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FISHERY COMMITTEE FOR THE EASTERN CENTRAL ATLANTIC

Scientific Sub-Committee

Seventh Session

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STATUS SUMMARY FOR SMALL PELAGIC STOCKS IN THE NORTHERN AREA OF THE EASTERN CENTRAL ATLANTIC - CECAF
Main outcomes of the FAO Working Group on the Assessment of Small Pelagic Fish off Northwest Africa 2012-2015

SUMMARY

The FAO Working Group on the Assessment of Small Pelagic Fish off Northwest Africa meets annually to update stock assessments and provide advice for management for the main small pelagic species and stocks in the region. In all 4 meetings from 2012 to 2015 have been held since the last meeting of the Scientific Sub-Committee.

The species assessed by the Group are: sardine (*Sardina pilchardus*), sardinella (*Sardinella aurita* and *Sardinella maderensis*), horse mackerel (*Trachurus trecae*, *Trachurus trachurus* and *Caranx rhonchus*), chub mackerel (*Scomber colias*), bonga (*Ethmalosa fimbriata*) and anchovy (*Engraulis encrasicolus*) in the region between the southern border of Senegal and the northern Atlantic border of Morocco.

This report describe the main trends in catches of the main pelagic fish, recent changes in the fisheries, addresses data quality issues with respect to sampling and provide an update on the most recent assessment results for the small pelagic species, as well as the management recommendations formulated by the working group. The report focuses on the results of the assessment from the last (2015) working group, whereas the readers are invited to consult all of the earlier working group reports from 2012-2014 that have been provided as reference documents. Of the stocks assessed sardine Stock A+B and Stock C were found non fully exploited, Chub-mackerel and Atlantic horse mackerel were considered fully exploited, whereas sardinella, bonga, ethmalosa, anchovy and Cunene horse mackerel were found to be overexploited.

INTRODUCTION

1. This summary report provides a summary of the results of the work of the FAO Working Group on the Assessment of Small Pelagic Fish off Northwest Africa which has met four times since the last meeting of the Scientific Sub-committee in September 2011:

    • 2012: Twelfth meeting of the FAO Working Group on the Assessment of Small Pelagic Fish off Northwest Africa, 21–25 May 2012. Dakar, Senegal (CECAF/SSCVII/2015/Ref.1).
    • 2013: Thirteenth meeting of the FAO Working Group on the Assessment of Small Pelagic Fish off Northwest Africa, 10 -15 June 2013. Nouadhibou, Mauritania (CECAF/SSCVII/2015/Ref.2)
    • 2014: Fourteenth meeting of the FAO Working Group on the Assessment of Small Pelagic Fish off Northwest Africa. 19 - 24 May 2014. Banjul, The Gambia (CECAF/SSCVII/2015/Ref.3).
    • 2015: Fifteenth meeting of the FAO Working Group on the Assessment of Small Pelagic Fish off Northwest Africa. 20- 25 July 2015. Casablanca, Morocco (CECAF/SSCVII/2015/Ref.4)

2. The Working Group Reports are provided as reference documents on the meeting website: http://www.fao.org/fishery/nems/40755/en:

3. The overall objective of the Working Group is to assess the state of the small pelagic resources in Northwest Africa and make recommendations on fisheries management and exploitation options aimed at ensuring optimal and sustainable use of small pelagic fish resources for the benefit of coastal countries.

4. The species assessed by the Group were: sardine (*Sardina pilchardus*), sardinella (*Sardinella aurita* and *Sardinella maderensis*), horse mackerel (*Trachurus trecae*, *Trachurus trachurus* and *Caranx rhonchus*), chub mackerel (*Scomber colias*), bonga (*Ethmalosa fimbriata*) and anchovy (*Engraulis encrasicolus*) in the region between the southern border of Senegal and the northern Atlantic border of Morocco.

5. The working group include participants from up to eight countries (Morocco, Mauritania, Senegal, The Gambia, Spain, The Russian Federation, Norway and The Netherlands) and FAO traditionally participates. The chairperson of the Group, including for the 2015 session was Mr Birane Sambe from the Canary Current Large Marine Ecosystem Project (CCLME). At the 2015 meeting Ms. Aziza Lakhnigue from INRH, Morocco was voted the new chairperson by the working group members for the next 3 meetings. A revised Terms of Reference for the chair was also discussed and agreed by the members of the working group.

METHODS

6. The main model used by the Working Group is the dynamic version of the Schaefer (1954) model. This model has traditionally been applied to sardine, sardinella, horse mackerel, chub mackerel and bonga but the working group has not been in a position to apply it to sardinella in recent years due to the lack of a consistent time series of abundance. Simple medium-term projections of future yields and stock development were made using the Schaefer model fitted to the historical data with a time horizon of five years. All projections took as their departure point the estimated stock status in the last year of data available. Future management strategies were defined as changes in fishing mortality and/or catch relative to those estimated for the last year of data available.

7. For Anchovy a Length Cohort Analysis (Jones, 1984) has been applied to estimate the current F-level and the relative exploitation pattern on the fishery over the last few years. A length-based Yield per Recruit Analysis was then run on these estimates, to assess the status of the stock in

relation to the biological reference points F_{max} and $F_{0.1}$. This model has also been applied to bonga and sardinella in recent years.

8. For the mackerel stock, catch-at-age data from the Russian fleet are available, and age-based methods such as XSA (Shepherd, 1999) and ICA (Patterson and Melvin, 1995) have been used as the basis for scientific advice, is the results of analysis of correlation within cohorts was considered adequate by the working group.

9. The 2015 working group meeting applied the following models:

Species	**Stock**	**Model**
Sardine	A+B	Production model;
	C	Production model;
Round sardinella	Whole sub region	LCA and Y/R
Atlantic Horse mackerel	Whole sub region	Production model
Cunene horse mackerel	Whole sub region	Production model
Chub mackerel	Whole sub region	Production model; XSA; ICA
Anchovy	Whole sub region	LCA and Y/R
Bonga	Whole sub region	LCA and Y/R;

10. In addition, a special focus was given to exploring possible options for alternative assessment methods for the different species, following up on recommendations from a technical review and the CECAF Expert group meeting on assessment methods (FAO, 2015).

PRINCIPLES AND APPROACH TAKEN BY THE WORKING GROUP

11. The working group strives to be consistent, which means to use the same type of method and abundance indices for the different stocks while being open to explore alternative options.

12. Adopted agreed assessment categories and reference points are as indicated below.

Assessment categories

13. The three assessment categories adopted by the CECAF scientific working groups include:

- **Non-fully exploited:** The stock is in good condition and fishing pressure can be increased without affecting the sustainability. All increases must be seen in the context of the general environmental situation.
- **Fully Exploited:** The fishery operates within the limits of sustainability. Current fishing pressure seems sustainable and can be maintained,
- **Overexploited:** The fishery is in an undesired state both in terms of biomass and fishing mortality. Fishing pressure should be reduced to allow the stock to grow.

Reference points for management recommendations

14. The Working group has adopted the following Biological Reference Points (BRPs):

- **Target Reference Points**: $B_{0.1}$ and $F_{0.1}$
- **Limit Reference points:** B_{MSY} and F_{MSY}

The Group will present for each stock estimates of:

$\mathbf{F_{cur}/F_{MSY}}$: Ratio between the observed fishing mortality coefficient for the last year of the series and that which would give a maximum sustainable yield over the long term.)

