GENERAL FISHERIES COMMISSION FOR THE MEDITERRANEAN (GFCM)

REPORT OF THE FIFTH STOCK ASSESSMENT SUB-COMMITTEE MEETING (SCSA)

Nicosia (Cyprus), 3-6 June 2003

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[1] Annexed to annex 1 .
[2] Annexed to annex 1 .

1. OPENING OF THE MEETING

The Fifth meeting of the SAC Sub-Committee (SC) on Stock Assessment (SCSA) of the GFCM was held at Holiday Inn Hotel in Nicosia (Cyprus) from 3 to 6 June 2003. It was opened and chaired by the Co-ordinator of the SCSA Mr P. Oliver.

2. ADOPTION OF THE AGENDA AND ARRANGEMENTS OF THE SESSION

The agenda of the meeting was adopted (Annex 1).

The meeting was attended by 22 scientists from 8 countries as well as by an expert from the EU and 2 from the FAO Regional Projects COPEMED and ADRIAMED (Annex 2).

3. REVIEW AND ANALYSIS OF THE ASSESSMENTS

The SC worked taking into consideration the assessments submitted by the Working Groups (WGs) on demersal and small pelagic species (Annexes 3 and 4) held on March of this year in Tangier (Morocco) and the ones carried out by the SC in 2002. The results were the following 24 stocks evaluated for which the SC provides advice to SAC:

HAKE (*Merluccius merluccius*)

- Stock in Geographical Sub Area 7 Gulf of Lions (Assessed in 2002)
- Stock in Geographical Sub Area 9 Ligurian and northern Thyrrhenian (Assessed in 2003).

RED MULLET (*Mullus barbatus*)

- Stock in Geographical Sub Area 9 Ligurian and northern Thyrrhenian (Assessed in 2002)
- Stock in Geographical Sub Area 10 Southern and central Thyrrhenian (Assessed in 2003)
- Stock status in Geographical Sub Area 3 Southern part of Alboran Sea (Assessed in 2003).

RED SHRIMP (*Aristeus antennatus*)

- Stock in Geographical Sub Area 1 Northern Alboran Sea (Assessed in 2003).
- Stock in Geographical Sub Area 5 Balearic Island (Assessed in 2003).
- Stock in Geographical Sub Area 6 Northern of Spain (Assessed in 2003).

ANCHOVY (*Engraulis encrasicolus*)

- Stock in Geographical Sub Area 1. Northern Alboran Sea. (Assessed in 2002)
- Stock in Geographical Sub Area 6, Northern Spain. (Assessed in 2002)
- Stock in Geographical Sub Area 7-6.north, Gulf of Lions and North Catalonia (Assessed in 2003 by hydroacoustic methods)
- Stock in Geographical Sub Area 17 Northern Adriatic (Assessed in 2003).
- Stock in geographical Sub Area 22 Aegean Sea (Assessed in 1999 and submitted in 2002)

SARDINE (*Sardina pilchardus*)

- Stock in Geographical Sub Area 1. Northern Alboran sea (Assessed in 2002).
- Stock in Geographical Sub Area 3 Southern Alboran Sea (assessed in 2003).
- Stock in Geographical Sub Area 6, Northern Spain (Assessed in 2002).
- Stock in Geographical Sub Area 7 Gulf of Lions (Assessed in 2003).
- Stock in Geographical Sub Area 16 Sicily Channel (Assessed in 2003)
- Stock in Geographical Sub Area 17 Northern Adriatic (Assessed in 2003).
- Stock in geographical Sub Area 20+22 Eastern Ionian Sea and Aegean Sea (Assessed in 2002)

OTHER DEMERSAL SPECIES :

- Stock of *Trachurus trachurus* in Geographical Sub Area 3 Southern part of Alboran Sea (Assessed in 2003).
- Stock of *Parapenaeus longirostris* in Geographical Sub Area 3 Southern part of Alboran Sea (Assessed in 2003).
- Stock of *Aristeomorpha foliacea* in Geographical Sub Area 11 Sardinia (Assessed in 2002)
- Stock of *Nephrops norvegicus* in Geographical Sub Area 9 Ligurian and northern Thyrrhenian (Assessed in 2002).

3.1. DEMERSAL WORKING GROUP

Enrico Arneri presented the report of the Fourth meeting of the SAC Working Group on Demersal Species held in March 2003 in Tanger (Annex 5). 15 scientists from 3 countries attended the meeting.

15 technical papers were presented and discussed by the Working Group. These documents were classified as: (i) assessment documents and (ii) assessment-related documents. Nine assessments were carried out covering 8 GSA and 5 species.

HAKE

Stock assessment of hake (*Merluccius merluccius*) Geographical Sub Area 7 Gulf of Lions (Assessed in 2002)

FISHERIES : Hake (*Merluccius merluccius*) is one of the most important demersal species of commercial fisheries in the Gulf of Lions. In 2001 it was exploited by 113 French trawlers, 95 French gillnetters, 26 Spanish trawlers and 20 Spanish longliners. The catches of the trawlers are mainly composed of juveniles living on the continental shelf, while gillnetters and longliners are exploiting the adult part of the stock (spawners) living on the slope and in non trawlable areas. 80% of the landings are done by the trawlers; the total landings remained quite stable during the period 1988 (2941 tonnes) to 2001 (2693 tonnes). During the same period, the total number of trawlers decreased from 196 to 139, while the number of gillnetters increased from 20 to 95 and the longliners fleet increased from 13 to 20 boats. During some periods, discards can represent a significant part of the total European hake catch, both in weight and in number

SOURCE OF MANAGEMENT ADVICE: Stock assessment of the French-Spanish shared stock of hake (*Merluccius merluccius*) in the Gulf of Lions: a comparative approach. French-Spanish Working Group (IFREMER – IEO – CMIMAICM) Length cohort analysis (LCA) and yield per recruit analysis (Y/R) were developed on a mean pseudocohort (1998-2001). The results have been compared to a previous similar analysis for the period 1988-1991. The objectives were to analyse hake dynamics in the Gulf of Lions and to compare its exploitation pattern and exploitation rate over a 10 years period.

STOCK STATUS: General status of resource: Growth overexploitation The biomass values showed a decreasing trend from 1988-91 to 1998-01 periods, but remained stable from 1998-00 to 1998-01. Current biomass is 2.37% of virgin biomass; For females, if Fcurrent is reduced by 82%, Y/Rmax would be 3.3 times higher the current value. For males, if Fcurrent is reduced by 68%, YRmax would be 1.6 times higher the current value. There is a risk of recruitment overexploitation. Spawning females in the current stock have been estimated around one million of individuals, in comparison to 20 millions of individuals in the virgin stock. It seems that the spawning stock is decreasing in comparison to previous analysis (1988-91).

WG MANAGEMENT ADVICE AND RECOMMENDATIONS (2002): To avoid recruitment overfishing: Reduce the effort of longline and gillnets in order to increase (or at least maintain) the SSB. Reduction of fishing effort could be achieved by establishing temporal closures for longline and gillnet during the period of maximum spawning, or by reducing time at sea, and/or fishing boats or/and engine power. To reduce growth overfishing: A transition analysis performed shows that the improvement of trawl selectivity is the most appropriate management measure (length at first capture fixed at 20 cm TL). Moreover, the reduction of fishing effort could be also considered: from the Y/R analysis, a reduction of about 80% of F should be necessary to reach the maximum Y/R at

the current fishing pattern, but taking into consideration the short database, a reduction of 20% is recommended. This reduction is still far from the biological optima of the stock. Reduction of fishing effort could be achieved by establishing temporal closures for longline and gillnet during the period of maximum spawning, or by reducing time at sea, and/or fishing boats or/and engine power. It should be considered that the effort reduction or selectivity improvements imply losses at short term but gains at medium term.

SCSA COMMENTS AND RECOMMENDATIONS (2002): The SC endorses the assessment and the recommendations. Both alternatives, decreasing effort and increasing length at first capture are independent and complementary management measures to reach the objectives.

SCSA COMMENTS AND RECOMMENDATIONS: Based on the assessment performed in 2002, the SC keep the recommendations endosed in 2002, considering that decreasing effort and increasing length at first capture are independent and complementary management measures to reach the management objectives. Moreover, the SC was informed that a French longliner targeting hake has started operating in the sub-area and recommends monitoring it to be included in the next year assessment.

Stock assessment of *Merluccius merluccius* **Geographical Sub Area 9 Ligurian and northern Thyrrhenian (Assessed in 2003).**

FISHERIES: Merluccius merluccius is one of the most important species in the Geographical Sub Area 9, considering both the amount of catch and commercial value. It is fished with different strategies and gears (bottom trawling, gill nets, hooks). Within the area, several fleets operating from the different ports exploit the species. The fishing pattern changes among the ports mainly due to the major use of one or other methods of capture.

The fishing pressure in the fishing grounds closer to each port is quite different. About 150 trawlers and a more limited number of vessels belonging to the artisanal fleet exploit the species. Annual landings in the area are around 500 tonnes.

Discard of undersized individuals of the species has been assessed for particular subareas and can be considered important. However, in some areas, a reduction of discards and of landings of undersized individuals did recently occur due to enforcement of controls.

SOURCE OF MANAGEMENT ADVICE: Data sources were trawl-surveys (national and MEDITS programmes) as well as Catch Assessment Surveys that include data collection of size structure of the catches. Length Cohort Analysis and Yield-per-Recruit analysis were used to assess the status of the stocks in the area as well as similations of changes of mesh size. All the analysis were done under different assumptions regarding natural mortality.

STOCK STATUS: In this new assessment a wider area than in 2002 has been considered, covering almost all the sub-area 9 (Tuscany). The species is now considered to be overexploited. Catch rates and total catches have shown in general negative trends during the last ten years. The current level of the Spawning Stock Biomass if compared with the pristine S.S.Biomass is considered in general too low, suggesting a risk of recruitment overfishing. However, standing stock size estimated through trawl-surveys suggests an increase in biomass of the species in most of the sub-areas of Geographical Sub Area 9. The contradiction between the trends observed from trawl-surveys and commercial data can be explained at least in part by changes in the target in the case of some of the fleets.

WG MANAGEMENT ADVICE AND RECOMMENDATIONS: Data for this assessment proceed from a year of monitoring landings on a monthly basis (year 2000). In each port with a fleet exploiting the European hake, monthly data on landings and size composition were collected. This allowed the construction of the size structure of the total annual catch by port and gear. A Length Cohort Analysis was utilised in order to estimate the fishing mortality vector and the number of individuals at sea by size. Successively, the contribution to each gear to the F vector was calculated. Two different assumptions as regards to the natural mortality were included in the analysis. A first analysis was performed assuming a constant value of M. In a second analysis, a vector of M assuming an inverse relationship with age was used. Forecast analysis assuming equilibrium were successively performed in order to evaluate the consequence of changes in fishing pressure and in selectivity.

The different trends of biomass between trawl surveys and commercial landings could be explained by the fact that fishermen in the recent years do not concentrate in nursery areas where density is higher, this can produce a reduction in commercial catch rates. This is reflected by a change in the length frequency distribution of commercial landings in some ports.

A status of growth overfishing is confirmed by this study. The species length at first capture is too low and fishing pressure very high. The current surviving fraction of the Spawning Stock Biomass ($\%SSB_0$) in both cases (assuming a constant low M and with M inversely related with age) is extremely reduced, indicating a real danger of recruitment overfishing for the stock.

The necessary reduction of fishing mortality should be of about 70% if the current mesh size is maintained. By enlarging the cod-end mesh size to 60 mm (stretched mesh size) the reduction, in order to drive spawning biomass to a safer level (about 30% of pristine stock), should be of about 60%. At the current very high levels of fishing pressure, simulations show that an enlargement of the legal mesh size up to 60mm would produce a long term improvement of more than 30% in yield per recruit while the improvement is considered negligible as regards to the Spawning Stock survival.

The reduction of fishing mortality can be obtained through a drastic reduction of fleet capacity or fishing activity. Alternatively this reduction could be obtained by establishing protected areas where young individuals are densely concentrated.

SCSA COMMENTS AND RECOMENDATIONS: The SC endorses the diagnosis of overexploitation and express concern for the low level of SSB which is well below the generally accepted safe biological levels. In consequence the SC recommends a reduction of 60% of fishing mortality and an improvement of the exploitation pattern. The reduction of fishing effort, either through a drastic reduction of fleet capacity or in fishing activity, is in this case more effective for a management goal of a spawning stock biomass enhancement. A safer value for the %SSBo (of about 30%) can be obtained as soon as the new equilibrium will be reached. The enlargement of the legal mesh size, up to 60mm, if not combined with fishing mortality reduction, determine a modest improvement of the Spawning Stock Biomass while producing a substantial improvement in Yields per recruit.

A final statement is necessary here, related to the important fleet reduction that has occurred in the last 3 years (up to 30% in some ports). It is likely that this fact had produced a noticeable reduction of the fishing mortality reported in the assessment. In fact, available data used for the assessment of the stock status corresponds to year 2000 situation and this reduction could not be taken under consideration in the analyses presented here. Hence, future assessments, discounting this reduction and using new data proceeding from the fisheries, is expected to show a less critical situation regarding the current stock status.

RED MULLET

Stock assessment of *Mullus barbatus* **Geographical Sub Area 9 Ligurian and northern Thyrrhenian (Assessed in 2002)**

FISHERIES: *Mullus barbatus* is among the most commercial valuable species in the area and make part of a species assemblage that is the target of the bottom trawling fleets that operate near shore and a real target in some particular periods when the species in densely concentrated near the coast. It is caught mainly with three different variants of the bottom trawl net. The fishing pressure on the species changes in the different sub-areas of the Geographical Sub Area 9 depending on the consistency of the fleets that exploit the different grounds as well as on their traditional targets. *Mullus barbatus* catches are higher during the post-recruitment period (from September to November). About 150 vessels exploit the species. Annual landings are around 350 tonnes. Discard of undersized individuals is in general negligible, due to the fact that immediately after recruitment, small sized individuals are still concentrated inside the 3 miles stripe forbidden for trawling activities. However, some illegal captures do occur.

SOURCE OF MANAGEMENT ADVICE: Data proceed from trawl-surveys (national and MEDITS programmes) as well as from Catch Assessment Surveys that includes data collection of size structure of the catches. Length Cohort Analysis, Composite Production Models and Yield-per-Recruit analysis were used for assess the status of the stocks in the area. Assessments were performed separately for different operational units present in the area.

STOCK STATUS: The species is considered fully exploited and in some areas overexploited, depending on the fishing grounds where the different fishing fleets operate with different levels of fishing effort. The current level of the Spawning Stock Biomass if compared with the pristine S.S.Biomass is considered too low, suggesting a risk of recruitment overfishing. Catch rates and total catches do not show any trend during the last ten years. However, standing stock size estimated through trawl-surveys suggests an increase in biomass of the species in most of the sub-areas.

WG MANAGEMENT ADVICE AND RECOMMENDATIONS (2002): Management measures should include spatial and temporal closures, effort limitation, a minimum landing size, gear modifications, quotas and market restrictions. A total closure of the 3 miles in order to protect juveniles immediately after recruitment is recommended.

SCSA COMMENTS AND RECOMMENDATIONS: Based on the 2002 assessment the SC keeps the recommendations given last year, i.e. reduction of fishing effort especially on the areas and season where and when recently recruited juveniles are concentrated. This can be obtained through the enforcement of a seasonal fishing ban of a period during the late summer and early autumn. This management measure should also produce a shift in the size of first capture.

