

# REPORT OF THE THIRD MEETING OF THE WORKING GROUP ON SMALL PELAGIC FISHERIES IN THE ALBORAN SEA

2-4 October 2012  
Nador, Morocco



**CopeMed II Technical Documents N° 30  
(GCP/INT/028/SPA – GCP/INT/006/EC)**

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ON SMALL PELAGIC FISHERIES IN THE ALBORAN SEA**

**2-4 October 2012  
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**November 2012**

The conclusions and recommendations given in this document and in other documents in the *Co-ordination to Support Fisheries Management in the Western and Central Mediterranean* CopeMed II Project series are those considered appropriate at the time of preparation. They may be modified in the light of further knowledge gained in subsequent stages of the Project. The designation employed and the presentation of material in this publication do not imply the expression of any opinion on the part of Food and Agriculture Organization of the United Nations, FAO, the Government of Spain or the Commission of the European Union concerning the legal status of any country, territory, city or area, or concerning the determination of its frontiers or boundaries. This document has been financed by the European Union and the Government of Spain. The views expressed herein can in no way be taken to reflect the official opinion of the European Union or the Government of Spain.

## Preface

The CopeMed II Project on *Co-ordination to Support Fisheries Management in the Western and Central Mediterranean* is executed by the Food and Agriculture Organization of the United Nations (FAO) and funded by the Government of Spain, represented by the Secretaría General de Pesca, and the European Union, represented by the European Commission (EC).

The objective of the project is to maintain the sustainability of the marine fisheries, including artisanal fisheries, in the central and western Mediterranean Sea and its ecosystem, taking into consideration environmental, biological, economic, social and institutional issues. In addition, the project will continue to reinforce the collaboration among the participating countries of the sub-region by promoting common activities and databases creation, experts' exchange of information, by supporting their participation in joint activities, mainly those related to shared and/or stranded stocks and its fisheries and by facilitating the participation of national experts on the activities of the Scientific Advisory Committee (SAC) of the General Fisheries Commission for the Mediterranean (GFCM).

Regions covered by CopeMed II are the western and central sub-regions of the Mediterranean. Countries participating and with representation in the Coordination Committee of the project are Algeria, France, Italy, Libya, Malta, Morocco, Tunisia and Spain. The main beneficiaries are the fishery policy-makers, managers and fishery administrations in the western and central Mediterranean countries. The project is also contributing to the strengthening of regional collaboration, by cooperating with the other FAO subregional projects, AdriaMed, MedSudMed and EastMed and by supporting capacity-building, standard methodologies, joint stocks assessment and the participation of the countries in relevant regional scientific organizations, such as the FAO's General Fisheries Commission for the Mediterranean (GFCM). Secondary beneficiaries include the national research institutes, fishers and fishers' associations, and industrial organizations.


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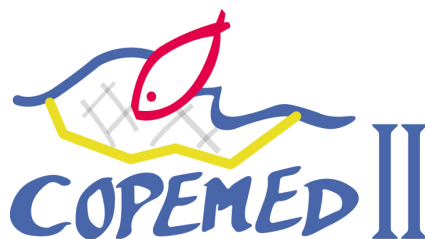
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## Preparation of this document

This document is the final version of the Third Meeting of the Working Group on Small Pelagic Fisheries in the Alboran Sea held in Nador (Morocco) from 2 to 4 October 2012, prepared by the Project CopeMed II.

### Acknowledgements

CopeMed II acknowledges the participation of Mediterranean experts from fisheries administrations and fisheries research institutions from Algeria, Morocco, Tunisia and Spain in the meeting to improve knowledge on the *Sardina pilchardus* and *Engraulis encrasicolus* stocks in the Alboran Sea.

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#### ABSTRACT

To answer the needs expressed by the CopeMed II countries, following the recommendations of the 5th meeting of the CopeMed II Coordination Committee, the Subregional Small Pelagic Species Working Group and the GFCM-SAC-SCSA requirements, the third study group meeting on small pelagic species (*Sardina pilchardus* and *Engraulis encrasicolus*) in the Alboran Sea (GSAs 01, 02, 03 and 04 of the GFCM) was held in Nador (Morocco) from 2 to 4 October 2012.

The main objective of the meeting was carrying out a joint stock assessment on *S. pilchardus* for Algeria, Morocco and Spain, by updating the database already used in the second meeting of the CopeMed II study group. Likewise, to compile the available data on distribution and abundance patterns, biological parameters, exploitation patterns and current situation of *E. encrasicolus* fisheries to carry out a preliminary joint stock assessment. Both assessments, were prepared in the frame of the FAO-CopeMed II project Small Pelagic Species study group, aiming at contributing to reinforce the subregional collaboration for the identification of the most relevant characteristics of the stocks, to formulate recommendations on fishery management, by using a standard methodology, and analyzing the obtained results.

For the first time a compilation of socioeconomic information of *S. pilchardus* and *E. encrasicolus* fishery through the indicators provided by the GFCM was attempted by the three countries. A first joint stock assessment on *S. pilchardus* in the Alboran Sea was carried out. The level of information provided to the SG was not the appropriate to carry out a joint assessment of the *E. encrasicolus* stock in the meeting. The SG recommended completing information on *E. encrasicolus* fishery in Algeria and Morocco to make progress in the anchovy joint stock assessment and advancing in the process of standardization of the acoustic assessment methodology based on the Acoustic Surveys (MEDIAS) protocol.

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Annex 3: Results of the analyses of the available datas and monitoring system concerning social and economic aspects

Annex 4: Socio economic indicators per LOU in the Alboran Sea

## 1. Background information

Small pelagic species represent an important fishery and economic activity for the countries bordering the Alboran Sea. Among the small pelagic species with great importance in terms of both total landings and economic value are sardine (*Sardina pilchardus*) and Anchovy (*Engraulis encrasicolus*), although other species are taking an important percentage in the production and economic value.

The General Fisheries Commission for the Mediterranean (GFCM) stress the importance of making common assessments of shared stocks of priority species. Fisheries experts of southern Mediterranean countries have demanded the exchange of information on fisheries data with the neighboring northern countries in order to improve knowledge on the status of fisheries resources and to propose new management measures for the sustainability of the fishery resources and its exploitation. The joint stock assessment of the main shared stocks in the Mediterranean Sea is considered as an important step to contribute reinforcing the subregional collaboration and to promote agreed management recommendations for fisheries in the GFCM area.

One of the main roles of the FAO subregional project is to support the scientific community to gather available information on the fisheries to assess the stocks, particularly those shared at least by two countries. CopeMed II emphasis is the reduction of the differences currently existing in the capacity of the participating countries and to promote subregional approach to fisheries research and management. The subregional working groups (WGs) on Mediterranean shared stocks organized by CopeMed II are of major importance for the reorientation of approaches to stock assessments (moving from single country analysis to joint subregional analysis) and to the possibility of implementing scientifically based management plans for the fisheries targeting shared stocks both in each specific country and at subregional level.

Sardine and Anchovy were identified by CopeMed II meeting on the definition of priority topics related to shared resources (demersal and pelagic) in the subregion<sup>1</sup> as priority species for the Strait of Gibraltar and Alboran Sea regions. Algeria, Morocco and Spain were identified as countries sharing these possible stocks. The 5<sup>th</sup> meeting of the Coordination Committee of CopeMed II (Málaga, 3-4 May 2012) agreed that the project should “*hold the first meeting of the WG for stock assessment of Engraulis encrasicolus of the Alboran Sea among Algeria, Morocco and Spain to prepare the national data on E. encrasicolus to define the stocks or stocks in the area and to prepare the evaluation of the stocks*” and “*hold the first meeting of the WG for stock assessment of Sardina pilchardus of the Alboran Sea among Algeria, Morocco and Spain*”.

In 2011, the Working Group on small pelagic fisheries in the Alboran Sea (SPASWG) presented a paper<sup>2</sup> during the SAC-SCSA WG on Small Pelagic Species in Chania (Crete,

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<sup>1</sup> CopeMed II. 2011. Report of the CopeMed II meeting on the definition of priority topics related to shared resources (demersal and pelagic) in the subregion. CopeMed II – ArtFiMed Technical Documents N°22 (GCP/INT/028/SPA-GCP/INT/006/EC). Málaga, 2011. 14pp.

<sup>2</sup> Kada O., Álvarez F., Giráldez A., Torres P., Najih M., Fernández I.L., Bernardon M. and Camiñas J.A. 2011. Preliminary analysis for identification of priority species of small pelagic shared stocks in GSA01 and GSA03 (Alboran Sea). Paper presented at the Working Group on Stock Assessment of Small Pelagic Species (SCSA-SAC, GFCM), (Chania, Crete. Greece, 24-29 October 2011). GCP/INT/028/SPA-GCP/INT/006/EC. CopeMed II Occasional Paper N° 8: 12 pp.



Greece) with preliminary information on the national fisheries of sardine and Anchovy from Morocco and Spain.

To answer the needs expressed by the CopeMed II countries, following the recommendations of the 5th meeting of the CopeMed II Coordination Committee, the GFCM-SAC-SCSA and the SPASWG requirements, CopeMed II was requested to support a new meeting of the SPASWG in 2012. The Third Meeting of the SPASWG was held in Nador (Morocco) from 2 to 4 October 2012, with experts from Algeria, Morocco, Spain and FAO-CopeMed, to compile and discuss the available data on distribution and abundance patterns, biological parameters, exploitation patterns, socio-economic indicators and current situation of sardine and Anchovy fisheries in the Alboran Sea to carry out joint stocks assessments of both species.