$\mathbf{F_{cur}/F_{SYCur}}$: Ratio between the observed fishing mortality coefficient for the last year of the series and that which would produce a sustainable catch at the current biomass level.)

$\mathbf{B_{cur}/B_{MSY}}$: Ratio between the estimated biomass for the last year of the series and the biomass corresponding to FMSY.)

$\mathbf{F_{cur}/F_{0.1}}$**:** Ratio between the fishing mortality coefficient observed for the last year of the series and $F_{0.1}$.

$\mathbf{B_{cur}/B_{0.1}}$: Ratio between the estimated biomass for the last year of the series and the biomass corresponding to $F_{0.1}$.

Where:

$\mathbf{F_{0.1}}$ - level of fishing mortality at which the slope of the Y/R curve is 10% of the slope at the origin

$\mathbf{F_{MSY}}$- value of F (and of other characteristics of the stock) where the long term total yield is maximum

$\mathbf{B_{0.1}}$ – is the value of B corresponding to $F_{0.1}$

$\mathbf{B_{MSY}}$ – is the value of B corresponding to F_{MSY}

15. The target reference points indicate the ideal situation for the stocks whereas the limit indicate that the situation that we do not want to surpass.

16. Management advice for the stocks is given in relation to the reference points and on the basis of the projections. The advice is intended to provide guidance to management on how to make the different stocks develop in a direction where each stock is exploited at an optimum level.

OVERALL REGIONAL TRENDS

Catch

17. The decreasing trend in total catch observed from 2010 to 2013, was reversed in 2014 and an increase in total catch of the main small pelagic fish in the subregion from around 2 million tonnes in 2013 to around 2.5 million tonnes in 2014 was observed, constituting a 24 percent increase as compared to 2013. Total catch of small pelagic fish for the period 1990–2014 has been fluctuating with an average of around 1.9 million tonnes while the average for the five last years have been 2.4 million tonnes.

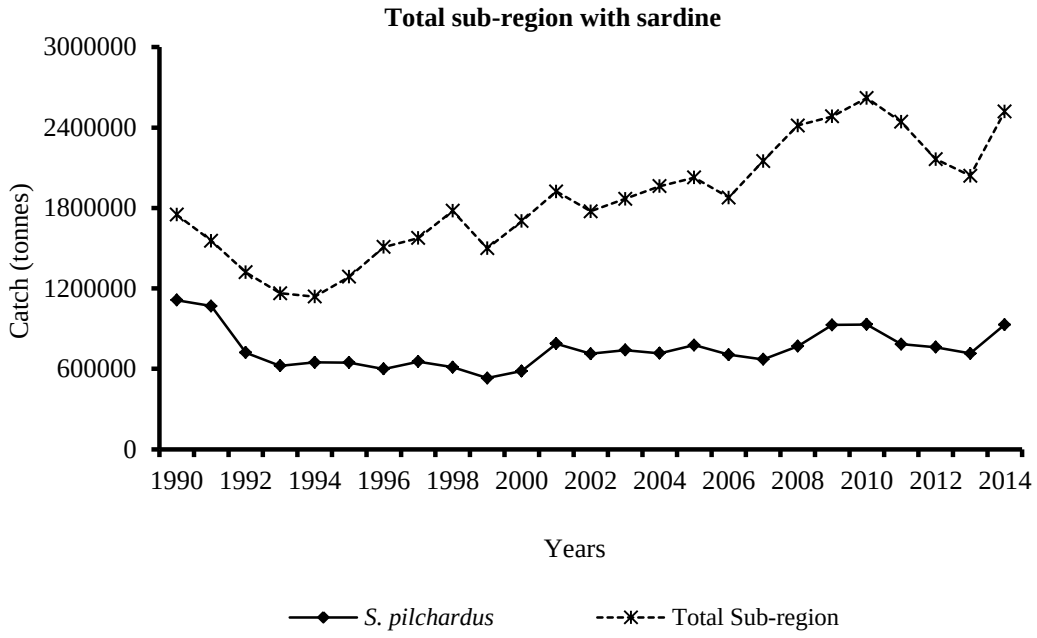


Figure 1a: Catches (1990–2014) in the sub-region with sardine (weight in tonnes)

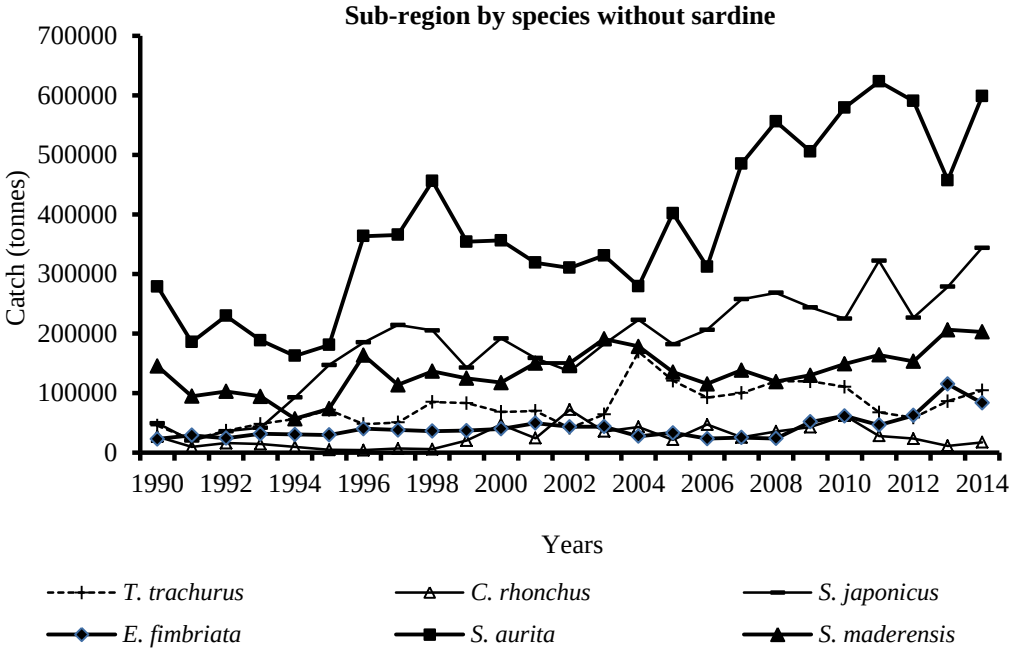


Figure 1b: Catches (1990–2014) in the sub-region without sardine (weight in tonnes)

18. Sardine (*Sardina pilchardus*) remains the dominant species, constituting about 37 percent of overall catch of the main small pelagic species in 2014. An increase in total catch (30 percent) was observed from 2013 to 2014 from 714 000 tonnes in 2013 to 929 000 tonnes in 2014. This increase is mainly attributable to an increase in catches in Zones A+B and in Mauritania.

