



Stock Assessment Form

Small Pelagics

Reference Year: 2017

Reporting Year: 2018

[A brief abstract may be added here]

Stock Assessment Form version 1.0 (November 2014)

Anchovy in GSA01 (Northern Alboran Sea)

Stock assessment form

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1 Basic Identification Data

Scientific name:	Common name:	ISCAAP Group:
<i>Engraulis encrasicolus</i>	Anchovy	35
1st Geographical sub-area:	2nd Geographical sub-area:	3rd Geographical sub-area:
1		
1st Country	2nd Country	3rd Country
Spain		
Stock assessment method: (direct, indirect, combined, none)		
Direct: Fishery Data		
Authors:		
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Affiliation:		
IEO. Instituto Español del Oceanografía		

2 Stock identification and biological information

2.1 Stock unit

The assessment of anchovy corresponds to the GSA01 (Northern Alborán Sea), but it is not known yet if this is a shared Mediterranean Moroccan and Algerian stock or a complete stock unit.

2.2 Growth and maturity

Table 2.2-1: Maximum size, size at first maturity and size at recruitment.

Somatic magnitude measured (LT, LC, etc)			LT	Units	cm
Sex	Fem	Mal	Combined	Reproduction season	Spring-Summer
Maximum size observed			18 (2017) 18.5 (1990-2016)	Recruitment season	Autumn
Size at first maturity			9.58 (2017) 10.20 (2004-2016)	Spawning area	All the coast
Recruitment size to the fishery			9.5	Nursery area	Málaga Bay

Table 2-2.2: M vector and proportion of matures by size or age (Males)

Size/Age	Natural mortality*	Proportion of matures
<i>Edad 0</i>	1.71	0.73
<i>Edad 1</i>	1.07	1.00
<i>Edad 2</i>	0.89	1.00
<i>Edad 3+</i>	0.82	1.00

Table 2-3: Growth and length weight model parameters

		Units	Sex			Years
			female	male	Combined	
Growth model	L _∞	cm			18.28	2016
	K				0.7210	2016
	t ₀				-0.7931	2016
	Data source	DCF 2016				
Length weight relationship	a				0.0062	2016
	b				3.0302	2016
	M (scalar)					
	sex ratio (% females/total)	52.4				

3 Fisheries information

3.1 Description of the fleet

The current fleet in GSA 01 the Northern Alboran Sea is composed by 79 units, characterised by small vessels, average TJB 25.9. 14% of them are smaller than 12 m (operational Unit 1), 86% > 12 m (operational Unit 2), and no one bigger than 24m. The purse seine fleet has been continuously decreasing in the last two decades, from more than 230 vessels in 1980 to 79 in 2017. A strong reduction of larger vessels occurred from 1985 onwards, possibly linked to a decreasing in anchovy catches in Northern Morocco, where a part of that fleet fished under agreement between the countries. Subsequently the fleet continued to decline but more slowly.

Anchovy in South Mediterranean Region is the main target species of the purse seine fleet in Northern Alboran Sea, due to its high economic value, although its abundance is rather low and very confined. Catches in the period 1990-2017 has been highly variable, with a minimum of 157 tons in 1993. Higher catches occurred in 1996, 2001, 2002 and 2013 they were caught between 2000 and 3200 tons. Until 2012 landings the South Mediterranean area comprised almost 100% of the total landing in GSA01, since then landings have been increasing in Gulf of Vera, reaching the landing in 2016 around 50% of the whole area. The whole period average is 879 tons. In the early twenties of the last century, anchovy was fished all around the Alboran Sea, but currently Málaga Bay is the only area where anchovy is fished throughout all the year and where more than 80% of catches are located. The fishery of anchovy in the Malaga Bay is exclusively focused on individuals from early age classes because older age classes are not found: almost all the catch corresponds to class 0 and 1. Years with higher catches are usually correlated with a successful and high recruitment period, while unsuccessful recruitment in a given year is correlated with a low level of catch.

The two operational units fish the same species, there are no major differences, sardine is the most fished species in their both. Although there is a slight difference in the percentage of mackerel catches, as bigger ships are able to fish species with more swimming ability.

Species with a lower economical value are also fished, sometimes representing a high percentage of landings: horse mackerel (*Trachurus spp.*), mackerel (*Scomber spp.*), and gilt sardine (*Sardinella aurita*). The interest about some of these species has been increasing as there is a new market for them; gilt sardine and mackerel, especially the first, are sold for tuna farming. A requirement for such sales is a high yield by fishing day, due to its low economic value. In the case of mackerel is mainly exported to Portugal.

Data used in the assessment correspond to DCF. Unit of effort has been effective fishing day. Series of CPUEs shows a very similar profile to catches.

Table 3-1: Description of operational units exploiting the stock

	Country	GSA	Fleet Segment	Fishing Gear Class	Group of Target Species	Species
Operational Unit 1*	Spain	1	G-Purse Seine (6-12 m)	02-Seine Nets	31- Small gregarious pelagic	ANE
Operational Unit 2	Spain	1	H-Purse Seine (>12)	02-Seine Nets	31- Small gregarious pelagic	ANE

Table 3.1-2: Catch, bycatch, discards and effort by operational unit in the reference year GSA01.