## **2. Opening of the meeting, election of Chairperson and adoption of the Agenda**

Mr. Mohamed Najih, Director of INRH Center in Nador welcomed the participants and congratulated the participation of experts from the three countries surrounding the Alboran Sea, Algeria, Morocco and Spain. He reviewed the current situation of the small pelagic fisheries in Morocco and also noted the importance of maintaining this collaboration

Mr. Mahmoud, Delegué de la Pêche à Nador, welcomed the participants of the three countries involved in the meeting, Algeria, Spain and Morocco and stressed the importance of the small pelagic fisheries for the Nador region and requested that the discussions of this international WG allow to support the management decision in the region. He particularly underlined the current problem in the Nador area of exploitation of juveniles of sardine by the local fleets

The meeting was called to order by Mr. Juan A. Camiñas, Coordinator of FAO-CopeMed II project, who welcomed the participants from Algeria, Morocco and Spain (Annex I) to the meeting.

He thanked the experts from the Centre National de Recherche et de Développement de la Pêche et l'Aquaculture (CNRDPA, Algeria), the National Institute of Fisheries Research (INRH, Morocco), the Spanish Institute of Oceanography (IEO) and the CopeMed II Project's staff for their participation in the meeting.

He underlined that the meeting was the result of the recommendation of the 5th CopeMed II Coordination Committee meeting and the SPASWG.

Mr. Federico Alvarez (Spain) was elected Chairperson of the meeting and the Agenda (Annex II) was adopted.

## **3. General information and objective of the meeting**

The Alboran Sea (GSAs 01, 02, 03 and 04) is bordered by 3 countries (Algeria, Morocco and Spain). Sardine (*Sardina pilchardus*) and Anchovy (*Engraulis encrasicolus*) are considered important and valuable exploited pelagic stocks. They are included in the list of priority shared stocks for the CopeMed II region and the GFCM.

The WG analyzed all available information and data on the fishery of *S. pilchardus* in the Alboran Sea area at national level:

- General description of the fisheries targeting sardine (fleets, fishing gears, fishing grounds, ports, landing, fishing effort, transformation of captures, commercialisation).
- Fisheries dynamics and fishing strategies.
- Biological and ecological characteristics.
- Movements across the regions: eggs, larvae, recruits and adults.
- Data collection systems: (Fishery Statistics available, E.g. effort and catches)
- Biological sampling of commercial catches.
- Experimental Surveys, e.g. acoustic and DEPM.
- Stock assessment (methods used and results), gaps, etc.
- Socio-economic available data.

Concerning the Anchovy (*Engraulis encrasicolus*) the main objective was to overview the available data and main gaps on biological and fisheries information on the Anchovy of the Alboran Sea, including fishery landings, fishing areas, size at landing distribution and availability of biological data for progressing in the definition of this stock. Additionally, the SG focussed their discussions in defining the national fisheries components (operational units) and the availability of national indicators on the socio-economic aspects of the fisheries and on the methodology for the standardisation of this kind of data and indicators.

During the meeting it was raised a discussion on the need to evaluate the stocks of the two main species, Sardine and Anchovy of the whole Algerian coast and the north of Tunisia within a new CopeMed SG, in order to complete the assessment of small pelagic in the CopeMed and MedSudMed region. Experts from Tunisia informed during the SG on demersal that data from northern Tunisia (GSA 12) are already included in the assessment performed on small pelagic and demersal by MedSudMed SG. Algerian experts indicated that the small pelagic fishery in Algeria cover the whole coast of the country. After a discussion on the needs to follow up the state of the small pelagic stocks in the whole CopeMed area it was agreed to incorporate the whole data from Algeria (GSA 04) to the SG on small pelagic of the Alboran Sea for the next annual meeting of the SG during 2013 and not create for the moment a new CopeMed SG for the GSA 04 and GSA 12.

#### 4. Description of the small pelagic fleet in the Alboran Sea

The description of the small pelagic fleet in the Alboran Sea was updated and summarized in the table 1. Considering the fact that all the Local Operational Units (LOU) target sardine and European pilchard, it was agreed to present a common table for the description of the fleet targeting the two concerned species (Table 1).

Local Operational Units by country	N°	Country	GSA	Fleet Segment	Fishing Gear Class	Group of Target Species	N° of boats	Capacity (GT)	Engine power (HP)	Boat size (m)	Catch (T)	Effort (Day/year)	crew
SPAIN	1	Spain	1	6-12 m	purse seine	Small pelagic	12	5,19	65,42	9,97		717	
	2	Spain	1	12-24 m	purse seine	Small pelagic	88	26,7	189,4	17,1		7427	
MOROCCO	3	Morocco	3	6-12 m	purse seine	Small pelagic	9	8,84	105,56		189	264	12
	4	Morocco	3	6-12 m	SS purse seine	Small pelagic	132	3,75	31,39				10
	5	Morocco	3	12-24 m	purse seine	Small pelagic	109	49,06	330,7		12991	7739	31
	6	Morocco	3	>24 m	purse seine	Small pelagic	4	86	525		492	270	43
ALGERIA	8	Algeria	4	6-12 m	purse seine	Small pelagic	6	14	152	9,5	4968,3	270	10
	9	Algeria	4	12-24 m	purse seine	Small pelagic	119	32,77	308,84	15,69		1444	20
	10	Algeria	4	12-24 m	Pelagic trawler	Small pelagic	38	63,4	518,0	20,7	1382	1332	10
	11	Algeria	4	>24 m	Pelagic trawler	Small pelagic	7	114	870	26		756	10

Table 1. Description of the small pelagic fleet in the Alboran Sea.

## 5. *Sardina pilchardus*

### 5.1. National information on *Sardina pilchardus*

#### 5.1.1. Moroccan data (*Sardina pilchardus*). Omar Kada, INRH, Nador

A revision of the fishery information and available data was carried out and the tables used in the assessment were updated. The WG was informed that an important number of small artisanal vessel targeting small pelagic.

Purse seiners represent approximately 20% of the active fleet. They are distributed on all ports in the region. The three main ports concentration seiners are Beni Nsar (Nador), Al Hoceima and M'diq.

According to the GFCM fleet classification, there are two categories and 4 local operational units fishing for sardine and European pilchard in the Moroccan Mediterranean.

#### The sardiniers:

These fishing units are composed by 3 boats (the main and two auxiliary): the main vessel with the gear and the skipper, an auxiliary boat with lights (lamparo) and the small auxiliary boat without engine. The main boat is equipped with hydraulic equipment to facilitate operations on board; the lamparo is equipped with lamps that are used to attract the schools of fish at night and the small rowing boat helps maintaining the proper form of the seine during the fishing operation. Each fishing unit employs between 9 and 40 fishermen (Zahri, 2004).

The fishing gear used by the fleet is a purse seine net composed of a grid of 9 and / or 11 mm side. According to the GT of the vessel and/or the depth of the fishing area, the dimensions of the device differ: its length varies between 300 m and 650 m, and the depth between 50 m and 160 m. According Roullot (1984), the theoretical fall to work for this machine is between 32 m and 70 m.

Following the GFCM classification, this category includes two local operational units.

1. Purse Seinners with length between 6 and 12 m (segment G),
2. Purse Seinners over 12 m in length (segment H).

In addition to the sardine and Anchovy, purse seiners target other species of commercial interest as *Trachurus spp.*, bug, mackerel, small tuna and sardine.

#### Small scale purse seine

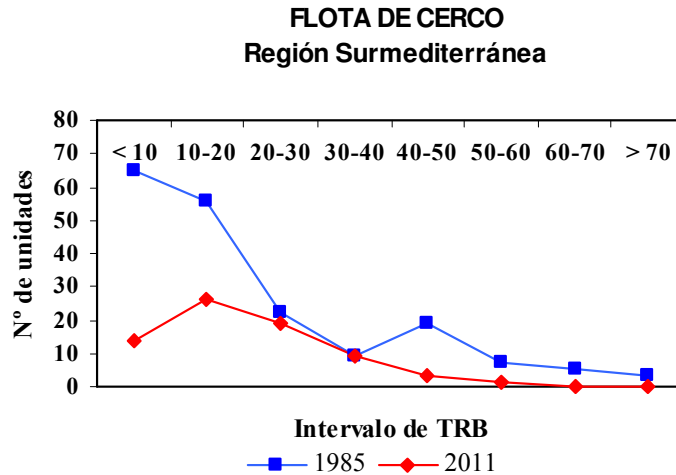
This category can be considered as an overlapping between the segment C of "motorized polyvalent boats from 6 to 12 meters long" and the B segment, "polyvalent motorized boats under 6 meters long ". The fishing unit is generally composed of two boats: the main vessel and an auxiliary boat with lights (lamparo). The principal boat is not fully equipped as it only has a mechanical winch. The lamparo (Photo 3) is equipped with lamps used to attract the school of fish at night. Sometimes the fishing unit includes a third boat that maintains the purse seine. Each unit includes a fishing crew of 8 people in general.

The fishing gear used by the fleet is a purse seine net composed of a grid of 9 and / or 11 mm side. The length of the seine is over 200 to 300 m, and its depth is about 40 m.

The species targeted by this fleet is mainly sardine. Other species are *Trachurus spp.*, *Auxis spp.*, bug, Atlantic bonito and Anchovy. These units can use hand lines targeting bluefin tuna. The level of capture of these units is around 4.000 tons per year which represents 22.5% of purse seine catches in Moroccan Mediterranean (APA, 2011).