Stock assessment of *Mullus barbatus* **Geographical Sub Area 10 Southern and central Thyrrhenian (Assessed in 2003)**

FISHERIES : *Mullus barbatus* is among the most commercial valuable species in the area and make part of a species assemblage that is the target of the bottom trawling fleets which operate near shore. No commercial catch data and no information on the fleets were reported to the demersal WG.

SOURCE OF MANAGEMENT ADVICE: Trawl survey data from MEDITS and SAMED EU projects. The indices of abundance (weight and number per square km by swept area method), size composition at sea by sex, sex ratio, maturity growth, natural and total mortality. The Length frequency analysis, Chen & Watanabe vector, Alagaraja formula, length convrted catch curve, simulation of different scenarios usin a pool dynamic model.

STOCK STATUS: Full exploitation and a growth overfishing can be assumed for the species. No significant trend in biomass abundance estimates.

WG MANAGEMENT ADVICE AND RECOMMENDATIONS: Data collected during MEDITS trawl surveys from 1994 to 2001 were used to estimate abundance indices, biological and demographic parameters applying the standardised protocols adopted in the SAMED project. Moreover, the consequences of changes in the exploitation scenarios (total mortality and gear selectivity) were simulated by a dynamic pool model in which stochasticity was introduced.

The abundance indices (number and weight per km^2) did not show any temporal trend. The results from the model showed that increasing the size at first capture would produce less advantage then decreasing total mortality. Under a conservative hypothesis (length at 50% of maturity of 140 mm), the performed analysis highlighted, in the current scenario, a level of 12% in the ratio between average Spawning Stock Biomass and average virgin Spawning Stock Biomass. As MEDITS bottom trawl surveys were carried out during the spawning season of the species, no significant trend of the abundance indices would indicate a stable condition for the spawner's fraction of the population.

The rather constant trawl survey biomass trend coupled with the indications derived from the dynamic pool model, could imply that the self renewal of the stocks is not compromised despite of the high total mortality (more than twofold the natural mortality). Growth overfishing can be assumed for the species.

A reduction of 10-15% of the total mortality, which could drive in a more save position the SSB/SSB_0 (the ratio between average Spawning Stock Biomass and average virgin Spawning Stock Biomass), could be probably obtained enforcing the area and temporal closures currently applied.

SCSA COMMENTS AND RECOMMENDATIONS: The SC endorses the WG recommendation of reducing 10-15% of the total mortality, which could drive in a more save position the SSB/SSB_0, which could be obtained enforcing the already existing permanent spatial closures complemented if necessary with temporary closures. Notwithstanding the stable trend or the relative aboundance index the SC indicates that it does not say anything on the sustainability of the stock.

Assessment of the stock status of *Mullus barbatus* Geographical Sub Area 3 Southern part of Alboran Sea (Assessed in 2003).

FISHERIES : The main demersal resources are Mullus barbatus, Trachurus trachurus and Parapenaeus longirostris, Sparids such as Pagellus acarne. The contribution of this species in the landings of demersal species is between 40% and 50 %.

The exploitation is carried out by coastal fleet composed mainly by trawlers. This fleet operates in the proximity of the base ports and the trips have duration between one and three days. The number of boats varies between 90 and 120 depending on the year and the fishing activity is carried out at depth less than 200 m.

SOURCE OF MANAGEMENT ADVICE: Monitoring of resources is based on landing statistics, biological data collected in the frame of a sampling programme developed in the two main landing ports. An analysis of length frequency distribution obtained from sampling of landings has been performed by means of analytical models (LCA) for the main resources exploited by the Mediterranean fleet of Morocco (geographic subarea 3).

STOCK STATUS:

WG MANAGEMENT ADVICE AND RECOMMENDATIONS : The Y/R analysis was utilised to test the behaviour of the populations to different exploitation levels. A situation of overexploitation has been detected. The sampling ports (Nador and Alhoceima) represent 86% of the total demersal Morocco Mediterranean landings. There are no discards. The season of recruitment was detected by analysis of monthly length frequency distribution. The catch of other gears except trawl-net is negligible.

A reduction of the fishing effort in coastal areas is recommended, and this could be achieved by transferring part of the fishing effort to more offshore fishing grounds.

SCSA COMMENTS AND RECOMMENDATIONS: The SC endorses the WG assessment and recommendation; however the SC draws up the attention of the WG regarding the necessity to include figures when a recommendation is made. In this case, taking into consideration the working paper submitted at the WG the SC considers that a reduction of 60% of current effort should be recommended. The SC also recommends to use also a more conservative reference point, such as F0.1, together with the Fmax.

RED SHRIMP

Stock assessment of red shrimp (*Aristeus antennatus*) in Geographical Sub Area 1 Northern Alboran Sea (Assessed in 2003).

FISHERIES: The red shrimp (*Aristeus antennatus*) is one of the most important resources of bottom trawling in Alboran Sea. It is fished on the slope between depths of 400 to 800 m. Landings in the period 1976-2001 were around 300 with a maximum of 517 t in 1991 and a minimum in 2001 115 t. Mean size in the landings was 27 mm CL and the catches in the last three years have decreased since the most recent peaks by about 50%.

SOURCE OF MANAGEMENT ADVICE: The state of the fishery of the Red shrimp (*A. antennatus*) considering the average 2000-2002 years and the whole population (females and males together) was analysed. Assessment of the exploited resource was carried out using length and age based methods (LCA and VPA) and yield per recruit analysis (Y/R). Size length catches were transformed into age data and a Pseudochort Analysis was performed.

STOCK STATUS: Results showed a stable fishery based on adults specimens. The VPA revealed that the mean age of the catch was greater than the mean age of the stock, however, the Y/R curves in all areas pointed to an overfishing scenario. Moreover, a very high fishing effort on the spawning stock biomass was detected.

WG MANAGEMENT ADVICE AND RECOMMENDATIONS: Yield per Recruit analysis shows a lower exploitation level. Yield per Recruit analysis showed an optimum effort close to half of the current level. A transition analysis of 15 years with a reduction effort factor of 25% in the first year could bring the biomass of the stocks up to 35% higher than the current value. As a general trend the mean length of the catch was larger than the size of first maturity. Fishing mortality by age have an increasing trend from year class 2 to the oldest, probably the age class 0 has a low accessibility. The recommendation is to keep the current level of effort and if possible to reduce it.

SCSA COMMENTS: The SC notes the state of full exploitation and that the current Biomass is about 13% of the Virgin Biomass. A 25% reduction of the effort could bring the biomass of the stock up to 35% higher than the current value in 3 years. The SC endorses the WG recommendation of keeping the current level of effort and if possible to reduce it as indicated by the analysis.

Stock assessment of red shrimp (*Aristeus antennatus*) in Geographical Sub Area 5 Balearic Islands (Assessed in 2003).

FISHERIES: The red shrimp (*Aristeus antennatus*) is one of the most important resources of bottom trawling in the Balearic Islands. It is fished on the slope between depths of 400 to 800 m. In biomass, it represents an average of 5% of the overall catches, but its economic value is 30% of the total earnings of the fishery. The trawl yields varied between 3 and 14 kg/h. The highest yields occurred in winter and spring. The decline of the sizes at first capture in 1997 and the increase of juveniles in the catches can be interpreted as a change in the fishery strategy, which has increased the exploitation effort on the small sizes. The average landings in the last three years has been 170 t. Mean CPUE varied from 25 to 45 kg per vessel and day. Mean size in landings was 29 mm CL.

SOURCE OF MANAGEMENT ADVICE: The state of the fishery of the Red shrimp (*A. antennatus*) considering the average 2000-2002 years and the whole population (females and males together) was analysed. Assessment of the exploited resource was carried out using length and age based methods (LCA and VPA) and yield per recruit analysis (Y/R). Size length catches were transformed into age data and a Pseudochort Analysis was performed.

STOCK STATUS: The VPA revealed that the mean age of the catch was greater than the mean age of the stock, however, the Y/R curves in all areas pointed to an overfishing scenario. Moreover, a very high fishing effort on the spawning stock biomass was detected.

WG MANAGEMENT ADVICE AND RECOMMENDATIONS: Landings keep up similar levels for the three years. Nevertheless it has been detected a smooth decreasing trend. Yield per Recruit analysis shows a full exploitation and an optimum effort close to half of the current level. A transition analysis of 15 years with a reduction an effort factor of 25% in the first year could bring the biomass of the stock up to 32% higher than the current value.

As a general trend the mean length of the catch was larger than the size of first maturity. Fishing mortality by year have an increasing trend from year class 2 to the oldest, probably the age class 0 has a low accessibility. Catches in the last three years have decreased since the most recent peaks by about 50%. The recommendation is to keep the current level of effort and if possible to reduce it.

SCSA COMMENTS: The SC notes the state of full exploitation and that the current Biomass is about 16% of the Virgin Biomass. A 25% reduction of the effort could bring the biomass of the stock up to 32% higher than the current value in 3 years. The SC endorses the WG recommendation of keeping the current level of effort and if possible to reduce it as indicated by the analysis.

Stock assessment of red shrimp (*Aristeus antennatus*) in Geographical Sub Area 6 Northern of Spain (Assessed in 2003).

FISHERIES: The red shrimp (*Aristeus antennatus*) is one of the most important resources of bottom trawling in this sub area. It is fished on the slope between depths of 400 to 800 m. Recent average annual landings were 114 t. Mean size in the landings was 26 mm CL.

SOURCE OF MANAGEMENT ADVICE: The state of the fishery of the Red shrimp (*A. antennatus*) considering the average 2000-2002 years and the whole population (females and males together) was analysed. Assessment of the exploited resource was carried out using length and age based methods (LCA and VPA) and yield per recruit analysis (Y/R). Size length catches were transformed into age data and a Pseudochort Analysis was performed.

STOCK STATUS: The VPA revealed that the mean age of the catch was greater than the mean age of the stock, however, the Y/R curves in all areas pointed to an overfishing scenario. Moreover, a very high fishing effort on the spawning stock biomass was detected.

WG MANAGEMENT ADVICE AND RECOMMENDATIONS: Results of the assessment showed a full exploitation based on adults specimens. Landings keep up similar levels for the three years analysed, nevertheless a smooth decreasing trend have been detected. Yield per Recruit analysis showed an optimum effort close to half of the current level. A transition analysis of 15 years with a reduction effort factor of 25% in the first year, could bring the biomass of the stocks up to 36% higher than the current value.

As a general trend the mean length of the catch was larger than the size of first maturity. The recommendation is to keep the current level of effort and if possible to reduce it.

SCSA COMMENTS: The SC notes the state of full exploitation and that the current Biomass is about 12% of the Virgin Biomass. A 25% reduction of the effort could bring the biomass of the stock up to 36% higher than the current value in 3 years. The SC endorses the WG recommendation of keeping the current level of effort and if possible to reduce it as indicated by the analysis.

OTHER SPECIES :

Giant red shrimp (*Aristeomorpha foliacea*), Norway lobster (*Nephrops norvegicus*), horse mackerel (*Trachurus trachurus*), Norway lobster (*Nephrops norvegicus*) and deep-water pink shrimp (*Parapenaeus longirostris*).

Assessment of the stock status of *Trachurus trachurus* Geographical Sub Area 3 Southern part of Alboran Sea (Assessed in 2003).

FISHERIES : The main demersal resources are Mullus barbatus, Trachurus trachurus and Parapenaeus longirostris, Sparids such as Pagellus acarne. The contribution of this species in the landings of demersal species is between 40% and 50 %.

The exploitation is carried out by coastal fleet composed mainly by trawlers. This fleet operates in the proximity of the base ports and the trips have duration between one and three days. The number of boats varies between 90 and 120 depending on the year and the fishing activity is carried out at depth less than 200 m.

SOURCE OF MANAGEMENT ADVICE: Monitoring of resources is based on landing statistics, biological data collected in the frame of a sampling programme developed in the two main landing ports. An analysis of length frequency distribution obtained from sampling of landings has been performed by means of analytical models (LCA) for the main resources exploited by the Mediterranean fleet of Morocco (geographic subarea 3).

STOCK STATUS:

WG MANAGEMENT ADVICE AND RECOMMENDATIONS : The Y/R analysis was utilised to test the behaviour of the populations to different exploitation levels. A situation of full exploitation was detected. The sampling ports (Nador and Alhoceima) represent 86% of the total demersal Morocco Mediterranean landings. There are no discards. The season of recruitment was detected by analysis of monthly length frequency distribution. The catch of other gears except trawl-net is negligible. Horse mackerel in Morocco is caught almost only by demersal trawlers.

The WG recommends not to increase the fishing effort.

SCSA COMMENTS AND RECOMMENDATIONS: No SC comments. The SC recommends to the WG that assessment should be presented on a species by species basis. The SC also recommends to use also a more conservative reference point, such as F0.1, together with the Fmax.

Assessment of the stock status of *Parapenaeus longirostris* Geographical Sub Area 3 Southern part of Alboran Sea (Assessed in 2003).

FISHERIES: The main demersal resources are *Mullus barbatus, Trachurus trachurus* and *Parapenaeus longirostris*, Sparids such as *Pagellus acarne*. The contribution of this species in the landings of demersal species is between 40% and 50 %.

The exploitation is carried out by coastal fleet composed mainly by trawlers. This fleet operates in the proximity of the base ports and the trips have duration between one and three days. The number of boats varies between 90 and 120 depending on the year and the fishing activity is carried out at depth less than 200 m.

SOURCE OF MANAGEMENT ADVICE: Monitoring of resources is based on landing statistics, biological data collected in the frame of a sampling programme developed in the two main landing ports. An analysis of length frequency distribution obtained from sampling of landings has been performed by means of analytical models (LCA) for the main resources exploited by the Mediterranean fleet of Morocco (geographic subarea 3).

STOCK STATUS:

WG MANAGEMENT ADVICE AND RECOMMENDATIONS: The Y/R analysis was utilised to test the behaviour of the populations to different exploitation levels. The pink shrimp shows a situation of underexploitation. The sampling ports (Nador and Alhoceima) represent 86% of the total demersal Morocco Mediterranean landings. There are no discards. The season of recruitment was detected by analysis of monthly length frequency distribution. The catch of other gears except trawl-net is negligible.

The WG recommends transferring part of the fishing effort exerted in coastal areas to deeper fishing grounds.

SCSA COMMENTS AND RECOMMENDATIONS: No SC comments. The SC recommends the WG combine assessments for males and females in order to have an assessment of the stock as a whole and give an advice on it.

Stock assessment of *Aristeomorpha foliacea* Geographical Sub Area 11 Sardinia (Assessed in 2002)

FISHERIES: Red shrimp *Aristaeomorpha foliacea* is caught only by deep water trawling. In the last twelve years an increase from 59 to 70 trawlers fishing on red shrimps was observed in the geographical sub-area.

SOURCE OF MANAGEMENT ADVICE: The assessment was carried out by Relative Y/R analysis using exploitation rate (E) as indicator of fishing effort. Data were collected during trawl survey programs. The current level of E was derived from Z and M estimates

STOCK STATUS: According to this analysis the current value of E is very close to Emax.

WG MANAGEMENT ADVICE AND RECOMENDATIONS: No management advice was given.

SCSA COMMENTS AND RECOMMENDATIONS: Based on the assessment of 2002 the SC keep the recommendation of not to increase the effort. The SC requests the WG to provide figures on current E.

