



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

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1 Basic Identification Data

Scientific name:	Common name:	ISCAAP Group:
Sardina Pilchardus	[Sardine]	[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:		
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Affiliation:		
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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 sardines in both areas. Similarly, part of the young recruited in the Gulf of Lions sardine 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 sardines 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	Winter
Maximum size observed	20.5	19		Recruitment season	
Size at first maturity			8.75	Spawning area	Offshore Rhone river
Recruitment size to the fishery			7	Nursery area	Coastal and lagoons

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

*Size at first maturity was calculated based on samplings in Novembre, Decembre and January (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

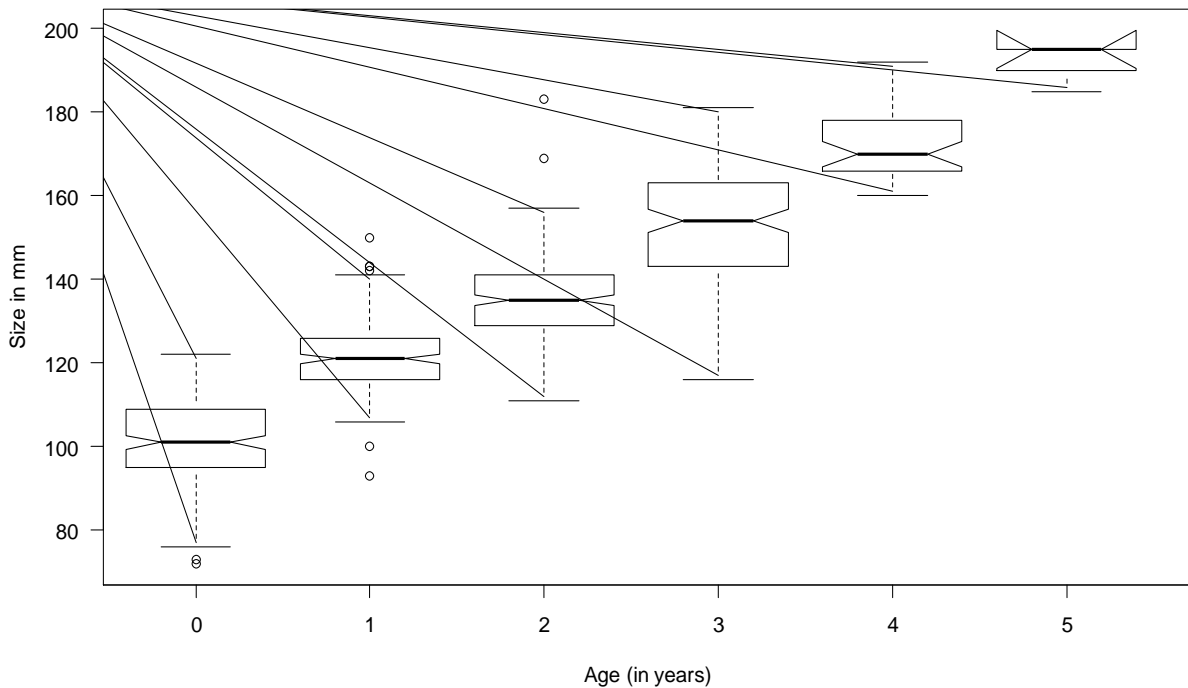
Table 2-2.3: M vector and proportion of matures by size or age (Females)

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 _∞				Due to the disappearance of old individuals and the slow growth since 2008, we were unable to fit a Von Bertalanffy curve, as the size age relationship appears linear (LM: P < 0.001, R ² = 0.68, a = 1.75 ± 0.27 cm.yr ⁻¹ ; see Figure below)	2008-2013
	K					
	t ₀					
	Data source	Growth parameters evaluated from PELMED data (i.e. July) on the 2008-2013.				
Length weight relationship	a				0.0036	2014
	b				3.23	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