### 5.1.2. Spanish data (*Sardina pilchardus*). Ana Giráldez. IEO, Málaga

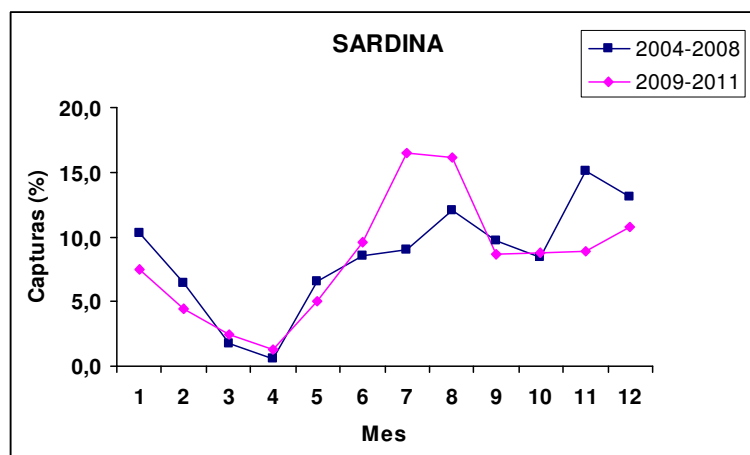
The purse seine fleet has continuously decreased, from 230 vessels in 1980 to 94 in 2008, representing a reduction of 59%. Currently this fleet is formed of small units: 88% are under 30 GT, with an average of 18.3 GT and an average power of 142 HP. Only 20% of units have a length of less than 12 meters. Traditionally, the most important ports in number of units and landings have been Almería, Adra and Málaga. Currently the port of Málaga is in recession and the port of Vélez Málaga is in expansion, being the largest port in the Bay of Málaga.



**Figure 1.** Spanish South-Mediterranean area (95 % of the whole GSA01 landings) purse seine fleet.

The sardine migration was discussed by the WG as consequence of the request of the WG and the interest to improve the biological behaviour of the species in the area.

Seasonality in the Anchovy catch has changed. Between 1985 and 1998 catches were mainly in autumn, beginning in June and ending in November. Since 2004-2008, it starts in May and finishes in December. The increase of number of catches in May can be explained as is the first fishing month in the entire Bay of Malaga, after the biological shutdown. In recent years, the fleet made a shutdown in January-February in the province of Almería and in April and March in Málaga, so these months are misleading data to the seasonality of the sardine, considering all ports.



**Figure 2.** Sardine catches (%) in the period 2004-2011.

Although periods of large oscillations are observed, a generally declining trend in catches of sardine and Anchovy is confirmed.

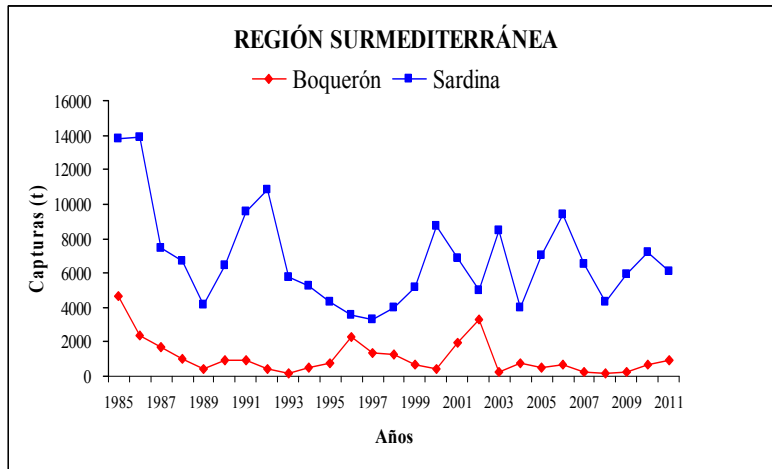


Figure 3. Sardine and Anchovy catches (tons) in the Spanish South-Mediterranean area.

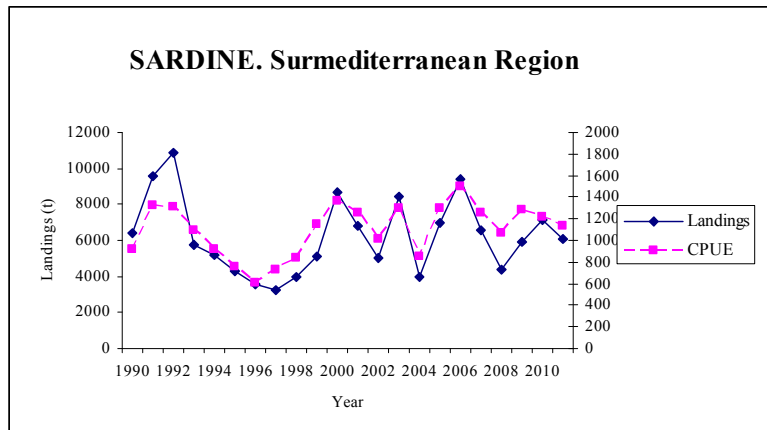


Figure 4. Sardine landings (tons) and CPUE in the Spanish South-Mediterranean area.

The Spanish fleet has been focused mainly focused on individuals between 0 and 3-4 years. Beyond the Bay of Málaga older individuals are fished.

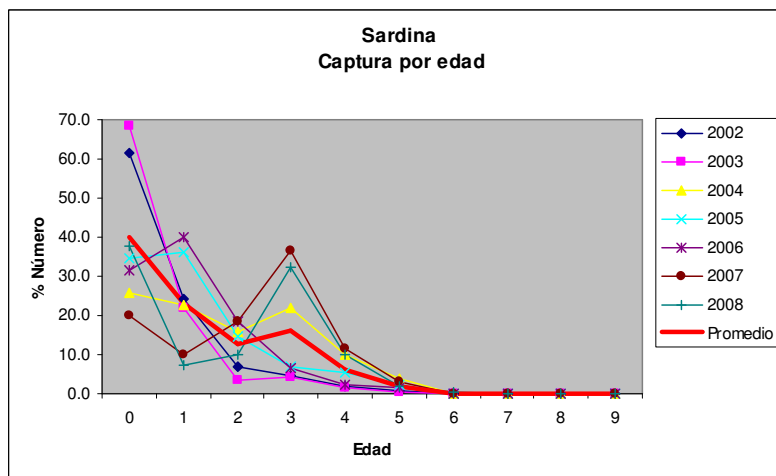
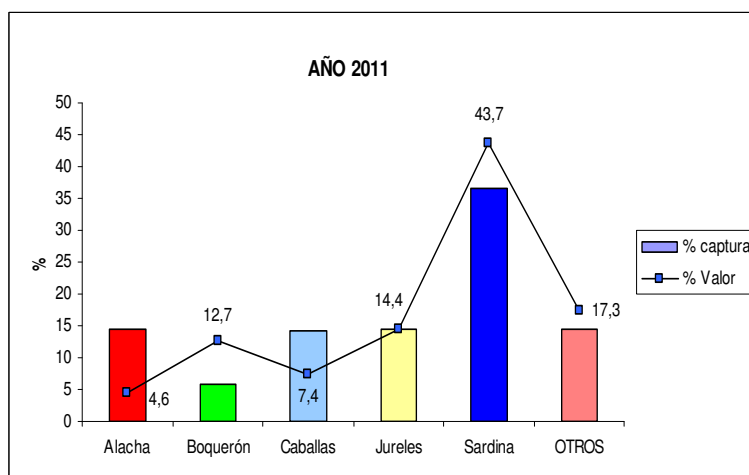


Figure 5. Sardine catches by age in the period 2002-2008.

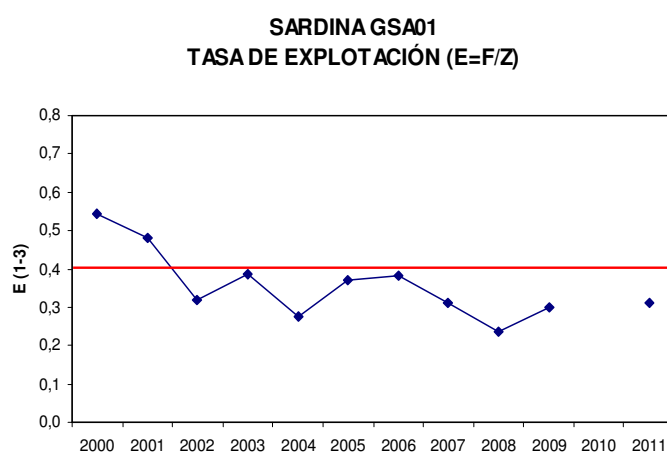
The use of larger sardine for tuna farming could explain the high catches of sardine seen in three years.

The species with the highest economic value is the Anchovy. However, sardine is an important support of the fishery, being the most abundant species.



**Figure 6.** Purse seine landings and value by species in the Spanish South-Mediterranean area (2011).

The sardine stock of the RSM is considered as sustainably exploited. However, we must take into account that the exploitation rate (E) is very sensitive to the values of natural mortality (M) concerned. Therefore, the WG suggested considering these benchmarks with caution.



