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منظمة الأغذية والزراعة للأمم المتحدة | 联合国粮食及农业组织 | Food and Agriculture Organization of the United Nations | Organisation des Nations Unies pour l'alimentation et l'agriculture | Organización de las Naciones Unidas para la Agricultura y la Alimentación

FISHERY COMMITTEE FOR THE EASTERN CENTRAL ATLANTIC

Scientific Sub-Committee

Seventh Session

Tenerife, Spain, 14–16 October 2015

STATUS SUMMARY FOR SMALL PELAGIC STOCKS IN THE SOUTHERN AREA OF THE EASTERN CENTRAL ATLANTIC - CECAF

SUMMARY

The third meeting of the FAO/CECAF Working Group on the Assessment of Small Pelagic Fish – Subgroup South was held in Pointe Noire, Congo, from 17 to 23 March 2014. The Group assessed the status of the Small Pelagic resources in Southwest Africa and advises on future effort and catch levels.

The species assessed by the Group were: sardinella (*Sardinella aurita*, *Sardinella maderensis* and *Sardinella* spp.), bonga (*Ethmalosa fimbriata*), anchovy (*Engraulis encrasicolus*), horse mackerel (*Trachurus trecae*) and *Decapterus* spp., in the region between the northern border of Guinea-Bissau and the southern border of Angola. The advices for the stocks are given in relation to the agreed reference points $F_{0.1}$, F_{MSY}, $B_{0.1}$. Three stocks could not be assessed using any of the models because the data available to the working group were not in the appropriate format and/or not sufficient to use in the assessment models.

Of the 16 stocks analysed, **four were found to be overexploited**: round sardinella (*S. aurita*) western stock; Cunene horse mackerel (*Trachurus trecae*) northern stock; Stock South; and *Caranx ronchus*, off Guinea. For these stocks, the recommendation was not to increase catch levels above the average of the last five years, this in order to allow the stock to grow. **Six stocks were found to be fully exploited**: flat sardinella (*S. maderensis*) western stock; *Sardinella* spp. northern stock and southern stock; bonga (*E. fimbriata*) northern stock and southern stock; and anchovy (*E. encrasicolus*) western stock. For these stocks, as a precautionary measure, the recommendation was that the catch level should not exceed the average catch of the last three years. One stock, the anchovy of the Congo, is considered **non- fully exploited**, and the Working Group recommended that the catch level should not exceed the average catches of the three last years.

For two of the stocks, the data did not provide reliable results, and for three stocks the data available were not sufficient to apply an assessment model. For these stocks, as a precautionary measure, the Working Group recommended that the catch level should not exceed the average of the last five or three years or, in some cases, the previous year's (2012) catch. The advice for each stock gives guidelines for managers in the management of the pelagic stocks in a way to make them develop in a direction where each stock is fished at an optimum level. The advice for each stock is given in terms of catch levels. It was noted that for shared stocks, such as many of the pelagic stocks, formal agreements on sharing arrangements would have to be made and management put into place. Moreover, many countries apply effort measures instead of catch measures, and it was noted that the catch advice can also be addressed through effort measures depending on the exigencies of the different countries.

INTRODUCTION

1. The third meeting of the FAO/CECAF Working Group on the Assessment of Small Pelagic Fish – Subgroup South was held in Pointe Noire, Congo, from 17 to 23 March 2014.
2. The overall objective of the Working Group is to contribute to the improved management of small pelagic resources in West Africa through the assessment of the state of the stocks and fisheries in order to ensure sustainable use of these resources for the benefit of coastal countries.
3. Altogether, 14 researchers from Angola, Benin, Cameroon, Cape Verde, Côte D'Ivoire, Democratic Republic of Congo, Congo, Gabon, Ghana, Guinea, Guinea Bissau, Togo, Norway, and FAO participated in this Working Group.
4. The working area for the Working Group is defined as the waters between the southern border of Senegal and southern border of Angola, including Cape Verde and S. Tome and Principe Iles.

Methods

5. After reviewing the available data, the Working Group concluded that the only class of methods that could be applied to all stock units was the dynamic production model. Remaining consistent with the methods used for earlier assessments, the dynamic version of the Schaefer (1954) model, through an Excel spreadsheet implementation of the dynamic version of this model, with an observation error estimator (Haddon, 2001), was used to assess the current state of the stocks and estimate the model parameters. The model was fitted to the data using the non-linear optimizer built into the Excel solver.
6. 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.

Management advice

7. The advices for the stocks are given in relation to the agreed reference points(FAO, 2006):

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

Results

8. A total of 7 species/species groups and 16 stocks were analysed by the Group.
9. The results of the assessments show that of the 16 stocks analysed four were found to be overexploited, six stocks were found to be fully exploited. One stock, the anchovy of the Congo, is considered non-fully exploited (Table 2).

Management Recommendations

10. For the overexploited stocks, the recommendation was not to increase catch levels above the average of the last five years, this in order to allow the stock to grow. Six stocks were found to be fully exploited for these stocks, as a precautionary measure, the

recommendation was that the catch level should not exceed the average catch of the last three years. For the stock non-fully exploited the Working Group recommended that the catch level should not exceed the average catches of the three last years.

Conclusions

11. Since most of the stocks are shared by two or more countries in the region, the Working Group strongly recommends the strengthening of regional cooperation in research and management. The members of the Working Group should discuss with fisheries managers of their countries their expectations in relation to management advice from scientists and develop strategies to improve the advice provided. For two of the stocks, the data did not provide reliable results, and for three stocks the data available were not sufficient to apply an assessment model. For these stocks, as a precautionary measure, the Working Group recommended that the catch level should not exceed the average of the last five or three years or, in some cases, the previous year's (2012) catch.

OVERALL REGIONAL TRENDS

Catch

12. There was an increase of 31 percent in total catches of the main small pelagic fish studied at this meeting, from 444 000 tonnes in 2011 to 581 000 tonnes in 2012. However, the trend observed since 1999 is rather stable, with few years showing catches either higher (1996 and 2003) or lower than the average. Total catches of small pelagic fish for the period 1990–2012 fluctuated about 514 000 tonnes (Table 1, Figure 1).