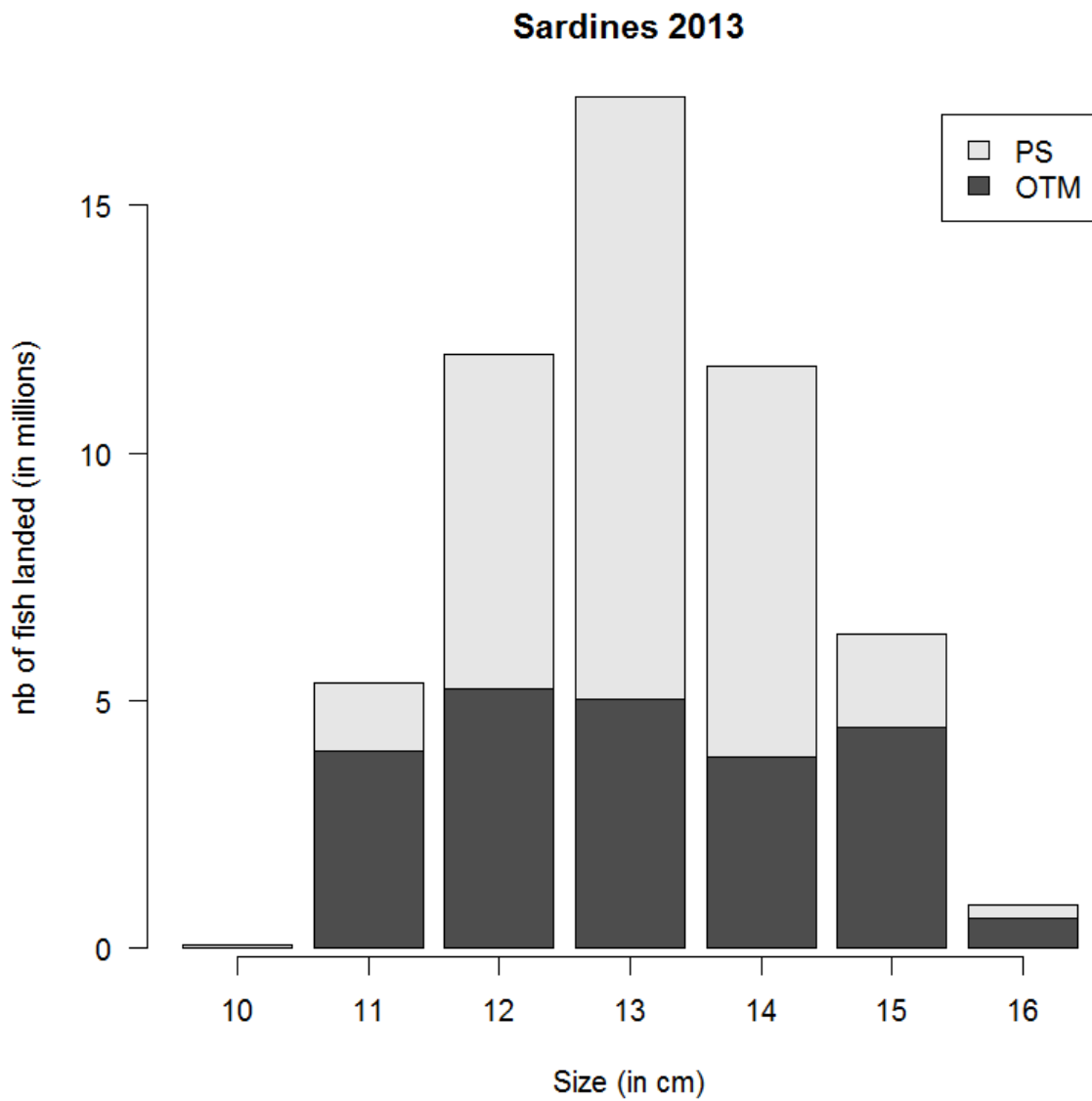
	Country	GSA	Fleet Segment	Fishing Gear Class	Group of Target Species	Species
Operational Unit 1*	FRA	[07]	E – Trawl (12-24 m)	03 - Trawls	31 – Small gregarious pelagic	PIL
Operational Unit 2	FRA	07	H – Purse Seine (12-24 m)	02 – Seine Nets	31-Small gregarious pelagic	PIL
Operational Unit 3						
Operational Unit 4	[Country4]	[GSA4]	[Fleet Segment4]	[Fishing Gear Class4]	[ISCAAP Group]	
Operational	[Country5]	[GSA5]	[Fleet Segment5]	[Fishing Gear	[ISCAAP	

Unit 5				Class5]	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 of the species assessed)	Other species caught (names and weight)	Discards (species assessed)	Discards (other species caught)	Effort (units)
FRA 07 E 03 31 -PIL	14	406	Anchovies	No discards	Sprattus sprattus	1
FRA 07 H 02 31 -PIL	23	583				13
[Operational Unit3]						
[Operational Unit4]						
[Operational Unit5]						
Total						

