SAC GFCM
Sub-Committee on Stock Assessment

Date* | 24 | October | 2011 | **Code*** | PIL0611Gar

Authors*

Garcia, E.*, Bellido, J.M., Torres, P., Quintanilla, L., Giráldez, A., Alemany, F., Iglesias, M., Gonzalez, M.

Affiliation*

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Species Scientific name*

1 *Sardina pilchardus - PIL*
Source: GFCM Priority Species

2
Source: -

3
Source: -

Geographical area*

Western Mediterranean (FAO Subarea 37.1.)

Geographical Sub-Area (GSA)*

06 - Northern Spain

Combination of GSAs 1
2
3

Code: PIL0611Gar

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Species Scientific name*	Sardina pilchardus - PIL	Species common name*	Sardine, Sardina

Data Source

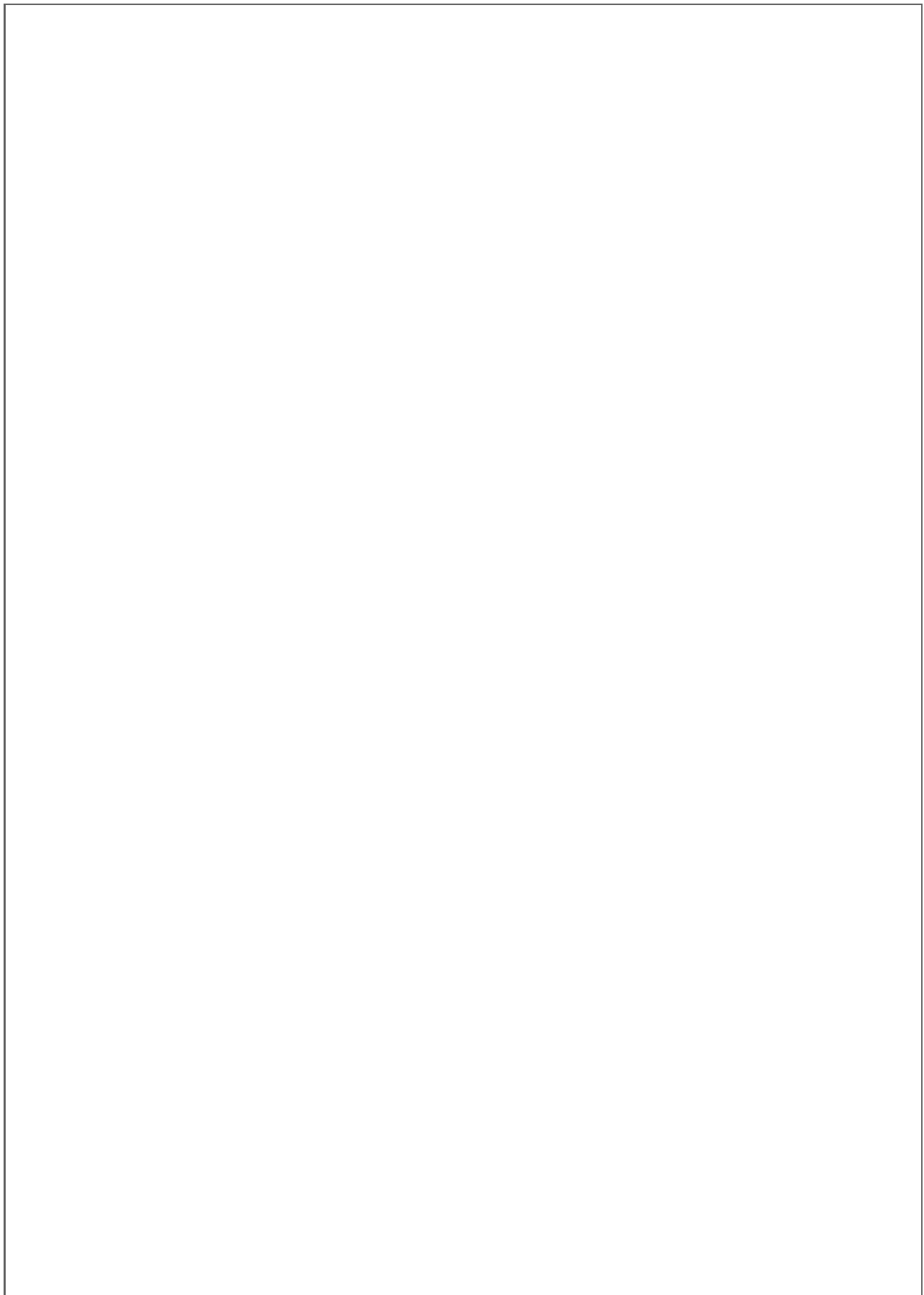| GSA*	06 - Northern Spain	Period of time*	1994-2010

Description of the analysis

Type of data*	Landings, Length and biological samplings. Tuning from Purse seiners	Data source*	Official Statistics, IEO Sampling Network, Acoustic Survey
Method of assessment*	XSA - Extended Survivor Analysis	Software used*	VPA Suite. Lowestoft. 1995

Sheets filled out

B	P1	P2a	P2b	G	A1	A2	A3	Y	Other	D	Z	C
1	1	1	1	---	1	1	1	---	1	1	1	1

Comments, bibliography, etc.

Fishery assessment by VPA methods of the Spanish Sardine Stock GSA06 is reported.
VPA Lowestsoft suite was used and XSA was the asessment method.
A separable XSA was also run as a exploratory analysis for the stock.
Stochastic short term projections were also produced.

Comments, bibliography, etc.

