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**FISHERY COMMITTEE FOR THE EASTERN CENTRAL
ATLANTIC**

Sixteenth Session

Tenerife, Spain, 22-24 October 2002

**SUMMARY REPORT OF THE SECOND MEETING OF THE
WORKING GROUP ON THE ASSESSMENT OF SMALL PELAGIC
FISH OFF NORTHWEST AFRICA**

INTRODUCTION

1. The second meeting of the FAO Working Group on the Assessment of Small Pelagic Fish off Northwest Africa was held in Banjul, Republic of the Gambia, from 5 to 12 April 2002.
2. The overall objective of the working group was to contribute to the improved assessment of small pelagic resources in Northwest Africa and the analysis of fisheries management and exploitation options aimed at ensuring optimal and sustainable use of small pelagic fish resources for the benefit of coastal countries.
3. The species to be assessed by the group were: sardine (*Sardina pilchardus*), sardinellas (*Sardinella aurita* and *S. maderensis*), horse mackerels (*Trachurus trecae* and *T. trachurus*) and mackerel (*Scomber japonicus*), in the region between the southern border of Senegal and the northern border of Morocco.
4. The working area for the working group is defined as the waters between the southern border of Senegal and the northern border of Morocco.
5. The terms of reference for the group were:
 - Presentation of working papers on research activities
 - Presentation of reports on acoustic surveys 2001
 - Review of catch, effort and biological data from 2000 and 2001.
 - Report on the progress made on age readings of sardine in Morocco and effort studies in Mauritania
 - Updating the existing data base
 - Updating stock assessments for all species
 - Formulation of management advice
 - Co-ordination of biological research projects.

ASSESSMENT RESULTS

Sardine

6. Following the procedure of previous meetings (FAO, 1985; 1990; 1997; 2001) the Working Group adopted the existence of three stocks:
 - Northern stock (35°45'-32°N)
 - Central stock (32°N-26°N) (Zone A+B)
 - Southern stock (26°N - southern limit of distribution) (Zone C)

The WG attempted to make separate assessments for the central stock (zone A and B) and the southern stock (zone C). The northern stock was not assessed, due to lack of data.

Central stock (zone A+B)

7. Models used were the separable Virtual Population Analysis (Pope 1977, 1979; Pope and Shepherd 1982; Stevens 1984), and the Excel version of Integrated Catch

Analysis (ICA) (FAO 2001). The period 1995-2001 was used for the separable part of the VPA.

8. The analysis of the time series 1976 – 2001 by separable VPA yielded unrealistic results, both in terms of fishing mortality and level of biomass. High residuals were found for certain age groups, which could indicate possible errors in the input data.

9. The application of ICA gave the following results:

- Spawning stock biomass increased from 1983 onwards to reach a maximum in 1986. It then declined gradually until 1992 when it dropped sharply.
- Fishing mortalities show a trend that is opposite to spawning stock biomass.
- The patterns of theoretical and observed catches are diametrically opposed.

10. On the basis of these results, the WG could not reach a conclusion concerning the state of the stock.

Southern stock (Zone C)

11. As for Zones A+B the Working Group reviewed the available information for the stock in zone C. It was noted that there were still important gaps in data from the past years and that the new data submitted at this year's meeting were scarce and incomplete in terms of the type of information collected as well as in the representation of fisheries and fishing seasons.

12. The last attempt to assess this stock was made in 2001 by applying the Separable VPA using the Lowestoft software (Darby and Flatman, 1994). Results from the analyses showed high and no randomly distributed residuals. Also the regression statistics were not satisfactory. The Working Group in 2001 therefore concluded that the results of the analyses were not reliable, possibly due to anomalies in the input data.

13. Considering that there is no new information, the Working Group decided not to make a new attempt at the present meeting to assess the Sardine stock in Zone C.