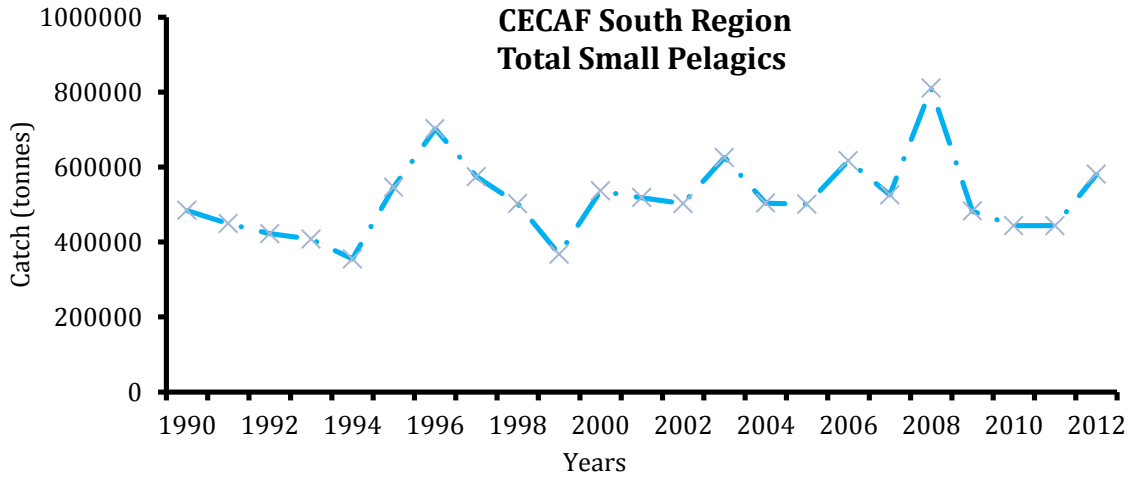

Figure. 1. Total Catch of Demersal South studied by the Small Pelagic South Working Group.

Table 1. Catch contribution in 2011-2012, percentage change and average in the period studied

	2011 Catch (t)	2012 Catch (t)	Catch contribution 2011%	Catch contribution 2012%	Percentage Change %	AVERAGE (1990-2012)
Sardinella spp.	125516	188475	28%	32%	50%	79199
E.fimbriata	89074	102722	20%	18%	15%	100008
S. aurita	53730	65724	12%	11%	22%	100240
E.encrasicolus	64193	58230	14%	10%	-9%	66935
T. trecae	19258	48189	4%	8%	150%	43760
Trachurus sp.	5644	38189	1%	7%	577%	29734
S. maderensis	42037	36241	9%	6%	-14%	48626
Others	7560	12379	2%	2%	64%	9439
S. japonicus	19658	10048	4%	2%	-49%	13910
Decapterus spp.	5162	9092	1%	2%	76%	4777
Ilisha africana	7409	6418	2%	1%	-13%	3661
Caranx	2789	3040	1%	1%	9%	5523
Other Carangidae	1644	1978	0%	0%	20%	9114
C. rhonchus (or D. rhonchus)	0	0	0%	0%		73
Total	**443673**	**580725**	**1**	**1**	**31%**	**514328**

13. The round sardinella (*S. aurita*) constituted almost 11 percent of total catches of small pelagic fish, in 2012, thus ranking as one of the most important small pelagic fish in the region. Total catches of round sardinella fluctuated between 35 000 and 237 000 tonnes in the period 1990–2012 with an average of about 100 000 tonnes. The overall trend has been a relatively steady decrease (with fluctuations) in catches for this species since 1999, with a total landing of about 66 000 tonnes in 2012 (Figure 2).

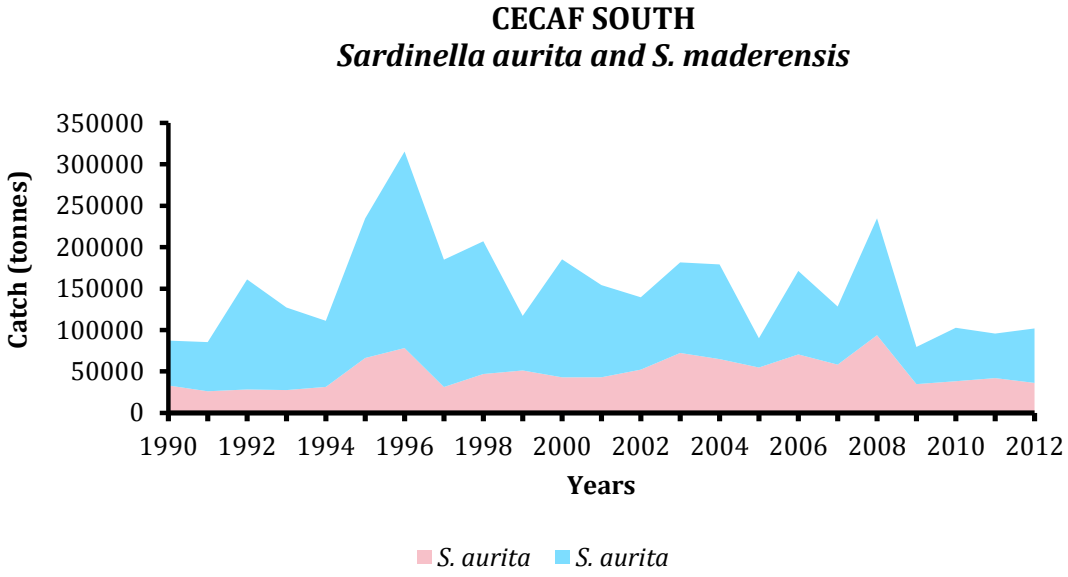

Figure. 2. Total Catch of round sardinella studied by the Small Pelagic South Working Group.

14. The catches of flat sardinella (*S. maderensis*) in 2012 were 36 000 tonnes, with a contribution to the total catches of the main small pelagic fish in the region of about 6 percent in 2012. The average for the period 1990–2012 for this species is 49 000 tonnes. Some countries report catches for Sardinella spp. as a whole, without separating the species (Figure 2).

15. Anchovy (*E.encrasicolus*) and bonga (*E.fimbriata*) are very important species in the southern region of CECAF. The total catches of anchovy in 2012 were about 58 000 tonnes, decreasing by about 9 percent compared with 2011 (Figure 2). An average of 67 000 tonnes of anchovy was recorded for the period analysed. Catches of bonga in 2012 constituted about 18 percent of total catches of small pelagic fish in the subregion (89 000 tonnes). Bonga, an estuarine species, is mainly targeted by artisanal fishers operating in the whole subregion with an average of 100 000 tonnes in the period 1990-2012.

