Stock Assessment Form

Small Pelagics

Reference Year:2014

Reporting Year:2014

[A brief abstract may be added here]

Stock Assessment Form version 1.0 (January 2014)

Uploader: *Please include your name*

Stock assessment form

1 Basic Identification Data

Scientific name:	Common name:	ISCAAP Group:
Engraulis Encrasicolus	[Anchovy]	[35]
1st Geographical sub-area:	**2nd Geographical sub-area:**	**3rd Geographical sub-area:**
[GSA07 Gulf of Lions]		
4th Geographical sub-area:	**5th Geographical sub-area:**	**6th Geographical sub-area:**
1st Country	**2nd Country**	**3rd Country**
France		
4th Country	**5th Country**	**6th Country**
Stock assessment method: (direct, indirect, combined, none)		
Direct (acoustic survey)		
Authors:		
Jean-Louis Bigot, Jean-Hervé Bourdeix, Claire Saraux		
Affiliation:		
IFREMER CS 30171 Av. Jean Monnet 34203 SETE CEDEX (France)		

The ISSCAAP code is assigned according to the FAO 'International Standard Statistical Classification for Aquatic Animals and Plants' (ISSCAAP) which divides commercial species into 50 groups on the basis of their taxonomic, ecological and economic characteristics. This can be provided by the GFCM secretariat if needed. A list of groups can be found here:

http://www.fao.org/fishery/collection/asfis/en

Direct methods (you can choose more than one):

- Acoustics survey
- Egg production survey
- Trawl survey
- SURBA
- Other (please specify)

Indirect method (you can choose more than one):

- ICA

- VPA
- LCA
- AMCI
- XSA
- Biomass models
- Length based models
- Other (please specify)

Combined method: you can choose both a direct and an indirect method and the name of the combined method (please specify)

2 Stock identification and biological information

Specify whether the assessment is considered to cover a complete stock unit. If the stock unit limits are more or less known, but for technical reasons the assessment only covers part of the stock (e.g. a GSA area but stock spreads to other GSAs), explain the state of the art of the stock unit knowledge. If there are doubts about the stock unit, state them here. If there is knowledge on migration rates between different stock units that affect the stock state them here.

2.1 Stock unit

The assessment covers the whole GSA07 area corresponding to the Gulf of Lions. However, we think that the Gulf of Lions may not correspond to a complete stock unit. Indeed, hydrological exchanges between the Gulf of Lions and the Catalan Sea for instance are well known, which should at least affect larval transport (see Ospina-Alvarez et al. 2013) and then recruitment of juvenile anchovies in both areas. Similarly, part of the young recruited in the Gulf of Lions anchovy population may come from larval transport from spawners of the Ligurian Sea. Further, preliminary genetic analyses have shown no differences between Spanish and French stocks of anchovies in the North-Western Mediterranean Sea.

2.2 Growth and maturity

Incorporate different tables if there are different maturity ogives (e.g. catch and survey). Also incorporate figures with the ogives if appropriate. Modify the table caption to identify the origin of the data (catches, survey). Incorporate names of spawning and nursery areas and maps if available.

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

Somatic magnitude measured (LT, LC, etc)				**Units**	
Sex	**Fem**	**Mal**	**Combined**	**Reproduction season**	Spring-Summer
Maximum size observed	18.5	17	18.5	**Recruitment season**	
Size at first maturity			7.75	**Spawning area**	Shelf and upper
Recruitment size to the fishery	5	5	5	**Nursery area**	Shelf and upper

*Maximum size observed corresponds to the maximum size ever observed in PELMED (1993-2014)

*Size at first maturity was calculated based on samplings in May, June and July (peak of reproduction) from 2009 onwards (as a change in size at first maturity was observed around 2008).

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

Size/Age	Natural mortality	Proportion of matures
…	…	…

Table 2-2.3: M vector and proportion of matures by size or age (Females)

Size/Age	Natural mortality	Proportion of matures
…	…	…

Table 2-3: Growth and length weight model parameters

			Sex			
		Units	female	male	Combined	Years
Growth model	L_∞				16.02	
	K				0.58	
	t_0				-1.38	
	Data source	Growth parameters evaluated from PELMED data (i.e. July) on the 2008-2013 period.				
Length weight relationship	a				0.0049	2014
	b				3.05	2014
	M (scalar)					
	sex ratio (% females/total)					

Length-weight relationship parameters are derived from data collected during the 2014 PELMED survey only

3 Fisheries information

3.1 Description of the fleet

Identification of Operational Units exploiting this stock. Use as many rows as needed

