SPELMED

Evaluation of the population status and specific management alternatives for the small pelagic fish stocks in the Northwestern Mediterranean Sea

D2.4.1.

Report on past and current catch and effort by stock in the study area and economic performance of main fisheries

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June 2018

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Executive summary

- Historical catches indicate that European sardine (*Sardine pilchardus*) has been exploited to higher levels and started to be highly exploited before European anchovy (*Engraulis encrasicolus*) in GSA 06 and GSA 07. Currently, the anchovy stocks (both GSAs) present better health than those of the sardine, which show low stock size regarding historical information of landings or catches.
- According to official fishery data at GSA level, discards are negligible for European sardine and European anchovy. However, the reconstructed catches suggest that discards represented, at least, above 7,000 and 20,000 annual tons of European anchovy and European sardine, respectively.
- The historic fluctuation trend of European anchovy suggests that recent declining of landings (2007) and subsequent increasing, may respond to cyclic variation of biomass, without disregarding the strong impact of the fishery in the study areas. Conversely, European sardine seems to be largely affected by fisheries pressure in both GSAs.
- Catch-at-length and catch-at-age of both species revealed that smaller individuals are being caught in recent years.
- The small-pelagic fish are mainly caught by purse seine fishery (VL12-24 m) in GSA 06 and purse seine (VL12-24 m) and mixed deep-water species (VL24-40 m) fisheries in GSA 07. Although the number of vessels is declining, the fishing effort in number of days at sea remains steady for the last years.
- The CPUE by fleet has a high intra and inter-annual variability as well as a spatial differentiation by port. Overall, fleets with commonly moderate CPUE values keep these CPUE values only during specific months. Conversely, fleets that usually obtained high CPUE are also capable to keep good CPUE during all year.
- According to the fishing strategy used by fleets in GSA 06 (fishing locally or actively spatial searching), we observe that the vessels that belong to different ports obtained different "success" regarding catch volume. Additionally, a fleet could obtain good CPUE of one, another or both species.
- Most of the fleets are losing net incomes or even are presenting losses during the period with available economic information. Some fleets have avoided reaching negative results by reducing the fleet size. However, the fleet size of the small pelagic fishery in GSA 07 is very small in comparison to GSA 06.
- Catch-at-length, fleet information and economic data for the GSA 07 include several gaps that hampered the performance of a complete analysis of the fisheries of European anchovy and European Sardine.

Introduction

The small-pelagic fish fisheries in the Spanish and French Mediterranean Sea target European anchovy (*Engraulis encrasicolus*) and European sardine (*Sardina pilchardus*) (Beveren et al., 2016). These fisheries employ purse seiners in GSA 06 and purse seiners and midwater otter trawls in GSA 07 (STECF, 2017). Landings of both species in GSA 06 are recorded since 1945 (IEO own data), while landings in GSA 07 have been estimated since 1860 (Beveren et al., 2016).

The reconstructed catches in the Mediterranean Sea (including the Gulf of Cadiz) of European anchovy reported until the 1996 almost 50,000 tons by year, while European sardine reconstructed catches indicated almost 140,000 tons until the 1958 (Coll et al., 2014). This high catches reported for several decades before now, contrasts with current low landings in GSA 06. For instance, the fleet landed less than 18,000 tons of anchovy in 2017, while they reported near 7,000 tons of sardine in the same period. This means that the current level of landings is just a small portion of the possible stock size. Similar circumstances have occurred to these two stocks in GSA 07. While the reconstructed catches of European anchovy were above 12,000 tons in 2004 and catches of European sardine were above 30,000 tons in 1969 in the French Mediterranean Sea, the current level of annual landings to 2015 was below 200 tons per species (Official data call framework updated to 2017).

This document is focused on achieving an integral interpretation of available fishery data to European anchovy and European sardine in GSA 06 and GSA 07 as the basis to set the stock assessment inputs and understand the stock assessment outputs. Accordingly, the main objective of this deliverable was to acquire an integrated knowledge to the fishery of European anchovy and European sardine in GSA 06 and GSA 07 from fishery-dependent data. In order to achieve this main goal, two specific objectives were outlined. First, we retrieved and analysed fishery and economic data from official data call and complementary sources. Secondly, we explored and prepared the best and most updated data that will be required to develop the stock assessment models proposed in this project. Specifically, we used information of catches reconstruction as well as official and alternative sources of catches or landings (e.g. “Sea Around Us” project, SAUP). Additionally, we explored the available information on catch-at-length and catch-at-age and temporal and spatial fishing effort. Finally, the 2017 DCF fishing fleet economic data was used to estimate the net incomes of the main fleets that target the studied stocks. By considering all this information at the same time, we diagnosed the current fishery trend (no stock status) of the two species in both GSAs.

Material and Methods

2.1. Biomass removal by fisheries

In order to understand the historical and regional context of the fishery of European anchovy (*Engraulis encrasicolus*) and European sardine (*Sardina pilchardus*), several sources of catches (landings and discards) or landings were reviewed. The FishStatJ - software for fishery statistical time series, version 3.04.8 (July 2018) was used to retrieve the time series of landings of European anchovy and European sardine in the Spanish and French Mediterranean Sea from 1950 to 2016 (FAO, 2018). Additionally, the "Sea Around Us" project (SAUP) was used to obtain an estimate of the catches (landings and discards) of both species to the Spanish Mediterranean plus the Gulf of Cadiz and the French Mediterranean (excluding Corsica) from 1950 to 2014 (Pauly and Zeller, 2015). Catch reconstruction of European anchovy and European sardine in the waters of Spain (mainland, Med and Gulf of Cadiz) were used as estimated by Coll et al. (2014). Catch reconstruction of these two species in the French Mediterranean was performed by Bulter et al. (2015).

Posteriorly, we retrieved the longest time series of catches that are available for GSA 06 and GSA 07. The *Instituto Español de Oceanografía* (IEO) provided the landings of both species since 1945 in GSA 06. This information was already used to perform the stock assessment by the Surplus production model (SPiCT) of European anchovy in GSA 06 (accepted) and European sardine (no accepted) (STECF, 2017, 2016) and European sardine in GSA 07 (no accepted) (STECF, 2017). We did not obtain the raw data on time series of landings for both species in GSA 07. Therefore, we achieved an understanding of the historical trend of these fisheries using the study performed by Beveren et al. (2016).

The stock assessment models that are preferred to assess the Mediterranean stocks are usually based on catches (landings and discards) but also include catch-at-length or catch-at-age information (STEFC, 2017). This means that catches are useful to understand the historical pressure on the stocks, but structure of the stock is required to determine how harvesting affects the sustainability of the fishery. Therefore, the time series of catches accepted by General Fisheries Commission for the Mediterranean (GFMC) and the Scientific, Technical and Economic Committee for Fisheries (STECF) to perform stock assessment is frequently accompanied by catch-at-length (or catch-at-age) data. Accordingly, the Data Call Framework (DCF) updated to 2016 that stores life-history information of the stocks, fishery-independent data (e.g. surveys) and fishery-dependent information (e.g. catches and size structure of the harvest stock) was used to explore the official time series of catches by GSA and stock level.

2.2.Catch at age

The catch-at-length from total landings of European anchovy and European sardine were obtained from the DCF. Using the slicing method available in the FLR project (http://www.flr-project.org/) to slice length to ages, catch-at-age of both stocks were estimated in GSA 06 and GSA 07. The von Bertalanffy growth parameters used to slice the length data were estimated from otolith readings, including larvae information in GSA 06 (see deliverable 1.3.1.1). Both, catch-at-length (input from DCF) and catch-at-length (output) are presented in this document (see annex section).

2.3.Fishing effort

The 2017 DCF fishing fleet economic data call was used to determine the fishing capacity (number of vessels) as well as fishing effort (days at sea) by fishery. The most important fisheries that harvest small-pelagic fish were considered in the analysis, such as Demersal fish (DEMSP), mixed deep water species (MDDWSP), small and large pelagic fish (SLPF) and small pelagic fish (SPF). Additionally the vessel size was also considered in the analysis, namely vessels of 6 m (VL0006), 6-12 m (VL0612), 12-18 (VL1218), 18-24 (VL1824) and 24-40 m (VL2440).

2.4.CPUE

The raw data available in GSA 06, which was provided by the *Instituto Español de Oceanografía* (IEO) for landings by port, was used to estimate the CPUE (ton day^{-1}). Records of European anchovy (112,118 records) and European sardine (100,061 records) were used to estimate the mean CPUE by landing port between years and months. A heat map was used to identify port catches level by year using a traffic light code, i.e. the CPUE was high (green), moderate (yellow) and low (red).

2.5.Fishing areas

Fishing position of vessels determined by Vessel Monitoring System (VMS) in the Catalan Sea were preliminary analysed in order to determine if the fleet that lands in a particular port exhibits a fishing strategy based on local fishing or active searching. The results of this spatial analysis were linked to the CPUE analysis in order to determine the "success" of the strategy that the fleets of the main ports have implemented.

2.6.Economic analysis

The economic performance of the fleets that contributed to most of the landings of European anchovy and European sardine in GSA 06 and GSA 07 was estimated from the data available in the 2017 DCF fishing fleet economic data call. To determine what fleets according to the type of fishery (e.g. small-pelagic fishery), gear (e.g. purse seiner) and vessel size (e.g. VL1218) should be analysed, both economic and fishery data call were compared. Additionally, other sources of information as the STECF and GFCM reports and stock assessment forms produced by the GFCM were used to complete gaps in economic o technical information.

The available data was cleaned in order to improve the economic inputs. This means that drastic changes in the values of a particular variable were not considered. Gaps on variables required to perform the economic analysis were overcome borrowing data from adjacent years. Fishing incomes took into account landings and subsidies. Costs were differentiated among wages and salaries of crew, energy cost, repair and maintenance and other variable costs. Additionally were considered in the analyses the non-variable costs and annual depreciation costs. Investment and tangible asset value (replacement) were considered when information was available. This economic information was used to determine the total incomes, total costs and net incomes to sub-region 37 (Mediterranean) and country (Spain or France). Posteriorly, the number of vessels associated to economic data call to sub-region and number of vessels to GSA level indicated by the stock assessment forms by GFCM were used to determine the economic performance by fleet and vessel size by GSA.

Results

3.1. Catches

3.1.1. Historic catches

Landings of European anchovy in the Spanish Mediterranean Sea reported by the Spanish government to FAO were around 30,000 tons from 1950 to 1980 (Figure 1). Between 1980 and 1996, landings of this species increased constantly, reaching the maximum of 50,000 tons in 1996. Since 1996, landings of European anchovy have been mainly decreasing, reaching the lowest value of the whole time series in 2011 (11,747 tons). This means that the current level of landings of European anchovy reported by FAO is between a fifth and a third of the historical levels.

The "Sea Around Us" project (SAUP) complemented the FAO statistics, rebuilding the historical catches (landings and discards) since 1950 (http://www.seaaroundus.org). Conversely, to expected, the reconstructed time series showed catches higher than landings reported by FAO. Additionally, the landings and catches did not show comparable trends. Landings reported by FAO only considered the Mediterranean Sea but SAUP included landings of the Gulf of Cadiz in the same assessment, leading to trend differences between both time series. However, the reconstructed catches (Coll et al., 2014) suggest that stock declining could have started 20 years before official statistics indicated (Figure 1).

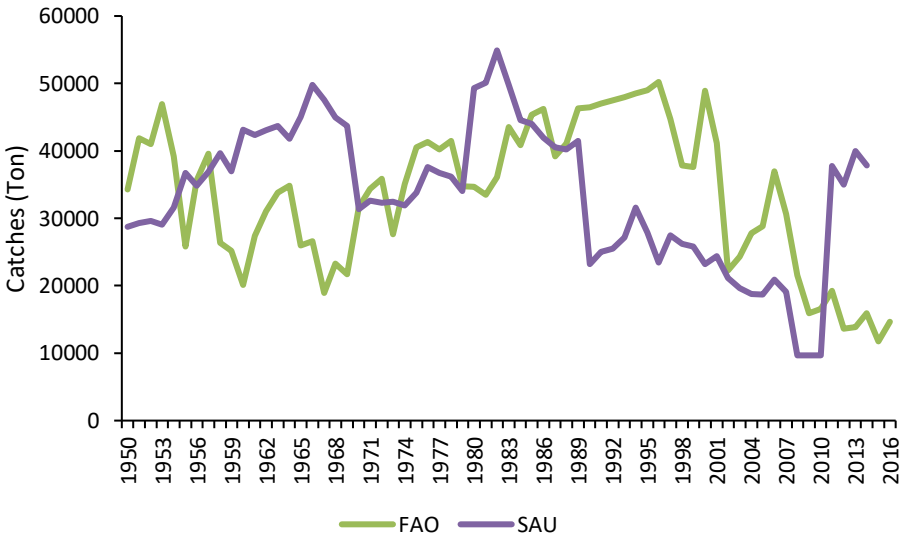


Figure 1. Official catches of European anchovy in the Spanish Mediterranean Sea and reconstructed catches in the Spanish Mediterranean Sea and Gulf of Cadiz by FAO and Sea Around Us project (SAUP), respectively.

According to FAO statistics, the landings of European sardine have oscillated around 20,000 tons (Figure 2). Since 1980, as occurred with European anchovy, the stock of European sardine declined until reaching the lowest landings (2,684 tons) in 2007. Since then, the stock has experienced a recovering to levels observed in the late eighties, above 20,000 tons. The catches reconstruction showed a quite different stock trend. The highest harvested biomass was estimated at 140,000 tons in 1958. After this year the Spanish stock in the Gulf of Cadiz and the Mediterranean Sea has been declining (Coll et al., 2014). The picture shown by SAUP suggests 1)

that the declining of the stock started four decades before identified by the FAO statistics and 2) the historic catches of European sardine could be much greater than officially reported (Figure 2).

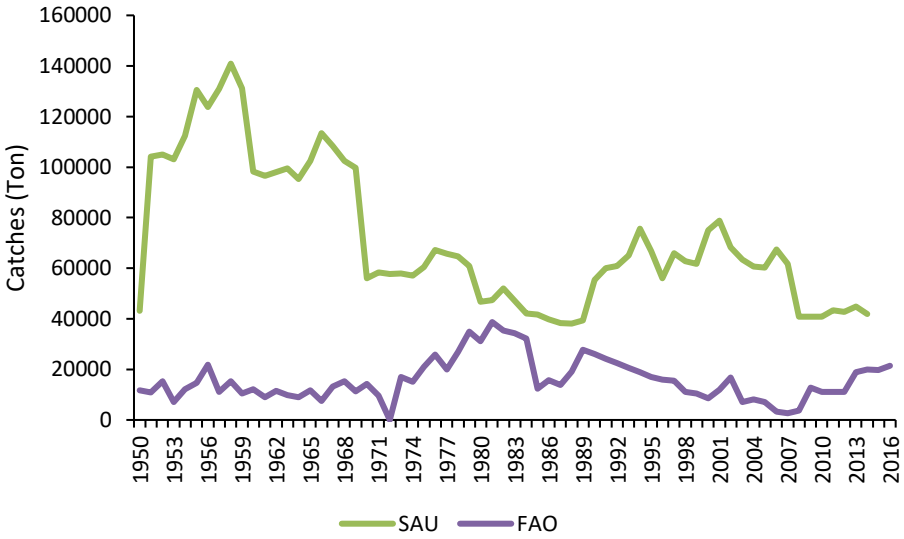


Figure 2. Official catches of European sardine in the Spanish Mediterranean Sea and reconstructed catches in the Spanish Mediterranean Sea and Gulf of Cadiz by FAO and Sea Around Us project (SAUP), respectively.

The trend in catches and landings of the two species was similarly in the French Mediterranean Sea (Figure 3, Figure 4). This trend is probably led by a lack of reconstruction of discards in this area (Bulter et al., 2015). Thus, this information assumes that discards has not occurred along the time series of catches, or that the catch reconstruction of European anchovy and European sardine is incomplete in this sub-region.

The catches of European anchovy have oscillated along the time series, suggesting that its biomass may change with independence of the fishing effort. From 1950 to 1965 the catches remained lower than 1,500 tons per year. Catches increased in average twice between 1965 and 1985, when a strong increase until 10000 tons was reported. Catches followed an oscillatory trend until 2003 when a drastic reduction of catches was reported, from almost 12,000 tons in 2003 to 2,228 tons in 2008 (Figure 3). Although landings reported by FAO continue to decrease, the reconstructed catches showed levels above those estimated after 1965. Later, when the time series of catches used to perform the stock assessment are discussed, we recall this difference between estimates of landings and catches.

