GENERAL FISHERIES COMMISSION FOR THE MEDITERRANEAN (GFCM)

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

Barcelona, Spain, 6-9 May, 2002

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1 OPENING OF THE MEETING

The fourth meeting of the of the SAC Sub-committee on Stock Assessment of the GFCM was held at the CSIC-Institute of Marine Sciences in Barcelona, from 6 to 9 May 2002. It was opened and chaired by the Co-ordinator of the SCSA Mr J. Lleonart.

2 ADOPTION OF THE AGENDA AND ARRANGEMENTS OF THE SESSION

The agenda of the meeting was adopted (Annex 1) and Mrs P. Martín was designated as rapporteur

The meeting was attended by 34 scientists from 8 countries (Annex 2).

3 REVIEW AND ANALYSIS OF THE GFCM/ICCAT WORKING GROUP ON LARGE PELAGIC SPECIES REPORT

Mr V. Restrepo presented the report of the sixth GFCM/ICCAT meeting, held in Malta in 15-19 April 2002 (Annex 3).

The report describes updates to the fishery databases maintained by ICCAT for bluefin tuna, swordfish, albacore and pelagic sharks.

Part of the GFCM/ICCAT report deals with the immediate and potential effects that the practice of bluefin tuna farming (fattening) has on statistics, management, the environment and socio-economic aspects.

After the presentation of the report, Mr S. Tudela raised to the consideration of the Subcommittee a WWF proposal in the sense of establishing a precautionary moratoria on new tuna farms followed by the elaboration of a Code of Conduct on Sustainable Tuna Farming Practices in the Mediterranean (see Annex 4). These proposals were built on the ground of the growing concern on the effects that increasing tuna farming has on the management of the bluefin tuna stock and the associated baitfish fisheries, the preservation of the marine ecosystems and the socio-economy of the affected areas. These aspects are highlighted in a specific report by WWF on tuna farming in the Mediterranean, which was made available to the SubCommittee (see ftp://cucafera.icm.csic.es/pub/scsa.). The Subcommittee discussed the proposal.

While there were some discrepancies about the convenience of asking for a moratoria at this moment, there was consensus about the need to develop a conceptual framework to provide the basis for the sustainability of tuna farming practices in the Mediterranean. To this end, the SubCommittee accorded the creation of a crosscutting working group with the mandate to elaborate a Code of Conduct on Sustainable Tuna Farming Practices in the Mediterranean, to provide common guidelines to make this activity a sustainable practice.

The need to provide a proposal of TOR for this proposed WG was raised, under the form of a specific set of issues to be dealt with. Consequently, it was decided to take for this purpose the comprehensive enumeration of the main problems and solutions related to tuna farming, worked out by the Joint GFCM/ICCAT WG in its last meeting, and listed in pages 12 and 13 of the corresponding report (see Annex 3) under the categories *Statistical effects, Biological effects, Managements effects, Potential environmental effects, Potential social and economical effects and Potential management effects.*

The potential overlapping of this new WG and the Joint GFCM/ICCAT WG was also addressed; it was concluded that both were clearly compatible. The output from this

crosscutting WG is expected to strongly contribute to the sustainability of tuna farming; otherwise the Subcommittee could recommend more effective measures.

In terms of stock assessment, it was noted that ICCAT has already scheduled a bluefin tuna assessment on 22-30 July 2002. In addition, the GFCM/ICCAT report mentions the possibility for ICCAT to conduct an assessment of Mediterranean swordfish in the near future.

4 REVIEW AND ANALYSIS OF THE ASSESSMENTS PRESENTED TO THE DEMERSAL WORKING GROUP

Mr H. Farrugio presented the report of the third meeting of the SAC Working Group on Demersal Species held in March 2002 in Rome (Annex 5). Forty-eight scientists from eight countries attended the meeting.

Twelve technical papers were presented and discussed by the Working Group. These documents were (i) assessment documents and (ii) assessment-related documents. Results of the EU SAMED (Stock Assessment in the Mediterranean) project were also presented to the Demersals WG meeting.

Seven assessments were endorsed by the SCSA:

- Stock assessment of *Merluccius merluccius* Geographical Sub Area 9 Ligurian and northern Thyrrhenian.
- Stock assessment of *Nephrops norvegicus* Geographical Sub Area 9 Ligurian and northern Thyrrhenian.
- Stock assessment of *Mullus barbatus* Geographical Sub Area 9 Ligurian and northern Thyrrhenian.
- *Aristeomorpha foliacea* Geographical Sub Area 11.
- Stock assessment of *Merluccius merluccius* in Geographical Sub Area 7, Gulf of Lions.
- Stock assessment of *Aristeus antennatus* in Geographical Sub Area 1,5 and 6, Northern Alboran Sea, Balearic Island and Northern of Spain.
- *Merluccius merluccius, Mullus barbatus and Nephops norvegicus* SAMED assessment results in the Northern coasts of the Mediterranean Sea. These assessments were presented to the SAMED seminar held in Rome, 18-19 March, 2002, under the umbrella of SAC; not being fully presented to the Demersals WG meeting in Rome, these assessments were presented to the SCSA by Mrs T. Spedicato.

Stock assessment of *Merluccius merluccius* **Geographical Sub Area 9 Ligurian and northern Thyrrhenian**

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. 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 sub-areas 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, Composite Production Models 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 overexploited, depending on the fishing grounds where the different fishing fleets operate with different levels of fishing effort. 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:

The current level of the spawning stock is very low (not more than 15%) regarding to the pristine level. Therefore a reduction of at least 15% of the fishing effort is considered to be necessary so as to minimise the risk of collapse of the stock. This measure can be complemented with the protection of the geographically stable nursery areas present during the whole year where highly vulnerable juveniles are concentrated.

SCSA COMMENTS:

The SC endorses the assessment and the recommendations

A clear status of overexploitation was detected, therefore a decrease of fishing effort is suggested in order to rebuild the stock, which should be implemented in a multiannual basis.

Stock assessment of *Nephrops norvegicus* **Geographical Sub Area 9 Ligurian and northern Thyrrhenian**

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:

The SC endorses the assessment

Stock assessment of *Mullus barbatus* **Geographical Sub Area 9 Ligurian and northern Thyrrhenian**

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. 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:

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:

The SC endorses the assessment

Since the WG recommendations were too general, the SC discussed the recommendation of a 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 *Aristeomorpha foliacea* Geographical Sub Area 11 Sardinia

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 E_{max}.

WG MANAGEMENT ADVICE AND RECOMENDATIONS:

No management advice was given.

SCSA COMMENTS:

The SC endorses the assessment and recommends not to increase the effort.

Stock assessment of *Merluccius merluccius* in Geographical Sub Area 7, Gulf of Lions

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 where 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 $F_{current}$ is reduced by 82%, Y/R_{max} would be 3.3 times higher the current value. For males, if $F_{current}$ is reduced by 68%, Y/R_{max} 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:

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:

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.

Stock assessment of *Aristeus antennatus* in Geographical Sub Area 1,5 and 6, Northern Alboran Sea, Balearic Island and Northern of Spain

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.

Landings in the three Geographical Sub Areas considered were between 100 and 150 t by each zone (landings at 6 sampling ports, representing around 80% of the red shrimp catch). Mean CPUE varied from 25 to 45 kg per vessel and day. Mean catch size oscillated between 28 and 32 mm CL and 22 and 25 mm CL for females and males respectively. Whilst the mean stock sizes were around 28-30 and 20-22 mm CL for females and males, age was close to one year for both.

SOURCE OF MANAGEMENT ADVICE:

Assessment of the exploited resource was carried out using length and age based methods (LCA and VPA) and yield per recruit analysis (Y/R). The interanual variability wasinvestigated studying the years 2000 and 2001.

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:

The Working Group recommends that the optimum effort should be half of the current fishing effort on females and three quarters of the current fishing effort on males.

SCSA COMMENTS:

The SC endorses the assessment.

The SC recommends the Demersal WG combine assessments for males and females in order to have an assessment of the stock as a whole and give an advise on it.

SAMED assessment results in the Northern coasts of the Mediterranean Sea

The source of the management advices is from SAMED EU Project that analysed and elaborated the data collected by MEDITS EU project at Mediterranean scale, using common and standardised methodology and procedures as far as the abundance indices, the demographic structure and parameters of the population at sea are concerned. Status of the *Merluccius merluccius*, *Mullus barbatus and Nephops norvegicus* stocks was assessed on the time series from 1994 to 1999 using two main reference indicators: the total mortality (Z) versus natural mortality (M) and a trend of the abundance indices (number and weight per km^2).

Merluccius merluccius

Geographical sub-areas			
1	Northern Alboran Sea		**0/–**
6	Northern Spain		**+/+**
7	Gulf of Lions		**0/+**
8	Corsica Island		**0/–**
11	Sardinia		**+/+**
9-10	Ligurian and Tyrrhenian Sea		**+/+**
10	North Sicily		**–/–**
15-16	South of Sicily		**–/–**
19	Western Ionian Sea		**0/(–)**
18	Southern Adriatic Sea		**–/–**
17	Northern Adriatic Sea		**–/0**
20	Eastern Ionian Sea		**+/(+)**
22	Aegean Sea		**+/(+)**
23	Crete Island		**–/+**

In the first column, the black square ( ) indicates the Geographical Sub Areas where the instantaneous coefficient of total mortality (Z), calculated on the female fraction of the stock, is higher than twofold the corresponding natural mortality coefficient (M). Both coefficients were considered invariant in time (equilibrium assumption) and size (i.e., no variation by size class).

In the second column a rough trend (1994-1999) analysis of the density indices ($\log_e$ transformed mean of individuals/km^2 vs. years) is reported: the first item indicates the shelf, the second one the slope. The symbols 0, **+, –** indicate a stable, increasing and decreasing tendency respectively. The symbol in parenthesis indicates that the correlation was significant ($p<0.05$).

In almost all the Geographical Sub Areas, the total mortality of the population at sea was considerably higher than twofold the natural mortality, indicating a situation of intense exploitation. The tendency of the abundance indices on the shelf and slope indicates a decreasing, although not significant, trend in several Geographical Sub Areas. This outcome, coupled with the level of the total mortality, would indicate a more critical situation for those hake stocks, while the increasing density indices in other Geographical Sub Areas mitigate the judgement on the condition of the stocks. In the examined period, none decreasing tendency of recruitment indices, as possible indicator of recruitment overfishing, was detected and stable nursery areas were identified. Even considering the limited sampling time and an higher avoidance ability to the bottom trawl by large size hake, a very low presence of full mature females was found, raising some concern about the buffering capabilities of the Mediterranean hake stocks. Globally a growth overfishing for the species can be assumed.

SAMED MANAGEMENT RECOMMENDATIONS

Temporal closure of the identified hake nursery areas.

Trawling effort limitation in space and time could be useful for the hake and the other species of the fishing assemblages. Some "input" limitation (i.e., number of hooks and gillnet hauled) should also be introduced in the long line and gillnet fisheries.

Mullus barbatus

Geographical sub-areas			
1	Northern Alboran Sea	N.A.	–
6	Northern Spain		–
7	Gulf of Lions		+
8	Corsica Island		0
11	Sardinia		–
9-10	Ligurian and Tyrrhenian Sea		(+)
10	North Sicily		–
15-16	South of Sicily		+
19	Western Ionian Sea		–
18	Southern Adriatic Sea	N.A.	+
17	Northern Adriatic Sea		+
20	Eastern Ionian Sea		(+)
22	Aegean Sea		+
23	Crete Island		(+)

In the first column, the black square ( ) indicates the Geographical Sub Areas where the instantaneous coefficient of total mortality (Z), calculated on the female fraction of the stock, is higher than twofold the corresponding natural mortality coefficient (M). Both coefficient were considered invariant in time (equilibrium assumption) and size (i.e., no variation by size class).

N.A. indicates that the estimate is not available for the Geographical Sub Area as the species did not comply in that area with the constraints imposed by the SAMED protocols for the evaluation of demographic parameters.

In the second column a rough trend (1994-1999) analysis of the density indices ($\log_e$ transformed mean of individuals/km^2 vs. years) is reported. Only the figures corresponding to the "shelf" macrostratum (10-200 m) are indicated considering the depth distribution pattern of the species.

The symbols 0, **+, –** indicate a stable, increasing and decreasing tendency respectively. The symbol in parenthesis indicates that the correlation was significant ($p<0.05$).

In the most part of the Geographical Sub Areas, the total mortality of the population at sea was considerably or moderately higher than twofold the natural mortality, indicating a situation of intense or at least full exploitation. The areas where both the information (high total mortality and negative density index trends) are converging should be considered with more caution, while the increasing density indices in other Geographical Sub Areas mitigate the judgement on the condition of the stocks. Bottom trawl surveys were generally carried out during the spawning season of the species, thus abundance is mainly referred to the "adults". This could imply that despite of the high total mortality the self renewal of the stocks is not compromised in some areas.

Excluding the Gulf of Lions and Corsica, globally a full exploitation and a growth overfishing, according to the Geographical Sub Areas, can be assumed for the species.

SAMED MANAGEMENT RECOMMENDATIONS

Maintaining the protection of the shallow waters, where the recruitment occurs (depth or distance from the coastline, depending on the shelf characteristics), along the year.

Temporal closure of the fishery accounting for both the recruitment of red-mullet and of the movements of recruits from shallower to deeper waters (mainly in the early autumn in the Western and Central Mediterranean) appear as crucial for delaying the time of the recruitment to the gear.

Nephrops norvegicus

Geographical sub-areas			
1	Northern Alboran Sea	N.A.	**+**
6	Northern Spain		**–**
7	Gulf of Lions		**+**
8	Corsica Island		**+**
11	Sardinia		**0**
9-10	Ligurian and Tyrrhenian Sea		**+**
10	North Sicily	N.A.	**+**
15-16	South of Sicily		**0**
19	Western Ionian Sea	N.A.	**(+)/0**
18	Southern Adriatic Sea		**0/0**
17	Northern Adriatic Sea		**+/–**
20	Eastern Ionian Sea		**(–)**
22	Aegean Sea		**–**
23	Crete Island	N.A.	**0**

In the first column, the black square ( ) indicates the Geographical Sub Area where the instantaneous coefficient of total mortality (Z), calculated on the female fraction of the stock, is higher than twofold the corresponding natural mortality coefficient (M). Both coefficient were considered invariant in time (equilibrium assumption) and size (i.e., no variation by size class).

N.A. indicates that the estimate is not available for the Geographical Sub Area as the species did not comply in that area with the constraints imposed by the SAMED protocols for the evaluation of demographic parameters.

In the second column a rough trend (1994-1999) analysis of the density indices ($\log_e$ transformed mean of individuals/km^2 vs. years) is reported. Only the figures corresponding to the "slope" macrostratum (201-800 m) are indicated considering the depth distribution pattern of the species, except for the Geographical Sub Areas 2.1.a, 2.2.b and 2.2.c where the species occurred, although with lower density, on the shelf (10-200 m depth) too.

The symbols 0, **+, –** indicate a stable, increasing and decreasing tendency respectively. The symbol in parenthesis indicates that the correlation was significant ($p<0.05$).

In the most part of the Geographical Sub Areas the total mortality of the population at sea was slightly or moderately higher than twofold the natural mortality, indicating a situation of slight overexploitation or a full exploitation. The areas where both the information (high total mortality and negative density index trends) are converging should be considered with more caution, while the increasing density indices in other Geographical Sub Areas mitigate the judgement on the condition of the stocks.

The known behavioural characteristics of this species (large periods of time inside the burrows, from which it emerges periodically giving rise to diurnal and seasonal fluctuations in the catches) makes it less vulnerable than other species to the fishing

pressure. Not withstanding patchiness in population structure and density dependence phenomena could be related with cases of “local” or “stock-let” overexploitation.

SAMED MANAGEMENT RECOMMENDATIONS

Technical improvement of the gear that avoid the capture of the small size norway lobster and reduce the impact of otter trawl doors on the bottom and the “scrapping” capability of the gear.

The complete documents are available at ftp:\cucafera.icm.csic.es\pub\scsa

5 REVIEW AND ANALYSIS OF THE ASSESSMENTS PRESENTED TO THE SMALL PELAGICS WORKING GROUP

Mr A. Kallianotis presented the report of the third meeting of the SAC Working Group on Small Species held in Rome, 20-22 March 2002 (Annex 6). Twenty-six scientists from six countries attended the meeting.

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

Ten assessments were endorsed by the SCSA:

- Stock assessment of *Engraulis encrasicolus* in Geographical Sub Area 1. Northern Alboran.
- Stock assessment of *Sardina pilchardus* in Geographical Sub Area 1. Northern Alboran.
- Stock assessment of *Engraulis encrasicolus* in Geographical Sub Area 6, Northern Spain.
- Stock assessment of *Sardina pilchardus* in Geographical Sub Area 6, Northern Spain
- Stock assessment of *Engraulis encrasicolus* in Geographical Sub Area 7-6, Gulf of Lions and North Catalonian.
- Stock assessment of *Sardina pilchardus* Geographical Sub Area 3 Southern Alboran Sea
- Stock assessment of *Engraulis encrasicolus* in Geographical Sub Area 17 Northern Adriatic .
- Stock assessment of *Sardina pilchardus* in Geographical Sub Area 17 Northern Adriatic
- Stock assessment of *Sardina pilchardus* in Geographical Sub Area 20+22 Eastern Ionian Sea and Aegean Sea .
- Stock assessment of *Engraulis encrasicolus* in Geographical Sub Area 22 Aegean Sea.

Stock assessment of *Engraulis encrasicolus* in Geographical Sub Area 1. Northern Alboran sea.

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:

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:

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

Stock assessment of *Sardina pilchardus* in Geographical Sub Area 1. Northern Alboran sea.

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:

Taking into account information available it does not seem necessary to recommend any reduction of fishing effort on this stock

SCSA COMMENTS:

No comments

Stock assessment of *Engraulis encrasicolus* in Geographical Sub Area 6, Northern Spain

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 (Tramontana 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:

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:

The SC endorses the assessment and recommends not to increase the fishing effort

Stock assessment of *Sardina pilchardus* in Geographical Sub Area 6, Northern Spain

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.

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:

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:

The SC endorses the assessment and recommendations

Stock assessment of *Engraulis encrasicolus* in Geographical Sub Area 7-6, Gulf of Lions and North Catalonia

FISHERIES:

Gulf of LIons and North Catalonian anchovy stock is shared by Spanish and French fleets. The Spanish fleet is composed by purse seiners and the French fleet mainly by trawlers and a few purse seine boats.

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:

The WG recommends to maintain the fishing effort and to continue evaluating yearly the state of the stock, due to the close relationship between environment factors and recruitment of the species, that combined with fishing pressure, can result in important fluctuations in the abundance of the stock.

SCSA COMMENTS:

The SC endorses the assessment and recommends not to increase the fishing effort.

Stock assessment of *Sardina pilchardus* **Geographical Sub Area 3 Southern Alboran Sea**

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 1990-2000 collected from commercial landings. The sampling port was Al Hoceima, that 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 $F_{0,1}$ corresponds to 60% of the current fishing mortality. The stock is thus overexploited. The F_{max} could not be estimated because the resulting Y/R curve was asymptotic.

WG MANAGEMENT ADVICE AND RECOMENDATIONS:

No management advice nor recommendations were proposed

SCSA COMMENTS:

This is a preliminary assessment of this fishery using this methodology. The SC recommends to continue further analysis with the available data.

Stock assessment of *Engraulis encrasicolus* in Geographical Sub Area 17 Northern Adriatic

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, Croatia.

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 anchovies decreased in the last years (1997-2001).

Discards: Discards are negligible.

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 (1975-2001). 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 17% of estimated biomass.

WG MANAGEMENT ADVICE AND RECOMMENDATIONS:

The current level of fishing effort should be maintained or slightly increased.

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 should improve the assessment of small pelagics in the Geographical sub area 17, Northern Adriatic.

SCSA COMMENTS:

The SC endorses the assessment and recommends not to increase the effort

The SC noted that in the frame of the ADRIAMED project for the first time an echo-survey has been jointly conducted covering the whole northern Adriatic. The SC recommends to combine this information in the future with on-going assessment programmes in the Adriatic based on VPA

Stock assessment of *Sardina pilchardus* in Geographical Sub Area 17 Northern Adriatic

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, Croatia. 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 2,000 t/year of discards were estimated by a specific research project.