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

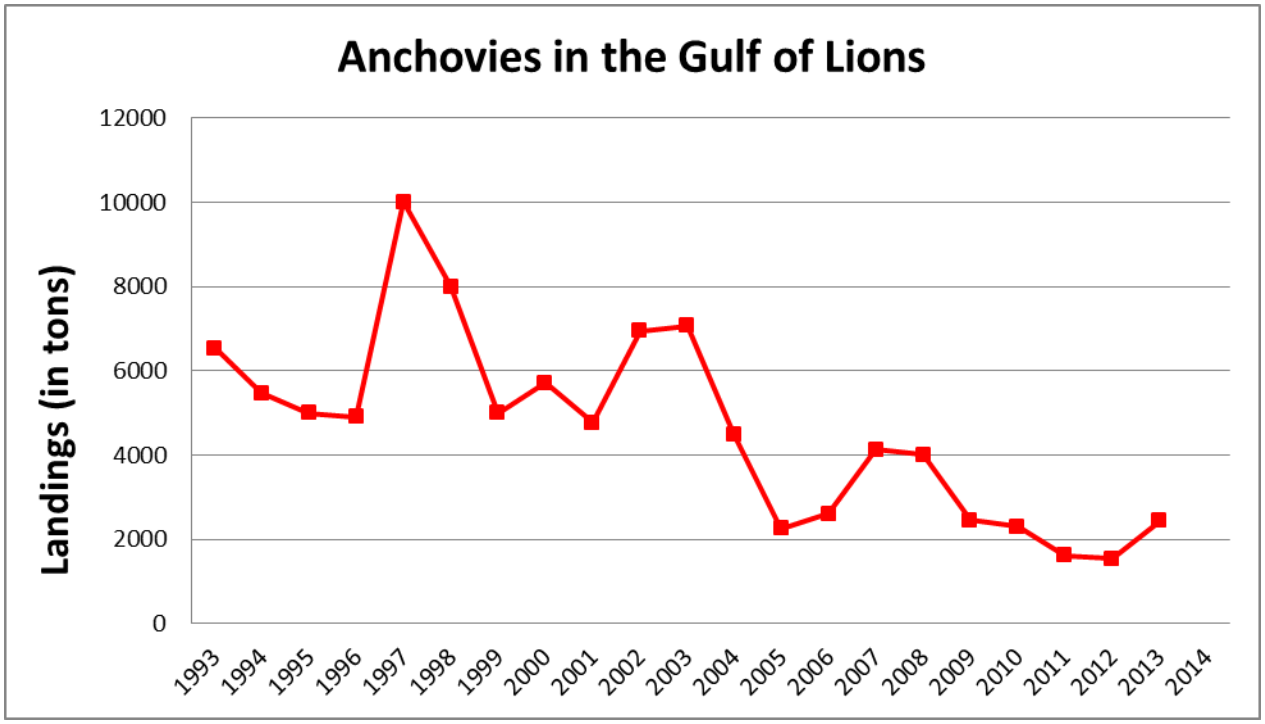
	Country	GSA	Fleet Segment	Fishing Gear Class	Group of Target Species	Species
Operational Unit 1*	FRA	[07]	E – Trawl (12-24 m)	03 - Trawls	31 – Small gregarious pelagic	ANE
Operational Unit 2						
Operational Unit 3	[Country3]	[GSA3]	[Fleet Segment3]	[Fishing Gear Class3]	[ISCAAP Group]	
Operational Unit 4	[Country4]	[GSA4]	[Fleet Segment4]	[Fishing Gear Class4]	[ISCAAP Group]	
Operational Unit 5	[Country5]	[GSA5]	[Fleet Segment5]	[Fishing Gear Class5]	[ISCAAP Group]	
Operational Unit 6	[Country6]	[GSA6]	[Fleet Segment6]	[Fishing Gear Class6]	[ISCAAP Group]	

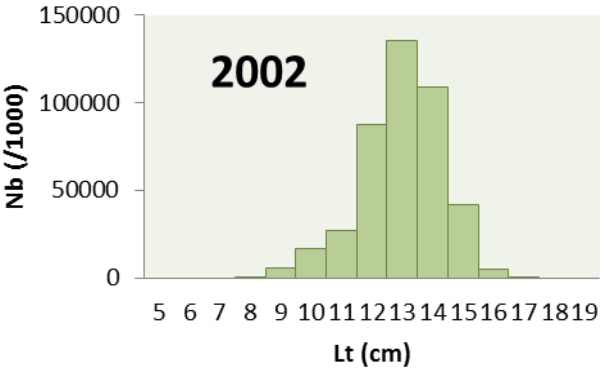
Table 3.1-2: Catch, bycatch, discards and effort by operational unit in the reference year

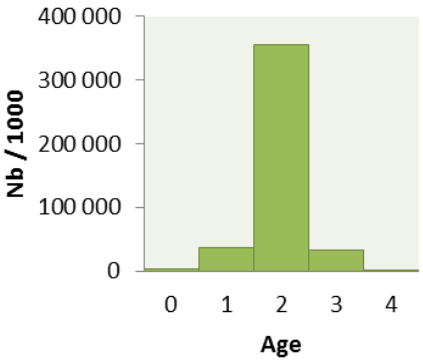
Operational Units*	Fleet (n° of boats)*	Catch (T or kg of the species assessed)	Other species caught (names and weight)	Discards (species assessed)	Discards (other species caught)	Effort (units)
FRA 07 E 03 31 - ANE	12	2435	Sardine	No discards	Sprattus sprattus	Nb boats
[Operational Unit2]						
[Operational Unit3]						
[Operational Unit4]						
[Operational Unit5]						
Total						

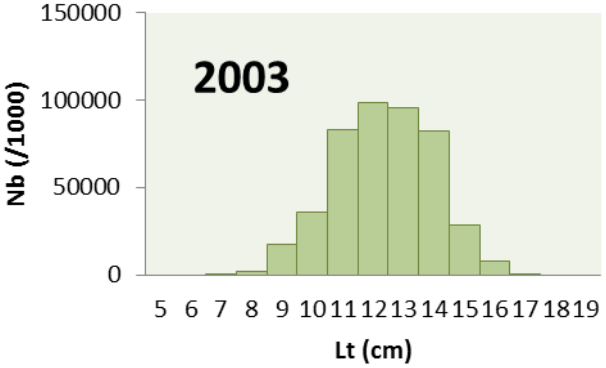
We estimated the number of boats as the number of boats landing more than 1T during the year. Only one of these 12 trawlers seems to fish small pelagic fish all along the year, the 11 others alternate with demersal species as well.