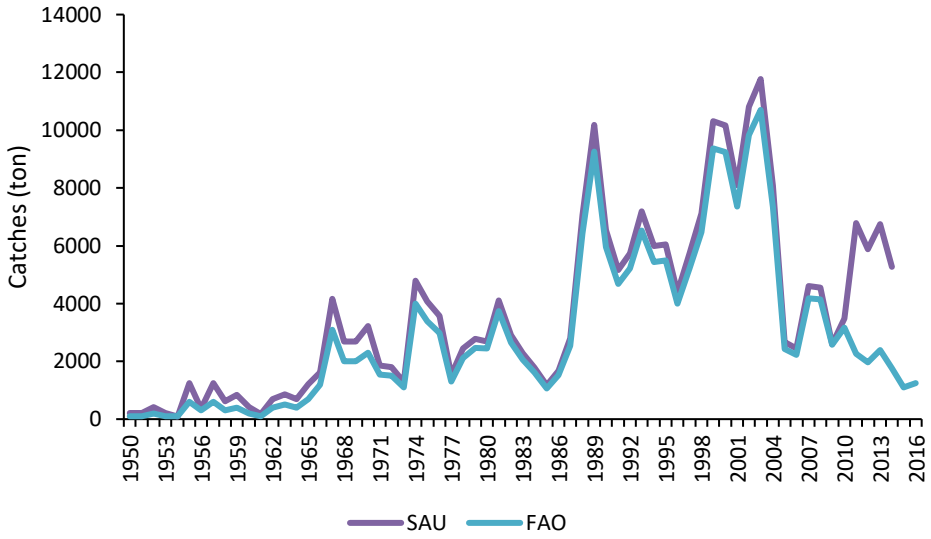


Figure 3. Official and reconstructed catches of European anchovy in the French Mediterranean Sea by FAO and Sea Around As project (SAUP), respectively.

The largest catches of European sardine in the French Mediterranean Sea occurred between 1960 and 1970, reaching catches (previously reconstructed) above 30,000 ton (Figure 4). Since then, the stock has been declining to reach the lowest catches of the whole time series in 2014 (630 tons). This dramatic reduction of catches is probably related to a further reduction of fishing effort than a simple reduction of catches.

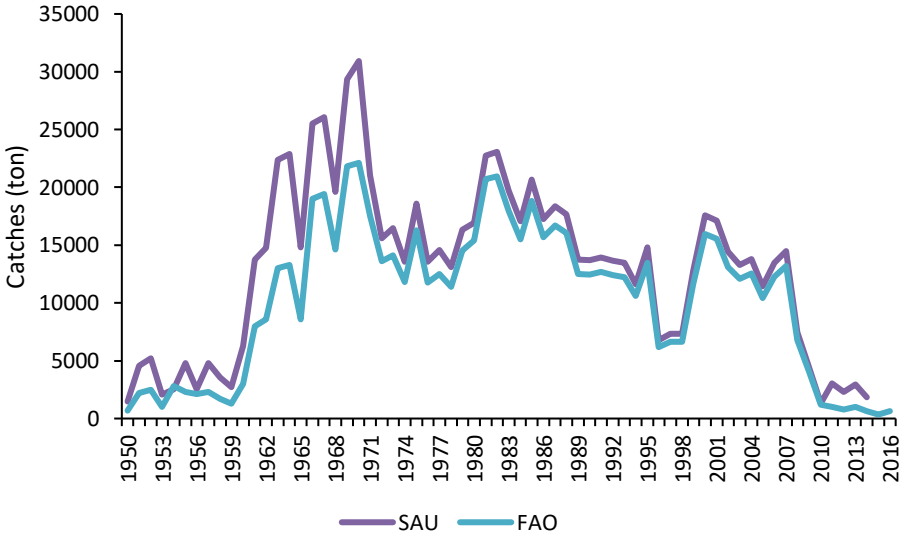


Figure 4. Official and reconstructed catches of European sardine in the French Mediterranean Sea by FAO and Sea Around Us project, respectively.

3.1.2. Landings and discards (historic perspective)

The FAO statistics do not split catches in landings and discards, essentially because countries usually report only landings. The SAUP reconstructed the catches (landings and discards) of the Spanish Mediterranean Sea (plus Gulf of Cadiz). Discards represented 26% (stand. dev= 2.8%) of catches of European anchovy in the Spanish Mediterranean. Additionally, although the estimates

of discards tended to decrease since 1980, landings tended to decrease with a larger rate (Figure 5). This means that commercial sizes are showing a faster declining in the fisheries than non-commercial sizes.

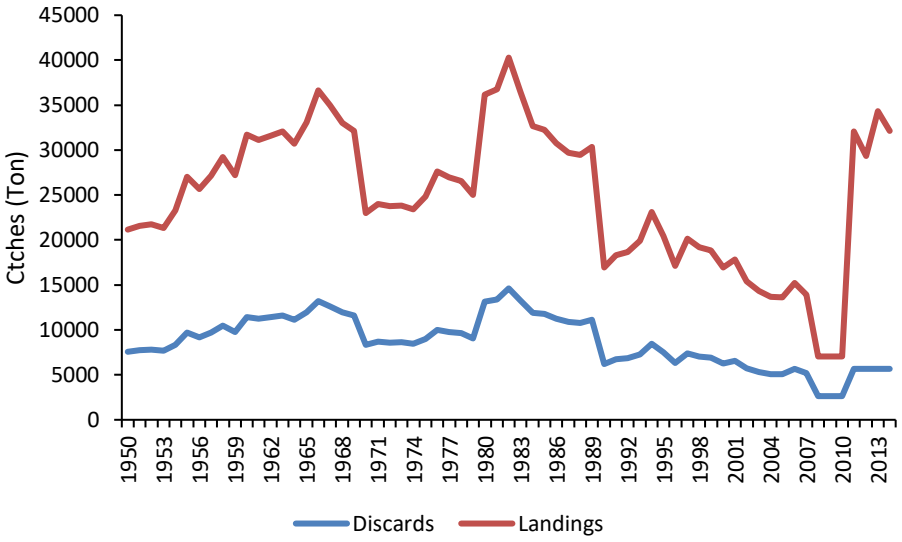


Figure 5. Reconstructed landings and discards of European anchovy in the Spanish Mediterranean Sea and Gulf of Cadiz by the Sea Around As project (SAUP).

The discards of European sardine represented 28% of the reconstructed catches. Additionally, discards were reported with a quite constant trend since 1980, suggesting that measures to reduce illegal sizes in catches have been insufficiently enforced since the seventies. An additional concern is exposed since 2010 because the estimates of discards are close of the estimates of landings (Figure 6). In other words, comparable quantities of legal (landings) and illegal (discards) catch are occurring.

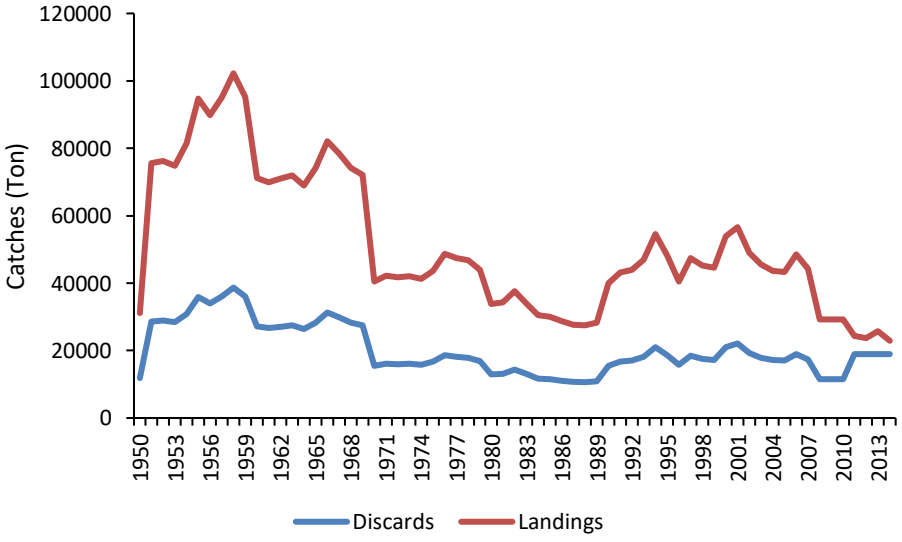


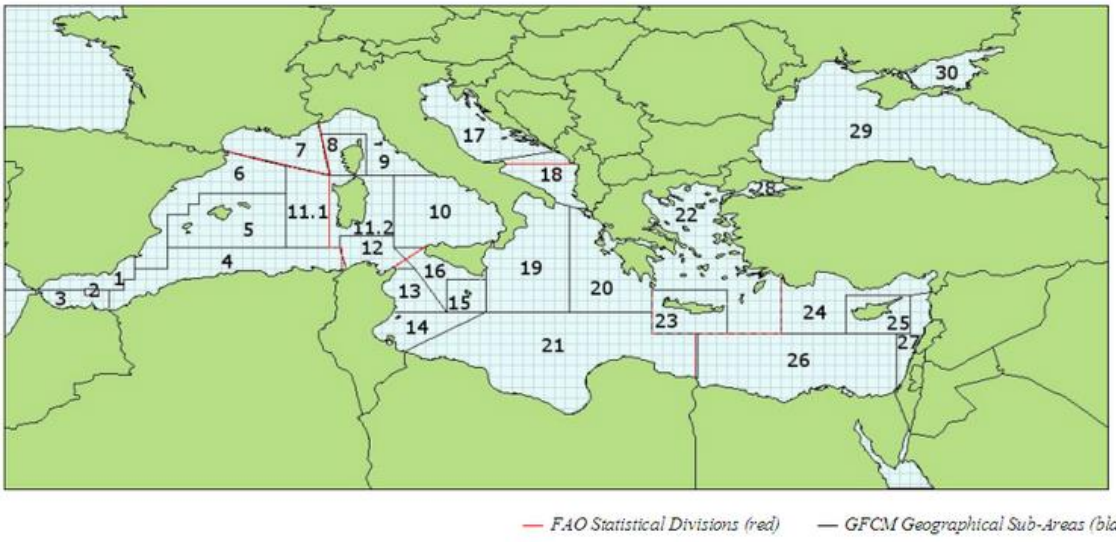
Figure 6. Reconstructed landings and discards of European sardine in the Spanish Mediterranean Sea and Gulf of Cadiz by Sea Around Us project (SAUP).

Finally, the reconstructed catches of the two species in the French Mediterranean Sea did not split landings and discards (Bulter et al., 2015). Is not possible to use the ratio between catches and discards of European anchovy and European sardine of the Spanish Mediterranean to infer the discards in the French Mediterranean as the fishing effort, both in terms of fleet and gears used to harvest both species, are different between Spain and France.

3.1.3. Catch by GSA

FAO as well as SAUP present statistics of landings and catch at a sub-region level (Spanish or French Mediterranean). This scale allows understanding the general context of the fishery trend. However, the geographic areas to assess the stock of both species in the Mediterranean require a more detailed focus (Figure 7).

Landings of European anchovy in the geographical area GSA 06 (Northern Spain) have been collected since 1945. From this year to 1966, landings of this species were below 5,000 tons (Figure 8). Between 1966 and 2008 at least four strong oscillations in landings were recorded. The highest landings were reported in 1979 and 1994 (> 2,000 tons). The lowest values in 1957 and 2007 are 10 times the highest landings reported in 1979. Since 2008 the landings of European anchovy have been increasing until reaching values comparable to those found around 1975.



01 - Northern Alboran Sea	07 - Gulf of Lions	13 - Gulf of Hammamet	19 - Western Ionian Sea	25 - Cyprus Island
02 - Alboran Island	08 - Corsica Island	14 - Gulf of Gabes	20 - Eastern Ionian Sea	26 - South Levant
03 - Southern Alboran Sea	09 - Ligurian and North Tyrrhenian Sea	15 - Malta Island	21 - Southern Ionian Sea	27 - Levant
04 - Algeria	10 - South and Central Tyrrhenian Sea	16 - South of Sicily	22 - Aegean Sea	28 - Marmara Sea
05 - Balearic Island	11.1 - Sardinia (west) 11.2 - Sardinia (east)	17 - Northern Adriatic	23 - Crete Island	29 - Black Sea
06 - Northern Spain	12 - Northern Tunisia	18 - Southern Adriatic Sea	24 - North Levant	30 - Azov Sea

Figure 7. Geographical subareas defined by the General Fisheries Commission for the Mediterranean (GFCM, 2009).

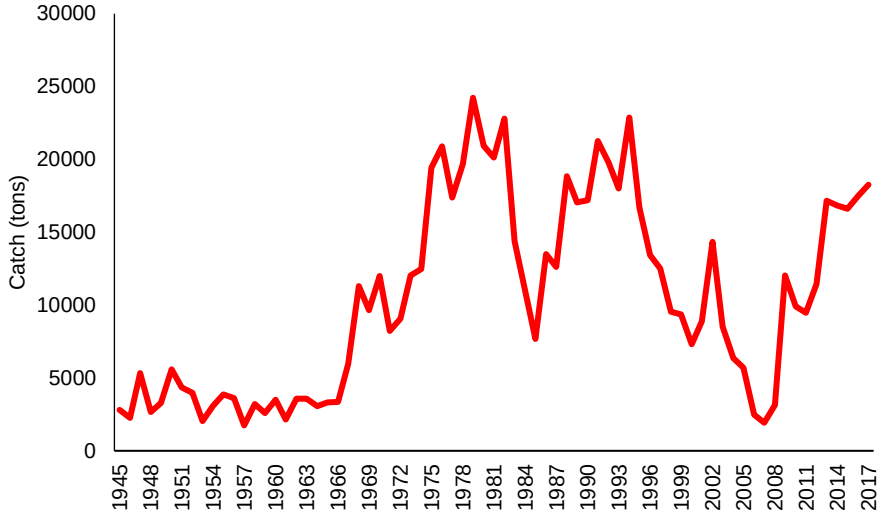


Figure 8. Historic catches of European anchovy recorded by the *Instituto Español de Oceanografía* (IEO) in GSA 06.

Landings of European anchovy have also been recorded since 1945. In GSA 06 European sardine has reported larger landings than European anchovy (at least twice). After a continued increase of landings between 1966 (12,000 tons) and 1994 (53,000 tons), a strong and continued decrease of landings happens until 2016 (6,300 tons) (Figure 9). This means that three decades spent to reach the highest reported landings but half of this time was required to reduce landings 8.4 times, reaching the lowest values of the recorded landings time series.

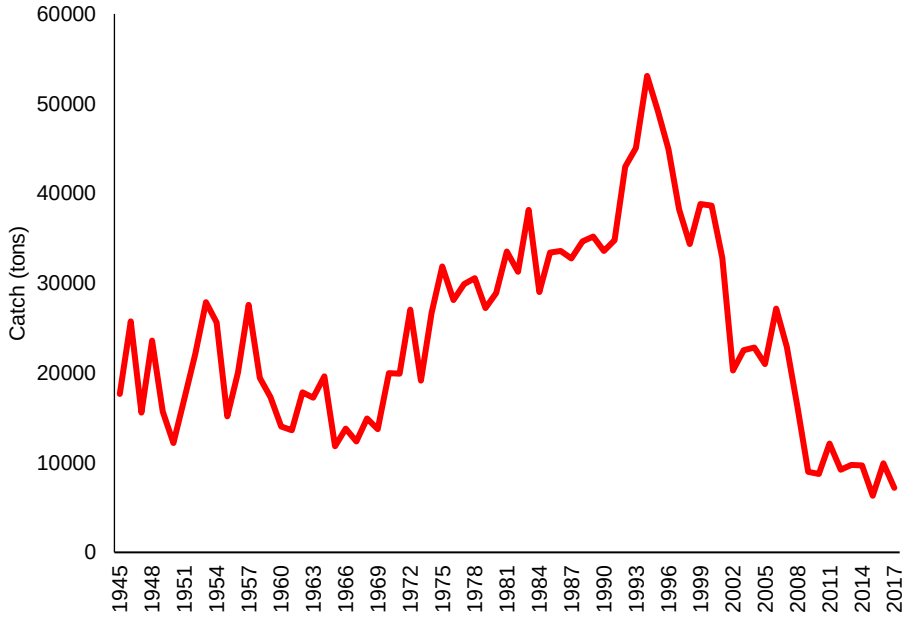


Figure 9. Historic catches of European sardine recorded by the *Instituto Español de Oceanografía* (IEO) in GSA 06.