SOURCE OF MANAGEMENT ADVICE:

SAC Assessment form VPA tuned by commercial CPUE (Laurec-Shepherd method)

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:

Monitoring of sardine discards at sea. Market strategies to increase the human consumption of sardine, to diminish discards at sea.

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.

SCSA COMMENTS:

The SC endorses the assessment and recommends not to increase the effort

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

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.

Stock assessment of *Engraulis encrasicolus* in geographical Sub Area 22 Aegean Sea

FISHERIES:

A purse seining fleet based in the ports of Alexandroupolis, Kavala and Thessloniki (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 RECOMENDATIONS:

No comments

SCSA COMMENTS:

is 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 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.

General considerations on small pelagics

In small pelagic fishes, abundance is heavily dependent on recruitment and stock biomass shows high inter-annual variability.

In the fisheries exploiting stocks of anchovies or other small pelagic species, for which the most recent scientific analyses (assessments, DEPM, surveys…) show an evident risk of recruitment overfishing, it is advisable to avoid the catch of fish smaller than their first maturity size.

It would be advisable that biomass estimations be made on a yearly basis in all geographical sub-areas, and scientific advice should be given sufficiently in time to allow the managers to adapt in real time the exploitation to the biological condition of the resources.

6 REPORTING ON THE STATUS AND TRENDS OF STOCKS UNDER THE GFCM MANDATE AS PART OF FIRMS (THE GLOBAL FISHERY RESOURCES MONITORING SYSTEM)

Mr M. Taconet presented the Fisheries Global Information System (FIGIS) from FAO, together with one of its subsystem of direct concern to the SAC/SCSA, the Fisheries Resources monitoring System (FIRMS), and the FIRMS-GFCM case study developed with the assistance of the COPEMED Information System expert Mr A.Bench (Annex 7).

7 REVIEW OF ASSESSMENT METHODS (POINT 1 OF THE TOR FOR THE SAC CGPM REPORT NO 26, ANNEX G)

Mr P. Oliver presented a working document prepared on behalf of COPEMED on methods for assessing Mediterranean fisheries (Annex 8). In this document, some of the existing methods, their data needs and expected outputs are revised to find the most suitable ones for establishing a harmonised assessment methodology in the Mediterranean. The author concludes 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.

This contribution opened a lively discussion as some participants enumerated other assessment methods considered appropriate for stock assessment, 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, comparison of methodologies could give more appropriate information to managers.

After the discussion no consensus was reached. Attendants were invited to produce working papers on these matters. These documents can be sent (deadline 1st June 2002) to the SAC through the national delegates or through the president of the SAC

8 REVIEW THE STANDARDIZED STOCK ASSESSMENT REPORTING FORMAT (POINT 5 OF THE TOR FOR THE SAC, CGPM REPORT NO 26, ANNEX G)

The revision of the assessments endorsed by the SC are presented in a normalised format, following the mandate of the GFCM.

9 UPDATING AND ANALYSES OF THE SHARED STOCKS (POINT 4 OF THE TOR FOR THE SAC, CGPM REPORT NO 26, ANNEX G)

Regarding the updating of the shared stocks, the SC proposed, because of their economical relevance, to include as shared stock in the Adriatic *Nephrops norvegicus*, and to withdraw *Boops boops* in this area. The SC considered also the inclusion of *Coryphaena hippurus* as a shared stock for Spain, Malta, Italy and Tunisia. A common assessment will be carried out next year.

10 UPDATING OF THE PRIORITY SPECIES (POINTS 2,6,7 AND 8 OF THE TERMS OF REFERENCE FOR THE SAC, CGPM RAPORT NO 26, ANNEX G)

Relating the unit stock issue, the SC refers to the paragraphs 21 and 23 of Small Pelagics WG report (Annex 6), that corresponds to two stock-assessment related

studies. The former examined the sardine population structure of the sardine shared stock in the Adriatic, and identified self-recruitment units using genetic marker variation analysis. The latter analyses the mithochondrial DNA of anchovy in the Black and Mediterranean seas and East Atlantic. Moreover during the SAMED seminar held in Rome under the umbrella of SAC, three specific papers were presented regarding *Solea vulgaris* and *Merluccius merluccius*.

Regarding point 6 of the Terms of Reference for the SAC, CGPM Raport No 26, Annex G, the SCSA noticed that a lot of information on biological parameters is provided in the assessment forms presented to the Demersals and Small Pelagics WG's. A review was prepared by Mr. F.Fiorentino in 2000, that could be updated by the results from SAMED seminar. Nevertheless the SC considered that the preparation of the tables as specified in point 6 requires particular dedication to this aim, and asks the GFCM and FAO regional programmes to assist in this compilation.

As for the selectivity parameters, the SC pointed out that during the SCSA meeting held in Madrid in 2000 a document was presented on this matter (Annex 9 to the 2000 SCSA report). Also, during the inter-sessional period a workshop on selectivity, sponsored by COPEMED, was held in Tunisia in 2001. This information could be included in those mentioned in the previous point.

Regarding point 8 of the Terms of Reference for the SAC, CGPM Raport No 26, Annex G, (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 explre different outputs consequent to different scenarios) the available assessment of demersal and pelagic species were presented to the corresponding WG's meetings. Furthermore in order to answer this requirement a simulation was done considering different scenarios for the Gulf Lions hake. See Annex 9 for details on the scenarios and the management option proposed. One of the simulation was aimed at the protection of hake juveniles by increasing lc to 20 cm TL. Also during the SAMED seminar held in Rome in March 2002 several papers on nursery areas were presented.

The SC recommended the inclusion of three sharks species, *Prionace glauca, Lamna nasus* and *Isurus oxyrhinchus* to the list of priority species, in line with the recommendation by the joint GFCM/ICCAT WG.

11 IDENTIFICATION OF BIOLOGICAL REFERENCE POINTS (SUGGESTED BY THE DEMERSALS WG)

This issue was discussed. The SC considered that, at the present moment, the establishment of common biological reference points seems premature, and more assessments are required. However the SC encouraged analyses on the most suitable biological reference points for the main species and methods. A preparation of a commented list of the already used BRP in the assessments produced in the WGs was proposed.

12 OTHER MATTERS

The SC expressed its concern that the GFCM did not adopt some of the management recommendations put forward by the SAC.

Concerning the reduction of the effort addressed to hake, and the management measures proposed for anchovy, the SC feels that the scientific basis for these recommendations were sound enough to be acceptable.

The SCSA expresses its concern that when a situation of overfishing coupled to environmental variability were detected, and no management measure is endorsed, this decision is not in line with the precautionary principle.

The SCSA expresses its concern for the low participation of scientists from many of the Mediterranean countries.

13 SCSA CONCLUSIONS AND RECOMMENDATIONS

The SCSA endorses all recommendations specified in the joint WG GFCM/ICCAT report (Annex 3).

The SubCommittee accorded to propose to the SAC the creation of a crosscutting working group with the mandate to elaborate a Code of Conduct on Sustainable Tuna Farming Practices in the Mediterranean, to provide common guidelines to make this activity a sustainable practice. The concurrence of scientist from ICCAT is recommended.

The SCSA has endorsed 19 of the assessments presented by the WGs. These include 7 species (5 demersal, 2 small pelagics) and 10 geographic sub areas.

	geographical sub areas										
	1	**3**	**5**	**6**	**7**	**9**	**11**	**17**	**20**	**22**	
Merluccius merluccius											**2**
Mullus barbatus											**1**
Nephrops norvegicus											**1**
Aristeus antennatus											**3**
Aristeomorpha foliaciea											**1**
Engraulis encrasicolus											**5**
Sardina pilchardus											**6**
	3	**1**	**1**	**3**	**2**	**3**	**1**	**2**	**1**	**2**	**19**

Regarding *Merluccius merluccius* the two assessments detected overfishing. The assessment of *Aristeus antennatus* (includes three sub areas) showed also overfishing. The assessment of *Mullus barbatus* showed in overfishing some zone of the sub area analysed and that of *Nephrops norvegicus* did not show overfishing. No conclusions were obtained from the *Aristeomorpha foliacea* assessment.

The SAMED project presented assessments based on MEDITS which include 3 species (*Merluccius merluccius, Mullus barbatus* and *Nephrops norvegicus*) in 15 geographic sub areas. For *Merluccius merluccius* temporal closures and effort limitations are recommended. For *Mullus barbatus*, temporal closures and enforcement of measures of protection of shallow waters are recommended in order to reduce mortality and enhance recruitment. For *Nephrops norvegicus* technological improvement is recommended in order to avoid catches of small individuals and reducing the impact of trawl doors.

In small pelagic fishes, abundance is heavily dependent on recruitment and stock biomass shows high inter-annual variability.

In the fisheries exploiting stocks of anchovies or other small pelagic species, for which the most recent scientific analyses (assessments, DEPM, surveys…) show an evident risk of recruitment overfishing, it is advisable to avoid the catch of fish smaller than their first maturity size.

4 of the assessments presented concern shared stocks, which are: *Merluccius merluccius* and *Engraulis encrasicolus* in the gulf of Lions, *Sardina pilchardus* and *Engraulis encrasicolus* in the Adriatic Sea.

Regarding the updating of the shared stocks, the SC proposed, because of their economical relevance, to include as shared stock in the Adriatic *Nephrops norvegicus*, and to withdraw *Boops boops* in this area. The SC considered also the inclusion of *Coryphaena hippurus* as a shared stock for Spain, Malta, Italy and Tunisia.

ANNEXES

1. Agenda
2. Paticipants
3. Report of the sixth GFCM-ICCAT Meeting on Stocks of Large Pelagic Fishes in the Mediterranean (Sliema, Malta, 15-19 April, 2002)
4. Building a framework for sustainable tuna farming practices in the Mediterranean A WWF's call on the GFCM/SAC Subcommittee on Stock Assessment to address the sustainability of increasing tuna farming in the Mediterranean Basin by Sergi Tudela,
5. Report of the Working Group on Demersal Species (Rome, 20-22 March, 2002)
6. Report of the Working Group on small pelagic species (Rome, 20-22 March 2002)
7. Reporting on the status and trends of stocks under the GFCM mandate as part of FIRMS (the global fishery resources monitoring system)
8. Methods for Assessing Mediterranean Fisheries by Pere Oliver
9. Transition analysis of *Merluccius merluccius* in the Gulf of Lions

ANNEX 1

GENERAL FISHERIES COMMISSION FOR THE MEDITERRANEAN

SCIENTIFIC ADVISORY COMMITTEE

SUB-COMMITTEE FOR STOCK ASSESSMENT

ICM-CSIC Barcelona

6-9 May 2002

AGENDA

Coordinator: J. Lleonart

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1. Opening of the meeting
2. Adoption of the agenda and arrangements of the session
3. Review and analysis of the GFCM/ICCAT Working Group on Large Pelagic Fishes
4. Review and analysis of the assessments presented to the demersal Working Group
5. Review and analysis of the assessments presented to the small pelagics Working Group
6. Reporting on the status and trends of stocks under the GFCM mandate as part of FIRMS (the global fishery resources monitoring system)
7. Review of assessment methods (point 1 of the ToR for the SAC*)
8. Review the standardized stock assessment reporting format (point 5 of the ToR for the SAC*)
9. Updating and analyses of the shared stocks (point 4 of the ToR for the SAC*)
10. Actualization of the priority species (points 2, 6, 7 and 8 of the ToR for the SAC*)
11. Identification of biological reference points (suggested by the Demersals WG)
12. Other matters
13. Adoption of the report

NOTES:

* GFCM Report N 26 (Lacco Ameno, Ischia, Italy, 10-13 September 2001, pages 26 and 27

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ANNEX 2

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REPORT OF THE SIXTH GFCM-ICCAT MEETING ON STOCKS OF LARGE PELAGIC FISHES IN THE MEDITERRANEAN

(*Sliema, Malta, 15-19 April, 2002*)

1. Opening of the meeting and arrangements

The meeting was held at the Crowne Plaza Hotel in Sliema.

The meeting was opened by the Hon. Ninu Zammit, Minister of Fisheries and Agriculture of Malta. The Minister highlighted the importance of fisheries -- and in particular of large-pelagic fisheries -- to Malta, and explained that Malta had a long tradition of managing its fishery resources in a conservative, responsible and sustainable way. The Minister also expressed concern for recent trends in large-pelagic fisheries on a Mediterranean-wide scale, and wished the participants a successful meeting that could fruitfully address such concerns and provide needed advice to the General Fisheries Commission for the Mediterranean (GFCM) and the International Commission for the Conservation of Atlantic Tunas (ICCAT). The Minister's speech is attached as **Appendix A**. Dr. Victor Restrepo, Chairman of the meeting, and on behalf of GFCM and ICCAT, thanked Minister Zammit and the government of Malta for hosting the meeting and providing all of the logistical arrangements.

The meeting agenda was approved after minor modifications and is attached as **Appendix 1**. The list of participants ("the Group") is attached as **Appendix 2,** and the list of documents presented as **Appendix 3**. The following participants served as rapporteurs:

Participant	Agenda Items
V. Restrepo	1, 8, 9
J.M. Ortiz and J.M. de la Serna	2
P. Kebe and P. Pallares	3
G. Tserpes and N. Miyabe	4
J.M. Fromentin	5
J. Powers	6
J.A. Camiñas and J. Pereira	7

2. Review of recent fishery developments in participating countries

Cyprus

The large pelagic swordfish fishery in Cyprus is carried out by 25-30 longline wooden vessels that are 15-16 m long, on average. These are multi-purpose boats. Bycatch species caught during swordfish targeting include bluefin, albacore, dolphin fish and sharks. Recent gear modifications have resulted in a marked increase in CPUE. Catches of swordfish were 82 MT in 2000 and 135 MT in 2001.

France

The French Mediterranean purse seine fleet has been comprised of 38 vessels for the last ten years. The fleet is subject to the submission of logbooks in compliance with ICCAT and Community regulations. The information from these documents is cross-checked against landing/trans-shipment information (mainly in Spain from the Balearic trips) to estimate the total catch. The total French catches of East Atlantic and Mediterranean bluefin tuna were 6,748 MT in 2001 (629 MT in the Bay of Biscay, and 6,119 MT in the Mediterranean).

The purse seine fishery is centered on fish of an average size of 10 to 30 kg (mainly age class 2 and 3) in the Spring and Autumn, and is carried out mainly in Gulf of Lyon and the Ligurean Sea. Some vessels explore the fishing areas situated in the central Mediterranean. In June and July, the French fleet mainly directs its efforts towards large fish (140 and 250 kg) coming to spawn around the Balearic Islands. It seems that the level of catches from the Balearic trips are in part determined by environmental factors which influence the availability of bluefin tuna *vis a vis* the fishing gear. It should be noted that the majority of the catches taken in the Mediterranean go directly to Spain to be either landed or put in cages for fattening, which has for some years caused major difficulties in estimating the size composition of the catch from landings.

Greece

The Greek large pelagic fleets exploit mainly the Aegean, Ionian and Cretan Seas but occasionally extend their activities to the eastern Levantine basin. The main target species include swordfish, bluefin tuna and, to a lesser extent, albacore.

Swordfish comprises the main bulk of large scombrid catches in the areas exploited by the Greek fleets and its production during the last decade fluctuated from 750 to 2,500 MT. The swordfish fishing season lasts from February to the end of September, as a closed season is in effect from October to January, aiming to the protection of 0-year olds. Swordfish fishing is carried out using drifting long-lines. The enforcement of the minimum landing size regulation has resulted, to a certain extent, in misreporting of the catches of undersized fish as statistics are mainly collected from landings.

The Greek bluefin tuna production increased from about 100 MT in 1990 to 1,200 MT in 1997. After the establishment of production quotas by the European Community (EC) and the ICCAT recommendations for reduction of the fishing pressure on the stock, a national regulation was enforced in 2001 aiming to restrict the fishing activity for tunas. According to this regulation a special license is required for a boat to enter the bluefin tuna fishery. Most of the boats targeting exclusively bluefin tuna are scattered in the North Aegean Sea, and use mainly hand lines. Their number is estimated to be up to 200 and their fishing activities on bluefin tuna are seasonal. The main fishing period lasts from September to April, following the market's demand.

In the South Aegean the large pelagic fleets target primarily swordfish, and bluefin tuna is a secondary target or by-catch species, at least during the swordfish season. During that period, bluefin tuna fishing is mainly carried out by means of drifting surface long lines. Hand lines are less common and mostly employed from October to January when the Greek swordfish fishery is closed by law.

The albacore fishery is limited to certain areas mostly during the autumn months and is mainly carried out by means of hand-lines, troll-lines and long-lines.

Italy

The Italian fishery for large pelagics showed some dramatic changes in the last five years, due to several factors. The most relevant was the enforcement of the ICCAT regulation on the bluefin tuna quota system, for the first time established in Italy and even in the Mediterranean. To better enforce the quota system, the Italian government adopted a domestic legislation, identifying all the vessels fishing for bluefin tuna and attributing them individual quotas, shared among gears.

The system is quite complicated to monitor (due to the high number of landing places along the Italian coasts), even if each vessel has to submit a statistical declaration of the catches. Any non-utilised or undeclared small percentage of catches by single vessels should add up to important quantities at a national level and for this reason new improvement of the systems are envisioned.

As concerns the bluefin tuna fishery, the catches match the quota but the difficulties to follow this important fishery are increasing due to tuna farming. In fact, only a minor quantity of catches from the tuna purse seine fishery were landed in Italy in 2001, because the tunas were sold at sea in international waters and moved into floating cages in other countries. As a consequence, it was impossible to obtain a size distribution of these catches from landings and this problem is expected to increase in the future. All the catches obtained by other systems show small variations.

The swordfish fishery got a minor quantity of catches, due to the progressive ban of driftnets adopted by the EC and enforced by the Italian government. The shift of the effort to the long-line fishery was only partial and not able to balance the previous production level. The size frequencies of the catches show a stable situation.

The albacore fishery showed a different pattern than in previous years, with a major concentration of catches in two short seasons, possibly due to environmental factors.

The catches of the minor tuna-like species (frigate tuna, Mediterranean spearfish, and others) are only partially monitored, but the situation appears almost stable, within the usual variability.

Several Italian scientific institutions have been involved in various research programs, providing a series of data collection and specific studies on tuna movements, on long-line by-catch, on micro-constituent elements, genetics and swordfish population dynamics. The length frequencies for the various species (based on several thousand samples) and from several areas have been provided in detail to this GFCM/ICCAT meeting, the results of the studies have been provided as well, while others will be presented in the next SCRS (ICCAT Standing Committee on Research and Statistics) meeting.

Japan

The Japanese fishery in the Mediterranean Sea entirely targets bluefin tuna with the use of longline gear. In this fishery, a small amount of swordfish is caught incidentally. Recently, bluefin catch in the Mediterranean Sea has been decreasing from about 800 MT in 1995 to less than 150 MT in 2000, although the fishing effort has been maintained at a relatively high level. There is no significant change in area and season of fishing. Large adult fish migrating for spawning are predominant in the catch. Japan prohibited its longline fleet to fish in this area during the spawning season, which is currently the whole of May. The number of boats is also limited to 35 annually.

Malta

The bluefin tuna season extends from May to July. In 2001 the species was targeted by 58 multi-purpose vessels of less than 24 m in length. The gear used is drifting surface longline. Fishing is undertaken mainly in the southwest area of the region and progressively further from the coast according to the normal movement of the bluefin tuna.

On the other hand, swordfish is targeted throughout the whole year. It is also targeted by surface longlines, which differ slightly from those used for tuna.

The season for dolphin fish starts in August and may extend until the end of January. It is targeted by FADs.