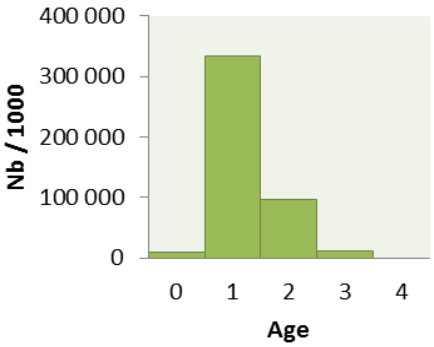
3.2 Historical trends

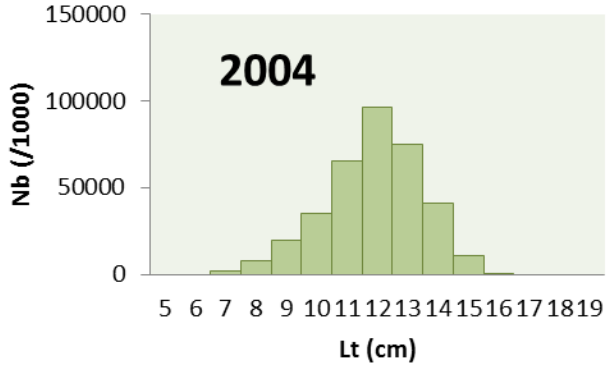








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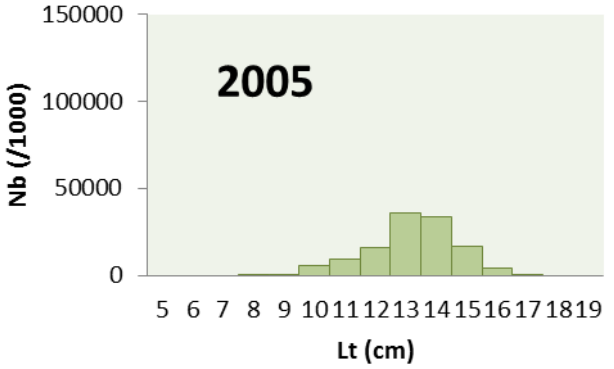
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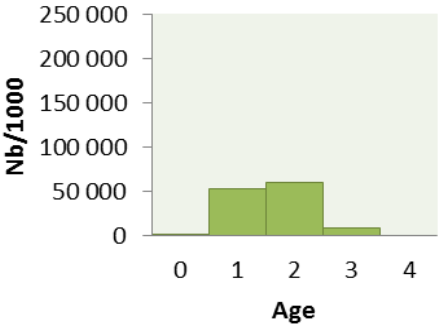
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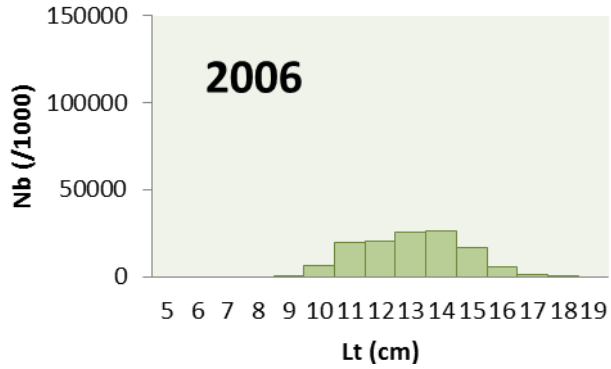
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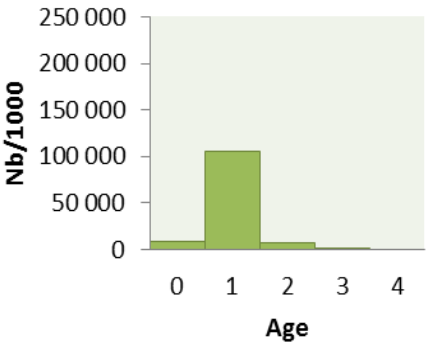
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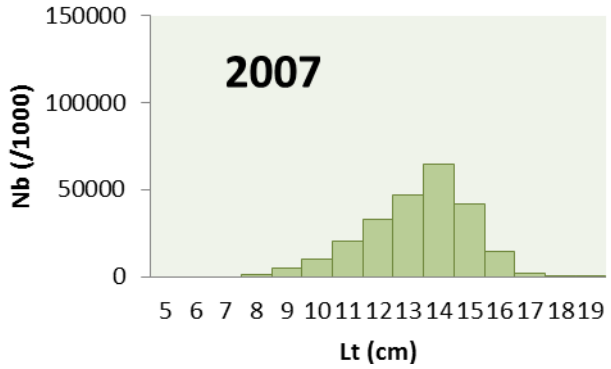
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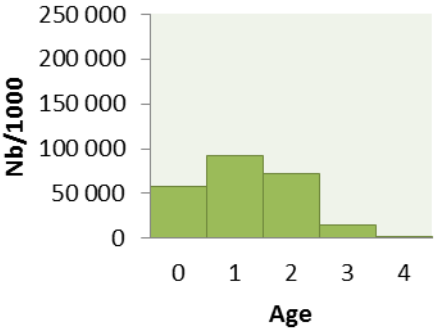
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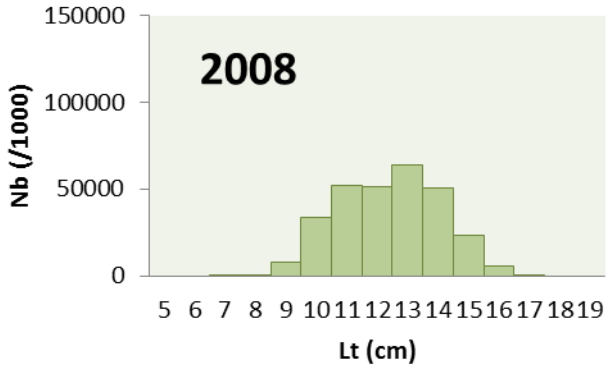
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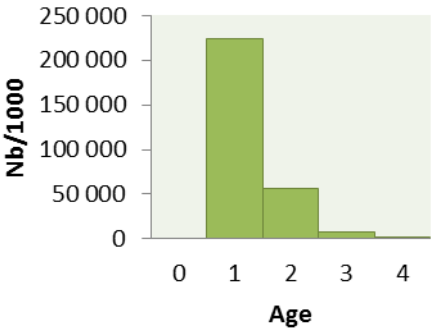
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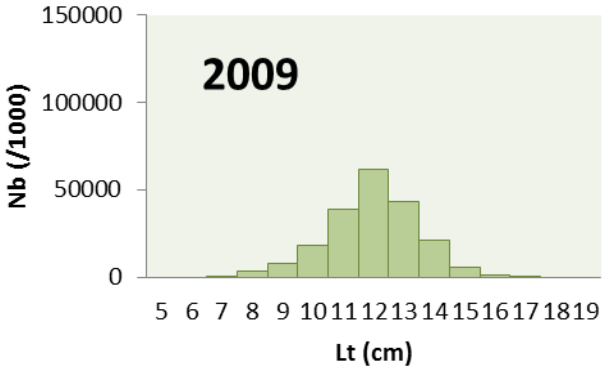