19. The other dominant species group is the *Sardinella* spp. (*S.aurita* and *S.maderensis*) which, as in 2013, constituted 32 percent of total catch of the main small pelagic fish species in 2014. Twenty-four percent for round sardinella (*Sardinella aurita*) and eight percent for flat sardinella

(*Sardinella maderensis*). The round sardinella is the second most important species in terms of catch, and catches has been on a high level since 2007 as compared to earlier years. Catches of the round sardinella showed a general increasing trend from 2006 to 2012, but decreased from 611 000 tonnes in 2012 to 458 000 tonnes in 2013, a decrease of 25 percent. In 2014, however, catches increased to around 598 000 tonnes, an increase 31 percent, and thus catches in 2014 was at the level of 2012 catches. The average catch over the last five years of round sardinella was about 570 000 tonnes as compared to 379 000 tonnes when looking at the time period 1990-2014. In contrast the catch of flat sardinella (*Sardinella maderensis*) showed a slight decrease as compared to 2013 when catches were 206 000 tonnes as compared to 203 000 tonnes in 2014, a decrease of 2 percent. The average over the last five years for this species being 175 000 tonnes as compared to a long term average (1990-2014) of 136 000 tonnes. There have been many changes in the fleet targeting sardinella in recent years, including time and area coverage, in particular in Mauritania.

20. Cunene horse mackerel (*Trachurus trecae*) is the most important species of horse mackerel reported in the catches, constituting about 9 percent (approximately 222 000 tonnes) of the total catch of the main small pelagic fish in 2014.This constitutes an increase of approximately 65 percent as compared to 2013, when the total reported catch was 135 000 tonnes. Before the reported increase in 2014, while catches had been fluctuating over the time series, the catches had been decreasing since 2008, when catches were around 401 000 tonnes, the highest catch of the time series. The average annual catch of the Cunene horse mackerel over the last five years was estimated at about 228 000 tonnes, as compared to a long term average of 179 000 tonnes (1990-2014). Catches of Atlantic horse mackerel (*Trachurus trachurus*) also increased from 2013 to 2014. About 86 000 tonnes of Atlantic horse mackerel (*Trachurus trachurus*) were landed in 2013, compared to 104 000 tonnes in 2014. This constitutes an increase of 21 percent as compared to 2013. The average catch of Atlantic horse mackerel over the last five years was 85 000 tonnes. The third species in this group, the false scad (*Caranx rhonchus*), also showed an increase in total catch from 2013 to 2014, with total catch of around 12 000 tonnes and 17 000 tonnes respectively, which represents a decrease of 53 percent approximately.

21. The catch of chub mackerel (*Scomber colias*) over the last ten years has shown a general increasing trend from around 137 000 tonnes in 2002 to 344 000 tonnes in 2014, the highest catch of the time series. Catches in 2013 was 278 000 tonnes. The average catch for the period 1990–2014 was estimated at around 183 000 tonnes, whereas the average for the last five years was 279 000 tonnes. In 2014 as in 2013, chub mackerel represented 14 percent of catches of total small pelagics.

22. The total catch of anchovy (*Engraulis encrasicolus*) in 2014 was around 19 000 tonnes, showing a continued decrease since 2011 (150 000 tonnes in 2011, decreasing to 115 000 tonnes in 2012 and 37 000 tonnes in 2013). Catches of this species have been fluctuating with an average of about 94 000 tonnes of anchovy for the last five years (20010–2014).

23. The catch of bonga (*Ethmalosa fimbriata*) in 2014 constitutes around 3 percent of total catch of main small pelagic fish in the subregion. This is a decrease as compared to 2013, when the species constituted 6 percent of total small pelagic catch. Total catch of bonga was around 83 000 tonnes in 2014, decreasing from115 000 tonnes in 2013, a decrease of 27 percent. An average of 73 000 tonnes of bonga was recorded over the last five years and the overall trend since 2008, with the exception of 2011 and 2014, shows a rapid increase for this period.

Table 1: Catch contribution in 2014 (5) and change since last year (percent)

Species	**Catch contribution 2014 (%)**	**Catch 2013 (tonnes)**	**Catch 2014 (tonnes)**	**Change (%)**
Sardina pilchardus	37%	714 000	929 000	+30%
S.aurita	24%	458 000	598 000	+31%
Scomber colias	14%	278 000	344 000	+24%
Trachurus trecae	9%	135 000	222 000	+65%
S.maderensis	8%	206 000	203 000	-2%
Ethmalosa fimbriata	3%	115 000	83 000	-27%
Trachurus trachurus	4%	86 000	104 000	+21%
Engraulis encrasicolus	1%	37 000	19 000	-48%
Caranx rhonchus	1%	12 000	17 000	+53%
TOTAL		2 041 000	2 521 000	+17%

Acoustic surveys

24. No regional coverage of the small pelagic stocks has been carried out in recent years. Since 2013, only the Moroccan research vessel conducted an acoustic survey in the period November-December.

25. The 2015 working group observed increases in abundance of some of the main species the northern part of the area where acoustic surveys were carried out, although overall biomass estimates for these species are not available given that surveys covering the whole distribution range of the species still remain a gap.

Environment

26. On the whole, in 2014, the amplitude of the annual variations of SMF position exceeded the average climate norm: in the first half of the year it was located mainly southward, and in the second half of the year –more northward as compared to its average annual location.

KEY RECENT DEVELOPMENTS – SMALL PELAGIC FISHERIES

27. Some recent developments that impact the fisheries in the subregion include:
    - Re-establishment of the fishing agreement between Morocco and the EU in Zone C north of Cape Blanc.
    - Introduction of new area restrictions (zoning) for industrial fishing vessels (Mauritania) and introductions of area closures for the sardine fishery (Morocco Zone A+B and Zone C – north of Cape Blanc)
    - Further expansion of the fishmeal industry in Mauritania:
        - The fish meal industry continues its expansion in Mauritania in 2014. The number of operational fishmeal factories went from 18 factories in 2012 to 22 in 2013, and several others were in constructions at the end of 2014.
        - The fish feeding these factories include *S. aurita*, *S. maderensis* and bonga. The percentage of *S. aurita* in the catches landed at the factories has increased from 30% in 2012 to 45% in 2013 and to 62% in 2014.
        - The number of pirogues (purse seines) working for these factories went from 63 in 2012 to 103 in 2013 and to 136 in 2014. As in 2013, some coastal seiners also worked for the fish meal factories.
    - Changes in fishing effort in Mauritania: The European fleet, operating under the EU fishing agreement was composed primarily of units coming from Eastern Europe Lithuania, Latvia and Poland. The Dutch vessels were only present the first few months of 2014, fishing mainly for sardine in the northern area- and not as traditionally for sardinella. Contrary to 2013, the non-EU fleet was present in Mauritania during the whole of 2014. Thus an increase in effort was observed.
    - Introduction of new mesh size restrictions in for gillnets targeting Bonga (The Gambia)
    - Improved monitoring of the catches of the Senegalese vessels operating outside Senegalese waters (Senegal)
    - Importance of the regional market for the export of sardinella to Mali from Saint Louis and to Guinea and Burkina Faso from Mbour and Joal. The catches in Saint-Louis, Senegal and along the Petite Côte (Mbour and Joal) are influences by the existence of a sub-regional market as well as the activities of the fish meal factories. In 2014, a high concentration of pirogues using encircling gillnets was observed between June and December. These pirogues came from other fishing zones in Senegal. Thus the catches of round sardinella from the « petite côte » saw a big increase (121 % in Joal and 50 % à Mbour).
    - Local co-management committees exist at some landing sites such as Kayar and on the ”Petite Côte” (Ngaparou et Pointe Sarène).
        - Measures relative to the banning of landing of juveniles of small pelagics during certain periods are still in effect at different landing sites. Violations of measures can be subject to sanction at local level, which may vary from site to site. Sanctions relate to confiscation of gear, catch, payment of fines etc.
    - In 2014, Mauritania gave 300 licences to senegalese artisanal fishermen for a duration of 3 months renewable during 1 year. The same regulations were in place in 2013. Of this fleet about 15 of the purse seiners must stay 15 days in Noukchott on a rotational basis until the end of the contract and the catch needs to be sold « on site ». the industrial fleet is composed of small local seiners of low tonnage. In 2014, three units were in activity in Casmance over a 2 month period.