Code: PIL0611Gar

Biology

Somatic magnitude measured (LH, LC, etc)*			Total Length		Units*	1/2 centimeter
Sex	Fem	Mal	Both	Unsexed		
Maximum size observed			23		Reproduction season	Oct-Mar
Size at first maturity			13.3		Reproduction areas	All the coast
Recruitment size			8.5		Nursery areas	Bays

Parameters used (state units and information sources)

		Units	Sex			
			female	male	both	unsexed
Growth model	L∞	cm			22	
	K	year-1			0.4586	
	t0	year			-1.4157	
	Data source					
Length weight relationship	a				0.0046	
	b				3.2058	

M		M vector (see comments)

sex ratio (mal/fem)	44/56

Comments

An individual ALK during the period 2003-2010 was used (the one for 2009 was missing son it was used ALK from 2008 instead)

Biological sampling 2003-2010 for Maturity at age and Weight-Length relationships.

Natural Mortality value (M) - Following the recomendation from the workshop on Mediterranean Stock Assessment Standardization (SG-ECA/RST/MED 09-01), a vector (declining value of M with age) instead of a constant value was used.
The vector was estimated using the ProdBiom method (Abella et al, 1997) based on Caddy (1991).

Age M

0 1.20
1 0.46
2 0.34
3 0.29
4 0.26
5+ 0.25

Comments

Code: PIL0611Gar

Data source*	Official Statistics, IEO Sampling Network, Acoustic Survey	Year (s)*	2000-2010
Data aggregation (by year, average figures between years, etc.)*	By year 2000-2010		

Fleet and catches (please state units)

	Country	GSA	Fleet Segment	Fishing Gear Class	Group of Target Species	Species
Operational Unit 1*	ESP	06	G - Purse Seine (6-12 metres)	02 - Seine Nets	31 - Small gregarious pelagic	PIL
Operational Unit 2	ESP	06	H - Purse Seine (12-24 metres)	02 - Seine Nets	31 - Small gregarious pelagic	PIL
Operational Unit 3	ESP	06	F - Trawl (>24 metres)	02 - Seine Nets	31 - Small gregarious pelagic	PIL
Operational Unit 4						
Operational Unit 5						

Operational Units*	Fleet (n° of boats)*	Kilos or Tons	Catch (species assessed)	Other species caught	Discards (species assessed)	Discards (other species caught)	Effort units
ESP 06 G 02 31 - PIL	4	Tons	7475				
ESP 06 H 02 31 - PIL	108	Tons					
ESP 06 F 02 31 - PIL	18	Tons					
Total	130		7475				

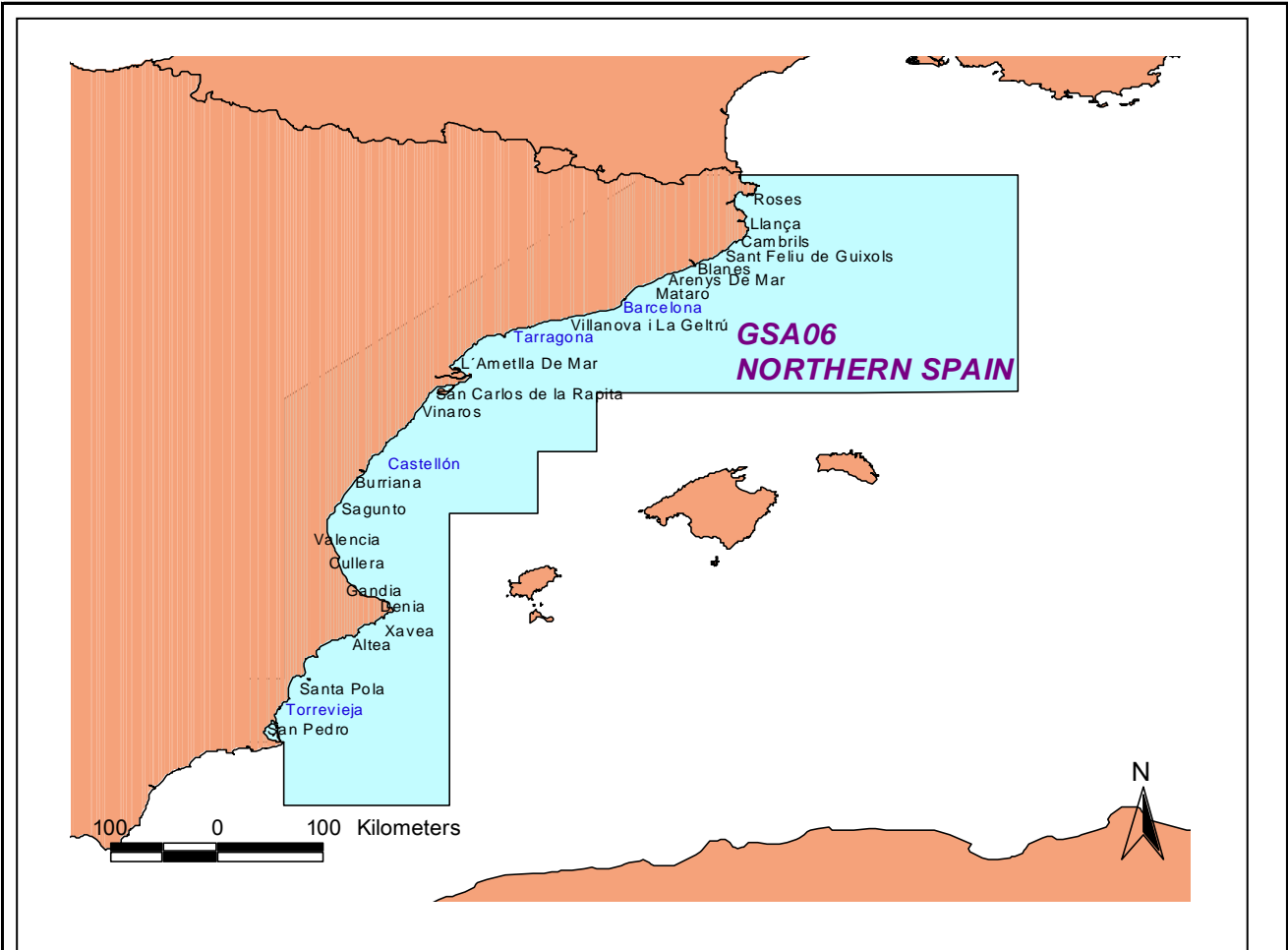| Legal minimum size	11 cm TL

Comments

The catch (landings) is not split by Fleet segments. It comprises 7475 Tons in 2010 for the three Operational Units. Although landings are not still separated by Fleet segments we can provide a segmentation of the pelagic fleet in GSA06, with number of boats for every fleet segment:

The Fleet Segment Purse Seine (6-12 metres) comprises 4 boats in 2010
The Fleet Segment Purse Seine (12-24 metres) comprises 108 boats in 2010
The Fleet Segment Purse Seine (greater than 24 metres) comprises 18 boats in 2010

Then, and because that landing aggregation, we prefer to fill pages P2a and P2b considering the three fleet segments as an unique pelagic fleet.