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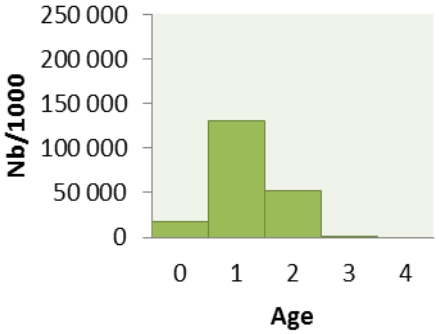
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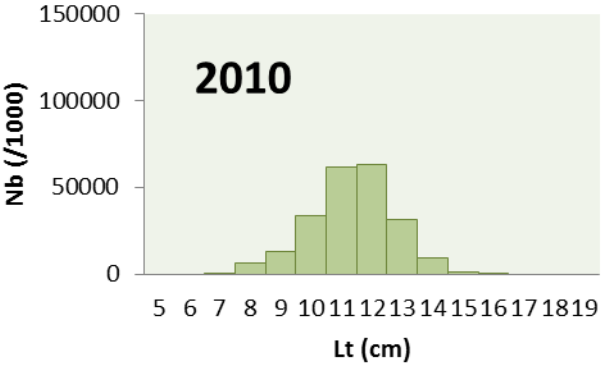
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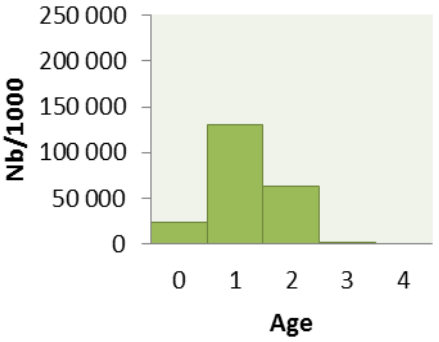
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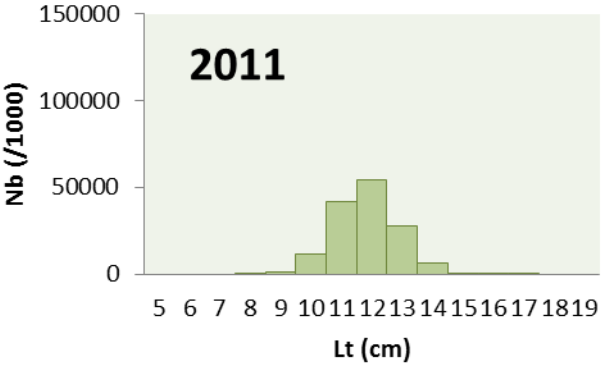
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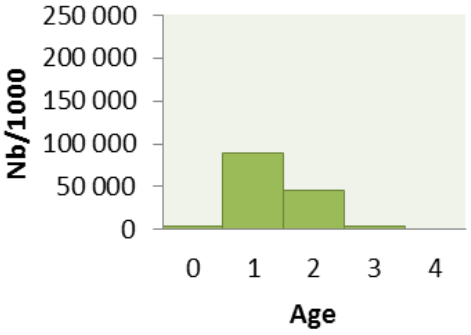
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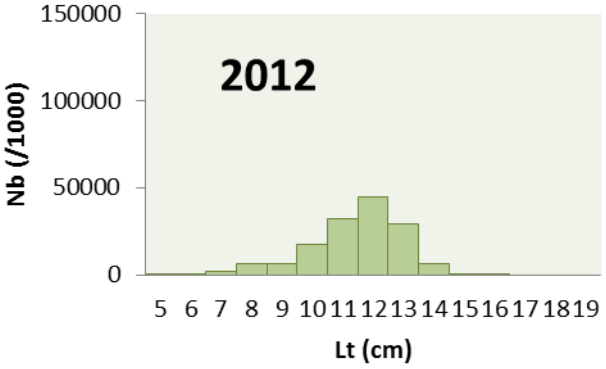
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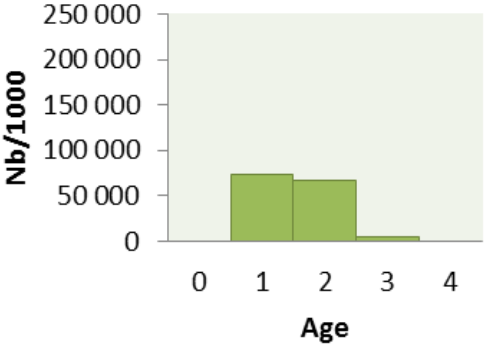
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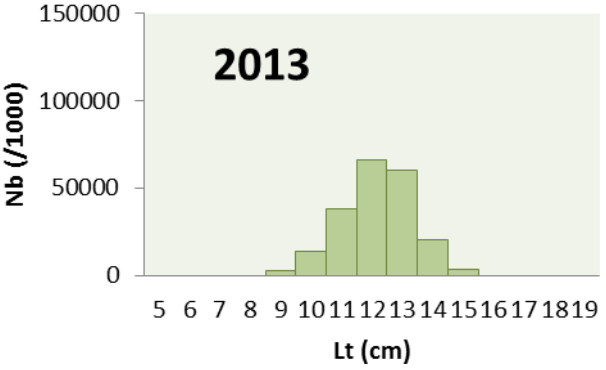
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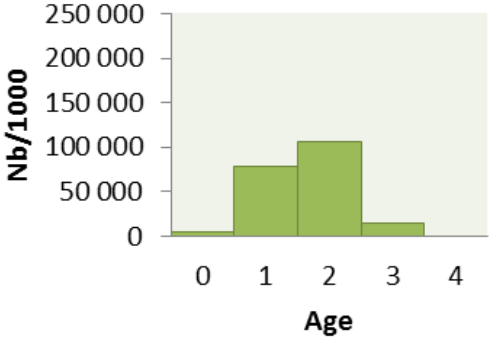
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3.3 Management regulations

