALL CATCHES – IMPLEMENTATION OF THE NEW CFP

KEY FINDINGS

- The landing obligation will prompt a different way of processing and storing fish material, which may also produce a spill over effect in other steps of the fishing process and commercialization.
- A SWOT analysis shows the **overall balance was detrimental to the implementation of the new CFP**, with 72.6% of negative aspects (Weaknesses and Threats) and 27.4% of positive aspects (Strengths and Opportunities).

Implementation of new CFP, and particularly the Landing obligation of all catches of regulated species in the EU Mediterranean, will bring some new questions to address in European fishery harbours. It is evident that the landing obligation will prompt a different way in processing and storing fish material, which may also produce a spill over effect in other steps of the fishing process and commercialization.

Garcia et al. (submitted) studied the possible consequences of the implementation of the new CFP in an important fishery harbour in the Spanish Mediterranean coast. By making interviews with different stakeholders, they produced a SWOT analysis to answer if this new regulation is viable in the present situation, what problems will be solved and what problems will be created. The SWOT analysis was particularly focused on the implementation of the discard ban and the landing obligation of all catches of regulated species in the EU Mediterranean.

Each question was related to one of the three items that were evaluated in the regulation, valuing the contribution of each: Rationale, Operability and Cost.

A SWOT analysis considers both internal and external aspects. Internal aspects are considered those, either positives (Strengths) or negatives (Weaknesses), that are already present in the current situation whilst external aspects are those, either positives (Opportunities) or negatives (Threats) to appear in a future situation, in this case the implementation of the new CFP.

Every expert was asked to mark questions between 0 – 10. Some questions were related to the present situation or internal aspects and some other questions were related to the future situation or external aspects. The internal aspects of the regulation with an average score between 0 and 4.9 were considered weaknesses, and between 5 and 10 strengths. Similarly, external aspects rated between 0 and 4.9 were considered threats, and rated from 5 to 10 opportunities.

We assessed the balance of the positive aspects (Strengths and Opportunities), negative aspects (Weaknesses and Threats), internal aspects (Strengths and Weaknesses) and external aspects (Threats and Opportunities) of the new CFP regulation.

The overall balance was detrimental to the implementation of the new CFP, with 72.6% of negative aspects (Weaknesses and Threats) and 27.4% of positive aspects (Strengths and Opportunities). Internal aspects of the regulation (Strengths and Weaknesses) were found

to have a greater contribution (58.6%) than external ones (41.4%, Opportunities and Threats).

The strengths of the regulation combine to form: 20.1%, rationale (9%), then Operability (7.7%) and finally Cost (3.4%). Weaknesses accounted for 38.6%: with Cost (20.5%) as the main Weaknesses contribution, then Operability (14.3%) and finally Rationale. Opportunities included the lower contribution covering 7.3% of the sum. Threats accounted for 34.0% of all levels particularly due to the influence of Operability (16.3%) and Cost (13.9%).

6. CONCLUSIONS AND RECOMMENDATIONS

KEY FINDINGS

- The landing obligation will provide solutions to some persistent problems derived from fishing, and will create new problems when implemented.
- It will produce a **better utilization of the fishing harvest**, providing raw material that can be valuable to different valorisation industries. Inversely, it will increase **removal of marine biomass and energy**.
- Another issue to consider is that landing such **volumes of marine debris can generate important environmental pollution in land**. This is a **particularly sensitive issue on the Mediterranean coast, with many touristic areas and where weather is warm almost all year**. If the volumes of marine debris are not disposed of by quick removal in appropriate conditions **they can cause poor hygienic and sanitary conditions**, adversely affecting the welfare of local communities.
- Apparently, **there are no incentives to land unwanted catches**, and penalties for failure to meet this requirement are not still clear in the Mediterranean, unlike Atlantic where penalty quotas will be implemented.
- One possible consequence of the **new Regulation** may be the increase in illegal marketing of fish below the minimum size. Landing, storage and transportation of juveniles will be legal and this **can simplify commercialization in the black market**

RECOMENDATIONS

1. **The best discards mitigation measure occurs at sea** and it is not to catch unwanted catch. **The key aspect of the Regulation should be better fishing practices** to avoid unwanted catch.
2. **Landing obligations for discards do not necessary reduce unwanted catch in the Mediterranean**. Inversely, we agree it may increase the **black market in juveniles**.
3. **Discards mitigation measures in the Mediterranean must be adjusted to the Mediterranean fishing management system, i.e. measures related to fishing effort** and no quotas/landing TACs. We consider effective fishing management based on fishing effort as the best and most logical fishing management system.
4. Some of these **measures can be reductions of fishing effort, better fishing selectivity and spatio-temporal fishing restrictions for vulnerable sizes and/or areas**.
5. The discard ban and landing obligation should be accompanied by **other measures for its successful implementation**. Some of these measures are **improvements of the control of fishing effort, effective enforcement and finally an agreement of the fishing sector to comply with the rules and regulations**.
6. **Discards should be managed in a fishery-by-fishery basis. Exemptions (*minimis*) can be an alternative for some selected fisheries**, of course if based on scientific studies.