Beveren et al. (2016) reconstructed landings of European anchovy and European sardine in the French Mediterranean Sea since 1865 (Figure 10). As observed in the Spanish Mediterranean Sea,

European anchovy in the French Mediterranean reported lower landings than European sardine (around a third). Historic exploitation of anchovy reached the highest catches in the eighties, declining since then. European anchovy started to be strongly exploited after European sardine did. However, European sardine reported landings between 10,000 and 20,000 tons from 1965 and 2008, while catches of European anchovy did not overcome 10,000 tons. Finally, both species showed landings declining during the recent part of the time series.

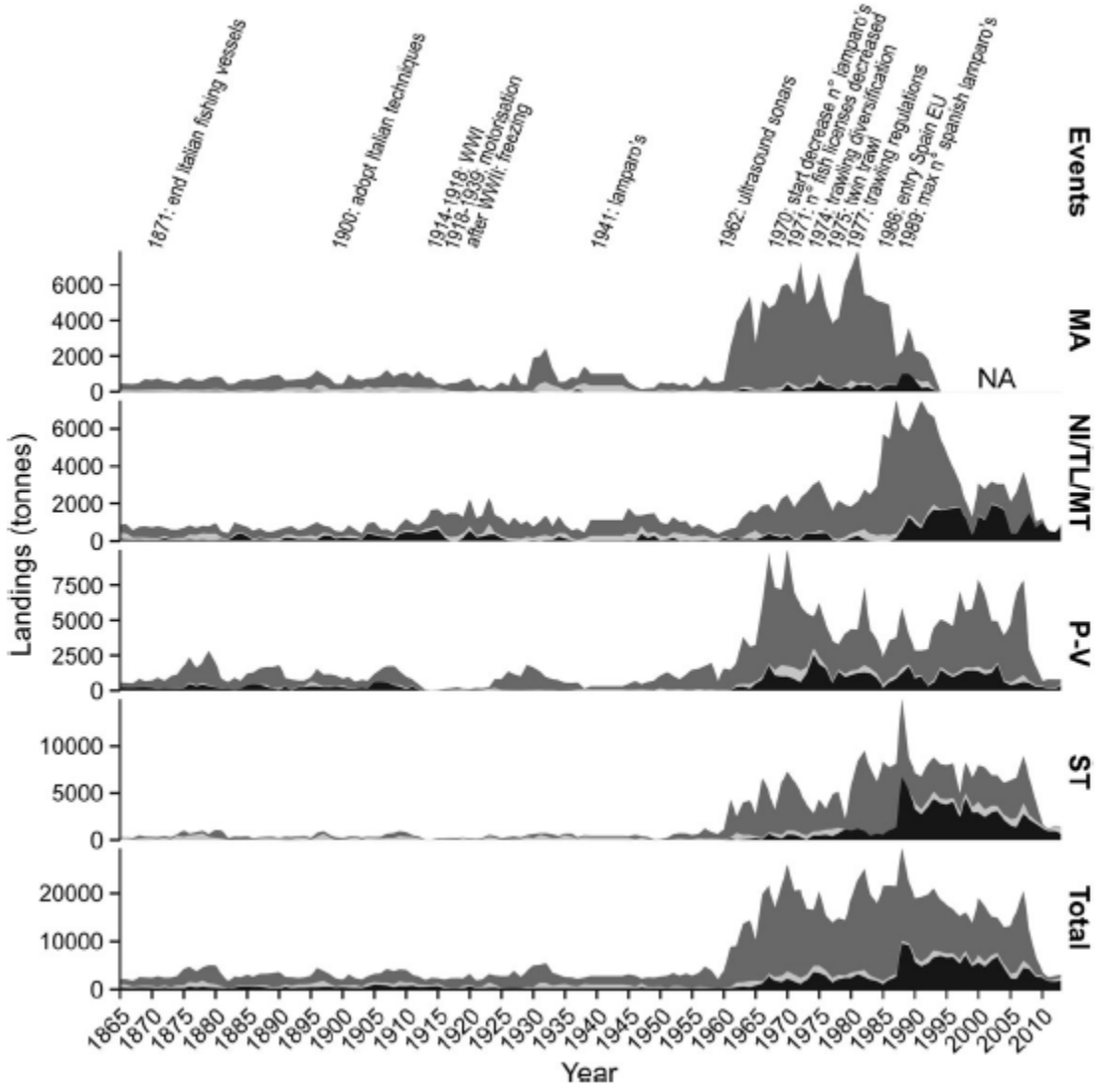


Figure 10. Landings of anchovy (black), mackerel (light grey), and sardine (dark grey) per sub-region. No data were available for the Second World War (1939–1944) and from 1994 onwards for Marseille. The total series (including Marseille) thus underestimates landings slightly during this period. The upper facet indicates several events that impacted fisheries effort. The dotted vertical line indicates 1960, the moment around which an effort increase occurred. Figure and figure caption from Beveren et al. (2016).

The catches of small pelagic fish in GSA 06 are mainly performed by purse seine gear, which represented a mean of 94% (European anchovy 2002-2016) and 98% (European sardine 2002-2016) on total harvested biomass (Annex 1). Landings of European anchovy have been increasing since 2007 (Figure 11), and the current values (2016) are comparable to those found in the

seventies (Figure 8). Conversely, landings of European sardine have tended to decrease during the same period (Figure 11).

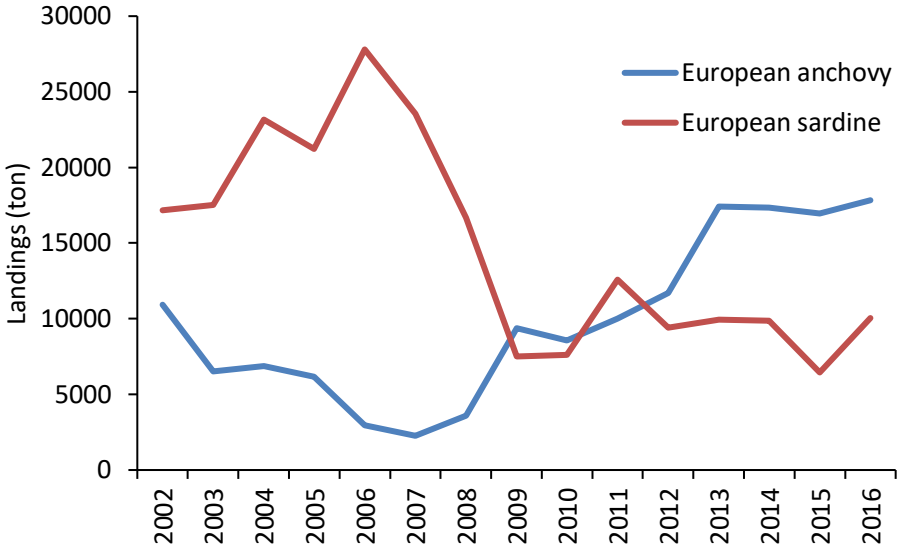


Figure 11. Landings of European anchovy and European sardine in GSA 06.

Purse seiners mainly perform the catches of small pelagic fish in GSA 07. This fleet has removed 72% of the landings of European anchovy and 82% of European sardine from 2002 to 2016 (Annex 2). However, Midwater otter trawl (OTM) reported large catches in 2016 (97% of total catches). Landings of both species were strongly reduced from 2004 to 2015 (Figure 5.12). However, landings in 2016 jumped up from near zero to 800 (European sardine) and 1,200 (European anchovy) tons. This change could be related to an increase in the fishing effort further than net increase of biomass of the stocks.

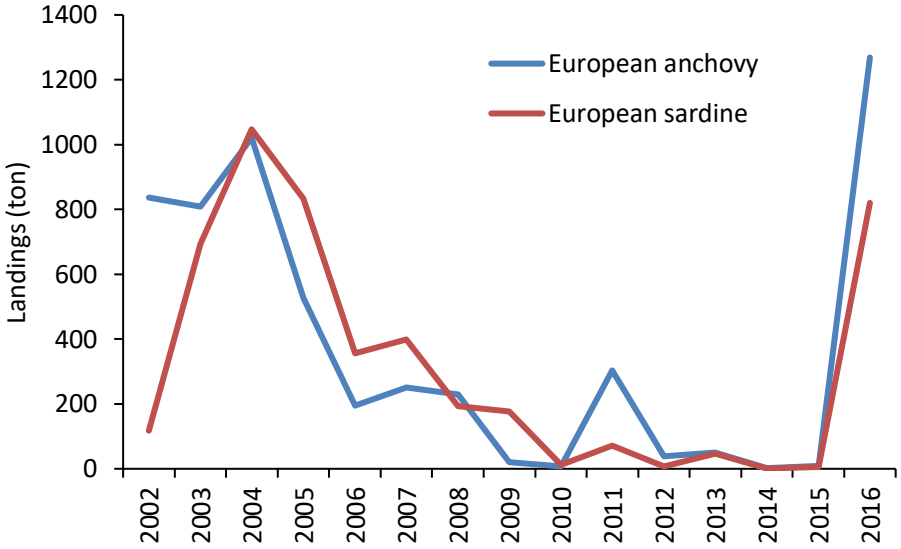


Figure 12. Landings of European anchovy and European sardine in GSA 07.

When available, the information on discards suggests that discards of both species are negligible (See from Figure 13 to Figure 15). These results did not match with those estimated by the Sea Around Us (SAUP) project (Figure 5 and Figure 6). Probably the main reason is due that the official data call collects the data that is effectively reported by the landing ports, while the SAUP project estimated the portion of catches that was not landed or properly reported with other methods.

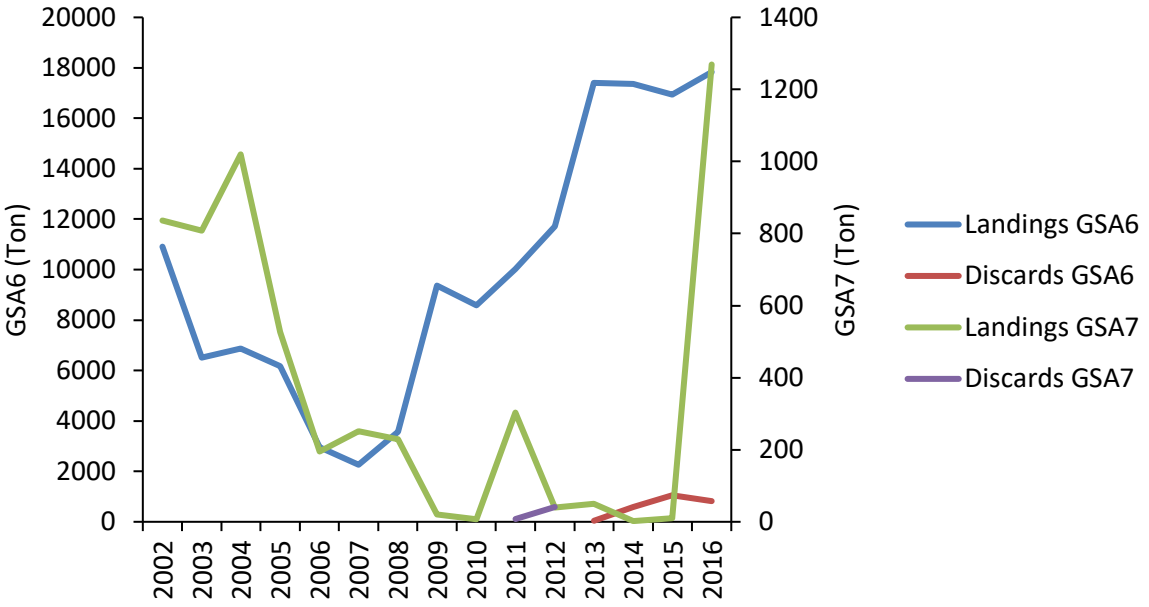


Figure 13. Catches of European anchovy.

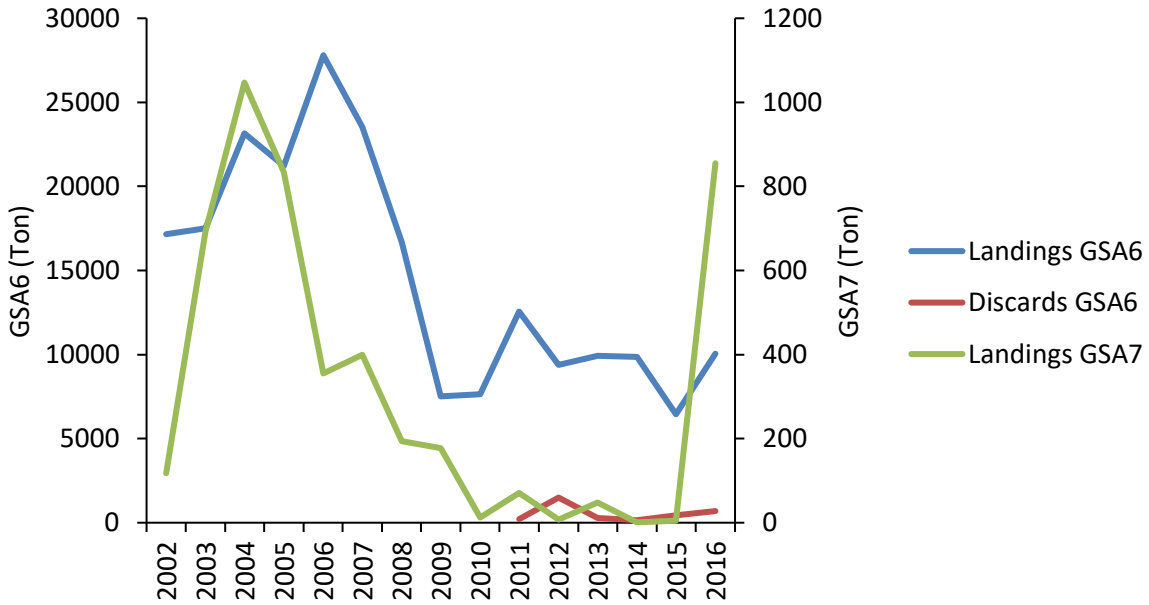


Figure 14. Catches of European sardine.

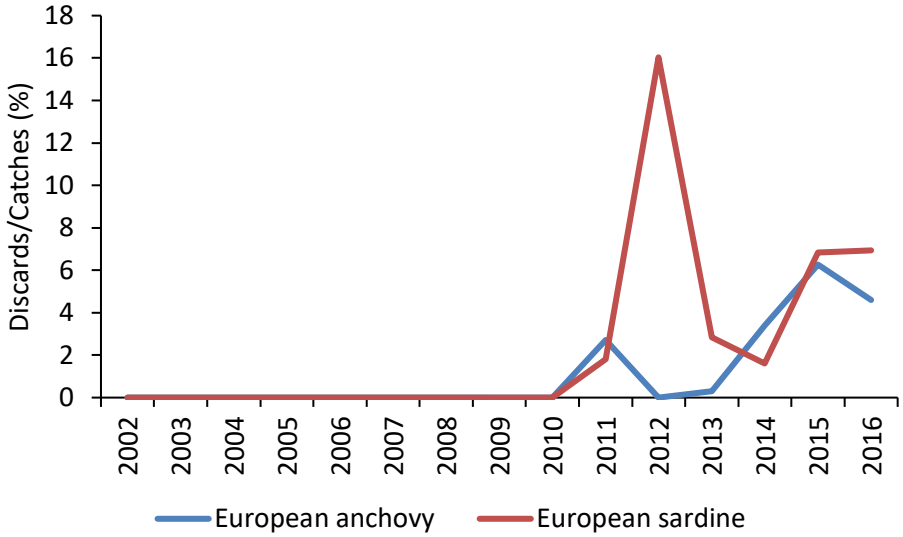


Figure 15. Discards of European anchovy and European sardine in GSA 06.