- Exclusive licence for trawling, with a given number each year (both for small pelagics and demersals) - fully respected
- Limited engine power for trawlers to 318 kW or 430 hp - not respected
- Length of fishing trawlers inferior to 25 meters - fully respected
- Fishing effort limitation :
    - No fishing on Saturdays and Sundays, authorised hours trip: 3.00am to 8.00pm - fully respected
    - Trawling forbidden from coast to 3NM - not fully respected
    - Professional organisation regulations: Additional holidays: on average 40 days/year - fully respected
    - Temporary stops (20d in 2011, 35d in 2012) for pelagic trawlers.

Management plans have also been established for trawlers in the Gulf of Lions in 2014. The objectives in terms of biomass, etc. have to be evaluated each year depending on GFCM stock assessments.

3.4 Reference points

Table 3.3-1: List of reference points and empirical reference values previously agreed (if any)

Indicator	Limit Reference point/empirical reference value	Value	Target Reference point/empirical reference value	Value	Comments
B	Blim	22 889 T	Bpa	45 778 T	
SSB					
F					
Y					
CPUE					
Index of Biomass at sea					

4 Fisheries independent information

4.1 Direct acoustic method

4.1.1 Brief description of the chosen method and assumptions used

Sampling was performed along 9 parallel and regularly spaced transects (inter-transect distance = 12 nautic miles, see map below). Acoustic data were obtained by means of echosounders (Simrad ER60) and recorded at constant speed of 8 $nm.h^{-1}$. The size of the elementary distance sampling unit (EDSU) is 1 nautical mile. Discrimination between species was done both by echo trace classification and trawls output (Simmons & MacLennan 2005). Indeed, each time a fish trace was observed for at least 2 nm on the echogram, the boat turned around to conduct a ≥30 min-trawl at 4 $nm.h^{-1}$ in order to evaluate the proportion of each species (by random sampling of the catch and sorting before counting and weighing per species). While all frequencies were visualized during sampling and helped deciding when to conduct a trawl, only the energies from the 38kHz channel were used to estimate fish biomass. Acoustic data were preliminary treated with Movies + software in order to perform bottom corrections and to attribute to each echotrace one of the 5 different echotypes previously defined. Acoustic data analyses (stock estimation, length-weight relationships, etc.) were later performed using R scripts.

Table 4.1-1: Acoustic cruise information.

Date	30 June 2014 – 04 August 2014		
Cruise	PELMED 14	**R/V**	L'Europe
Target species	Anchovy - Sardine		
Sampling strategy	9 // transects spaced 12Nm		
Sampling season	Summer		
Investigated depth range (m)	20-200m		
Echo-sounder	ER60 38 KHz for assessment 70, 120, 200 and 333 used as complementary frequency ME70 (3D echosounder) as support for echotype definitions (but used for the first time this year)		
Fish sampler	Pelagic trawl: 4FF176 with 7 m of vertical opening 4PM159 with 16 m of vertical opening		
Cod –end mesh size as opening (mm)	9 mm of mesh side; 18 mm of mesh size		

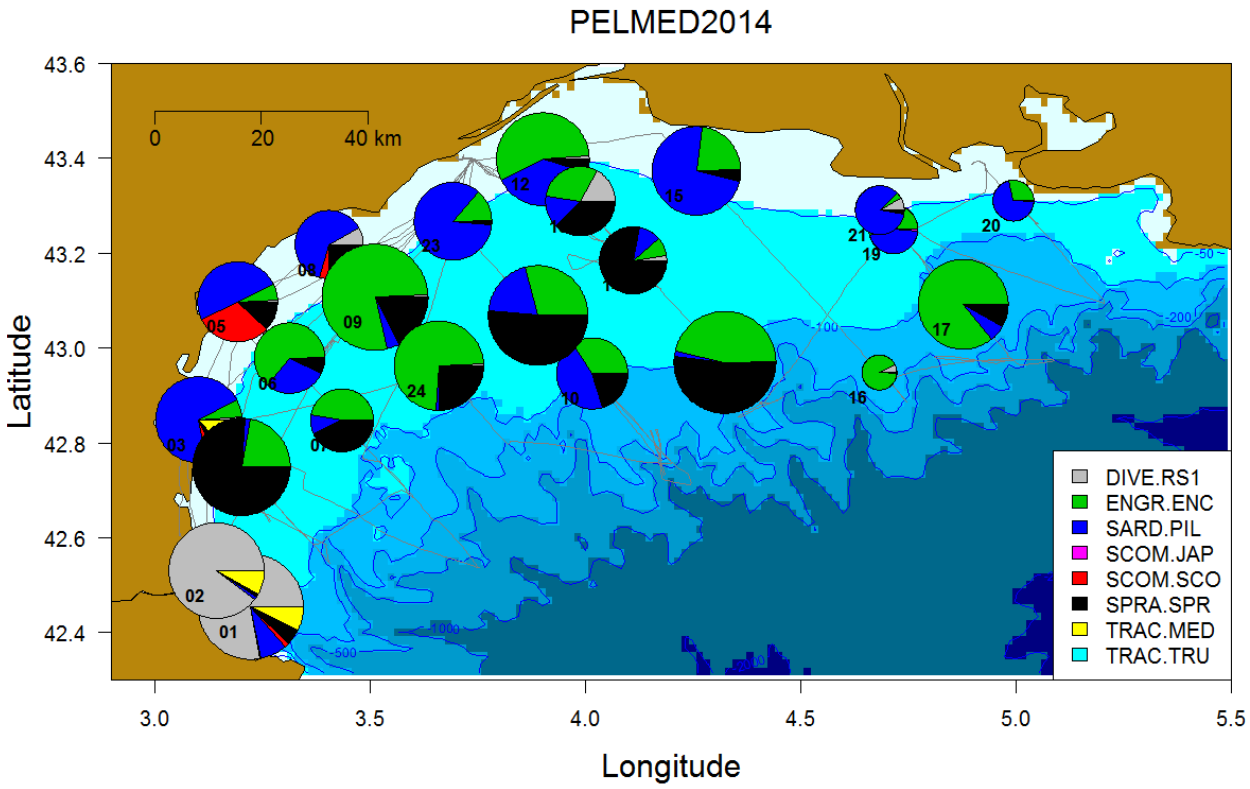
ESDU (i.e. 1 nautical mile)	1 Nm
TS (Target Strength)/species	- 71.2 for anchovy and sardine
Software used in the post-processing	Movies+ and R scripts
Samples (gear used)	Pelagic trawl
Biological data obtained	Length-Weight relationship, Age, Sex, Maturity
Age slicing method	Otolith
Maturity ogive used	L50