**Figure 7.** Sardine exploitation rate (E) in GSA 01.

### 5.1.3. Algerian data (*Sardina pilchardus*)

- The WG recommended the need of updating fisheries data in Algeria and its subsequent presentation to the WG for discussion.
- The significant increase in fishing effort of Algerian purse seiners fleet was discussed. The WG emphasized the importance of collaboration in fishery management between the 3 countries and Ms. Ben Smail was asked to prepare a document on the Algerian

fisheries to update and supplement the information already available of Morocco and Spain.

## 5.2. Joint stock assessment on *Sardina pilchardus*: Data and methodology

- Data Source: GSA01 (Northern Alboran Sea), GSA03 (Southern Alboran Sea). INRH and IEO.
- Data used:
  - Landings from 2003-2011 from all Fishery ports from GSA01 and GSA03.
  - Combined ALKs 2003-2011 for all the years (except 2009) from GSA01.
  - Length distribution 2003-2011.
  - Length distributions were converted to age distributions.
  - Biological sampling 2011 for Weight-Length relationships (GSA01).
- Type of data: Age composition of commercial catches and official landings.
- Method of assessment: Pseudo-cohort analysis and yield per recruit analysis.
- Software used: VIT (Leonart and Salat, 1997).

### Parameters used (state units and information sources)

		Units	Sex			
			female	male	both	unsexed
Growth model	L?				22,22	
	K				0,436	
	t0				-1,430	
	Data source	IEO Malaga				
Length weight relationship	a				0,0030	
	b				3,2	
	M				0,5	

**Table 2.** Parameters used in the sardine joint stock assessment.

### Time series

Year*	2003	2004	2005	2006	2007	2008
Catch	10671,863	12458,186	9228	5024,486	13574,112	9111,421
Minimum size	9	8	7	8,5	8	9
Average size Lc	16,35	15,39	14,8	15,37	16,53	16,66
Maximum size	22	21,5	21,5	21	22	23,5
Fleet	139	92	113	134	135	136

Year	2009	2010	2011			
Catch	15075,8855	11102,1255	7082,621			
Minimum size	10	8	10,5			
Average size Lc	15,37	16,03	16,9			
Maximum size	22,5	21	21			
Fleet	124	144	136			

**Table 3.** Time series of the sardine joint stock assessment.

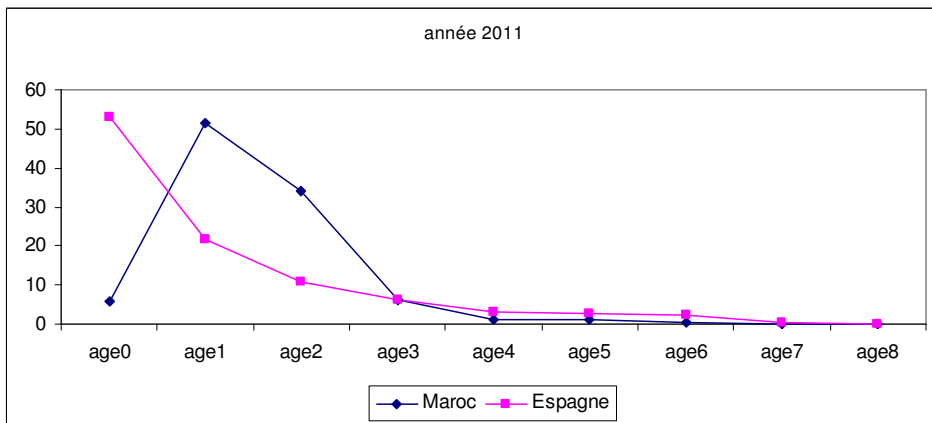
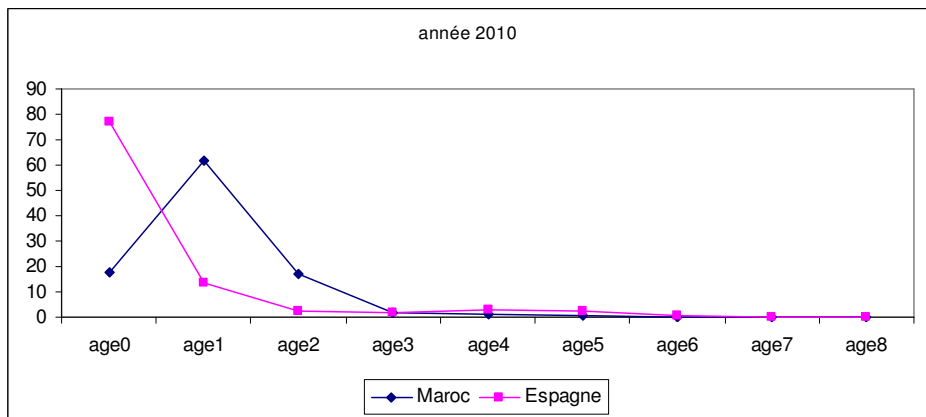
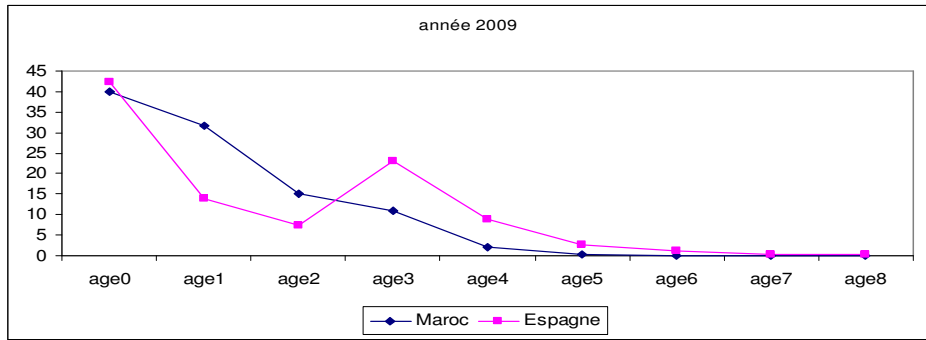
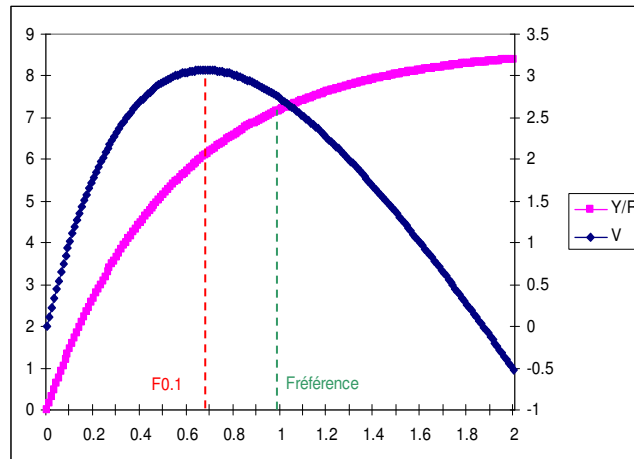


Figure 8, 9 and 10. Sardine catches by age in 2009, 2010 and 2011 (GSA01 and GSA03).

### 5.3. Results of the Joint stock assessment (*Sardina pilchardus*)

The results of the joint analysis showed that the fishing effort is mainly exercised on adult individuals (age 3 and age 4).





**Figure 11.** Sardine Yield per Recruit analysis in the Alboran Sea (GSAs 01 and 03).

The results of the yield per recruit analysis indicated that the stock of sardine in the Alboran Sea (GSAs 01 and 03) is overexploited. ( $F_{0.1} = 0.68$ )

The average exploitation rate is estimated to 0.43 (very close to the threshold  $F/Z = 0.4$  suggested as biological reference point for small pelagics (Patterson, 1992)). The exploitation rate can be considered moderate.

#### **5.4. Management advice and recommendations concerning *Sardina pilchardus***

The assessment suggestions should be taken as preliminary and cautionary, as this VIT assessment for this area is based on an average of short time series of data and between two countries.

This fishery is considered as overexploited. We advise to reduce the level of the fishing mortality by 30%. This can be obtained by reducing the fishing effort.

#### **5.5. Assessment's Conclusions:**

This assessment suggestions should be taken as preliminary and cautionary, as this VIT assessment for this area is based on an average of short time series of data and between two countries. The result of the joint analysis showed that the fishing effort is mainly exercised on adult individuals (age 3 and age 4). The analysis of the yield per recruit indicate that the stock of sardine in the alboran Sea (GSA01 and GSA03) is overexploited. ( $F_{0.1} = 0.68$ )

The average exploitation rate is estimated to 0.43 (very close to the threshold  $F/Z = 0.4$  suggested as biological reference point for small pelagics (Patterson, 1992)). The exploitation rate can be considered moderate.

In order to incorporate Algerians data in the assessment of this stock, the sizes at landings ports and biological sample system should be strengthened to equivalent levels to those made in Spain and Morocco.

The WG considered with interest the new information from Moroccan experts on artisanal purse seine fisheries targeting sardine that could represent up to 20% of the landings of the species. Incorporating data from these fisheries is considered necessary to improve the knowledge of the exploitation of the resource and therefore assessment analyzes.

Regarding biological sampling conducted by the INRH in Morocco, the WG considers should be done annually to update the variables used in the analysis.

The analysis of the landings by age groups from Spain and Morocco show their maximum values in the series in question, consistent with a high frequency of occurrence in the 0 age group. This observation is consistent with the biology and exploitation of these resources.

Preliminary data on the spatial distribution of different size groups indicate, in the case of Spain, a possible migration of juvenile stages from Almeria and Malaga bays towards adults fishing areas located west of both areas.