ASSESSMENT RESULTS AND MANAGEMENT ADVICE

Reference points and management advice

28. As for the previous years, the Working Group estimated the status of the stocks and fishery in relation to agreed reference points for management of the pelagic stocks in the sub-region. Projections of future yields and stock status under different scenarios for future management

measures were made, when possible. The management advice for the stocks is given in relation to the reference points and on the basis of the projections. They are intended to provide guidance to management on how to make the different stock develop in a direction where each stock is exploited at an optimum level. As far as possible, advice for each stock is given both in terms of effort and catch levels. Since most of the stocks are shared by two or more countries in the region, the Working Group strongly recommends the reinforcement of regional cooperation in research and management.

State of stocks and fisheries

29. Sardine in Zones A+B, show an increase in the acoustic abundance index for 2013 and an increase in the recruitment index for 2013 is also observed. The results of the production model show that the state of this stock continues to improve, and the stock is now considered non-fully exploited- as compared to fully exploited in the last assessment in 2014. It should be noted that the last year of the abundance series available to the group was 2013 (and not 2014). The results of the projections were not conclusive. However, considering the instability of this resource vis-a vis environmental changes call for the adoption of a precautionary approach requiring setting a catch limit for sardine in this zone at the same level as for 2014, which is around 550 000 tonnes.

30. Sardine (*Sardina pilchardus*) in Zone C was still considered non-fully exploited. In the absence of regional acoustic surveys, the stock was assessed using the survey index of the Moroccan Research Vessel Al-Amir, with the data up to 2013, the 2014 data not being available to the working group. The stock is influenced by environmental factors and shows fluctuations independent of fishing. Considering the observed fluctuations, total catch should be adjusted according to observed natural changes in the stock. The stock structure and abundance should be closely monitored by fishery independent methods covering the complete distribution area.

31. The assessment of sardinella (*S. aurita*, *S. maderensis* and *Sardinella* spp.) continued to pose a challenge to the working group. Due to the absence of regional acoustic estimates for recent years and the deterioration of the available CPUE series, the production model traditionally applied can no longer be used. However, as for the last assessment, length frequency data were available and the group could apply the LCA and Yield-per-Recruit Analysis, also applied in 2014, updating the length frequency matrix with information up to 2014. This analysis was done on round sardinella. The results of the assessments indicate that the stock is overexploited. The working group further notes that the catches in recent years (since 2007) are high, despite the state of overexploitation indicated by the working group. The increase of catches over a longer period, despite a stock being overexploited, could be linked to an increase in the level of recruitment during this period, There is no guarantee that such a high level of recruitment will continue in the future and high catches do not necessarily reflect the state of the stocks. As a precautionary measure, the Working Group retains its recommendation of previous years to reduce fishing effort for all fleet segments. The Working Group could not make a catch recommendation as at present it does not dispose an adequate index of abundance and is unable to predict future recruitment.

32. The results of the assessments showed no changes in the status of the horse mackerel species as compared to the two last assessments in 2013 and 2014. An increase in catch and effort is observed in 2014 compared to 2013 for both of the Trachurus species. The Cunene horse mackerel remains overexploited whereas the Atlantic horse mackerel is considered fully exploited. Given the mixed nature of this fishery and the results of the projections, the working group, as a precautionary approach, recommends to reduce both effort and catch for the two species.

33. The assessment of Chub mackerel (*Scomber colias*), using both a production model and an age based approached, indicate that the state of Chub mackerel has improved, and the stock is considered fully exploited as compared to overexploited last year. Catches for the species

however continue to increase, and the 2014 catches are the highest of the time series. The Working Group recommends not to exceed the mean level over the last five years in 2014 for the whole sub-region.

34. Anchovy (*Engraulis encrasicolus*) is still considered overexploited. The availability of this species is highly dependent on environmental factors and is fished opportunistically, thus the catches varies considerably from one year to another. Assessment was carried out on information from Zone North +A+B. The Working Group recommends that current effort should be reduced and on the long term be adjusted according to the natural fluctuations in this stock.

35. As in 2013 and 2014, the results from the assessment indicate that Bonga (*Ethmalosa fimbriata*) is overexploited at the subregional level. The working group notes a general increasing trend in catches, even though a decrease was observed in 2014. The Working Group recommends that effort should be decreased as compared to current levels for bonga to regain a catch level that can ensure sustainability.

Table 2 below provides a summary of the assessments and management recommendations by the 2015 Working Group:

Stock	Last year– 2014– catch in 1 000 tonnes (2010–2014 avg.)	*$B_{cur}/B_{0.1}$	*$F_{cur}/F_{0.1}$	Assessment	Management recommendations
Sardine *S. pilchardus* Zone A+B	573 (435)**	122%	48%	Non-fully exploited (2013)	The stock continues improve as compared the 2013 assessment and the stock is considered non-fully exploited. The results of the projections were not conclusive. However, considering the instability of this resource vis-a vis environmental changes call for the adoption of a precautionary approach requiring setting a catch limit for sardine in this zone at the same level as for 2014, which is around 550 000 tonnes .
Sardine ** *S. pilchardus* Zone C	344 (378)**	141%	32%	Non fully exploited (2013)	The stock is influenced by environmental factors and shows fluctuations independent of fishing. Considering the observed fluctuations, total catch should be adjusted according to observed natural changes in the stock. The stock structure and abundance should be closely monitored by fishery independent methods covering the complete distribution area.
Sardinella** *S. aurita* *S. maderensis* *Sardinella* spp. Whole subregion	598 (570) 203 (175) 801 (745)	- - -	250% (LCA-Y/R) - -	Overexploited	The working group notes that in the absence of acoustic estimates for recent years and the deterioration of CPUE series the production model traditionally applied could not be used. However improved length frequency data made possible the application of an LCA model and a yield per recruit analysis. The results of the assessments indicate that the stock is overexploited. The working group further notes that the catches in recent years (since 2007) are high, despite the state of overexploitation indicated by the working group. The increase of catches over a longer period, despite a stock being overexploited, could be linked to an increase in the level of recruitment during this period, There is no guarantee that such a high level of recruitment will continue in the future and high catches do not necessarily reflect the state of the stocks. As a precautionary mesure, the Working Group retains its recommendation of previous years to reduce fishing effort for all fleet segments. The Working Group could not make a catch recommendation as at present it does not dispose an adequate index of abundance and is unable to predict future recruitment.
Horse mackerel *T. trachurus* *T. trecae* Whole subregion	104 (95) 222 (228)	105% 23%	104% 1329%	*T. trachurus* fully exploited and *T. trecae* are overexploited.	An increase in catch and effort is observed in 2014 compared to 2013 for both of the Trachurus species. *T.trecae* remains overexploited whereas *T.trachurus* is fully exploited. Given the mixed nature of this fishery and the results of the projections, the working group, as a precautionary approach, recommends to reduce both effort and catch for the two species.
Chub mackerel *Scomber colias* Whole subregion	344 (280)	135%	140%	Fully exploited	The working group adopted, based on the results of both the production model and the analytical model that the stock is fully exploited The Working Group recommends not to exceed the mean level over the last five years 280 000 tonnes in 2014 for the whole sub-region.
Anchovy *Engraulis encrasicolus* Whole subregion	19 (94)***	NA	112% (LCA-Y/R)	Over exploited	The results of the model indicate that the species is overexploited. The availability of this species is highly dependent on environmental factors and is fished opportunistically, thus the catches varies considerably from one year to another. Assessment was carried out on information from Zone North +A+B. The Working Group recommends that current effort should be reduced and on the long term be adjusted according to the natural fluctuations in this stock.