Stock assessment of *Nephrops norvegicus* **Geographical Sub Area 9 Ligurian and northern Thyrrhenian (Assessed in 2002).**

FISHERIES: *Nephrops norvegicus* is a very important species with a very high commercial value. It is the target of a variable fraction of all the fleets operating in the Geographical Sub Area 9 during the whole year. Annual landings in the area do not reach 100 tonnes. The species is caugth with the traditional Italian bottom trawl net at depths

between 250-500 m.About 40 vessels exploit the species in the area. No discards of the species exist being the size of almost all the individuals caught around or beyond the legal size.

SOURCE OF MANAGEMENT ADVICE: Data were collected during trawl-surveys (national and MEDITS programmes) as well as from Catch Assessment Surveys that includes data collection of size structure of the catches, 1985-2001. Length Cohort Analysis and Yield-per-Recruit analysis were used to assess the status of the stocks in the area.

STOCK STATUS: The species is considered to be fully or underexploited, depending on the fishing grounds exploited by the different fishing fleets with different rates. Catch rates showed in general positive trends during the last ten years. The current level of effort and fishing pattern looks adequate in order to warrant the sustainability of the resource and fishery.

WG MANAGEMENT ADVICE AND RECOMMENDATIONS: No specific recommendation.

SCSA COMMENTS AND RECOMMENDATIONS: No SC recommendation. The SC was informed that the fishing effort targeting on Norway lobster has increased recently.

DEMERSAL WG ASSESSMENT RELATED DOCUMENTS

Discussion on the assessment related documents is reported in the Demersal Working Group report. Two documents were related to the use of different assessment methodology. The first one deals with the use of Surplus Production Models in the assessment of demersal trawl fishery in Albania. Using catch and effort data series (1960-1992) hake and red mullet were analysed. The models did provide more reliable results for hake than for red mullet, a species characterised by a short life span and discrete recruitment. Unfortunately recent data are missing therefore the document cannot be considered for resources management purposes.

In a second methodological document, probability models for the abundance indices and ages obtained from trawl survey data are applied in a case study on hake in Spanish Mediterranean. The results of the models application allow establishing geographical models that could be used as index of acces sibility.

Two other documents where reporting partial data coming from the trawl survey programme MEDITS on hake and red mullet in North Alboaran Sea. Trawl survey time series of relative abundance index (8 years) showed no trend along the continetal shelf and a decreasing trend in the slope (200-800 m). This was noted by the working group as a possible index of exceeding fishing effort on the slope. For red mullet, trawl surveys time series, showed an apparently stable situation since 1996.

Finally a document reported on distribution pattern of deep-water pink shrimp (*Parapenaeus longirostris*) in the South Adriatic Sea. Trawl-survey data (MEDITS project) were mapped by means of G.I.S. techniques together with the bottom temperature data. Results underlined differential distribution of the species according to geographical zones and depths and the likely influence of water temperature.

3.2. SMALL PELAGICS WORKING GROUP

Mr A. Kallianotis presented the report of the fourth meeting of the SAC Working Group on Small Species held in Tangier (Morocco), March 2003 (Annex 6). Eleven (Twenty-six) scientists from five (six) countries attended the meeting.

Eleven (Nineteen) technical papers were presented and discussed by the Working Group 8 GSA and 4 species. These documents were (i) assessment documents and (ii) assessment-related documents.

ANCHOVY

Stock assessment of *Engraulis encrasicolus* in Geographical Sub Area 1. Northern Alboran Sea. (Assessed in 2002)

FISHERIES: Anchovy and Sardine are the main target species of the purse seine fleet in the Northern Alboran Sea. Other accompanying species with lower economical importance are also caught such as: Horse mackerel (*Trachurus* spp), mackerel (*Scomber* spp), Atlantic saury (*Scomberesox saurus*) and gilt sardine (*Sardinella aurita*). In the South-Mediterranean Region (from Gibraltar Strait to Cape of Gata) the fleet continuously decreased in the last two decades, from more 230 vessels in 1980 to 120 in 2001. The present fleet has a mean GRT of 17.2. Only Malaga Bay fishing area, which represents 85% of total landings, has been considered by the WG. After 1993 minimum a slight recovery of landings was observed in 1996, but a new diminution occurred in the following years, reaching a minimum in 2000. Finally, a strong increment of landings was recorded in 2001, together with an increase of CPUE values, which reached this year the highest level since 1995, despite the autolimitations in the volume of landings decided by the fishermen in order to maintain the market prices.

SOURCE OF MANAGEMENT ADVICE: Information from fishery: Landings and CPUE trends. Acoustic survey carried out 2000 to 2001.

STOCK STATUS: Biomass estimation for Malaga Bay in 2001 survey (13210 tonnes) represented an important increment respect to the previous year situation (1716 tonnes). Since most of the stock is concentrated in Malaga Bay this estimation can be considered as
representative of the whole northern Alboran area.

WG MANAGEMENT ADVICE AND RECOMMENDATIONS (2002): Since that fishing effort was already significantly reduced in number of vessels (from 185 in 1985 to 120 in 2001), and taking into account the good 2001 recruitment, it would be recommendable to maintain the current level of fishing effort. However, taking into account the important fluctuations of this stock and the few age classes composing the catches (practically only 0 and 1), it would be necessary to continue the monitoring of this stock.

SCSA COMMENTS (2002): The SC endorses the assessment and recommends that, although the image of the stock situation has changed because of the very good last year recruitment, the Subcommittee recommends maintaining the current level of fishing effort.

SCSA COMMENTS (2003): Since no assessment was submied in 2003, the SC requests the WG to up date this assessment. In adition the SC was informed that a temporarly fishing ban for purse seiners has been inforced during spring in the last years.

Stock assessment of *Engraulis encrasicolus* in Geographical Sub Area 6, Northern Spain (Assessed in 2002).

FISHERIES: Anchovy and sardine are the main target species of the purse seine fleet in the Northern Spain. Sardine is the species with the highest amount of catch; on the other hand, anchovy is the most sought due to its economical value. The present fleet has 191 purse seiners, a 12% smaller than the previous year, with a mean GRT of 32.60. A peak of landings of around 22000 tonnes was found in 1994, but then decreased to an overall value of 6000 tonnes in year 2000; this value is the lowest for the last fiveteen years. The anchovy landings represent 80% of the total catch anchovy in Spanish Mediterranean.

SOURCE OF MANAGEMENT ADVICE: Acoustic surveys carried out from 1990 to 1993, and from 1995 to 2001, between La Nao Cape and Creus Cape (Tramo ntana Region).

STOCK STATUS: The period in which the surveys were carried out corresponds to the recruitment season of the species. The most important recruitment area is located between Barcelona and the south of the Ebro River Delta. For this area, the surveys suggested that the recruitment was very low from 1996 to 2000, but the population appeared to have recovered in 2001 to amounts close to the half of those found in 1992, when the highest value was estimated. The estimated biomass for the whole area in 2001 (27000 tonnes) was two times higher than that in 2000.

WG MANAGEMENT ADVICE AND RECOMMENDATIONS (2002): Taking into account the important fluctuations observed in the recruitment, which have a direct effect on the total biomass of the stock, it is recommended that current levels of fishing effort should be maintained.

SCSA COMMENTS (2002): The SC endorses the assessment and recommends not to increase the fishing effort.

SCSA COMMENTS (2003): Since no assessment was submied in 2003, the SC requests the WG to up date this assessment. In adition the SC was informed that a temporarly fishing ban for purse seiners has been inforced during spring in the last years.

Stock assessment of *Engraulis encrasicolus* in Geographical Sub Area 7-6.north, Gulf of Lions and North Catalonia (Assessed in 2003 by hydroacoustic methods)

FISHERIES: Gulf of Lions and North Catalonian anchovy stock is shared by Spanish and French fleets. Both France and Spain are sharing this stock with a predominance of Spanish purse seiners fishing at night with lights in the Gulf of Lions. At the moment, there is no conflict with French trawlers that operate only during daytime. The annual catch is between 5000 and 6000 tonnes. The production, however, is regulated by market demand. When market prices are low, pelagic trawlers shift their activities toward demersal resources, which are overexploited. Echo-integration methodology is used annually since 1993 in the Gulf of Lions, during summer, in order to estimate the importance and the variations of resources of anchovy, sardine and other commercial pelagic species. The state of the anchovy population in the Gulf of Lions appears to improve, since in the last two years an increase in the reproductive biomass has been observed, (48000, 70000 and 112000 t. respectively in 1999, 2000 and 2001). On the other hand, for sardine, the biomass seems to be stable.

SOURCE OF MANAGEMENT ADVICE: Biomass and abundance indices obtained by direct methods from French and Spanish surveys (from 1990 to 1993 and from 1995 to 2001) are analysed and combined, as well as catches and fishing effort series for 1993-2001

STOCK STATUS: High level of biomass and relatively low catches

WG MANAGEMENT ADVICE AND RECOMMENDATIONS (2003): Taking into account the high level of biomass available at this time and the relatively low catches on this shared stock, the WG recommends to maintain the fishing effort and to continue evaluating yearly the state of the stock, due to the variability of the recruitment of the anchovy that can result in important natural fluctuations in the abundance of the stock.

SCSA COMMENTS: The SC endorses the assessment and recommends not increasing the fishing effort.

Stock assessment of *Engraulis encrasicolus* in Geographical Sub Area 17 Northern Adriatic (Assessed in 2003).

FISHERIES: Anchovy (*Engraulis encrasicolus*, L.) is one the most important commercial species of the Adriatic Sea. The small pelagic fishery is particularly diffuse in the Northern and Central Adriatic Sea and sardine is fished by the fleets of Italy, Slovenia and Croatia. The Italian fleet in the Northern and Central Adriatic is composed of about 132 (66 couples) pelagic trawlers (*volante*) mainly operating from Trieste to Ancona and of about 36 *lampara* vessels (purse seiners with light) which operates mainly in the Central Adriatic Sea. Fishing regime (regulations in force in Italy): Since 1988 closing fishing season concerning trawling is also applied to mid-water pair trawlers during summer (about 45 days of closing season between July and September). Closing fishing season is not applied for the purse seiners. Fishing activity is suspended during week-end.

The estimated stock biomass of Adriatic anchovy by VPA, carried out in the context of FAO-Adriamed-SP research programme, showed strong fluctuations during the observed period (1975-2002). After the collapse occurred in 1987 the recovery of the stock biomass shows now a positive trend. Nevertheless, the biomass level has not reached the previous high values.

SOURCE OF MANAGEMENT ADVICE: SAC Assessment form VPA tuned with CPUE (Laurec-Shepherd method)

STOCK STATUS: The estimated stock biomass of Adriatic anchovy by VPA showed a strong fluctuation during the observed period (1975-2002). Collapse occurred in 1987 and the recovery of the stock biomass shows a positive

trend. Nevertheless, the biomass level has not reached the previous higher values. The present amount of catches is about the 22% of estimated biomass.

WG MANAGEMENT ADVICE AND RECOMMENDATIONS: Given this situation and considering also that the present amount of catches (22,150 tonnes, average catch on the period 2000-2002) is about the 22% of the estimated biomass, the current level of fishing effort should not be increased.

SCSA COMMENTS: The SC endorses the assessment and recommends not increasing the effort. In this context, the SC also considers that GFCM Members should provide updated figures on size and characteristics of fishing fleets and gear exploiting this stock in order to stablish the current level of fishing effort. The SC noted that in the frame of the ADRIAMED project for the first time a joint analytical assessment covering the whole northern Adriatic and an echosurvey in the northern part were conducted. The SC recommends combining the outcomes of both approaches in the forthcoming assessment.

Stock assessment of *Engraulis encrasicolus* in geographical Sub Area 22 Aegean Sea (Assessed in 1999 and submitted in 2002)

FISHERIES: A purse seining fleet based in the ports of Alexandroupolis, Kavala and Thessaloniki (Greece) operates in the area. No available data on fishing effort, trends in catches, landings and discards.

SOURCE OF MANAGEMENT ADVICE: The DEPM was applied for estimating the anchovy spawning biomass at an area indicated between the Thraki mainland in the north and the isles of Samothraki and Thasos in the south.

STOCK STATUS: The estimated spawning biomass, in 1999, yielded 13180 tonnes

WG MANAGEMENT ADVICE AND RECOMMENDATIONS (2002): No comments

SCSA COMMENTS (2002): The SCSA recommended to the WG to extend the study area and to include the whole spawning ground of the stock in order to increase the precision of the estimation. The SCSA also recommended a standardisation of the methodology used by different groups of the small pelagic WG operating in the same area. Such approach would provide a more accurate evaluation of the stock spawning biomass.

SCSA COMMENTS (2003): Since no assessment was submied in 2003, the SC requests the WG to up date this assessment. The SC has been informed that information on fleets, catch trends and discarded catches exist and in consequence recommends that this information will be made available for the WG.

SARDINE

Stock assessment of *Sardina pilchardus* in Geographical Sub Area 1. Northern Alboran sea (Assessed in 2002).

FISHERIES: Anchovy and Sardine are the main target species of the purse seine fleet in the Northern Alboran Sea. Other accompanying species with lower economical importance are also caught such as: Horse mackerel (*Trachurus* spp), mackerel (*Scomber* spp), Atlantic
saury (*Scomberesox saurus*) and gilt sardine (*Sardinella aurita*). In the South-Mediterranean Region (from Gibraltar Strait to Cape of Gata) the fleet continuously decreased in the last two decades, from more 230 vessels in 1980 to 120 in 2001. The present fleet has a mean GRT of 17.2. Only Malaga Bay fishing area, which represents 85% of total landings, has been considered by the WG. A peak of landings of around 6000 tonnes was found in 1991-1992, but then decreased to an overall mean value of 1000-2000 tonnes during 1994-1998. From 1998 onwards, both landings and CPUE showed an increasing trend, reaching in 2000 and 2001 CPUE values higher than those observed in previous years

SOURCE OF MANAGEMENT ADVICE: Information from fishery: Landings and CPUE trends

STOCK STATUS: Unknown

WG MANAGEMENT ADVICE AND RECOMMENDATIONS (2002): Taking into account information available it does not seem necessary to recommend any reduction of fishing effort on this stock

SCSA COMMENTS (2002): No comments

SCSA COMMENTS (2003): Since no assessment was submied in 2003, the SC requests the WG to up date this assessment. In adition the SC was informed that a temporarly fishing ban for purse seiners has been inforced during spring in the last years.

Stock assessment of *Sardina pilchardus* **Geographical Sub Area 3 Southern Alboran Sea (Assessed in 2003).**

FISHERIES : Sardine is one of the most exploited species in the Moroccan Mediterranean. The landings of this species represent around 80% of the total small pelagics landings. At present the species is exploited by 141 purse seiners, of a mean gross tonnage of 40 tx and mean horsepower 450 cv. The vessels operate all the year, 5-6 days per week, 12 to 15 hours at sea per fishing day. During one fishing day two or three fishing operations can be carried out. Sardine landings have undergone important fluctuations during the period 1984-2000, with a maximum around 28000 toones in 1987, and a minimum value around 9300 tonnes in 1998. The fishing effort (number of fishing days*GRT) has also fluctuated during 1992-2000, with a maximum in 1993 and a minimum in 1998. In 1999 and 2000 the fishing effort increased.

SOURCE OF MANAGEMENT ADVICE: The method used was LCA, applied to annual length frequency distributions for the period 1990-2001 collected from commercial landings. The sampling port was Al Hoceima, which is the most important fishing port regarding sardine landings in the Moroccan Mediterranean. Data on von Bertalanffy growth parameters are those estimated during Spanish 1998 echo surveys in the Alboran Sea.

STOCK STATUS: Sardine biomass has decreased during the period 1993-1997 but later, since 1998, a positive trend has been observed. Results indicate that the optimum fishing mortality F0,1 corresponds to 60% of the current fishing mortality. The stock is thus overexploited. The Fmax could not be estimated because the resulting Y/R curve was asymptotic.