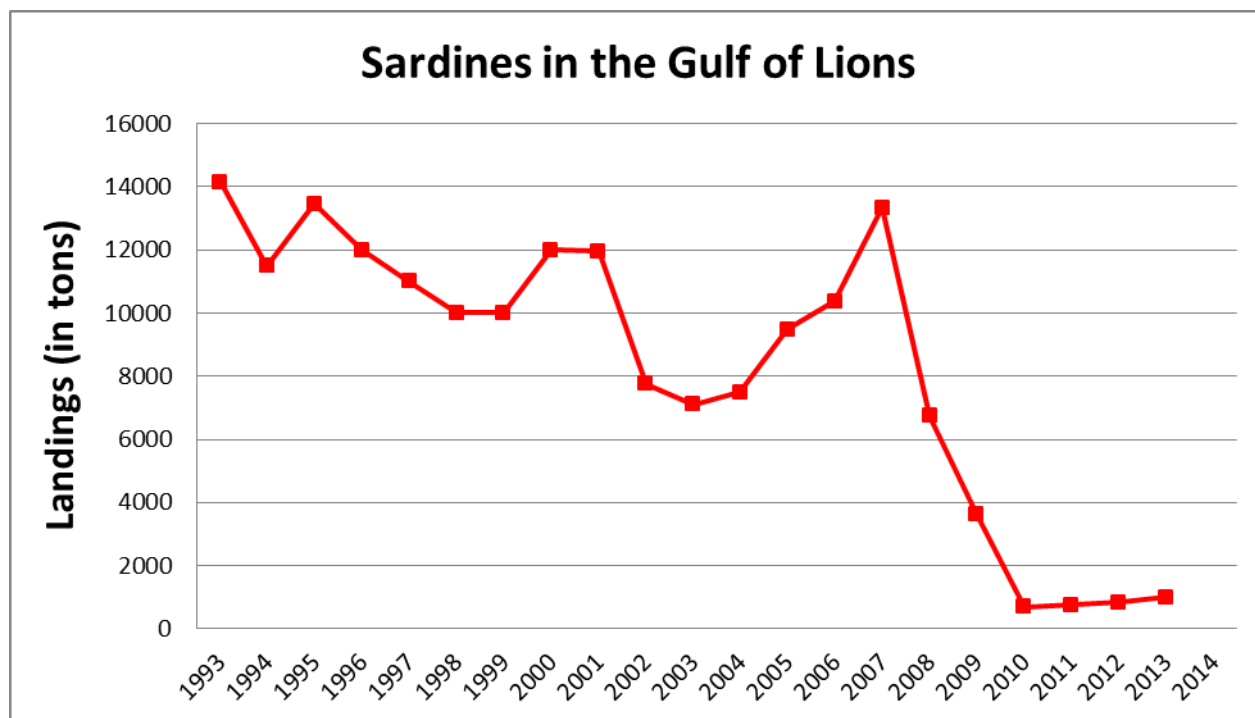
We estimated the number of boats as the number of boats landing more than 1T during the year. Only one of these 14 trawlers seems to fish small pelagic fish all along the year, the 13 others alternate with demersal species as well. The landings of the purse seines are also very seasonal, one season offshore Marseille from January to May (with most landings in April-May) and one season of Port-Vendres in July-August. This activity is very opportunistic and none of these boats are focusing on sardines all throughout the year, the landings per boat vary between 1 and 100T.