Landing Ports are shown in the attached Figure. Sampling ports are highlighted in blue.Tuning data from acoustic survey ECOMED (2003-2009) and MEDIAS (2009-2010) were used.

Comments

Roses
Llança
Cambrils
Sant Feliu de Guixols
Blanes
Arenys De Mar
Mataro
Barcelona
Villanova i La Geltrú
Tarragona
GSA06
NORTHERN SPAIN
L´Ametlla De Mar
San Carlos de la Rapita
Vinaros

Castellón
Burriana
Sagunto
Valencia
Cullera
Gandia
Denia
Xavea
Altea

Santa Pola
Torrevieja
San Pedro

100   0   100   Kilometers

N

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Assessment form

Sheet P2a
Fishery by Operational Unit

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Data source*	Official Statistics, IEO Sampling Network	OpUnit 1*	ESP 06 G 02 31 - PIL

Time series

Year*	2002	2003	2004	2005	2006	2007
Catch	14338	8538	8097	6216	3096	2570
Minimum size	6	6	7.5	7.5	10	7
Average size Lc	13.1	13.4	13.2	14.3	13.4	14.6
Maximum size	17.5	17.5	17	18	18.5	18
Fleet	157	161	155	147	139	132

Year	2008	2009	2010			
Catch	2558	9814	7475			
Minimum size	6	8.5	8.5			
Average size Lc	12.8	14.36	14.08			
Maximum size	18.5	17	23			
Fleet	132	132	130			

Selectivity   Remarks

L25	
L50	
L75	
Selection factor	

Structure by size or age
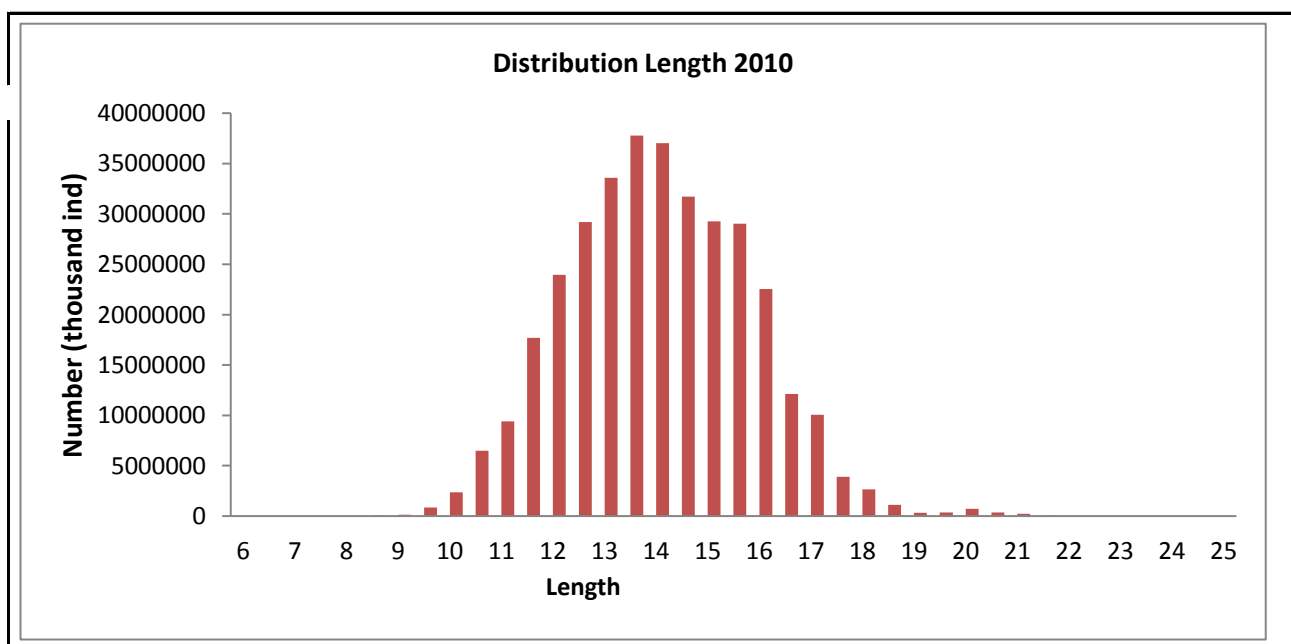
Distribution Length 2010