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

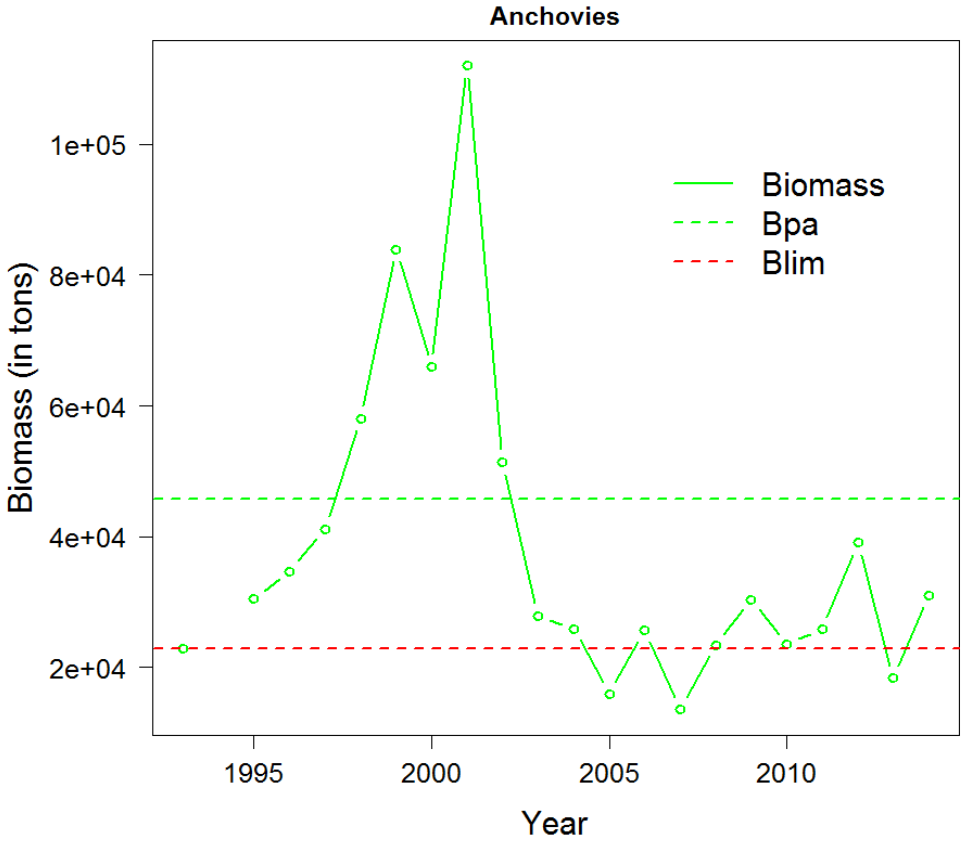
	Biomass in metric tons	**fish numbers**	**Nautical Area Scattering Coefficient**	**Indicator …**	**Indicator …**
Anchovies	30 939	3 829 437 957			
Sardines	62 458	5 612 181 051			
Sprats	27 149	4 827 349 951			

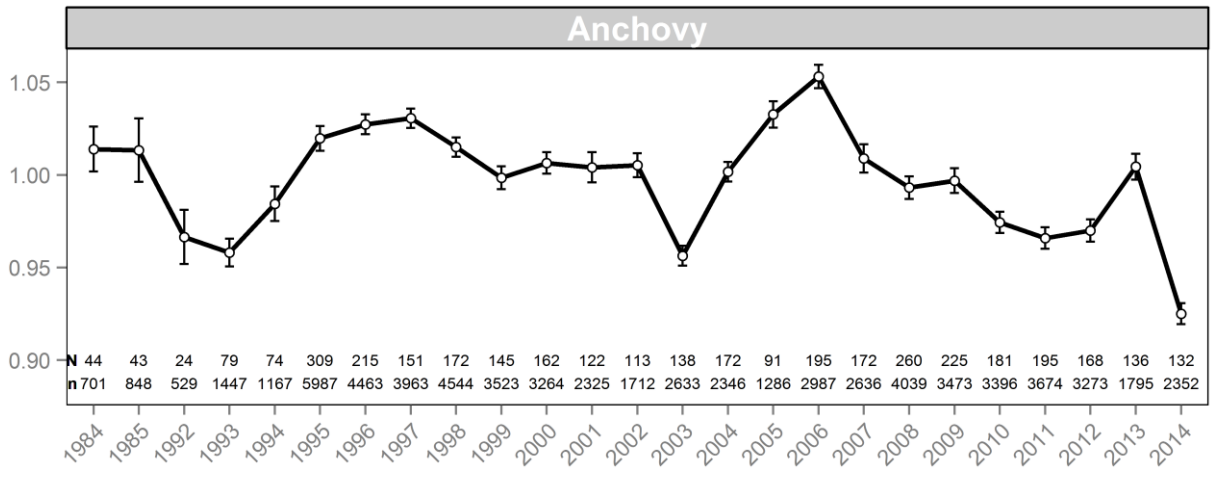
This corresponds to the abundance and biomass of the whole sampled area.