3.2.Catch at length and catch at size

3.2.1. Catch at length

The official data stored in the DCF indicated that the individuals of European anchovy in GSA 06 removed by fishery mainly ranged between 7 and 18 cm (Annex 5). However, a reduction of around 3 cm in the size distribution was observed between early and late years (Figure 16). This suggests that the fishery is targeting smaller individuals with time.

Length (cm)	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
5	0	0	0	0	0	0	0	0	0	0	26	0	42	0	0
6	0	49	0	0	0	0	5	0	0	356	129	0	735	208	0
7	0	64	5	10	0	4	427	56	34	731	2386	494	3015	1193	689
8	989	1832	1926	20	0	23	1688	1148	285	17259	14436	9321	9900	7231	3368
9	5363	5868	17559	321	0	170	8683	5688	3494	51015	68206	37841	49240	53156	20274
10	19628	9689	24815	5003	1183	326	23898	18909	18745	63250	151042	136028	215312	242624	104609
11	31195	21813	36786	14001	11713	312	38064	31429	44216	92071	168500	300374	337708	480129	224884
12	34605	43422	83114	30092	21282	2975	42465	58478	123188	134960	152358	402900	379361	424610	387999
13	81583	74892	121997	43828	30509	10047	47564	136130	185482	171981	158671	320810	301575	265199	307663
14	154357	109777	80441	73340	28273	20641	37068	160569	114544	131724	126115	148712	149858	73935	221862
15	110115	60172	24989	71363	20323	25619	16580	86263	35516	47682	65127	40831	32864	7920	61900
16	31360	7630	3299	24756	9323	15112	2560	13889	3514	4711	15279	3861	3423	54	5053
17	20204	261	1	2831	2038	2201	95	389	265	71	882	99	79	0	43
18	6140	0	0	17	152	8	143	0	0	0	0	0	0	0	0
19	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure 16. Length structure of landings of European anchovy in GSA 06. Data official by Data Call Framework (DCF). Green shows largest values and red shows smallest values.

European sardine in GSA 06 is mainly caught in sizes between 10 and 18 cm (Annex 6). Nevertheless, after increasing the size of the individuals caught (2007) from 11 to 20 cm, the size of individuals was reduced between 9 and 16 cm (Figure 17).

Length (cm)	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
5	0	0	0	0	0	0	0	0	0	0	40	0	0	0	0
6	0	13	89	0	0	0	0	0	0	0	132	0	0	0	0
7	0	0	533	0	0	0	0	0	0	405	104	0	0	0	0
8	230	203	5274	0	0	0	0	0	66	2360	195	26	158	282	1303
9	693	2358	11298	2611	1053	141	189	301	988	1316	2959	1339	4170	3526	7498
10	5702	23774	26049	35723	16255	910	4616	6398	8836	19163	18847	14824	18258	19759	37115
11	7713	71148	80656	61954	29928	9927	23288	33643	27018	85319	56600	57630	49190	45342	92780
12	16076	69806	151619	71220	35523	44188	55100	77031	53033	106652	94493	100496	112931	98952	184850
13	85175	99688	133188	107428	44995	50175	63339	102779	71207	132774	99446	130701	148003	114885	156766
14	174290	132374	135381	152291	111365	59705	63703	75721	68603	140438	79323	99829	111729	66078	94862
15	157215	139656	152030	151874	206861	115738	83928	34503	58124	77623	59231	63051	58949	23693	38590
16	94641	88169	105433	111888	188213	118419	89957	17653	34592	33161	37012	30630	17934	8540	9816
17	38705	35065	51694	59791	108739	87370	78124	9514	13920	16670	15635	8539	6416	2308	1746
18	8543	10832	21253	17135	48567	80124	45571	5718	3768	6082	3818	2158	1454	929	382
19	752	2786	11269	5231	17337	40573	21035	2956	682	1145	594	557	892	376	215
20	11	654	4413	1403	4996	9982	5689	1674	1111	277	64	109	126	82	46
21	0	69	1134	338	796	804	295	450	311	33	24	4	138	4	3
22	0	7	131	79	134	144	3	40	30	3	0	0	0	0	0

Figure 17. Length structure of landings of European sardine in GSA 06. Data official by Data Call Framework (DCF). Green shows largest values and red shows smallest values.

According to the DCF, the catch at length of European anchovy (Annex 7) and European sardine (Annex 8) was only available from 2009 to 2012 in GSA 07. Additionally, low number of individuals were sampled, hampering the slicing from length to age.

3.2.2. Catch at age

The available length frequencies derived from catches of the studied species in both GSAs were sliced (to Annex 12). The results are shown in the Table 1. The slicing process used the von Bertalanffy growth parameters updated in the deliverable 1.3.1.1. Accordingly to these results, the small-pelagic fishery in GSA 06 targets ages 1 and 2 of European anchovy and ages 0 and 1 of European sardine. Although the available information in GSA 07 indicated that most caught ages are comparable to those found in GSA 06 of both species, a larger uncertainty involves years without available data.

Table 1. Percentage of number at age of European anchovy and European sardine landed in GSA 06 and GSA 07. Results are obtained of analysing the official data provided by the DCF (see from Annex 5 to Annex 12). Green shows largest values and red shows smallest values.

European anchovy in GSA6

age	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
0	1.3	2.3	4.9	0.1	0.0	0.3	4.9	1.3	0.7	9.7	9.2	3.4	4.2	4.0	1.8
1	33.7	44.7	67.5	35.0	51.8	17.6	69.3	47.8	70.2	64.6	68.3	82.8	83.2	90.8	76.6
2	53.4	50.7	26.7	54.5	38.9	59.7	24.5	48.1	28.4	25.1	20.7	13.5	12.3	5.3	21.2
3	6.3	2.3	0.8	9.3	7.5	19.5	1.2	2.7	0.7	0.7	1.7	0.3	0.2	0.0	0.4
4	5.3	0.1	0.0	1.1	1.8	2.9	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0

European anchovy in GSA6

age	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
0	-	-	-	-	-	-	-	0.0	1.2	0.0	0.4	-	-	-	-
1	-	-	-	-	-	-	-	71.8	98.8	97.4	97.1	-	-	-	-
2	-	-	-	-	-	-	-	28.2	0.0	2.6	2.5	-	-	-	-
3	-	-	-	-	-	-	-	0.0	0.0	0.0	0.0	-	-	-	-
4	-	-	-	-	-	-	-	0.0	0.0	0.0	0.0	-	-	-	-

European sardine in GSA7

age	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
0	19.6	39.5	45.8	35.8	15.7	17.0	27.4	59.8	47.1	55.8	58.2	59.8	62.7	73.5	76.7
1	78.8	58.4	49.9	61.1	75.5	61.7	59.0	37.3	51.2	43.0	40.8	39.6	36.8	26.2	23.2
2	1.6	2.1	4.3	3.1	8.8	21.3	13.6	2.9	1.7	1.2	1.0	0.6	0.5	0.4	0.1

European sardine in GSA7

age	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
0	-	-	-	-	-	-	-	2.5	3.3	34.9	36.8	-	-	-	-
1	-	-	-	-	-	-	-	87.3	95.4	64.3	60.5	-	-	-	-
2	-	-	-	-	-	-	-	10.2	1.3	0.8	2.6	-	-	-	-

3.3.Fishing effort

The small pelagic species (SPS), which include European anchovy and European sardine, are mainly harvested in GSA 06 by the small-pelagic fishery (> 92%, Annex 13, Annex 14). According to the official data call, since 2009 the number of vessels in the small-pelagic fishery has remained stable (Table 2). In GSA 07, SPS were targeted by the demersal species fishery from 2002 to 2009, and since 2010 mainly by the small pelagic fishery (Annex 15 and Annex 16). The official data call only included vessel information of 2015 and 2016 in GSA 07 (Table 3). Considering the available information of two GSAs, the fleet that harvests small pelagic fish in GSA 07 is five times smaller than the fleet in GSA 06.

Table 2. Number of vessels by fishery that reported catches of small pelagic fish in GSA 06. Fisheries targeting demersal species (DEMSP), mixed deep water species (MDDWSP), small and large pelagic fish (SLPF) and small pelagic fish (SPF) are shown. Data was retrieved from the 2017 DCF fishing fleet economic data call.

Year	DEMSP	MDDWSP	SLPF	SPF
2009	6726	494	726	673
2010	5318	417	672	489
2011	6611	504	686	608
2012	6585	490	784	583
2013	6643	427	708	601
2014	6525	464	687	587
2015	6221	504	683	553
2016	6177	527	665	590

Table 3. Number of vessels by fishery that reported catches of small pelagics in GSA 07. Fisheries targeting small pelagic fish (SPF) are shown. Data was retrieved from the 2017 DCF fishing fleet economic data call.

Year	SPF
2015	94
2016	112

In terms of the type of fishery (it is not gear level), European anchovy and European sardine in GSA 06 are mainly harvested by the small-pelagic fishery (SPF) on board of vessels between 12 and 24 m of length (Table 4). These two species are harvested in GSA 07 by the SPF with vessels larger than 6 m (According to DCF). However, the annual stock assessment forms produced by the GFCM indicated that most of vessels are larger than 12 m. This information may be downloaded from http://www.fao.org/gfcm/data/safs. Additionally, the mixed deep water fishery, which use vessels larger than 24 m, are involved in the fishery of these two species (Table 4). In term of days at sea, the fleets that target European anchovy and European sardine have maintained a stable effort along the available time series (Table 5).

Table 4. Vessel size (%) of the fleets that catch small pelagic fish in GSA 06 and GSA 07. Fisheries targeting demersal species (DEMSP), mixed deep water species (MDDWSP), small and large pelagic fish (SLPF) and small pelagic fish (SPF) are shown. Data was retrieved from the 2017 DCF fishing fleet economic data call. Green shows largest values and red shows smallest values.

		DEMSP	MDDWSP	SLPF	SPF
	Vessel size	**50806**	**3827**	**5611**	**4684**
GSA 06	VL0006	4.57	0.00	5.13	0.00
	VL0612	55.89	1.23	80.15	1.22
	VL1218	19.16	9.27	13.37	33.34
	VL1824	14.02	50.72	1.25	52.68
	VL2440	6.08	38.88	0.04	12.77
GSA 07	VL0006	11.79	0.00	39.57	3.32
	VL0612	34.82	0.00	53.96	32.56
	VL1218	6.40	2.96	5.76	15.28
	VL1824	20.69	26.08	0.72	26.25
	VL2440	26.31	70.97	0.00	22.59

Table 5. Days at sea of the fleets that catch small pelagic fish in GSA 06 and GSA 07. Fisheries targeting demersal species (DEMSP), mixed deep water species (MDDWSP), small and large pelagic fish (SLPF) and small pelagic fish (SPF) are shown. Data was retrieved from the 2017 DCF fishing fleet economic data call. Green shows largest values and red shows smallest values.

	Year	DEMSP	MDDWSP	SLPF	SPF
GSA 06	2009	151304	5035	4275	17563
	2010	145299	4620	4477	16985
	2011	145746	4450	3796	17831
	2012	142457	4933	4379	17339
	2013	142034	3902	3830	18956
	2014	150637	3705	4057	19556
	2015	141184	3830	3516	17589
	2016	142488	4919	3576	19187
GSA 07	2009	1701	274	4	94
	2010	2949	169	75	4
	2011	2960	280	100	167
	2012	2873	100	78	15
	2013	2514	142	77	52
	2014	2549	256	124	
	2015	2553	368	103	1063
	2016	2215	848	62	2211

3.4.CPUE in GSA 06

Taking advantage of the raw data available in GSA 06, provided by the *Instituto Español de Oceanografía* (IEO) for landings by port, a more detailed analysis than that allowed by the DCF was performed to CPUE level. We determined that eight ports (from Blanes to Burriana) showed several high CPUE of European anchovy (> 1,300 tons by haul) along time series (highlighted with green colours) (Figure 18). On the other hand, twelve ports showed several high CPUE of European sardine (green squares > 1,000 tons by haul) (Figure 19). Additionally, the number of ports with largest catches of one of the species changed, meaning that a spatial differentiation of best catches of both species may occur.

Port	2009	2010	2011	2012	2013	2014	2015	2016	2017
Blanes	1158	1228	1228	1177	1325	1572	1467	1550	1557
Alicante									1327
Vilanova y la Geltrú	1469	1181	1272	1035	1243	1335	1159	1227	1254
Vinaroz	1194	1195	1225	1234	1175	1681	1292	1412	1610
Jávea	1440	801	544	706.1	1201	1126	1227	1473	1832
Tarragona	1474	1182	1152	1158	1461	1217	1244	998.6	1200
Gandía	1949	917	741	1086	1728	1011	1075	1137	2039
Burriana	1182	867	791	1050	1342	1093	1294	1228	1838
Arenys de Mar	1075	1045	1155	892.9	1452	1063	1301	1220	1235
Palamós	951.9	1143	1199	1083	1278	1320	1166	1110	1217
Roses	1146	1386		1532	1005	1145	934.3	1076	910.6
La Escala	974	1192	1043	1114	1204	1004	1118	1212	1190
Torrevieja	1159	426	552	514.2	1463	1131	1068	1034	1062
Castellón	1041	807	543	884.6	1329	1067	1224	1283	1563
San Feliú de Guixols	867.1	1003	873	951.3	1066	1118	1215	1358	1051
Cambrils	1006	970	898	851	1408	1093	1105	1039	1163
Valencia	1870							875.6	1460
Barcelona	1118	1004	836	684.4	1183	1036	981.7	1026	1091
Ametlla de Mar	957.9	883	947	750.3	1200	862.4	863.5	1195	730.7
San Pedro del Pinatar			10	64	1336	841.8	670.2	857.6	1188
Altea	956.1	587	513	612.3	1139	916.6	1279	953.4	1205
Denia	65	480				875			

Figure 18. Mean catch per landed haul of European anchovy by port from 2009 to 2017 in GSA 06. Green shows largest values and red shows smallest values.

Port	2009	2010	2011	2012	2013	2014	2015	2016	2017
La Escala	1071	1022	1106	964.7	1548	1123	1174	1244	1069
Roses	1224	1048		956.1	1377	1009	908.4	934.3	1137
Vilanova y la Geltrú	1024	864	1187	1075	992.4	791	787.8	1196	925
Alicante									888
Jávea	1009	870	1112	809	1287	648	833.7	740.4	618.9
Arenys de Mar	950.8	994	1024	980.3	1077	724.1	645.6	860.1	734.2
Palamós	888.3	1187	1059	1018	1280	838.2	510.2	865.9	610.3
Blanes	1037	1251	956	971.5	1092	746.5	540	827.2	688.8
Barcelona	744.8	858	1089	893.3	807.7	969.5	628.6	949.7	745.2
Torrevieja	705.1	1092	1100	1137	773.5	758.7	533.3	754.1	752.4
Altea	1557	1114	1080	846	793.3	485.6	226.1	310.4	579.6
Gandía	661.2	716	1241	683.7	1079	468.8	507	576.4	806
San Feliú de Guixols	844.3	1013	920	663.1	832.2	685.2	412.6	683.8	534.2
Burriana	1039	941	1043	725.7	488.8	725.8	557.5	501.1	462.5
Cambrils	970.2	710	858	751.2	583.7	599.3	278.9	759.1	380.6
Ametlla de Mar	908.3	634	726	395.3	442.7	354.3	88.11	795.2	367.7
Tarragona	920.7	785	960	774.2	579.9	572.5	263.5	814.5	487.7
Castellón	838.5	642	913	493.7	516.7	703.8	542.8	551.3	375.9
San Pedro del Pinatar			384	1309	688.4	599.6	384.5	509.3	728
Vinaroz	506.4	569	852	299.3	412.5	830.2	493.8	410.4	396.8
Valencia								439.4	420.6
Mataró			33.5						

Figure 19. Mean catch per landed haul of European sardine by port from 2009 to 2017 in GSA 06. Green shows largest values and red shows smallest values.

The analysis by monthly level revealed for both species that 1) ports that reported the largest CPUE produced good fishing results in several months (e.g. Blanes and Vinaroz to European anchovy and La Escala y Rosas to European sardine) (Figure 20 and Figure 21). Conversely, ports where CPUE was lower also presented worse results among months; 2) ports located in the middle part of the list in Figure 20 and Figure 21 tend to report better CPUE between July and January (European anchovy) and between May and October (European sardine). This means that fleets that hold high CPUE are capable to produce better catches along year.