Operational Units*	Fleet (n° of boats) *	Catch (T or kg of the species assessed) Tons	Other species caught (names and weight) Tons	Discards (species assessed)	Discards (other species caught)	Effort (units)
ESP 01 G 02 31-ANE	11	99	Sardine: 312 Trachurus spp: 390 Scomber spp: 274 Sardinella: 220 Otros: 157	negligible	negligible	Effective fishing day for species
ESP 01 H 02 31-ANE	68	2257	Sardine: 3343 Trachurus spp: 1537 Scomber spp: 3082 Sardinella: 2237 Otros: 1047	negligible	negligible	Effective fishing day for species
Total	79	2356	12589			

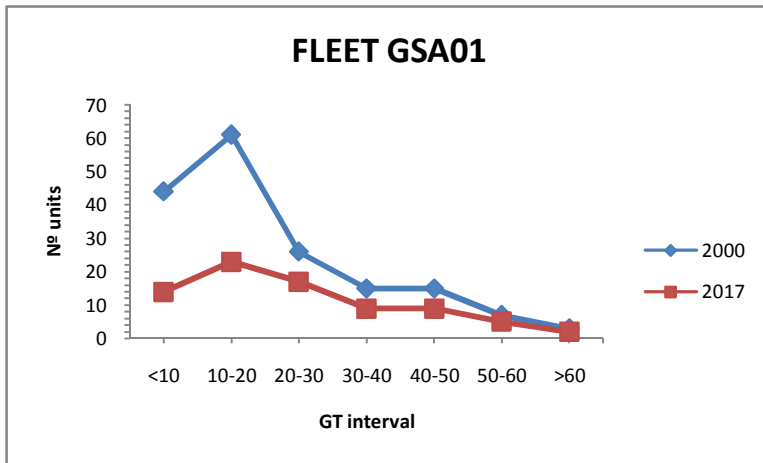


Fig. 3.2.1. Fleet GSA01 in years 2000 and 2017.

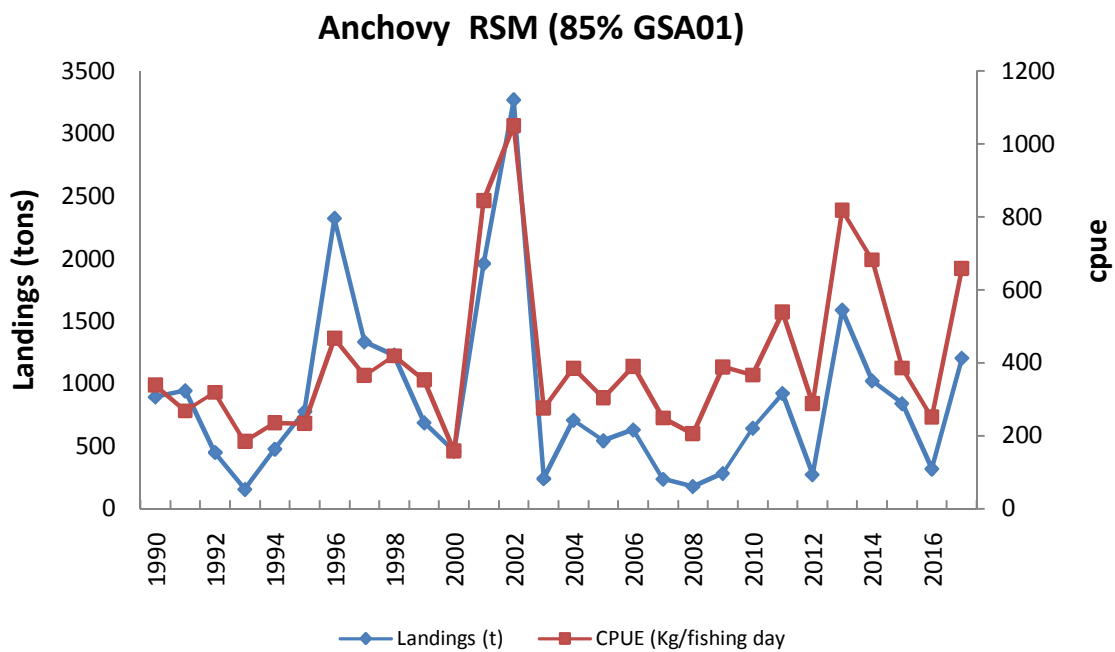
A great decrease in the smallest units (Fig. 3.2.1).

Table 3.1-3: Catches and CPUEs 1990-2017. The landing and CPUEs are from the South Mediterranean Region which comprises 85 % of the landing in 2003-2012. Since 2012 landings in the Northern part has increase (Gulf of Vera)

YEAR	Catch (tons) RSM	CPUE (Kg/day) RSM	Catch (tons) GSA01
1990	896	339	1260
1991	944	268	1371
1992	451	319	505
1993	157	184	165
1994	478	236	493
1995	779	234	804
1996	2322	467	2331
1997	1335	365	1351
1998	1230	419	1233
1999	689	353	705
2000	461	158	461
2001	1961	845	1990
2002	3268	1051	2876
2003	242	276	248
2004	709	385	827

2005	546	304	599
2006	632	391	667
2007	237	249	258
2008	178	205	222
2009	285	389	294
2010	645	366	867
2011	923	539	976
2012	275	288	531
2013	1589	819	2145
2014	1024	683	1311
2015	842	386	1089
2016	320	251	1178
2017	1205	658	2356
Average 1990-2017	879	408	1040