Sardinella

14. No new studies on stock identity of sardinella have been carried out in the interim period since the last meeting of the Working Group in March 2000. Following the procedure for that meeting, the Working Group agreed on the existence of one stock for the two species of sardinellas (FAO, 2001).

15. The BIODYN model (Punt & Hilborn, 1996) has been used for the assessment (FAO, 2001). The parameters that gave the best fit were estimated for both species using the OBSTWO spreadsheet.

16. Although total catch data were available for both species of sardinella, very few data existed on effort that was directed specifically at these species. There is the Dutch fleet that targets sardinella, but the effort series is too short. Therefore, the WG proposed to use the CPUE of the artisanal fishery in Senegal as an index of abundance. In addition, the stock estimates by R/V Dr Fridtjof Nansen were used for the period 1995-2001.

17. A good simulation of the observed data series for *Sardinella aurita* and *S. maderensis* by the Schaefer model was obtained, except for the Nansen indices for *S. maderensis*. The MSY for *Sardinella aurita* was estimated at 575 121t using the CPUE from the artisanal fishery in Senegal as an index of abundance and 508 112 t using the Nansen abundance index. The MSY for *Sardinella maderensis* (CPUE index artisanal fishery Senegal) was estimated at 208,968t.

18. It is noted that for *S. aurita* the two indices give similar estimates for MSY, with an SSQ that is much lower in case of the artisanal CPUE series. The results show a fluctuating CPUE, with an increasing trend during the last two years for both series of indices.

19. For *S. maderensis* the results of the model show a relative stable CPUE during 1990-2001, except for the years 1992-1993 and 1997-1998.

20. The results obtained provide useful information on the dynamics and possible states of the stock. On the basis of these results, a precautionary TAC of 600,000 for the two species combined would seem to be justified. This estimate is higher than the one given in last year's report (500,000 tonnes). This seems to be consistent with the increasing trends in some CPUE series for certain fleets. However, considering the uncertainties in the results of dynamic models, the WG decided to retain the value of last year, i.e. 500,000 tonnes.

Horse mackerel

21. For a detailed description of the stock identity of the two species of *Trachurus*, the reader is referred to the report of the WG meeting in Nouadhibou in 2001 (FAO, 2001).

22. For exploratory purpose, a separable VPA was run for the two species (*Trachurus trachurus* and *T. trecae*). Thereafter, an Integrated Catch Analysis (ICA) was run for each of the species separately.

23. Data on age composition and mean weight-at-age of catches by year, used by the 1998 working group, were updated, the available series covering the period 1979-2000. For *T. trachurus* the catch-at-age series presented in last year's report was changed because the group believed that there are two stocks, one from zone A+B and northwards in Morocco, and another one being distributed from zone C southwards. The catch-at-age matrix from 1990 to 2000 was recalculated so that the total catch (in tonnes) was consistent with the total catch reported by each country.

24. The results of the separable VPA's show that there are relatively high residuals in the analyses, especially for *T. trecae*.

25. The ICA was run successfully for *T. trachurus*. For *T. trecae*, the ICA did not find a reasonable solution. This may be explained by the large discrepancy between the stock trajectory of the separable VPAs (of the catch at age analysis) and the stock trajectory of the R/V Dr Fridtjof Nansen acoustic time series for this stock.

26. The results of the ICA for *T. trachurus* indicate that the stock has been through fluctuations during the last 20 years, and that the stock has been in a declining phase in recent years. The acoustic time-series for *T. trecae* shows the opposite trend with an increasing trend in stock biomass.

27. During the trial runs of the Excel-version of ICA, it was discovered that the program found several different solutions (minimum SSQs), with quite different SSB and F-levels. The present assessments must therefore be looked upon as preliminary and the stock and F-levels must not be used for management purpose. However, the trends in stock and F's seem to be well estimated.

Mackerel

28. For the assessment of the mackerel, the WG (FAO, 2001) has assumed that there are two stocks in the region from Morocco to Senegal:

- The “northern stock” distributed from Bojador to the north of Morocco;
- The “southern stock” distributed from Bojador to Senegal.