Port	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dic
Blanes	1565	803	1139	1522	1222	1450	1506	1120	1337	1846	1776	1777
Alicante			1119	898.9	611	124		344.8	1465	2209	1246	
Vilanova y la Geltrú	1132	1340	1016	946.6	1116	1436	1731	1087	1274	1310	1552	1259
Vinaroz		1129	807	806.4	1046	1560	1745	1543	1624	1265	717.4	577.2
Jávea	1621	1456	970	1038	1081	1016	1052	987.2	1415	1670	1645	1243
Tarragona		1231	1032	898.1	1181	1355	1396	1050	1410	1258	1215	1660
Gandía	915.8	1211	496	838.4	1101	1428	1353	1351	1186	1350	1688	1253
Burriana		883	762	906.3	978.1	1214	1557	1351	1412	1525	1600	48
Arenys de Mar	1497	798	826	983.7	883.7	1295	1458	815	1033	1379	1909	2281
Palamós	1610	1102	1295	1034	1128	1026	950.5	1044	1156	1550	1512	1550
Roses	1187	1222	1092	972.2	706.7	664.1	731.9	980.2	1801	1521	1518	1633
La Escala	1396	1231	1062	998.2	683.8	793.9	846.5	1062	1507	1483	1378	1305
Torrevieja	877.5	829	784	813.7	748.7	1282	1333	1215	1329	1555	1169	532.7
Castellón		829	707	804.6	888.1	1159	1350	1189	1276	1337	1268	148.2
San Feliú de Guixols	1400	1035	788	956.5	1131	1001	1047	865.4	1040	1374	1406	1468
Cambrils		1136	784	788.1	1091	1217	1293	1016	1280	871.1	978.9	1339
Valencia	291.5	1185	963	671.2	940	1073	1664	171.1	2276	2094	223.5	
Barcelona	1095	832	934	940.3	762.1	1184	1321	867	968.6	1087	1361	888.9
Ametlla de Mar		1042	935	662.5	843.3	1053	1155	894.4	888.4	840.3	797.6	1229
San Pedro del Pinatar	574.5	748	590	768.2	608.7	954.6	1124	1105	1329	1315	644.2	546.7
Altea	1137	805	718	807.1	510.4	549.2	743.3	714.2	1210	1707	1336	1143
Denia						70			673.3			

Figure 20. Mean catch per landed haul of European anchovy by month. The CPUE has integrated all available years (2009 to 2017) in GSA 06. Green shows largest values and red shows smallest values.

Port	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dic
La Escala	1281.8	687.7	918.7	1112.3	1261.7	1194.7	1254.4	1087.4	1196.6	1379.3	1406.6	1107.8
Roses	1103.0	673.8	998.3	901.5	1087.6	1128.5	1341.7	1122.8	1082.5	1282.6	974.4	1104.0
Vilanova y la Geltrú	610.9	391.3	587.6	930.6	1338.0	1117.4	670.2	1225.2	1100.0	1229.8	1163.1	950.3
Alicante			795.3	503.2	990.4				1443.1	1109.4	712.7	
Jávea	359.5	578.4	608.2	760.7	862.9	910.8	1072.2	1161.3	1268.4	1056.6	411.2	129.2
Arenys de Mar	525.0	496.0	503.6	801.7	818.7	1028.4	997.5	873.4	908.7	1230.6	1126.2	1460.1
Palamós	824.8	333.7	935.4	737.3	728.9	1008.7	1119.5	772.4	694.3	970.5	680.7	675.4
Blanes	801.5	363.6	706.6	878.7	920.6	964.7	862.6	790.2	778.4	1114.7	966.0	735.0
Barcelona	628.0	522.6	527.7	675.3	1036.9	1164.6	811.4	867.1	983.2	998.3	947.6	1358.6
Torrevieja	588.7	787.9	527.4	510.2	795.2	931.0	1306.8	1097.8	1264.1	724.2	806.7	425.7
Altea	359.4	645.1	440.9	580.9	823.6	1005.8	1100.8	1190.4	1220.2	577.9	833.3	391.8
Gandía	317.2	475.4	720.4	824.9	505.8	653.4	1085.5	802.0	994.2	873.3	334.0	11.0
San Feliú de Guixols	532.7	220.8	568.1	579.7	524.6	807.7	883.1	562.3	562.8	825.1	712.8	613.5
Burriana		577.7	575.3	556.0	805.6	591.2	655.2	888.6	1036.8	573.7	1075.0	465.0
Cambrils		386.1	338.2	610.4	857.5	933.7	553.7	1198.2	947.1	852.9	765.0	456.6
Ametlla de Mar		331.8	339.8	672.2	906.6	536.4	775.4	1139.6	1109.7	605.0	781.0	417.7
Tarragona		358.1	343.6	526.0	753.5	900.9	610.4	894.2	938.1	881.8	574.1	418.3
Castellón		448.6	468.4	444.0	621.3	561.3	615.2	777.3	1020.4	618.6	1125.2	632.5
San Pedro del Pinatar	655.7	611.0	446.2	559.2	620.0	430.7	346.9	857.5	786.4	658.2	108.9	516.7
Vinaroz		540.9	570.2	524.9	682.4	378.2	441.3	421.1	660.2	571.6	782.7	623.1
Valencia	559.2	362.2	460.3	917.3	302.0				480.5			

Figure 21. Mean catch per landed haul of European sardine by month. The CPUE has integrated all available years (2009 to 2017) in GSA 06. Green shows largest values and red shows smallest values.

3.5.Fishing areas

The ports of Escala, Roses, Vilanova, Javea, Arenys de Mar and Barcelona presented the highest and more recurrent CPUE for European sardine in GSA 06 (Figure 21). Only the fleet from La Escala, which showed the best CPUE among ports in GSA 06, focused the fishing hauls near the landing port in 2017 (Figure 22 and Figure 23). This suggests that this particular area promotes good catches of European Sardine in comparison with the fishing capacity of the area. Conversely, vessels from the ports of Roses, Vilanova I la Geltrú, Arenys de Mar and Barcelona used larger areas (far from landing port) to fish. In these cases, a more active search was used as fishery strategy.

The ports of Blanes, Vilanova I la Geltrú, Vinaroz, Javea and Tarragona presented most of the best CPUE of European anchovy (Figure 20). Tarragona used a strategy of "local" fishing areas (Figure 23c), while Blanes and Vilanova i la Geltrú employed larger areas to produced good CPUE. Among all fleets that fish small pelagic in GSA 06, that from Vilanova I la Geltrú is the only one producing high CPUE of both species. These results suggest that an active spatially searching strategy is successfully employed by this fleet.

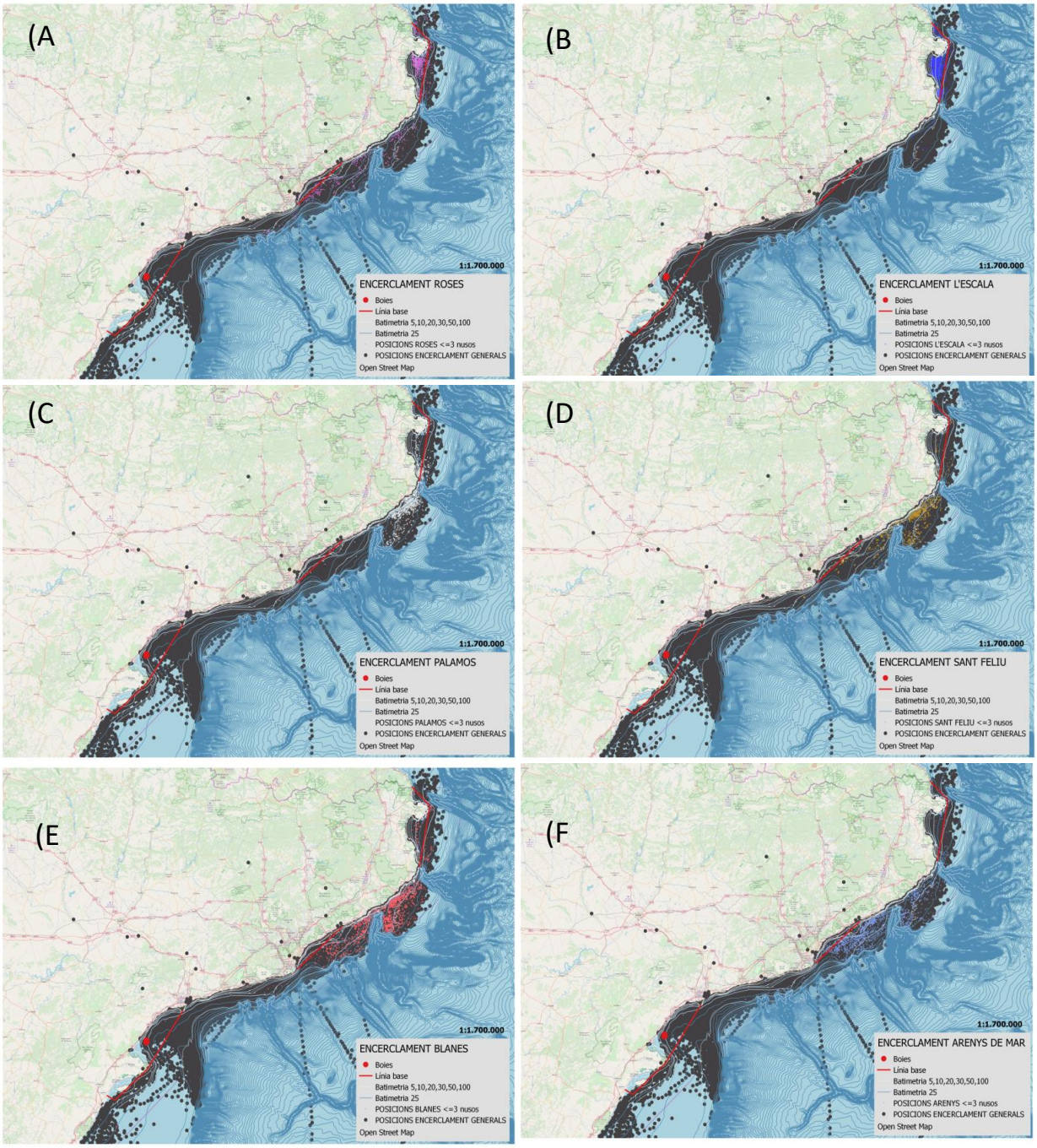


Figure 22. Fishing position in 2017 (<3knots) of purse-seiners of North Catalonia by base harbour of the vessels. Black points correspond to all positions in general and coloured dots correspond to the vessels of the specific harbour (A) Rosas, (B) L' Escala, (C) Palamós, (D) Sant Feliu, (E) Blanes, (F) Arenys de Mar. *Source:* Fisheries and Maritime affairs Department of the Government of Catalonia.

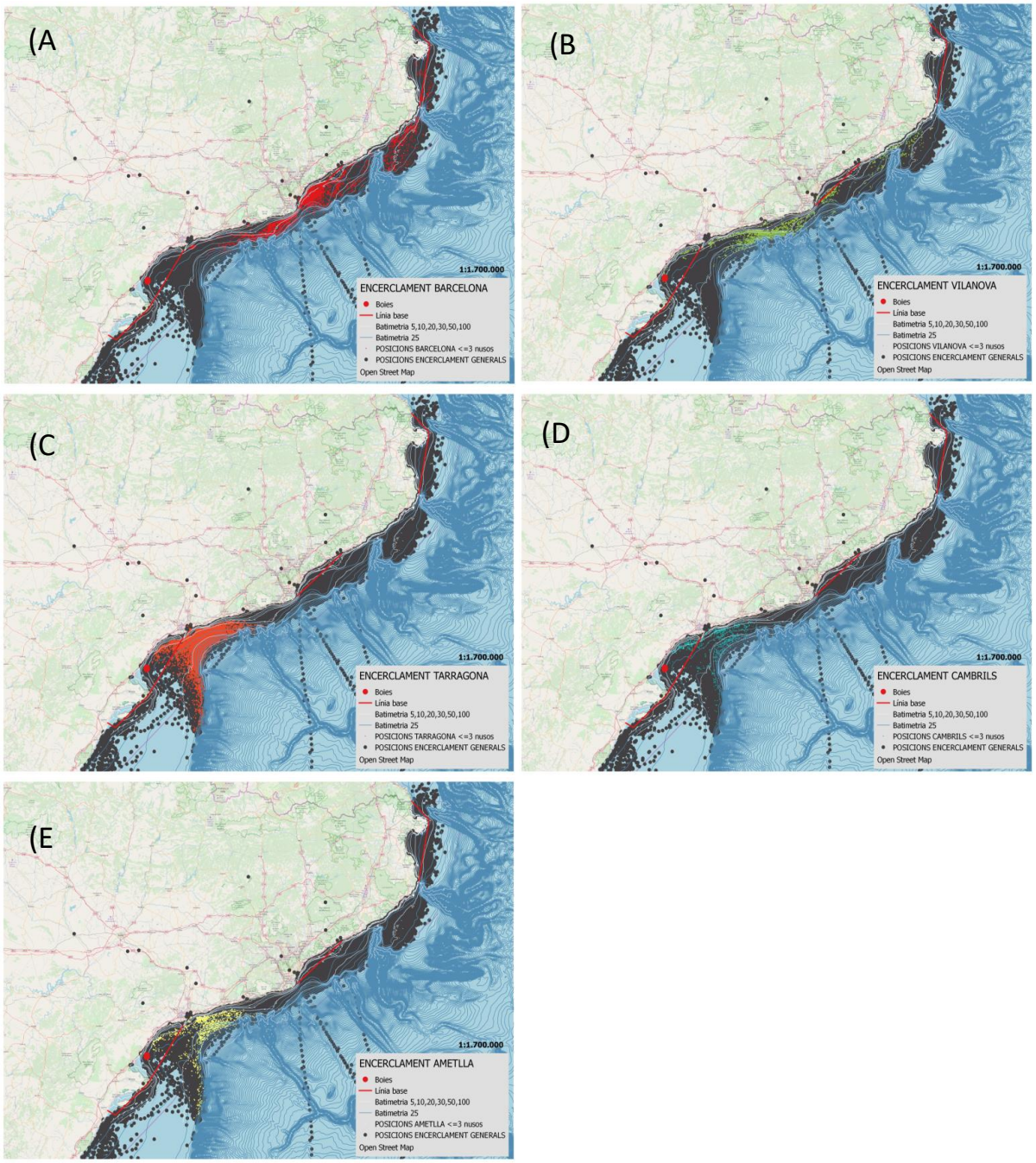


Figure 23. Fishing position in 2017 (<3knots) of purse-seiners of South Catalonia by base harbour of the vessels. Black points correspond to all positions in general and coloured dots correspond to the vessels of the specific harbour (A) Barcelona, (B) Vilanova i la Geltrú, (C) Tarragona, (D) Cambrils, (E) L' Ametlla de Mar. *Source:* Fisheries and Maritime affairs department of the Government of Catalonia.

3.6.Economic performance

The purse seiner fleet that uses vessels from 12 to 18 m of length has decreased its size. 125 vessels were fishing in 2008 but only 90 vessels (72%) continue fishing in 2015 in GSA 06. Between 2009 and 2012 the benefits of this fleet was declining (Figure 6.24). This result suggests that once the fleet size was reduced, the net incomes may increase, as it was observed since 2012. Thus, there are some inputs that indicate a fishing effort too high before 2012. According to the official sources to determine the fleet size, the 2017 DCF fishing fleet economic data call to sub-region 37 and the stock assessment forms by GFCM to GSA 06, indicated that the purse seine fleet (VL1218) in GSA 06 is similar or higher than in sub-region 37 (Figure 25). Therefore, the net incomes of this fleet to different geographical levels are comparable. These results suggest that either the fleet to sub-region level is underestimated or the fleet to GSA 06 is overestimated.