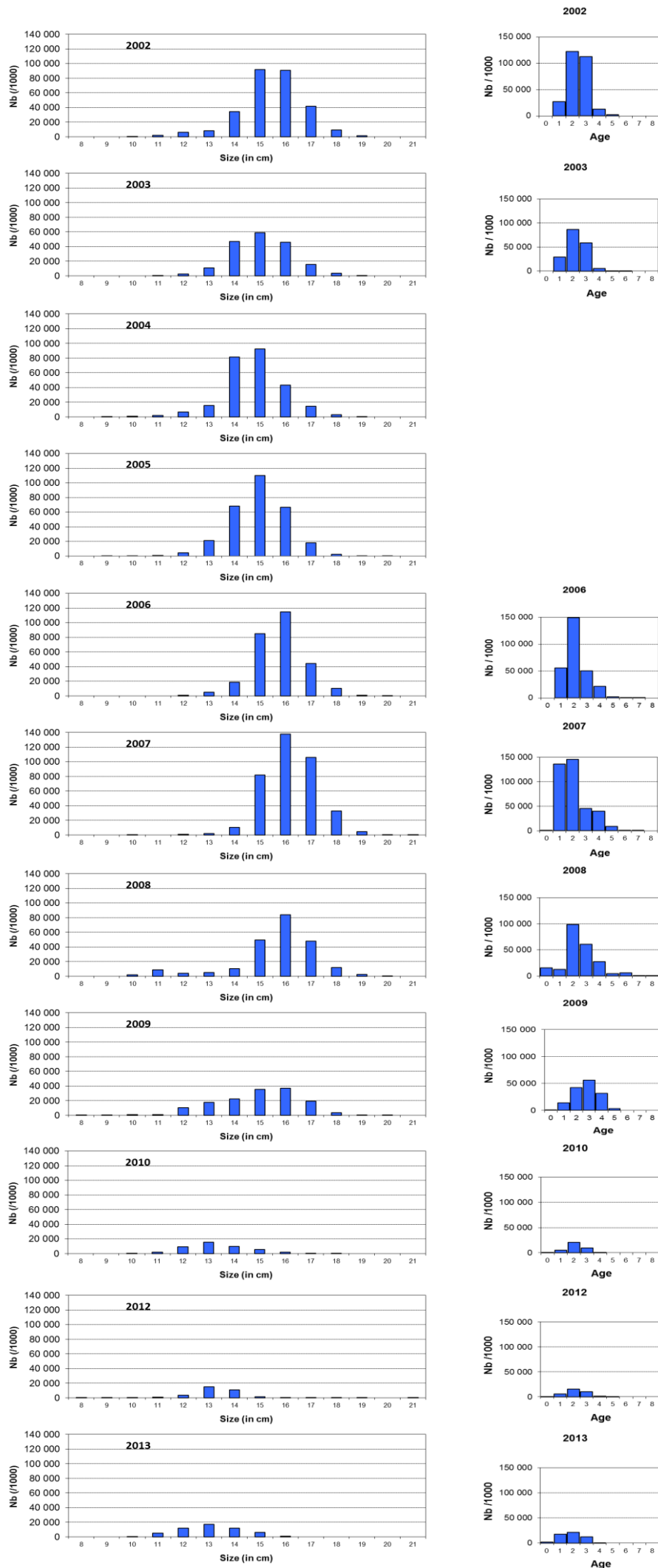


Size structure of the landings depending on the fleet.

3.2 *Historical trends*

Time series analysis with tables and figures showing the observed trends in catches, landings, fishing capacity or effort .





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/emp irical reference value	Value	Target Reference point/empi rical reference value	Value	Comments
B					
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		

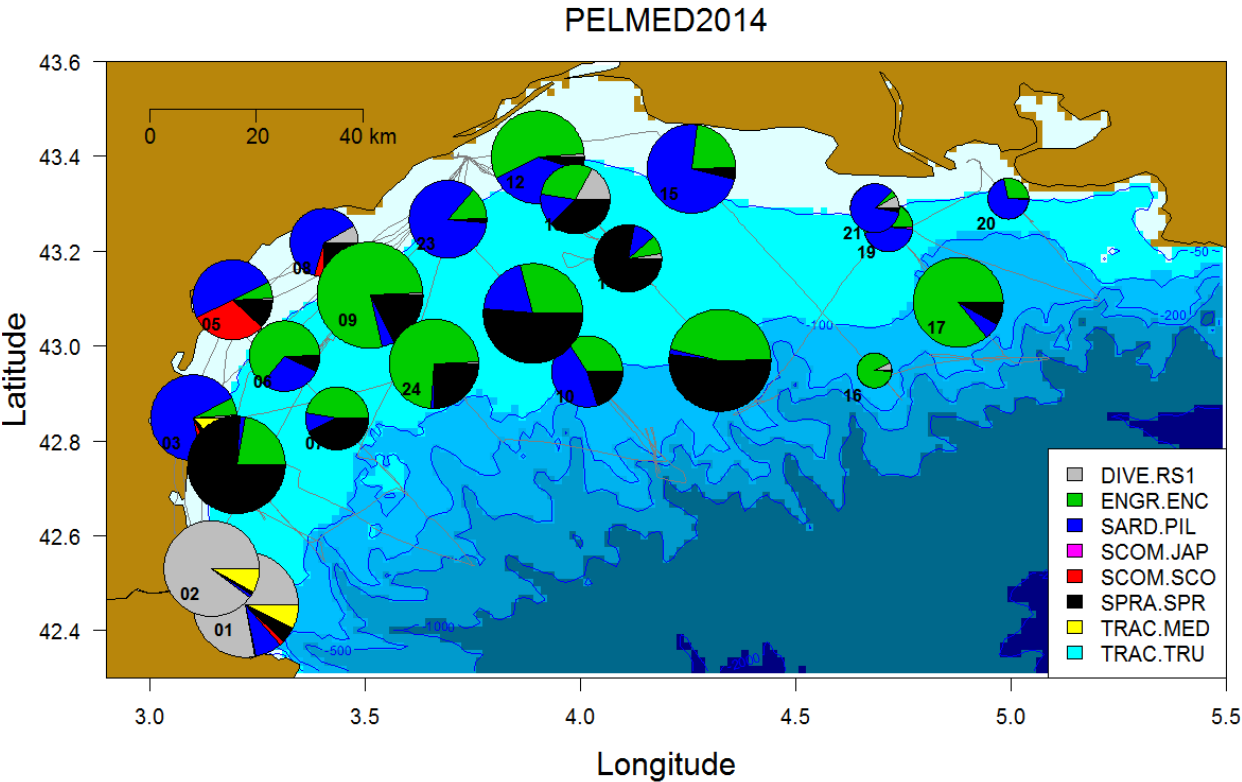
TS (Target Strength)/species	- 71.2 for anchovy and sardine
Software used in the post-processing	Movies+ and R scripts
Samples (gear used)	Pelagic trawl
Biological data obtained	Length-Weight relationship, Age, Sex, Maturity
Age slicing method	Otolith
Maturity ogive used	L50