Structure by size or age

Distribution Length 2002

Distribution Length 2003

Distribution Length 2004

Distribution Length 2005

Distribution Length 2006

Distribution Length 2007

Distribution Length 2008

Distribution Length 2009
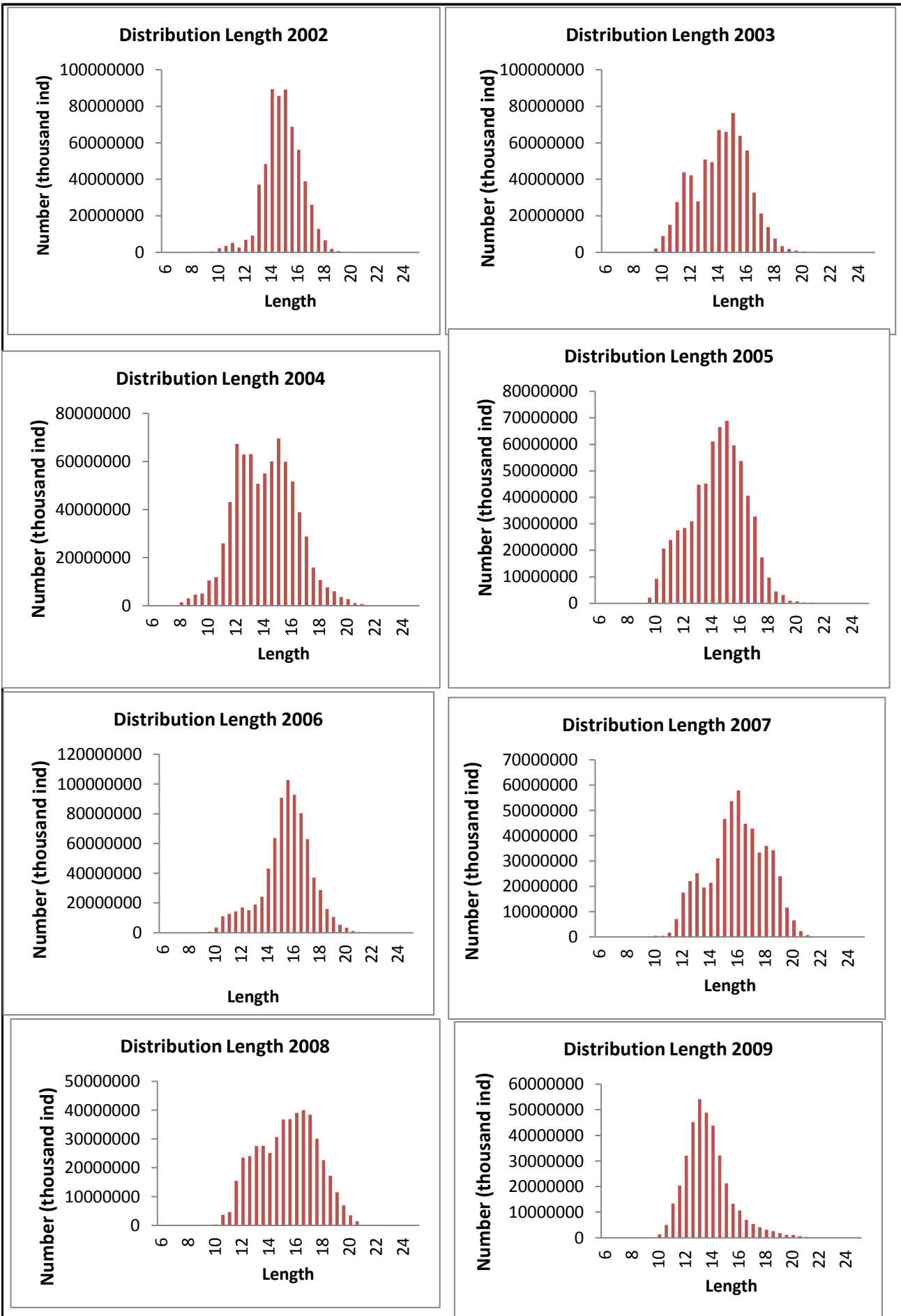
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Assessment form

Sheet P2b
Fishery by Operational Unit

Code: PIL0611Gar
Page 1 / 1
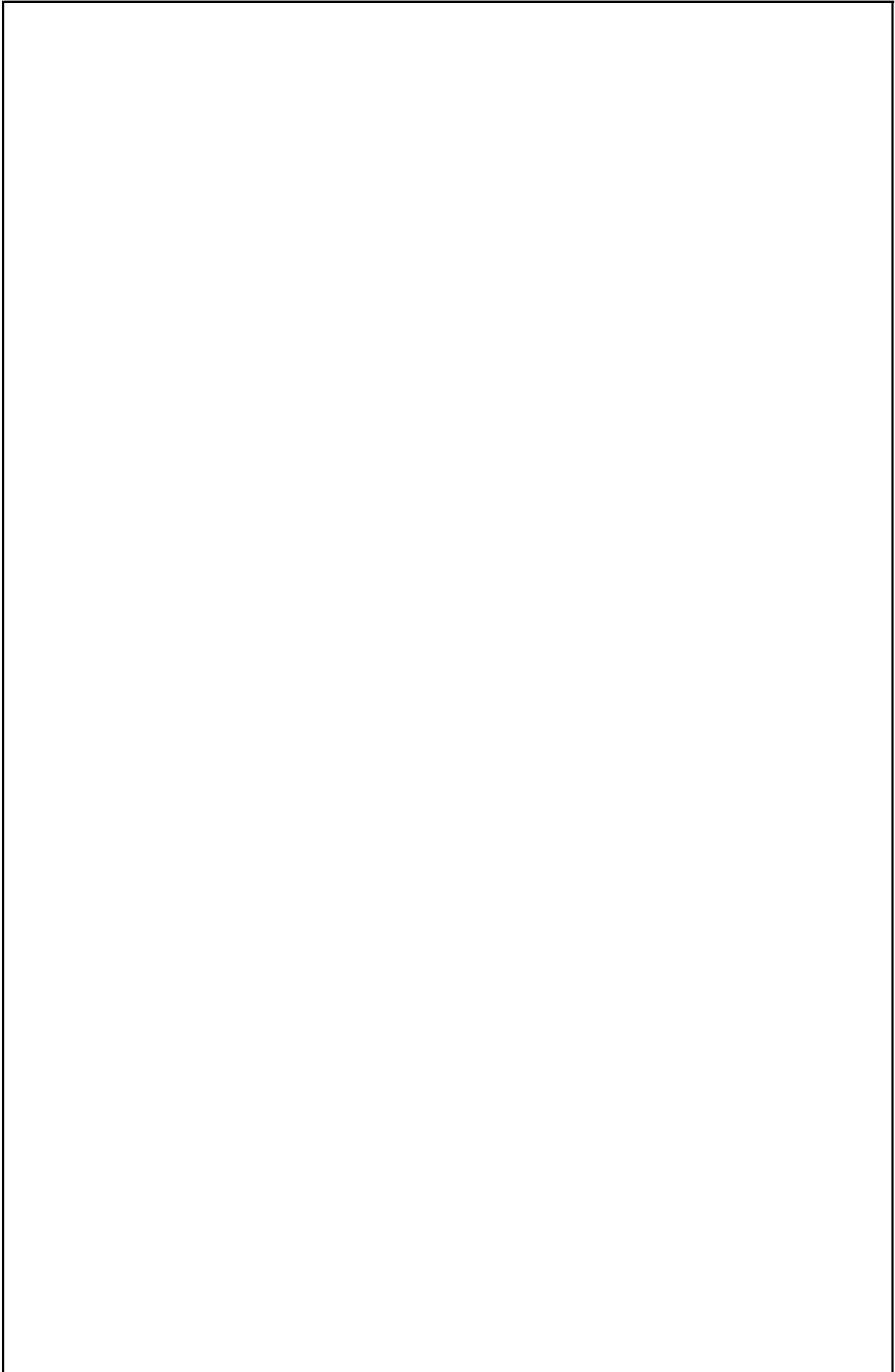
Data source*	Official Statistics, IEO Sampling Network	OpUnit 1*	ESP 06 G 02 31 - PIL