3.2 Historical trends



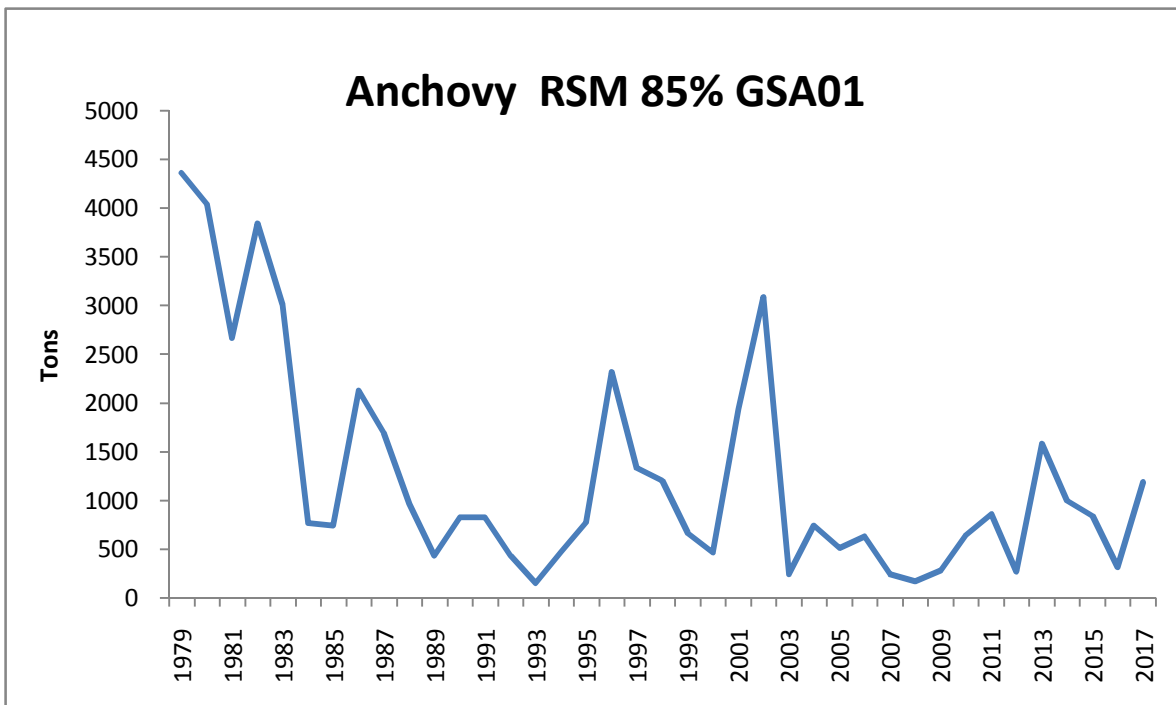
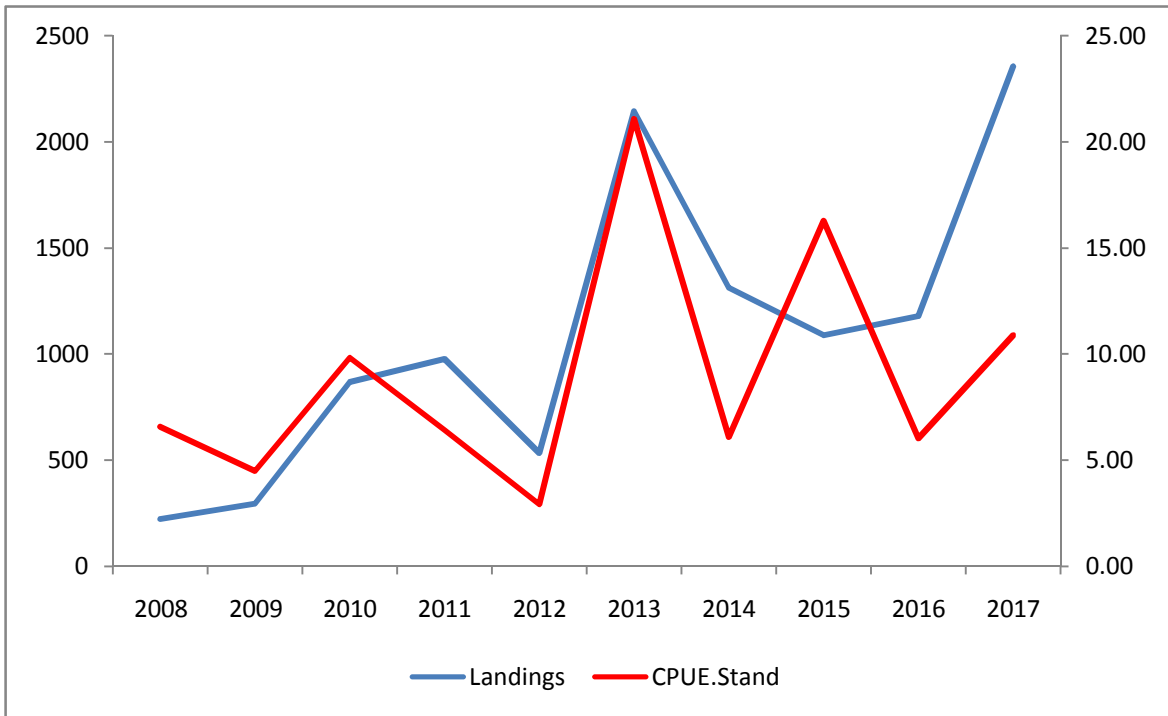


Fig. 3.2.1. Trend in anchovy landing and CPUEs, years 1990-2017 Northern Alboran Sea (standard CPUE only 2008-2017).

Landing is highly variable and mainly based on the recruitment. The series of CPUEs from 1990 to 2017 show the same profile of landing without any trend (Fig. 3.2.1).