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

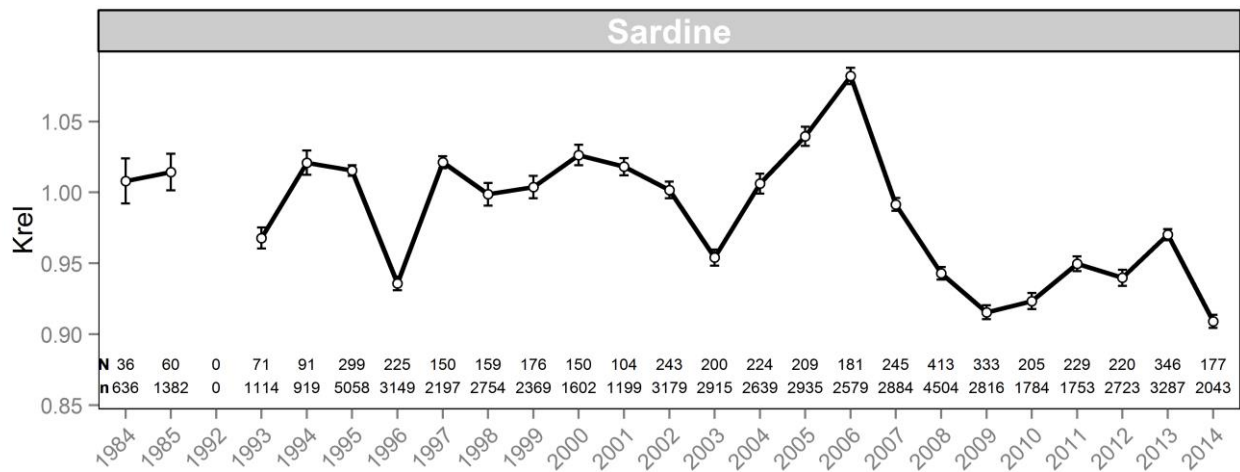
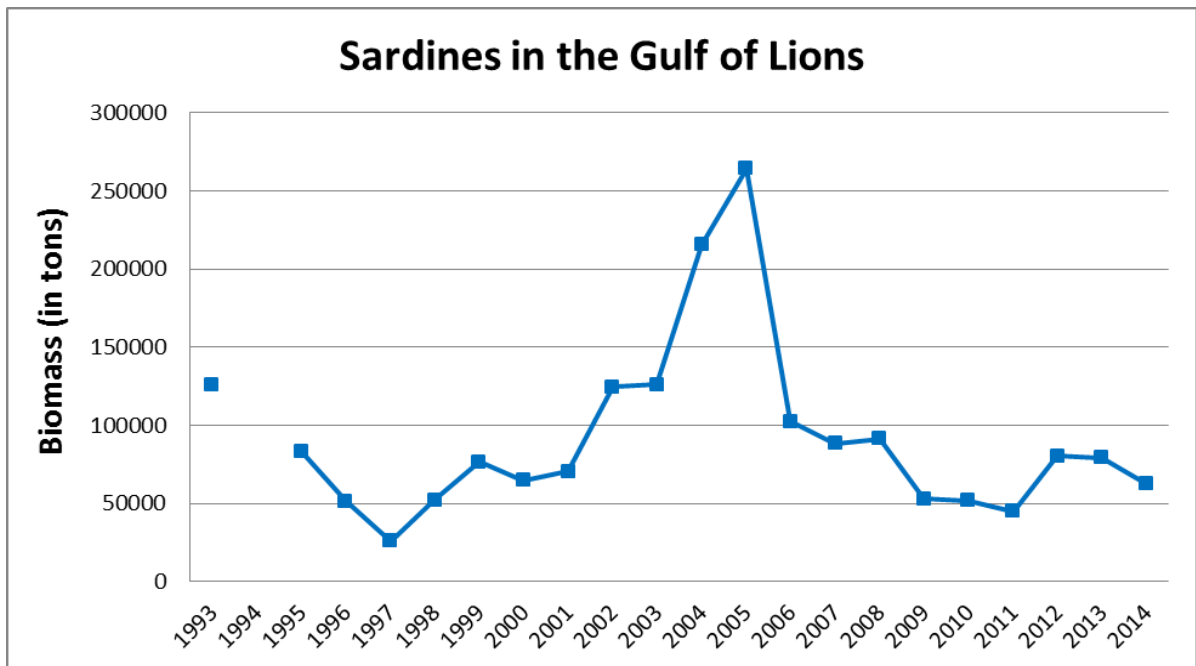
	Biomass in metric tons	fish numbers	Nautical Area Scattering Coefficient	Indicator ...	Indicator ...
Sardines	62 458	5 612 181 051			
Anchovies	30 939	3 829 437 957			
Sprats	27 149	4 827 349 951			