Regulations in force and degree of observance of regulations

Fishing license: fully observed.
Minimum landing size 11cm: not fully observed (Some landings under minimum size in some specific ports).
No fishing allowed on weekend. Time at sea 12 hours per day and 5 days a week: fully observed.
Several technical measures regulations (gear and mesh size, engine, GRT, etc...): not fully observed.
Temporary fishing closure (two months, variable along the time series): fully observed.

Accompanying species

The most important are:
Anchovy (*Engraulis encrasicolus*)
Mediterranean Horse Mackerel (*Trachurus mediterraneus*)
Other Horse Mackerels (*Trachurus trachurus* and *Tachurus picturatus*)
Mackerel (*Scomber scombrus*)
Chub Mackerel (*Scomber japonicus*)
Round sardinella (*Sardinella aurita*)
Bogue (*Boops boops*)

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Sex*	Both

Time series

Analysis # *	XSA

Data	Size	Age		Model	Cohorts	Pseudocohorts
(mark with X)	X	X		(mark with X)	X	

Equation used	VPA		Tunig method	XSA
# of gears	Purse seiners		Software	VPA95. Lowestoft suite
$F_{terminal}$	Not relevant to XSA			

Population results (please state units)

	Sizes	Ages		Amount	Biomass
Minimum	23	0	Recruitment	1268 millions	
Average	See page 2a		Average population		
Maximum	8.5	5+	Virgin population		
Critical			Turnover		

Average mortality

	Total	Gear					
F_1	F = 1.14						
F_2							
Z	See Comments						

(F1 and F2 represent different possible calculations. Please state them)

Comments

Reference F is Fbar1-3 (average of ages 1 to 3 are considered the reference ages of this fishery).
Following the recommendation from the Wokshop on Mediterranean Stock Assessment
Standardization (SG-ECA/RST/MED 09-01), a vector instead of a constant value was used.
The vector was estimated using the ProdBiom method (Abella et al., 1997) based on Caddy (1991).

Landings decrease in 2010, reaching up 7475 t, wich represents the lowest landings of the assessed
time series.
Fishing mortality is at a moderate-high level (F10 = 1.14) lower to that of 2008 (2.55)
Recruitment in 2010 (1268 millions) is higher to 2008 (746) the lower value of the time series,
following the decreasing trend from 2003 onwards.
The trend of the recruitments is so important as they can affect seriously to the stock health.
Total Biomass (TB = 31689 t) is the lowest value of the time series.and Spawning Stock Biomass
(SSB = 16917 t) is the second lower value of the time series.

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Sex*	Both	Gear*	Purse seiners		Analysis # *	**XSA**