WG MANAGEMENT ADVICE AND RECOMMENDATIONS (2002): Neither management advice nor recommendations were proposed

WG MANAGEMENT ADVICE AND RECOMMENDATIONS (2003): The production of sardine in the Mediterranean coast of Morocco is estimated at 14000 mt/year landed by a fleet of 141 boats carrying out more than 15000 trips per year. According to the biomass estimation made in the Institute of Nador by length cohort analysis, the stock of sardine presended a strong decrease from 1992 to 1997 and a trend of slightly increasing biomass from 1998 to 2001. The higher mortality rate was observed for speciments larger than 16 cm.

SCSA COMMENTS: The SC recommends continuing further analysis with the available data. Furthermore, considering the decreasing trend of catches despite the increasing fishing effort on this stock and the recommendations provided by the marrocan scientists[3] to the WG, the SC recommends the WG to analyse in depth this recommendations.

Stock assessment of *Sardina pilchardus* in Geographical Sub Area 6, Northern Spain (Assessed in 2002)

FISHERIES: Anchovy and sardine are the main target species of the purse seine fleet in the Northern Spain. Sardine is the species with the highest amount of catch; on the other hand, anchovy is the most sought due to its economical value. The present fleet has 191 purse seiners, a 12% smaller than the previous year, with a mean GRT of 32.60. Sardina landings have increased from 70´s, reaching a maximun of 53000 tonnes in 1994. For the last years there was a decrease reaching 38000 tonnes in year 2000.

[3] - Reduce the fishing pressure during 3 years
- Establish a temporary ban in January
- Establish closed areas in the lagune of Nador and Bay of Al Hoceima
- Ban fishing in May in the area between Kariat Arkmen and the Chafarinas Islands

SOURCE OF MANAGEMENT ADVICE: ECOMED acoustic surveys carried out from 1990 to 1993, and from 1995 to 2001, between La Nao Cape and Creus Cape (Tramontana Region).

STOCK STATUS: From 1990 to 2001, the estimated biomass fluctuated from 200000 tonnes in 1992 to 50000 tonnes in 2000. The estimation for 2001 was 97000 tonnes, which was double than in the previous year. The most important recruitment corresponded to the years 1991 and 1992, whereas the lower values were found in 2000 and 2001.

WG MANAGEMENT ADVICE AND RECOMMENDATIONS (2002): Taking into account the present level of biomass and catches, as well as the low level of recruitment detected in the two last years, it would be recommended not to increase the current level of fishing effort.

SCSA COMMENTS (2002): The SC endorses the assessment and recommendations.

SCSA COMMENTS (2003): Since no assessment was submitted in 2003, the SC requests the WG to up date this assessment.

Stock assessment of *Sardina pilchardus* in Geographical Sub Area 7 Gulf of Lions (Assessed in 2003)

FISHERIES: Sardine is exploited in the Gulf of Lions by 120 mid water trawlers shifting toward demersal ressources when the market prices are low and by 8 purse seiners operating in the zone. The number of the involved trawlers changes every month according to the targeted species. The mean fished quantity reported in the relative stock assessment form, for the period 1999-2001, arises to 9000 t.

SOURCE OF MANAGEMENT ADVICE: Starting from 1993, echo-integration methodology is used annually in the Gulf of Lion, in order to estimate the importance and the variations of sardine stock and other commercial pelagic species.

STOCK STATUS: The resource is reported as moderately exploited.

WG MANAGEMENT ADVICE AND RECOMENDATIONS: From these results the species biomass is reported to be stable and the average value for the period 1999-2001, is calculated to be about 76000 t.

SCSA COMMENTS AND RECOMMENDATIONS: The SCSA reccomends to continue the investigation on biomass and fishing effort estimation.

Stock assessment of *Sardina pilchardus* in Geographical Sub Area 16 Sicily Channel (Assessed in 2003)

FISHERIES:

SOURCE OF MANAGEMENT ADVICE:

STOCK STATUS:

WG MANAGEMENT ADVICE AND RECOMMENDATIONS (2003): Biomass evaluations from six echo-surveys carried out from June 1998 to July 2002 in the Strait of Sicily were presented. Both sardine and anchovy populations experienced quite large inter-annual fluctuations, from about 36,000 t in July 2000 to 6,000 t in 2002 for sardine and 7,000 t in 1998 to 23,000 t in 2001 for anchovy. Specifically for anchovy this evidence would suggest, taking also into account the age structure of the catches (low proportion of juveniles), the importance of environmental factors variability on yearly recruitment success. Acoustic evaluations are largely consistent with landings (from purse seiners and midwater pair trawlers) recorded in Sciacca (the most important base port in the M.U. 16 for the small pelagics landings) during the year following the evaluation campaigns. The recent decreasing trend in sardine biomass suggest to consider the risks connected to possible negative effects on this population, resulting from wintertime (from January to March) pressure of other fishing gears on larval stages.

SCSA COMMENTS AND RECOMMENDATIONS: According to the results presented on the local sardine stock, the SCSA reccomends to the WG to present an assessement form where the time series of data on biomass estimation, the fleet characteristics and catch data will be included, allowing the proper assessment of the sardine and anchovy stock and the formulation of some management measures. The impact of local fisheries directed to larval or juvenile speciments of this species should be carefully evaluated and the results should be presented in the next meeting of the WG.

Stock assessment of *Sardina pilchardus* in Geographical Sub Area 17 Northern Adriatic (Assessed in 2003)

FISHERIES: Sardine (*Sardina pilchardus*, Walb.) is one of the most important commercial species of the Adriatic Sea. The small pelagic fishery is particularly diffuse in the Northern and Central Adriatic Sea and sardine is fished by the fleets of Italy, Slovenia, and Croatia.The Italian fleet in the Northern and Central Adriatic is composed of about 132 (66 couples) pelagic trawlers (*volante*) mainly operating from Trieste to Ancona and of about 36 *lampara* vessels (purse seiners with light) which operates mainly in the Central Adriatic Sea.

Fishing regime (regulations in force in Italy): Since 1988 closing fishing season concerning trawling is also applied to mid-water pair trawlers during Summer (about 45 days of closing season between July and September). Closing fishing season is not applied for the purse seiners. Fishing activity is suspended during week-end.
Trends in landings: Landed sardines decreased in the last years (1997-2001).
Discards: No information are available for the last years (2000 and 2001). In the previous period (1987-1999) an average of about 2000 t/year of discards were estimated for the Italian fleet by a specific research project.

SOURCE OF MANAGEMENT ADVICE: SAC Assessment form VPA tuned by commercial CPUE (Laurec-Shepherd method) on a 1975-2002 time series.

STOCK STATUS: The estimated stock biomass of sardine by VPA showed a peak between 1983 and 1985, then a gradual decrease appeared and the stock reached its lowest value in 1999. In 2000, and in a stronger way in 2001, the sardine estimated biomass increased. The present level of catches is about the 18% of the estimated biomass.

WG MANAGEMENT ADVICE AND RECOMMENDATIONS (2002): Monitoring of sardine discards at sea and market strategies to increase the human consumption of sardine, to diminish discards at sea are recommended. The new research programme supported by FAO-ADRIAMED, entitled "Data Collection and Biological Sampling System on Small Pelagics in the Adriatic Sea (Adriamed-SP)" is now implemented. Data collected with this project will improve assessment of small pelagics in Adriatic.

WG MANAGEMENT ADVICE AND RECOMMENDATIONS (2003): The estimated stock biomass of sardine by VPA carried out in the framework of FAO-Adriamed-SP research programme, showed a peak between 1983 and 1985, then a continuous decrease appeared and the stock reached its lowest value in 2001. Given this situation and considering also that the present level of the catches (19,300 tonnes, average catch on the period 2000-2002) is about the 19% of the estimated biomass, the current level of fishing effort should not be increased. Due to the low market demand in Italy for sardines, discards at sea may occur and hence monitoring of sardine discards at sea is suggested.

SCSA COMMENTS AND RECOMMENDATIONS: More than endorse the WG recommendation of not to increase the effort, the SC express concern regarding the continous decreasing trend of biomass estimates observed during the last 20 years and in consequence recommends implementing more cautious measures, including reduction of fishing effort, to revert this trend and to reduce the Exploitation Rate below the current level of 0.4[4]. The SC, conscious of the fact that anchovy is the target species of the Italian fleet whilst the Slovenian, Albanian and Croatian fleets are targeting on sardine, also recommends to implement, as soon as possible, a harmonized management in the sub-area for small pelagics. In this context, the SC also considers that GFCM Members should provide updated figures on size and characteristics of fishing fleets and gear exploiting this stock in order to stablish the current level of fishing effort.

[4] Refernce point for small pelagics (Patterson, K. 1992. Fisheries for small pelagic species: an empirical approach to management targets. Rev.Fish Biol.Fish.,2:321-338.

Stock assessment of *Sardina pilchardus* in geographical Sub Area 20+22 Eastern Ionian Sea and Aegean Sea (Assessed in 2002)

FISHERIES: A purse seining fleet based in the ports of Volos, Chalkis, Corinthos and Patras (Greece) operates in the area. No available data on fishing effort, trends in catches, landings and discards.

SOURCE OF MANAGEMENT ADVICE: The document includes biomass estimation of sardine stocks en central Aegean and eastern Ionian Seas, based on DEPM.

STOCK STATUS: Total spawning biomass was estimated in 2000 to be 19.826 tonnes

WG MANAGEMENT ADVICE AND RECOMENDATIONS: No comments

SCSA COMMENTS: The assessment is considered to be preliminary. The SCSA recommends to organise and conduct a long term programme on biomass estimation and to present a new assessment.

SMALL PELAGICS WG RELATED DOCUMENTS

In the 4th WG o small pelagic species 5 assessment related documents were presented. The first one was relative to a new reserch campaign aiming to the biomass estimation of four small pelagic species (anchovy, sardine, round sardinella and horse macherel) conducted in the south part of Alboran Sea. According to the results presented 1/3 of sardine biomass was found in the sea zone ovest Al Hoceima and 2/3 to the east. In this first campaign no anchovy biomass estimation was made due to the reduced number of speciments caught during the scientific cruises. The second document, reports on anchovy and sardine landings in the major Greek fishing ports collected on a monthly basis from 1991 to 2001. The monthly commercial average landings of the two species exhibited a clear seasonal pattern The existence of temporal cycles in the anchovy/sardine ratio in Greek waters, should be incorporated in catch-yield equations in order to improve the employed managerial schemes. The thirth document is a study on age structure and growth parameters for the anchovy fishery *Engraulis encrasicolus* in the Strait of Sicily. The age structure of the catches was dominated by the 2-year-class (55-63%) and the 1-year-class (30-41%), whereas the 0-year-class (1-5%) and the 3-year-class (3-5%) represent a small proportion of the catches. The von Bertalanffy growth model shows that pooled mean parameters of males and females did not present any significant differences (L8 =18.6 cm, k = 0.29 year-1 and to=-1.81). The fourth document assess some aspects of anchovy reproductive biology along a six years period from data collected from the population off the southern coast of Sicily (Geographical sub-area16). Estimated a size at first maturity (L_{50}) with confidence limits were 11.27 ± 0.09 cm for males and 11.24 ± 0.09 cm for females. The last document, presents an analysis of the size at first maturity of anchovy populations in the management units 6 (north Spain). The results gave a size at first maturity of 11.1 cm.

PROGRESS ON THE DOLPHINFISH STOCK ASSESSMENT

COPEMED project presented an overview of the sub-program CORY which studied the dolphinfish (*Coryphaena hippurus*) fishery in 2000, 2001 operating from 4 different contries in Central-Western Mediterranean. A report of this study was distributed among the participants (ftp://cucafera.icm.csic.es/pub/scsa/). The main findings of the study can be summarized as follows:

Very different levels of organization of the fishery in each area were detected. For instance the basic data such as landings and effort are registered by the Fishing authorities only in three areas, while in Sicily the data are not available.

The best measure of effort in this fishery should be the number of FADs fished/day. This is very difficult to assess due to the irregular and intense activity of the fleet and to the many factors that determine whether the operation has actually been conducted on each particular FAD visited that day. Therefore, with the available data, the number of boats by stratum had been adopted as the effort measure. Time series of landings and of the number of boats (1981-2001) was available for Malta and Mallorca.

The fishing regulation is also variable, in Malta and Majorca there is the maximum control (sorting of the fishing places, opening of the fishery, total dedication to the fishery for the boat during the season, gear, etc) while in Sicily

and Tunisia there are less controls. For instance in Tunisia the boats could have on board different gears and use them indistinctly.

The capture of very small fish on July carried out in Tunisia and Sicily is an unwise practice because these fish will give a better yield in September-October.

Although preliminary, this study represents the first attempt for the joint evaluation of this highly migratory species which stock belongs to the same population all over the area and which is included in the target species GFCM list.

COPEMED-CORY team recommends the continuation of this study and foresees, after a deeper analysis and discussions, the elaboration of a more technical document as close as possible to the Stock Assessment SAC official forms.

The Subcommittee has suggested that the current team of scientists working on *Coryphaena* should be regarded as a specific Working Group for the species and would present any future work done directly at the Subcommittee meetings

SCSA GENERAL RECOMMENDATIONS ON STOCK ASSESSMENT

The SC expresses its concern about the low **participation**, in number of experts and countries involved, in both WGs. This lack of participation could jeopardise the existence of this WGs in the future and in consequence the work of the SAC. The lack of specific budget both at national and GFCM level to participate to the assessment meetings constitutes a key problem in this context.

In this context and in order to facilitate the participation and reduce de cost of meetings, the SC proposes for the next year to have consequtively in the same place and dates the WGs and the the Subcommittee meetings. In any case not less than six full days will be needed to complete the work.

The SC considers that, as **general rules for the WGs**, copies of the standard forms shold be distributed to everybody in electronic format before the WG meetings. The SC stressed the WG members not to present assessment results as independent documents in order avoid duplicating the information. The data and parameters that might be needed to redo the calculations should be included in these forms. Any kind of proposal aiming at the improvement of the forms is welcome. As agreed during the previous meetings, the SC also recommends to give priority to those assessments dealing with shared stocks and priority species. The SC urges the WGs to include relevant assessment figures in their advice.

In the 3rd SCSA (Rome, 15-18 May 2001) it was proposed to revise the available information about the length at **first maturity of anchovy** from the Mediterranean Sea. The length at first maturity was defined as the length at which 50% of the individuals in the population are matures (L50). A working paper was presented in the forth session of SAC (Athens, 4-7 June 2001), showing the results on this topic. L50 is thereby reported to have a value over 11 cm, except for one case in the Eastern Adriatic where was calculated to be 9.1 cm. In the 4th WG on small pelagic species (Tangier, 12-14 March 2003), two assessment related documents where presented, where studies from other Mediterranean areas, showed that the size at first maturity was calculated to be about 11 cm. However, taken into account the existence of other data not presented previously in that WG, was suggested to all participants to proceed further to the appropriate evaluations of the available data following the agreed standardized prodedure (it will be available in the scsa ftp site[5]). The SCSA encourages the participants to proceed furhter to this analysis.

Market price affects small pelagic fisheries in some Mediterranean areas, causing **discards** at sea expecially for sardine, which has lower market values. In the WG on small pelagic species it was reccomended to implement projects to monitor, year by year, the discarded quantities and to promote market campaigns that would increase the demand of discarded species. The SCSA endorsing this reccomentation suggests to present the available information in the next WG and to evaluate the impact of discarded quantities in the stock assessments of these species.