The WG agreed to advance the process of standardization of the acoustic assessment methodology based on MEDIAS protocol. In the case of Algeria and Morocco WG receive a comparative table of the methods used in each of the two countries and stockings.

CopeMed reported their willingness to continue to support the participation of experts of WG meetings in campaigns and means for facilitating the process of standardization.

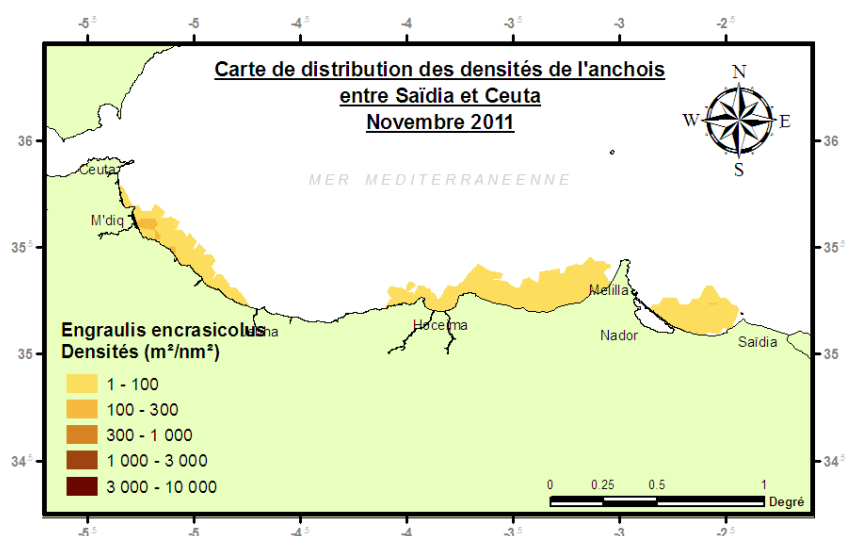
## 6. *Engraulis encrasicolus*

### 6.1. National information on *Engraulis encrasicolus*

#### 6.1.1. Moroccan data (*Engraulis encrasicolus*)

Mr. Omar Kada, (INRH, Nador) summarized the Anchovy available information on GSA 03: purse seiners are distributed in all ports in the region, representing approximately 20% of the active fleet. The three main ports concentrating the fleet are Béni Nsar (Nador), Al Hoceima and M'diq.

Concentrations of Anchovy are observed in the whole GSA 03. This species is found in high densities in the east of Ras Kabdana and around the islands Jaafariennes.



**Figure 12.** *Engraulis encrasicolus* density in Morocco (Acoumed, INRH survey. November 2011).

According to the GFCM fleet classification, there are 2 fleet categories and 4 local operational units fishing for sardine and Anchovy in the Moroccan Mediterranean:

### Category 1: The purse seiners

These fishing units are composed by 3 boats (the main and two auxiliary): the main vessel with the gear and the skipper, an auxiliary boat with lights (lamparo) and the small auxiliary boat without engine. The main boat is equipped with hydraulic equipment to facilitate operations on board; the lamparo is equipped with lamps that are used to attract the schools of fish at night and the small rowing boat helps maintaining the proper form of the seine during the fishing operation. Each fishing unit employs between 9 and 40 fishermen (Zahri, 2004).

The fishing gear used by the fleet is a purse seine net composed of a grid of 9 and / or 11 mm side. According to the GT of the vessel and/or the depth of the fishing area, the dimensions of the device differ: its length varies between 300 m and 650 m, and the depth between 50 m and 160 m.

Following the GFCM classification, this category includes two local operational units.

3. Purse Seiners with length between 6 and 12 m (segment G),
4. Purse Seiners over 12 m in length (segment H).

In addition to the sardine and Anchovy, purse seiners target other species of commercial interest as *Trachurus spp.*, bug, mackerel, small tuna and sardine.

### Category 2: Small scale purse seiners

This category can be considered as an overlapping between the segment C of "motorized polyvalent boats from 6 to 12 meters long" and the B segment, "polyvalent motorized boats under 6 meters long ". The fishing unit is generally composed of two boats: the main vessel and an auxiliary boat with lights (lamparo). The principal boat (Photo 1 and 2) is not fully equipped as it only has a mechanical winch. The lamparo (Photo 3) is equipped with lamps used to attract the school of fish at night. Sometimes the fishing unit includes a third boat that maintains the purse seine. Each unit includes a fishing crew of 8 people in general.

The fishing gear used by the fleet is a purse seine net composed of a grid of 9 and / or 11 mm side. The length of the seine is over 200 to 300 m, and its depth is about 40 m. The hauling operations are done by hand (Photo 4). The species targeted by this fleet is mainly sardine. Other species are *Trachurus spp.*, *Auxis spp.*, bug, Atlantic bonito and Anchovy. Those units can use hand lines targeting bluefin tuna.

The level of capture of these units is around 4.000 tons per year which represents 22.5% of purse seine catches in Moroccan Mediterranean (APA, 2011).

**Photo 1** (Camiñas)



**Photo 2** (Zahri)



Photo 3 (Zahri)



Photo 4 (Kada)



### 6.1.2. Spanish data (*Engraulis encrasicolus*)

Ms. Ana Giráldez (IEO, Málaga) presented a summary of the Spanish fishery essentially developed in GSA 01. Although historically Spanish purse seiners fished in the south of the Alboran Sea under different agreements, currently purse seiners are not able to fish in GSA 02 and GSA 03, by different reasons: distance from the base ports, economic restraints and regulatory or abundance related matters. The main species in the Spanish purse seine fishery in the Alboran Sea GSA 01 are sardine (*Sardina pilchardus*) and Anchovy.

Anchovy has higher prices than the ones of sardine, but it was not always like that. Until the late 1960s the sardine was the most expensive species. The same fleet targets sardine or Anchovy in the GSA 01, according the season and abundance. Catches are highly variable.

Both the catches and the fleets that are described below correspond to the Spanish South-Mediterranean area that represents 95 % of the whole GSA01 landings.

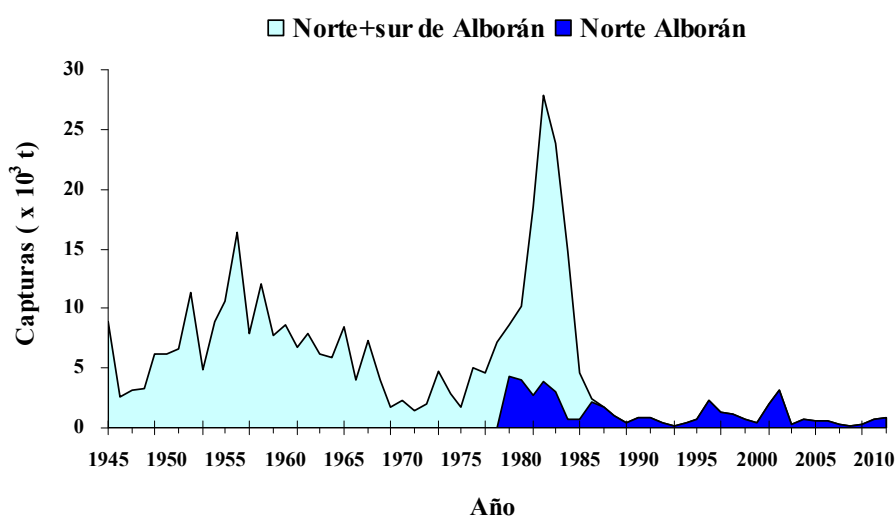
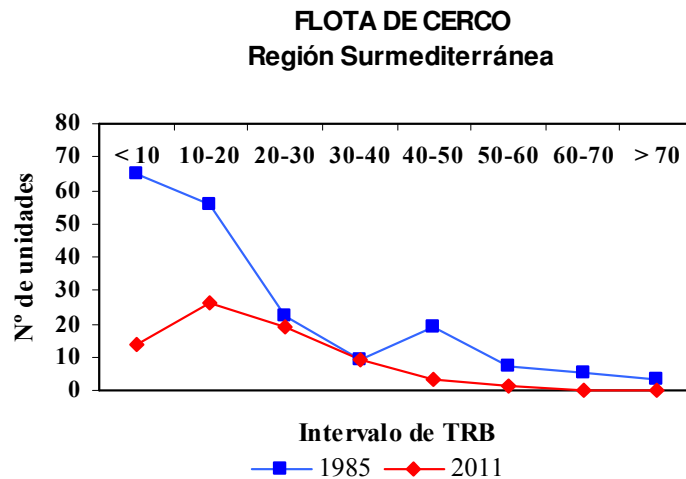


Figure 13. Anchovy landings in Spain (1945-2010).

The purse seine fleet has decreased from 230 vessels in 1980 to 72 in 2011, representing a reduction of 69%. This fleet is made up of small units: 82% are less than 30 GT, with an

average of 20.2 GT and an average power of 153 HP. Only 12.5% of the units have length of less than 12 meters. This fleet corresponds to the GFCM categories G (Purse seine 6-12 m) and H (Purse seine 12-24 m).