4.1.2 Spatial distribution of the resources

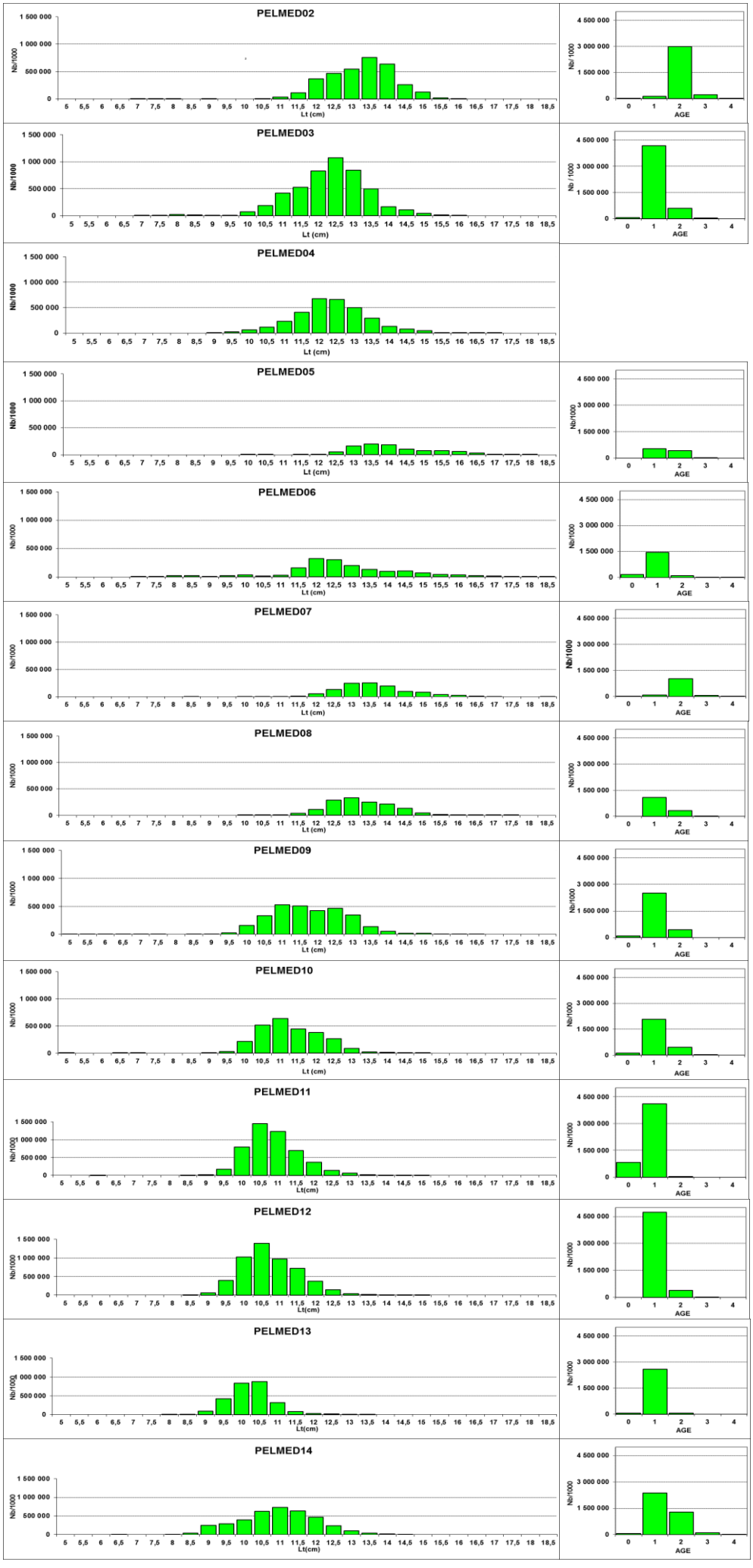


4.1.3 Historical trends





Le Cren condition index along all July acoustic surveys.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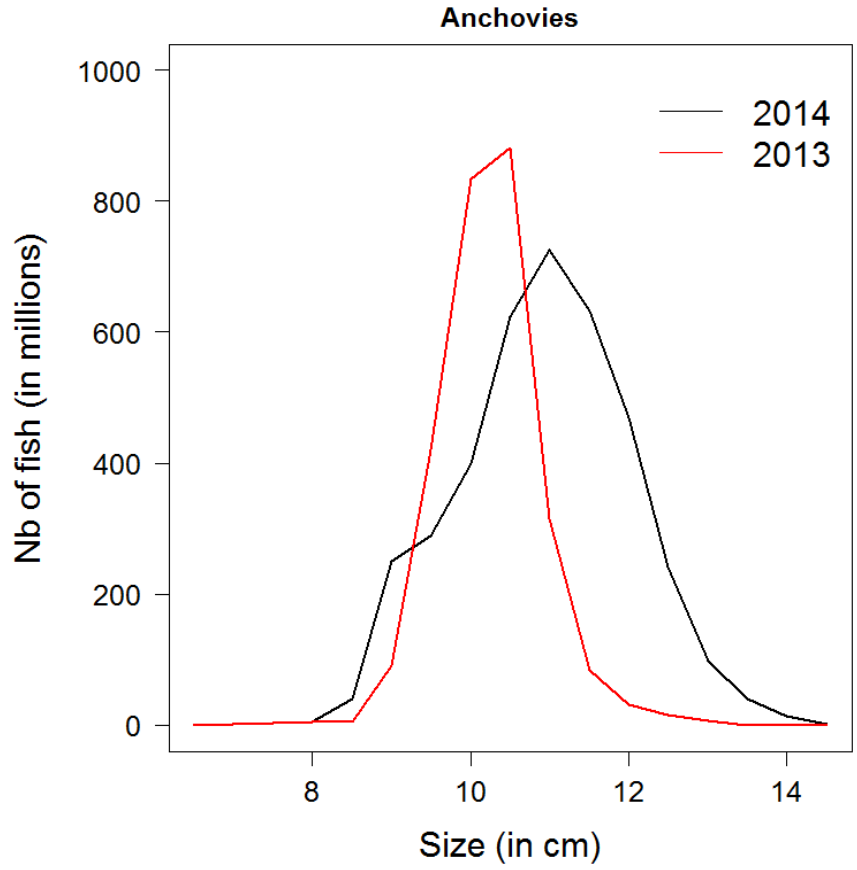
Nb/1000
Lt (cm)
AGE