6.1. Conclusions

The EU Fisheries Policy is facing major challenges in the near future as, according to the latest annual reports of the STECF, up to 85% of the Mediterranean fish stocks in European waters are classified as overfished. The introduction of the obligation to land all catches in the recent reform of the Common Fisheries Policy (CFP) represents a fundamental shift in the management approach to EU fisheries switching the focus from the regulation of landings to catches. The landing obligation included under Article 15 of the new CFP basic Regulation prohibits the discarding of species subject to catch limits (i.e. TAC and quota species) as well as those subject to minimum size limits in the Mediterranean.

Apparently, the new CFP aims to eliminate discards and to make fishing, particularly trawling, more sustainable and profitable long-term (European Parliament, 2013). However, the proposed approach suggests many doubts about its effective implementation and enforcement, at least in regard to the Mediterranean Sea with a fisheries management system not based on quotas unlike the Atlantic.

The landing obligation will provide solutions to some persistent problems derived from fishing, and it will create new problems when implemented. Among others, this new regulation will produce a better utilization of the fishing harvest, providing very cheap raw material that can be valuable to different valorization industries. Inversely, it will result in a reduction of marine biomass and energy, further consequences of which still remain unclear. Socio-economic consequences should be also analysed. Implementation of the new CFP can be expected to increase costs in fishery ports for handling the increase of new landings of unwanted catch as well as to change and maybe increase the onboard duties for the fishing crew.

Apparently, there are no incentives to land unwanted catches, although penalties for failure to meet this requirement are not still clear in the Mediterranean, unlike the Atlantic where penalty quotas will be implemented.

One possible consequence of the new regulation may be the increase in illegal marketing of fish below the minimum size.

Landing of juveniles is prohibited in the current Regulation. Accordingly, for commercialization throughout the black market, operators have to hide the juveniles from the control at the landing, storage and transportation for the human consumption market. When the new CPC comes into force operator will only have to hide juveniles on the marketing for human consumption, the precedent steps (landing, storage and transportation) will be legal and this can simplify black market commercialization, maybe just with a change of direction in the final destination of the transport. Also, it will be hard to explain that catches are not allowed for human consumption and cannot generate an economic return. However, they can be exploited for industrial use, with resulting economic return.

Another issue to consider is that landing such volumes of marine debris can generate important environmental pollution inland. This is a particularly sensitive issue on the Mediterranean coast, with many touristic areas and where weather is warm almost all the year. If the volumes of marine debris are not disposed of by a quick removal in appropriate conditions, they can cause poor hygienic and sanitary conditions, affecting adversely the welfare of local communities.

In the case study of the Spanish port which can serve as an example for extrapolation to any port on the Mediterranean coast, the overall balance of the new CFP regulation through a SWOT is mostly negative, the negative aspects being 72.6% and the positive aspects 27.4%. For achieving the objectives, the balance should have a very large contribution of strengths and opportunities. This SWOT balance does not ensure that the new CFP Regulation will achieve its objectives.

The lack of storage for unwanted catch both in vessels and ports, with the economic cost for the implementation of new rules in vessels and ports as well as the potential lack of means of control to ensure effective monitoring may negatively influence the implementation of the measure. However, the most determinant threat is in our opinion the fishing sector's perception that it has not been involved as fishermen who have the final decision to reject or retain fish onboard.

6.2. Recommendations

1. The best discards mitigation measure occurs at sea and it is not to catch unwanted catch. The key aspect of the Regulation should be better fishing practices to avoid unwanted catch.
2. Landing obligations do not necessarily reduce unwanted catch in the Mediterranean. Inversely, we would argue that it may increase the black market of juveniles.
3. Discards mitigation measures in the Mediterranean must be adjusted to the Mediterranean fishing management system, i.e. measures related to fishing effort and no quotas/landing TACs. We consider an effective fishing management based on fishing effort as the best and most logical fishing management system.
4. Reductions of fishing effort, better fishing selectivity and spatio-temporal fishing restrictions for vulnerable sizes and/or areas can be some of these measures.
5. The discard ban and landing obligation should be accompanied by other measures for its successful implementation. Some of these measures are improvements of control of fishing effort, effective enforcement and finally an agreement by the fishing sector to comply with the rules and regulations.
6. Discards should be managed on a fishery-by-fishery basis. Exemptions (minimis) can be an alternative for some selected fisheries, of course provided they are based on scientific studies.

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