Morocco

In Morocco, swordfish is caught mainly by drift net, while bluefin tuna is mainly exploited by traps, by hand line, and is taken as a by-catch in the purse seine fishery. Over the last ten years the total production of swordfish increased notably to over 5,000 MT in 1997, but has shown a declining trend since 1998. The production of bluefin tuna has shown a tendency to increase, reaching 2,923 MT in 2000. Swordfish taken in the Alboran Sea have an average size (107 cm) smaller than those taken in the Straits of Gibraltar (143 cm). Bluefin tuna taken by hand line have an average fork length of 228 cm. Male swordfish are clearly dominant in sizes below 140 cm, while females are dominant in size classes greater than 150 cm.

Portugal

Portuguese catches of bluefin tuna are mostly made by three gears: bait boat, longline and traps. Other gears catch minor amounts, mostly incidental.

Since 1990, a fleet of three longliners has been operating in the in the eastern Atlantic and in the Mediterranean, catching an average of 300 MT. The Mediterranean Sea has been the main fishing area for this fleet until 1996, but since 1997 fishing has taken place mostly in the eastern Atlantic. A total of 448 MT of bluefin were caught during 2001 but only 64 MT were from the Mediterranean. Minor catches of swordfish and albacore are also caught incidentally by this fleet.

One trap has been operating in the South of Portugal since 1995. In 2001, the bluefin catch taken by this trap amounted to 15 MT.

Bluefin catches taken by the bait boat fleets, which operate around the Madeira and Azores islands are quite variable from year to year and are related to the local abundance of bluefin in the proximity of the islands. In 1997 and 1998 a great increase of the abundance of large bluefin tuna around the islands was observed. This was reflected in the bait boat catches, which reached 447 and 265 MT, respectively. In 2001 the catches dropped down to 2 MT in the Atlantic islands.

Spain

In the Mediterranean Sea, the Spanish fisheries targeting bluefin tuna reached an average catch of about 2,500 MT for the last two years. Purse seining represents 69% of the total catch, longline 23%, hand line 4% and bait boat and surface gears around 2.5%. The catch for the traps in the Mediterranean Sea has been almost insignificant for the last seven years. For 2001, catch and fishing effort remained stable.

As regards swordfish, it is caught by longline. Average mean catch for the last few years was 1,300 MT. Swordfish is exploited throughout the whole year with maximum activity during summer and autumn months. In 2001, swordfish catch and fishing effort remained stable.

Albacore is captured by surface longline, bait boat, trolling and surface gears. Average catches for the last years reached 310 MT. In 2001, fisheries targeting albacore remained stable as regards catch and fishing effort.

Small tuna in the Mediterranean Sea are caught by surface gears and traps. Frigate tuna represents the highest fraction of the catch (800 MT), followed by the Atlantic bonito (400 MT).

During 2001, projects DG-XIV-97/029, 97/050 and 97/074, funded by the EC and dealing with bluefin tuna, swordfish and sharks biological and fishing research, were completed. Projects DG-XIV-99/022 and 99/032 dealing with bluefin tuna historical series analysis, swordfish abundance indices standardization and swordfish sexual maturity by means of histological analysis, respectively, will continue. Project FAO-COPEMED Large Pelagic 2001, the participating countries of which are Morocco, Tunisia, Libya, Malta and Spain, will continue. Results from project FAIR- 97/3975 EU dealing with bluefin tuna electronic tagging were submitted. The On-Board Observers Program, coordinated by Project 408 of the Spanish Institute of Oceanography (IEO, Málaga, Spain), will continue. Furthermore, seven scientific documents were submitted to the SCRS and other ICCAT meetings. As regards the current GFCM- ICCAT meeting, five documents dealing with bluefin tuna and swordfish were submitted.

Tunisia

The fish commonly grouped in the category of large pelagics are among the most important of all around the coasts of Tunisia, particularly bluefin tuna (*Thunnus thynnus*), little tuna (*Euthynnus alletteratus*), bonito (*Sarda sarda*), frigate tuna (*Auxis rochei*) and swordfish (*Xiphias gladius*).

The first two species continue to give rise to a local industry, as a large part of the fish caught is processed in canning. Bluefin and swordfish comprise the species preferred by the export market. These products are largely directed towards Japan and some European countries. In 2001, an important proportion of the purse seine bluefin catch, estimated at 1,400 MT, was exported to Spain for fattening before their export to Japan.

Although the number of tuna vessels has fallen considerably from 70 units in 1999 to only 45 in 2001, total catches, particularly of bluefin tuna, have not fallen.

Currently almost 45 tuna vessels measuring between 15 and 38 meters in length overall are dedicated to tuna fisheries along the Tunisian coasts. About forty longline vessels continue to operate in Tunisian waters targeting swordfish. The main effort is concentrated towards the north of the country. Nevertheless, since 1998, this activity has become more generalized along the entire coastline of Tunisia.

In 2001, catches of tuna and tuna-like species (swordfish) reached 8,482 MT. In terms of proportion, small tunas constitute 60% of the total catch at 5,628 MT, while the catch of bluefin tuna is estimated at 2,287 MT, representing only 27% of the catch. The proportion of swordfish catches remains at about 7%, at 567 MT. The weight of the fish caught varies from 50 kg to more than 250 kg.

The landings of bluefin purse seiners currently constitute 90% of the national catch.

The contribution of two traps to the national catch of bluefin tuna is disappearing more and more. In 2001, the production of traps did not exceed 3 MT, representing less than 2% of the bluefin tuna catches.

As regards research activity, Tunisia continues to participate in an ambitious research programme aimed at improving knowledge on the biology and ecology of large pelagic fishes in the Mediterranean. Said programme

is jointly funded by FAO/COPEMED and the Institut National des Sciences et Technologies de la Mer (INSTM, Tunisia).

Turkey

In 2001, the catch of bluefin tuna in Turkish waters was carried out by 25 purse seiners. The fishing began in February and continued until the middle of July. In February, March and April, the catch of bluefin tuna was conducted in the North and Central Aegean Sea. In May, June and July, catches were made in the eastern Mediterranean Sea, especially in the Bay of Antalya. The evaluation of the catch data for 2001 is not completed. The total bluefin catch for 2001 probably will be around 2,300 MT.

As regards swordfish, in 2001 in Turkish waters it was caught in the northern part of the Aegean Sea by drift nets and longlines and in the Mediterranean Sea by longlines. In 2001 a total of 510 MT of swordfish were caught in Turkish waters.

On the other hand, Turkey is going to start the fattening of bluefin tuna in the summer of 2002. One farm with a capacity of 840 MT per year will begin to operate in Gazipasa, in Antalya bay.

In 2001, around 14,000 MT of bonito (*Sarda sarda*) were caught mainly by Purse Seiners in the Black Sea, the Sea of Marmara. Considerable quantities of Atlantic little tunny (*Euthynnus alletteratus*), frigate tuna (*Auxis rochei*) and albacore (*T. alalunga*) were also caught by purse seiners in the eastern Mediterranean Sea.

3. Review and updates to biological knowledge and fishery database

The ICCAT Secretariat presented catch tables by fleet, gear and year for bluefin tuna, swordfish, albacore and small tuna in the Mediterranean Sea, as well as catalogues of data available (ICCAT Task I and Task II) for bluefin, swordfish, albacore and sharks. The catalogue tables were updated during the meeting and are attached as **Tables 1 to 4**.

FAO provided the Secretariat with table showing the discrepancies between the FAO database and the ICCAT databases for the Mediterranean area. The Group noted that most discrepancies referred to small tunas and countries that did not normally report to ICCAT. Participants recommended that the ICCAT Secretariat and FAO continue to collaborate in order to improve their catch data bases, while attempting to minimize duplication of work by national scientists and correspondents.

3.1 Bluefin Tuna

Ten documents were presented, seven regarding biology and three relating to statistics.

Biology

Document SCRS/02/033 presented length-weight relationships for bluefin tuna from the eastern Mediterranean Sea. The estimated models were based on data from the Greek fisheries exploiting the Ionian, Aegean and Levantine Seas and allow conversion from upper jaw fork length to gilled-gutted weight and from pectoral fin-fork length to dressed weight.

Document SCRS-02/041 presented the results of the larvae survey carried out by the IEO around the Balearic Islands during June-July, 2001. Number of bluefin tuna, albacore and frigate tuna larvae and larval density distribution are reported as well as oceanographic factors for the characterization of the prospected area.

Document SCRS- 02/045 presented a sex- ratio by length class analysis for bluefin tuna caught by the Spanish traps in the Strait of Gibraltar and the purse seine and longline fisheries in the Mediterranean Sea. The observed differences are explained in the light of differential growth rates and differential maturity patterns depending on the origin of the fish.

Document SCRS/02/48 gives a description of the Moroccan tuna fisheries, including biological elements collected in accordance with ICCAT recommendations and in collaboration with FAO and COPEMED projects. The Moroccan tuna fishery centers essentially on the exploitation of swordfish and bluefin tuna. Swordfish is

caught mainly by drift net and bluefin tuna mainly by trap and hand line, and as by-catch in the purse seine fishery. Production of bluefin tuna has displayed an increasing trend, reaching 2,923 MT in 2000.

The fishing effort of Atlantic traps has progressively increased between 1986 and 1992, followed by a phase of decline until 1997. It has showed a slight renewed increase since 1998. This increase in fishing effort during the period 1986 to 1992 is explained by the increase in the number of operational traps, which has increased form one unit in 1986 to five in 1992. Bluefin tuna exploited by hand line has an average fork length of 228 cm.

Documents SCRS/02/50, 51, 52 and 53, presented by Tunisia, were written thanks to the FAO/COPEMED project which financed a line of research on large pelagic fishes, in accordance with the ICCAT recommendations, which aimed to improve knowledge of the Mediterranean fisheries, in the areas of fishery statistics and biological and environmental research.

Document SCRS/02/051 presents estimates of size-weight relationships based on sampling carried out on these fish in 2000 and 2001. The curves derived from this work match, or almost match, those found by other authors who have carried out the same research.

Document SCRS/02/052 gives an overview of the variations in of the gonado-somatic index (GSI) of fish taken by Tunisian purse seiners during the spawning period in the 2000 and 2001 seasons. In general, we have concluded that the GSI is more important in small size adults, and decreases markedly as the size of the animal increases. For both the sexes, the older individuals have an earlier spawning period.

Document SCRS/02/53 based on 1,839 observations of sex and fork length of bluefin tuna landed by Tunisian purse seiners presents an analysis of the sex ratio of these fish. During 2000, females were dominant, which was judged to be the result of sampling error. Furthermore, these results were totally contradicted during 2001 when, thanks to a significant number of samples, an equitable distribution of the two sexes was observed.

The Group noted discrepancies between the sex-ratio presented in document SCRS/02/045 and SCRS/02/053. Nevertheless, these differences may be due to a fishing gear effect.

After some discussion the Group decided that the new biological data and length-weight relationships presented should be considered as preliminary, and that the current biological parameters used in assessment by ICCAT should be maintained.

Given the results of recent larval surveys (SCRS/02/41), the Group considered that it would be opportune to continue this research beyond 2002, although funding is not yet available for studies after this year.

Statistics

Revision of ICCAT Task I and Task II data

Document SCRS/02/38 provided a short description of the Turkish bluefin tuna fishery in 2001. Fishing by purse seiners began in February and continued until the middle of July. In October and November, bluefin tuna were caught by hand lines in the north Aegean Sea. The Turkish purse seiners found, in May 2001, a new bluefin tuna catch area, about 30-40 miles from the port of Antalya, in the eastern Mediterranean Sea. From May to 15 July, the majority of the catches of bluefin tuna were made in the new catch area in the eastern Mediterranean Sea. The length frequency distribution of 328 bluefin tuna in Turkish waters caught by purse seiners is illustrated in the document. The length of these bluefin was between 81 cm and 269 cm (mean of 145 cm ±2.27 cm). The evaluation of the catch statistics for 2001 is not completed. The catches for 2001 will probably be about 2,300 MT. As larval investigations of bluefin tuna and other big pelagic fish have not been carried out in this area, it seems necessary to conduct larval investigations in the eastern Mediterranean Sea and in the vicinity of the Bay of Antalya.

Document SCRS/02/46 discusses the major changes which happened in the bluefin tuna fishery after the adoption of the quota system in 1998, which strongly affected the possibility of collecting good statistical data: fishermen are more afraid and the development of the tuna farming and fattening reduced the availability of size frequencies from the purse-seine fishery.

For this reason, all the data are becoming more important for the statistical system. The bluefin tuna data collected, among serious difficulties, refer to one of the most important areas in the Mediterranean (Sicily and Tyrrhenian areas) and they can offer a comparison between the previous data sets and the current situation.

The most recent years provided a total of 12,743 bluefin tuna samples, among which only 507 were obtained in 2001, confirming the extreme difficulty involved in obtaining them. The average length (FL) was 201.4 cm in 1998, 154.8 cm in 1999, 161.2 cm in 2000 and 145.9 cm in 2001, but the differences are mostly linked to the quantity of purse-seine catches in the sample, as well as to the presence of small tunas caught by some minor fisheries.

Document SCRS/02/48 - See section 3.1 above

Document SCRS/02/50 presents a breakdown of the landings of 45 tuna purse seiners targeting bluefin tuna, based on monthly sampling carried out on this species. Based on weight of sample and the demographic breakdown, monthly national production was computed by multiplying the number of fish sampled by the conversion factor obtained. The study showed that in 2000 the purse seiners targeted individuals of lower age classes (30 to 60 kg), while in 2001 the situation changed through the presence of 11.2% of fish greater than 200 kg.

As a result of COPEMED support, new catch and effort data, as well as size frequency data (1999-2001) were provided from Morocco, Libya, Malta and Tunisia. Greece also provided size frequency and catch and effort data for 2000; France provided size frequency data for 1999-2001, and Italy size frequency for 1998-2001. These new data will be incorporated into the ICCAT database and summary tables accordingly.

As a general rule, the Group recommended that original size data should be provided, and that raised or otherwise processed data should be accompanied by an explanation of the process used.

The Group discussed the historical revised catch data from Malta. This revision was presented last year during the SCRS plenary too late for the ICCAT Bluefin Tuna Species Group and the ICCAT Sub-committee on Statistics to review it. The Group considered that the new procedure used by Malta to estimate their catches improved the statistics and consequently recommends to the species group that these data be accepted and included in the ICCAT database. At the same time, the Group recommended to Malta to present this revision as an SCRS document rather than include it in their national report, and to present it at the next bluefin tuna assessment in July 2002.

Estimation of unreported catches

Three points were raised on this issue. The first discussion centered on whether NEI ("not elsewhere included") estimated catches should be changed if ICCAT Task I or trade data from the bluefin tuna statistical document program was changed or revised. The Group agreed that such data should be revised in this event.

The second discussion was about whether or not to apply conversion factors to trade data to Contracting Parties. The Group decided that conversion factors should be applied in all cases for consistency, except data resulting from farmed belly meat products. The reason for this decision is that there is a good possibility of double-counting when farmed belly meat is exported in different shipments from other tuna products, mainly due to the differences in prices between these products. It was confirmed that the factor of 0.8, which is currently applied to farmed tuna (i.e., assuming 25% gain in weight during fattening), should be maintained.

The third issue discussed concerned whether or not the category of NEI combined should be maintained, and if so, which countries should be included. After considerable discussion relating to the merits of aggregation and dis-aggregation the data of each country, it was decided to maintain all the countries presently included in this category (Croatia, France, Italy, Morocco, Portugal, Spain) together with Libya, Malta and Tunisia. The list of countries included may be changed according to developments in the markets and the industry. The Group agreed that re-export data, available since 1999, should be included in the estimation of unreported catches, unless the importation was reported to the Commission by the first importing country. The reason for this is that the re-exports reported by Japan in its biennial summaries to the ICCAT Secretariat are simply imports into Japan that originate in a given country but which went through other countries before reaching Japan; thus these entries for a given country of origin are labelled as "indirect imports" in **Table 5**. It was also agreed that a summary table should be included in the report to show an estimation of the unreported catches (**Table 6**), as well as a table showing a detailed comparison of catch and trade data for all countries (**Table 5**). It was agreed

that the following note would figure on the detailed table: “Negative differences between Task I and trade data may be due catches of third parties being exported to Japan from the country for which the negative difference appears, although the catches were not made by the latter”.

The formulation used to compute NEI (unreported) catches was:

NEI = A – B – C – 0.8xD

where

A = Task I (reported catch)
B = Imports into USA
C = Imports into Japan for all products excluding farming (includes indirect imports, or “re-exports”)
D = Imports into Japan for farming products (includes indirect imports, or “re-exports”)

3.2 Swordfish

Four documents were presented: one relating to biology, two to statistics and one to both biology and statistics.

Biology

Document SCRS/02/032 presented a series of length-weight relationships for Mediterranean swordfish. The estimated equations were based on an extended data series (about 25,000 observations) from the main Greek and Italian fisheries and allow conversions from lower jaw fork length to gilled-gutted weight. Differences on the length-weight relationship among fisheries and month of capture were found to be statistically significant. Regarding the new length-weight relationship presented (SCRS/02/32), the Group considered that differences with the curve currently used in assessment could be due to discrepancies in the size distribution used. In many cases, the main differences affected the bigger size classes (greater than 190 cm), which are not common in catches. The Group recommended that the authors revise the document to include the basic size data used.

Document SCRS/02/39 provides a short description of the Turkish swordfish fishery in 2001. In 2001, swordfish in Turkish waters were caught in the Aegean and in the Mediterranean Sea. A total of 510 MT of swordfish were caught. The length distribution of swordfish in 2001 in Turkish waters is illustrated in the paper. The measured lengths of 111 specimens were between 70.5 cm and 185 cm LJFL (59.46%). Regarding the total number of the sampled fish, 115 cm (12.6%) and 110 cm (10.8%) length classes were more numerous than the other length classes. The total number of sampled swordfish under 135 cm (LJFL) was 72.97%.

Document SCRS/02/48 describes Moroccan tuna and swordfish fisheries. Swordfish are caught mainly by drift net. During the last ten years, the total production of swordfish has increased notably, and exceeded 5,000 MT in 1997, but has shown a decreasing trend since 1998. The swordfish catch of vessels fishing with drift nets from the port of Nador remained practically stable between 1990 and 1994, when it began to increase, reaching a maximum in 1998, followed by a decline until the year 2000. In 2001 the number of vessels was 357. Swordfish taken in the Alboran Sea are of a smaller average size (107 cm LJFL) than those taken in the Straits of Gibraltar (mean = 143 cm LJFL). Male swordfish are clearly dominant in the size range of less than 140 cm LJFL. Females are dominant in sizes greater than 150 cm LJFL. In relation to differences in growth and maturity between the Atlantic Ocean and Mediterranean Sea suggested in SCRS/02/048, the Group decided that there were no new elements to add to the discussions held during the GFCM/ICCAT Bari meeting of 1995. The Group noted that direct comparisons of results cannot be easily made because the various past studies are based on different data sets and do not always follow similar methodological approaches.

Statistics

Document SCRS/02/48 - See section 3.1 above

Document SCRS/02/39- See section 3.2 above

As a result of the COPEMED support new catch and effort data as well as size frequency data (1999-2001) were provided from Morocco, Libya, Malta and Tunisia. Greece provided size frequency for 2000 and catch and effort data for 1988, 1992, 1994, 1995, 1998, 1999 and 2000, and Italy provided size frequency data for 1998-2000. These new data will also be incorporated into the ICCAT database, and the summary tables were updated accordingly.

The Group asked Turkey to submit the new data mentioned in document SCRS/02/039 to the ICCAT Secretariat.

Document SCRS/02/054 provides total catch and effort statistics from Cyprus.

3.3 Albacore

One document was presented during the meeting.

Biology

Document SCRS/02/044 updated the information on the Spanish longline, bait boat, troll and surface fisheries directed to albacore (*Thunnus alalunga*) in the Mediterranean Sea for the last years. Data on catch, fishing effort, CPUE and size distributions by spatial- temporal strata are reported.

Statistics

Size data from Italy for the years 1998-2001 were submitted to ICCAT and will be incorporated in the database. Catches for Greece purse seiners (1999-2000) were reclassified from purse seine to unclassified gear.

It was noted that some historical Turkish bluefin tuna catches reported to ICCAT may have been albacore.

3.4 Sharks

Two documents were presented to the Group.

Biology

Document SCRS/02/043 reported biological and statistical information on *Prionace glauca* caught as bycatch in the Spanish longline swordfish fishery in the Mediterranean Sea.