Surveys

16. Several pelagic surveys have been carried out in the region since the 1980s, all of them by the Norwegian research vessel R/V Dr. Fridtjof Nansen. The Senegalese R/V Itaf Deme also carried out pelagic surveys in Sierra Leone in 2008 and 2009.

17. The longest survey series is that of Angola, where R/V Dr. Fridtjof Nansen has carried out acoustic surveys since 1985. From 1995[1] to 2013, a series of annual acoustic surveys were carried out in the same season (August–September).

[1] In 1995 and 1996, two acoustic surveys were carried out, one in February–March and one in July–August.

Environment

18. These stocks are influenced by a tropical hydro climate characterized by three current systems (the Guinea current, the Canary current and the Equatorial counter current) which affects the oceanographic conditions and the pelagic species. The dominant current system is the Guinea current and the offshoot of the Canary current (blowing from February to April) which flows eastward along the coast to join the westward flowing South Equatorial current (May–July) off the coast of Liberia.

State of stocks and management recommendations

19. A summary sheet with the complete results of the assessments and management recommendations is given in Table 3.

20. The FAO/CECAF Working Group has agreed on the existence of various stocks for the species studied in the Southern CECAF Area (Table 2; Figure 3).

Table 2. Stocks and species considered by the Group

Sub-group/Species/Group of species/stocks	**Zone**
***Sardinella maderensis, S. aurita and Sardinella* spp.**	
Stock North	Guinea Bissau, Guinea , Sierra Leone & Liberia
Stock West	Côte d´Ivoire, Ghana, Togo & Benin
Stock Central	Nigeria & Cameroon
Stock South	Gabon, Congo, Democratic Republic of the Congo & Angola
Ethmalosa fimbriata	
Stock North	Guinea Bissau, Guinea , Sierra Leone & Liberia
Stock West	Côte d´Ivoire, Ghana, Togo & Benin
Stock Central	Nigeria & Cameroon
Stock South	Gabon, Congo, Democratic Republic of the Congo &Angola
Engraulis encrasicolus	
Stock West	Cote d´ Ivoire, Ghana, Togo & Benin
Stock South	Congo
Chinchard et autres *Carangidae*	

Sub-group/Species/Group of species/stocks	Zone
Trachurus trecae	
Stock North	Guinea Bissau, Guinea , Sierra Leone & Liberia
Stock West	Côte d´Ivoire, Ghana, Togo & Benin
Stock South	Gabon, Congo, Democratic Republic of the Congo & Angola
Decapterus spp.	
Stock North	Guinea

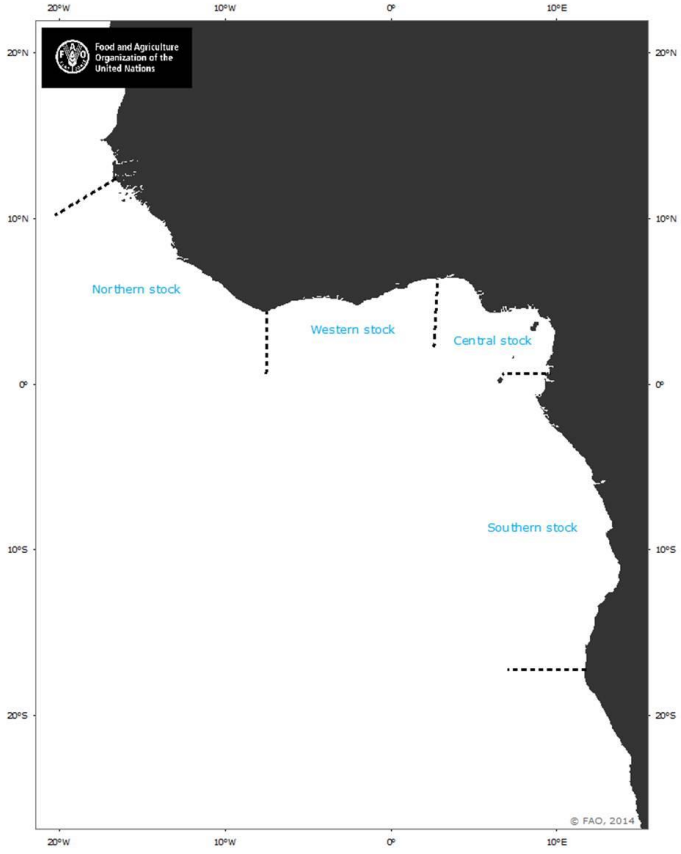

Figure 3. Stocks for the species studied in the Southern CECAF Area

***Sardinella* spp.**

Northern stock

21. This stock was analysed with data from Guinea Bissau, Guinea, and Liberia the data from Sierra Leone were not available to the Working Group. Although the model shows that the stock is non-fully exploited, other knowledge available on these fisheries from the region

indicate that *Sardinella* spp. is probably fully exploited. Considering the many uncertainties in the data made available to the working group and the lack of information on the fishery from Sierra Leone and the artisanal fisheries in Guinea-Bissau and Liberia, the Working Group decided to be cautious with respect to the advice provided. As a precautionary measure, the recommendation was not to exceed the current fishing level. As the current catch information is uncertain, the Working Group did not make a specific catch recommendation. The main limitation to the assessment is non-availability of time series data in the region.

Southern stock

22. The total catch data for *Sardinella* spp. from the artisanal and industrial fisheries for the Congo and all fleets, including the purse seiners for Angola for the period 1990–2011 were analysed. The data for Gabon and the Democratic Republic of the Congo were limited and were not included in the analysis. The model shows that *Sardinella* spp. in the south is fully exploited. As the current fishing mortality is less than that which can be maintained at the current biomass level, the biomass is expected to grow in future years if the current fishing mortality is maintained. There is some limitation of the assessment with the biomass indices from the R/V F.NANSEN, there is a decreasing trend since 2006. As a precautionary approach, the recommendation is not to exceed the average catch level of the last five years (80 000 tonnes). (Figure 4).

Sardinella aurita

Western Stock

23. The data from Côte d´Ivoire, Ghana, Togo & Benin were analysed. The results of the assessment model show that the stock of round sardinella is **overexploited** in terms of biomass although, the current fishing mortality is less than that which can be maintained at the current biomass level. This implies that if the yield remains at current level, the biomass will increase. The assessment was done with data up to 2011, although there are certain indications that biomass increased in 2012. , as a precautionary measure, the catch level should not exceed the average of the last five years (33 000 tonnes) in order to allow the stock to grow (Figure 5).