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

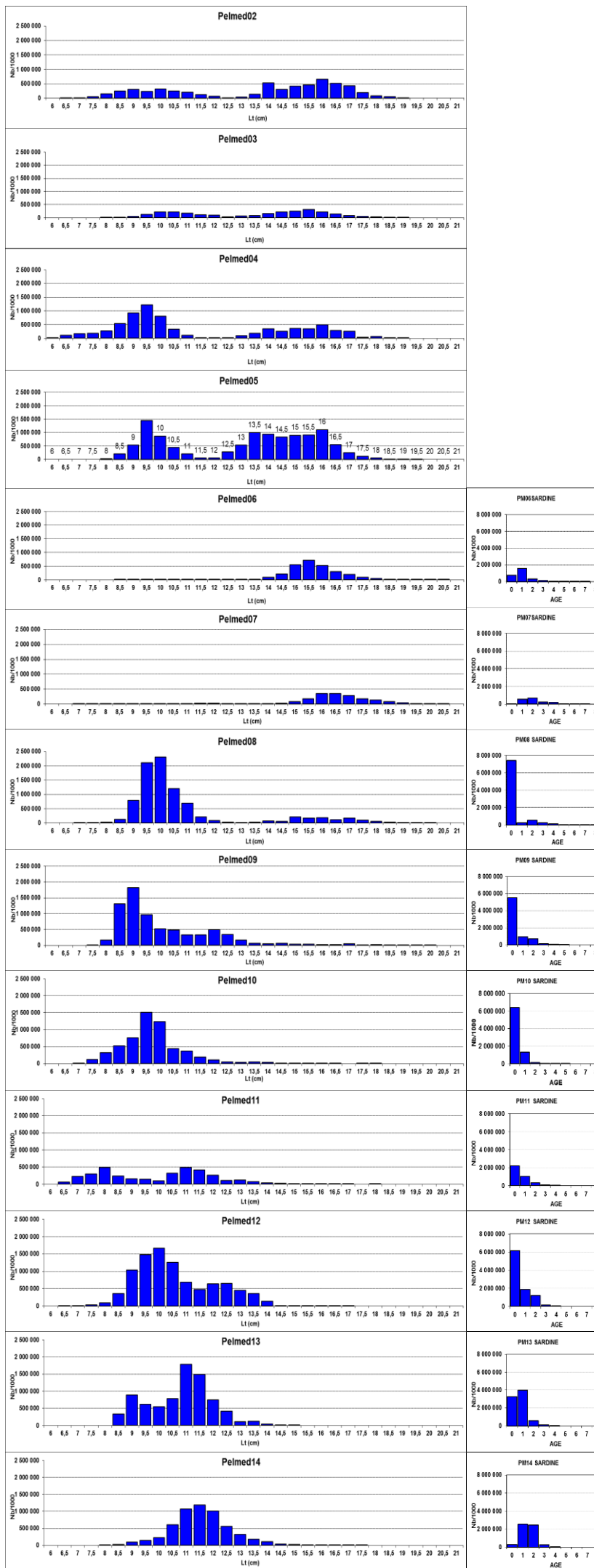
4.1.2 Spatial distribution of the resources