Statistics

Document SCRS/02/042 reported statistical information on the species associated with the Spanish longline swordfish fishery in the Mediterranean Sea for 1999 and 2000. Estimates are made by at-sea observers, but all *Prionace glauca* are landed.

The Group reviewed the catalogue provided by the Secretariat, and noted that data for 2000 from Spain was missing. It was agreed that the table would be updated by the Secretariat.

FAO announced that in recent years the breakdown by species of the FAO shark statistics has improved thanks to better reporting from some countries and as additional sources became available (e.g., ICCAT bycatch data). Italy proposed to recuperate information from on-board observer programs which had been undertaken within European Community Projects.

3.5 Other species

One document (SCRS/02/049) on dolphin fish (*Coryphaena hippurus*) was presented to the Group.

Some discussion as to whether this species was within the mandate of the Group arose. However, as it was one of the GFCM priority species, it was pointed out that the GFCM-ICCAT forum was the only place where scientific discussion on this species could take place.

Biology

Length frequency distributions by month and area strata collected during the 2001 Maltese fishery are included in document SCRS/02/049. It was reported that population dynamics data on this species have been collected by Italy, Spain, Malta and Tunisia within the framework of the COPEMED project since 2000 and by

other EC-funded projects before this date. These data are currently being processed and a final report will be drawn up by the COPEMED group by July 2002.

Statistics

Catch and effort data for the Maltese dolphin fish fishery are presented in SCRS/02/49.

4. Evaluation of data availability and feasibility of assessments in the near future

The Group evaluated the available data by species in the ICCAT database and discussed their adequacy for relevant assessments in the near future. The discussion is summarized below:

Bluefin tuna

An assessment of the east Atlantic-Mediterranean stock is scheduled for July 2002. Some CPUE data from various fisheries were mentioned or available during the meeting and it is expected that updated or new standardized CPUE data from the Moroccan, Spanish, Japanese and Turkish fisheries will be available in time to be used for the July 2002 assessment. The Group suggested that an effort should be made to include data covering the year 2001 too. However, bearing in mind that the shortage in the data that are required for stock assessment has been improved, it would be very difficult a full-scale assessment for this stock. Therefore, it was suggested that simpler methods and other approaches (e.g., simulations) be conducted in order to estimate at least an abundance trend for the stock.

Swordfish

SCRS/02/034 presented a preliminary assessment of the Mediterranean stock based on fisheries data from the central and eastern Mediterranean. Results revealed the existence of relatively stable recruitment and exploitation patterns, but further investigation was suggested on: (a) the assumption that the length composition of the catches of the examined fleets is representative of the Mediterranean situation and (b) the sensitivity of the stock estimates on the methods employed for calculating standardized CPUE time series.

The Group noted that the quality and quantity of the available data has been greatly improved since the 1995 preliminary assessment. Although it was noted there are still several gaps in the available data series, the Group felt that the SCRS should examine the possibility of conducting a tentative assessment in the near future.

Albacore

The Group was of the opinion that the available data are very poor to allow any reliable assessment in the near future. It was stressed the need to obtain more information, especially regarding Task II and size data.

Sharks

The ICCAT and FAO databases concerning shark statistics have been considerably improved. It is expected that the new data collection systems that are established in the EU countries will facilitate the collection of the relevant data from the various Mediterranean fisheries capturing sharks. Observer programs that operate in various fisheries (e.g. tuna) having shark by-catches could also contribute to the collection of shark statistics. However, it was noted that GFCM does not include sharks in its priority list of species and it was stressed the importance of finding additional funds and staff to support the consistent collection of shark statistics and research needed for stock assessment in the Mediterranean.

Dolphin fish

The Group was informed that an assessment is planned for the species in the near future. However, it was noted that additional data are needed, as several aspects regarding the species biology and exploitation pattern are still poorly known.

5. Effects of bluefin tuna farming on stock assessment

Three documents have been presented in relation to this topic: SCRS/02/35, SCRS/02/36 and SCRS/02/37.

Document SCRS/02/35 focuses on the difficulties to estimate size composition of the catch of the French purse seiners (PS). From the late 1970s to the mid-1990s, size frequencies were calculated through the sale records of the French local seafood traders. However, the rapid spatial expansion of the fishery during the 1990s made this sampling strategy progressively inadequate. The 2001 size composition of the catches of the French PS was therefore estimated from the EU log-books. Size frequencies appeared roughly in agreement with those estimated from the local seafood traders between 1982 and 1998, but its accuracy remains uncertain because of a lack of a standard protocol and of sampling on catch coming from heterogeneous and/or multiple shoals. The document concluded that an observer program should be implemented to correct and validate these estimations.

Document SCRS/02/36 reviewed briefly the history and current status of bluefin farming in the Mediterranean. Initially (since 1979) large lean fish captured in the trap were used for farming, using a fixed cage of 70x40x20 meters. However, since 1996, small to medium size fish caught by purse seiners are mostly used in cages of 50m diameter and 20-30 m depth. Except for a few experimental cases where fish are kept over years, they are fattened only for several months and mostly exported to Japanese Sashimi market. The paper discussed benefit of the farming (e.g. increased price, market, quality of small tunas, new jobs etc.) as well as problems associated with farming (difficulties in getting accurate catch, identification of fish, sampling, encouraging effort for small fish, environmental and socio-economic problems).

Document SCRS/02/37 gives the opinion of the ICCAT Secretariat regarding the reporting of the Mediterranean BFT catch that goes into cages for fattening operations. The ICCAT Convention together with the United Nations Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (UNFA) should be interpreted as a requirement for the flag States involved in the initial capture of the tuna that are destined for caging to report the relevant fishery statistics to ICCAT. There are practical difficulties to obtain reliable catch statistics for these fisheries, particularly if the system relies solely on logbooks. But these difficulties are far from insurmountable as they could be tackled with, for example, observer programs and modified Bluefin Tuna Statistical Document (BTSD) and indirect sampling methods.

There was a general agreement within the Group to recognize that BFT fattening operations significantly affect BFT data collection, and consequently the stock assessment procedure. The difficulties to estimate size composition of the catch are, for instance, encountered by all countries having PS fleets involved in farming operations. Several possible solutions, such as observers on board, modified BTSD, cameras to get the length of the fish within the nets, have been discussed. It was also noted that FAO is reviewing the effects of fattening operations of various fish species on wild stocks. The situation of Mediterranean BFT fattening in 2001, its impacts on stocks assessment and the possible solutions that could be implemented, are listed below.

The present situation of Atlantic bluefin tuna fattening in the Mediterranean

Economic gains in Atlantic bluefin tuna (BFT) fattening have lead the private sector to invest into this relatively new culture system. The interest over the past few years has increased remarkably as reflected by the increased number of fattening units established throughout the Mediterranean Sea and new licence applications being submitted to the relevant national authorities. From 1996 to 2001, there was at least a 20-fold increase in the number of cages in the Mediterranean (this expansion being probably under-estimated, see SCRS/02/36). The import of farmed BFT to Japan started in 1997 and reached more than 7,700 MT in 2001 (SCRS/02/36), so that about 2/3 of the Mediterranean BFT imported to Japan now originate from caging (SCRS/02/37).

BFT fattening is defined as the collection of wild specimens ranging from <10 kg to fish >200 kg being confined within large floating netcages (diameters from 50-100 metres) for periods spanning from a few months up to 2 years (in Croatia). From this point onwards weight increments are gained through standard ongrowing fish farming practices. However, this farming technique should not be referred to as a true form of aquaculture practice as the initial stages of the life cycle are not controlled and artificially propagated. The Group further discussed whether the term “farming” should be avoided, since it could be also understood in the sense of aquaculture. This term is, however, generally used in the ICCAT Commission as “keeping fish in a cage for few months to increase fat contents and hence fish value”. The Group agreed to use either “farming” or “fattening”.

To-date, and for the foreseeable future, the fattening of Atlantic bluefin tuna exclusively relies on the supply of wild caught fish. This trend is likely to continue until the successful and economical closed cycle of BFT is achieved through applied and co-ordinated research programmes and projects, such as DOTT (Domestication of *Thunnus thynnus*, see http://www.mu.ieo.es/thunnus/) funded by the EC. The fattening process of BFT is a relatively simple practice with fish been typically fed a variety of small pelagic species as well as cephalopods such as squid. Imports of frozen fish such as herrings and mackerels from Northern European countries constitute the major component of the diet fed to the confined tunas. It appears, however, that established fattening units also supply themselves with fresh bait obtained from local fishermen and not necessarily statistically recorded.

Farmed BFT are mostly provided by Mediterranean purse seiners and to a lesser extent by traps. The transfer of live fish from the seine to the towing cages is done in the open sea (generally where the catch has occurred), simply by joining both nets. Depending on the fishing area, the transfer of the towing cage takes from few days to several weeks (the speed of the tugboat being ~1 kt). The counting of the fish within the seine is done by divers and persons on board. Furthermore, some cameras are used to count the fish when they go from the seine to the towing cage. Mean weight is preliminarily estimated through dead fishes in the seine, then it is later assessed when tunas are transferred into ongrowing cages. Though some attempts have been made to use cameras for estimating length of the fish, but the size composition, and hence the total weight, are still crudely estimated. This problem can induce long disputes between fishermen and farmers.

Impacts of farming

The development of farming has generated several problems that make the assessment and management of the bluefin tuna stock more difficult. The Group listed main difficulties that have been clearly documented and on which it has expertise and mandate:

Statistical effects:

- Total weight of the catch more difficult to estimate than before (ICCAT-Task I)
- Deteriorating precision and accuracy of the size composition of the catch (ICCAT-Task II)
- Loss of information about the origins of the catch (flag, area, season, transfer and destination)
- Abundance trends of purse seiners (PS) hard to estimate because of changes in fishing effort and fishing strategy being difficult to quantify (ICCAT-Task II)
- Lack of information on growth and conversion rates in cages[1]

Biological effects:

- Loss of the availability of biological samples (to perform studies on fecundity, reproduction and growth), due to a decrease in landings [2]

Management effects:

- Make current regulations, such as TACs and size limits, more difficult to assess
- Induce conflicts between fishing activities (e.g., between towing cages and long liners, LL)
- Induce shift and concentration in the fishing effort of PS in some areas

Potential problems that could arise in near future, but for which the Group has no mandate (e.g. allocation issues) nor the expertise, is listed below:

Potential environmental effects:

- Impact on wild marine populations used as bait
- Pollution, contamination and possible alteration of local environments
- Contamination of farmed tunas by chemicals, metals, drugs, etc.,.

Potential social and economical effects:

- Interactions with various coastal activities, such as tourism and small-scale fisheries
- Gears and fishing operations conflicts
- Conflicts between aquaculture operations (competition for bait)

[1] Data required in relation to bluefin tuna statistical document (BTSD) to backcalculate weight at catch

[2] The impact is mainly negative at present, but could be also positive in future if access is given to scientists to perform experiments and/studies on reared tuna.

Potential management effects:

- General increase in fishing effort of PS and, in near future, probable increase towards small to medium size bluefin tuna

Potential solutions of these various difficulties could be (without any consideration about the priority of the following points):

- Observers on board and on cages (relate to: 1.1, 1.2, 1.3, 1.4; 2.1; 3.1, 3.2)
- Adaptation and application of imaging technology to measure transferred fish (relate to: 1.1, 1.2; 3.1)
- Extension and modification of the BSTD to alive fish (relate to: 1.1, 1.2; 3.1)
- Modification of the log-books to report details on fish transferred into pools (relate to: 1.1, 1.2; 3.1)
- Implementation of cooperation between flag and farming countries as well as imported markets (relate to: 1.1, 1.2, 1.3; 3.1)
- Surveys, monitoring and studies on: the biology of wild and farmed fish (relate to: 1.5; 2.1), the environmental impacts of farming (relate to: 4.1, 4.2, 4.3) and social and economical consequences of farming (relate to: 5.1, 5.2)
- Regulation of farming activities (e.g., regarding the number and location of the cages, relate to: 6.1).

6. Responses to GFCM

At the Twenty-sixth Session of GFCM the Commission recommended that the Joint GFCM/ICCAT Working Group on Stocks of Large Pelagic Fishes in the Mediterranean address the Commission's "concerns on the sustainability of the bluefin resources including developments in bluefin tuna penning/farming in the Mediterranean."

The above recommendation is very broad and far-reaching and cannot be fully evaluated at the current meeting. However, the Commission should note that Section 5 of this report discusses some details on existing and potential issues associated with "penning/farming," in particular possible statistical, biological, environmental, socioeconomic and management effects. While the Group has neither the information nor the expertise to fully determine the effects, there are several potential solutions that Mediterranean countries should consider implementing (as noted in Section 5).

Additionally, the Group notes that the sustainability of bluefin tuna will be addressed through the ICCAT/SCRS bluefin working group analysis of the stock assessment data. An assessment meeting of this group is scheduled for the end of July 2002. The report of that working group will be reviewed by the SCRS in October. However, there are still limitations with the stock assessment data from the Mediterranean and other areas. These limitations have been reported in previous SCRS reports and some of the limitations are discussed in this document. Therefore, it is expected that the results of the assessment will still have important uncertainties.

7. Recommendations

General

1. Most of the recommendations made by the Group require an increase in the workload of the experts in the area and can only be carried out with the corresponding support through human resources and funding. The Group notes increasing difficulties in the access to the necessary funding and therefore recommends that the required steps be taken, both by the Regional Fisheries Organizations and by their members, to provide the resources needed to carry out the work that is mandated.

Statistics

2. Various Mediterranean countries use drift nets to catch tunas and tuna-like species. An increase in the use of these gears by some countries was noted during the meeting of the Group. In some cases, the experts have not presented information regarding the fishery, description of fishing gear, catches, or any other useful information for the assessment and management of the fisheries. The Group recommends that in order to facilitate the standardization of data with regard to the various gears included in the "drift net" category, detailed catch and operational information about the fishery be submitted by those countries which have not already done so.

3. Activities relating to the fattening of tunas caught from the wild stocks are denominated in various ways according to whether they are carried out by working groups on marine culture or fisheries, and differences have also been observed in the denominations given by ICCAT and FAO (e.g., fattening, farming, caging, penning). The Group recommends that common definitions be adopted for the terminology relating to this activity, if possible with the help of the Coordinating Working Party on Fishery Statistics (CWP). To this end, it is recommended that those responsible for the FAO, GFCM and ICCAT Glossaries collaborate in order to agree on common definitions.

4. Currently, there are difficulties in estimating bluefin tuna catches. Although data on farming operations are not directly related to ICCAT's mandate to collect statistics from capture fisheries, the reporting of such data to ICCAT would allow for more complete catch estimates. It is recommended that data on bluefin farming (inputs and outputs to fattening operations) be reported to ICCAT.

5. The Group noted that migratory sharks do not figure on the list of priority species of the GFCM. Given that the members of ICCAT are obliged to present information on by-catches of shark taken in the tuna fisheries, the Group recommends that the GFCM adopt the same measures as ICCAT and that such measures be implemented in the countries in the area. The relevant catch and sampling statistics should be transmitted to ICCAT. At the same time, the GFCM should include those species for which ICCAT is compiling data on its list of priority species (*Prionace glauca*, *Lamna nasus* and *Isurus oxyrinchus*).

Research

6. The Group recommends that more biological studies be carried out on the maturity of swordfish caught in the eastern Mediterranean, with the aim of testing whether the currently adopted maturity ogive (Bari, 1995) should be revised. The Group also requests that progress be made in the comparison of gonadosomatic indices corresponding to individuals caught in the same area and obtained by the same methods, before initiating a comparison of indices from different areas of eastern and western Mediterranean.

7. As regards the possible inclusion of dolphin fish (*Coryphaena hippurus*) as a species to be considered by the Group, it was recommended that those countries involved in the fishery of this species in the Mediterranean, which participated in a joint project financed by FAO-COPEMED on this species (Spain, Malta, Italy and Tunisia), carry out an assessment on this stock next year. The Group recommends that this evaluation be presented to the next GFCM/ICCAT Group for validation.

8. Progress has been made in recent years regarding information and data on Mediterranean swordfish. Various projects financed by the EC and national governments have permitted the compilation of the historical data of some fisheries. The FAO-COPEMED Project has facilitated the collection of more recent information in several countries in the south of the basin. The Group believes that sufficient progress has been made for the ICCAT SCRS to carry out an assessment of Mediterranean swordfish within the next two years. However, it is noted that many gaps still exist in the database. Therefore, the Group recommends any available historical or recent data that are not part of the ICCAT database be transmitted to ICCAT. As well, assessment scientists should develop methodologies that can treat missing data appropriately.

9. Interested scientists should collaborate together with ICCAT to raise awareness about tagging programs with the objective of improving reporting rates.

10. The collection of fishery-independent data on bluefin abundance via larval and aerial surveys should be continued in order to develop long-term fishery-independent indices for stock assessment.

8. Other matters

8.1 Reporting of tag recoveries

Concerns were expressed about the possibility that not enough efforts are being made to raise awareness about tagging programs and a consequent decrease in reporting rates for recovered tags. While participants agreed that non-reporting had always been a problem, there was no evidence that this problem had worsened in recent years.

However, the Group noted that more efforts should be made to increase awareness by both (a) putting out more posters in various languages, and (b) stepped-up personal contacts with fishermen. It was recommended that interested scientists collaborate with ICCAT to make up-to-date posters.

It was mentioned that ICCAT sometimes receives recovered tags (both traditional and archival) for which it has no record of release, so that it is difficult to find out what laboratory or agency reported it. It was reported that the SCRS is working on ways to improve the inventory on tag releases.

8.2 Popup tags

An update on popup tagging was requested. It was mentioned that a EU project had completed a study involving 62 tags placed on bluefin in the Mediterranean (39 single point and 23 archival). The report of this project is in preparation and will be made available for the bluefin assessment meeting in July 2002.

In regards to future activities in the Mediterranean, it was mentioned that there are plans to put out at least 10 more tags in 2002. However, several participants expressed concern about the lack of funding for these research activities in the eastern Atlantic and Mediterranean. However, it was mentioned that the new EC Data Framework Programme envisions the possibility of funding such projects within National Programs.

As a separate possible activity, it was mentioned that efforts are currently under way for collaboration between COPEMED participants and countries in the western Atlantic to collaborate on archival tagging within the ICCAT Bluefin Year Program (BYP). While COPEMED countries will seek to provide the live bluefin for tagging, it is hoped that tag donors will be found.

In regards to funding activities in the western Atlantic, it was mentioned that the funding situation has not changed much with respect to past years. A report updating tagging efforts is expected at the 2002 ICCAT bluefin assessment.

8.3 Fishery-independent surveys

Document SCRS/02/041 relates to a larval survey off the Balearic Islands in which scientists from several disciplines collaborated successfully. The survey will be repeated in 2002 but funding is expected to end after that. It was also mentioned that similar surveys can potentially be conducted for spawning bluefin off Turkey. Participants agreed that it would be useful to examine the feasibility of making fishery-independent indices of abundance based on routine larval surveys such as these.

It was also mentioned that France and Italy are collaborating together in a EU-funded aerial survey for bluefin tuna. This type of survey could also become potentially a fishery-independent index of abundance, especially for young bluefin.

8.4 Juvenile an dead discards of swordfish

Participants received copies of a recently adopted Resolution by ICCAT for Evaluating Alternatives to Reduce Catches of Juveniles on Dead Discards of Swordfish. This resolution calls for flag states of vessels that catch swordfish in the Atlantic and Mediterranean to evaluate time-area closures that could reduce the mortality of undersized swordfish and to present such studies to the ICCAT SCRS.

9. Adoption of the report and closure

The report was adopted during the meeting.

The Chairman thanked participants for their contributions and thanked the government of Malta for hosting the meeting. The meeting was adjourned.

Appendix A

Speech by the Minister for Agriculture and Fisheries Mr Ninu Zammit.

Mr. Chairman, distinguished delegates, ladies and gentlemen.

Once again, Malta is pleased to host this very important meeting of the GFCM-ICCAT Working Group which is expected to contribute significantly to the management and fate of the Mediterranean resources of blue-fin tuna and other migratory species. Malta's doors have always been open for discussions on the sustainability of living marine resources and our country has always been a firm supporter of responsible fishing.