The longest history series, since 1979, shows a decreasing trend.

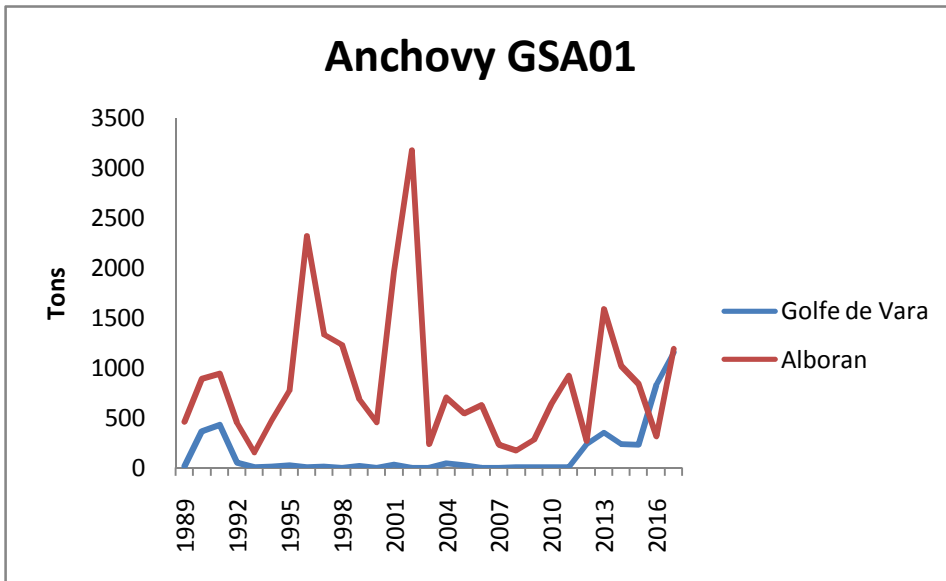
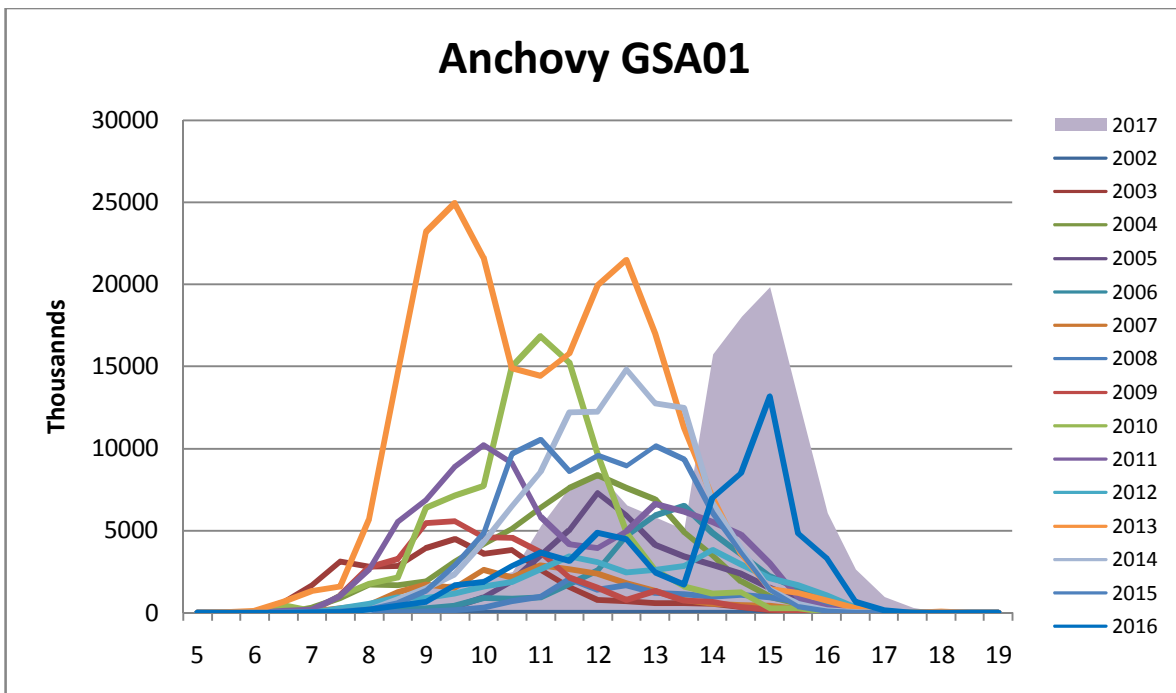
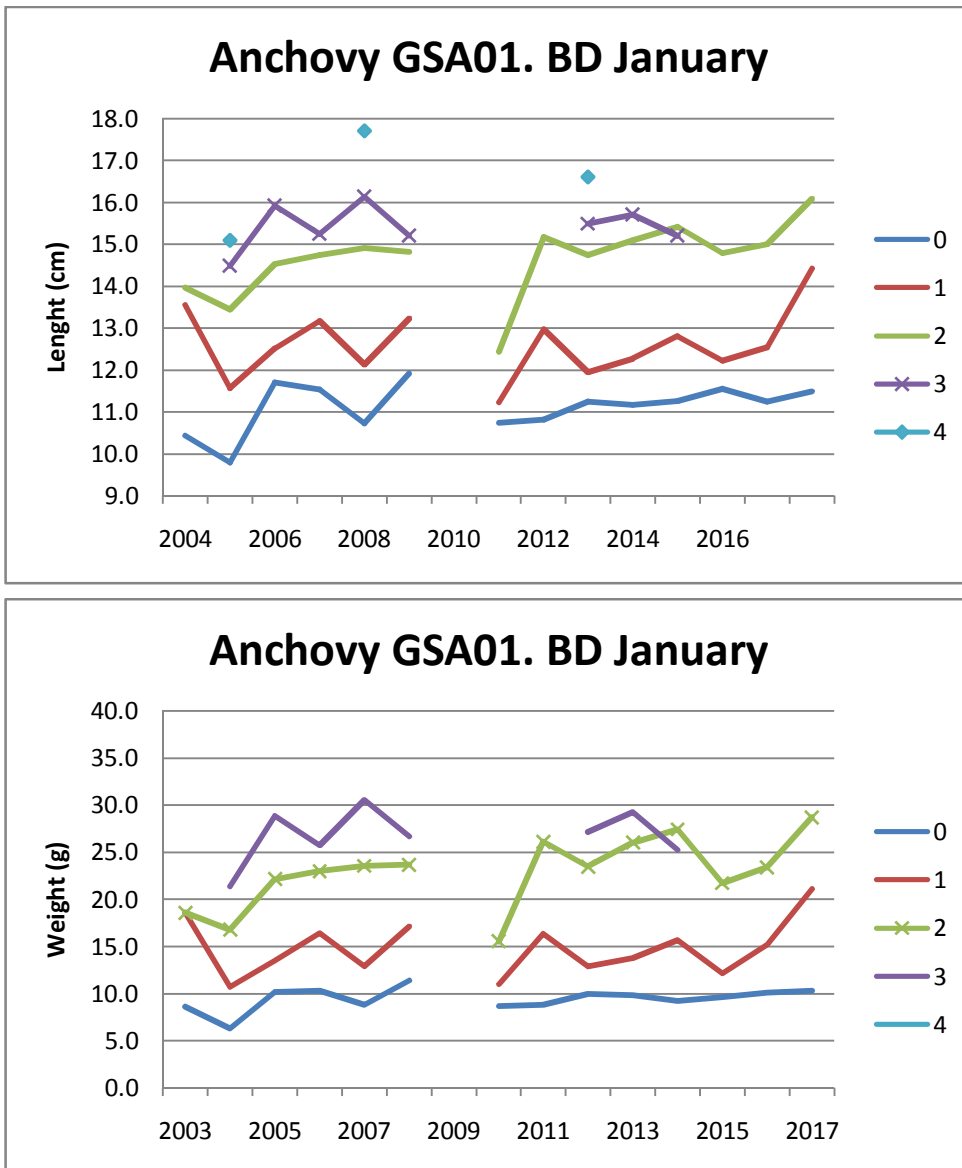