3.6.1. Small pelagic fishery in GSA 06

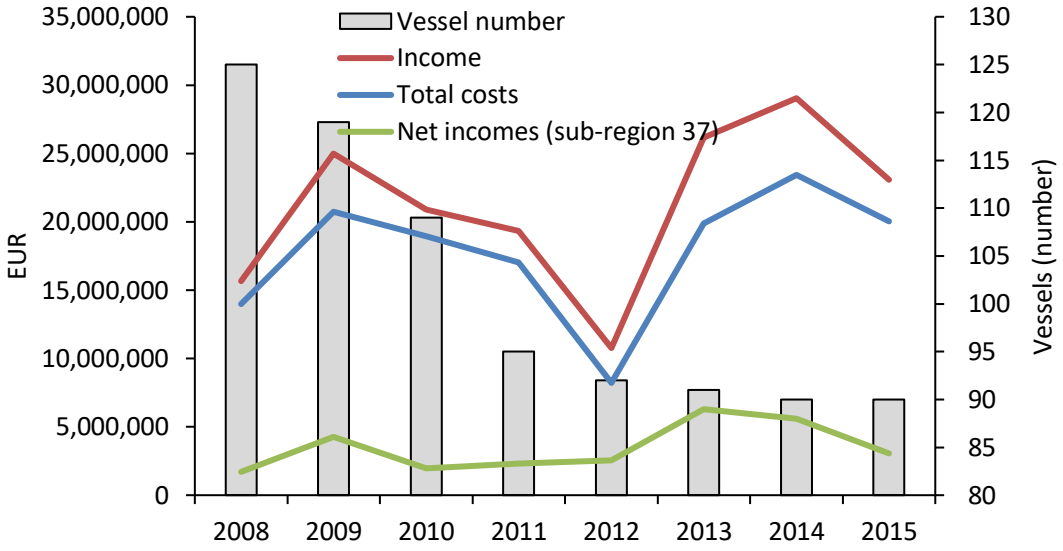


Figure 24. Economic performance of the purse seiner fleet (vessel length 12-18 m) that harvest small-pelagic fish in the Spanish Mediterranean Sea. Details are shown in the Annex 18.

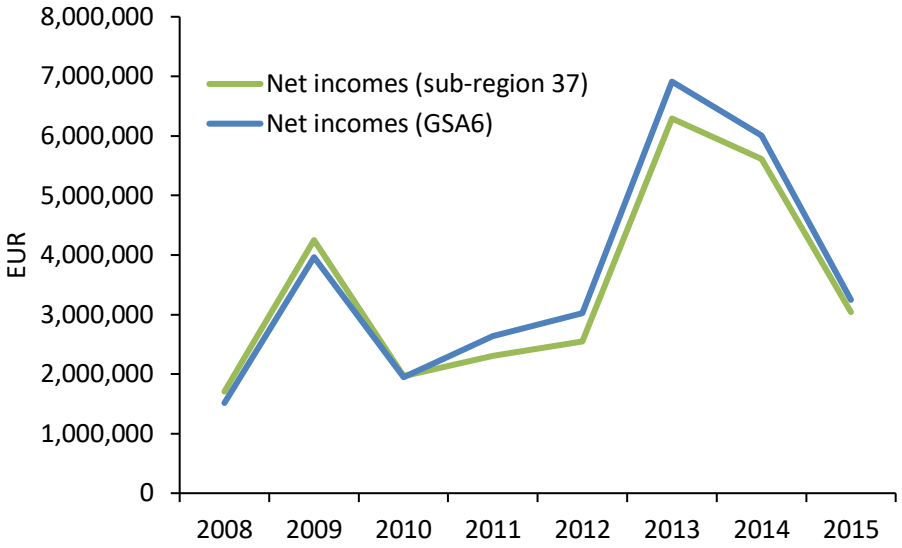


Figure 25. Net incomes of the purse seine fleet (VL1218) that harvests European anchovy and European sardine in the Spanish Mediterranean Sea (sub-region 37) and GSA 06. Details are shown in the Annex 18.

The purse seine fleet (VL1824) showed a similar behaviour in respect of fleet size and trend of net incomes fleet composed by smaller vessels (Figure 25). However, the net incomes of this fleet has been larger despite number of vessels is lower. According to these results, the fleets that target small pelagic (VL1218 and VL1824), including European anchovy and European sardine, could increase the net incomes once the fleet size was reduced. At the same time, larger vessels produced best economic results. The VL1824 fleet in GSA 06 showed lower benefits with regards to all fleet in Spanish sub-region 37 since 2012 (Figure 27). Thus, the reduction of this fleet in GSA 06 could be larger than in other GSA areas (1 and 5).

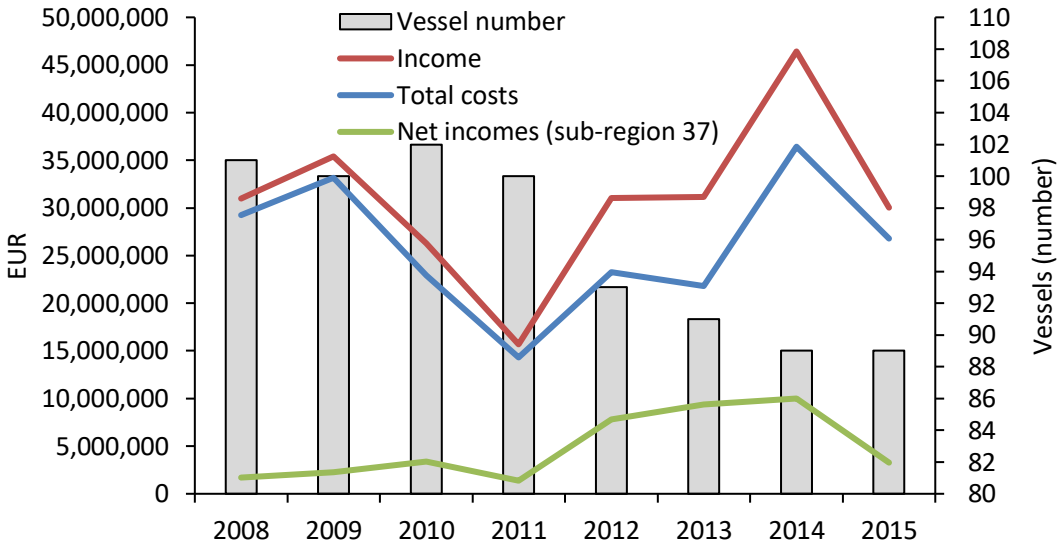


Figure 26. Economic performance of the purse seine fleet (vessel length 18-24 m) that harvest small-pelagic fish in the Spanish Mediterranean Sea. Details are shown in the Annex 18.

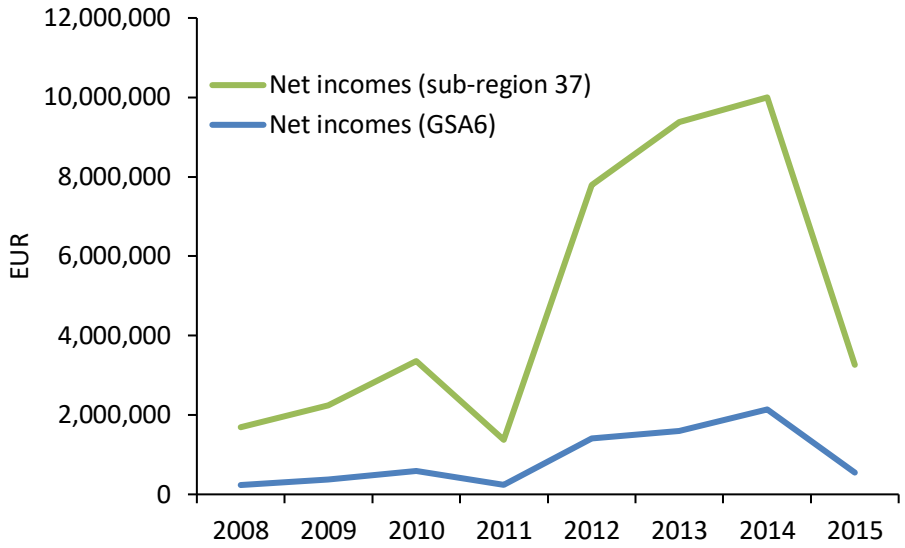


Figure 27. Net incomes of the purse seine fleet (VL1824) that harvests European anchovy and European sardine in the Spanish Mediterranean Sea (sub-region 37) and GSA 06. Details are shown in the Annex 18.

3.6.2. Small pelagic fishery in GSA 07

European anchovy and European sardine are harvested in GSA 07 by two fleets, bottom otter trawl (OTB) and purse seiners (PS) (Annex 2). However, the midwater otter trawl (OTM), reported high catches of European anchovy in 2016. According to the annual stock assessment form delivered by the General Fishery Commission for the Mediterranean (http://www.fao.org/gfcm/data/es/), the fleets that harvest these two species are mainly composed by vessels between 12 and 24 m of length. Given that the 2017 DCF fishing fleet economic data call splits the economic information by range of vessel length, the economic analysis considered vessels between 12 and 18 m (VL1218) and 18-24 m (VL1824). The annual catches of European anchovy (mean=23.36 ton) and European sardine (mean=23.28 ton) reported by the OTB are very low in comparison to target species (e.g. hake). Given that this fleet catches other species than small-pelagic fish, the economic performance of this fleet was not assessed because the results are difficult to interpret (biased) in a context of the small pelagic fishery. Thus, the economic analysis has considered the purse seiners coded as VL1218 and VL1824. Additionally, the midwater otter trawl with available information (VL2440) in the 2017 DCF fishing fleet economic data call was analysed.

The size of the purse seine fleet (VL1218) has decreased since 2011 (Figure 28). However, the total cost of operating this fleet increased during the same period. These results suggest that the reduction in the stock size did not compensate the incomes by vessel. Thus, fleet may tend to maintain losses and promotes higher size reduction. Comparatively, the VL1218 fleet in GSA 07 produces near a quarter of the total incomes of this fleet in the whole French Mediterranean area (area 37) (Figure 29).

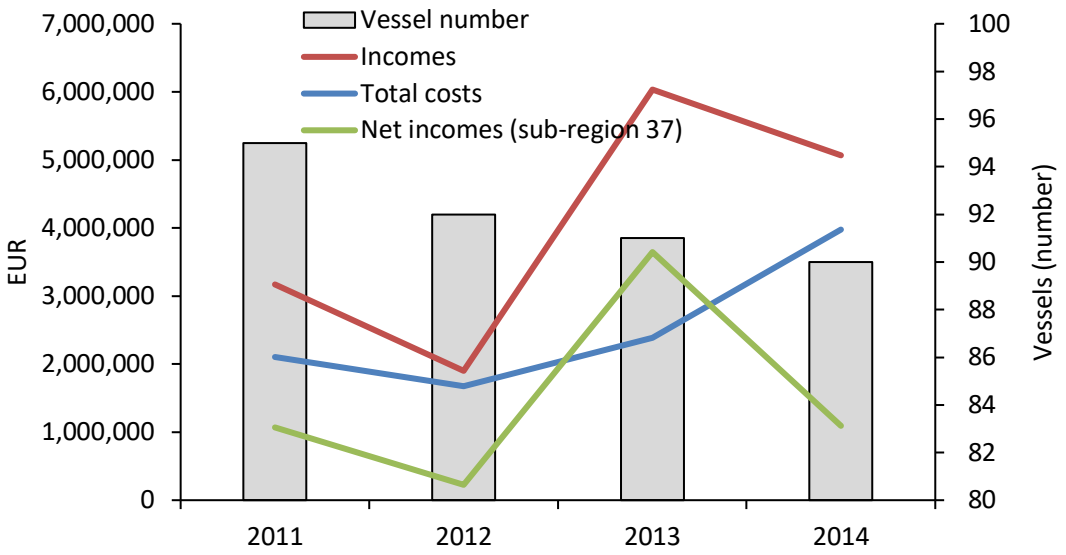


Figure 28. Economic performance of the purse seine fleet (VL1218) that harvests European anchovy and European sardine in the French Mediterranean Sea. Details are shown in the Annex 19.

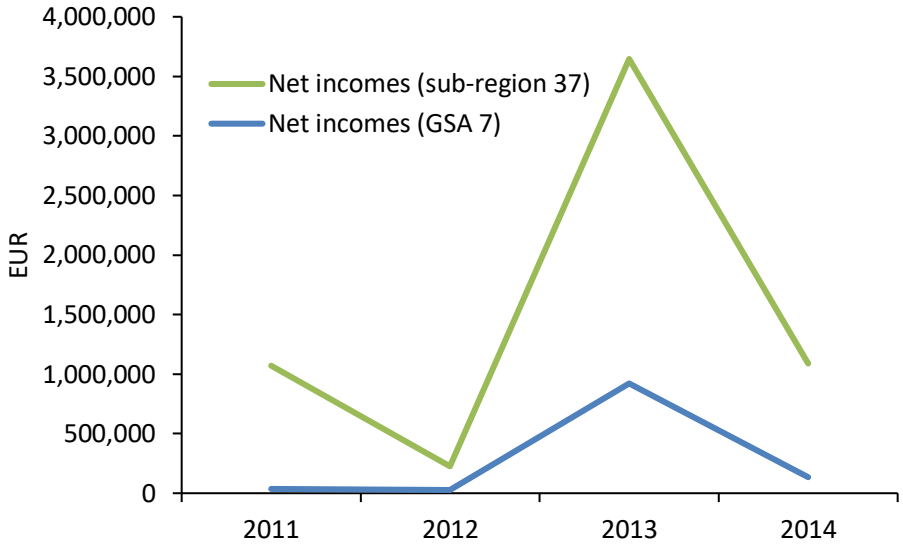


Figure 29. Net incomes of the purse seine fleet (VL1218) that harvests European anchovy and European sardine in the French Mediterranean Sea (sub-region 37) and GSA 07. Details are shown in the Annex 19.

The 2017 DCF fishing fleet economic data call only included economic information of the purse seine fleet VL1824 in GSA 07 in 2009 and 2010 (Figure 30). However, the economic analysis of this fleet indicated that the fishing activity is producing losses (Figure 31). This is occurring because the total cost of this fleet composed by large vessels is higher than the net incomes. This result is opposite to that found to the same fleet in GSA 06, where the VL1824 purse seine fleet produced larger benefits than the VL1218 fleet.

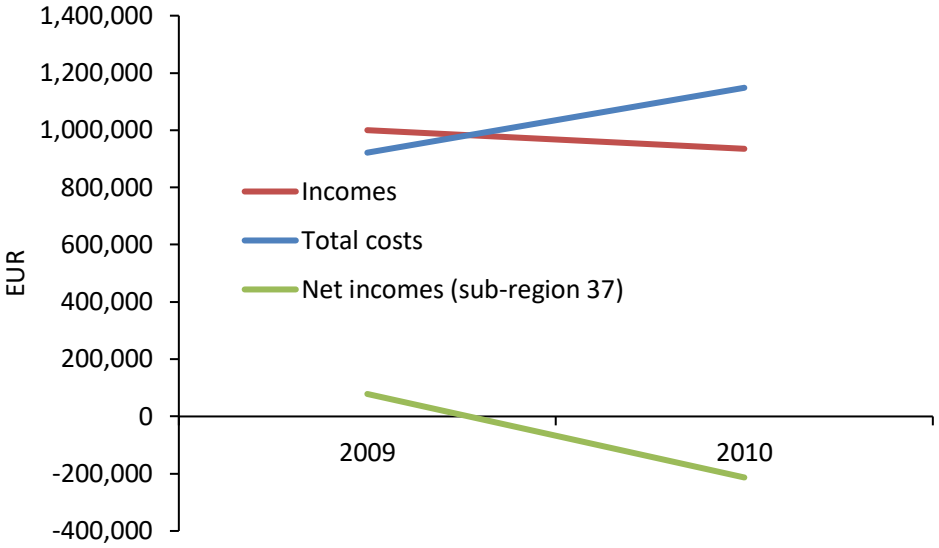


Figure 30. Economic performance of the purse seine fleet (VL1824) that harvests European anchovy and European sardine in the French Mediterranean Sea. Five vessels have been considered in the analysis. Details are shown in the Annex 20.