Sardinella maderensis

Western Stock

24. The data from Côte d´Ivoire, Ghana, Togo & Benin were analysed and the model applied fitted reasonably well the data. The results of the assessment of flat sardinella show that the stock is fully exploited. Given that this species is caught together with round sardinella, which is considered overexploited, there is a need for caution. Any further increase in effort in the fishery could lead to higher fishing mortality, thus reducing the biomass. Although flat sardinella is **fully exploited**, as a precautionary measure, the catch level should not exceed the average of the five last years (13 000 tonnes) (Figure 6).

Central stock

25. No assessment was done for the central stock for round and flat sardinella as no CPUE series were available. Catches show increasing trends. An analysis of catches in Nigeria shows a general increase in round sardinella catches since 2007, whereas catches of flat sardinella have been stable in recent years. As a precautionary measure, catches should not exceed the average of the last five years (14 000 tonnes).

Ethmalosa fimbriata

Northern stock

26. Bonga has been intensively fished for a long time in the subregion. As a coastal and estuarine species, bonga is mainly fished by the artisanal fisheries. The data from Guinea

Bissau, Guinea and Liberia were analysed and input in the assessment model. The accepted model results indicate that the current biomass for the northern stock is 11 percent above the biomass at B0.1, and that the current fishing mortality is 10 percent more than that at F0.1. This stock is considered **fully exploited**. As a precautionary measure, do not increase catches above the average of the last five years (44 000 tonnes) (Figure 7).

Western stock

27. The CPUE from Ghana's artisanal fleet (1990–2012) was chosen to fit the model because the series made available to the Group were believed to better reflect the variations in the stock. The estimate of the total catches for Côte d'Ivoire, Ghana and Benin from 1990 to 2012 was used. For the western stock, Togo has no catch data for the entire period concerned. Benin, for its part, has no data on the first seven years (1990–96). The Côte d'Ivoire series begins in 1999 with data unavailable in 2007 and 2008. However, the Ghana artisanal fishery series is complete (1990–2012) and that of the coastal fishery is sporadic. For the western stock, the model results do not make it possible to draw a conclusion on the status of the stock. Moreover, the catches show annual fluctuations. No specific recommendation was made owing to the uncertainties in the data. Close monitoring of the stock is recommended.

Central stock

28. No assessment made, but catches have been stable in the last few years. As a precautionary measure, the average of the last five years (24 000 tonnes) should not be exceeded.

Southern stock

29. The CPUE from the artisanal fleet of the Congo (1998–2012) was chosen to fit the model because the series made available to the Working Group was believed to better reflect the variations in the stock. Gabon's CPUE, which had been used previously, was not available from 2008 to 2102. The estimate of the total catches for the time series of all the countries (the Congo, Gabon and the Democratic Republic of the Congo) in the southern stock from 1998 to 2012 was analysed. Angola provided no catch data for the species. The model results indicate that the current biomass for southern stock is 14 percent above the biomass at B0.1, and that the current fishing mortality is close to that at F0.1. This stock is considered **fully exploited**, As a precautionary measure, catches of this species should not be increased above the average of the last five years (14 000 tonnes).

Engraulis encrasicolus

Northern stock

30. No assessment was made for the northern stock owing to the fact that the Working Group has not had any data from Guinea Bissau, Guinea, and Liberia, on the CPUEs since the last assessment in 2009. No management measures were advised.

Western stock

31. The data of anchovy (*Engraulis encrasicolus*) presented to the Working Group was analysed for Benin, Côte d'Ivoire, Ghana and Togo from 1990 to 2012. The abundance indices used to adjust the model are the CPUEs from the artisanal fisheries in Ghana and Togo. The two CPUEs represent the abundance variability estimated by the model during these years. As the results obtained are similar to the two CPUEs, the Working Group decided to maintain the results estimated with the CPUE from Togo for continuity in the 2009 assessment, and as a precautionary measure. The results show that the current biomass is 85 percent of the corresponding biomass at $B_{0.1}$, and the fishing mortality observed in 2012 is 53 percent of the fishing mortality $F_{0.1}$. From this assessment, it appears that the stock is **fully exploited**, but the catches of the artisanal fishery in Côte d'Ivoire are not available. The lack of data from this country affects the assessment of the western stock and consequently, the results

of the model must be accepted with caution. For the western stock (Benin, Ghana and Togo), catches should not exceed the average of the last three years (56 000 tonnes).

Southern stock

32. Only the Congo has a series of anchovy data for the southern stock (Angola, the Congo, the Democratic Republic of the Congo, and Gabon) from 1998 to 2012. The other countries have sporadic data. The Congo CPUE represents the abundance variability estimated by the model over these years. The model results show that the current biomass is 27 percent higher than the biomass corresponding to B0.1, and the fishing mortality observed in 2012 represents 44 percent of the fishing mortality $F_{0.1}$. From this assessment, it appears that the stock is not **fully exploited.** As a precautionary measure for the Anchovy southern stock, catches should not exceed the average catch of the last three years of 790 tonnes. (Figure 8).

Decapterus spp.

Northern stock

33. As data from Sierra Leone were not available to the Working Group, and the data series from Liberia was not continuous, the Working Group decided to disaggregate the northern stock to assess the *Decapterus* spp. stock of Guinea only. The results of the model indicate that the current biomass is 73 percent less than the biomass at $B_{0.1}$. The relationship between the current fishing mortality and $F_{0.1}$ is 176 percent, 76 percent more than the fishing mortality at $F_{0.1}$. The fishing mortality is greater than the fishing mortality coefficient that would provide a sustainable yield at the current biomass level. The results of the model indicate that the stock is **overexploited.** As a precautionary measure, catches should be decreased. The Working Group maintains the 2009 recommendation that catches should not exceed 3 000 tonnes.

Trachurus trecae and other Carangidae

Northern stock

34. The data of Cunene horse mackerel in Guinea-Bissau, Guinea and Liberia were used for the period 1997–2012. Catches for Guinea-Bissau for the period 1998–1999 were not available. Data for Sierra Leone were not available. The results of the analysis show that current biomass (Bcur) represents 71 percent of the target biomass B0.1. The current fishing mortality (Fcur) is 77 percent of the target fishing mortality (F0.1) and is currently below the fishing mortality that would provide a sustainable yield at the current biomass level (F_{SYcur}). The results show that the *Trachurus trecae* northern stock is **overexploited**. As a precautionary measure, the Working Group recommends no increase in catches of this species above the 2012 level (10 000 tonnes), this in order to allow the stock to grow.