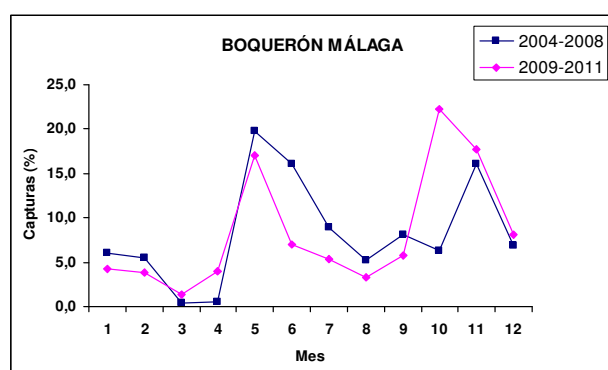
The most important ports in number of units and landings have been Almería, Adra and Málaga. Currently the port of Málaga is in recession and the port of Vélez Málaga is in expansion.



**Figure 14.** Spanish purse seine fleet.

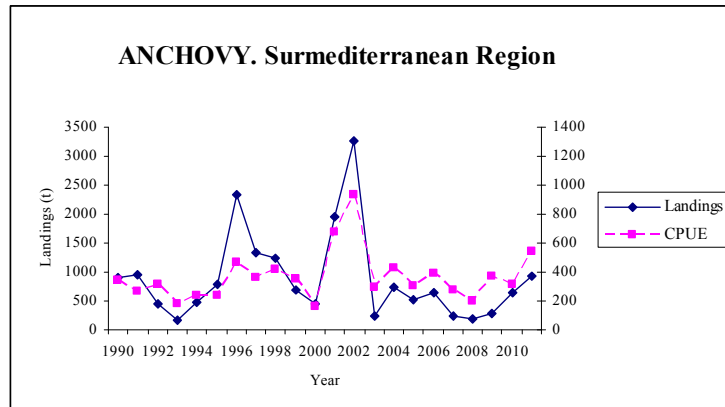
The Anchovy is fished mainly in the Bay of Málaga (representing 80% of all Anchovy of the South-Mediterranean area). The Bay of Málaga is the only place in the Andalusian Mediterranean where Anchovy is fishing all year round.

Seasonality in the Anchovy catch has changed. Between 1985 and 1998 catches were mainly in autumn, during the recruitment season, capturing mainly juveniles. Since 2004-2008, there are two periods, a peak in summer (reproductors catches) and one in autumn. Until 2009 there was an annually closed season in March and April.



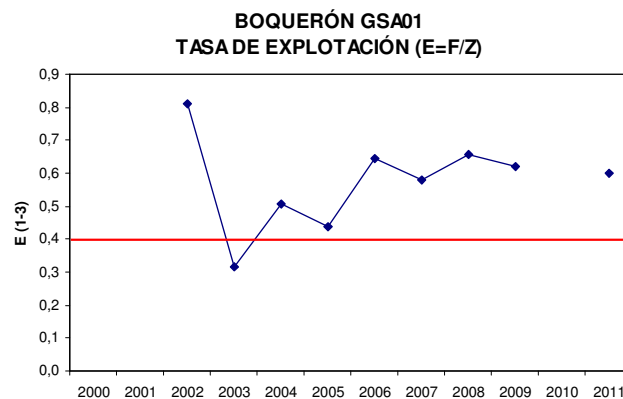
**Figure 15.** Seasonality in the Anchovy landed in Málaga.

The Spanish fleet has been focused mainly on class 0 individuals, so that high catches are correlated with periods of good recruitment.



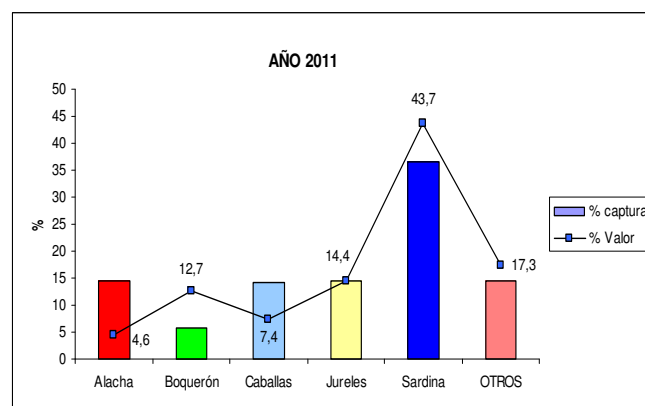
**Figure 16.** Anchovy landings and CPUE in the Spanish South-Mediterranean area.

Although the stock of Anchovy in GSA 01 has been assessed by the IEO and presented to the SCSA WG on small pelagic, in the Spanish South-Mediterranean area is considered overexploited. However, it should be taken into account that the exploitation rate (E) is very sensitive to the values of natural mortality (M) concerned. Therefore, the SG suggested considering these benchmarks with caution. The exploitation rate in 2011 corresponds to the assessment carried out within the Scientific, Technical and Economic Committee for Fisheries (STECF).



**Figure 17.** Anchovy exploitation rate (E) in the Spanish South-Mediterranean area.

Although sardine is the most abundant species, Anchovy is the species with the highest value in 2011 (12.7%). However sardine is also an important support of the fishery.



**Figure 18.** Anchovy and other species purse seine landings and value in the Spanish South-Mediterranean area (2011).

### 6.1.3. Algerian data (*Engraulis encrasicolus*)

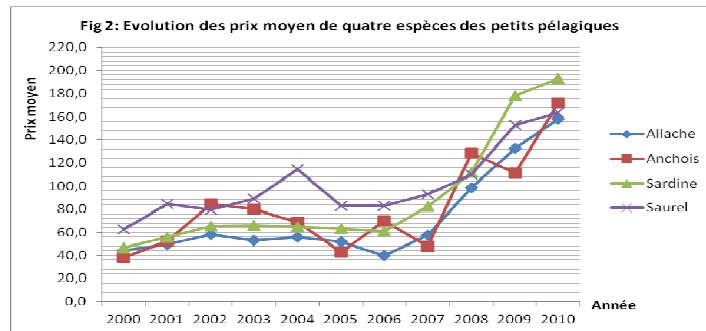
Considering the whole Algerian coast, small pelagic landings represent around 80% of the total national captures. Main landing ports in the Alboran Sea (a small part of GSA 04) are Ghazaouet, Béni-Saf and Bouzedjar.

Fishing gears targeting small pelagic are in general purse seine and trawl. The trawl was introduced in the early 90s due to the progress in trawl design. According to a survey (CNRDPA, August 2012), 80% of the fleet in Ghazaouet is equipped with trawl, meanwhile in the port of Beni Saf, 12 vessels of a total of 85, are using trawl. This trawl requires a power greater than 430 HP. The different fleet units targeting small pelagic in Algeria are:

Fishing Gear Class	Fleet Segment	Capacity (GT)	Engine power (HP)
Purse seine	G (6-12 m)	14	152
Purse seine	H (12-24 m)	33	308
Pelagic trawler	J (12-24 m)	63	518
Pelagic trawler	J (>24 m)	114	870

**Table 4.** Algerian Operational units.

The evolution of the mean landing price by target species show the contribution of Anchovy and the increasing values of this species from 2007:



**Figure 19.** Small pelagic prices evolutions in Algeria, 2010.

According to CNRDPA experts, Anchovy is present at landings in 2012 (January-August) in the ports of Beni-Saf and Ghazouet. Most of the captures during the aforementioned period and ports were surveyed with purse seine. The landing data available for the two species Sardine and Anchovy showed a negative trending in the period 2000-2010. Sardine is the most abundant in the major Algerian ports.



**Figure 20.** Sardine and Anchovy landings in Algeria during the period 2000-2010.

The Algerian effort data come from a 2004 survey conducted by the CNRDPA. A new survey was initiated in 2012 and the results (fishing effort, landings estimate, employment, investment, fleet characteristics, cost and charges) will be available in early 2013. Landings are recorded by MPRH collectors in all sites with infrastructure (port, guard, hall, etc.).

### 6.1. Description of the fleets fishing in GSA 01, 03 and 04

The description of the small pelagic fleet in the Alboran Sea was updated and synthesized in table 5 for Algeria, Morocco and Spain. Considering that the Local Operational Units (LOU) in the three countries are targeting sardine and Anchovy, it was agreed to present a common table for the description of the small pelagic fleet of the Alboran Sea (Table 5).

Local Operational Units by country	N°	Country	GSA	Fleet Segment	Fishing Gear Class	Group of Target Species	N° of boats	Capacity (GT)	Engine power (HP)	Boat size (m)	Catch (T)	Effort (Day/year)	crew
SPAIN	1	Spain	1	6-12 m	purse seine	Small pelagic	12	5,19	65,42	9,97		717	
	2	Spain	1	12-24 m	purse seine	Small pelagic	88	26,7	189,4	17,1		7427	
MOROCCO	3	Morocco	3	6-12 m	purse seine	Small pelagic	9	8,84	105,56		189	264	12
	4	Morocco	3	6-12 m	SS purse seine	Small pelagic	132	3,75	31,39				10
	5	Morocco	3	12-24 m	purse seine	Small pelagic	109	49,06	330,7		12991	7739	31
	6	Morocco	3	>24 m	purse seine	Small pelagic	4	86	525		492	270	43
ALGERIA	8	Algeria	4	6-12 m	purse seine	Small pelagic	6	14	152	9,5	4968,3	270	10
	9	Algeria	4	12-24 m	purse seine	Small pelagic	119	32,77	308,84	15,69		1444	20
	10	Algeria	4	12-24 m	Pelagic trawler	Small pelagic	38	63,4	518,0	20,7	1382	1332	10
	11	Algeria	4	>24 m	Pelagic trawler	Small pelagic	7	114	870	26		756	10

**Table 5.** The small pelagic fleet segments operating in the Alboran Sea (CopeMed II, 2012).

## 7. Advances in the joint assessment of Anchovy stock

The Study Group was aware of the lack of biological and fisheries data presented to the meeting, mainly from Morocco and Algeria, and of the impossibility to conduct a general analysis of the state of the stock of Anchovy in the GSAs 01, 03 and 04.