Stock	Last year– 2014– catch in 1 000 tonnes (2010–2014 avg.)	*$B_{cur}/B_{0.1}$	*$F_{cur}/F_{0.1}$	Assessment	Management recommendations
Bonga *Ethmalosa fimbriata* Whole sub-region	83 (67)	NA -	164% (LCA-Y/R)	Overexploited	The working group notes a general increasing trend in catches even though a decrease was observed in 2014. The Working Group recommends that effort should be decreased as compared to current levels for bonga to regain a catch level that can ensure sustainability.

*All advice is based on the results of the production model, unless otherwise indicated.
**Assessment relates to 2013 as the data available did not allow for an assessment up to 2014
*** Catches of anchovy in Mauritania before 2013 (1997-2012) is believed to include also small horse mackerel. See Chapter 6 for details.

FUTURE RESEARCH

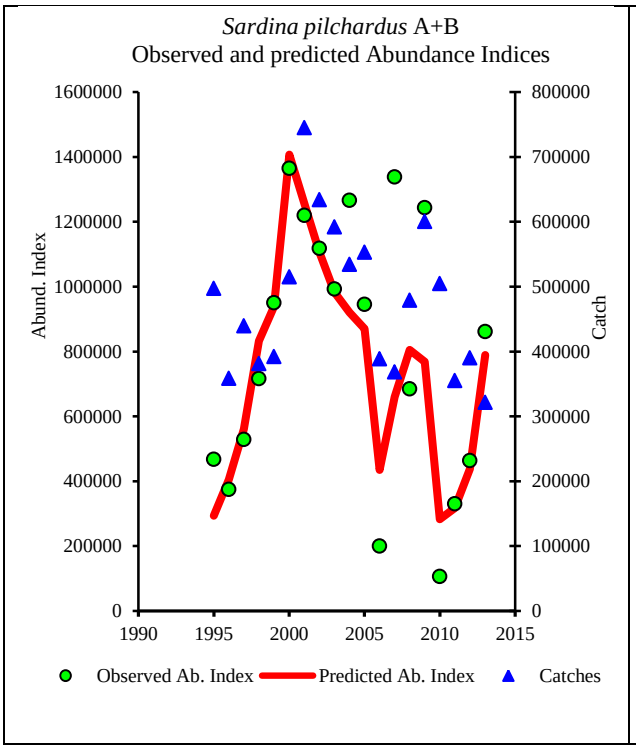
The 2015 Working Group recommends that the following research areas and actions should be pursued in 2015/2016.

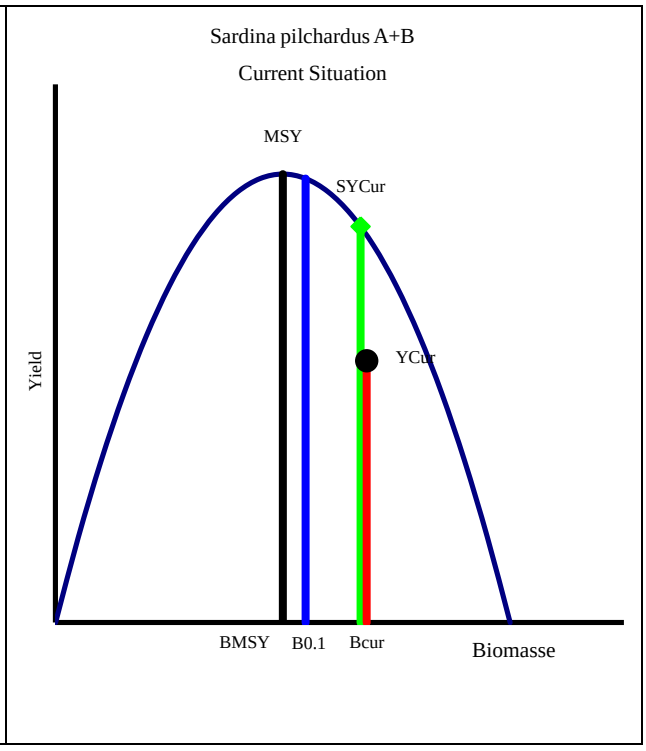
1. The working group notes with satisfaction the review of the assessments and the models applied by the group over the last 15 years and recommend that the group members familiaize themselves with the new assessment tools presented during the working group (ex SCAA) with the aim to improve the quality and pertinence of the working groups recommendations.
2. In order to apply the SCAA model, the group recommends an improvement of the quality of the length frequency data that serve as the basic entry data for this model.
3. The group recommends to organize training sessions for the scientists of the sub-region to get a good understanding of these new assessment tools.
4. The assessment of small pelagics is critically dependent on the quality of the acoustic estimates. The absence of acoustic surveys in recent years has not made it possible to update assessments by the global model on certain stocks, particularly those of sardinella. Acoustic surveys and related activities, such as coordination between countries and intercalibration, should be continued to maintain and improve the time series. It is, therefore, strongly recommended that the coordinated surveys conducted during the last quarter of each year should be resumed and that the Planning Group for the Coordination of Acoustic Surveys should meet in October 2015.
5. The recurrent problems for the Senegalese vessel to participate in acoustic surveys were noted with great concern and the Working Group urges Senegal to find a solution to ensure complete coverage of the main shared small pelagic stocks in the future.
6. The group recommends the continuation of the he recruitment surveys for horse mackerel, chub mackerel and sardine carried out by the Russians and that it should be extended to cover the whole subregion. It is also important that this work is carried out in collaboration with research vessels of the countries of the sub-region for all the species studied including sardinella.