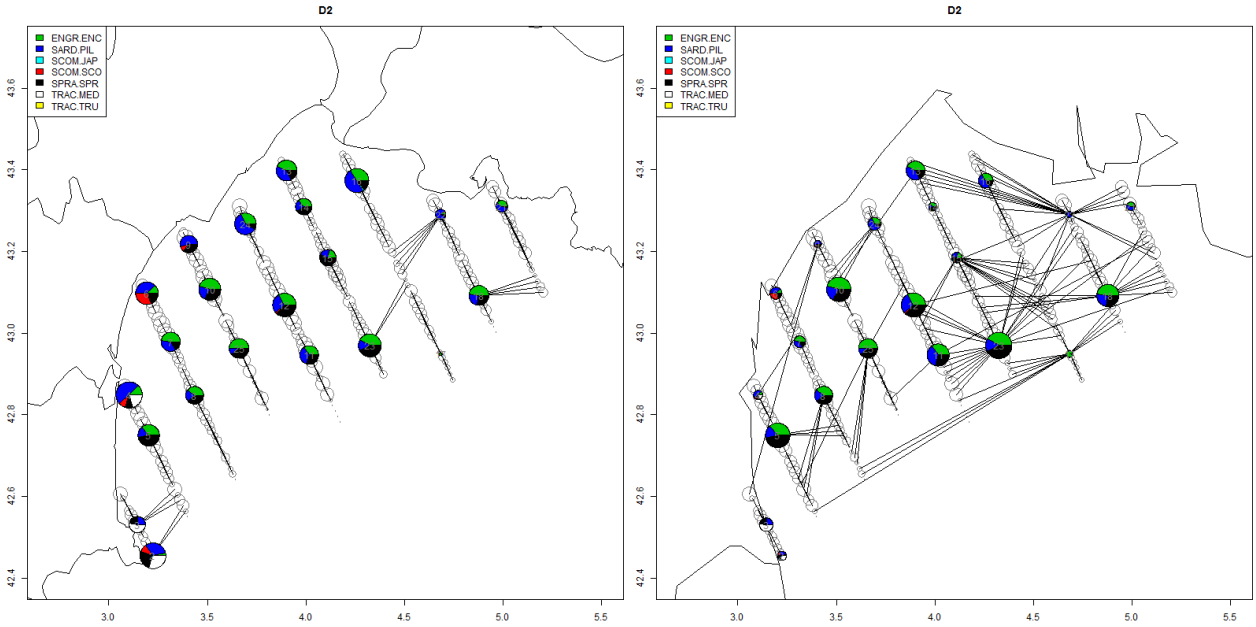
5 Ecological information

5.1 Protected species potentially affected by the fisheries

No protected species should be affected by small pelagic fisheries

6 Stock Assessment

The stock assessment relies only on the direct method with no analytical model being used. Yet 2 different methods have been tested and 2 trawl allocations to echotraces have also been tested. The two methodologies only differed on the use of mean size and weight per species per trawl vs. the use of the whole size distribution estimated per trawl. Trawl allocation has been done in two different ways: 1) closest trawl allocation, where each echotrace is attributed the closest trawl under the condition that the trawl is in the correct stratum (surface vs pelagic), 2) expert allocations. In allocation 2, each echotrace was allocated a trawl according to the form and intensity of the echotrace. This also enables to put more importance on depth strata than the closest trawl allocation. Indeed, depth has been shown to be an important factor of the spatial distribution of these species and of the size structuration (sardines are more coastal than anchovies and small individuals are also more coastal regardless of the species). The 2 allocations for bottom energy are shown below (near trawl on the left and expert allocation on the right).



Due to really bad weather during the survey, less trawls than usual were conducted, resulting in a much higher difference between the near trawl and expert trawl allocation than usual (CV of 20% for anchovies compared to < 5 % the other years). Using the near trawl had a tendency to overestimate anchovies and underestimate sardines, sprats being quite consistent between the two. Because the near trawl allocation resulted in some trawls being used for very different depth strata and very different echotraces, we decided to retain the expert trawl allocation as the result of the assessment.

7 Stock predictions

As no analytical assessment exists, no stock predictions are done.

8 Draft scientific advice

Based on	Indicator	Analytic al 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				D	
	Catch				D	
Stock abundance	Biomass	Blim and Bpa	30 939 T	Blim = 22 889 T Bpa = 45 778 T	N	Low biomass
Recruitment					D	
Final Diagnosis		Low biomass + poor fish condition ➔ reduce fishing mortality				

Biomass is higher than last year, but still below B_{pa}. Landings seem to have stabilized around 2000T for the last 5 years. The fishing effort is much more opportunistic than before and only 1 boat has kept small pelagics as its only target. The total number of boats landing anchovies is not negligible. However, all but 1 of them fish only at given periods. Further, biological parameters show that anchovies were slightly larger than the previous year, but their condition is even poorer, suggesting that they have not recovered from poor exogenous environmental factors yet.

As a consequence, the stock is judged of low biomass (situated between B_{lim} and B_{pa}).

It is important to note that the error associated with this year assessment might be higher than usual due to poorer sampling this year. Indeed, the survey suffered from very bad weather conditions, decreasing the number of trawls conducted to identify fish associated with different echotraces.

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

*Fc 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 B0.1 or BMSY. 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)*