Fig. 3.2.2. Landings in GSA01, South Mediterranean Region (RSM) and Gulf of Vera in different lines. Since 2012 landings in the Northern part has increase (Gulf of Vera)

3.3 Length distribution fishery



3.4 Length and Weight by age Fisher



Figures 3.4.1 & 3.4.2. Length and weight by age 2003-2017.

Length and weight at age increasing in the last years.

3.5 Body Condition

The formula used for the calculation of the Condition Factor was Le Cren (1951). Monthly evolution of this factor in anchovy (Fig. 3.5.1) shows a good nutritional status at certain times of the year with no trend over the years 2004-2017. However, the values are lower than in 1989-1990.

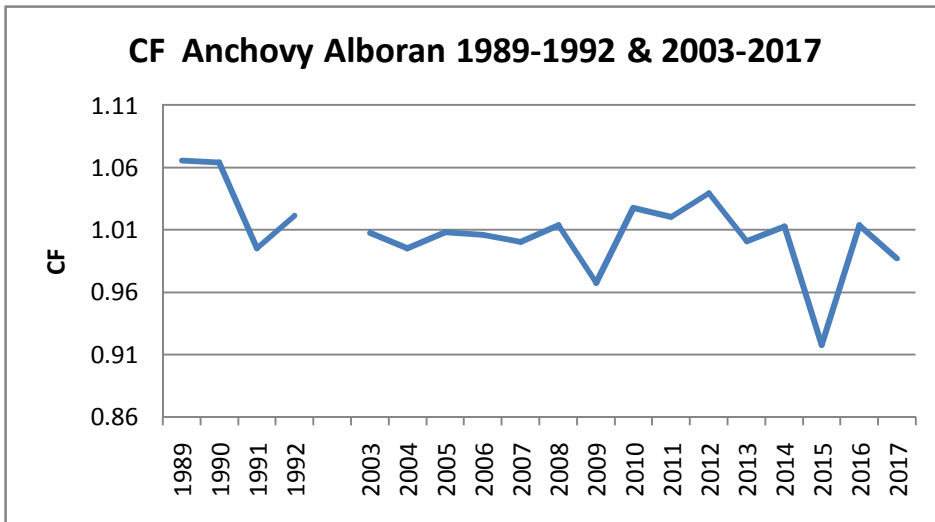
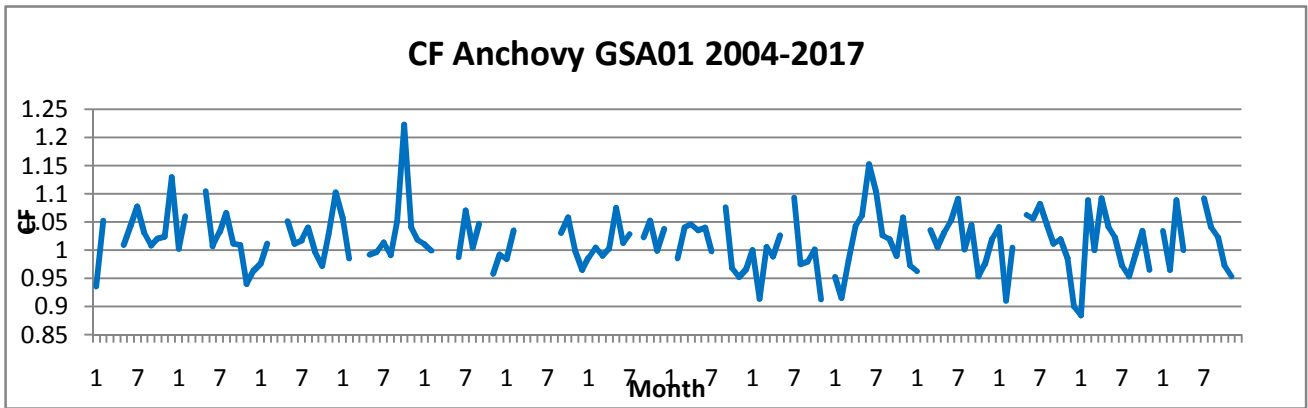