The agenda of this meeting largely deals with the deterioration of the Eastern Atlantic – Mediterranean blue-fin tuna stock and the associated increase in fishing effort and operations targeting this species. Malta raised its concern on the situation in the central Mediterranean during the 26th Session of the General Fisheries Commission for the Mediterranean (GFCM) in September 2001 in Ischia, and gladly welcomed the Commission's decision to forward the issue to a specialised GFCM-ICCAT Working Group to be studied in more detail. I trust that this meeting will draw up sound management recommendations to safeguard our valuable fisheries resources, whilst also considering socio-economic aspects.

The blue-fin tuna fishery has increased exponentially in the Mediterranean during the last decades and accounts for a large percentage of the annual earnings of fishermen. However, the economic importance has overshadowed the necessity to conserve the migratory blue-fin tuna stock, and technological developments and novel operations have overridden existing management strategies.

This situation has resulted in a negative effect not only on the population of this species but also on the economic gain of fishermen, especially those involved in small scale operations. About one third of the Maltese annual value of landings is attached to the very short tuna fishery season. In this respect, I would like to invite this Working Group to give management advice on the basis of the best available scientific information whilst ensuring the serene coexistence of industrial and artisanal fishing operations on the high seas.

Malta has highly regarded the United Nations Convention on the Law of the Sea (UNCLOS) as the foundation for international fisheries policies and responsible fisheries management, and has fully implemented the Convention regulations throughout the years.

Last year, it also ratified the Agreement on straddling and highly migratory fish stocks, which is an UNCLOS instrument of particular relevance to the subject matters addressed by this Working Group. Malta has complied with all the obligations laid down in this Agreement, even before ratification, including the responsibilities for collecting and exchanging data necessary for stock assessments. In fact, the Malta Centre for Fisheries Sciences has been involved in collaborative research work on blue-fin tuna, swordfish and dolphin fish for the past three years within the framework of the GFCM, FAO sub-regional projects and the International Commission for the Conservation of Atlantic Tunas (ICCAT). In recent years, Malta has also increased its participation, as an observer, in ICCAT meetings and its scientific committee sessions, and it hopes to achieve Contracting Party status in the very near future.

Malta's commitment to its conservation approach has recently been renewed by hosting a seminar in collaboration with the Food and Agriculture Organization on the Code of Conduct for Responsible Fisheries, and by publishing a Maltese version of the Code. FAO has taken great initiatives to implement various aspects of the Code by formulating, together with its members, a number of International Plans of Action, Agreements and Strategies. The IPOA to deter illegal, unreported and unregulated (IUU) fishing, the IPOA for the management of fishing capacity and the Compliance Agreement, which Malta will ratify in the coming months, are amongst the most important instruments which must be followed by all coastal states if future generations are to enjoy sustainable levels of abundance of the fisheries resources within our seas.

May I take this opportunity to confirm that Malta will eagerly continue to collaborate with other countries on a bilateral, regional and global level to achieve the common goal of sustaining the fisheries resources of the world's Large Marine Ecosystems. At the regional level, Malta hopes that the autonomous GFCM with its own funds and budget will soon be born, so that the important work it has generated through its new set-up and technical backing of FAO, could be taken further.

Finally, I would like to welcome you all to Malta, an island surrounded by crystal clear blue waters in which a conservative fisheries management regime has always prevailed.

Appendix 1

Agenda

1. Opening of the meeting and arrangements
2. Review of recent fishery developments in participating countries
3. Review and updates to biological knowledge and fishery database
   3.1 Bluefin tuna
   3.2 Swordfish
   3.3 Albacore
   3.4 Sharks
   3.5 Others
4. Evaluation of data availability and feasibility of assessments in the near future
5. Effects of bluefin tuna farming on stock assessment
6. Draft responses to GFCM
7. Recommendations
8. Other matters
9. Adoption of the report and closure

Appendix 2

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Appendix 3

List of documents / Liste des documents / Lista de documentos

SCRS/02/032 Length-weight relationships for the Mediterranean swordfish - Tserpes, G., P. Peristeraki, A. di Natale, A. Mangano

SCRS/02/033 Length and weight conversion equations for bluefin tuna from the eastern Mediterranean Sea - Peristeraki, P. G. Tserpes, C. Koutsikopoulos, G. Katselis, A. Kallianotis

SCRS/02/034 Assessment of the Mediterranean swordfish stock based on Greek and Italian fisheries data - Tserpes, G., C. Darby, A. di Natale, P. Peristeraki, A. Mangano

SCRS/02/035 Are the EU logbooks satisfactory to compute size frequencies of bluefin tuna catches of the French purse seiners? - Fromentin, J.M.

SCRS/02/036 General review of bluefin tuna farming in the Mediterranean area - Miyake, P.M., J.M. de la Serna, A. di Natale, A. Farrugia, N. Miyabe, V. Ticina

SCRS/02/037 Notes on the collection and provision of fisheries data related to tuna caging: a perspective from the ICCAT Secretariat - ICCAT Secretariat

SCRS/02/038 Short description of the Turkish bluefin tuna fishery in 2000-2001 - Oray, I.K., F. S. Karakulak

SCRS/02/039 Short description of the Turkish swordfish fishery in 2000-2001 - Oray, I.K., T.Z. Aliçli

SCRS/02/040 Description of Japanese fishery and statistics in the Mediterranean - Miyabe, N.

SCRS/02/041 Bluefin tuna and associated species spawning grounds in the oceanographic scenario of the Balearic archipelago during June 2001 - Garcia, A., F. Alemany, P. Velez-Belchi, J.L. Lopez Jurado, J.M. de la Serna, C. Gonzalez Pola, J.M. Rodriguez, J. Jansá

SCRS/02/042 Nuevos datos científicos sobre desembarcos de especies asociadas realizadas por la flota española de palangre de superficie en el Mediterráneo en 1999 y 2000 (New scientific data on by-catch landings of the Spanish longline fishery for swordfish in the Mediterranean during the years 1999 and 2000) - Valeiras, J., J.M. de la Serna, D. Macias, E. Alot

SCRS/02/043 Contribución al estudio biológico de la tintorera *(Prionace glauca)* capturada accidentalmente en la pesquería de palangre de superficie de pez espada en el Mediterráneo occidental (Contribution to the biological study of blue shark *(Prionace glauca)* caught incidentally by the Spanish surface longline fisheries for swordfish in the western Mediterranean) - Valeiras, J., J. M. de la Serna

SCRS/02/044 El atún blanco *(Thunnus alalunga)* del Mediterráneo occidental - de la Serna, J.M., J. Valeiras, E. Alot, D. Godoy

SCRS/02/045 Análisis del sex-ratio pro clase de edad del atún rojo (*Thunnus thynnus* L.) en el Mediterráneo occidental y Atlántico este - de la Serna, J.M., J.M. ortiz de Urbina, E. Alot

SCRS/02/046 Size frequency composition of the bluefin tuna catches in the Tyrrhenian Sea and in the Straits of Sicily in the period 1999-2001, A. Di Natale, Mangano, A, Asaro, A., Bascone, M., Celona, A., Navarra, E., Valastro, M.

SCRS/02/047 Bluefin tuna fisheries in the Central Mediterranean. Department of Fisheries and Agriculture of Malta.

SCRS/02/048 L'Exploitation et la biologie de l'espadon (*Xiphias gladius*) et du thon rouge (*Thunnus thynnus*) des Côtes Marocaines. A. Srour et Abid, N.

SCRS/02/049 Catch and Effort Data of Dolphin Fish Fishery 2001. M. Camilleri and Darmanin, M.

SCRS/02/050 La Pêche du thon rouge a la senne tournante en Tunisie au cours de 2001 - A.Hattour.

SCRS/02/051 Relation Taille poids des captures de thon rouge en Tunisie –A. Hattour.

SCRS/02/052 Analyse de l'indice gonadosomatique du thon rouge capturé par les senneurs Tunisiens – A.Hattour.

SCRS/02/053 Analyse du sexe ration par classe de taille du thon rouge capturé par les senneurs tunisiens- A. Hattour

SCRS/02/054 Swordfish fishery in Cyprus- E. Economou

Table 1. Catalog of available data for bluefin tuna (**BFT**) in the Mediterranean. "task i" = Total catch in metric tons; "Size" and "Ceff" shaded cells indicate whether any size frequency data or catch/effort data are available (shaded cells with diagonal patterns denote data that became available during this meeting).

Fleet	Data	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
ALGERIE	Taski	100	100	100	98	62	98	56	52	78								150	150	150	150	100	100	1		33	66
	Size																										
	Ceff																										
CHI.TAIP	Taski																										
	Size																										
	Ceff																										
CHINA.PR	Taski																										
	Size																										
	Ceff																										
CROATIE	Taski																										
	Size																										
	Ceff																										
CYPRUS	Taski																										
	Size																										
	Ceff																										
ESPANA	Taski	168	273	553	54	597	60	136	345	282	374	561	620	377	1272	953	1635	651	404	604	617	349	182	212	420	203	120
	Size																										
	Ceff																										
FRANCE	Taski	507	816	966	899	798	783	329	615	294	384	400	599	214	668	953	390	1000	1500	2500	1500	1100	2200	1100	1400	1800	1600
	Size																										
	Ceff																										
GREECE	Taski	400	400	400	800	600	1200	900	500	700	700	900	1100	1000	1200	600	700	500	600	500	500						
	Size																										
	Ceff																										
ISRAEL	Taski																										
	Size																										
	Ceff																										
ITALY	Taski	2200	1978	1766	2483	2344	2144	1926	2810	2953	1987	1345	1772	1612	2483	2642	1565	1575	3037	2430	3152	2264	2480	3718	3167	6839	7083
	Size																										
	Ceff																										
IT.TY-LI	Size																										
	Ceff																										
ITA_CADR	Size																										
	Ceff																										
ITA_NTYR	Size																										
	Ceff																										
ITA_STYR	Size																										
	Ceff																										
ITA-LIGU	Size																										
	Ceff																										
ITA-N.IO	Size																										

Fleet	Data	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
	Ceff																										
ITA-SARD	Size																										
	Ceff																										
ITA-SICI	Size																										
	Ceff																										
JAPAN	Taski																							112	246	2195	1260
	Size																										
	Ceff																										
KOREA	Taski																										
	Size																										
	Ceff																										
LIBYA	Taski	1000	1100	900	1700	1200	1200	1200	1200	1200	1100	1100	1000	800	100	400	600	700	800	1000	2000	500	600	449	475	1469	780
	Size																										
	Ceff																										
MADEIRA	Taski																										
	Size																										
	Ceff																										
MALTA*	Taski	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100						21	37
	Size																										
	Ceff																										
MAROC	Taski																172	11	27	5			79	37	1	9	40
	Size																										
	Ceff																										
NEI	Taski																										
	Size																										
	Ceff																										
NEI-105	Taski																										
	Size																										
	Ceff																										
NEI2	Taski																										
	Size																										
	Ceff																										
NEI-81	Taski																										
	Size																										
	Ceff																										
PANAMA	Taski																										
	Size																										
	Ceff																										
PORTUGAL	Taski																										
	Size																										
	Ceff																										
R.F.YUGO	Taski																										
	Size																										
	Ceff																										

Fleet	Data	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
TUNISIE	Taski	465	410	290	320	355	301		34		85			404	260	376	601	293	307	184	77	153	206	57	52	136	83
	Size																										
	Ceff																										
TURKEY	Taski								800	400	500	300	300	200	100		100	100	1488	310	393	138	22	68	66	34	17
	Size																										
	Ceff																										
YUGOSLAV	Taski	657	531	279	588	654	346	253	382	388	224	109	123	87	277	271	134	246	331	150	301	90	326	200	224	317	155
	Size																										
	Ceff																										

Table 1. (Cont.)

Fleet	Data	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
ALGERIE	Taski	49	40	20	150	190	220	250	252	254	260	566	420	677	820	782	800	1104	1097	1560	156	156	157	1947	2142	2330	2012
	Size																										
	Ceff																										
CHI.TAIP	Taski																		328	709	494	411	278	106	27	169	
	Size																										
	Ceff																										
CHINA.PR	Taski																			97	137	93	49				
	Size																										
	Ceff																										
CROATIE	Taski																1418	1076	1058	1410	1220	1360	1105	906	970	930	903
	Size																										
	Ceff																										
CYPRUS	Taski					10	10	10	10	10	10	10	10	10	10	10	10	10	14	10	10	10	10	21	31	60.8	
	Size																										
	Ceff																										
ESPANA	Taski	253	158	165	115	133	354	989	812	2743	1460	701	1178	1428	1645	1822	1392	2165	2018	2741	4607	2588	2205	2000	2003	2772	
	Size																										
	Ceff																										
FRANCE	Taski	3800	3182	1597	1578	1701	2350	4878	3660	3600	5430	3490	4330	5780	4434	4713	4620	7376	6995	11843	9604	9127	8201	7100	6153	6780	6119
	Size																										
	Ceff																										
GREECE	Taski										11	131	156	159	182	201	175	447	439	886	1004	874	1217	286	248	622	
	Size																										
	Ceff																										
ISRAEL	Taski																					14					
	Size																										
	Ceff																										
ITALY	Taski	10369	6263	4983	4020	6272	6017	6658	5865	7140	7199	7576	4607	4201	4317	4110	3783	5005	5328	6882	7062	10006	9548	4059	3278	3845	
	Size																										

Fleet	Data	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
	Ceff																										
IT.TY-LI	Size																										
	Ceff																										
ITA_CADR	Size																										
	Ceff																										
ITA_NTYR	Size																										
	Ceff																										
ITA_STYR	Size																										
	Ceff																										
ITA-LIGU	Size																										
	Ceff																										
ITA-N.IO	Size																										
	Ceff																										
ITA-SARD	Size																										
	Ceff																										
ITA-SICI	Size																										
	Ceff																										
JAPAN	Taski	968	520	61	99	119	100	961	677	1036	1006	341	280	258	127	172	85	123	793	536	813	765	185	361	381	136	
	Size																										
	Ceff																										
KOREA	Taski																			684	458	591	410	66			
	Size																										
	Ceff																										
LIBYA	Taski	799	336	677	424	398	271	310	270	274	300	300	300	300	84	258	290	338	546	1332	1500	732	552	820	745	1063	
	Size																										
	Ceff																										
MADEIRA	Taski																										
	Size																										
	Ceff																										
MALTA*	Taski	25	47	26	23	24	32	40	31	21	21	41	36	24	29	48	63	48	151	343	353	243	249	244	269	376	
	Size																										
	Ceff																										
MAROC	Taski	1	7		2		2		1	4	12	56	116	140	295	1149	925	205	79	1092	1035	586	535	564	636	695	
	Size																										
	Ceff																										
NEI	Taski							1		19		168	183	633	757	341	1750	1349	1624								
	Size																										
	Ceff																										
NEI-105	Taski																				240	1990	362	368			
	Size																										
	Ceff																										
NEI2	Taski															19	49	49									

Fleet	Data	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
	Size																										
	Ceff																										
NEI-81	Taski																				111		696	267	76		
	Size																										
	Ceff																										
PANAMA	Taski		4										72	67		74	287	484	467	1499	1498	2850	236				
	Size																										
	Ceff																										
PORTUGAL	Taski																278	320	183	428	446	274	37	54	76	60.8	
	Size																										
	Ceff																										
R.F.YUGO	Taski																				2	4				4.3	
	Size																										
	Ceff																										
TUNISIE	Taski	66	131	141	262	228	218	298	293	307	369	315	456	624	661	406	1366	1195	2132	2503	1897	2393	2200	1745	2352	2184	
	Size																										
	Ceff																										
TURKEY	Taski	181	177	127	27	391	565	825	557	869	41	69	972	1343	1707	2059	2459	2817	3084	3466	4220	4616	5093	5899	1200	1070	
	Size																										
	Ceff																										
YUGOSLAV	Taski	562	932	1049	756	573	376	486	1222	755	1084	796	648	1523	560	940											
	Size																										
	Ceff																										

* Catches for Malta 1990-1999 were revised and submitted for approval by 2002 BFT species group:

81	105	80	251	512	587	399	393	407	447	

Table 2. Catalog of available data for swordfish (**SWO**) in the Mediterranean. "taski" = Total catch in metric tons; "Size" and "Ceff" shaded cells indicate whether any size frequency data or catch/effort data are available (shaded cells with diagonal patterns denote data that became available during this meeting).

FLEET	Data	1950	1951	1952	1954	1955	1956	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
ALBANIA	Task-i																								
	Size																								
	CEFF																								
ALGERIE	Task-i																						100	196	500
	Size																								
	CEFF																								
CHI.TAIP	Task-i																								
	Size																								
	CEFF																								
CROATIE	Task-i																								
	Size																								
	CEFF																								
CYPRUS	Task-i																								5
	Size																								
	CEFF																								
ESPANA	Task-i	586	580	337	452	340	393	414							1200	1000	700	1000	1100	900	1100	1300	1105	700	89
	Size																								
	CEFF																								
FRANCE	Task-i																								
	Size																								
	CEFF																								
GREECE	Task-i																								
	Size																								
	CEFF																								
ITALY	Task-i																	1568	2240	2016	3248	4144	3136	3730	3362
	Size																								
	CEFF																								
ITA-LIGU	Size																								
	CEFF																								
ITA-N.IO	Size																								
	CEFF																								
ITA-S.AD	Size																								
	CEFF																								
ITA-SARD	Size																								
	CEFF																								
ITA-SICI	Size																								
	CEFF																								
ITA-TYRR	Size																								

FLEET	Data	1950	1951	1952	1954	1955	1956	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
	CEFF																								
JAPAN	Task-i																								
	Size																								
	CEFF																								
KOREA	Task-i																								
	Size																								
	CEFF																								
LIBYA	Task-i														224	224	336	560							
	Size																								
	CEFF																								
MALTA	Task-i																			112	224	224	224	192	214
	Size																								
	CEFF																								
MAROC	Task-i										94	188	94	282	224	192	170	197	250	214	327	230	183	196	118
	Size																								
	CEFF																								
NEI2	Task-i																								
	Size																								
	CEFF																								
PORTUGAL	Task-i																								
	Size																								
	CEFF																								
TUNISIE	Task-i																							5	3
	Size																								
	CEFF																								
TURKEY	Task-i							500	200	112	112	112	224	112	112	336	111	115	133	99	76	60	59	15	10
	Size																								
	CEFF																								

Table 2. (Cont.)