29. During this meeting, only the “southern stock” has been considered and an Integrated Catch Analysis (ICA) was run for this species.

30. Data on age composition and mean weight-at-age of catches by year, used by the 1998 working group, have been completed for recent years. The available series covers the period 1992- 2001.

31. The results of the ICA show that the total biomass reached a maximum in 1995 (1.1 million tonnes) and decreased from 1996 to 2001. The residuals obtained are generally satisfactory. The distribution of fishing mortality at age shows variations between years according to the change in strategy of the pelagic trawlers fleet in Morocco and Mauritania.

32. There is no information on the size distribution of mackerel in catches between Dakhla and Cape Barbas, where small fish is normally very abundant and sometimes caught in large numbers.

33. Generally, the estimations by ICA were in good agreement with the results of Russian acoustic surveys, which gives credibility to the calculations. The use of oceanographic factors to forecast chub mackerel abundance should be complemented by recruitment surveys that provide actual indices of recruitment strength.

MANAGEMENT RECOMMENDATIONS

Sardine

34. Because of uncertainties in the assessment, a prognosis has not been made and the results of the assessment should not be used for management purposes. Results of acoustic surveys indicate an increase in stock size during the last years.

Sardinella

35. In view of the uncertainty of results based on global models, the working group considers that the results obtained this year should not be used to revise the recommendation given last year. It is therefore recommended to set a precautionary TAC of 500,000 tonnes for both species combined in the total area. This figure corresponds approximately to the maximum level observed in the period 1990-2001.

36. It should be noted that the total catch in the region has dropped below 500,000 tonnes in the last three years, despite a substantial increase in fishing effort of the EU industrial fleet in Mauritania. Catches per unit of effort in the EU-fishery in Mauritania show a decline over the last 4 years, suggesting a reduction of the stock in this area. This information, combined with the prospects of poor recruitment, should be a good reason to set the TAC not higher than 500,000 tonnes.

Horse mackerel

37. The annual catches of the different species have fluctuated strongly over time, but all species show an increasing trend from 1990 to 2001. The CPUE data, calculated for vessels that targeted horse mackerel, show a declining trend. Moreover, the acoustic estimates of R/V Dr Fridtjof Nansen show a decreasing trend for both species of *Trachurus*. This decline is partly compensated by the increase in biomass of false scad.

38. Considering the many uncertainties in the assessment of these stocks, a precautionary approach should be taken in management of the stocks. For this reason, the WG recommends a restriction of fishing effort to the current level.

Mackerel

39. The results of the ICA analysis indicate a decreasing trend in biomass. Although the results are uncertain, due to inconsistencies in the input data, the Working Group considers that there is reason for a precautionary approach, avoiding an increase in fishing effort.

FUTURE RESEARCH***Sardine***

40. A biological sampling programme has to be established for all fisheries in the area. This sampling programme has to cover the entire fishing season and all fleets. At least 100 fish should be measured per sample.

41. Sampling for age composition should cover the entire length distribution. In each length, ten otoliths should be taken.

42. All input data for the assessment models have to be ready on the first day of the WG meeting. The data series should include data for the previous year.

Sardinella

43. The R/V Dr Fridtjof Nansen surveys and the calibration exercises should be continued. Joint surveys with research vessels of the sub-region should be carried out.
44. An otolith exchange should be carried out as soon as possible and an age reading workshop organised.
45. Studies aimed at finding a representative index of fishing effort for sardinellas as well as on the application of analytical models should be stimulated and conducted.
46. A monitoring programme of the artisanal fishery for sardinella in Mauritania should be started.