Western stock

35. No reliable results from the assessments. Catches from Côte d'Ivoire, Ghana, Togo and Benin have decreased over the last five years. As a precautionary measure, catches of this species should not be increased above the average of the last five years (12 000 tonnes).

Southern stock

36. The data of *Trachurus trecae* were analysed were in the period 1990–2012 for the four countries Angola, Congo, Democratic Republic of the Congo, and Gabon. The results of the assessment indicate that the current biomass level Bcur of the stock is 43 percent of the biomass at B0.1, and the ratio between current fishing mortality and F0.1 is 92 percent. The model shows that the stock is **overexploited**. However, the catches of this species are not fully recorded. Survey data show a general decreasing trend over the time series until 2011, followed by an increase in biomass for 2012 and 2013. Currently, the fishing mortality is lower than what would produce a sustainable yield at the current biomass level, which could lead to an improved situation if the general conditions remain stable. The Working

Group recommends that the catch levels of this species should not be increased, this in order to allow the stock to recover.

Management recommendations

37. The results of the assessments show that many of the stocks analyzed are fully to overexploited, and the Working Group thus recommended that fishing effort should be reduced for the overexploited stocks or not increased for the other stocks, to avoid further depletion. When possible, recommendations on catch levels are also indicated for each stock. Given that most fisheries in the region are multi-specific, an overall reduction in fishing effort is necessary.

GENERAL CONCLUSIONS

38. As a basis for providing scientific advice for fisheries management, there is generally a need for information on the status and development of the various fish stocks. To manage fisheries in a sustainable way, there is also a need for knowledge of the status and development of the fishing pressure on the different fish stocks. In many regions of the world, all this information is not readily available. For some fish stocks, a lot of information exists, both on stock status and on fishing pressure, while for many stocks such information is limited. To compile all kinds of information on the fish resources, and turn it into useful information for managers, poses a challenge and especially so if the quality of the basic information is poor. Sometimes, the basic data are so limited and inadequate that there is hardly any relevant information that can be used as a basis for management.

39.To assess fish stocks and the fishery in a reliable way, there is generally a need to have a reliable stock definition and to have a time series of data for the defined stocks. This occurs because it is the trends, or the lasting changes in the specific fish stocks that are of interest and that may be changed by managing the fisheries. Therefore, it is important to establish a reliable time series of abundance indices and catch statistics for each stock. A time series needs to be at least five years long before it can be used as reliable information on any trends, and therefore, it takes time to establish sound basic information to be used in fish stock assessments.

40. In the area assessed by this Working Group, there are major challenges in obtaining reliable information from the available data.

41. Similarly to the previous Working Group in 2009, emphasis was this year put on the development of the database for the different fish stocks. Nevertheless, a number of assessments were made for some of the main stocks using a dynamic production model. For some of the species/stocks, the model did not produce reliable results owing to insufficient and inconsistent input data. The results of the dynamic production model depend strongly on the quality of the data, a quality of data that the Working Group does not have at its disposal. These data limitations must be kept in mind when interpreting the results of the assessments. For some stocks, only catch trends could be analysed owing to the lack of effort information.

42. Fishery-dependent information is based on catch statistics, effort data and the biological samples that are taken in the various fisheries, such as length measurements, etc. From these data, it is possible to obtain information relevant for fish stock assessments such as total catch, length groups harvested (and quantity thereof), CPUE, etc. The Working Group appreciates the effort made to obtain all these data, which are of the utmost importance for fish stock assessment and management; however, some deficiencies were noted. These deficiencies relate to, among others, incomplete (e.g. owing to incomplete sampling or under-reporting) or, in the case of some countries, lack of catch and effort data for some species/stocks of importance to the region. Inconsistencies between different data sets were still observed, and low sampling intensity and coverage was reported for several countries, especially in artisanal fisheries. Attention should be given to the aforementioned issues and, in particular, efforts should be made to verify and update existing catch and effort series, and to bring about one reliable series

of total catch and effort data for stock assessments. An effort should also be made to ensure that catch and effort data are reported from all fleet segments. A more in-depth analysis of the CPUE series is also encouraged in order to facilitate the application of the assessment models.

43. In addition to the fisheries-dependent information, the Working Group also has access to fishery-independent data, from the surveys by the R/V Dr Fridtjof Nansen. The Senegalese R/V Itaf Deme has also carried out acoustic surveys in some countries of the subregion since the last meeting in 2009 (Benin, Côte d'Ivoire, Ghana, Togo in 2012, and Guinea-Bissau in 2011 and 2013). The reports from these surveys were not all available to the Working Group. Survey information is very valuable and in many cases represents the most important information on the status and development of the pelagic fish stocks, particularly when time series are available.

44. The advice for the stocks is given in relation to reference points. For the sake of comparability and consistency, the reference points chosen were the same as those used in the FAO Working Group for the Assessment of Small Pelagic Fish off Northwest Africa. The advice for each stock gives guidelines for managers in the management of the pelagic stocks in a way to make them develop in a direction where each stock is fished at an optimum level. The advice for each stock is given in terms of catch levels. It was noted that for shared stocks, such as many of the pelagic stocks, formal agreements on sharing arrangements would have to be made and management put into place. Moreover, many countries apply effort measures instead of catch measures, and it was noted that the catch advice can also be addressed through effort measures depending on the exigencies of the different countries.

45. Finally, the Working Group noted that for some species/stocks in the southern CECAF area, observed data deficiencies in catch and effort data for some countries were related to the relatively lower importance of these species to the countries concerned. The Working Group should therefore carefully review the species/stocks adopted at the first meeting in 2006 (FAO, unpublished report) to better focus future assessments.

FUTURE RESEARCH

46. Several recommendations were made by the previous Working Group sessions with respect to research to be pursued. The Working Group noted that work has been started to improve the statistical and biological sampling systems in the countries of the sub-region. Studies on biological aspects of certain species analyzed within the framework of the Working Group had also been initiated. Some recommendations, for various reasons, were not taken into consideration. Biological information is almost inexistent and sampling for biological purposes is not carried out on a regular basis in the sub-region. For most recommendations follow up activities had been initiated, although many of them require continuation to be useful for the assessments.