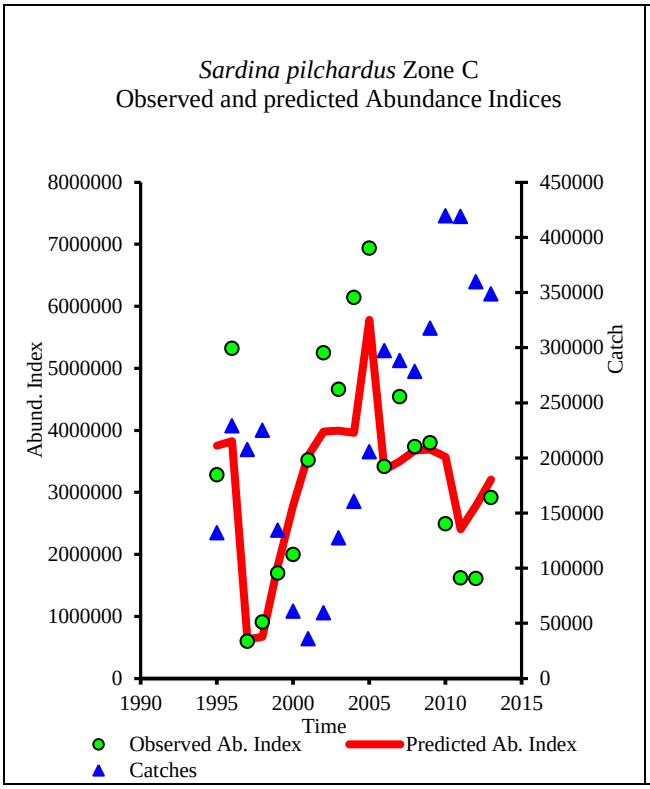
7. It is essential to improve biological sampling by increasing the number and size of samples and to ensure that all size ranges and fleet segments are covered at all landing sites throughout the year. Each country and each subgroup must ensure that length composition of the catch and surveys is organised in a way exploitable by the Working Group before the next meeting.
8. Studies should be undertaken on stock identity and stock migration, by for example, tagging, learning from the experiences of other regions.
9. Work on age reading of sardine, sardinella, horse mackerel and chub mackerel needs to be strengthened through regular sampling and reading of all size classes throughout the year and through stimulation of regional exchanges of samples and results.
10. The development and improvement of assessment methods should be continued, including the integration of environmental aspects. The version of the production model used by the Working Group should be developed, including other versions of the production functions, multiple abundance indices and uncertainty estimates as well as other methods.