Horse mackerel

47. It was noted that with the exception of recommendations 3 and 4 of the 2001 WG report, the recommendations of that meeting had not yet been implemented. Therefore, the WG reiterates them as follows:
48. At least monthly sampling on board industrial vessels to establish species composition, length and age distribution etc. should be conducted. This activity should have the highest priority.
49. An age reading programme for the three species should be initiated.
50. All the historic data series on catches, effort and biological parameters should be utilised in future assessment.
51. The acoustic surveys should be continued and the acoustic estimates should be split by age groups, if possible.
52. A regional programme should be established to assess the entire stock including the coastal component of the horse mackerels and other species of small pelagics.
53. Stock assessment methods should be developed to use environmental factors to forecast possible changes in stocks, and to use the results of these methods as an additional source of information.

Mackerel

54. For a better assessment of the mackerel stocks, the WG makes the following recommendations (in order of priority):
 - to establish an adequate sampling programme for all the countries fishing in the region;
 - to adopt the same age reading method for mackerel;
 - to conduct further studies on stock identity;
 - all acoustic surveys should give a separate estimate for mackerel;

- it is recommended that the comparative studies of environment and biomass indices are presented at the next meeting.

MANAGEMENT CONCLUSIONS

55 During this year's meeting the emphasis was on updating the data base as well as knowledge of assessment methods within the group. At the beginning of the meeting a two-day course in basic assessment methodology was held.

56 A number of preliminary assessments for various species were carried out, but with few reliable results. The reason for this was poor quality of the input data, and to some extent problems in using the existing models. During future meetings, this aspect of the work will require more attention. A Planning Group to discuss the data collection will be held in Senegal before the November-December Survey.

57 Although the group is not yet in a position to make short/long-term projections, it is expected that the pelagic stocks will decline further in case of an expansion of the (industrial) fishing effort in the area.

58 As a general recommendation the group therefore suggests to adopt a precautionary approach, and not to increase the combined catch of small pelagics above the average level attained during the most recent 5 years (1997-2001).

Table 6a- Synthesis of Information – Coastal Pelagic Fish

Resources	Region	Biomass (x1000t)	Management Recommendations	Comments
Sardine	Morocco, Zones A+B+C Dec 1999	2 630	Reduction of effort	Risk of overexploitation according to the 1990-1999 analysis of acoustic series. Intensification of age reading programmes
Sardinella	Morocco, Dec. 1999	1500	Possible increase of effort, except on the Petite Côte of Senegal	According to the acoustic surveys, exploitation is probably moderate, except in the Petite Côte of Senegal
	Mauritania Nov./Dec1999	742		
	Senegal & Gambia Nov/Dec1999	1385		
	Guinea Bissau 1995	15		Old assessment, need to be updated. Comparison with other assessment methods. Intensification of age reading programmes.
	Guinea 1996	125		
	Sierra Leone 1989	239		
Sardinella and anchovies	Côte d'Ivoire 1999	42	Monitoring of effort	Biomass stable enough or high
	Ghana 1999	40		
	Togo-Bénin 1999	5		
Total pelagics	Nigeria			Exploitation probably moderate
	Cameroon	162		
	Cape Verde 1999	50		
Carangids	Morocco 1999 Cap Juby-Cap Blanc	430	Control effort	High Biomass according to acoustic methods. Increase of effort is possible. Intensification of age reading programmes
	Mauritania 1999	296	Monitoring effort	
	Senegal/Gambia 1999	67	Control effort	
	Guinea Bissau 1995	90		
Carangids and Scombroids	Liberia 1991	44		
	Côte d'Ivoire 1999	30	Possible increase of effort	Biomass high according to acoustic methods
	Ghana 1999	50	Reduction of effort	Biomass low according to acoustic methods
	Togo, Bénin 1999	4	Possible increase of effort	Biomass high according to acoustic methods