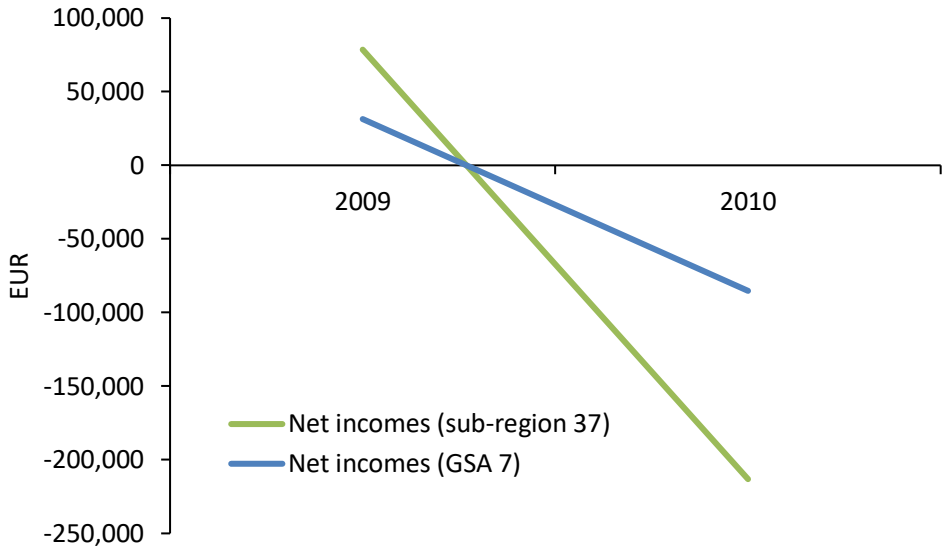


Figure 31. Net incomes of the purse seine fleet (VL1824) that harvests European anchovy and European sardine in the French Mediterranean Sea (sub-region 37) and GSA 07. Two vessels have been considered in the analysis of GSA 06. Details are shown in the Annex 20.

Finally, the midwater otter trawl fleet (VL2440) reduced the fleet size in two third in only three years (Figure 32). Nevertheless, the net incomes practically did not increase, meaning that the fleet reduction was the minimum required to avoid falling in losses.

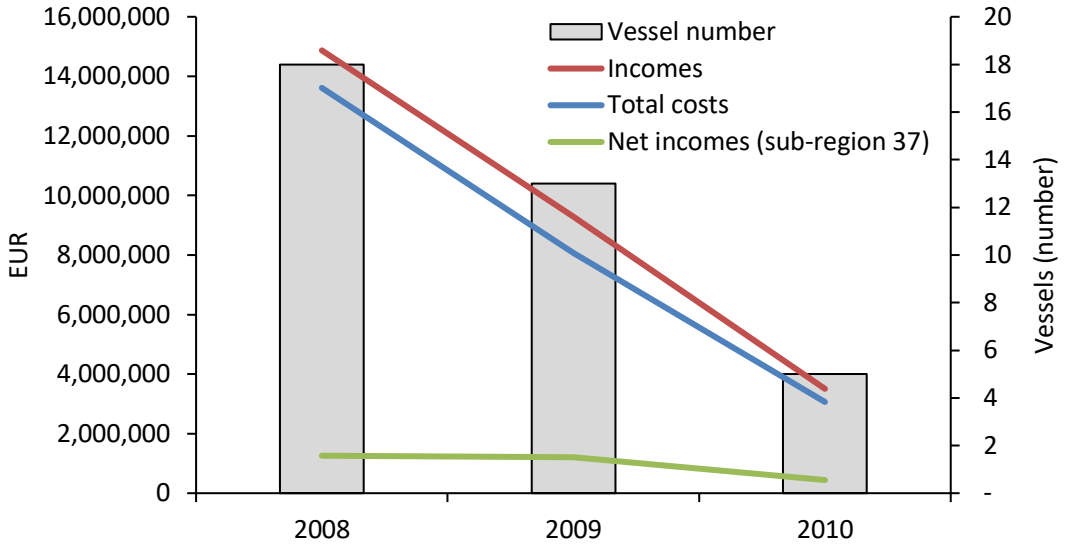


Figure 32. Economic performance of the midwater otter trawl fleet (VL2440) that harvests European anchovy and European sardine in the French Mediterranean Sea. It is assumed that all vessels that belong to this fleet are in GSA 07. Details are shown in the Annex 21.

Discussion and conclusions

This deliverable aim at determining the past and current catch and effort by stock (European anchovy and European sardine) in GSA 06 and GSA 07. Our analysis suggest that European anchovy stock holds a healthier status than European sardine, while fleet size is decreasing as one of the measures to avoid falling in economic losses.

4.1. Information regarding GSA 06

In general terms, European anchovy in the study area has shown oscillatory landings since the sixties, when fishing effort increased (Beveren et al., 2016). In fact, over last decades the catches of this species has been increasing, after a strong depletion of the stock size (around decade 2000s). This means that the perceived size of the stock (or stocks) and the level of overexploitation that could be inferred only from catches is limited. In other words, the catches reported from European anchovy are the result of the interaction between the fishing effort (too high during several decades) and "natural" variability of the stock size.

Since 1950, European anchovy in GSA 06 have been harvested to levels that have reached catches above 40,000 tons, and reconstruction of catches suggested that these catch levels have also been achieved in recent years (2010 and subsequent years). Official catches used in stock assessment report around 20,000 tons during last years, meaning that real biomass removals by the fleet may be larger than currently reported by the landing ports. This implies that the stock size (and historical trend) used in stock assessment could be biased.

European sardine seems to maintain an antagonist trend in catches in comparison with European anchovy. This trend was evident in the official catches used to perform stock assessment since

2002. Nevertheless, it is not possible to advise that under higher presence of one of the species, another one declines. In fact, the analysis of CPUE and spatial distribution of the fleet revealed that fleets from certain ports are capable to produce high catches of both species during the same months. Additionally, fleets from some ports can extend the "fishery period" to practically the whole year. Thus, the link between fishing effort and environmental availability of the resource is complex and hard to be generalized. Reconstructed catches of European anchovy suggest that catches of this species from the Spanish Mediterranean Sea and the Gulf of Cadiz, and particularly in GSA 06, were above 120,000 (in the fifties) and 50,000 (in the nineties) tons, respectively. This may have had a large ecological implication, because a low fraction of the stock, one fifth or less, currently remains at sea.

From the economic point of view, it is expected that larger although unreported catches would allow that fleet size does not decrease. However, in the last decade a 30% of the purse seine fleet with 12-18 m of length and 13% of the purse seine fleet with 18-24 m of length have left the fishery while that net incomes have returned or increased to levels of the first reported year (2008). Thus, in order to maintain the level of net incomes by vessel, the fleet required to be constrained.

Further than reducing the fleet size, the fleets that target small pelagic fish in GSA 06 currently catch smaller individuals than occurred in early reported years. This is in line with information from changes in the distribution of abundance and biomass by length and age from deliverable 1.3.3.1. Thus, the modes of the individuals caught by the purse seine fleet are in average 3 cm (European anchovy) and 2 cm (European sardine) smaller than in the historical period. This result holds an open discussion about if the fishery is responsible to select smaller individuals or if smaller individuals are driven by environmental conditions. Overall, the information analysed in the present report suggests that the fishery of small-pelagic fish in GSA 06 have promoted large depletion of the stock size of European sardine and reduction of the stock size of European anchovy. To conserve as high as possible catches by vessel it may be necessary not only a reduction of the fleet size but also a change in the minimum size allowed to catch.

4.2. Information regarding GSA 07

Several sources of fishery data that were available to GSA 06, including CPUE by port and spatial distribution of the purse seine fleet, were not available for the GSA 07, impairing the analysis to improve the knowledge of the fishery of European anchovy and European sardine in this area. Additionally, although the purse seine fleet is used in both areas to fish small-pelagic fish, the midwater otter trawl fleet was only deployed in French waters. Thus, in order to improve the understanding of the small-pelagic fishery in GSA 07 some results from GSA 06 were borrowed to help interpreting the GSA 07 results. Nevertheless, both fleet size and data availability are smaller in GSA 07 than in GSA 06.

The reconstructed catches of European anchovy in the French Mediterranean Sea have oscillated between 3,000 and 12,000 tons during the time series. Larger catches of European sardine have declined since early seventies from 30,000 to less than 3,000 tons in 2014. In general terms, the tendency of the catches of these two species follow the trend already identified in GSA 06. Thus, reconstructed catches, but also landings used in stock assessment, have showed a clear decreasing trend. The reported catches of both species are an exception to this for year 2016, jumping from near zero catches in 2015 to equal or upper levels of the highest catches reported since 2002. According to the trend observed in GSA 06, better catches of European anchovy could be feasible, although is difficult to determine if the level reported corresponds to a reliable estimates of

catches. We highlight that the official economic data was not available after 2010, hampering a comparison between the produced catches and the economic fleet performance.

European sardine was largely depleted in GSA 06 and showed a comparable trend in GSA 07. Therefore, large catches of this species in GSA 07 seem less probable than in case of European anchovy. Nevertheless, the fleet size in GSA 07 is smaller in comparison to the fleet size of GSA 06, meaning that if some vessels will leave the fishery, those that remain probably will obtain better catches. At the same time, one way to optimize the fishing effort may be employing large vessels. Particularly, the midwater otter trawl fleet that uses vessels with 24-40 m of length was the responsible of the large catches in 2016 (two active vessels). Thus, a combination of better fishing performance of the fleet and increase in resources availability may become in outstanding catches. Selectivity derived from different gears used to harvest small pelagic fish may also affect the performance of the fleet. Nevertheless, this topic has not been deeply explored in GSA 07 yet.

Conversely to expected, the length-at-age and economic data of both species under the DCF is deficient in GSA 07. This is translated into problems to assess and advise about the fishery. This is the reason why the stock status of European anchovy and European sardine in GSA 07 have been assessed (no always accepted) using models based on catch instead of catch-at-age data, e.g. Surplus production models (STECF, 2016).

In order to improve the management of the stocks of the studied species in GSA 07, it is important to wait for the results of the genetic analyses that may offer recommendations to implement or not a shared assessment and management for GSA 06 and GSA 07. Meanwhile, the fishery-dependent data from GSA 07 should be improved.

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Annexes

Annex 1. Catches of European anchovy and European sardine by gear in GSA 06.

European anchovy			
Year	**GNS**	**OTB**	**PS**
2002		251.67	10664
2003		119.51	6389.95
2004		519.43	6342.64
2005		463.67	5702.46
2006		494.45	2463.15
2007		348.86	1913.33
2008		450.52	3124.18
2009		131.94	9234.98
2010		173.51	8399.2
2011	21.89	531.51	9468.03
2012	5.99	265.88	11433.91
2013	2.71	217.57	17177.92
2014	10.81	497.44	16849.58
2015	4.1	341.54	16599.68
2016		328.67	17501.73

European sardine			
Year	**GNS**	**OTB**	**PS**
2002		169.62	16998
2003		163.11	17360
2004		338.05	22833
2005		246.58	20983
2006		654.63	27145
2007		641.09	22911
2008		485.17	16185
2009		100.64	7406.1
2010	26.31	125.59	7475.3
2011	31.35	402.32	12135
2012	10	191.82	9193.5
2013	27.47	167.61	9733.7
2014	8.71	209.12	9659.5
2015	2.3	138.25	6309.1
2016		108.18	9934.2

Annex 2. Catches of European anchovy and European sardine by gear in GSA 07.

European anchovy			
Year	OTB	OTM	PS
2002	82.05		754.06
2003	94.30		714.43
2004	69.58		950.81
2005	4.95		522.00
2006	6.66		188.46
2007	16.24		234.56
2008	17.13		212.33
2009	2.25		17.46
2010	2.69		4.08
2011	6.21		297.54
2012	3.97		35.23
2013	2.00		47.75
2014	1.98		
2015	9.51		
2016	31.01	1225.69	12.11

European sardine			
Year	OTB	OTM	PS
2002	31.2		86.88
2003	63.46		629.3
2004	141.89		905.22
2005	9.37		823.96
2006	8.16		347.33
2007	26.25		373.43
2008	32.28		161.51
2009	17.67		159.8
2010	5.06		7.6
2011	3.62		67.23
2012	1.64		5.18
2013	0.66		46.72
2014	0.69		
2015	0.19		5.18
2016	7.20	77.76	734.91

Annex 3. Catches of European anchovy.

	GSA 06		GSA 07	
Year	**Landings**	**Discards**	**Landings**	**Discards**
2002	10916		836	
2003	6509		809	
2004	6862		1020	
2005	6166		527	
2006	2958		195	
2007	2262		251	
2008	3575		229	
2009	9367		20	
2010	8573		7	
2011	10021	259	304	8
2012	11706		39	41
2013	17398	41	50	
2014	17358	578	2	4
2015	16945	1051	10	
2016	17830	814	1269	

Annex 4. Catches of European sardine.

	GSA 06		GSA 07	
Year	**Landings**	**Discards**	**Landings**	**Discards**
2002	17168		118	
2003	17523		693	
2004	23172		1047	
2005	21229		833	
2006	27800		355	
2007	23552		400	
2008	16671		194	
2009	7507		177	
2010	7627		13	
2011	12568	215	71	
2012	9395	1494	7	
2013	9929	269	47	
2014	9877	147	1	
2015	6450	432	5	
2016	10042	692	856	

Annex 5. Length structure of landings of European anchovy in GSA 06. Data official by Data Call Framework (DCF).

Length (cm)	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	26	0	42	0	0
6	0	49	0	0	0	0	5	0	0	356	129	0	735	208	0
7	0	64	5	10	0	4	427	56	34	731	2386	494	3015	1193	689
8	989	1832	1926	20	0	23	1688	1148	285	17259	14436	9321	9900	7231	3368
9	5363	5868	17559	321	0	170	8683	5688	3494	51015	68206	37841	49240	53156	20274
10	19628	9689	24815	5003	1183	326	23898	18909	18745	63250	151042	136028	215312	242624	104609
11	31195	21813	36786	14001	11713	312	38064	31429	44216	92071	168500	300374	337708	480129	224884
12	34605	43422	83114	30092	21282	2975	42465	58478	123188	134960	152358	402900	379361	424610	387999
13	81583	74892	121997	43828	30509	10047	47564	136130	185482	171981	158671	320810	301575	265199	307663
14	154357	109777	80441	73340	28273	20641	37068	160569	114544	131724	126113	148712	149858	73935	221862
15	110115	60172	24989	71363	20323	25619	16580	86263	35516	47682	65127	40831	32864	7920	61900
16	31360	7630	3299	24756	9323	15112	2560	13889	3514	4711	15279	3861	3423	54	5053
17	20204	261	1	2831	2038	2201	95	389	265	71	882	99	79	0	43
18	6140	0	0	17	152	8	143	0	0	0	0	0	0	0	0
19	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Annex 6. Length structure of landings of European sardine in GSA 06. Data official by Data Call Framework (DCF).

Length (cm)	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	40	0	0	0	0
6	0	13	89	0	0	0	0	0	0	0	132	0	0	0	0
7	0	0	533	0	0	0	0	0	0	405	104	0	0	0	0
8	230	203	5274	0	0	0	0	0	66	2360	195	26	158	282	1303
9	693	2358	11298	2611	1053	141	189	301	988	1316	2959	1339	4170	3526	7498
10	5702	23774	26049	35723	16255	910	4616	6398	8836	19163	18847	14824	18258	19759	37115
11	7713	71148	80656	61954	29928	9927	23288	33643	27018	85319	56600	57630	49190	45342	92780
12	16076	69806	151619	71220	35523	44188	55100	77031	53033	106652	94493	100496	112931	98952	184850
13	85175	99688	133188	107428	44995	50175	63339	102779	71207	132774	99446	130701	148003	114885	156766
14	174290	132374	135381	152291	111365	59705	63703	75721	68603	140438	79323	99829	111729	66078	94862
15	157215	139656	152030	151874	206861	115738	83928	34503	58124	77623	59231	63051	58949	23693	38590
16	94641	88169	105433	111888	188213	118419	89957	17653	34592	33161	37012	30630	17934	8540	9816
17	38705	35065	51694	59791	108739	87370	78124	9514	13920	16670	15635	8539	6416	2308	1746
18	8543	10832	21253	17135	48567	80124	45571	5718	3768	6082	3818	2158	1454	929	382
19	752	2786	11269	5231	17337	40573	21035	2956	682	1145	594	557	892	376	215
20	11	654	4413	1403	4996	9982	5689	1674	1111	277	64	109	126	82	46
21	0	69	1134	338	796	804	295	450	311	33	24	4	138	4	3
22	0	7	131	79	134	144	3	40	30	3	0	0	0	0	0
23	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Annex 7. Length structure of landings of European anchovy in GSA 07. Data official by Data Call Framework (DCF).