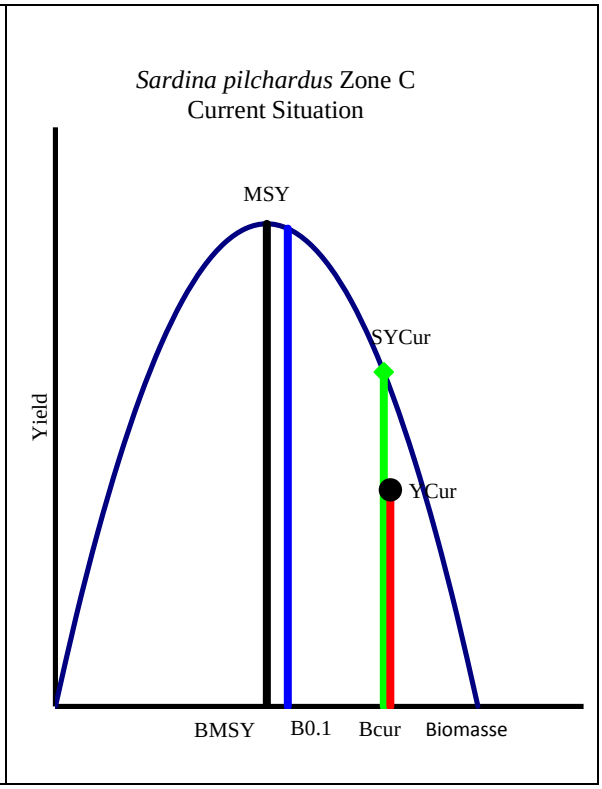
SOME ASSESSMENT RESULTS

Sardine

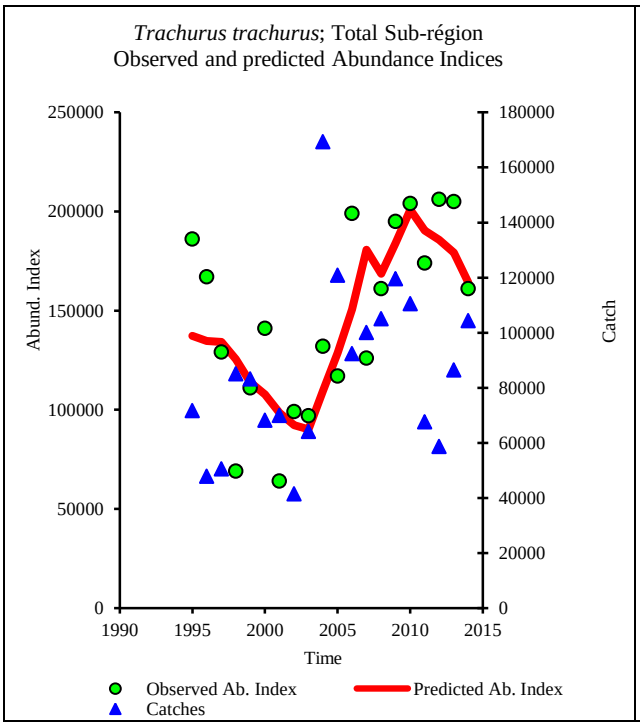


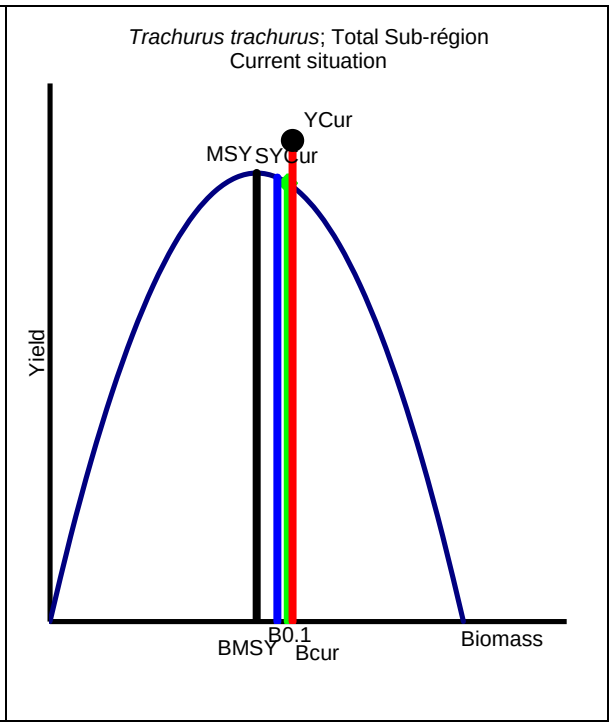


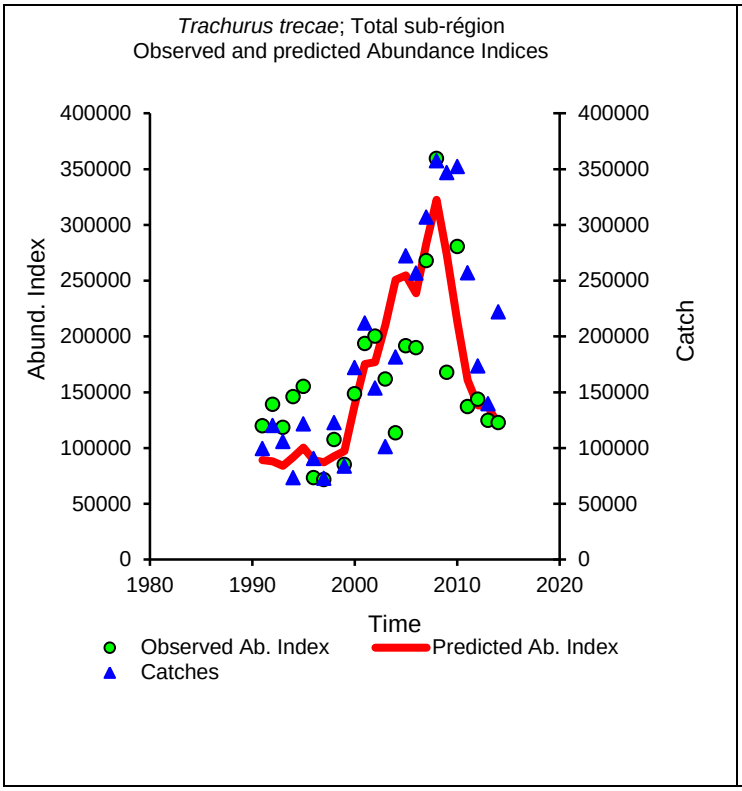


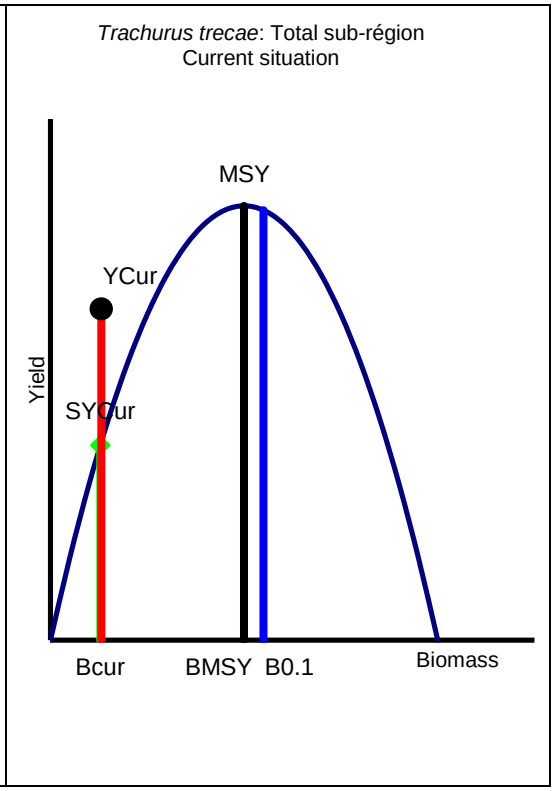


Horsemackerel

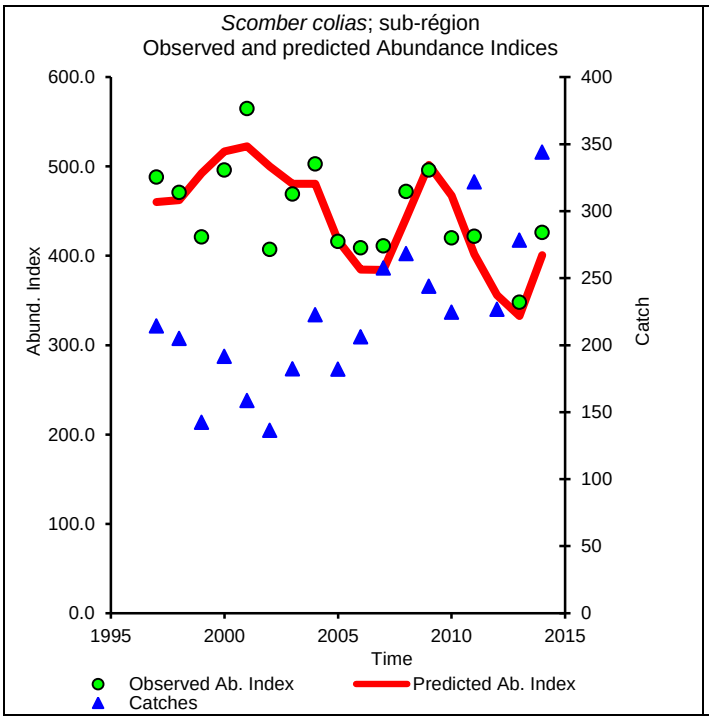


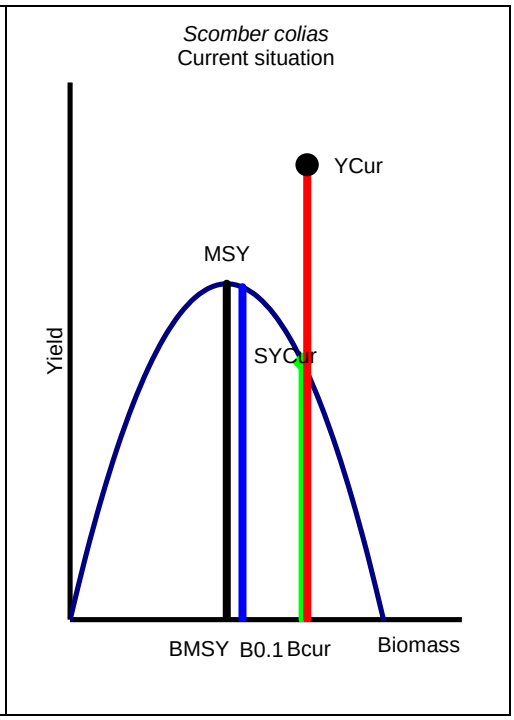




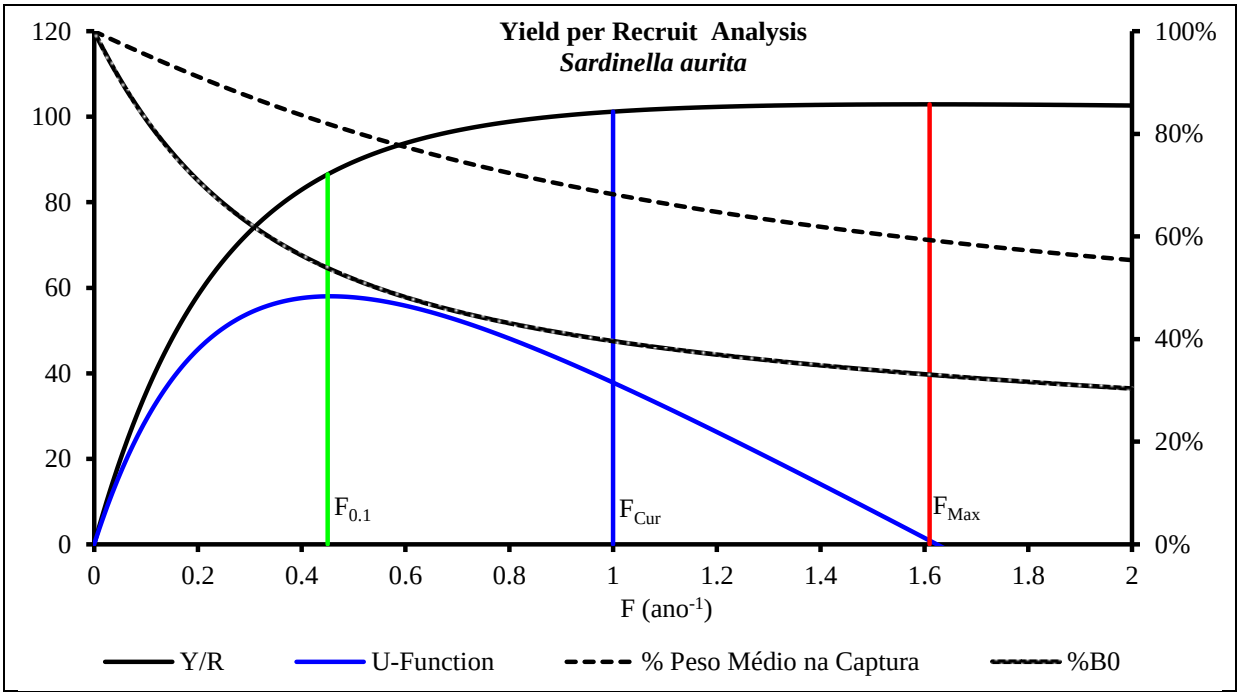