Data source	Input data for XSA

Data
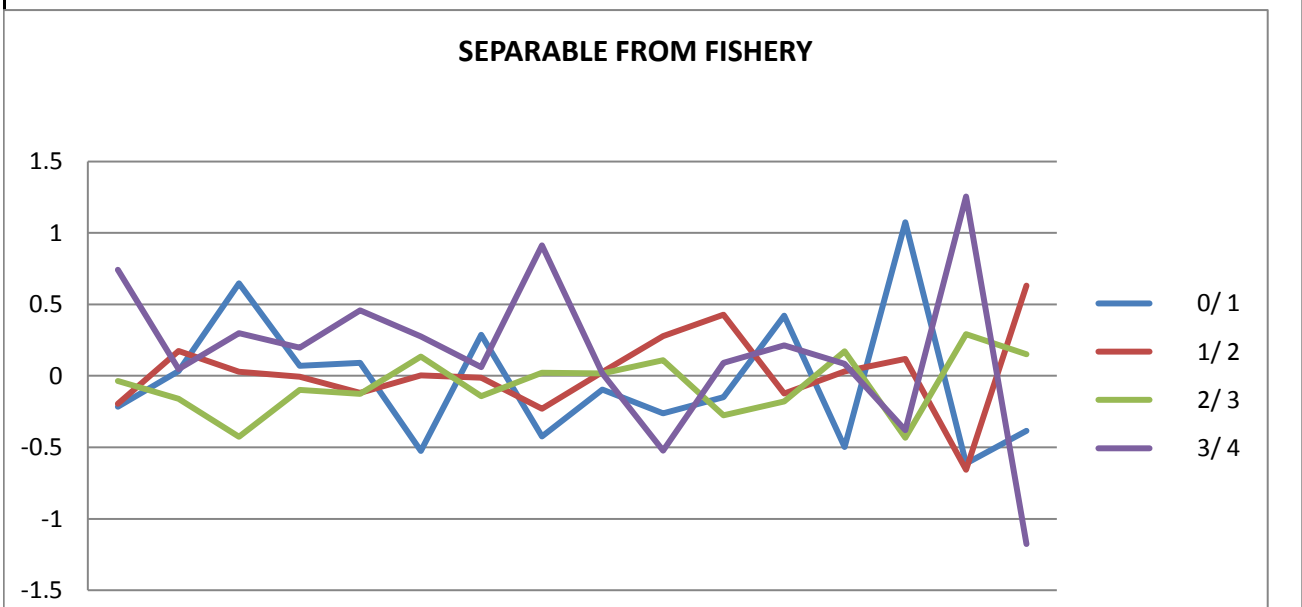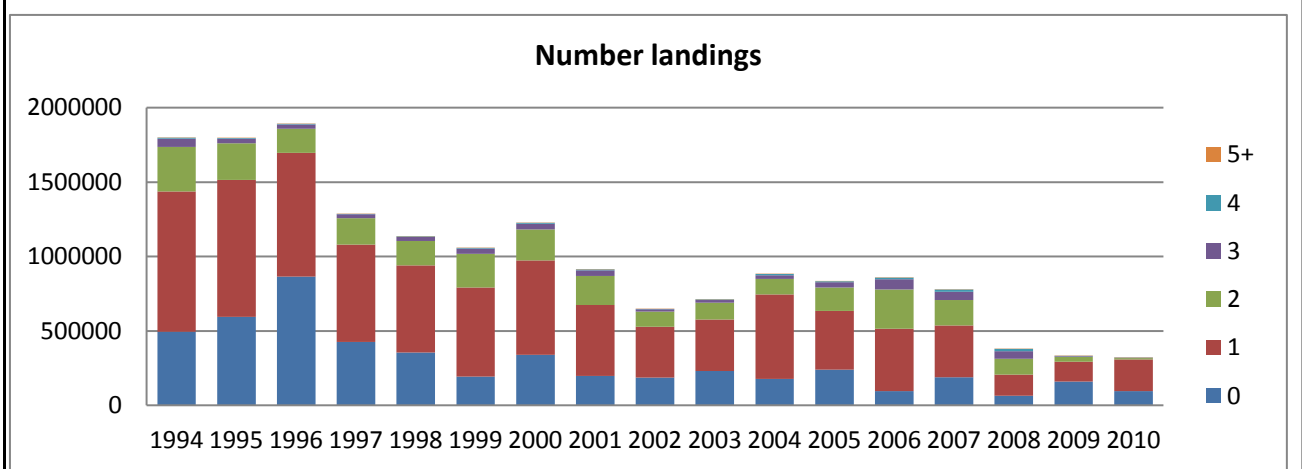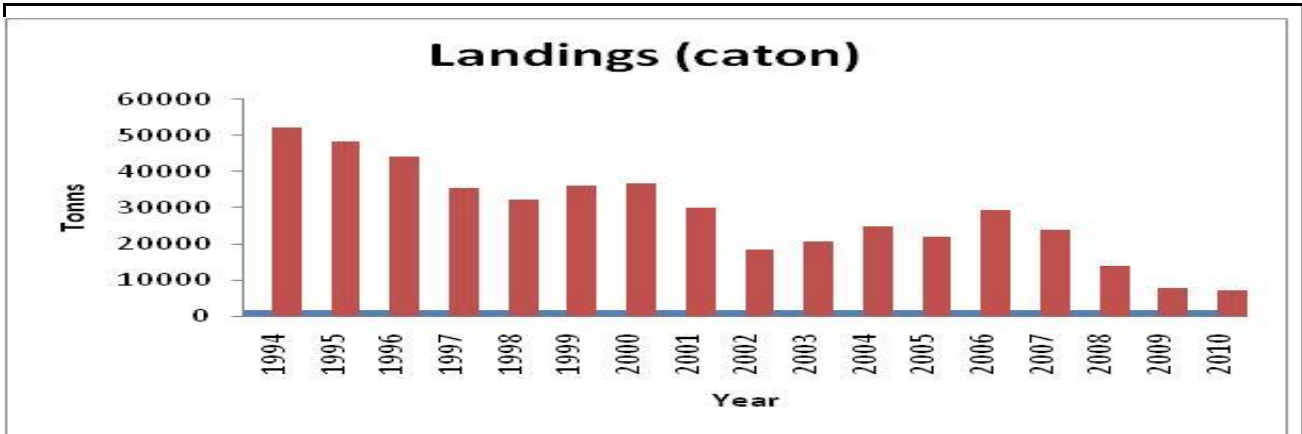
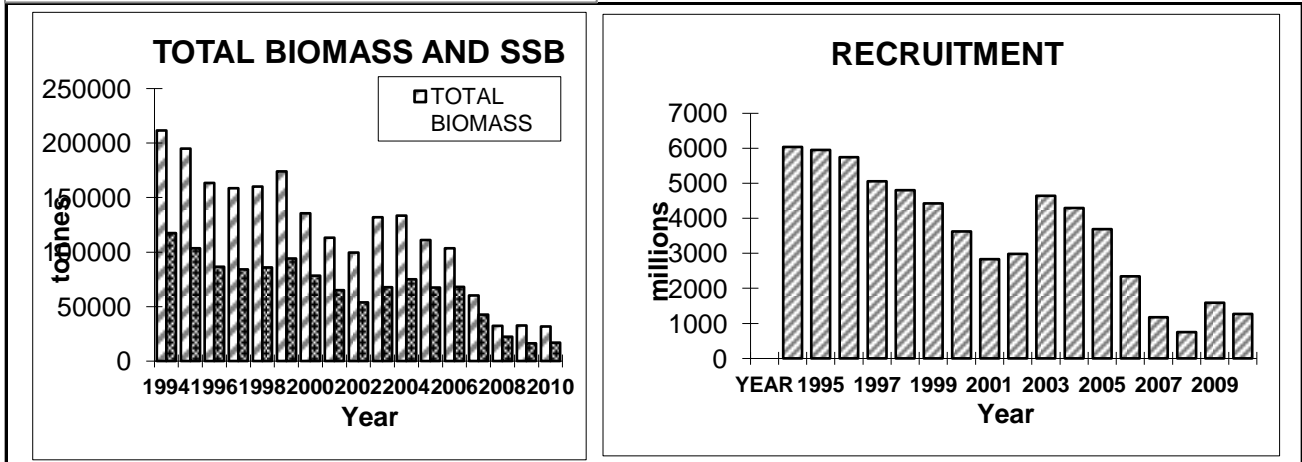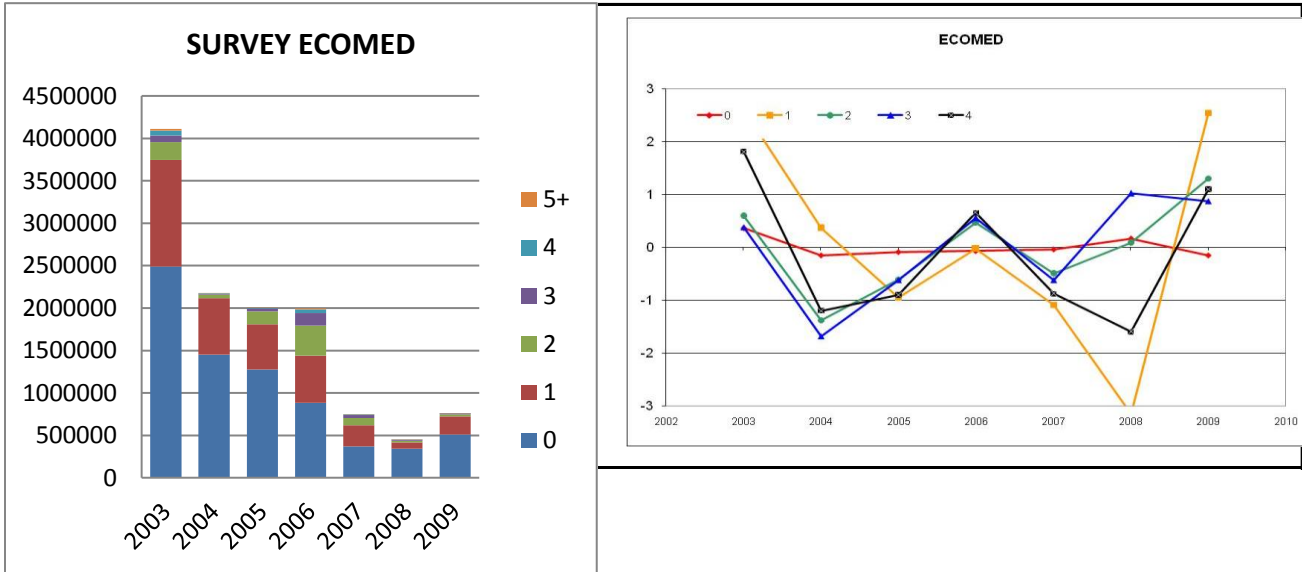## SAC GFCM - Sub-Committee on Stock Assessment (SCSA)