47. Some of the main recommendations on areas of work that require attention are summarised below:

- All data for the next Working Group must be prepared and sent to the chairman of each species group and FAO by the national focal points at the latest one week before starting the first part of the next meeting.
- Intensify sampling for length frequencies and species composition of catches including bycatch in all the main fisheries and present to the next Working Group meeting. Priority should be given to the main species, so as to obtain a complete catalogue of the basic biological parameters.
- Continue developing CPUE series from surveys and commercial fisheries. Continue to improve sampling by increasing the number of samples and sample size of each sample covering all size ranges. All fleet segments and all quarters of the year. Each

country and subgroup must ensure that length composition of the catch and surveys is organized in a way exploitable by the Working Group before the next meeting.

- Scientific surveys should be continued and abundance indices independent of the commercial fisheries should be integrated into the assessment models.
- Continue the collection of data from the artisanal fishery including effort and catch by species and gear.

Table 3. Summary of assessments and management recommendations

Stock	Last year catch[2] (tonnes) (5 year average)	$B_{cur}/B_{0.1}$ %	$F_{cur}/F_{0.1}$ %	Assessment	Management recommendations
Sardinella					
S. aurita					
West[3] (Côte d'Ivoire, Ghana, Togo and Benin)	35539 (33304)	82	46 (CPUE Ghana inshore)	Stock is overexploited. Biomass increased in 2012	As a precautionary measure, do not exceed catch level above the average of the last five years (33 000 tonnes) to allow the stock to grow
Central (Nigeria)	7031 (5934) (average 4 years due problem 2008 data)	-	-	No assessment made as no CPUE series is available. Trends in catches show a general increase since 2007	As a precautionary measure, do not exceed the average of the 4 last years (5934 tonnes).
S. maderensis					
West (Côte d'Ivoire, Ghana, Togo and Benin)	13 854 (12 953)	105	106 (CPUE Ghana Artisanal)	Stock is fully exploited. Given that this species is caught together with *S.aurita* which is considered overexploited caution is called for.	As a precautionary measure, catch level should not exceed the average of the 5 last years (13 000 tonnes).
Central (Nigeria)	13 969 (14 114)	-	-	No assessment made as no CPUE series are available. Trends in catches show a stable trend last years.	As a precautionary measure, do not exceed the average of the 5 last years (14 000 tonnes).
***Sardinella* spp.**					
North (Guinea-Bissau, Guinea, Sierra Leone and Liberia)	44090* (39 743)	157	48 (GB Total catch)	The working group adopted that the stock is fully exploited. The results of the model show that the stock is not fully exploited, however considering the uncertainties in the data and the lack of information on the fishery from Sierra Leone and the artisanal fisheries in Guinea Bissau and Liberia the working group decided to take a precautionary approach.	As a precautionary measure, do not exceed current fishing level. As the current catch information is uncertain, the working group did not make a specific catch recommendation.
South (Gabon, Congo, DR Congo and Angola)	116 886 (80 824)	116	94 (CPUE Nansen)	Stock is fully exploited. Biomass has shown decreasing trend since 2006. 2012 catch is the highest of the time series.	As a precautionary approach, it is recommended not to exceed catch level of the average of the last 5 years (80 000 tonnes)

[2] 2012

[3] assessment made up to 2011

Stock	Last year catch[2] (tonnes) (5 year average)	$B_{cur}/B_{0.1}$ %	$F_{cur}/F_{0.1}$ %	Assessment	Management recommendations
Bonga (*E. fimbriata*)					
North (Guinea)	59 645 (44 638)	111	110	Stock is fully exploited	As a precautionary measure, do not increase catches from the averageof the 5 last years (44 000 tonnes).
Central (Nigeria)	23 235 (23 550)	-	-	No assessment made, but catches are stable the last years.	As a precautionary measure, do not exceed the average of the 5 last years (24 000 tonnes).
West (Côte d'Ivoire, Ghana, Togo and Benin)	1028 (1875)	-	-	No reliable results from model. Catches fluctuate annually.	No specific recommendation was made due to the uncertainties in the data. Close monitoring of the stock is recommended
South (Gabon, Congo, DR Congo)	17 559 (14 288)	114	95	Stock is fully exploited.	As a precautionary measure, do not increase catches of this species from the average of the 5 last years (14 000 tonnes).
Anchovy (*E. encrasicolus*)					
West (Côte d'Ivoire, Ghana, Togo and Benin)	56064 (54050)	85	53	Stock is fully exploited	Catch level should not exceed the average level of the 3 last years (56 000 tonnes).
South Congo	993 (692)	127	44	Non-fully exploited. Can sustain an increase in exploitation	As a precautionary measure, catch level should not exceed the average catches of the 3 last years (790 tonnes).
Horse mackerel and other *Carangidae*					
Trachurus trecae					
North (Guinea Bissau, Guinea, and Liberia) (NO CATCH SL)	9 654(17 382)	71	77	The results of the model indicate that the stock is overexploited. Catch last year low compared to catches over the last 10 years.	As a precautionary measure, do not increase catches of this species above the 2012 level (10 000 tonnes) to allow the stock to grow.
West (Côte d'Ivoire, Ghana, Togo, Benin)	13 011 (12 128)	-	-	No reliable results from assessments. Catches decrease over the last 5 years	As a precautionary measure, do not increase catches of this species from the average of the 5 last years (12 000 tonnes).
South (Gabon, Congo, DR Congo and Angola)	39 210 (21 660)	43	92	Overexploited. Survey data shows a general decreasing trend over the time series until 2011, followed by an increase in biomass for 2012 and 2013	Catch levels of this species should not be increased to allow the stock to recover
***Decapterus* spp.**					
North (Guinea)	6679(4297)	73	176	Overexploited	Catches should be decreased and the working group retains the 2009 recommendation that catches should not exceed 3 000 tonnes.