FLEET	Data	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
ALBANIA	Task-i																					13	13	13	13		
	Size																										
	CEFF																										
ALGERIE	Task-i	368	370	320	521	650	760	870	877	884	890	847	1820	2621	590	712	562	395	562	600	807	807	807	825	709	816	1081
	Size																										
	CEFF																										
CHI.TAIP	Task-i																		1	1		1	3				
	Size																										
	CEFF																										
CROATIE	Task-i																							10	20		

FLEET	Data	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
	Size																										
	CEFF																										
CYPRUS	Task-i	59	95	82	98	72	78	103	28	63	71	154	84	121	139	173	162	73	116	159	89	40	51	61	92	82.3	135
	Size																										
	CEFF																										
ESPANA	Task-i	89	667	720	800	750	1120	900	1322	1245	1227	1337	1134	1762	1337	1523	1171	822	1358	1503	1379	1186	1264	1443	905	1436	
	Size																										
	CEFF																										
FRANCE	Task-i																										12
	Size																										
	CEFF																										
GREECE	Task-i						91	773	772	1081	1036	1714	1303	1008	1120	1344	1904	1456	1568	2520	974	1237	750	1650	1520	1960	
	Size																										
	CEFF																										
ITALY	Task-i	3747	3747	4506	3930	4143	3823	2939	3026	9360	10863	11413	12325	13010	13009	5524	4789	7595	6330	7765	6725	5286	6104	6104	6312	7515	
	Size																										
	CEFF																										
ITA-LIGU	Size																										
	CEFF																										
ITA-N.IO	Size																										
	CEFF																										
ITA-S.AD	Size																										
	CEFF																										
ITA-SARD	Size																										
	CEFF																										
ITA-SICI	Size																										
	CEFF																										
ITA-TYRR	Size																										
	CEFF																										
JAPAN	Task-i	1		2	3	1		5	6	19	14	7	3	4	1	2	1	2	4	2	4	5	5	7	5		
	Size																										
	CEFF																										
KOREA	Task-i																										
	Size																										
	CEFF																										
LIBYA	Task-i																							11		7.6	
	Size																										
	CEFF																										
MALTA	Task-i	175	223	136	151	222	192	177	59	94	108	97	131	207	121	122	119	71	76	42	58	58	83	116	147	140	
	Size																										
	CEFF																										
MAROC	Task-i	186	144	172					43	39	38	92	40	62	97	1249	1706	2692	2589	2654	1696	2734	4900	3228	3238	2708	
	Size																										
	CEFF																										
NEI2	Task-i					728	672	517	532	771	730	767	828	875	979	1360	1292	1292									

FLEET	Data	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
	Size																										
	CEFF																										
PORTUGAL	Task-i																									13.3	
	Size																										
	CEFF																										
TUNISIE	Task-i	5					7	19	15	15	61	64	63	80	159	176	181	178	354	298	378	352	346	414	468	483	
	Size																										
	CEFF																										
TURKEY	Task-i	7	34	20	44	13	70	40	216	95	190	226	557	589	209	243	100	136	292	533	304	320	320	320	113		
	Size																										
	CEFF																										

Table 3. Catalog of available data for albacore (**ALB**) in the Mediterranean. “taski” = Total catch in metric tons; “Size” and “Ceff” shaded cells indicate whether any size frequency data or catch/effort data are available (shaded cells with diagonal patterns denote data that became available during this meeting).

Fleet	Data	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
CHI.TA	Taski																																					
	size																																					
	ceff																																					
CYPRUS	Taski																																				5.5	
	size																																					
	ceff																																					
ESPANA	Taski								200									900	572	535	1331	531			3		84	547	227	290	218	475	404	380	126	284	151.8	
	size																																					
	ceff																																					
FRANCE	Taski																				141	250	20	60	31	31	121	140	11	64	23	3		5	5			0.3
	size																																					
	ceff																																					
GREECE	Taski																						484	500	500	500	500	500	500	1	1		952	741	1152	2005	1786	
	size																																					
	ceff																																					
ITALY	Taski	500	500	500	500	500	500	500	500	500	500	500	560	613	590	833	500	600	700	700	1942	3348	3208	3433	3529	3529	1191	1191	1464	1		1109	1769	1414	1414	2561	3630	
	size																																					
	ceff																																					
ITA-SI	size																																					
	ceff																																					
JAPAN	Taski								1				1																									
	size																																					
	ceff																																					
KOREA	Taski																																					
	size																																					
	ceff																																					
MALTA	Taski																																	1	1		4	
	size																																					
	ceff																																					
NEI2	Taski																													500								
	size																																					
	ceff																																					
YUGOSL	Taski					200																																
	size																																					
	ceff																																					

Table 4. Catalog of Mediterranean **shark** data available in the ICCAT data base.

Code	Name	ScieName	Flag	Year	Gear	Area	condition	fish #s	rweight	dwt	effort	type effort	remarks	c.factor
ALV	Thresher	Alopias vulpinus	EC.ESPAÑA	1997	LL	MEDI			3.5				by catch swo	
ALV	Thresher	Alopias vulpinus	EC.ESPAÑA	1998	LL	MEDI			7.0				by catch swo	
ALV	Thresher	Alopias vulpinus	EC.ESPAÑA	2000	LL	MEDI			4.6				by catch swo	
BSH	Blue shark	Prionace glauca	CYPRUS	2000	LL	MEDI			8.9		433,673	no of hooks		
BSH	Blue shark	Prionace glauca	EC.ESPAÑA	1997	LL	MEDI			146.5				by catch swo	
BSH	Blue shark	Prionace glauca	EC.ESPAÑA	1998	LL	MEDI			59.2				by catch swo	
BSH	Blue shark	Prionace glauca	EC.ESPAÑA	1999	LL	MEDI			20.3	16.97				1.19
BSH	Blue shark	Prionace glauca	EC.ESPAÑA	2000	LL	MEDI			25.9	16.97				1.19
BSH	Blue shark	Prionace glauca	JAPAN	1994	LL	MEDI			5.0					
BSH	Blue shark	Prionace glauca	JAPAN	1995	LL	MEDI			7.0					
BSH	Blue shark	Prionace glauca	JAPAN	1996	LL	MEDI		50.0	1.0		2,725	10**3 hooks		
BSH	Blue shark	Prionace glauca	JAPAN	1997	LL	MEDI		37.0	1.0		1,133	10**3 hooks		
BSH	Blue shark	Prionace glauca	JAPAN	1998	LL	MEDI		7.0			1,259	10**3 hooks		
BTH	Bigeye thresher	Alopias superciliosus	EC.ESPAÑA	1998	LL	MEDI			0.2				by catch swo	
DGH	Dogfishes and hounds nei	Squalidae, Scyliorhinidae	CYPRUS	2000	GILL	MEDI			13.2		111,304	working days		
GAG	Tope shark	Galeorhinus galeus	EC.ESPAÑA	1997	LL	MEDI			0.5				by catch swo	
GAG	Tope shark	Galeorhinus galeus	EC.ESPAÑA	1998	LL	MEDI			0.7				by catch swo	
PXX	Pelagic Sharks nei		JAPAN	1995	LL	MEDI			1.0					
PXX	Pelagic Sharks nei		EC.ESPAÑA	2000	LL	MEDI			0.4					
SKH	Various sharks nei	Selachimorpha(Pleurotremata)	CYPRUS	1999	LL	MEDI		74.0	4.2		292,840	no of hooks	2nd Quarter	
SKH	Various sharks nei	Selachimorpha(Pleurotremata)	CYPRUS	1999	LL	MEDI		166.0	1.4		157,727	no of hooks	4th Quarter	
SKH	Various sharks nei	Selachimorpha(Pleurotremata)	CYPRUS	1999	LL	MEDI		292.0	4.9		353,413	no of hooks	3rd Quarter	
SKH	Various sharks nei	Selachimorpha(Pleurotremata)	CYPRUS	1999	LL	MEDI		18.0	1.2		56,100	no of hooks	1st Quarter	
SMA	Shortfin mako	Isurus oxyrinchus	EC.ESPAÑA	1997	LL	MEDI			5.8				by catch swo	
SMA	Shortfin mako	Isurus oxyrinchus	EC.ESPAÑA	1998	LL	MEDI			6.8				by catch swo	
SMA	Shortfin mako	Isurus oxyrinchus	EC.ESPAÑA	1999	LL	MEDI			4.7					
SMA	Shortfin mako	Isurus oxyrinchus	EC.ESPAÑA	2000	LL	MEDI			2.9					
SMA	Shortfin mako	Isurus oxyrinchus	JAPAN	1996	LL	MEDI		33.0	2.0		2,725	10**3 hooks		
SPN	Hammerhead sharks nei	Sphyrna spp	EC.ESPAÑA	1997	LL	MEDI			0.5				by catch swo	
THR	Thresher sharks nei	Alopias spp	EC.ESPAÑA	1999	LL	MEDI			6.7					
SKH	Various sharks nei	Selachimorpha(Pleurotremata)	KOREA	1995	LL	N-E+Med		35.0						
SKH	Various sharks nei	Selachimorpha(Pleurotremata)	KOREA	1995	LLD	N-E+Med		58.0						

Table 5. Detailed comparison between Task-I catch data (MT) and exports to Japan and USA (MT, round weight) of Bluefin tuna between 1993 and 2000[3]. Shaded cellls denote cases in which round weight estimates from trade data are greater than reported Task I statistics.

			Task-1								USA Imports (no farm)			JAPAN Imports (no farm)									JAPAN Imports (farm)						DIFFERENCE = Task1 - [(U1 + J1 + J2 + 0.8*(JF1 + JF2))							
											direct imports			direct imports								indirect imports	direct Imports					in-direct im-ports							
											[U1]			[J1]								[J2]	[JF1]					[JF2]							
Party	Fleet Name	Gear Code	1993	1994	1995	1996	1997	1998	1999	2000	1999	2000	2001	1993	1994	1995	1996	1997	1998	1999	2000	2001	1999	2000	1997	1998	1999	2000	2001	2000	1993	1994	1995	1996	1997	1998	1999	2000
CP	ALGERIE	GILL						200	158	214																					0	0	0	0	0	200	158	214
		HAND						180	208	159																					0	0	0	0	0	180	208	159
		LL								700																					0	0	0	0	0	0	0	700
		PS						900	1056	778																					0	0	0	0	0	900	1056	778
		TL						93	174	88																					0	0	0	0	0	93	174	88
		TRAP						399	367	290																					0	0	0	0	0	399	367	290
		TROL															0														0	0	0	0	0	0	0	0
		UNCL	1097	1560	156	156	157	175	179	101																					1097	1560	156	156	157	175	179	101
	CHINA.PR	LL		97	137	93	49											57		20											0	97	137	93	-8	0	-20	0
	CROATIA	HAND					6	1	39								30	23	10	35	38	29									0	0	0	-30	-17	-9	4	-38
		HARP															0														0	0	0	0	0	0	0	0
		LL					11	16	10								3	6	14	8	3	10									0	0	0	-3	5	2	2	-3
		PS	1058	1410	1220	1360	1088	889	921	930		0	2				1	377	152	17	141	232			86	35	674	1006			1058	1410	1220	1359	711	668	875	250
		TRW																	0												0	0	0	0	0	0	0	0
		UNCL																0				0			18	248					0	0	0	0	0	-15	-198	0
	EC-ESPANA	BB	48		206	5	4	11	4						1	34	13		62	1											48	-1	172	-8	4	-51	3	0
		HAND	200	93	726	206	69	76	21	67						1			1		2	12									200	93	725	206	69	75	21	65
		LL	40	178	368	369	871	253	418	493	1	8	17		960	3036	832	1056	272	554	588	515				0					40	-782	-2668	-463	-185	-19	-137	-103
		PS	1431	1725	2896	1657	1172	1573	1504	1676	87	161	258	187	5368	5307	3284	737	397	784	221	169		25	262	1447	3111	4395	5754		1244	-3643	-2411	-1627	225	18	-1855	-2247
		RR															3														0	0	0	-3	0	0	0	0
		S.UN	146	336		76	30	55	35	38																					146	336	0	76	30	55	35	38
		SPOR						18	8	11																					0	0	0	0	0	18	8	11
		TRAP	6		1	1	1	5	1	0								0	5	0											6	0	1	1	1	0	1	0

[3] Negative differences between Task I and trade data may be due to catches of third parties being exprorted to Japan from the country for which the negative difference appears, although the catches were not made by the latter.

			Task-1								USA Imports (no farm)			JAPAN Imports (no farm)									JAPAN Imports (farm)					DIFFERENCE = Task1 - [(U1 + J1 + J2 + 0.8*(JF1 + JF2))							
											direct imports			direct imports								indirect imports		direct Imports				in-direct im-ports							
											[U1]			[J1]								[J2]		[JF1]				[JF2]							
Party	Fleet Name	Gear Code	1993	1994	1995	1996	1997	1998	1999	2000	1999	2000	2001	1993	1994	1995	1996	1997	1998	1999	2000	2001	1999	2000	1997	1998	1999	2000	2001	2000	1993	1994	1995	1996	1997	1998	1999	2000
		TROL		13	15			9	8									0													0	13	15	0	0	9	8	0
		UNCL	147	396	395	274	58		4	488							1				3	1						10			147	396	395	273	58	0	4	477
	EC-FRANCE	BB																	3												0	0	0	0	0	-3	0	0
		GILL															31		8		1	2									0	0	0	-31	0	-8	0	-1
		HAND														8	1	1		0											0	0	-8	-1	-1	0	0	0
		LL														0	5		23		22	24									0	0	0	-5	0	-23	0	-22
		PS	6965	####	9494	8547	7701	6800	5907	6780	2	4	1	480	720	2921	3682	1918	97	282	389	2131	671							6965	11323	8774	5626	4019	4882	3677	5822
		SPOR	30	40	50																										30	40	50	0	0	0	0	0
		TRAP												1																	0	-1	0	0	0	0	0	0
		TROL																				0									0	0	0	0	0	0	0	0
		TRW																	1		0	0									0	0	0	0	0	-1	0	0
		UNCL			60	580	500	300	246					4	91	7	8		2	6	17		19								0	-4	-31	573	492	300	244	-25
	EC-GREECE	BB												2	19	28	40	42	23	59	49									0	-2	-19	-28	-40	-42	-23	-59
		GILL												0																	0	0	0	0	0	0	0	0
		HAND	339	766	915	784	1127	279	233	597	3	4	17	181	387	399	495	305	251	237	212									339	585	528	385	632	-26	-21	356
		LL	68	88	57	58	58	3	10	15			14	17	4	4	3	0	9	4	0									68	71	53	54	55	3	1	11
		PS	32	32	32	32	32	4	5	10				8				2	4	1										32	24	32	32	32	2	1	9
		RR												3	0															0	-3	0	0	0	0	0	0
		TRAP												0																0	0	0	0	0	0	0	0
		UNCL												131	4	2		1		3	39									0	-131	-4	-2	0	-1	0	-3
	EC-IRELAND	PS																0												0	0	0	0	0	0	0	0

Table 5. (Cont.)

			Task-1								USA Imports (no farm)			JAPAN Imports (no farm)									JAPAN Imports (farm)						DIFFERENCE = Task1 - [(U1 + J1 + J2 + 0.8*(JF1 + JF2))							
											direct imports			direct imports								indirect imports	direct Imports					in-direct imports							
											[U1]			[J1]									[JF1]												
Party	Fleet Name	Gear Code	1993	1994	1995	1996	1997	1998	1999	2000	1999	2000	2001	1993	1994	1995	1996	1997	1998	1999	2000	2001	1999	2000	1997	1998	1999	2000	2001	2000	1993	1994	1995	1996	1997	1998	1999	2000
	EC-ITALY	BB							0	0					3			15													0	-3	0	0	-15	0	0	0
		GILL	209	72	109	57	150		10	13																					209	72	109	57	150	0	10	13
		HAND	161	324	351	122	186	5	0	3					4	23	2	0	1		8	1									161	320	328	120	186	4	0	-5
		HARP	2	2	4	10	20		5	5																					2	2	4	10	20	0	5	5
		LL	135	1018	2103	2100	1620	292	515	287	25	15	44		407	1180	1388	781	406	910	687	433	6	15							135	611	923	712	839	-114	-427	-430
		PS	4162	4654	3613	7060	7068	3334	1859	2801	9	17	2	73	461	453	566	1179	3739	5791	3001	112		191				115	2	4089	4193	3160	6494	5889	-405	-3941	-409
		RR	50	100	150			4	10	0	3	3		40	39	205	74	50	12	21	91	2		19							11	61	-55	-74	-50	-8	-14	-113
		SPOR	410	480	491	360	350	5	415	383																					410	480	491	360	350	5	415	383
		TRAP	199	182	241	297	154	419	308	353					120	188	180	82	156	133	163	229		73							199	62	53	117	72	263	175	116
		UNCL		50					156	0			1		14	12	10	2	1		77	113		85							0	36	-12	-10	-2	-1	156	-161
	EC-PORTUGAL	LL	183	428	446	274	37	54	76	61							274		61	101		64									183	428	446	0	37	-7	-25	61
	EC-U.K	HAND													0																0	0	0	0	0	0	0	0
		UNCL													0																0	0	0	0	0	0	0	0
	G.CONAKRY	LL													282	240	171	399	428												0	-282	-240	-171	-399	-428	0	0
	G.EQUATORIAL	LL																659	333	78	17										0	0	0	0	-659	-333	-78	-17
	JAPAN	LL	793	536	813	765	185	361	381	136																					793	536	813	765	185	361	381	136
	KOREA	LL		684	458	591	410	66							82	74	32	248	110												0	602	384	559	162	-44	0	0
	LIBYA	LL		732	825		448	409	450	1002									191	240	461	344									0	732	825	0	448	218	210	542
		PS	546	450	495	598	32	230	195	16					1			20	13		24										546	449	495	598	12	218	195	-8
		TRAP		150	180	134	72	181	100	44					1			6	28	22											0	149	180	134	66	153	78	44
		UNCL													34				4		29										0	-34	0	0	0	-4	0	-29
	MAROC	GILL	6	16	92	30	17	18	6	6																					6	16	92	30	17	18	6	6
		HAND		373	816	541	455	544	600	650		0				28	1	11	91		38	4									0	373	788	540	444	453	600	612
		LL															0														0	0	0	0	0	0	0	0
		TRAP	73	703	127	15	63	2	30	39					3	2	2		11												73	700	125	13	63	-9	30	39
	PANAMA	LL	467	1499	1498	2850	236							467	1056	1262	825	579													0	443	236	2025	-343	0	0	0
	TUNISIE	HAND	43	81	57	92	113	48	43	74					0	3	23	4	1	2	2	0									43	81	54	69	109	47	41	72
		LL													0	1				1	1	8									0	0	-1	0	0	0	-1	-1
		PS	1997	2253	1617	2147	1992	1662	2263	2029	9	23	7		68	600	1212	547	945	668	620	519									1997	2185	1017	935	1445	717	1585	1387

			Task-1								USA Imports (no farm)			JAPAN Imports (no farm)										JAPAN Imports (farm)						DIFFERENCE = Task1 - [(U1 + J1 + J2 + 0.8*(JF1 + JF2))							
											direct imports			direct imports								indirect imports		direct Imports					in-direct imports								
											[U1]			[J1]										[JF1]													
Party	Fleet Name	Gear Code	1993	1994	1995	1996	1997	1998	1999	2000	1999	2000	2001	1993	1994	1995	1996	1997	1998	1999	2000	2001	1999	2000	1997	1998	1999	2000	2001	2000	1993	1994	1995	1996	1997	1998	1999	2000
		TRAP	92	169	223	154	95	35	46	81					49	102	26	27	10	22	0	5									92	120	121	128	68	25	24	81
		TROL													0	11	28	5													0	0	-11	-28	-5	0	0	0
		UNCL													3	2	1	5			0	3									0	-3	-2	-1	-5	0	0	0
NCC	CHI TAI	LL	328	709	494	411	278	106	27	169				696	494	411	275		27	22	448										328	13	0	0	3	106	0	147
NCO	BELIZE	LL												145	399															0	-145	-399	0	0	0	0	0
	CYPRUS	HAND	4											0	0															4	0	0	0	0	0	0	0
		LL	10	10	10	10	10	21	31	61	9										18									10	10	10	10	10	21	31	43
	ISRAEL	UNCL				14																									0	0	0	14	0	0	0	0
	MALTA	HAND														137				0										0	0	-137	0	0	0	0	0
		LL	151	343	353	243	249	244	269	376				114	154	220	249	53	84	87	213	150	78							151	229	199	23	0	191	36	211
		PS												5																0	-5	0	0	0	0	0	0
		TRAP												2																0	-2	0	0	0	0	0	0
		UNCL															1	0	0												0	0	0	-1	0	0	0	0
	TURKEY	GILL																8													0	0	0	0	-8	0	0	0
		HAND															1														0	0	0	-1	0	0	0	0
		PS	3084	3466	4219	4616	5093	5899	1200	1070			71	61	139	156	359	417	292	506	444										3084	3405	4080	4460	4734	5482	908	564
		UNCL				1								33	1	6	2		44	28	68										0	-33	0	-6	-2	0	-44	-28
	YUGOSLAVIA REP. FED.	PS				2	4																								0	0	2	4	0	0	0	0
		UNCL								4																					0	0	0	0	0	0	0	4

NOTE: The following conversion factors were used to estimate round weight for various products in the trade statistics (import data in the tables are already converted):

Belly Meat from farmed tuna x 1.0 = round weight.
Belly meat from wild tuna x 10.28 = round weight.
Dressed weight x 1.25 = round weight.
Fillets x 1.67 = round weight.
Gilled&Gutted weight x 1.16 = round weight.
Other products x 2.0 = round weight.

Table 6. Estimates of unreported catches for bluefin tuna in the Mediterranean.