Figure 3.5.1. Monthly and annual evolution of the Condition Factor from 2004 to 2017.

3.6 Management regulations

Regulated by Fishery European regulations REGULATION (EC) N° 1967/2006 of December 21, 2006, with a more restrictive Spanish regulations.

Features gear: Minimum aperture of 14 mm mesh, The height of the purse seine shall not exceed 82 m and the use of purse seines is not allowed at a depth less than 70 percent of the net length, Length net will not exceed more than 300 m except for Alboran Sea which may be up to 450 m.

Characteristics of vessels: No less than 9 m long, maximum power 450 hp, only one auxiliary boat and there is a Regulating for its power lights. **Fishing areas:** prohibited fishing less than 35 m deep, although at a distance of 300 m offshore it is permitted at a lower depth than 50m. There are forbidden areas to safe anchovy recruitment. **Fishing effort:** No fishing on weekend, restricted fishing areas and seasonal closures in some regions. **Minimum sizes:** Minimum legal landing size 9 cm. **List of species authorized** to be fished by the gear. There is a margin of 2% of others species

4 Fisheries independent information

4.1 Acoustic survey: ECOMED and MEDIAS

4.1.1 Brief description of the chosen method and assumptions used

In the Spanish Mediterranean waters an acoustic survey has been annually carried out since the 90'. Until 2009 the survey (ECOMED) was carried out in late autumn focusing on the anchovy (*Engraulis encrasicolus*) recruitment; since 2009 the acoustic survey season changed to summer in order to standardize with the rest of acoustic surveys carried out by the European countries in Mediterranean Sea and to start the MEDIAS (Mediterranean acoustic surveys) series. The pelagic community is nowadays assessed, focusing on the spawning stock biomass (SSB) for anchovy and the recruitment of sardine. The GFCM Geographical Sub-Area covered are the GSA 06 (Northern Spain) and 01 (Northern Alboran Sea), prospecting the continental shelf (20 to 200 m depth) by means of a scientific echosounder EK60 (Simrad), equipped with 5 frequencies (18, 38, 70, 120 and 200 kHz).

Acoustic data are recorded continuously at a constant ship speed of 10 knots from sunrise to sunset, along parallel equidistant transects lying perpendicular to the bathymetry. The echosounder is calibrated before each survey following standard techniques (Foote et al., 1987).

Midwater pelagic trawls were deployed to determine the species proportions present in the area. Acoustic data are processed using Echoview (Mirymax Ltd.) software and PESMA (VisualBasic) software. Echo trace classification is based on echogram visual scrutinisation, usually the allocation is on account of representative fishing station and very few times on direct allocation. Results of biomass (tons) and abundance (nº individuals) are presented by species, length and age.

Direct methods: acoustics

Table 4.1-1: Acoustic cruise information.

Date	MEDIAS: June-July 2013; ECOMED: November-December		
Cruise	ECOMED and MEDIAS	R/V	Miguel Oliver
Target species	Anchovy and sardine		
Sampling strategy	66 tracks normal to the coast. Inter-transect distance: 4 or 8 nautical miles		
Sampling season	MEDIAS: June-July 2012; ECOMED: November-December		
Investigated depth range (m)	30-200 m depth		
Echo-sounder	Scientific Echo-sounder EK60 equipped with 5 frequencies (18, 38, 70, 120 & 200 kHz)		
Fish sampler	Pelagic trawls with 10, 16 & 18 m vertical opening		
Cod –end mesh size as opening (mm)	20 mm		

ESDU (i.e. 1 nautical mile)	Elementary Distance Sampling Unit: 1 nautical mile
TS (Target Strength)/species	-72.6 dB for anchovy and sardine
Software used in the post-processing	SonarData Echoview, PESMA (Visual Basic)
Samples (gear used)	Pelagic trawl
Biological data obtained	Length-weight relationship, age, sex, maturity
Age slicing method	Otolith
Maturity ogive used	

Table 4.1-2: Acoustic results, if available by age or length class

	Biomass in metric tons	fish numbers millions	Nautical Area Scattering Coefficient	Indicator ...	Indicator ...
2014	1320	55			
2015	3052	203			
2016	574	26			
2017	1200	57	without gulf of vera		