FIGURES

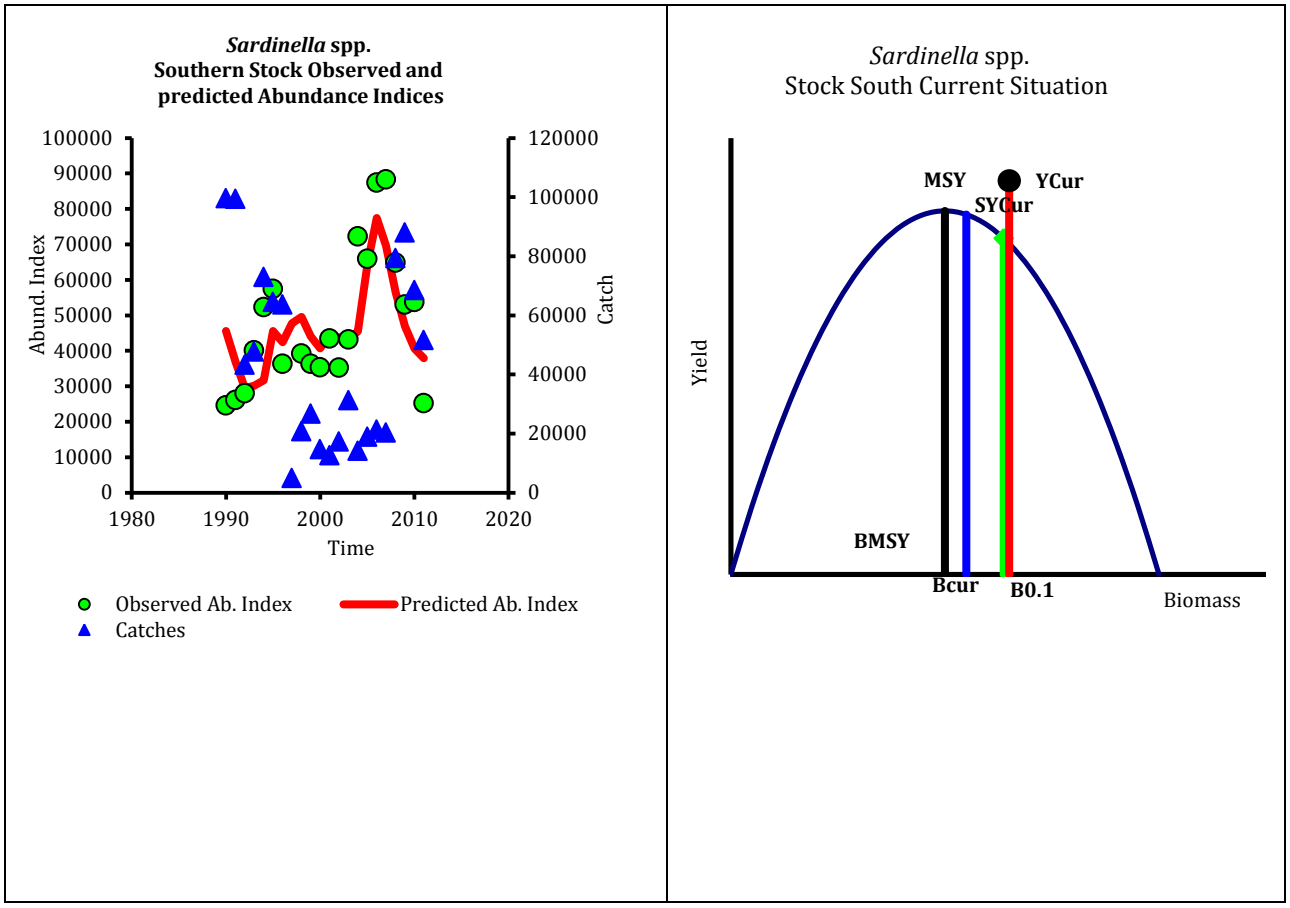

Figure 4. *Sardinella* spp. Southern Stock (Data from Congo and Angola)