Assessment form

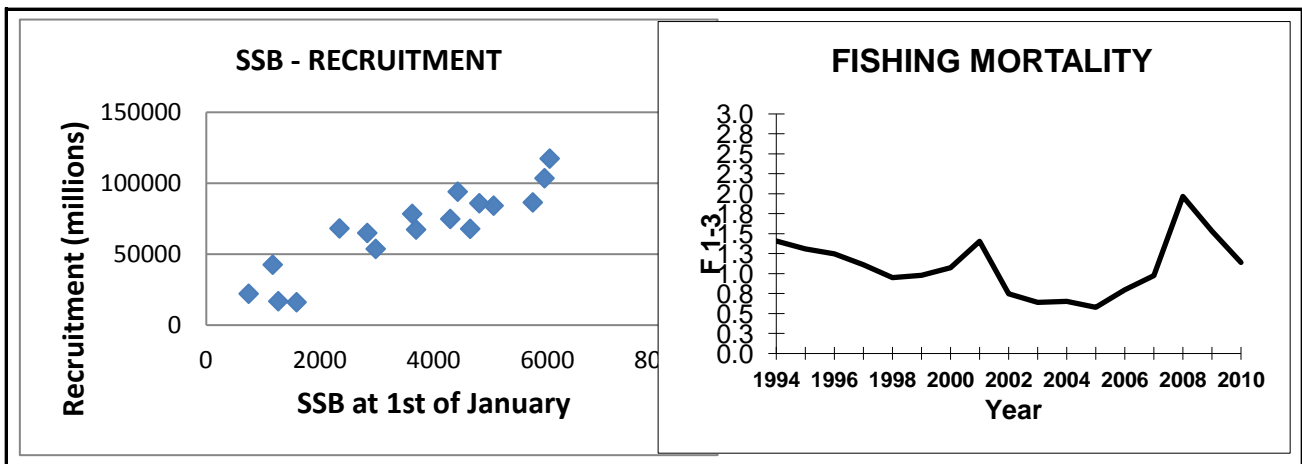**Sheet A3**

Indirect methods: VPA results

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Sex*	Both	Gear*	Purse Seiners		Analysis #*	XSA

Population in figures

SURVEY ECOMED

ECOMED

TOTAL BIOMASS AND SSB

RECRUITMENT

Fishing mortality rates

SSB - RECRUITMENT

FISHING MORTALITY

Other assessment methods

Short Terms Determnistic Projections for three years (2011 to 2013).

MFDP software (Multi-Fleet Deterministc Projections).

Landings in 2010 were 7475 t and are predicted to be close to 8592 t in 2011 and 8274 t in 2012.
Total biomass will decrease with 36002 t in 2011, 35308 t in 2012 and 35058 t in 2013, what account for a decrease on stock numbers.
SSB will also decrease from 23377 t in 2011to 22513 t in 2013.