4.1.2 Spatial distribution of the resources

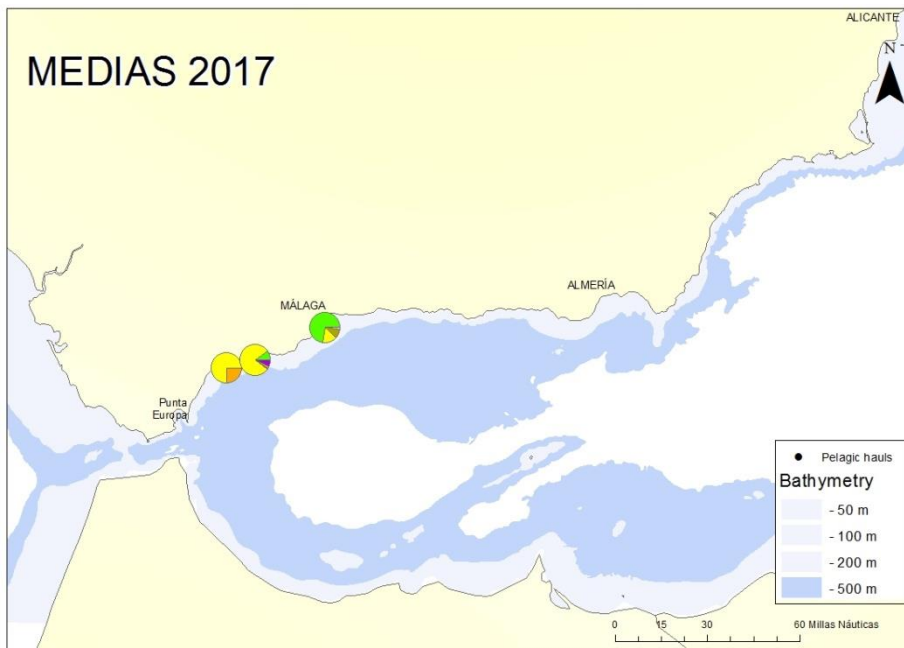


Fig.4.1.2.1. Only three hauls were positive for the anchovy in MEDIAS 2017. The northern area was not assessed.



Fig.4.1.2.1. Anchovy distribution area in Northern Alboran Sea in 2017, the northern area was not assessed.

Very small population, they were only found in 3 trawls in the acoustic survey, concentrated in the central area (Málaga Bay).

4.1.3 Historical trends

Until 2009 the IEO carried out an acoustic survey assessment (ECOMED) around the Spanish Mediterranean. In 2009 began the survey MEDIAS. Both surveys are not comparable because the first is done in autumn and the second in summer. Medias evaluates spawning anchovies and

ECOMED recruitment of this species.

Unfortunately the surveys have only covered all the area in 2004-2005 and 2013-2016. For some years it has been only assessed Málaga Bay. The anchovy assessments in Málaga Bay can be considered a good estimate of the biomass of this species in Northern Alboran Sea as anchovy is concentrated in this area. Figure 4.1.3.1 shows the exceptional recruitment that occurred in 2001 (13.200 t).

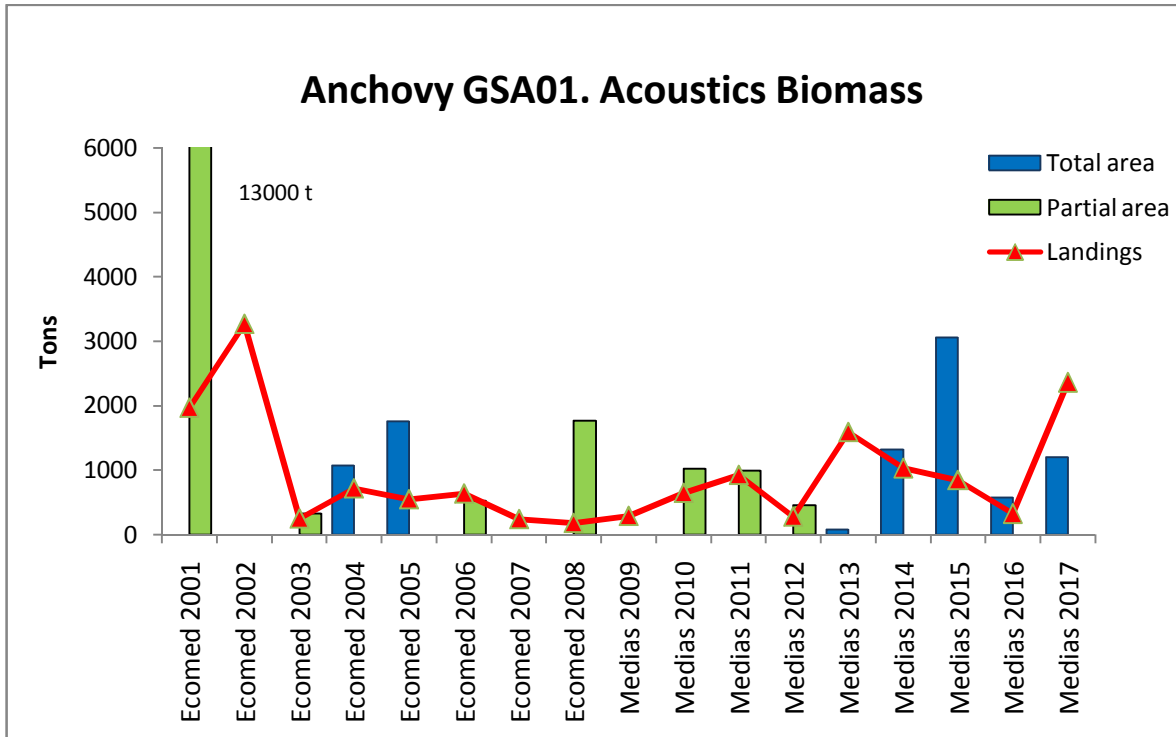


Figure 4.1.3.1. Evolution of biomass assesses in the Alboran Sea for surveys ECOMED and MEDIAS.