Length (cm)	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0
10	0	0	0	0	0	0	0	0	14	0	10	0	0	0	0
11	0	0	0	0	0	0	0	2	54	202	79	0	0	0	0
12	0	0	0	0	0	0	0	23	16	179	117	0	0	0	0
13	0	0	0	0	0	0	0	69	1	70	26	0	0	0	0
14	0	0	0	0	0	0	0	29	0	11	6	0	0	0	0
15	0	0	0	0	0	0	0	8	0	1	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Annex 8. Length structure of landings of European sardine in GSA 07. Data official by Data Call Framework (DCF).

Length (cm)	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	13	6	0	0	0	0
13	0	0	0	0	0	0	0	10	5	32	22	0	0	0	0
14	0	0	0	0	0	0	0	44	20	35	32	0	0	0	0
15	0	0	0	0	0	0	0	89	20	30	9	0	0	0	0
16	0	0	0	0	0	0	0	111	88	12	5	0	0	0	0
17	0	0	0	0	0	0	0	106	18	6	0	0	0	0	0
18	0	0	0	0	0	0	0	39	2	1	2	0	0	0	0
19	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Annex 9. Age structure of landings of European anchovy in GSA 06. Data official by Data Call Framework (DCF). Slicing from length to age was performed using the updated vBGP (L_∞=18.1, k=0.684, t_0=-0.215, see deliverable 1.3.1.1)

age	0	1	2	3	4
2002	6352	167011	264472	31360	26370
2003	7813	149816	169949	7630	261
2004	19490	266712	105430	3299	1
2005	351	92924	144703	24756	2848
2006	0	64687	48596	9323	2190
2007	197	13660	46260	15112	2209
2008	10803	151991	53648	2560	238
2009	6892	244946	246832	13889	389
2010	3813	371631	150060	3514	265
2011	69361	462262	179406	4711	71
2012	85183	630571	191240	15279	882
2013	47656	1160112	189543	3861	99
2014	62932	1233956	182722	3423	79
2015	61788	1412562	81855	54	0
2016	24331	1025155	283762	5053	43

Annex 10. Age structure of landings of European sardine in GSA 06. Data official by Data Call Framework (DCF). Slicing from length to age was performed using the updated vBGP (L_∞=20.5, k=0.985, t_0=-0.142, see deliverable 1.3.1.1).

age	0	1	2
2002	115589	464851	9306
2003	266990	395264	14348
2004	408706	444538	38200
2005	278936	475844	24186
2006	127754	615178	71830
2007	105341	381232	131627
2008	146532	315712	72593
2009	220152	137391	10838
2010	161148	175239	5904
2011	347989	267892	7540
2012	272816	191201	4500
2013	305016	202049	2828
2014	332710	195028	2610
2015	282746	100619	1391
2016	480312	145014	646

Annex 11. Age structure of landings of European anchovy in GSA 07. Data official by Data Call Framework (DCF). Slicing from length to age was performed using the updated vBGP (L_∞=18.1, k=0.684, t_0=-0.215, see deliverable 1.3.1.1).

age	0	1	2	3	4
2002	0	0	0	0	0
2003	0	0	0	0	0
2004	0	0	0	0	0
2005	0	0	0	0	0
2006	0	0	0	0	0
2007	0	0	0	0	0
2008	0	0	0	0	0
2009	0	94	37	0	0
2010	1	85	0	0	0
2011	0	451	12	0	0
2012	1	232	6	0	0
2013	0	0	0	0	0
2014	0	0	0	0	0
2015	0	0	0	0	0
2016	0	0	0	0	0

Annex 12. Age structure of landings of European sardine in GSA 07. Data official by Data Call Framework (DCF). Slicing from length to age was performed using the updated vBGP (L_∞=20.5, k=0.985, t_0=-0.142, see deliverable 1.3.1.1).

age	0	1	2
2002	0	0	0
2003	0	0	0
2004	0	0	0
2005	0	0	0
2006	0	0	0
2007	0	0	0
2008	0	0	0
2009	10	350	41
2010	5	146	2
2011	45	83	1
2012	28	46	2
2013	0	0	0
2014	0	0	0
2015	0	0	0
2016	0	0	0

Annex 13. Catches of European anchovy by fleet in GSA 06.

	landings				discards
Year	DEMSP	MDDWSP	SLPF	SPF	DEMSP
2002				10915.67	
2003				6509.46	
2004				6862.07	
2005				6166.13	
2006				2957.6	
2007				2262.19	
2008				3574.7	
2009	131.94			9234.98	0.03
2010	173.51			8399.2	0.1
2011	521.86	9.65	21.89	9468.03	271.09
2012	262.64	3.24	5.99	11433.91	0
2013	209.29	8.28	2.71	17177.92	52.52
2014	487.69	9.75	10.81	16849.58	588.64
2015	339.28	2.26	4.1	16599.68	1061.96
2016	328.13	0.54		17501.73	821.59

Annex 14. Catches of European sardine by fleet in GSA 06.

	landings				discards
Year	DEMSP	MDDWSP	SLPF	SPF	DEMSP
2002				17167.63	
2003				17523.35	
2004				23171.5	
2005				21229.28	
2006				27799.73	
2007				23552.18	
2008				16670.55	
2009	100.64			7406.13	0.15
2010	125.59		26.31	7475.34	0.04
2011	399.57	2.75	31.35	12134.67	226.8
2012	191.02	0.8	10	9193.47	1506.23
2013	165.78	1.83	27.47	9733.72	281.11
2014	207.26	1.86	8.71	9659.45	157.95
2015	137.74	0.51	2.3	6309.08	441.51
2016	108.18			9934.2	695.65

Annex 15. Catches of European anchovy by fleet in GSA 07.

	Landings	
Year	DEMSP	SPF
2002	836.11	
2003	808.73	
2004	1020.39	
2005	526.95	
2006	195.12	
2007	250.80	
2008	229.46	
2009	2.25	17.46
2010	2.69	4.08
2011	5.69	297.54
2012	3.97	35.23
2013	2.00	47.75
2014	1.98	
2015	9.34	
2016	0.38	1237.55

Annex 16. Catches of European sardine by fleet in GSA 07.

	Landings	
Year	DEMSP	SPF
2002	118.08	
2003	692.76	
2004	1047.11	
2005	833.33	
2006	355.49	
2007	399.68	
2008	193.79	
2009	17.67	159.80
2010	5.06	7.60
2011	3.62	67.23
2012	1.64	5.18
2013	0.66	46.72
2014	0.69	
2015	0.19	5.18
2016	0.18	837.49

Annex 17. Economic data of the purse seine fleet (vessel length 12-18 m) that harvest small-pelagic fish in Spanish area 37, according to the 2017 DCF fishing fleet economic data call. The number of vessels provided to sub-region and GSA level (GFCM) are used to scale the economic performance to GSA 06.

	unit	2008	2009	2010	2011	2012	2013	2014	2015
Income from landings	€	15681429	24989817	20896272	19340549	10765953	26155904	29044417	23096270
Direct income subsidies	€	392884	869454	377958	0	0	197925	0	287280
Wages and salaries of crew	€	6774040	12987454	9630762	9195730	4936438	11988752	13938674	11324400
Unpaid labour value	€	529190	1306632	3536038	1209645	111229	245708	1132495	838766
Energy costs	€	1971562	1667911	2221192	2573019	1119017	1968884	1935989	1651636
Repair & maintenance costs	€	1510788	1570175	1350275	1218984	981558	1792525	1814531	1306142
Other variable costs	€	2896633	2197590	1692676	2511440	1001556	3317214	4181884	4401217
Other non-variable costs	€	293036	1010637	498322	323358	67980	550921	429061	530339
Annual depreciation costs	€	1458833	269741	1442666	378570	407805	437040	518422	450131
Investments	€	1655022	1082900	0	0	248400	300300	0	360000
Tangible asset value (historical)	€	4882232	4489896	4138953	3643614	3033984	3165139	3141640	2740121
Tangible asset value (replacement)	€	5733283	5326959	4818598	4165249	3501549	3737252	3612070	3225621
		2008	2009	2010	2011	2012	2013	2014	2015
Income	€	15681429	24989817	20896272	19340549	10765953	26155904	29044417	23096270
Labour costs	€	7303230	14294085	13166800	10405374	5047667	12234461	15071169	12163166
Fuel costs	€	1971562	1667911	2221192	2573019	1119017	1968884	1935989	1651636
Variable costs	€	4407422	3767766	3042951	3730424	1983114	5109739	5996415	5707360
Non variable	€	293036	1010637	498322	323358	67980	550921	429061	530339
Total costs	€	13975250	20740399	18929265	17032175	8217778	19864004	23432634	20052501
		2008	2009	2010	2011	2012	2013	2014	2015
Net incomes (sub-region 37)	€	1706179	4249419	1967007	2308374	2548175	6291900	5611783	3043769
Net incomes (sub-region 37)	€/vessel	13,649	35,709	18,046	24,299	27,698	69,142	62,353	33,820
		2008	2009	2010	2011	2012	2013	2014	2015
Vessel number (V1218)		111	111	108	109	109	100	96	96
Net incomes (GSA6)		1515087	3963743	1948961	2638836	3024573	6911410	6010220	3246686

Annex 18. Economic data of the purse seine fleet (vessel length 18-24 m) that harvest small-pelagic fish in Spanish area 37, according to the 2017 DCF fishing fleet economic data call. The number of vessels provided to sub-region and GSA level (GFCM) are used to scale the economic performance to GSA 06.

	unit	2008	2009	2010	2011	2012	2013	2014	2015
Income from landings	€	30963974	35393571	26288681	15684825	31036505	31165473	46424232	30040692
Direct income subsidies	€	645152	955128	707071	278200	0	0	61631	43965
Wages and salaries of crew	€	16383927	19336871	12478368	5942210	10409121	12658540	24372303	16120334
Unpaid labour value	€	1211992	1477925	1065434	0	799769	1345279	859759	1397294
Energy costs	€	3406393	2721699	3567092	3129949	4862367	3542905	3759382	2171766
Repair & maintenance costs	€	3445195	3096457	1630791	1726270	1880295	1402722	2321231	1325479
Other variable costs	€	3885413	5376537	3012067	3178100	4362052	2472410	3708230	4905675
Other non-variable costs	€	935865	1146610	1182129	334815	937386	365447	1404780	855034
Annual depreciation costs	€	2614776	3757282	5015630	898623	4398338	1126359	2170528	683515
Investments	€	880143	2275000	0	425000	0	0	921916	684890
Tangible asset value (historical)	€	13471050	12355072	10795749	9515991	8273853	7839428	8477089	7734783
Tangible asset value (replacement)	€	14221547	13141284	11561500	10102519	8859124	8259303	9137285	8807112

		2008	2009	2010	2011	2012	2013	2014	2015
Income	€	30963974	35393571	26288681	15684825	31036505	31165473	46424232	30040692
Labour costs	€	17595919	20814796	13543803	5942210	11208891	14003818	25232062	17517628
Fuel costs	€	3406393	2721699	3567092	3129949	4862367	3542905	3759382	2171766
Variable costs	€	7330608	8472994	4642858	4904369	6242347	3875133	6029461	6231155
Non variable	€	935865	1146610	1182129	334815	937386	365447	1404780	855034
Total costs	€	29268784	33156099	22935881	14311342	23250990	21787303	36425685	26775583

		2008	2009	2010	2011	2012	2013	2014	2015
Net incomes (sub-region 37)	€	1695189	2237473	3352799	1373483	7785515	9378171	9998547	3265109
Net incomes (sub-region 37)	€/vessel	16,784	22,375	32,871	13,735	83,715	103,057	112,343	36,687

		2008	2009	2010	2011	2012	2013	2014	2015
Vessel number (V1824)		14	17	18	17	17	15	19	15
Net incomes (GSA6)	€	234,977	380,370	591,670	239,673	1,414,787	1,594,289	2,139,015	550,299

Annex 19. Economic performance of the purse seine fleet (V1218) that harvests European anchovy and European sardine in the sub-region 37 (Mediterranean sea) to France, according to the 2017 DCF fishing fleet economic data call. The number of vessels provided to sub-region and GSA level (GFCM) are used to scale the economic performance to GSA 07.

	unit	2011	2012	2013	2014
Income from landings	€	3171714	1900804	6033353	5066466
Direct income subsidies	€	0	0	64449	418423
Wages and salaries of crew	€	1206781	939002	1098720	1062084
Unpaid labour value	€	0	0	0	0
Energy costs	€	168562	93954	106970	464345
Repair & maintenance costs	€	137605	41557	162026	486870
Other variable costs	€	323863	210441	546004	1005020
Other non-variable costs	€	263707	389950	473905	958158
Annual depreciation costs	€	456469	334583	370027	304294
Investments	€	0	26560	0	0
Tangible asset value (replacement)	€	3344444	2661272	3072163	1973283
		2011	2012	2013	2014
Incomes	€	3171714	1900804	6033353	5066466
Labour costs	€	1206781	939002	1098720	1062084
Fuel costs	€	168562	93954	106970	464345
Variable costs	€	461468	251999	708030	1491889
Non variable	€	263707	389950	473905	958158
Total costs	€	2100519	1674904	2387625	3976475
		2011	2012	2013	2014
Net incomes (sub-region 37)	€	1071195	225900	3645728	1089991
Net incomes 37	€/vessel	11,276	2,455	40,063	12,111
		2011	2012	2013	2014
Vessel number (V1218)		3	11	23	11
Net incomes (GSA 7)	€	33,827	27,010	921,448	133,221

Annex 20. Economic performance of the purse seine fleet (V1824) that harvests European anchovy and European sardine in the sub-region 37 (Mediterranean sea) to France, according to the 2017 DCF fishing fleet economic data call. The number of vessels provided to sub-region and GSA level (GFCM) are used to scale the economic performance to GSA 07.

	unit	2009	2010
Income from landings	€	1000000	935000
Direct income subsidies	€	0	0
Wages and salaries of crew	€	558735	761449
Unpaid labour value	€	0	0
Energy costs	€	75000	85690
Repair & maintenance costs	€	17500	27500
Other variable costs	€	136890	36850
Other non-variable costs	€	133300	236651
Annual depreciation costs	€	456469	334583
Investments	€	0	0
Tangible asset value (replacement)	€	0	0
		2009	2010
Incomes	€	1000000	935000
Labour costs	€	558735	761449
Fuel costs	€	75000	85690
Variable costs	€	154390	64350
Non variable	€	133300	236651
Total costs	€	921425	1148140
		2009	2010
Net incomes (sub-region 37)	€	78575	-213140
Net incomes 37	€/vessel	15,715	- 42,628
		2009	2010
Vessel number (V1224)		2	2
Net incomes (GSA 7)	€	31,430	- 85,256

Annex 21. Economic performance of the Midwater otter trawl fleet (V2440) that harvests European anchovy and European sardine in the sub-region 37 (Mediterranean sea) to France, according to the 2017 DCF fishing fleet economic data call. The same number of vessels provided to sub-region was used to the economic performance of this fleet in GSA 07.

	unit	2008	2009	2010
Income from landings	€	14871074	9284989	3506010
Direct income subsidies	€	541534	9523	1180
Wages and salaries of crew	€	5145224	3272344	992029
Unpaid labour value	€	0	0	0
Energy costs	€	4050224	2178191	1099330
Repair & maintenance costs	€	1070724	458398	137054
Other variable costs	€	739673	1185825	347314
Other non-variable costs	€	2606544	977864	488366
Annual depreciation costs	€	0	0	0
Investments	€	0	0	78740
Tangible asset value (replacement)	€	0	0	0
		2008	2009	2010
Incomes	€	14871074	9284989	3506010
Labour costs	€	5145224	3272344	992029
Fuel costs	€	4050224	2178191	1099330
Variable costs	€	1810397	1644223	484368
Non variable	€	2606544	977864	488366
Total costs	€	13612389	8072622	3064093
		2008	2009	2010
Net incomes (sub-region 37)	€	1258685	1212367	441917
Net incomes 37	€/vessel	69,927	93,259	88,383
		2008	2009	2010
Vessel number (V2440)		18	13	5
Net incomes (GSA 7)	€	1,258,685	1,212,367	441,917