Fleet	Gear	Area	1993	1994	1995	1996	1997	1998	1999	2000
NEI-1	LL	MED	0							
NEI-105	LL	MED		282	240	171	399	428		
NEI-134	LL	MED		145	399					
NEI-81	LL	MED			0		659	333	78	17
NEI-10							8		20	
NEI-118								64	42	
NEI-COMB	ALL GEARS	MED		0	0	0	0		0	
NEI-COMB	TRAP	AE		773	211		101	1030	1995	109
NEI-COMB	TOTAL	AE+MED		773	211	0	101	1030	1995	109

NEI-1	Unidentified nationality
NEI-105	G. Conakry
NEI-134	Belize
NEI-81	G. Equatorial
NEI-10	Greece
NEI-118	China PR
NEI-COMB	MED (Spain, Croatia, Italy, France, Portugal, Morocco, Malta, Libya, Tunisia) + Atlantic TRAP (Spain, Morocco)

ANNEX 4

GFCM/SAC Subcommittee on Stock Assessment

Barcelona, 6-9 May 2002

Building a framework for sustainable tuna farming practices in the Mediterranean

A WWF's call on the GFCM/SAC Subcommittee on Stock Assessment to address the sustainability of increasing tuna farming in the Mediterranean Basin

Sergi Tudela,

World Wide Fund for Nature (WWF), Mediterranean Programme Office

Tuna farming/fattening is a recent activity in the Mediterranean region, which is growing exponentially fuelled by the high short-term profits related to the Japanese sushi market. It is a completely new large-scale agro-industrial activity taking place in the coastal commons, whose sustainability regarding fish stocks and coastal ecosystems is a matter of concern to many different stakeholders. Moreover, the lack of a specific regulatory frame to be applied to this complex activity showing important effects on fisheries and ecosystems in the Region makes the consideration of tuna farming by the competent Fisheries Management Body at the pan-Mediterranean level -the GFCM- a clear priority.

WWF has actively worked to raise worldwide attention on this problem. Recently, coinciding with the last GFCM/ICCAT Working Group meeting, the conservation organization released a report gathering some of the scattered information available on the effects of these practices, as well as raising major environmental concerns on associated features undermining sustainability. This report is submitted here to the consideration of the GFCM/SAC Subcommittee on Stock Assessment.

WWF believes that 1) an immediate precautionary **moratorium** on new tuna farms is urgently needed prior to 2) the development of a pan-Mediterranean **regulatory frame** seeking the sustainability of this activity. To this end we suggest, at a first step, the elaboration of a binding **Code of Conduct on Sustainable Tuna Farming Practices in the Mediterranean**, to provide the rational basis (as well as common standards) for further regulation initiatives from the appropriate national or supranational (GFCM, ICCAT, EU) decision-making organisms.

Consequently, we propose to this Subcommittee to raise a formal recommendation in this sense to the Fifth GFCM/SAC Session to be held in Rome next July.

ANNEX 5

GENERAL FISHERIES COMMISSION FOR THE MEDITERRANEAN (GFCM)

WORKING GROUP ON DEMERSAL SPECIES
Rome, Italy, 20-22 march, 2002

OPENING OF THE MEETING

1. The third meeting of the SAC Working Group on Demersal Species of GFCM was held at the FAO headquarters in Rome from 20 to 22 March 2002. It was opened by the Coordinator of the Working Group, Mr H. Farrugio (IFREMER).

2. The meeting was attended by 48 scientists from 8 countries. The list of 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 is attached as Appendix C.

4. Three rapporteurs Mr M.Camilleri (MCFS), Mrs.C.Mellon (IFREMER) and Mr. Enrico Arneri (IRPEM - CNR) and two chairpersons Mr F.Fiorentino (IRMA - CNR) and Mrs P.Pereda (IEO) were designated.

5. The Working Group agreed that the papers presented at the present meeting should be sent to Mr Jordi Lleonart (CSIC), Coordinator of the SAC Sub-Committee on Stock Assessment and to the GFCM Secretariat in a camera-ready format for possible insertion on a website and for possible publication in the "Studies and Reviews" publication series of GFCM.

PRESENTATIONS TO AND DISCUSSIONS BY THE WORKING GROUP

6. 14 technical papers were presented and discussed by the Working Group.

7. These documents covered 14 Management Units (MUs), as a whole or in part, and 7 species. The table attached in Appendix D indicates the species studied and the MUs 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.

9. SAMED also made the WG Sheets TS1, TS2, and TS3 available; these sheets related to *M. merluccius*, *M. barbatus* and *N. norvegicus* (see appendix D).

ASSESSMENT DOCUMENTS

10. Seven documents of this type were reviewed and are referenced by a specific number (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). Such references should be used when completing the standard forms adopted by the Working Group.

11. Forms D, Z and TST, related to the synthesis of the assessments and the abstracts of the working papers were discussed. These forms are presented in Appendix E.

Document n° 1a : HKE-9-02 : Stock assessment of *Merluccius merluccius* in Geographical Sub Area (GSA) 9, 1985-2001

12. Data derived from trawl surveys and from a catch assessment survey for the same period (1990-1998) show trends of indices of abundance which are not in agreement. It is possible that the distribution and the catchability of each species may change at different exploitation rates and hence catch per unit effort from commercial fleet data may not be a good index of abundance. These results may be also due to changes in the fleets' behaviour or to changes in the target species. Fishing pressure is not regularly distributed. It seems difficult to perform an overall stock assessment.

13. A status of growth overfishing was suspected for the species. The species did not show evident changes in abundance of young age classes which can be considered as a sign of recruitment overfishing.

14. Considering the fraction of the Spawning Biomass surviving at the current level of effort, an adequate number of spawners have to be maintained and hence, it is important to control and not encourage a more general use of gears such as long lines and trammel nets, suitable for the capture of big fish living offshore some times in non-trawlable areas).

15. Management recommendations : Areas and/or seasonal closures should be useful in order to protect nursery areas which are geographically very stable. Some considerations on the adults need to be taken with regards to the increase of fishing pressure by the fixed gears.

16. It was suggested that a reduction of effort should drive the spawning biomass to a safer level.

17. The mesh size currently in use gives rise to a far too small size of first capture (8-9 cm), which is much lower than the legal size of the species (20 cm). An increase in mesh size (about 55 mm) should produce a slight improvement in Y/R for hake, but contemporarily important losses with regards to the catch of several other species that make part of the commercial assemblages. An alternative suggestion was to increase the size of first capture which could be achieved by means of the self-regulation of the fleet by avoiding the fishing grounds where small hakes are concentrated or by the enforcement of temporal or total closures of defined areas. The first of these two options are currently applied (even if not legally regulated) in the Viareggio fishing area.

Document n° 1b : NEP-9-02 : Stock assessment of *Nephrops norvegicus* in GSA 9, 1985-2001

18. The assessment was based on 27 Grund trawl surveys, 8 Medits trawl surveys

and other data collected during other EU financed projects such as NEMED. The biological parameters in the analysed areas were found to be very similar except for natural mortality. A general increase in CPUE and landings over the years was reported. The dominant length class mode for both males and females was 30-35cm and an expected rise in fishing mortality was reported upwards from this length class. From yield per recruit estimations the resource was found to be in underexploited or slightly overexploited conditions. The fishing pressure is not regularly distributed in the area due to vessel characteristics, resource availability and market demand. There are noticeable differences in fishing pattern. An increase in total mortality has been detected in recent years and it was suggested that the situation must be kept in check. Despite a reduction in fishing effort on juveniles it was pointed out that the size at first capture is too low. No specific limitation is recommended.

Document n° 1c : MUT-9-02 : Stock assessment of *Mullus barbatus* in GSA 9, 1985-2001

19. Only a very slight increase in CPUE over the years was detected for this species. It was reported that fishing effort levels and catch rates differ by area within this GSA but in general there was an increase in biomass over time. A reduction in fishing effort particularly on spawning stock was suggested since the resource is fully or overexploited. Management measures should include area closures, 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 on the area is recommended.

20. A proposal to include variance coefficients when quoting biomass figures in the future was put forward by the working group. Some participants also expressed the fact that the description of proposed management measures should be accompanied by a quantitative component eg. the percentage of reduction in fishing effort; the size of the closed area.

Document n° 2 : *Aristeomorpha foliacea* in GSA 11

21. The distribution of *Aristeomorpha foliacea* in Sardinian waters was illustrated. It was reported that there were more cohorts of females (3-4) than of males (2). A high total mortality Z for this species was attributed to low recruitment as proved by an analysis which followed cohorts through time. An increase in fishing effort (+19%) on this species was also reported and exploitation was approaching E max. However, considering that the biomass remained relatively constant and that the species is relatively short lived, the increase in total mortality Z was attributed to natural causes.

Document n° 6 : HKE-7-02 : Stock assessment of French-Spanish shared stock of *Merluccius merluccius* in GSA 7, 1998-2001

22. The assessment was based on the commercial catches of French and Spanish trawlers, French gillnets and Spanish longlines. The catches by year and gear, as well as the size composition and biological parameters for the specimen caught were analysed. The results seem to highlight a growth overfishing scenario and a reduction in fishing

mortality was suggested to increase the yield per recruit. A decrease in spawning stock biomass was also detected and the risk of recruitment overfishing was quite evident. A series of simulations of transition analysis with time with decreasing fishing effort and improving trawl selectivity showed short term losses but medium term gains in yield. In conclusion it was suggested that growth overfishing could be reduced by increasing the current size at first capture to reach the legal size of 20 cm (whilst improving trawl selectivity) and reducing trawling effort. On the other hand the risk of recruitment overfishing could be diminished by reducing the longline and gillnet fishing effort. In addition, protecting juveniles outside the current trawl protected areas, as well as improved statistics and more sampling activities were seen as other positive options for improving the status of the stock and the quality of the assessment respectively. An overall 20% reduction in fishing effort was suggested as an immediate measure.

23. The problem of masking of medium-large sized fish in trawls by the predominance of small fish was pointed out by the working group. It was also pointed out that the low catches of large fish by other gears exerting a high effort is an indicator of low abundance of the large size classes.

Document n° 8 : ARA-1/5/6-02 : Stock assessment of *Aristeus antennatus* in the GSAs 1, 5 and 6

24. The assessment was carried out in the Alboran Sea, Alicante Gulf and Balearic Islands. Whilst there was a high variability in monthly landings and trawling practices by region, the differences in length and CPUE between ports were not significant. It was also reported that male and female Y/R were very different to each other. 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 point to an overfishing scenario. Moreover, a very high fishing effort on the spawning stock biomass was detected. It was suggested that the optimum effort should be half or three quarters of the current fishing effort on females and males respectively. The maximum yield was close to 12g per recruit for females and 5g for males.

Document n° 9 : The Pomo/Jabuka Pit critical area : cooperative approach for the identification of fisheries management options

25. Analysis of length frequency data and indices of abundances (N/km2) from MEDITS 1996-2001 for two target species: hake (Merluccius merluccius) and Norway lobster (Nephrops norvegicus) pointed out that these two populations in Pomo/Jabuka Pit represent common and shared stocks. In the case of the hake population, the area is the main nursery ground in the Adriatic Sea (in which GSA, Northern or Southern?).

26. Analysis of available and long-term series reliable ("grey literature") statistical data described the economic importance of the area for the Adriatic trawl fisheries, and after being applied into the holistic model, a high level of population exploitation, i.e. beyond MSY and fopt, was highlighted.

27. The results of Y/R model analysis indicated that in the case of both species a eumetric catch could be achieved, either by a cod-end mesh size increase (*N. norvegicus* and *M. merluccius*) or a decrease of fishing effort (*M. merluccius*).

28. Recommendations : according to the Y/R curve an increase in the mesh size, or alternatively a decrease in fishing effort is necessary. The possibility of closing the area during part of the year could be useful.

29. Discussion : the WG highlighted that fitting the surplus production model without using the running average of effort could give a too optimistic result. It was also suggested that using a Hilborn and Walters dynamic approach could give a more realistic view of status of the stock.

Document n° 10 : SAL-12/13/14-02 : Ecobiology and stock assessment of *Sarpa salpa* in GSAs 12, 13 and 14

30. The Y/R curves obtained for this species seemed very similar between the management unit 12 and 13 (fully exploited). In the GSA 14 the stock of this species seemed to be slightly underexploited.

Document n° 11 : PAC-3-02 : Stock assessement of *Pagellus acarne* in GSA 3

31. The results of an assessment of *Pagellus acarne* in Moroccan waters was presented. The assessment was based on data obtained between 1998-2000 during which time an increase in fishing effort coupled by a decrease in CPUE was observed. An effort reduction between 30-40% was recommended in the light of the results obtained from the Yashimoto and Clarke model.

ASSESSMENT RELATED DOCUMENTS

Document n° 3 : Medits results in the Alboran Sea (GSA 1 and 3)

32. This paper related to the distribution of a selection of demersal resources in the Alboran Sea. It was reported that the biomass distribution depended quite significantly on oceanographic features. *P. longirostris* was found to be very scarce on the Northern side of the Alboran Sea (GSA 1) and nurseries were concentrated on the Southern side (GSA 3). The abundance of *P. acarne, M. surmuletus* and *M. barbatus* varied not only geographicaly, but also with depth and time. No differences in this regard were observed, but for *M. merluccius*.

Document n° 4 : Spatial and seasonal of juvenile concentrations in the Gulf of Saronikos and the Cyclades islands

33. The juveniles of hake occur throughout the year at all depths. Their spatial distribution is largely depended on the oceanographic conditions. Due to the occurrence of juveniles during spring of some other commercial species such as Mullus surmuletus in the catch of beach seiners, the decrease of the fishing season for this gear has already enforced.

Document n° 5 : Hake discards in the NW Mediterranean

34. Discards of small fish (less than 15mm) were significant in all sampled ports in the western Mediterranean especially in Sete and Porto Santo Stefano. The abundance in the resource and magnitude of discards varied by season and area. The variation in discard quantity by area was attributed to the local practice of fishermen and market demand. It was recommended that discards should be taken into account when carrying out future assessments.

Document n° 7 : Standardized measures of relative abundance of demersal fish in Greece.

35. This paper was presented during the SAMED workshop and was not discussed by the present working group. However, this paper has been included in Annex E of this report.

RESULTS OF THE EU SAMED (STOCK ASSESSMENT IN THE MEDITERRANEAN) EU PROJECT :

36. Within the framework of the activity of the Sub-Committee on Stock Assessment of the Scientific Advisory Committee of GFCM-FAO, the Seminar "Stock assessment and production of demersal resources in the Mediterranean" was held at the FAO Headquarters between 18-19 March 2002.

37. The main aims of the Seminar were:

- to present the results obtained within the framework of the MEDITS and SAMED EU projects;
- to promote the exchange of experiences among fishery researchers;
- to stimulate discussion on the contribution of different complementary approaches to the stock assessment.

38. Twenty communications regarding the SAMED results were presented and discussed. The communications were related to the following topics:

a) Biological and demographic parameters of demersal resources, based on data coming from direct or indirect methods.
b) Production models (analytical and/or global) for analysing the current state of the resources.
c) Spatio temporal pattern of recruitment in Mediterranean demersal resources.

In order to ensure wide diffusion of the Seminar outcome, the publication of a special issue of the FAO journal "Studies and Reviews" was decided upon. For this purpose an Editorial Board, composed of John Pope, Giuseppe Lembo and Jorge Csirke was appointed.

39. Following the Seminar, an overview of the SAMED results was also presented during the Working Group on Demersals. Although the SAMED Project was not yet concluded, a great effort was made to make the WG the Sheets TS1, TS2, and TS3 available; these sheets related to *M. merluccius*, *M. barbatus* and *N. norvegicus* for 14,

13 and 10 GSAs, respectively. The sheets B and Z will be sent to the Co-ordinator of the Sub-Committee on Stock Assessment in the forthcoming days.

40. As a general outcome of the SAMED analysis it was highlighted that the values of Z for the examined species were, in several GSAs, much higher than M, implying a fully or an overexploited status of resources. Owing to the fact that neither target, nor limit reference points were discussed and adopted, indications on the levels of reduction of fishing mortality were not quantified. Hence the need of a discussion on the reference points was warmly recommended.

41. However, it was suggested that management options such as the protection of recruits by closure of nursery areas and closed season should be implemented.
Finally, it was demonstrated that for the first time data collected using a standard methodology, for six years trawl surveys, were elaborated adopting common protocols in order to contribute in giving assessments of the status of the resources.

GENERAL DISCUSSION

42. The working group recalled the request by the GFCM to focus assessment-related work on shared stocks. However, it was noted that only few works of this kind have been presented until now at the working group (hake stock in the Gulf of Lions, Adriatic fisheries). The main problem was associated with the uncertainty of identifying the shared stocks of the priority species listed by the GFCM. It was pointed out that, in fact, Adriamed had worked on the identification of shared stocks in the Adriatic and 13 shared Adriatic demersal species had been included in Annex E of the report of the meeting of the Sub-Committee on Stock Assessment 2001. It was stated that whilst stock assessment work carried out by the working group should focus on those shared stocks for which data already exists, FAO regional projects such as Adriamed, Copemed and MedSudMed are very likely to make major contributions in the near future.

GENERAL CONCLUSIONS AND RECOMMENDATIONS

43. The conclusions and recommendations of the stock assessments included in this report have been agreed upon by this working group.

44. 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 prioritary species of regional or sub-regional concerns.

- Avoid papers which were not assessments, or are not dealing with methodologies directly linked with assessments.

- 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. Any kind of proposal aiming to the improvement of the forms is welcome

- Since the WG has not yet agreed on a common standard evaluation method, assessments should be done using the longest reliable data series available and the most appropriate methods.

- The identification of biological reference points is recommended and should be included in the agenda of the next SCSA meeting.

- The eligibility of a new method used should be discussed by the working group and agreed upon or otherwise.

- Scientists are invited to analyse the effects of alternative exploitation strategies on the resources, using simulation methodologies.

- The Working Group regretted the absence of experts from the Eastern Mediterranean and Black Sea region and called on these countries to make an effort to send scientist to the Working Group session.

The address of the web site where the complete set of documents should be put is:

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

COORDINATION OF THE DEMERSALS WORKING GROUP

45. Considering that the current coordinator of this working group could no longer take on this responsibility, the working group unanimously agreed that Mr. Enrico Arneri (IRPEM - CNR) would act as the new coordinator of the demersals working group.

46. The working group acknowledged the sterling work carried out by the outgoing coordinator Mr. Henri Farrugio and thanked him for his great efforts in undertaking this important task.

DATE AND PLACE OF THE NEXT MEETING

47. The next meeting will be held early in March 2003. The location of the meeting will be identified by the Scientific Advisory Committee.

ANNEX 6

GENERAL FISHERIES COMMISSION FOR THE MEDITERRANEAN
SCIENTIFIC ADVISORY COMMITTEE
Sub-Committee for Stock Assessment
Working Group on small pelagic species
FAO, Rome, 20-22 March 2002

OPENING OF THE MEETING

1. The third meeting of the SAC Working Group on Small Pelagic Species of GFCM was held in FAO, Rome from 20 to 22 March 2002.

2. Twenty-six scientists from six countries attended this meeting. Moreover delegates from European Union, AdriaMed and MedSudMed, 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. P. Vidoris (NAGREF-FRI). was the Reporter.

PRESENTATIONS TO AND DISCUSSIONS BY THE WORKING GROUP

5. Nineteen technical papers were presented and discussed by the Working Group.

6. These documents covered totally or partially 13 Management Units (MUs) and five 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. Ten 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). Such references should be used when completing the standard forms adopted by the last session of the Working Group.

9. Forms D, Z, concerning the synthesis of the assessments and the working papers were discussed.

10. Document n° 01. ANC+SAR_ 01 _02 *Engraulis encrasicolus* + *Sardina pilchardus*. 1990-2001

Sardine. A peak of landings of around 6000 tons was found in 1991-1992, but then decreased to an overall mean value of 1000-2000 metric 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. Taking into account these results it does not seem necessary to recommend any reduction of fishing effort on this stock

Anchovy. Only Malaga bay area, which represent 85% of total landings, has been considered.