[5] ftp://cucafera.icm.csic.es/pub/scsa/

In consideration of the reporting of some assessment results, the SC felt necessary to clarify that **GFCM Geographical sub-areas** have not been established specifically for stock assessment purposes. Therefore, stock assessment work should not necessarily be limited by Geographical sub-areas boundaries but should encompass as much as possible the occurrence area of the stock concerned. At the same, the SC considered important the study area to be clearly specified when assessment results are from limited area within the Geographical sub-area.

The SC took note with satisfaction of the joint effort made in the Adriatic region by Albania, Croatia, Italy and Slovenia to perform analytical assessment of anchovy and sardine stocks through the common monitoring programme, AdriaMed-SP, promoted by the FAO-AdriaMed Project. The SC also underlined the similar effort being made by France and Spain on the hake stock in the Gulf of Lions. The SC fully supported these initiatives and strongly recommended their continuation thus ensuring **routine appraisal of shared fishery resources** occurring over relatively large areas.

4. REVIEW OF ASSESSMENT METHODS

In the 2002 the SC considered that given the available information in the area, the LCA is, at present, the only current option available to start assessing and providing advice in a harmonised way and on a regular basis at the regional level. Later on this approach could be improved. Nevertheless, other assessment methods are considered appropriate for stock assessment in the area, such as those based on production models or on direct evaluations of the resources, for which time series already exists in many areas of the Mediterranean.

It was also stressed that, considering the uncertainty in the analyses, comp arison of methodologies could give more appropriate information to managers.

Attendants were invited again to produce working papers on these matters to submitted at the 2003 SCSA meeting. In this context, a new method called Direct Survival Method (DSM) was presented (annex 5)

Dr. Pilar Hernandez introduced a summary of the main steps of the DSA method highlighting the fundamentals and some of the pros and cons stressing that results of comparisons either with commercial data or with classical methods (such as VPA) were positive in the sense that the same conclusions are achieved through all of them. The whole work is a quite extense article that is going to be published as a special methodological issue in *Scientia Marina* journal and some of the examples used for testing can be separated articles in other *peer review* journals.

A summary of the abstracts and conclusions of the different section of the paper are included in annex 5.

A round of questions was opened mainly dealing with (i) what are the pros and cons of the method, (ii) how much has it been tested with other sets of data or with other species and (iii) on what are the data needs.

The answers were that the method has been tested with other fish and not fish species (*Mullus barbatus* and *Aristeus atennatus*) in other areas is going to be tested this next months (South-Eastern coast of Brasil), and regarding the data needs it was clear that they are the same than for other methods (Abundance indices from direct methods or catch-at-age data from commercial sources).

A table summarizing all this items is requested to the authors in the shortest time possible to be added to the Sc report. And when possible this table should include the final results of both VPA and DSA in the shape of a table or figure.

At the end an invitation has been done to the scientist present to send their data to the authors, or to promote visits to their centers in order to test the method in situ and in close collaboration with the authors. The possibility of organizing a special working session within the framework of Subcommittee WGs is also contemplated and discussed.

This method has been applied to the **Stock of hake (*Merluccius merluccius*) in Geographical Sub Areas 1, 6 and 7 Alboran Sea, Northern Spanish coast and the Gulf of Lions.** In this work, a new stock assessment method, named Direct Survivor Analysis, was presented. Models for the survivor function of exploited demersal resources on a cohort basis are established and verified. The proposed models are applied to estimate and to test hypothesis on

recruitment trends, to compare the survival and the life expectancy for a set of cohorts. This enables to link trawl surveys data with commercial landing data in order to produce an evaluation of the stock. Statistical fundamentals of the method can be compared with the classical stock assessment methods (VPA and other methods used in Mediterranean context) and finally the validity of direct and indirect evaluation methods was discussed.

The study area is the Spanish Mediterranean and the trawl data corresponds to Medits surveys in the period 1994 – 2000. The assessment refers to hake for the Spanish coast (geographical subareas 1 and 6). The results of this new assessment method are quite pessimistic. In the Spanish coast the mean life expectancy is 0.8 year while in the Gulf of Lyons, using the same method it is 1.03 year. To obtain the optimal Y/R the effort should be reduced by 80%.

The SCSA welcomed the new method of assessment, pointing out that a new method to be accepted should be tested and validated. It was suggested that a table of pros and cons was performed by the authors.

It was also commented that if data regarding size structure proceed from trawl surveys, it will be impossible to reconstruct the size structure of the commercial catch for almost all the species, especially for those that are caught with different gears for whom are more or less vulnerable or accessible depending to their sizes. This fact precludes the estimation of the fishing mortality rates for the fraction of the stock not vulnerable to the trawling gear (as in the case of the hake). Does the model assume that the older individuals of hake (not vulnerable to the trawl nets) are exposed to the same fishing mortality rates estimated for younger ages or the model follows some other procedure?

The SC taked aslo note of the results obtained by the analysis and considers necessary a further scientific scrutiny before accepting them. In this context the SC recommends that the authors of these method conacted data owners around the Mediterranean in order to continue testing the method. To do that the authors should send, as soon as possible, throught the scsa distribution list, instructions on how to prepare the data to apply the method. The scientist are also invited to contact the authors to estimulate this exercise. A Working Session during the WGs meeting for next year could be also organised to analyse and validate the method as well as to standarized the procedure to apply it and interpret the results. The SCSA invites SAC to support this exercise.

5. REVIEW THE STANDARDIZED STOCK ASSESSMENT REPORTING FORMAT

The SC discussed on the necessity that the FAO and FIGIS Project inform the GFCM members, on the data, validation and transmissions procedures from the SC data used by FIGIS as soon as possible. In order to know the Commission members position, this communication, should be made before to continue including such data into the FIGIS system. The SC understand that his task concerning data and information from GFCM finish when the SC advise to the SAC but, the SC has not competence on data and information transmission to the FAO FIGIS project.

6. UPDATING AND ANALYSIS OF THE SHARED STOCKS LIST

The following share stocks are proposed by the SC to be incorporated to the GFCM list of shared stocks:

- Sole (*Solea solea*) in the Northern Adriatic, Croatia, Albania, Slovenia and Italy.
- Monkfish (*Lophius spp.*) in the Northern Adriatic, Croatia, Albania, Slovenia and Italy.
- Black spot seabream (*Pagellus bogaraveo*) in the Alboran Sea and the strait of Gibraltar area, Spain and Morocco.
- Sardine and anchovy (*Sardina pilchardus* and *Engraulis encrasicolus*) in the Aegean Sea, Greece and Turkey.
- Lobster (*Palinurus elephas*) and red mullets (*Mullus spp*) in Corsica and Sardinia.
- Hake (*Merluccius merluccius*) and Micromesistius poutassou and norway lobster North Tyrrhenian and Corsica.
- Lobsters (*Palinurus elephas and P. mauritanicus*) in the Sicily channel, Tunisia and Italy.

The SC also agreed to complement the current list of main Adriatic species whose are shared by including the following species agreed upon by the regional experts collaborating with AdriaMed.

- *Eledone cirrhosa* (Albania, Croatia, Italy)

- *Eledone moschata* (Albania, Croatia, Italy, Slovenia)
- *Loligo vulgaris* (Albania, Croatia, Italy, Slovenia)
- *Lophius budegassa* (Albania, Croatia, Italy)
- *Lophius piscatorius* (Albania, Croatia, Italy, Slovenia)
- *Pagellus erythrinus* (Albania, Croatia, Italy, Slovenia)
- *Solea vulgaris* (Albania, Croatia, Italy, Slovenia)
- *Sepia officinalis* (Albania, Croatia, Italy, Slovenia)
- *Parapenaeus longirostris* (Albania, Croatia, Italy)
- *Scomber scomber* (Albania, Croatia, Italy, Slovenia)

7. REVISION OF THE PRIORITY SPECIES LIST

The SC suggests to incorporate the following species to the GFCM list of priority species:

- European eel (*Anguilla anguilla*)
- Black spot seabream (*Pagellus bogaraveo*)
- All *Acipenser* species as well as those of the genera *Huso*

8. IDENTIFICATION OF BIOLOGICAL REFERENCE POINTS

The SCSA have had limited time to address deeply the matter of the conservation reference points and, unfortunately, no specific working documents were presented during the session.

Nevertheless, a lively discussion was undertaken and the SCSA recognised that the Mediterranean scientific community has so far used several suitable indicators even though outside an agreed standardised framework. The SCSA considered that agreed indicators relevant to the several dimensions of the fisheries systems are needed to measure the state of the exploited resources and of the environment as well as the economic and social performances of the exploiting systems.

The SCSA recognised that the definition of standardized sustainable exploitation indicators and reference points (*i.e.* specific values of indicators) are basic to establish an agreed rule-based approach to fisheries management as well as to make operational the precautionary approach. The latter is basic both to secure a sustainable exploitation of the resources, as requested by the FAO Code of Conduct and other international soft-law agreements, by discounting the typical great uncertainty of fisheries systems, and also to provide a useful tool to guide, and to evaluate the performance of, the management system.

The SCSA recognised that it is a very important and urgent task for the Mediterranean scientific community to develop an agreed precautionary framework for some demersal and small pelagic keystone species including, for example, hake, red mullets, common sole, Norway lobster, deep water rose shrimps, red and red-blue shrimps, sardine and anchovy amongst others.

Within its mandate, which is dealing with the state of the resources, the SCSA considered urgent the establishment of an agreed set of sustainable indicators and to fix limit (LRP) and target reference points (TRP), even though the final acceptance of a TRP is more a task for the managers than for the scientists. LRP need to be agreed as a basis either for fisheries management or recovery plans agreed by all parties sharing common resources.

So far, several indicators and reference points have been proposed and regularly utilised by the different scientists in the Mediterranean such as certain value for the exploitation rate (E) or for the SSBc/SSBo that, however, have been adopted from scientific work done outside the area. For example the threshold value E=0.4 for the small pelagic and the threshold value of about 0.3-0.4 for the SSBc/SSBo for gadiformes.

Their use, even though considered suitable for the Mediterranean, has occurred, however, outside an agreed precautionary framework able to highlight areas of different risk for the sustainability of the resource. In fact the lack either of basic data or of long-time data series have prevented to develop such a framework. In particular, the lack of routinely catch/landing assessment survey has prevented to estimate time series of SSB, B and F vectors that are basic to develop it.

Therefore, the SCSA considers fundamental to develop and maintain routinely catch/landing assessment surveys in all the Countries bordering the Mediterranean. To this end, the hopeful launch of the MEDFISIS programme could represent a step to further develop this type of surveys in the area.

However, the lack of routinely catch assessment surveys, at least going on for sufficient several years in most of the geographical sub-areas, does not prevent to estimate sustainable indicators and precautionary reference points suitable for management. To this end, other valuable sources of information, such as those derived from trawl survey, could be used.

In particular, during the discussion the possible utility of using a variant of production models, that is a composite model, has been thoroughly evaluated. This approach allows to defining which is the situation of different fisheries, exploiting certain stocks with different rates, as regards the value of Z that produces the maximum biological production (Z_{MBP}). Couples of CPUEs and Z, here considered as a direct indicator of fishing effort, both derived from trawl surveys constitute the basic infroation needed.Z_{MBP} is considered a precautionary reference point whose value is always lower than that corresponding to the MSY. In other words it informs a more precautionary approach to fishery management.

In view of this and to further develop along the direction requested by the GFCM, the SCSA believe that a suitable data set to apply this approach is represented by the MEDITS and SAMED programmes for the Northern part of the Mediterranean Basin. Other useful set of data might be available in other sub-region as for example demersal trawl survey data in Tunisia, since 1998. Other suitable data sets might be available in other Countries.

Therefore the SCSA invites SAC and GFCM, if do they want proceed further ahead, to convene a workshop early next year, and before the routinely stock assessment working groups session, that should analyse trawl survey data. SAC is requested to identify the chairman of the working group, and to fix the venue and date of the meeting as well as to provide suitable terms of reference and list of key-stone species that should be analysed.

The SCSA suggests to add to the assessment sheets (D) some reference points: exploitation rate (E), SSBc/SSBo , $Z_{MBP.}$ By doing so, an easy and quick inter-annual comparison of the state of the exploitation will be allowed.

To summarise the SCSA recommends SAC and GFCM Members to support:

1) The establishment of a workshop to apply composite models to a selected group of key-stone species at Mediterranean level. The aim is to estimate the precautionary reference point Z_{MBP}.
2) to support the establishment of catch assessment surveys on a routinely basis in order to collect data needed to estimate B, SSB and the F vectors.
3) to include in the sheet D of the standard assessment forms the following points: : exploitation rate (E), SSBo/SSBv , Z_{MBP}

9. THE SC IN INTERNET

ftp and distribution list …

Due that all documents presented and produced by the SC and their WGs since their creation in 2000 have been placed in the ftp side, there are problems of space in the ftp site for which reason the SC have to look for a solution to reduce it. A solution could be to zip all documents and eliminate copies in doc or pdf format. In any case any suggestion from SAC will be welcome.

10. NOMINATION OF COORDINATORS FOR THE SC AND WGs

The following candidates were identified by the SC:

WG on Small pelagic species: Dra. Isabel Palomera
WG on Demersal species: Dr. Enrico Arneri
SC of Stock Assessment: Dr. Pere Oliver

11. OTHER MATTERS

MEDSUDMED

An update on activities conducted by MedSudMed Project was presented to the Sub-Committee. The objectives of the Project were recalled, as well as the follow-up of the 1st Coordination Committee's decisions, *e.g.* to organize four Expert Consultations on: (i) Spatial Distribution of demersal resources and the influence of environmental factors and fishery characteristics (Malta, December 2002); (ii) Small pelagic fish: stock identification and oceanographic processes influencing their abundance and distribution (Libya, TBD); (iii) Marine Protected Areas and fisheries management (Tunisia, March 2003); (iv) Data Base and Information System (Italy, TBD).

A summary of the two Expert Consultations that were already organized by the Project was made, recalling the objectives, expected outputs and general organization. A copy of the preliminary draft of the Expert Consultation on Demersal Resources was distributed among the participants. Moreover, as a follow-up of this Expert Consultation, the Project organized a regional workshop on Standardization of trawl surveys protocols in the MedSudMed area (Mazara del Vallo, May 2003). The Sub-Committee was informed on the main issues that were addressed during this workshop, the objective of which was to discuss and draw-up a common protocol for the collection of data comparable at regional level.

The meeting was also informed on the MedSudMed's initiative of creating a Database and Information System. The objective of this activity is the establishment of a reliable and permanent regional system to facilitate the exchange of standardized information. The system will contain several types of data (having different levels of accessibility according to their confidentiality) and will be connected to the National Databases, according to terms that are being discussed with the Project's participating countries.

The SC welcomed the activities of the FAO MedSudMed Project and in particular the Project target related with the implementation of the ecosystem approach to Mediterranean marine fisheries as the Commission adopted. The SC express its interest that the implementation of the ecosystem approach at subregional level in the MedSudMed Project area could be an starting step for the development of this approach for the whole Mediterranean. The SC is also interested in to be active part of the implementation of such ecosystem approach and to participate in the related activities of the Project.