Nevertheless, the SG considered that the level of information referred to the abundance of the stocks in GSA 01 obtained by the IEO (where the information is systematically obtained) and the existing information of landings of the Spanish fleet, the Spanish data could be considered for a first approach to the state of the Anchovy stock in the Alboran Sea. Considering this approach, it could be stated that current landings of Anchovy in the Alboran region are at a very low level relative to the available historical landings of the Spanish fleet in GSA 01.

## 8. Results and conclusions regarding social and economical analysis of the small pelagic fisheries

The group welcomes the CopeMed initiative of having extended to the analysis of the socioeconomic aspects, the Working Group on small pelagic stocks in the Alboran Sea, by integrating socio-economists experts, and encourage the participation of experts from all the countries concerned.

Firstable, the group actualized the description of the small pelagic fleet in the Alboran sea. (CF Table 1) and thereafter, the group identified the main indicators aiming at describing the Alboran small pelagic fishery. The following indicators were retained :

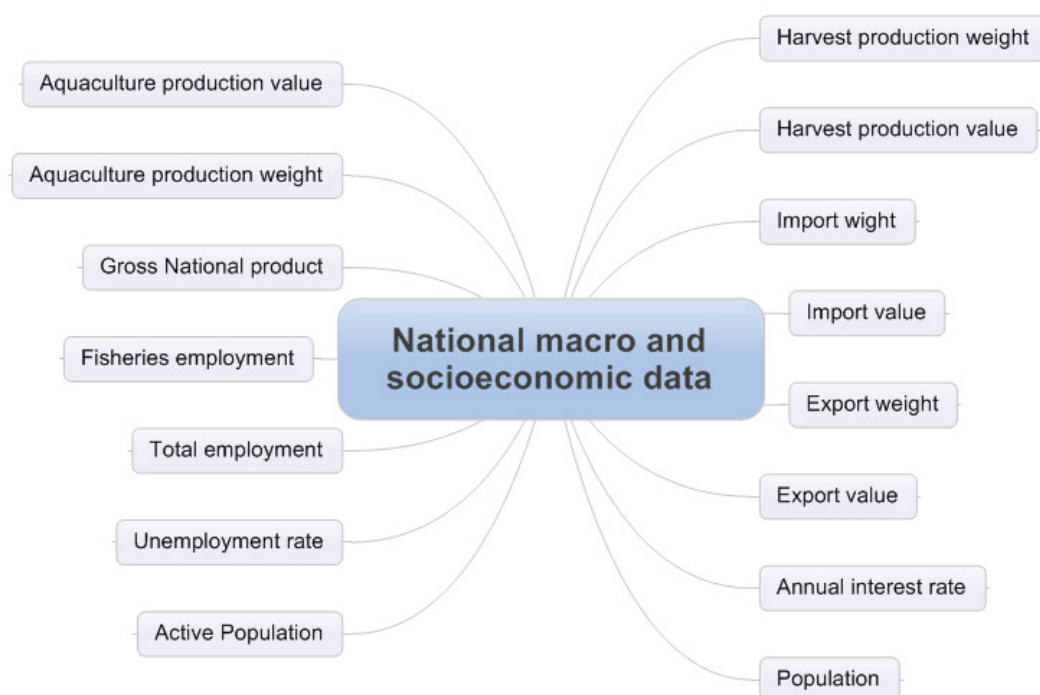


- ✓ Fleet :
  - Number
  - Investment (\$)
  - Effort (Day/year)
  
- ✓ Catch :
  - Target species (T)
  - Other species (T)
  
- ✓ Value :
  - Target species (\$)
  - Other species (\$)
  
- ✓ Employment :
  - Direct
  - Indirect

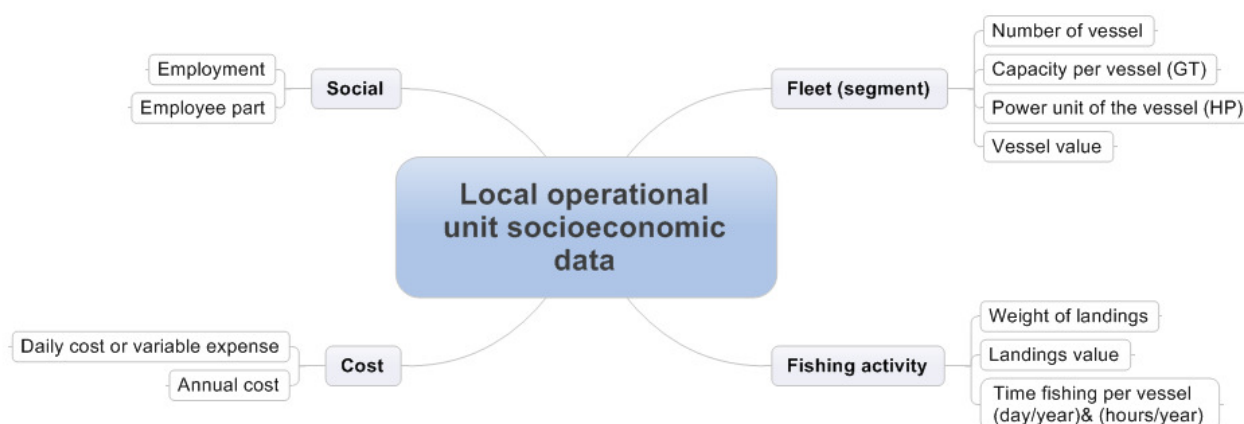
A table with all this indicators per country and LOU was fulfilled with the most recent data available. (Annex X : Socio economic indicators per LOU in the Alboran sea)

It was agreed that this exercise could be carried out for significant years, which would allow to analyze the evolution and trend of the indicators over the period selected. Unfortunately, the datas for precedent years were not available to realize this exercise.

Finally the group revised by countries, all the basis data needed at national scale (CF Figure 21 ) and at the LOU scale (Cf figure 22), to harmonize definitions, identify data gaps and recommend the improvement of existing data collection systems. (Cf Annexe X Results of the analyses of the available datas and monitoring system concerning sosio economic data)



**Figure 21:** National datas



**Figure 22:** Local operational unit's datas

### Regarding the monitoring of fishing activity, and socioeconomic Data

**Algeria:** Although the current implementation of a new pilot fisheries statistical system with the support of the FAO<sup>3</sup>, the monitoring of fishing activity does not take place in a regular and systematic way in Algeria. All effort Data come from a 2004 survey conducted by the CNRDPA. A new survey was initiated in 2012. The results will be available early 2013. (Fishing effort, landings estimate (volume and value), employment, investment, fleet characteristics, cost and charges). The landings are recorded by MPRH collectors present in all sites with infrastructure (port, guard, hall ...)

The group recommends that a system for monitoring fishing activity (effort and landings) should be implemented in three main ports of Alboran

**Morocco:** For small scale fisheries, the group recommended that this class should be taken into account in the actual system of fishing activity monitoring. For Socio economic aspects, specific surveys are necessary.

**Spain:** The monitoring system for fisheries data collection and biological data is already functioning for small pelagic in GSA 01. Socio-economic data are surveyed by the regional authority (Junta de Andalucía) and the national government statistics fishery service in Madrid.

### On the assessment of fisheries

In the context of the ecosystem approach to fisheries sardine and European pilchard in the Alboran Sea, the Group considers that bioeconomic modeling is a tool for decision support suitable for the analysis and evaluation of and fishery management measures.

<sup>3</sup> FAO TCP/ALG/3301 Project « Assistance pour la mise en place d'un Observatoire Socio-Économique et Statistique National des Pêches » relating to the statistical monitoring of fisheries in Algeria.

Therefore, socioeconomists experts recommend the continuation of the work initiated (Data preparation and validation of the methodology) in order to:

- Complete the biological analyzes of the resource with socio economic analysis.
- Complete the scientific recommendations on the state of the stock, with recommendations on economic and social sustainability of fisheries.
- Perform different scenarios to analyze the socio-economic impacts of recommendations aimed at reducing fishing mortality of the affected resources.

This preliminary work led to the assessment of the available Data and the monitoring systems in place in the country and make recommendations to address the gaps identified.

This initiative will strengthen the ongoing work at the GFCM and particularly those concerning Task 1.

Considering the results obtained and the methodology (work Franquesa, Malouli, Alarcon., 2001), its adaptation to the case of the small pelagic fishery in the Alboran Sea, the Group recommends that the consultation process and results obtained can be completed and presented during the next meeting of the subcommittee on economic and social sciences GFCM (February 2013)

## **9. General recommendations of the Study group**

Fisheries statistics and biological monitored information of the Anchovy exploited by national fisheries in the Alboran Sea are essential for the understanding of the situation and trends of this species in GSAs 01, 02, 03 and 04. Improvement of the national monitoring systems is highly recommended by the CopeMed SG on Anchovy.

The level of information provided to the SG was not the appropriate to carry out a joint assessment of the *E. encrasicolus* stock in the SG meeting. In order to carry out a joint assessment next year, the SG recommended a bigger effort in Algeria and Morocco to facilitate the data and existing information of the national fisheries targeting Anchovy to the experts of the CopeMed SG.