Chub mackerel

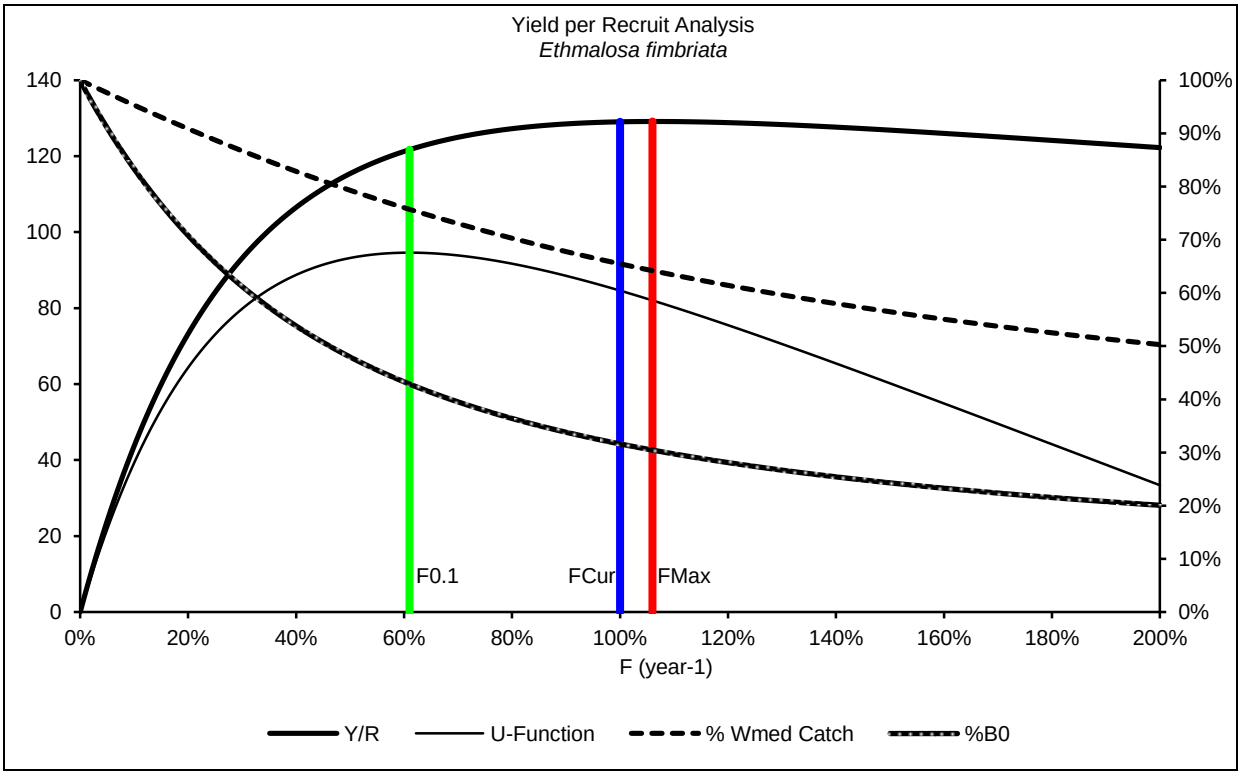




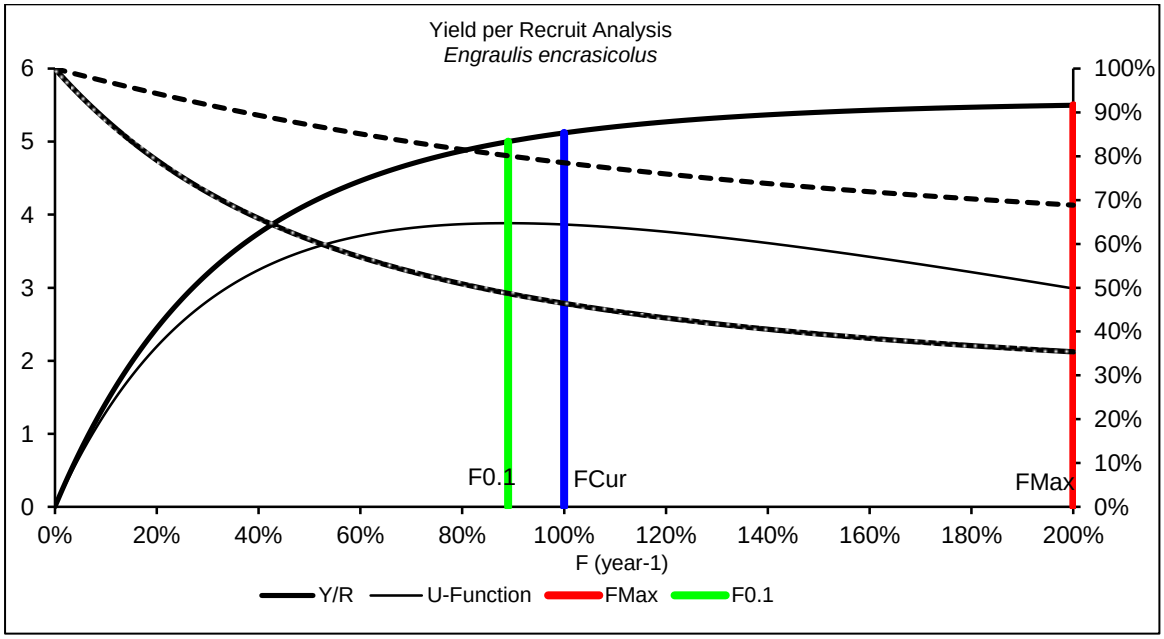
Sardinella



Bonga



Anchovy


Yield per Recruit Analysis
Engraulis encrasicolus
6
5
4
3
2
1
0
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
F0.1
FCur
FMax
0%
20%
40%
60%
80%
100%
120%
140%
160%
180%
200%
F (year-1)
Y/R
U-Function
FMax
F0.1