Hence, this explotation pattern of maintaining F statu quo 2011-2013 with scenarios of low recruitments rates, will remain constant at low levels.

Table below shows the management options from the short term prediction.

2011 Biomass	SSB	FMult	FBar	Landings		2013 Biomass	SSB
36002	23377	1	1.3042	8592			
2012 Biomass	**SSB**	**FMult**	**FBar**	**Landings**			
35308	22764	0	0	0		42427	29742
.	22764	0.1	0.1304	1262		41233	28563
.	22764	0.2	0.2608	2382		40191	27536
.	22764	0.3	0.3913	3382		39276	26635
.	22764	0.4	0.5217	4282		38466	25839
.	22764	0.5	0.6521	5098		37744	25132
.	22764	0.6	0.7825	5841		37097	24499
.	22764	0.7	0.9129	6522		36514	23929
.	22764	0.8	1.0434	7150		35984	23413
.	22764	0.9	1.1738	7732		35501	22943
.	22764	1	1.3042	8274		35058	22513
.	22764	1.1	1.4346	8781		34649	22117
.	22764	1.2	1.565	9257		34270	21751
.	22764	1.3	1.6955	9705		33918	21412
.	22764	1.4	1.8259	10130		33589	21095
.	22764	1.5	1.9563	10532		33281	20800
.	22764	1.6	2.0867	10915		32992	20522
.	22764	1.7	2.2171	11280		32719	20261
.	22764	1.8	2.3476	11628		32462	20015
.	22764	1.9	2.478	11962		32218	19783
.	22764	2	2.6084	12282		31986	19563

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Indicators and reference points

Criterion	Current value	Units	Reference Point	Trend	Comments
B					Not Reference Point defined
SSB					Not Reference Point defined
F					Not Reference Point defined
Y					Not Reference Point defined
CPUE					Not Reference Point defined

Stock Status*   Use one (or both) of the following two systems for the stock assessment status description

Unidimensional	○	? - (or blank) **Not known or uncertain**. Not much information is available to make a judgment;
	○	U - **Underexploited, undeveloped or new fishery**. Believed to have a significant potential for expansion in total production;
	○	M - **Moderately exploited**, exploited with a low level of fishing effort. Believed to have some limited potential for expansion in total production;
	○	F - **Fully exploited**. The fishery is operating at or close to an optimal yield level, with no expected room for further expansion;
	●	O - **Overexploited**. The fishery is being exploited at above a level which is believed to be sustainable in the long term, with no potential room for further expansion and a higher risk of stock depletion/collapse;
	○	D - **Depleted**. Catches are well below historical levels, irrespective of the amount of fishing effort exerted;
	○	R - **Recovering**. Catches are again increasing after having been depleted or a collapse from a previous;

	Exploitation rate	Stock abundance
Bidimensional	○ No or low fishing ○ Moderate fishing ● High fishing mortality ○ Uncertain / Not assessed	○ Virgin or high abundance ○ Depleted ○ Intermediate abundance ○ Uncertain / Not assessed ● Low abundance

Comments

It is really important to point that the stock is in danger of recruitment overexploitation due to the decreasing trend in recruitment and very low levels of the spawning stock biomass.

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Management advice and recommendations*

Regarding suggestion for management options, this fishery is considered overexploited. The explotation rate (fishing mortality) is at a high level, the stock abundance in 2010 remains at low levels, though it has increased from 2008 to the lowest value of the entire series.

Unless the recruitment levels increase in the near future, this fishery will be being exploited at above a level which is believed to be sustainable in the long term, with no potential room for further expansion and a higher risk of stock depetion/collapse.

Advice for scientific research*

Comments*

Conclusions - Assessment:

Landings in 2010 were7475 t, showing a decrease from that of previous years.
The time series shows an irregular pattern but a continuous decreasing trend with the lowest landings of the assessed time series in 2010.

Fishing mortality is at a moderate-high level (F10 = 1.14), showing an erratic behavior of that.

Recruitment in 2010 (R10 = 1268 millions) decreases slightly from that of 2009 (1590 millions) but is higher than the lowest value reached in 2008 (747 millions).
The trend of the recruitments is as important as they can affect seriously to the stock health.

Both Total Biomass in 2010 (TB = 31689 t) and Spawning Stock Biomass in 2010 (SSB = 16917 t) also show a decreasing trend and the lowest levels of the assessed time series.

Conclusions - Cast Forecasting

Assuming Statu quo F (Fbar08-10 = 1.546) and the recruitment (1343 millions):

-Landings in 2010 were 7475 t and are predicted to be close to 8592 t in 2011 and 8274 t in 2012.
-Total biomass will decrease with 36002 t in 2011, 35308 t in 2012 and 35058 t in 2013, what account for a decrease on stock numbers.
-SSB will also decrease from 23377 t in 2011to 22513 t in 2013.

Hence, this explotation pattern of maintaining F statu quo 2011-2013 with scenarios of low recruitments rates, will remain constant at low levels.

Conclusions - Management considerations:

This fishery is considered overexploited. Unless the recruitment levels increase in the near future, this fishery will be being exploited at above a level which is believed to be sustainable in the long term, with no potential room for further expansion and a higher risk of stock depletion/collapse.

Abstract for SCSA reporting

Authors Garcia, E.*, Bellido, J.M., Torres, P., Quintanilla, L., Giráldez, A., Alemany, F., Iglesias, M., Gonzalez, M.

Year 2011

Species Scientific name Sardina pilchardus - PIL

Source: GFCM Priority Species

Source: -

Source: -

Geographical Sub-Area 06 - Northern Spain

Fisheries (brief description of the fishery)*

Source of management advice*

(brief description of material -data- and methods used for the assessment)

Stock Status*

O - Overexploited. The fishery is being exploited at above a level which is believed to be sustainable in the long term, with no potential room for further expansion and a higher risk of stock depletion/collapse;

Exploitation rate

High fishing mortality

Stock abundance

Low abundance

Comments

Management advice and recommendations*

Advice for scientific research*