12. ANNEXES

1. Agenda
2. Participants
3. Report of the Working Group on Demersal Species 2003
4. Report of the Working Group on small pelagic species 2003
5. Direct Survival Method

ANNEX 1

AGENDA

Coordinator: P. Oliver
Email: pere.oliver@ba.ieo.es

1. Opening of the meeting
2. Adoption of the agenda and arrangements of the session
3. Review and analysis of the assessments presented to the demersal Working Group (point 1.5 of the GFCM Mandate for SAC*). Report of WG_2003 in ftp:\\cucafera.csic.es\pub\scsa.
4. Review and analysis of the assessments presented to the small pelagics Working Group (point 1.5 of the GFCM Mandate for SAC*). Report of WG_2003 in ftp:\\cucafera.csic.es\pub\scsa.
5. Review of assessment methods (point 1.3 and 1.5 of the GFCM Mandate for SAC* and the annexed item on assessment methods from the Report of the fifth session of the SAC. July 2002).
6. Review the standardized stock assessment reporting format.
7. Updating and analyses of the shared stocks (point 1.1 of the GFCM Mandate for SAC* and the list of shared stocks in the Report of the fifth session of the SAC. July 2002). Report of SCSA_2002 in ftp:\\cucafera.csic.es\pub\scsa
8. Revision of the priority species list (point 1.5 of the GFCM Mandate for SAC*).
9. Identification of biological reference points (point 1.4 of the GFCM Mandate for SAC*)
10. The SC in internet: FTP site and e-mail list
11. Nomination of co-ordinator for the SC and WGs
12. Other matters
13. Adoption of the report

* Annexed to this agenda.
For further information please contact Dr. Oliver (pere.oliver@ba.ieo.es).

FTP site: ftp://cucafera.icm.csic.es/pub/scsa/

Subscribing e-mail list: https://llistes.cmima.csic.es/listinfo/scsa

Sending an e-mail to the list scsa@icm.csic.es

***(27 GFCM REPORT, ROME, ITALY, 19-22 NOVEMBER 2002 - APPENDIX F)**

**REFERENCE FRAMEWORK FOR THE MANDATE OF THE SCIENTIFIC ADVISORY COMMITTEE (SAC)
FOR THE INTERSESSIONAL PERIODS 2003 AND 2004**

SAC is requested to strengthen the critical role of Coordinators of subcommittees with the aim to improve the linkages among subcommittees and National focal points of GFCM Members.

1. Management of fisheries

SAC is requested:

1.1. To update the list of shared stocks identifying also the geographical sub-areas as well as the operational units involved. For this purpose SAC should make use both of the knowledge on stock units and of the spatial distribution of operational unit activities as well as of the mixed nature of some fisheries. Deepening both the knowledge and the list of shared stocks should not necessarily extend the list of priority species, so far agreed, for which scientific assessment and advice has to be provided.

1.2. To update, at sub-regional level and by geographical sub-areas, the inventory of operational units generating catches of shared stocks. To this end, SAC is also requested to monitor and fine tune, as necessary, the fleet segmentation, as adopted in principle (Appendix E of the report of the 5th Session of SAC). Whenever possible, description of Operational units should report the share, by weight and value, of priority species as well as of other important species, their fishing regime, trends in catches and landings, discard estimates.

1.3. To continue its ongoing works of reviewing and debating stock assessment methods with the aim both to widen the use of common agreed standards and methodologies and to continue to improve the scientific quality of submitted assessments.

To compare, and comment, as relevant, the outcomes and recommendations arising both from stock assessment methods and from other fisheries assessment tools mainly based on economic and social matters. Evaluations coming from bio-economic models should also be used for comparison. To this end, SAC should implement some case studies where both approaches are applicable.

1.4. To initiate an in-depth reflection on conservation reference points (safe biological limits, precautionary reference points) that could be routinely used in the Mediterranean to establish a precautionary approach. SAC is also requested to highlight gaps in the current scientific knowledge and research and monitoring needs to set up such a framework.

1.5. To update evaluation for priority demersal and small pelagic species, by using the most recent data sets collected both by direct and indirect methods. SAC is requested to give priority to assessment of stocks in those geographical sub-areas not yet concerned by the 2001 and 2002 SAC assessments.

However, SAC should feel free both to extend the list of priority species and to accept for consideration stock assessments of species not included in the current list of priority species.

SAC is requested to explore different outputs consequent to different management scenarios for fisheries where there is evidence of overfishing. In the light of the above outputs SAC is requested to evaluate the appropriateness of present management measures and should propose new or alternative conservation measures whenever necessary. In this regard, the GFCM invites SAC also to take into account both the knowledge of nursery and reproductive areas (geographic co-ordinates) and the outcomes of experiments aiming to improve the exploitation pattern. SAC advices should highlight different management options in terms of risk to be avoided, expected improvements and cost/benefit both in biological and socio-economic terms.

List of priority species:

Merluccius merluccius, Micromesistius poutassou, Merlangius merlangus, Mullus barbatus, Mullus surmuletus, Pagellus erythrinus, Psetta maxima, Engraulis encrasicolus, Sardina pichardus, Sardinella aurita, Sprattus sprattus, Trachurus trachurus, Trachurus mediterraneus, Thunnus thynnus, Thunnus alalunga, Xiphias gladius, Coryphaena hippurus, Aristeomorpha foliacea, Aristeus antennatus, Parapenaeus longirostris, Nephrops norvegicus, Eledone cirrhosa, Prionace glauca, Isurus oxyrhinchus, Lamna nasus and Acipenser sturio .

1.6. To participate actively in the Joint GFCM/ICCAT Working Group on tuna farming.

1.7. To participate actively in the Joint EIFAC/GFCM Working Group on management of sturgeon.

(REPORT OF THE FIFTH SESSION OF THE SAC. JULY 2002)

REVIEW OF STOCK ASSESSMENT METHODS FOR THE MEDITERRANEAN

1. Following the request of the Commission at its Twenty-sixth Session, the Committee has evaluated three documents related to stock assessment methodology in the Mediterranean which had been prepared by a number of authors (GFCM:SAC5/2002/Inf.13, Inf.14 and Inf.15). SAC interpreted the request of the Commission as calling for the identification of a set of methods which would allow for the drawing up of proper management advice, based on the most reliable data available.

2. The three documents gave an overview of the common methods used and their applicability to the Mediterranean fisheries resources. One of these documents singled out length cohort analysis (LCA) based on length frequency as the most appropriate method in order to provide advice in the short-term and taking into consideration the poor conditions of data availability in most of the areas of the region. The other two documents suggested that options should be left open to use the most relevant methodology depending on the type of data series and resources available, as well as considering management objectives to be reached.

3. Due to the biases and uncertainties, which are an integral part of practically all stock assessment methods, the Committee recommended, whenever possible, that a number of methods should be applied before results and subsequent management recommendations could be put forward. In this way, more accurate scientific evidence could be obtained to reach agreed objectives. However, this hopeful approach will need to be financially supported by GFCM Members.

4. The Committee further recognized that it has embarked on such a mission only recently and that the task should be appreciated as an ongoing process which requires the input of future scientific work.

Notwithstanding the above, SAC trusted that the methods used so far were scientifically sound.

(REPORT OF THE FIFTH SESSION OF THE SAC. JULY 2002)

IDENTIFICATION OF SHARED STOCKS IN EACH GFCM GEOGRAPHICAL SUB-AREA

The Committee reviewed the list updated by the Sub-Committee for Stock Assessment. It noted that Bogue (*Boops boops*) from the Adriatic was cancelled from the previous list and that the Norway lobster, the Dolphin fish, and the following sharks species: *Prionace glauca, Isurus oxyrhinchus* and *Lamna nassus* have been added. It endorsed these amendments. The amended list is shown below.

Species Area Countries

1. Hake Gulf of Lions France and Spain
2. Hake Adriatic Albania, Croatia, Italy, Slovenia
3. Hake Sicily Channel Italy, Tunisia, Libya and Malta
4. Anchovy Gulf of Lions France and Spain
5. Anchovy Adriatic Albania, Croatia, Italy, Slovenia
6. Sardine Adriatic Albania, Croatia, Italy, Slovenia
7. Sprat Adriatic Croatia, Italy, Slovenia
8. Red mullet Adriatic Albania, Croatia, Italy, Slovenia
9. Blue whiting Adriatic Albania, Croatia, Italy
10. Bluefin tuna All Mediterranean All countries
11. Swordfish All Mediterranean All countries
12. Albacore All Mediterranean All countries
13. Norway lobster Adriatic Albania, Croatia, Italy, Slovenia
14. Dolphin fish Western Mediterranean Italy, Malta, Spain and Tunisia
15. *Prionace glauca* All Mediterranean All countries
16. *Isurus oxyrhinchus* All Mediterranean All countries
17. *Lamna nassus* All Mediterranean All countries

ANNEX 2

LIST OF PARTICIPANTS

NAME	INSTITUTE/ORGANISATION	COUNTRY	E-MAIL
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ANNEX 3

WORKING GROUP ON DEMERSAL SPECIES
Tangier, Morocco, 12-14 march, 2003

OPENING OF THE MEETING

1. The fourth meeting of the SAC Working Group on Demersal Species of GFCM was held at Hotel Mercure in Tangier from 12 to 14 March 2002. It was opened by Mr A. Berraho president of GFCM.

2. The meeting was attended by 15 scientists from 3 countries and representatives from FAO and EC . The list of participants is attached as Appendix A.

3. The Agenda of the Working Group was adopted and the list of documents was updated. The final list is attached as Appendix B.

4. Three rapporteurs Ms Pilar Pereda (IEO), Ms Aina Carbonell (IEO) and Mr. Enrico Arneri (ISMAR - CNR) were designated. Mr Enrico Arneri was nominated chairperson of the meeting.

PRESENTATIONS TO AND DISCUSSIONS BY THE WORKING GROUP

6. 15 technical papers were presented and discussed by the Working Group.

7. These documents covered 8 Geographical Subareas (GSAs), as a whole or in part, and 5 species. The table attached in Appendix C indicates the species studied and the GSAs referred to.

8. Two types of documents were presented: (i) assessment documents and (ii) assessment-related documents. The conclusions and recommendations related to the assessment presented in each document and endorsed by the Working Group are listed.

ASSESSMENT DOCUMENTS

10. Nine documents of this type were reviewed (see Appendix B) and they are referenced by a specific number; by the FAO code of the species, by the number of the GSA and the year of presentation). Such references should be used when completing the standard forms adopted by the Working Group.

11. Assessment forms related to the synthesis of the assessments and the abstracts of the working papers were discussed. These forms are presented in Appendix D.

Document n° 1: ARI-1-03 : Stock assessment of the red shrimp (*Aristeus antennatus*) in geographical subarea 1 : northern Alboran sea.

Document n° 2: ARI-5-03 : Stock assessment of the red shrimp (*Aristeus antennatus*) in geographical subarea 5 : northern Spanish coast.

Document n° 3: ARI-6-03 : Stock assessment of the red shrimp (*Aristeus antennatus*) in geographical subarea 6 : Balearic Island.

12. The state of the fishery of the Red shrimp (*A. antennatus*) in three Spanish GSAs considering the average 2000-2002 years and the whole population (females and males together) was analysed. Size length catches were transformed into age data and in each geographical subarea a Pseudochort Analysis was performed. Results showed a stable fishery based on adults specimens. Landings keep up similar levels for the three years in each zone considered. Nevertheless a smooth decreasing trend have been detected. Differences

between zones showed smaller length sizes for the Alicante zone (in the geographical subarea 5). Yield per Recruit analysis shows a lower exploitation level for the Vera gulf followed for the Balearic and Alicante zone. Yield per Recruit analysis showed an optimum effort close to half of the current level. A transition analysis of 15 years with a reduction effort factor of 25% in the first year, could bring the biomass of the stocks up to 35% higher than the current value.

13. The three assessments correspond to three geographical subareas, but the question was raised whether they can be considered or not separate stocks taking into account fishing fleets, biology and geographical barriers. As a general trend the mean length of the catch was larger than the size of first maturity. Fishing mortality by year have an increasing trend from year class 2 to the oldest, probably the age class 0 has a low accessibility.

14. Catches in the last three years have decreased since the most recent peaks by about 50%.

15. The recommendation is to keep the current level of effort and if possible to reduce it.

Document n° 4: MUT-3-03 : Etat des stocks des principales ressources en Méditerranée marocaine – *Mullus barbatus.*

Document n° 5: HOM-3-03 : Etat des stocks des principales ressources en Méditerranée marocaine – *Trachurus trachurus.*

Document n° 6: DPS-3-03 : Etat des stocks des principales ressources en Méditerranée marocaine – *Parapenaeus longirostris.*

16. An analysis of length frequency distribution obtained from sampling of landings has been performed by means of analytical models (LCA) for the main resources exploited by the Mediterranean fleet of Morocco (geographic subarea 3). The species analysed are red mullet (*Mullus barbatus*, horse mackerel (*Trachurus trachurus*), and pink shrimp (*Parapenaeus longirostris*).

17. The Y/R analysis was utilised to test the behaviour of the populations to different exploitation levels. A situation of overexploitation has been detected for red mullet and of full exploitation for the horse mackerel, the two species with coastal distribution. The pink shrimp which has a more offshore distribution shows a situation of underexploitation.

18. The sampling ports (Nador and Alhoceima) represent 86% of the total demersal Morocco Mediterranean landings. There are no discards for these three species. The season of recruitment was detected by analysis of monthly length frequency distribution. The catch of other gears except trawl-net is negligible. Horse mackerel in Morocco is caught almost only by demersal trawlers.

19. A reduction of the fishing effort in coastal areas is recommended, and this could be achieved by transferring part of the fishing effort to more offshore fishing grounds.

Document n° 7 : HKE-9-03 : Assessment of the stock status of hake *Merluccius merluccius* in the Tuscany coast (Geographical Subarea 9)

20. Data for this assessment proceed from a year of monitoring landings on a monthly basis (year 2000). In each port with a fleet exploiting the European hake, monthly data on landings and size composition were collected. This allowed the construction of the size structure of the total annual catch by port and gear. A length converted catch curve was utilised in order to estimate the fishing mortality vector and the number of individuals at sea by size. Successively, the contribution to each gear to the F vector was calculated. Two different assumptions as regards to the natural mortality were included in the analysis. A first analysis was performed assuming a constant value of M. In a second analysis, a vector of M assuming an inverse

relationship with age was used. Forecast analysis assuming equilibrium were successively performed in order to evaluate the consequence of changes in fishing pressure and in selectivity.

21. The different trends of biomass between trawl surveys and commercial landings could be explained by the fact that fishermen in the recent years do not concentrate in nursery areas where density is higher, this can produce a reduction in commercial catch rates. This is reflected by a change in the length frequency distribution of commercial landings in some ports.

22. A status of growth overfishing is confirmed by this study. The species length at first capture is too low and fishing pressure very high. The current surviving fraction of the Spawning Stock Biomass ($\%SSB_0$) in both cases (assuming a constant low M and with M inversely related with age) is extremely reduced, indicating a real danger of recruitment overfishing for the stock.

23. At the current very high levels of fishing pressure, simulations show that an enlargement of the legal mesh size would produce a modest improvement of yields and of the Spawning Stock survival.

24. The reduction of fishing mortality can be obtained through a drastic reduction of fleet capacity or in fishing activity. Alternatively the reduction of fishing mortality could be obtained by establishing protected areas where individuals are densely concentrated.

Document n° 8 : MUT-10-03 : Assessment of the stock status of red mullet *Mullus barbatus* in Geographical Subarea 10 Southern and Central Tyrrhenian Sea.

25. Data collected during MEDITS trawl surveys from 1994 to 2001 were used to estimate abundance indices, biological and demographic parameters applying the standardised protocols adopted in the SAMED project. Moreover, the consequences of changes in the exploitation scenarios (total mortality and gear selectivity) were simulated by a dynamic pool model in which stochasticity was introduced.