There are years when is not possible assess the area with the survey, the resources are too close to the shore (<30m), where the artisanal fleet is concentrated and it is not possible fishing. EPM is not applicable with such a low abundance (A. Garcia).

There is not a long historical series of acoustic assessment, there are partial assessments for some years but only four can be considered completed and without continuity.

5 Stock Assessment

Very variable catches and based on recruitment. The population is very small and, often, it is restricted to a bay. Acoustic evaluations present problems for their use in the analytical evaluation of the stock. An in-depth analysis of the usefulness of these surveys is needed for the evaluation of stock (comparison of fishing areas and prospecting area, etc. Based on the trends of different indicators no signs of overexploitation are detected (increase in size average, CPUE nominal and

standard are stable, stable landings.) The WG suggests adopting a precautionary approach and not increasing fishing mortality.

6 Stock predictions

6.1 Short term predictions

6.2 Medium term predictions

6.3 Long term predictions

7 Ecological information

7.1 Protected species potentially affected by the fisheries

A list of protected species that can be potentially affected by the fishery should be incorporated here. This should also be completed with the potential effect and if available an associated value (e.g. bycatch of these species in T)

7.2 Environmental indexes

If any environmental index is used as i) a proxy for recruitment strength, ii) a proxy for carrying capacity, or any other index that is incorporated in the assessment, then it should be included here.

Other environmental indexes that are considered important for the fishery (e.g. Chla or other that may affect catchability, etc.) can be reported here.

8 Draft scientific advice

(Examples in blue)

Based on	Indicator	Analytical reference point (name and value)	Current value from the analysis (name and value)	Empirical reference value (name and value)	Trend (time period)	Status
Fishing mortality	Fishing mortality					
	Fishing effort					
	Catch					
	Exploitation					
Stock abundance	Biomass					O_L
	SSB					
Recruitment					D	
Final Diagnosis	Uncertain					

State the rationale behind that diagnoses, explaining if it is based on analytical or on empirical references

8.1 Explanation of codes

Trend categories

- 1) N - No trend
- 2) I - Increasing
- 3) D – Decreasing
- 4) C - Cyclic

Stock Status

Based on Fishing mortality related indicators

- 1) **N - Not known or uncertain** – Not much information is available to make a judgment;
- 2) **U - undeveloped or new fishery** - Believed to have a significant potential for expansion in total production;
- 3) **S - Sustainable exploitation**- fishing mortality or effort below an agreed fishing mortality or effort based Reference Point;
- 4) **IO –In Overfishing status**– fishing mortality or effort above the value of the agreed fishing mortality or effort based Reference Point. An agreed range of overfishing levels is provided;

Range of Overfishing levels based on fishery reference points

In order to assess the level of overfishing status when $F_{0.1}$ from a Y/R model is used as LRP, the following operational approach is proposed:

- If $F_c^*/F_{0.1}$ is below or equal to 1.33 the stock is in (**O_L**): **Low overfishing**
- If the $F_c/F_{0.1}$ is between 1.33 and 1.66 the stock is in (**O_I**): **Intermediate overfishing**
- If the $F_c/F_{0.1}$ is equal or above to 1.66 the stock is in (**O_H**): **High overfishing**

* F_c is current level of F

- 5) **C- Collapsed**- no or very few catches;

Based on Stock related indicators

- 1) **N - Not known or uncertain**: Not much information is available to make a judgment
- 2) **S - Sustainably exploited**: Standing stock above an agreed biomass based Reference Point;
- 3) **O - Overexploited**: Standing stock below the value of the agreed biomass based Reference Point. An agreed range of overexploited status is provided;

Empirical Reference framework for the relative level of stock biomass index

- **Relative low biomass**: Values lower than or equal to 33rd percentile of biomass index in the time series (**O_L**)

- **Relative intermediate biomass:** Values falling within this limit and 66th percentile (**O_I**)
 - **Relative high biomass:** Values higher than the 66th percentile (**O_H**)
- 4) **D–Depleted:** Standing stock is at lowest historical levels, irrespective of the amount of fishing effort exerted;
 - 5) **R –Recovering:** Biomass are increasing after having been depleted from a previous period;

Agreed definitions as per SAC Glossary

Overfished (or overexploited) - A stock is considered to be overfished when its abundance is below an agreed biomass based reference target point, like *B_{0.1}* or *B_{MSY}*. To apply this denomination, it should be assumed that the current state of the stock (in biomass) arises from the application of excessive fishing pressure in previous years. This classification is independent of the current level of fishing mortality.

Stock subjected to overfishing (or overexploitation) - A stock is subjected to overfishing if the fishing mortality applied to it exceeds the one it can sustainably stand, for a longer period. In other words, the current fishing mortality exceeds the fishing mortality that, if applied during a long period, under stable conditions, would lead the stock abundance to the reference point of the target abundance (either in terms of biomass or numbers)

References

Le Cren, ED. The Length-Weight Relationship and Seasonal Cycle in Gonad Weight and Condition in the Perch (*Perca fluviatilis*). *Journal of Animal Ecology* 20, No. 2 (Nov., 1951), pp. 201-219.