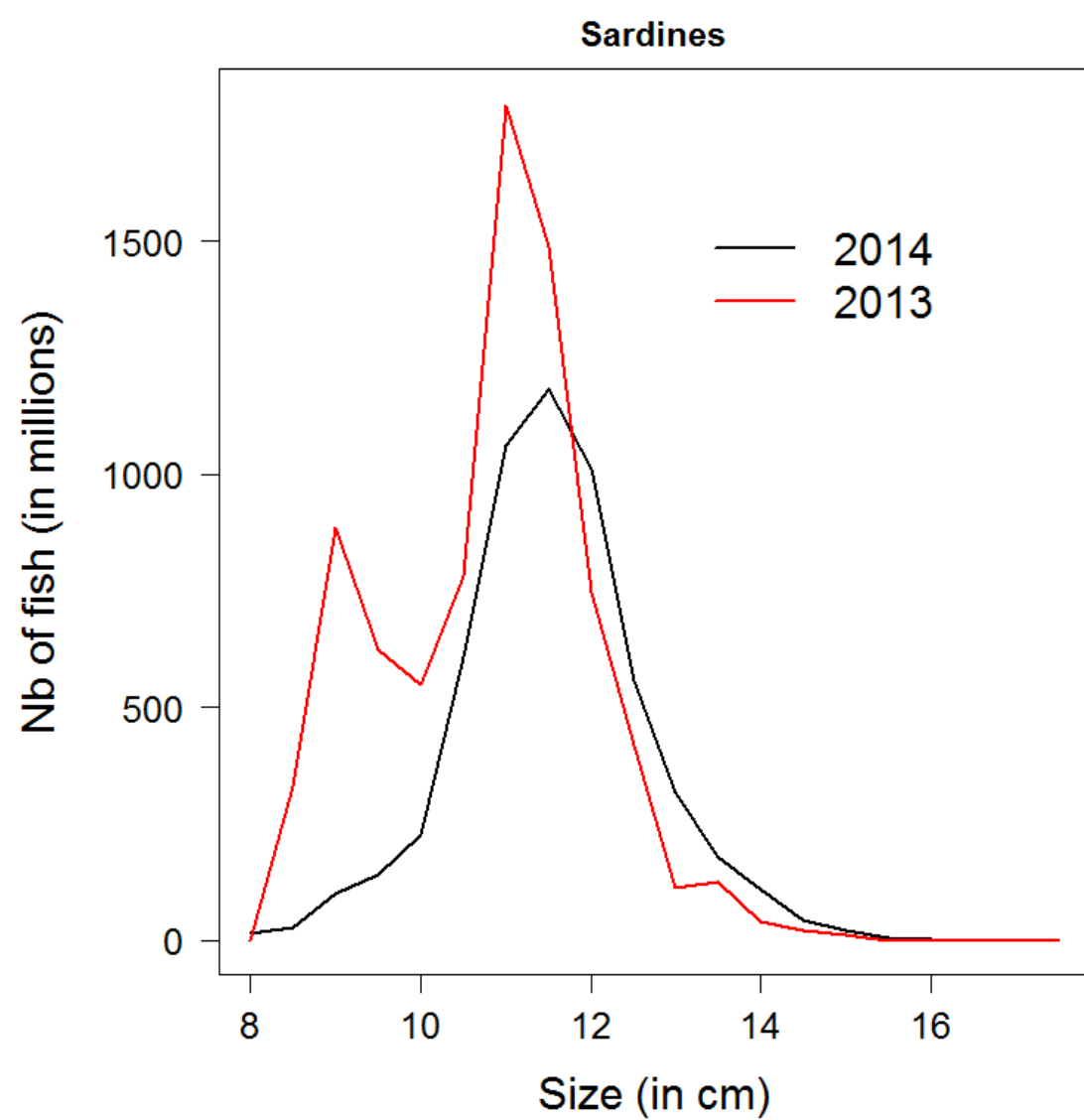


4.1.3 Historical trends



Le Cren condition index of all July surveys





5 Ecological information

5.1 Protected species potentially affected by the fisheries

No protected species should be affected by small pelagic fisheries

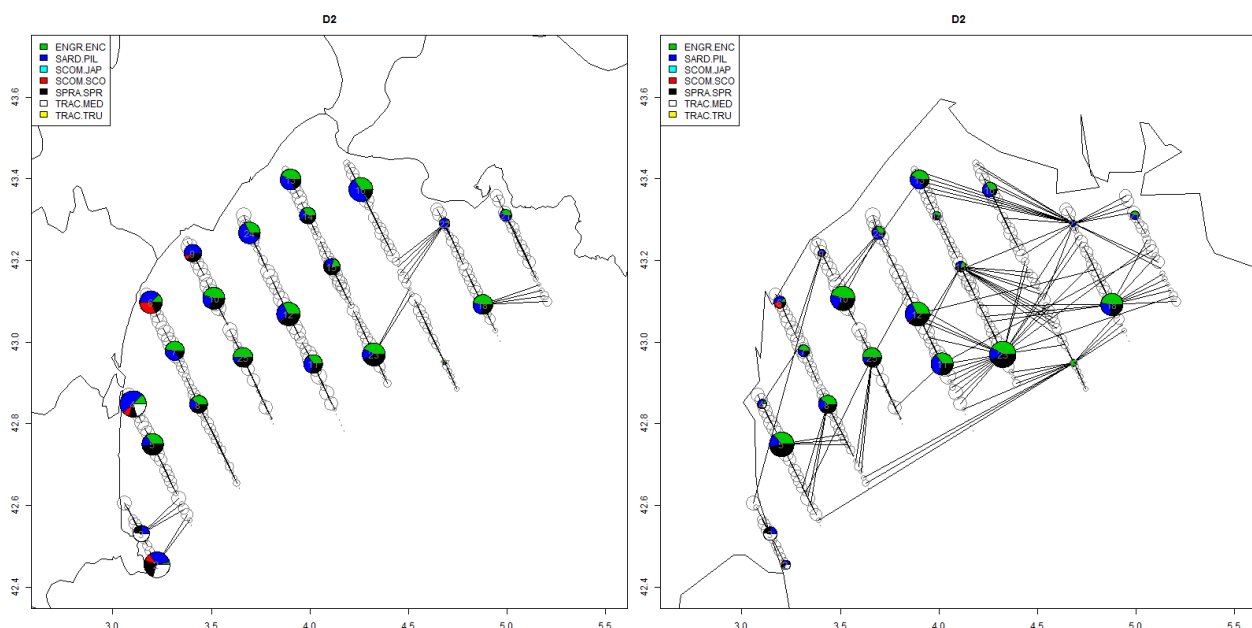
5.2 Environmental indexes

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

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

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 echotracers 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 echotracer 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 echotracer was allocated a trawl according to the form and intensity of the echotracer. 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 17% for sardines 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

(Examples in blue)

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					
	Catch				D	
Stock abundance	Biomass		62 458 T		Low / Intermediate	
	SSB					
Recruitment			Almost absent this year			
Final Diagnosis						

Biomass is slightly lower than last year. But the important information of the year is the quasi absence of recruitment. The size distribution of sardines is usually bimodal during the PELMED July survey. However, this year the first peak (between 8 and 10cm) was totally missing. Similar observations were made on sprats

for which the first peak was barely visible. This suggests poor environmental conditions for recruits of winter spawners and is worrying for the sardine population in the next 1 or 2 years. Indeed, recruitment had been surprisingly high these last years, preventing the population from getting depleted, while the big and old individuals disappeared. This year, some large individuals were observed but still very few compared to a decade ago. Further, the body condition index (as for anchovies) is at its worse. All these signs show that the population has not yet recovered, so that poor (if not null) recruitment might have important consequences on the future. 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.

Finally, the fishing pressure is still very low, landings being lower than 1 000T. Trawlers landed a bit more sardines than last year, but purse seiners decreased their effort. The activity of purse seiners on sardines is still very opportunistic: seasonal and over small areas.

8.1 *Explanation of codes*

Trend categories

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

Stock Status

Based on Fishing mortality related indicators

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

Range of Overfishing levels based on fishery reference points

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

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

* F_c is current level of F

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

Based on Stock related indicators

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

Empirical Reference framework for the relative level of stock biomass index

- **Relative low biomass:** Values lower than or equal to 33rd percentile of biomass index in the time series (**O_L**)
 - **Relative intermediate biomass:** Values falling within this limit and 66th percentile (**O_I**)
 - **Relative high biomass:** Values higher than the 66th percentile (**O_H**)
- 4) **D – Depleted:** Standing stock is at lowest historical levels, irrespective of the amount of fishing effort exerted;
- 5) **R –Recovering:** Biomass are increasing after having been depleted from a previous period;

Agreed definitions as per SAC Glossary

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

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