In order to explore the use of Algerian data in the next SG meeting, the Anchovy fishery should be regularly sampled and the whole monitoring system should be strengthened especially to obtain size distributions at landing and biological parameters. This monitoring system should take information and biological samples from each of the operational units targeting this species (purse seine and trawl).

The SG agreed to advance the process of standardization of the acoustic assessment methodology based on the MEDIAS protocol. Algeria and Morocco were endorsed to prepare a table comparing the MEDIAS protocol with the methods used in each of the two countries.

The SG recommended that the consultation process on socio-economic indicators, started by CopeMed II with the three countries, and the results obtained should be completed and prepared by a socioeconomic expert and CopeMed to present a document to the next meeting of the SAC - Subcommittee on Economy and Social Sciences (February 2013).

The SG requested the support of CopeMed to continue with the task assigned to by the CopeMed Coordination Committee CCC). In relation with this request, CopeMed expressed its

willingness to continue supporting the organization of the Anchovy SG meeting and the participation of experts of the SG at international meetings and in campaigns. As well, by facilitating the process of standardization of protocols, methodologies and analysis, according to the availability of funds and the extension of the project and the mandate of the CCC.

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## **Annex 2: Agenda of the meeting.**

### **Day 1**

1. Opening of the meeting and organizational issues.
2. Election of Chairperson and the reporter and adoption of the Agenda
3. Objectives of the meeting and Background information  
*The background, objectives and Terms of References (TORs) and expected outputs of the meeting will be introduced. The recommendations and the main achievements of the last WG will be reviewed.*

### **Session 1. Sardine**

4. Sardine in the Alboran Sea. New information including socio-economic data
5. Updating the 2011 assessment of sardine stock between Spain and Morocco. New available data
6. Practical session (stock assessment using joint data) to update

### **Day 2**

### **Session 2. Anchovy**

7. Overview of the available data on the Anchovy of the Alboran Sea, including fishery data (by national experts), for progressing in the definition of this stock.  
*Based on documents prepared by the national experts the available information and knowledge on the Anchovy fisheries in the country and particularly:*
  - *General description of the fisheries targeting anchovy (fleets, fishing gears, fishing grounds, ports, landing, fishing effort, transformation of captures, commercialization)*
  - *Fisheries dynamics, fishing strategies.*
  - *Biological and ecological characteristics (e.g. age-length key, length-weight relationship, growth equation, maturity at age, size at first maturity).*
  - *Movements across the regions: eggs, larvae, recruits and adults*
  - *Data collection systems:*
    - *Fishery Statistics available, e.g. effort and catches*
    - *Biological sampling of commercial catches*
  - *Experimental Surveys, e.g. acoustic and DEPM*
  - *Stock assessment (methods used and results), gaps, ...)*
  - *Socio-economic available data*

8. Practical session: Anchovy joint stock assessment using joint data, first attempt

### **Day 3**

8. Practical session: Anchovy stock assessment (cont.)

### **Session 3. Methodologies**

9. Review of methodologies and agreement on appropriate methods and period of year to review the campaigns of direct methods, depending on the target species of the region
10. Standardization of protocols for biological sampling and statistics, including socio-economic issues, between countries for sardine and anchovy

### **Session 4. Discussion, Conclusions and Recommendations**

11. The scientific network of experts and specialist on small pelagic species in the CopeMed area: situation.
13. Discussion of the results and possible follow up
14. Other issues
15. Conclusions and recommendations of the WG



## Annex 3: Results of the analyses of the available datas and monitoring system concerning social and economic aspects.

### National Data

National Data:

- Spain : Complete the missing values
- Morocco : Ok
- Algeria : ok

Regional Data:

- Spain : Complete the missing values
- Morocco : Ok
- Algeria : Complete the missing values for the Alboran sea

**Add a new data :**

Minimum salary : (SMIG, SMAG)

### Local operational units

**Données de base**

**Fleet**

Vessel number : Only consider the active fleet

- Spain : OK
- Morocco : Revision of the classification for the *petits metiers* class
- Algeria : Revision of the active fleet

Capacity (GT) : OK

Power (HP) : OK

Vessel value (VB) : \$ : Define the estimation methodology

Investment (Vessel, gear and material et licence ...) \$ : Define the estimation methodology

**Fishing activity**

Effort : Include systematically the positive and negative fishing time (operation) when calculating effort

Day/year

- Spain : Verify and and precise the estimation methodology
- Morocco : precise the estimation methodology for the coastal fleet (year 2011)
- Algeria : precise the estimation methodology

Hour/day (TJ, TH) :

- Spain : ?
- Morocco : Data available, to be actualized
- Algeria : Information to be collected

**Landing weight:** Include targeted species (sardina and anchovy) and the weight/other species landed

- Spain : ok
- Morocco : ok

- Algeria : The landings are presented by *métier* and concern only the sardina and anchovy. The landings of the other species are only available by *métier*.

**The average price of species:** Average of the first sale price during the year in \$ (exchange rate of the year corresponding to the data)

- Spain : ok
- Morocco : ok
- Algeria : The prices are presented by *métier* and concern only the sardina and anchovy. The prices of the other species are only available by *métier*.

## Costs (\$)

Daily cost or variable expense

- Common costs (fuel lubricants, Food, Ice, landings Taxes, Fees agents, Various small material ...)
- Other variable costs (supported by the owner): Tax income, wages and shares...
  - Spain : To complete and precise the methodology
  - Morocco : Available (to be confirmed)
  - Algeria : unavailable. Surveys to be realized (included in the 2012 survey)

## Annual cost

Amortization (boat, gear, engine, navigation equipment) costs fishing rights, salaries (mechanic, watchman ...)

- Spain : to be completed
- Morocco : Available (to be confirmed)
- Algeria : unavailable. Surveys to be realized (included in the 2012 survey)

## Social

Direct employment

- Spain : to be completed
- Morocco : ok
- Algeria : ok. To be presented by segment

Indirect employment: Define the methodology

Employee part

- Spain : to be completed
- Morocco : ok
- Algeria : ok. To be presented by segment

**Annex 4: Socio economic indicators per LOU in the Alboran Sea.**

Pays	longueur segment	Engin	Nbre bateaux	Effort (j/an)	Production (Tonnes/an)					prix moyen (\$)					va leur (\$)					Emplois directs
					S.P	E.e	T.t	autre	total	S.P	Ee	T.t	autre	total	S.P	E.e	T.t	autre	total	
Maroc	>24 m	senne	4	264	105	3	18	63	189	0,84	2,57	-	0,64	0,82	88.440	7.707	-	40.177	155.194	110
	12-24 m	senne	109	7.739	6070	253	3151	3517	12991	1,20	1,69	-	0,84	1,11	7.299.732	428.665	-	2.948.891	14.376.173	3325
	6-12 m	senne	9	270	110	3	83	296	492	0,94	2,94	-	0,80	1,03	102.886	8.819	-	237.786	505.999	170
	<6 m	senne	132																	1360

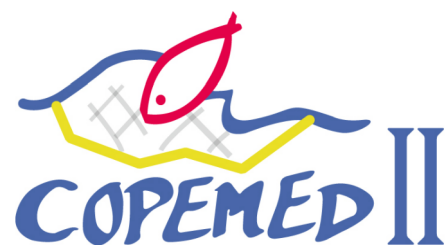
Taux de chage utilisé US\$/MAD (2010) = 8,2525 ; sera actualisé selon 2011

Pays	longueur segment	Engin	Nbre bateaux	Effort (j/an)	Production (Tonnes/an)					prix moyen (\$)					va leur (\$)					Emplois directs
					S.P	E.e	T.t	autre	total	S.P	Ee	T.t	autre	total	S.P	E.e	T.t	autre	total	
Espagne	12-24 m	senne	88	7.427	5.702	883	1.470	4.751	12.806	1,48	2,78	1,08			8.433.919	2.455.824	1.582.282	3.460.808	15.932.833	
	6-12 m	senne	12	717	364	39	139	256	798	1,41	2,45	1,24			512.771	96.564	172.569	550.576	1.332.480	

Effort sardine

Pays	longueur segment	Engin	Nbre bateaux	Effort (j/an)	Production (Tonnes/an)					prix moyen (\$)					va leur (\$)					Emplois directs
					S.P	E.e	T.t	autre	total	S.P	Ee	T.t	autre	total	sardine	Anchois	chinchard	autre	Total	
Algérie	6-12 m	senne	6	270	4.810	159	-	5.469	10.438	2,59	2,11	0	2,10		12.457.900	334.435		11.485.698	24.278.033	60
	12-24 m	senne	119	1.444																2380
	12-24 m	chalut	38	1.332	1.297	86	-	4.160	5.542	2,59	2,11	0	2,10		3.359.230	180.616		8.735.008	12.274.854	380
	>24 m	chalut	7	756																70

Pays	longueur segment	Engin	Nbre bateaux	Effort (j/an)	Production (Tonnes/an)					prix moyen (\$)					va leur (\$)					Emplois directs
					S.P	E.e	T.t	autre	total	S.P	Ee	T.t	autre	total	S.P	E.e	T.t	autre	total	
Alboran	>24 m																			
	12-24 m																			
	6-12 m																			
	<6 m																			
TOTAL			518	19.949	18.458	1.425	4.861	18.512	43.256						32.254.879	3.512.629	1.754.851	27.458.944	68.855.566	7.795



Coordination to Support Fisheries Management in  
the Western and Central Mediterranean

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