Table 6b- Synthesis of Information – Demersal Resources

Region	Resources	Catch Potential (x1000t ⁻¹)	Management Recommendations	Comments
Maroc	Octopus 1997	30 – 50	Reduction of effort	All the demersal resources are highly exploited or overexploited. Intensification of age reading programmes and updating research
	Deepwater Shrimps 1997	8.7 - 9.2	Control effort	
	Hake 1997	8.2 -9.7	Monitor effort	
	Demersal Fish 1993		Reduction of effort	
Mauritanie 1998	Octopus	21- 40	Reduce effort	All the demersal resources are highly exploited or overexploited. Catch and effort data are generally weak. Intensification of age reading programmes and updating biological research.
	Cuttlefish	10	Can support more fishing units, but not trawlers	
	Squid	6		
	Demersal fish	Unknown	Probably fully or over exploited	
	Hake	>13	Control effort	
	Deepwater Shrimps	2.5	Freeze effort	
	Coastal Shrimps	1		
	Crabs	0.4		
	Pink Lobster	0.8	Fish with traps	
	Green Lobster	0.22	Careful in increasing effort	
Sénégal	Praires V. rosalina V. verrucosa	300 0.5 – 1.0	Not to increase fishing effort	Lack of biological and statistical information. Biological studies necessary. Only the Hake and the shrimps are not overexploited.
	Demersal Resources	130	Reduce effort	
	Coastal Shrimps	3.5 - 4	Freeze effort	
	Octopus and Cuttlefish	4.3 for Cuttlefish	Possible to increase effort	
	Coastal Demersal fish		Reduce effort	
	Deepwater Shrimps (Gambas)	3 -3.5	Freeze effort	
	Hake	0.5	Possible to increase effort	
	Deepwater Red Crab			
Other Deepwater fish				

Maximum Sustainable Yield (MSY)

Table 6b- Synthesis of Information – Demersal Resources

Region	Resources	Biomass (x1000t)	Catch Potential (x1000t ¹)	Management Recommendations	Comments
Gambia	Coastal Demersal Resources		15	Freeze effort until new data is available	Lack of biological and statistical information. Biological studies necessary.
Cape Verde 1999	Pink Lobster		50 - 70	Freeze effort	The lobsters are fully exploited. Intensification of biological studies.
	Demersal Fish		3 - 5	Possibility to increase effort	
Guinea Bissau	Coastal Shrimps			Reduce effort	Data incomplete. Lack of biological and statistical information
	Céphalopods				
Guinea 1992 and 1996	Demersal Fish		10 - 28		
	Shrimps		1	Freeze effort	Resources seem to be fully exploited. Necessary to update assessment.
	Cephalopods		10		
Demersal species	112 - 48	15			
Sierra Leone 1993	Crabs and Lobsters			Possibility to increase effort	Signs of high exploitation. Assessment to be updated.
	Shrimps		2.6 - 3.5	Freeze effort	
	Demersals		18 - 45	Reduce effort	
Liberia 1981	Demersal fish		15		Assessment very old.
	Crustaceans		1.2 - 1.6 (1977)		
Côte d'Ivoire 1999	Demersal Fish	16.8	13 - 15 1982)		Data incomplete. Lack of biological and statistical information
	Coastal Shrimps		0.35	Possible to increase effort	
	Red Crab		0.2 à 0.6	Freeze effort	
Ghana 1999	Demersal Fish	82			Data incomplete. Lack of biological and statistical information
	Coastal Shrimps		0.29	Freeze effort	
Togo-Bénin 1999	Demersal Fish	1.7	12.5		Data incomplete. Lack of biological and statistical information
	Coastal shrimps		0.054 (Bénin)	Monitor effort	
Nigeria	Demersal Fish 1986		11.7 - 23.4	Control effort	Data incomplete. Lack of biological and statistical information
	Coastal Shrimps 1999		8.8	Possible to increase effort	
Cameroon	Demersal Fish		17 - 19	Reduce effort	Data incomplete. Lack of biological and statistical information.
	Coastal shrimps 1999		0.8		

(1)Maximum Sustainable Yield (MSY)