26. The abundance indices (number and weight per km^2) did not show any temporal trend. The results from the model showed that increasing the size at first capture would produce less advantage then decreasing total mortality. Under a conservative hypothesis (length at 50% of maturity of 140 mm), the performed analysis highlighted, in the current scenario, a level of 12% in the ratio between average Spawning Stock Biomass and average virgin Spawning Stock Biomass. As MEDITS bottom trawl surveys were carried out during the spawning season of the species, no significant trend of the abundance indices would indicate a stable condition for the spawner's fraction of the population.

27. The rather constant trawl survey biomass trend coupled with the indications derived from the dynamic pool model, could imply that the self renewal of the stocks is not compromised despite of the high total mortality (more than twofold the natural mortality). Growth overfishing can be assumed for the species.

28. A reduction of 10-15% of the total mortality, which could drive in a more save position the SSB/SSB_0 (the ratio between average Spawning Stock Biomass and average virgin Spawning Stock Biomass), could be probably obtained enforcing the area and temporal closures currently applied.

Document n° 14 HKE-1/6-03: Direct survivor analysis and the identification of recruitment trends on trawl surveys data.

29. In this work, a new stock assessment method, named Direct Survivor Analysis, was presented. Models for the survivor function of exploited demersal resources on a cohort basis are established and verified. The proposed models are applied to estimate and to test hypothesis on recruitment trends, to compare the survival and the life expectancy for a set of cohorts. This enables to link trawl surveys data with commercial landing data in order to produce an evaluation of the stock. Statistical fundamentals of the method can be compared with the classical stock assessment methods (VPA and other methods used in Mediterranean context) and finally the validity of direct and indirect evaluation methods was discussed.

30. The study area is the Spanish Mediterranean and the trawl data corresponds to Medits surveys in the period 1994 – 2000. The assessment refers to hake for the Spanish coast (geographical subareas 1 and 6). The results of this new assessment method are quite pessimistic. In the Spanish coast the mean life expectancy is 0.8 year while in the Gulf of Lyons, using the same method it is 1.03 year. To obtain the optimal Y/R the effort should be reduced by 80%.

31. The WG welcomes a new method of assessment, pointing out that a new method to be accepted should be tested and validated, therefore the assessment can be considered as a preliminary document. It will be further discussed at the SCSA meeting.

ASSESSMENT RELATED DOCUMENTS

Document n° 9 : Assessment of demersal resources exploited by the Albanian trawl fishery: the case studies "hake" and "red mullet"

32. The past and current status of Albanian demersal trawl fishery was discussed on the basis of catch and effort data (time series 1960-1992) from the archives of Fisheries Research Institute of Durrës (Albania). Fishing effort steeply increased during the eighties, while a slight reduction has been reported for 1990-1992 when important political and economic changes occurred in the country. Annual yields and CPUEs for total demersal catches show quite stable trends up to the eighties, then they increased in the following two-three years as a result of the increased fishery effort. Strong fluctuations of fishery yields and CPUEs are reported from 1984 up to 1992. With regard to demersal fishery "target species", surplus production models (biomass-dynamic models) fitted to the available data highlight the decrease of CPUE values for the hake (Merluccius merluccius) in the period of investigation. The same models did not provided reliable results for the red mullet (Mullus barbatus), a species characterised by a short life span and discrete recruitment.

33. Despite the constraints of the models used, new information for the area investigated is reported. The results have to be considered as the first attempt to study the Albanian demersal fishery in a thirty-years period.

34. The working document was prepared with the contribution of the ADRIAMED project. It mainly concerns the application of Surplus Production Models in the Mediterranean. The exercise was carried out regarding two species, hake and red mullet, distributed in the Geographic sub-area 18 (South Adriatic, Albanian fishery).

35. The paper stimulated the discussion on the use of Surplus Production Models in the Mediterranean. Unfortunately, due to the considered period it is useless to resource management purposes because recent data are missing.

Document n° 10 : French-Spanish shared stock of Merluccius merluccius in GSA 7 Gulf of Lyons.

36. The last year Working Group recommended for future assessment the application of the VPA tuned by abundance index from commercial fleets and/or independent indices from surveys. Taking into consideration the shortness of the available time series (1998-2002), and that the biological parameters demanded to run the VPA have not been updated the French and Spanish team has decided to wait one year to perform a new analysis.

37. The French and Spanish team did not consider necessary to repeat the analysis in the same way as it was made in previous year because the fisheries did not change substantially. The data bases have been updated and main characteristics of the fisheries during 2002 are presented in this document.

38. A selectivity experience was held in the Gulf of Alicante, García et al 2002 and the WG notes that square mesh of 20 mm side length improves the selectivity from diamond mesh of 40 mm stretch length. L50 with the square mesh was 14 cm while with the diamond mesh L50 was 11 cm.

39. The French and Spanish team maintain the same recommendation as in previous assessment: to reduce growth overfishing by improving the fishing pattern of the trawl fishery to arise the minimum length of catches equal the minimum legal landing size and reducing the effort of trawl. To avoid recruitment overfishing by reducing the effort of longline and gillnets in order to increase (or at least maintain) the SSB.

Document n° 11 : Fishery and population of hake in the north Alboran sea (W. Mediterranean).

40. Hake (M. merluccius) is one of the main target species of the north Alboran sea trawl fleet. Their catches are made up mostly of young individuals, distributed in a wide bathymetric range from 30 m to 300 m, occupying the whole shelf and upper slope. Adults become more abundant from 300 m accompanying the catches of *Parapenaeus longirostris*, *Nephrops norvegicus* and *Aristeus antennatus*.

41. Selectivity experiences showed the relevance of juveniles in the catches. There are no discard for this species and the nursery area is located in the eastern area (Almería). Trawl surveys time series showed the relative abundance index (8 years) with no trend along the continental shelf and showed a decreasing trend in the slope (200-800 m). This was noted by the working group as a possible index of exceeding fishing effort.

42. A discussion on the standardisation of age reading for hake has taken place and the WG recognise that this task should be tackled in the future constituting a group of hake otolith reading specialists. This will allow to obtain reliable age length key.

Document n° 12: Fishery and population of red mullet in the north Alboran sea (W. Mediterranean).

43. Red mullet (*Mullus barbatus*) is one of the main target species of the North Alboran sea trawl fishery and common in the artisanal fleets catches. It is distributed in a bathymetric range from 0 m to 200 m occupying the whole shelf on muddy and sandy bottoms although the highest values were estimated in the Almería harbour (eastern area) at the depths between 50 and 70 m.

44. Values resulting of MEDITS series show a apparently stable situation in the shelf of north Alboran Sea since 1996.

Document n° 13 : Probability distributions of trawl-survey data. Its application to identify spatio-temporal trends of abundance indices and age structures.

45. In the present work, probability models for the abundance indices and ages obtained from trawl survey data, are proposed, verified and analysed. The models are applied to identify spatio-temporal trends of biomass indices and age structures. The study area is the Spanish Mediterranean and the trawl data analysed correspond to Medits surveys in the period 1994 – 2000. The species considered is hake *Merluccius merluccius*. The suggested probability model works with mixed distribution. The results of the models application allow to establish geographical models that could be used as index of accessibility.

Document n° 15 : Relationships between environmental parameters and stock distribution: can the bottom temperature affect the Adriatic population of the deep water pink shrimp?

47. Distribution pattern of deep-water pink shrimp – *P. longirostris* - in the South Adriatic Sea are reported. Trawl-surveys data (MEDITS project) have been analysed, and abundance indices distributions were mapped by means of G.I.S. techniques together with bottom temperature data. Results underlined differential distribution of the species according to geographical zones and depths, and the likely influence of water temperature.

48. The WG noted the importance of investigating the influence of water masses on the movements of fishery resources as penaeid shrimps, hake etc., which could have important consequences also in fishery assessment and management. This kind of investigations are beginning to be conducted in different areas of the Mediterranean.

GENERAL DISCUSSION

49. According to the terms of reference provided by GFCM, the effects of alternative exploitation strategies have been analysed, using simulation methodologies (see documents 1, 2, 3, 7 and 8).

50. All the stocks analysed are national stocks and shared stock assessments have not been presented.

51. The WG expresses its concern about the low number of countries participating in the WG (3 countries this year). This lack of participation could jeopardise the existence of this WG in the future.

52. The lack of specific budget to conduct assessment investigation and to participate to the assessment meeting constitutes a key problem in this context.

53. The WG proposes for the next year to meet in the same place the days before the Subcommittee meeting.

GENERAL CONCLUSIONS AND RECOMMENDATIONS

54. The conclusions and recommendations of the stock assessments included in this report have been agreed upon by this working group and reported under each assessment.

55. As a result of the discussions and reviews of the documents made available to it, the Working Group agreed on the following conclusions and recommendations:

- Distribute copies of the documents and standard forms, or send them to everybody in electronic format before the meeting.
- As agreed during the previous meetings, priority should be given to papers dealing with shared stocks and priority species of regional or sub-regional concerns.
- Assessments should be presented using the standard forms. The data and parameters that might be needed to redo the calculations should be included in these forms. It is suggested to make the filling of the forms more user friendly by automating some data input. Any kind of proposal aiming at the improvement of the forms is welcome.
- The MEDITS group is willing to report their survey results to this WG. Moreover in few months FAO will publish the results of the previous surveys 1994-1999 carried in the framework of the SAMED project.
- The identification of suitable biological reference points should be included in the agenda of the next SCSA meeting.

56. The documents produced by this meeting will be available at :

ftp://cucafera.icm.csic.es/pub/scsa/

ANNEX 4

WORKING GROUP ON SMALL PELAGIC SPECIES
Tanger, 12-14 March 2003

OPENING OF THE MEETING

1. The fourth meeting of the SAC Working Group on Small Pelagic Species of GFCM was held in Tanger from 12 to 14 March 2003.

2. Eleven scientists from five countries attended this meeting. Moreover a delegate from European Union participated to the discussions during the sessions. The list of the participants is attached as Appendix A.

3. The Agenda of the Working Group was adopted (Appendix B) and the list of documents was updated. The final list of documents presented during the meeting is attached as Appendix C.

4. Mr. A. Kallianiotis (NAGREF-FRI) chaired the Session. Mr. B. Patti (IRMA-CNR) was the Reporter.

PRESENTATIONS TO AND DISCUSSIONS BY THE WORKING GROUP

5. Eleven technical papers were presented a nd discussed by the Working Group.

6. These documents covered totally or partially 8 Management Units (MUs) and four species.

7. Two types of documents were presented: (i) assessment documents and (ii) assessment related documents. The conclusions and recommendations adopted by the Working Group and referring to assessment presented in each document are as follows:

ASSESSMENT FORMS AND DOCUMENTS

8. Six documents of this type were reviewed. The documents are referred to by numbers (See Appendix C) by the FAO code of the species, by the number of the management unit and the year of presentation (the date indicated after the scientific name of the species refers to the period of the study).

9. Document n° 01. ANC _ 7_ 03 *Engraulis encrasicolus* 1985-2002.

Anchovy is an important commercial species of the gulf of Lions. The annual catch is between 5000 and 6000 tonnes. The production, however, is regulated by market demand. When market prices are low, pelagic trawlers shift their activities toward demersal resources, which are overexploited. Echo-integration methodology is used annually since 1993 in the gulf of Lions, during summer, in order to estimate the importance and the variations of resources of anchovy, sardine and other commercial pelagic species. The state of the anchovy population in the Gulf of Lions appears to improve, since in the last two years an increase in the reproductive biomass has been observed, (48000, 70000 and 112000 t. respectively in 1999, 2000 and 2001). On the other hand, for sardine, the biomass seems to be stable.

During the working group on small pelagic species celebrated in Rome last year, we presented with our Spanish colleagues a document titled « Preliminary results on anchovy shared stock in the Gulf of Lions ». The main results of that document are :

- fleets from both France and Spain are sharing this stock with a predominance of Spanish purse seiners fishing at night with lights in the Gulf of Lions. At the moment, there is no conflict with French trawlers that operate only during daytime.
- considering the present biomass values estimated by direct methods, at the moment, it is suggested to maintain the effort to the present level.

For the present working group in Tangiers, we didn't prepare any paper. We have been collecting some information (catches, fishing effort) but they are not validated for the moment, due to a change in file format for official collected data on catches and effort. We will provide assessment forms with only preliminary data. Biomass evaluation by echo-integration, is in process but not yet available.

The conclusions of the last year's paper remain in use, and for French data in the Gulf of Lions, we did not observe in 2002 any important modifications in the level of catches.

10. Document n° 02. SAR _ 7_ 03 *Sardina pilchardus* 1985-2002.

The sardine catch in the gulf of Lions is about 11000 t., on the average, for the period 1999-2001. The landings and the fishing effort are monitored since 1985.

Although the production of sardine is less regulated by fishing market than that of anchovy, as mentioned before when the market prices are low, pelagic trawlers shift toward demersal resources.

Echo-integration methodology is used annually since 1993 in the gulf of Lion, during summer, in order to estimate the importance and the variations of resources in anchovy, sardine and other commercial pelagic species. For sardine, the biomass is stable (76000 t., period average 1999-2001).

The resource is moderately exploited and regulations are established by professional and national organisations.

11. Document n° 03. ANC-17-02 *Engraulis encrasicolus* 1975-2002.

The estimated stock biomass of Adriatic anchovy by VPA, carried out in the context of FAO-Adriamed-SP research programme, showed strong fluctuations during the observed period (1975-2002). After the collapse that occurred in 1987 the recovery of the stock biomass shows now a positive trend. Nevertheless, the biomass level has not reached the previous high values.

Given this situation and considering also that the present amount of catches (22,150 tonnes, average catch on the period 2000-2002) is about the 22% of the estimated biomass, the current level of fishing effort should not be increased.

12. Document n° 04. SAR_17_03. *Sardina pilchardus* 1975-2002.

The estimated stock biomass of sardine by VPA carried out in the framework of FAO-Adriamed-SP research programme, showed a peak between 1983 and 1985, then a continuous decrease appeared and the stock reached its lowest value in 2001.

Given this situation and considering also that the present level of the catches (19,300 tonnes, average catch on the period 2000-2002) is about the 19% of the estimated biomass, the current level of fishing effort should not be increased. Due to the low market demand in Italy for sardines, discards at sea may occur and hence monitoring of sardine discards at sea is suggested.

13. Document n° 05. ANC+SAR_16_03 *Engraulis encrasicolus* + *Sardina pilchardus* 1997-2002.

Biomass evaluations from six echo-surveys carried out from June 1998 to July 2002 in the Strait of Sicily were presented. Both sardine and anchovy populations experienced quite large inter-annual fluctuations, from about 36,000 t in July 2000 to 6,000 t in 2002 for sardine and 7,000 t in 1998 to 23,000 t in 2001 for anchovy. Specifically for anchovy this evidence would suggest, taking also into account the age structure of the catches (low proportion of juveniles, see document n°9), the importance of environmental factors variability on yearly recruitment success. Acoustic evaluations are largely consistent with landings (from purse seiners and midwater pair trawlers) recorded in Sciacca (the most important base port in the M.U. 16 for the small pelagics landings) during the year following the evaluation campaigns. The recent decreasing trend in sardine biomass suggest to consider the risks connected to possible negative effects on this population, resulting from wintertime (from January to March) pressure of other fishing gears on larval stages.