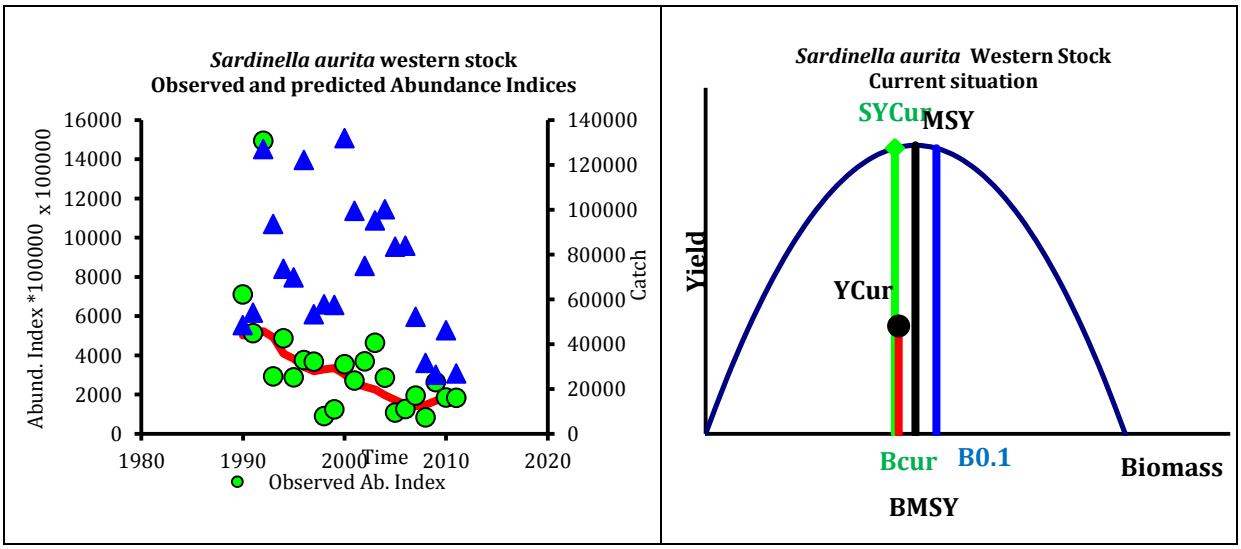

Figure 5. *Sardinella aurita*. Western Stock

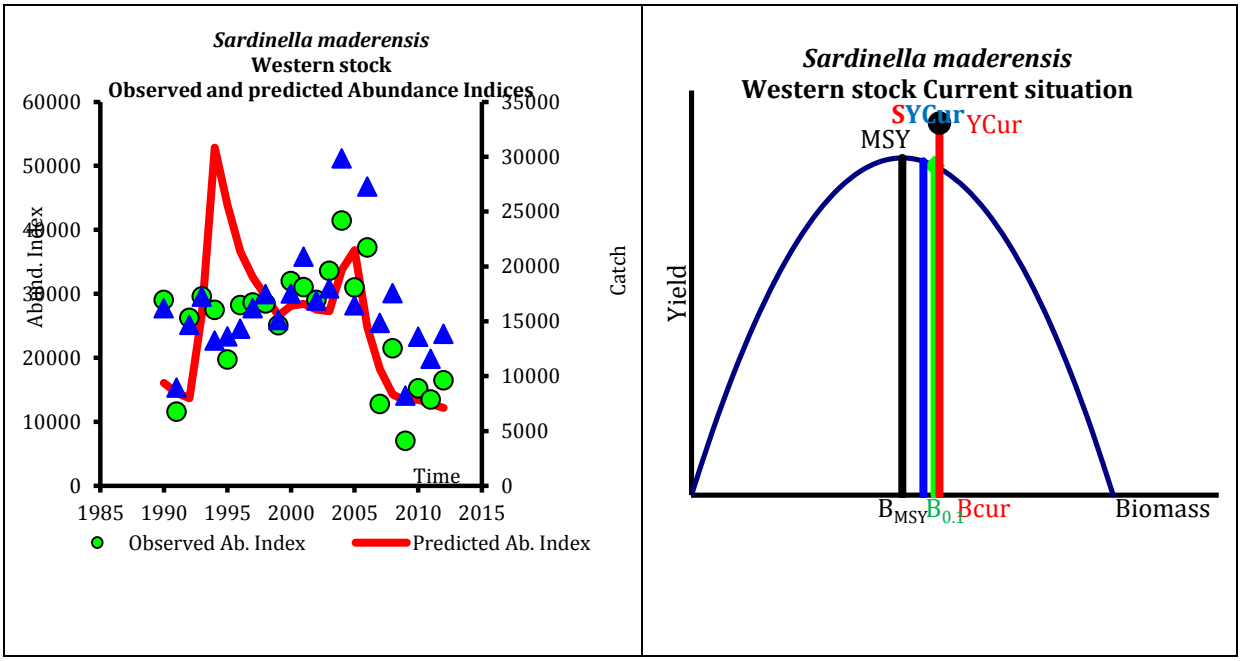

Figure 6. *Sardinella maderensis* Western Stock

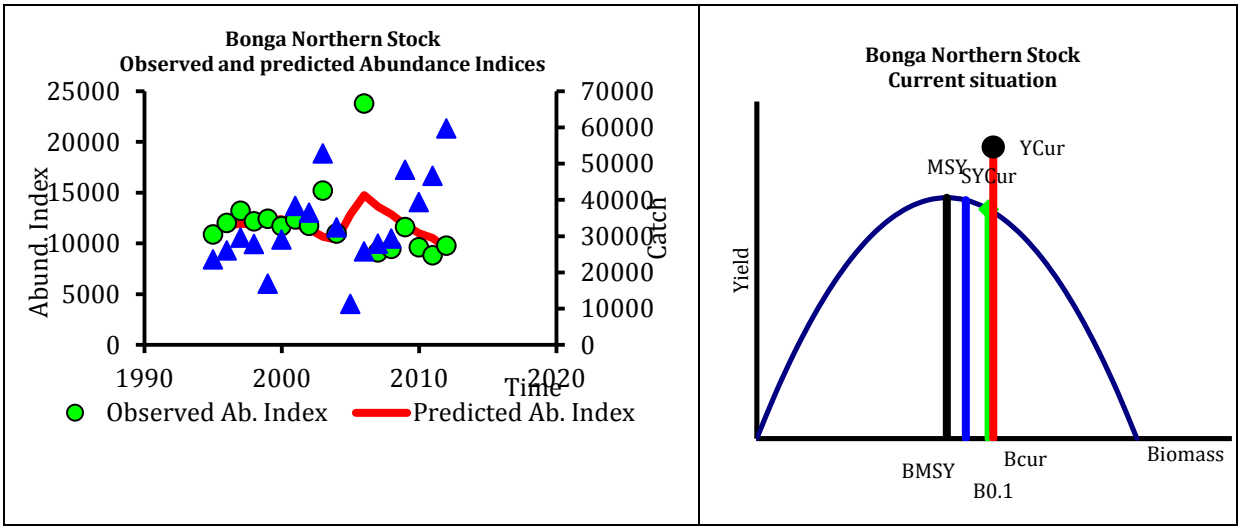

Figure 7. Bonga in the northern stock

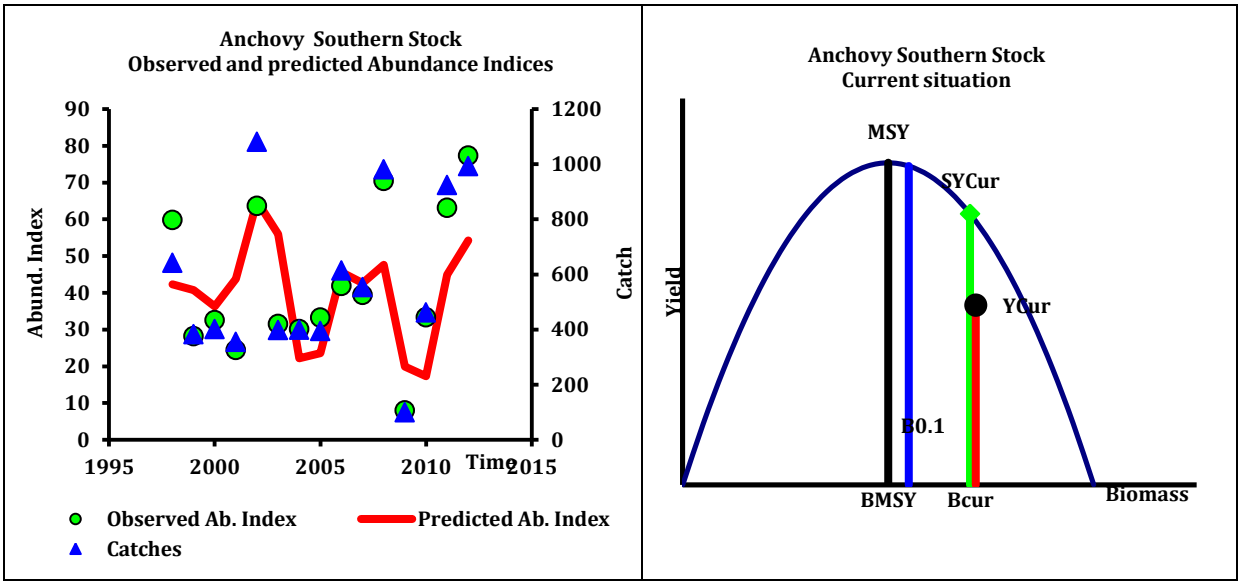

Figure 8. Anchovy in Southern stock