14. Document n° 06. SAR_3_03. *Sardina pilchardus* 1990-2001.

La sardine est l'une des espèces les plus exploitées en Méditerranée marocaine. La production annuelle en cette espèce, estimée à 14000 tonnes /an, est l'œuvre d'une flotte sardinière composée de 141 unités réalisant plus de 15000 sorties en mer /an. Les valeurs de mortalité par pêche par classe de taille et de la biomasse moyenne annuelle du stock sont obtenues. L'évaluation de la biomasse de la sardine ainsi que son état d'exploitation a été basé sur l'analyse de cohortes par longueur (LCA). Le stock de la sardine méditerranéenne a connu une forte diminution entre les années 1992 et 1997, une légère tendance à la hausse de cette biomasse est observée à partir de 1998 jusqu'à 2001. Les valeurs de mortalité par pêche les plus élevées sont observées surtout pour les individus adultes de plus de 16 cm.

RELATED DOCUMENTS

15. Document n° 07. SAR+SARD AUR+ TRAC TRAC_3_03. *Sardina pilchardus Sardinella aurita Trachurus trachurus* 2002.

Pour une meilleure compréhension des fluctuations de ces ressources intimement liées aux conditions environnementales qui conditionnent fortement l'échec ou la réussite du recrutement qui génère à son tour des biomasses dont l'importance est proportionnelle au degré de réussite de recrutement, on a souvent eu recours à la planification des campagnes de prospection et d'évaluation acoustique. Le programme de prospection mis en place à partir de l'année 2002, concerne les 4 principales espèces des petits pélagiques : Anchois, sardine, sardinelle et chinchard. Toutefois, une attention particulière est accordée à la sardine et l'anchois, en raison de l'intérêt socio-économique de ces deux espèces. La répartition de la sardine méditerranéenne dépend étroitement de l'étendu du plateau continental. Les majeures concentrations sont observées au niveau de la région d'Al Hoceima, là où le plateau continental est relativement plus large.

Pour les estimations de biomasse, la formule de TS utilisée est celle du hareng de la mer du Nord (TS=20logL-72), appliquée pour les 4 principales espèces de petits pélagiques lors des campagnes d'évaluation acoustique des côtes atlantiques marocaines par le N/O norvégien « Dr Fridtjof Nansen».

La sardine présente le 1/3 de sa biomasse à l'Ouest d'Al Hoceima et les 2/3 à l'Est. La biomasse de l'anchois n'a pas été calculée en raison de sa faible présence dans les captures des pêches scientifiques. Le suivi de l'évolution des débarquements de cette espèce montre une chute drastique depuis les années 80.

16. Document n° 08. SAR+ANC_20, 22_03, *Sardina pilchardus* + *Engraulis encrasicolus*, 1991-2001.

European sardine (*Sardina pilchardus*) and anchovy (*Engraulis encrasicolus*) are the most important pelagic fish, in terms of landings, in Greek waters, reaching about 30% of the total landings. The greatest proportion of the mean annual anchovy and sardine catches comes from northwestern Aegean Sea regions, and the fishing gear responsible for such catches is the purse-seine. The present study reports on anchovy and sardine landings in the major greek fishing ports collected on a monthly basis from 1991 to 2001. The monthly commercial average landings of the two species exhibited a clear seasonal pattern; the anchovy landings peaked in June-July, while those of sardine in May and then in October. Significant inter-annual fluctuations appeared also in the landings of the two species; anchovy landings ranged between 4,800 t., in 1991, and 13,500 t., in 1998, and sardine landings ranged between 5,500 t., in 1997, and 11,000 t., in 1992. Inter-annual variations appeared also in the anchovy/sardine landings ratio, and it might be associated to relative changes in recruitment rates, a change in the relative availability of the two species to purse-seiners and/or in the relative fishing effort expended on each species. Our data corroborate previous findings on the existence of temporal cycles in the anchovy/sardine ratio in Greek waters, which should be incorporated in catch-yield equations in order to improve the employed managerial schemes.

17. Document n° 09. ANC_16_03 *Engraulis encrasicolus* 2000-2001.

In this study age structure and growth parameters for the anchovy fishery *Engraulis encrasicolus* were estimated for the first time in the Strait of Sicily. The sampling was carried out from May 2000 to October 2001 on board of commercial fishing vessels. The age structure of the catches was dominated by the 2-year-class (55-63%) and the 1-year-class (30-41%), whereas the 0-year-class (1-5%) and the 3-year-class (3-5%) represent a small proportion of the catches. The von Bertalanffy growth model and back calculation analyses were applied to estimate anchovy growth

parameters using the FISAT program. Pooled mean parameters of males and females did not present any significant differences (L8 =18.6 cm, k = 0.29 year-1 and to=−1.81).

18. Document n° 10. ANC_16_03 *Engraulis encrasicolus* 1997-2002.

Some aspects of anchovy reproductive biology were assessed along a six years period from data collected in the main spawning ground of the population off the southern coast of Sicily (M.U.16). This work represents the first attempt to investigate the reproductive features of the anchovy population in this area. Gonosomatic index (GSI) and size at first maturity (SFM) were assessed in their intra-annual and inter-annual evolution. Monthly gonosomatic index values and corresponding maturity stages evolution indicated that the spawning season approximately extends from late March-April to August-September, though the greatest part of spawning effort appears in July–August. Estimated size at first maturity (L_{50}) with confidence limits were 11.27 ± 0.09 cm for males and 11.24 ± 0.09 cm for females.

19. Document n° 11. ANC _ 6 , 7_ 03 *Engraulis encrasicolus* 2002.

During the last meeting of the Working Group of Small Pelagics of the SCSA (Rome, 2002), it was decided to perform a simultaneous analysis of the size at first maturity of the Mediterranean anchovy populations. In this paper we present the results of the analysis made to the spawning grounds concerning the management units 6 (north Spain) and 7 (Gulf of Lions). Ten samples coming from the landings of one harbour at M.U. 6 and 4 samples from two harbours at M.U. 7 were analysed. The results are quite different for both regions, giving a size at first maturity of 11.1 cm and 12.8 cm respectively. Nevertheless, the last one must be taken with caution, due to the absence of individuals below 12 cm during the peak spawning period. In summary, taking into account previous studies (see revision presented by A. Giraldez at SCSA, 2001) and the present study, we conclude that, the size at first maturity of anchovy at the NW Mediterranean is over 11 cm. That means a size at least two centimetres over the legal size established for the anchovy (Council Regulation EC No 1626/94).

Recommendations

20. Anchovy abundances are heavily dependent on recruitment and show high inter-annual variability. As anchovy is a short-lived species, it is important to ensure its reproductive potential and thus one management option, to allow the sustainability of the species' stock, is to adjust the size at first capture to the size at first maturity. Studies on the size at first maturity presented in the framework of this meeting showed that for some areas this parameter's value is about 11 cm. There is evidence, however, from other Mediterranean regions that the species presents a different size at first maturity there. The W.G. suggested to all participants to gather the relevant data, proceed to the appropriate evaluations of that data, and present the results in the next meeting, in order to clarify the value of the anchovy's size at first maturity in all Mediterranean management units.

21. Market price affects anchovy and sardine fisheries, causing discards at sea expecially for sardine, which has lower market values. It is recommended to implement projects to monitor, year by year, discards at sea. Moreover, market campaigns that would increase the demand of sardine and diminish possible discards at sea are also recommended.

DATE AND PLACE OF THE NEXT MEETING

22. The next meeting will be held in March 2004 at FAO Headquarters in Rome, Italy.

ADOPTION OF THE REPORT

23. The report of the 4th W.G on small pelagic species of the Sub Committee on Stock Assessment was adopted on 14 March 2003.

ANNEX 5

DIRECT SURVIVAL ANALYSIS: A NEW STOCK ASSESSMENT METHOD:

by

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[(2)]Project FAO-COPEMED.

SECTION I.- PROBABILITY DISTRIBUTIONS OF TRAWL-SURVEY DATA.

MODELS AND APPLICATIONS.

In the present section probability models for the abundance indices and ages obtained from trawl survey data, are proposed, verified and analyzed. The models are applied to identify spatio-temporal trends of biomass indices and age structures. The main goals are the diagnosis of possible increasing/decreasing temporal trends, the establishment of bathymetric and geographical models and to create the support to analyze the survival of the resources and its evolution. The study area is the Spanish Mediterranean and the trawl data analyzed corresponds to Medits surveys in the period 1994 – 2000.

SECTION II: THE FUNDAMENTALS

A rigorous definition of the Survival and Mortality through their properties and their probabilistic versions is presented. The link with the basic equations of Marine Population Dynamics is analysed. And the assumptions and limits of the classical approach are highlighted. Finally an extension of this classical framework through the Weibull Distribution identified in the preceding paper is established, as well as the simulation of this distribution.

CONCLUSIONS

The properties of survival and mortality have been rigorously established and examples of published and unpublished, adequate and inadequate models have been done. The probabilistic versions of this functions have been set up. The stock and catch equations in terms of survival are deduced in a general framework. And simulation procedures for time of life distributions have been treated.

This represents a new approach to Marine Population Dynamics. In fact the usual stock and catch equations, corresponding to constant mortality rates in the considered interval of ages, are the most simple possible versions of the general framework here presented.
But “most simple possible versions” do not mean the unique. Do not mean the best. And do not mean even adequate. The fact that this simple versions are usually considered as if they where “the versions”, it is to say, “the only ones”, in the opinion of the authors, constitutes one of the “dogmas” that have been installed in Marine Population Dynamics.
An alternative, using the Weibull distribution, has been presented. And its high flexibility has been shown by simulation procedures. And the applications will be developed in following works.

SECTION III: REFERENCE PARAMETERS.-

In this section the Weibull survival model presented in the preceding paper is elaborated in order to obtain some reference parameters as the Critical Age, the Life Expectancy, the Median Survival Time, the Mean Residual Lifetime and the Yield per Recruit.

CONCLUSIONS

In the first work an extension of the classical Marine Population Dynamics was proposed through a model of timelife as a battery of two weibull distributions and considering the age of first capture as the cut-off of the unexploited and exploited phases of the cohort.

Under this extended model, the reference parameters related to the diagnosis of the fishery can be established in a way that generalizes the known expressions derived from the classical exponential model.

The Critical Age, the Life Expectancy, the Median Survival Time, the Mean Residual Lifetime and the Yield per Recruit have been generalized and computer solutions have been implemented.

SECTION IV: ESTIMATING THE MODEL WITH TRAWLL SURVEY DATA

In this section, the parameter estimation of the Weibull survival model presented in preceding works is elaborated using trawl survey data. The estimation allows to establish a baseline survival function. And from this baseline survival, the specific estimation of the survival in the different considered cohorts is obtained through an adaptation of the separable model of the fishing mortality rates introduced by Pope and Shepherd. And this allows to test hypothesis on the evolution of the survival on the study period. Finally to identify trends on the recruitment.

CONCLUSIONS

The identification of baseline age interval (an interval in which the obtained catches in the trawl survey may be assumed to be representative of the studied cohorts of the population) allows to estimate the parameters of the proposed Weibull model by maximum likelihood, and therefore to estimate the baseline survival in the study period. The model presents an excellent fit.

The separable model of fishing mortality rates (Pope an Shephered, 1984), has been adapted. And so, the survival/mortality of each specific cohort may be expressed as a power/multiple of the baseline survival/mortality. From this approach, the evolution of the survival and mortality over the successive cohorts in the study period become a particular case of the "proportional hazard models" considered in the general survival analysis framework. And the exponent/factors of the power/multiple relationship may be estimated by non linear regression or maximum likelihood. And again the successive estimated and modelized survivals of the different specific cohorts present an excellent fit.

The model allows to test hypothesis over the survival and mortality on the study period by the likelihood ratio method. In particular the test of stability of the survival on the study period has been presented. And, in the example dedicated to *Merluccius merluccius* in Spanish Mediterranean, this hypothesis is rejected. In fact the proportionality factors between the total mortality rates of the successive cohorts and the corresponding to the baseline survival, show an increasing trend (that means a decreasing trend in the survival) during the study period.

The elaboration of the catch equation established in preceding papers provides the expression of the catches in successive age subintervals as linear regression on a covariate which depends on the survival. And the regression coefficients are proportional to the recruitment of the considered cohort. So the possible trends in this regression coefficients reflect trends on the recruitment, whose statistical signification may be quantified. And in the developed example, a slightly but significant increasing trend of the recruitment, has been verified in the study period.

SECTION V.- LINKING THE MODEL WITH COMMERCIAL LANDING DATA.

A link between the preceding analysis of trawl survey data and the commercial "catch at age" data, generally obtained to evaluate the population by application of analytical models, is established.

The estimated baseline survival (Part IV), with the proposed versions of the stock and catch equations (Part II) and the adaptation of the Separable Model (Part IV) are applied to commercial catch at age data. This allows first to estimate the survival corresponding to the landing data. And, by the other hand, to estimate an effective age of first capture, and the initial size of the cohort. So, to complete the parameter model estimation and, in consequence, the estimation of the whole survival and mortality (Part II), as well as the reference parameters (Part III) useful for management purposes. The complete model provides the evaluation of the stock at any age. The coherence (hence the mutual "calibration") between the two kinds of information may be analysed and shown, as well as the comparison with results obtained by other methods (VPA). Finally to improve the diagnosis about the exploitation estate of the population.

CONCLUSIONS

The basic estimation of the baseline survival, obtained from trawl survey data, may be completed by analysing commercial "catch at age" data. And this can help to check the coherence of the two kinds of information and the relationship between their respective survival and reference parameters.

And the application of the method can be useful for management and calibration purposes: In the developed example, *Merluccius merluccius* appears in a precarious state in the westernmost Mediterranean (Spanish Mediterranean and Gulf of Lions). Specially in Spanish Mediterranean. For a population whose virginal life expectancy should be around 5 years and which potential time of life over 13, we find a life expectancy less then 1.4 years in the Gulf of Lions and less then one year in Spanish Mediterranean. And the virginal life expectancy is now very near the 99% percentile in the Gulf of Lions and even worse in Spanish Mediterranean. And with a decreasing survival in Spanish Mediterranean in the considered period (years 1994 – 2000). With estimates exploitation rates of 0.65 and 0.58 respectively in Spanish Mediterranean and the Gulf of Lions. And an estimated fishing mortality that in order to recover the maximum sustainable yield should be reduced in 67.97% in the Spanish Mediterranean and 62.45% in the Gulf of Lions.

And the results of the model application to the available information of the pseudo-cohorts of the Gulf of Lions provide an excellent fitting with the catch at age data and the evaluation of the stocks are very similar to that obtained by VPA analysis performed by previous works.

FINAL COMMENTS

In his work J. Caddy (1991) considers natural mortality as a continuous function of age so-called "reciprocal function" and to which necessarily the condition of a strictly positive age is imposed without calibrating theoretical consequences of such condition (an infinite initial stock size). On the other hand and may be under the influence of VPA approach, in this and further other works, the reciprocal continuous function is used to obtain a "mortality vector". In other words a continuous function is approximated by a step function. In the present work, the authors do not impose artificial conditions either to the age (that can be 0) or to the stock (that must be finite and bounded, even for age 0). On the contrary through the set of papers here presented we demonstrate that one can DIRECTLY work with the Continuous Survival Model.

Nevertheless we want to stress that beyond the apparent differences with J. Caddy's work, our critical reading of his work has served as guide and has oriented us in the construction of the models here introduced. In our opinion, this is an example of the seed left by sound works of some scientists. They not only provide new ideas but also introduce them as new questions (Caddy's mentioned work title ends with a question mark "?"). Instead of a closed way they provide open horizons, dialectical systems generator of new hypothesis and models, connecting with ideas applied in other scientific fields. It is from this perspective that we have read and understood this and other works by J. Caddy.