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, besides to an increase of CPUE values, which reached this year the highest level since 1995, despite the autolimitations in the volume of landing decided by the fishermen in order to maintain the market prices.

The last acoustic assessment available, from 2001 ECOMED survey, indicated that anchovy biomass in Málaga Bay was 13 210 metric tonnes, showing an important increment respect to the previous situation. Since most of the stock is concentrated in Malaga Bay this estimation can be considered as representative of the whole northern Alboran area.

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 actual level of fishing effort. However, taking into account the important fluctuations of this stock and the few age classes composing it (practically only 0 and 1), it would be necessary to continue the monitoring of this stock.

11. Document n° 02. ANC+SAR_ 06 _02 *Engraulis encrasicolus* + *Sardina pilchardus*. 1990-2001

ECOMED surveys were carried out from 1990 to 1993, and from 1995 to 2001, between La Nao Cape and Creus Cape.

Sardine. From 1990 to 2001, the estimated biomass fluctuated from 200 000 t in 1992 to 50 000 t in 2000. The estimation for 2001 was 97 000 t, 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.

Taking into account the actual 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 actual level of fishing effort.

Anchovy. 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 at 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 t) was two times higher than that computed for 2000. However, taking into account the important fluctuations observed in the recruitments, which have a direct effect on the total biomass of the stock, it is recommended that actual levels of fishing effort should be maintained.

12. Document n^{o} 03. ANC_ 6+7 _02. *Engraulis encrasicolus* 1993-2001.

The situation of Gulf of Lions and North Catalonia anchovy shared stock was presented. Even if the GFCM management units are different, many arguments support the concept of a shared stock between France and Spain. This regards mainly the continuous distribution of the adults, eggs, larvae and juveniles and the exploitation of this resource by both fleets of each country in the Gulf of Lions, without any conflict at present. Biomass and abundance data obtained by direct methods from French and Spanish surveys are analysed and combined, as well as catches and fishing effort. Taking into account the high level of biomass available at this time and the relatively low catches on this shared stock, the W.G. recommends to maintain the fishing effort but to continue to evaluate yearly the state of the stock, due to the close relationship between environment factors and recruitment of the anchovy that can result in important natural fluctuations in the abundance of the stock.

13. Document n^{o} 04. SAR_03_02. *Sardina pilchardus* 1990-2000.

La sardine (*Sardina pilchardus*) est l'une des espèces les plus exploitées en Méditerranée marocaine, elle constitue 80% des débarquements de la flottille sardinière. L'évaluation de la biomasse de la sardine ainsi que son état d'exploitation a été basée sur l'analyse de cohortes par longueur (LCA) d'une série de données sur la composition en tailles collectée au cours de la période 1990-2000. La biomasse a connu une phase de diminution à partir de 1992 suivie d'une augmentation à partir de 1998. Il est constaté que l'intensité de pêche est plus élevée sur les adultes avec une mortalité par pêche qui dépasse l'optimum de 40%. Face a cette situation de surexploitation de la ressource, il est recommande de diminuer l'effort de peche de 40% par rapport au niveau actuel.

14. **Document n° 05. ANC+SAR_16_02 *Engraulis encrasicolus* + *Sardina pilchardus* 1997-2001.**

Results from two echo-surveys carried out during July and September 2000 were presented and discussed. Biomass estimates show anchovy population amounts to about 1/3 of sardine biomass, as already observed in July 1998. A comparison with a DEPM estimate of anchovy spawning biomass obtained for the same area revealed a good agreement between the two methodologies in 1998. In contrast, results diverged in summer 2000, when acoustic estimates were about 4 times higher (2,800 tons vs. 11,000 tons). Acoustic biomass estimate for anchovy was reconfirmed by landings recorded in Sciacca, the most important base port in the study area for the small pelagics landings. It is worth noting in this context that anchovy and sardine populations represent approximately 90% of landings. However, during the period 1997-2001 landings (and CPUEs) of the anchovy population experienced very high (most probably, mainly environmentally induced) inter-annual fluctuations, while

sardine fluctuations were much less pronounced. Consequently, anchovy landings, which amounted to about 1/10 of sardine landings in 1999, became predominant in year 2001. So, as concerns the management issues, present results suggest the situation of anchovy population in M.U. 16 to be more critical compared to sardine population, as the combination of adverse environmental conditions with high fishing effort patterns might have very negative consequences for the resource.

No formal assessment forms were filled out because of the lack of sufficient information for the delivering of specific recommendations for the management of small pelagic species in the study area (M.U. 16, South of Sicily). In particular, there is a need for reliable estimates of total catches from the whole M.U., which combined with the acoustic biomass estimates would permit to evaluate the exploitation rates of local purse seine and mid-water pair trawling fisheries.

15. Document n° 07. SAR_17_02. *Sardina pilchardus* 1975-2001

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.
Given this situation and considering also that the present level of catches (18,800 tonnes, average catch on the period 1999-2001) is about the 18% of the estimated biomass, the current level of fishing effort could be moderately increased.
Due to the low market demand for the species, discards of sardine at sea may occur. Monitoring of sardine discards at sea is recommended. Moreover, market campaigns that would increase the demand of sardine and diminish discards at sea are also recommended.

16. Document n° 08. ANC+SAR_17_02. *Engraulis encrasicolus* + *Sardina pilchardus* 2001.

In the Central and Northern Adriatic Sea hydroacoustic surveys have been carried out by the Marine Fishery Research Institute of Ancona since the 1970s. However, only the Western sector of the Adriatic could be surveyed. For the first time a hydroacoustic-pelagic trawl survey combined with environmental parameters monitoring, covering the whole Northern Adriatic Sea, was jointly carried out by Croatia (Institute of Oceanography and Fisheries, Split), Italy (IRPEM-CNR, Ancona) and Slovenia (National Fishery Research Institute, Ljubljana). This cooperative survey exercise was promoted by and carried out within the framework of the FAO-AdriaMed Regional Project. The fact that the previous years surveys had been carried out only within the western sector has lead to an underestimation of 33% of the total pelagic biomass. The experimental application of the Voronoi diagram geometric algorithm for the survey area subdivision was presented to the WG and discussed. The WG recommended echosurveys to be conducted also in the eastern part of Adriatic Sea for more reliable estimation of pelagic biomass. The WG recommended also that the methodology used in this assessment would be improved, by increasing the number of hauls.

17. Document n° 10. ANC-17-02 *Engraulis encrasicolus* 1975-2001.

The estimated stock biomass of Adriatic anchovy by VPA showed a strong fluctuation during the observed period (1975-2001). 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.
Given this situation and considering also that the present amount of catches (20,542 tonnes, average catch on the period 1999-2001) is about the 17% of estimated biomass, the current level of fishing effort should be mantained or slightly increased.

18. Document n^{o} 12. SAR_20+22_02. *Sardina pilchardus* 2000-2001.

The first DEPM parameters are presented for Mediterranean sardine (*Sardina pilchardus*) stocks of the central Aegean and Ionian Seas. This application of DEPM presented particular interest and difficulties due to the peculiar topography of the survey area (consisting of many small-sized, semi –enclosed gulfs) and the small size and increased patchiness of sardine populations. Fish in the Ionian Sea showed a delayed spawning peak (end of January-March) compared to the Aegean Sea (November-January) and consequently the DEPM surveys were carried out in December 2000 (Aegean Sea) and January-February 2001 (Ionian Sea). To increase the number of age categories for constructing mortality curves and increase the precision of daily egg production estimates, we included both eggs and yolk-sac larvae in single embryonic mortality curves. Composite spawning frequency estimates (based on both Day-1 and Day-2 female spawners, defined by the postovulatory follicle method) were calculated and batch fecundity was measured in hydrated, tertiary-yolk globule and migratory nucleus females. In contrast to other sardine and anchovy species and subspecies, the Mediterranean sardine exhibits a group-synchronous oocyte development with a well-defined hiatus in oocyte size frequency distributions established before the onset of final maturation. The estimate of total spawning biomass for the surveyed area (central Aegean and Ionian Seas) was 19826 metric tons with a coefficient of variation CV = 0.429. Compared to existing values for Atlantic sardine stocks, the estimates of spawning frequency and batch fecundity were only slightly lower in the Mediterranean, despite considerable differences in mean female weight between the Mediterranean and the Atlantic populations.

19. Document n^{o} 13. ANC_22_02. *Engraulis encrasicolus* 1999.

The application of the DEPM 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 yielded 13180 t in 1999. The extension of the study area to include the whole Thracian Sea, would increase the precision of estimations providing a more representative picture of the spawning stock in the overall area. Moreover, standardization of the methodologies used would provide more comparable results and would eventually lead to a more accurate evaluation of spatial and temporal effects on the spawning biomass of small pelagics.

RELATED DOCUMENTS

20. Document n° 06. ANC_16_02 *Engraulis encrasicolus* 1998-2000.

Based on the results of two combined oceanographic surveys carried out during the end of June and the beginning of July 2000, the anchovy (*Engraulis encrasicolus*) spawning biomass in M.U. 16 was evaluated through the Daily Egg Production

Method (DEPM). Spawning biomass amounted to about 2,850 metric tons. This DEPM application, jointly with those carried out in 1998 and 1999, are considered especially relevant in relation to the hydrographic phenomena characterising the environmental regime of the Strait of Sicily. The main results of DEPM application during the period 1998-2000 were presented to the W.G. However this working paper was not considered for discussion between participants of the W.G. due to the non-attendance of both the authors

21. Document n° 09. SAR_17+18+19_02. *Sardina pilchardus* 1997-1998.

The Adriatic shared stock of European sardine (*Sardina pilchardus*) was examined for population structuring and to identify self-recruiting units using genetic marker variation analyses. The genetic stock structure analysis of 11 sardine samples (307 individuals) collected from Adriatic Sea and Ionian neighbouring area from December 1997 to July 1998, carried out through sequence variation analysis of a 307bp cytochrome *b* gene, showed an overall lack of genetic subdivision among samples. This finding is in agreement with previous data obtained with other types of genetic markers (i.e., allozymic and mtDNA restriction fragment length polymorphism). These data indicated Adriatic sardine shared stock as a part of a larger self-recruiting population whose boundaries are larger than the investigated area and contradicted the previously hypothesised existence of two sub-populations of sardines in the Adriatic Sea argued on morphological differences, which could be rather attributed to different hydrographical and/or ecological conditions occurring in different areas of Adriatic Sea.

22. Document n^{o} 11. ANC+SAR-17-02 . *Engraulis encrasicolus* + *Sardina pilchardus* 2001.

The small pelagic species (*Engraulis encrasicolus*, L., *Sardina pilchardus*, Walb.) are the most important shared stocks of Adriatic fishery. They represent about the 85% of the Italian small pelagic catches, the 85% of the Croatian total catches and a considerable percentage of the catches of Slovenia and Albania. Thus they are of key importance for Adriatic fisheries. In the past, data on small pelagics of Adriatic were collected in each country applying different methodologies, because data collection was focused to different goals. As consequence, data could be not comparable and they risk to be not useful for joint data processing and data analysis.

Since June 2001 a new research programme titled "Data Collection and Biological Sampling System on Small Pelagics in the Adriatic Sea (AdriaMed-SP)" has been implemented in the context of the FAO-ADRIAMED project. Albania, Croatia, Italy and Slovenia participate in the AdriaMed-SP programme. The primary objective of AdriaMed-SP is to build a network in Adriatic for data collection (statistical and biological data) using the same methodology. Consequently, it will be then possible to carry out joint elaboration and analysis of data.

Adriamed-SP could be decisive for an efficacious joint management of small pelagics in Adriatic.

It is strong recommended to maintain and to improve in the near future the Adriatic joint network on small pelagics built in the ambit of the research programme Adriamed-SP.

23. Document n^{o} 14. ANC_01+07+09+17+18+20+22+29_02. *Engraulis* encrasicolus 1988-2001.

Analysis of genetic variation in the mitochondrial DNA of European anchovy (*Engraulis encrasicolus*) revealed strong population structure in the Black and Mediterranean Seas and the East Atlantic. Two distinct groups of haplotypes (phylads A and B) were revealed, the relative proportions of which varied widely in different basins. Black sea contained only phylad A, whereas its frequency declined to app. 0.85 to the northern Aegean, to 0.40 in the Ionian Sea, Ligurian Sea, the Gulf of Lions and the Bay of Biscay, and to 0.14 in northern Adriatic. Unexpectedly, an area defined by Cape Verde to the South, north coasts of Portugal to the North, and Alboran Sea to the East, was characterized by phylad proportions more similar to the North Aegean or the Black Sea rather, than to the neighboring areas of Mediterranean and the Bay of Biscay. Given the complex and information rich population structure of this species in the Mediterranean, monitoring of genetic variability in this species, both in space and time, should constitute an integral part of studies for stock structure.

24. Document n^{o} 15. BOO+TRA_22_02. *Boops boops* + *Trachurus trachurus* + *Trachurus mediterraneus*. 1998-2000.

Samplings were carried out with chartered trawler and beach seiner monthly in the Saronikos Gulf (Sep '98 to Aug '99) and bimonthly in the Cyclades islands (Sep '99 to Aug '00) in order to identify sites of juvenile concentrations. Juveniles of picarel (*Spicara smaris*) and bogue (*Boops boops*) caught by beach seiner were not observed in the Saronikos Gulf during the open fishing season (Oct-May) except for bogue caught during October. On the contrary juveniles of these species, caught by beach seiner as well, were observed in the Cyclades islands during late spring and spring respectively. The time difference for the occurrence of juveniles in the two areas appears to be related to different time of spawning connected with seawater temperature. In the Saronikos Gulf juveniles of Mediterranean horse mackerel (*Trachurus mediterraneus*) caught by beach seiner and of horse mackerel (*Trachurus trachurus*) caught by trawler were observed during October and May (open fishing season) respectively. Trawler in the Cyclades islands did not catch juveniles of small pelagics. Due to the occurrence of juveniles in the catch of beach seiners mainly during spring, the fishing season for this gear has been recently decreased.

25. Document n^{o} 16. ANC+SAR+TRA_20+22_02. *Engraulis encrasicolus, Sardina pilchardus, Trachurus* sp. 2000-2001.

The purse seine fishery in the west coast of Greece (Patraikos gulf) and in the central Aegean Sea (Pagassitikos gulf) was investigated on a monthly basis, from June to December 2000 and from March to December 2001. Sardine and anchovy composed about 80% of the catch in both areas, but the proportion of each species varied. Other important species were *Boops boops*, *Trachurus* sp., *Scomber japonicus* and *Sardinella aurita*

26. Document n^{o} 17. ANC+SAR_20_02. *Engraulis encrasicolus, Sardina pilchardus* 2000-2001.

The reproduction of sardine and anchovy was studied in Patraikos gulf (West Greece). Samples were collected with commercial purse seiners, on monthly basis, from June

to December 2000 and from March to December 2001. The spawning season for anchovies is quite elongated but is more intensive during the summer months. The reproduction of sardine is taking place during winter. The results showed that the L_{50} for both males and females anchovies was 12.8 cm. For female sardines maturity was attained at 14.1 cm and for male sardines at 13 cm. These results are considered preliminary and further studies are needed.

27. Document nº 18. ANC+SAR_20+22+23_02. *Engraulis encrasicolus, Sardina pilchardus* 1996-2001.

Data on fishing effort (fishing days at sea) and corresponding total catch/day for the purse seine fleet have been collected by the Institute of Marine Biology of Crete (IMBC) since the second half of 1995. Data were collected over a net of 21 stations throughout the Greek Seas. In the present study we analyzed the monthly data of fishing effort as well as catch per day during 1996-2000, using time series analysis. The following vessel size groups were considered: purse-seiners smaller than 15 m and larger than 15 m. Collected data were also aggregated for five fishing subareas: North Aegean, Central Aegean, South Aegean, Cretan waters and Ionian Sea. The analysis of the time series of catch/day indicated that pelagic resources, have been declining in the main fishing grounds. This declining trend was mainly reflected in the anchovy catch per day series, than in the sardine series. Declining catch/day trends are regarded as strong indicators of overfishing especially in the light of the fact that fishers maintain high catch rates by fishing in "hot spots". The results of the present analysis provide important information on the state of the Greek pelagic fisheries resources, which are characterized by a complete lack of accurate long-term data on catch per unit of effort.

28. Document nº 19. ANC_22_02. *Engraulis encrasicolus*, 1984-2000.

In the present study the Autoregressive Integrated Moving Average (ARIMA) and the Exponential Smoothing models were used to analyze the anchovy monthly landings as they recorded by the auctions statistics. The data are monthly totals of landings in weight for 16 consecutive years, January 1984 to December 1999, from the six main auctions located in the Aegean Sea; Alexandroupoli, Kavala and Mixaniona in the North Aegean Sea and Volos, Chalkida and Piraeus in the central Aegean Sea. Time series analysis concern the anchovy landing sizes as they recorded by the auctions statistics. The best fits were obtained by a multiplicative seasonal ARIMA model (0,1,2) (0,1,1) 12 and a multiplicative seasonal exponential smoothing model with damped trend, both indicating the multiplicative seasonality of the series. However, both methods did not provide annual forecasts with 95 % confidence intervals for the year 2000.

Recommendations

1. In small pelagic fishes, abundance is heavily dependent on recruitment and natural mortality shows high inter-annual variability. The study group recommends the conduction of direct biomass estimates for small pelagics in the Mediterranean by means of acoustics and the daily egg production method (DEPM) and the integrated analysis of catch-at-age data with direct biomass

estimates to efficiently assess the state of the stocks. It should be noted that for only 4 management units (Alboran Sea, Northern Spain, Gulf of Lions and Northern Adriatic) there are available time series data for stock assessment. In some other areas there are fragmental series of assessments in the framework of various EC projects. Biomass estimations have to be made on a yearly basis in all management units. Time series of assessment for small pelagic species in Mediterranean is of high priority and it is necessary for management recommendations. An effort should be made for such projects to be initiated. The application of acoustics and DEPM methods should be standardized among different Mediterranean research groups.

2. As a preliminary work to standardize methods, it will be useful to compare methodologies in age reading and the results of age-length keys for different years. At this purpose an *ad hoc* Working Group should meet to establish common criteria for age-reading in the GFCM area, in collaboration with other research groups working on the subject.

3. Lengths at first maturity estimates of the Mediterranean sardine and anchovy show deviations resulting by the adoption of different methodologies. Specifically, (a) the manner of assigning maturity stages (macroscopic vs. microscopic methods) (b) the timing of sample collection for estimating L_{50} in relation to the seasonal variation of spawning intensity and the timing of peak spawning. It is recommended that a standard procedure be adopted for the estimation of L_{50}. Standardized, unbiased estimates of L_{50} for anchovy and sardine stocks in the Mediterranean are urgently needed for the implementation of management measures.

4. The list of main target species should be reexamined during next year. Each participating country, will provide in the next meeting, a table with species to be included in the reference list. The WG intends to address a request to the SAC committee in order to produce priority criteria for the completion of the species list. Such criteria like the commercial value, the percentage in catch and the shared exploitation of the species may be considered.

5. Population structure and dynamics of small pelagic fish can best be understood by incorporating studies of genetic stock identification. Analysis of intra-specific genetic variability can provide important insights for the effective management of the stocks, as the case of anchovy has demonstrated. Therefore, it is recommended that analysis of genetic stock structure should constitute an integral part of stock assessment studies.

6. It was pointed out that, as in previous years, the presented studies covered only partially the GFCM area. More important small pelagic stocks in Alborán sea, Northern Spain, Gulf of Lions, Northern Adriatic, Strait of Sicily, Ionian and Aegean Sea have been regularly analyzed by the group. On the other hand, the absence of attendants from most of the Eastern and Southern Mediterranean and Black sea countries, as well as of experts working in some northern regions, as Ligurian and Tyrrenian seas and south Adriatic, have resulted in a lack of information from those areas. So, this WG strongly recommends to

GFCM to make a special effort and encourage all countries to attend these meetings.

7. The Working Group took note on the recent progress, concerning the standardization of methodologies and the joint assessment of stocks, made in the Western Mediterranean and the Adriatic Sea through the international cooperation promoted by the FAO-CopeMed and FAO-AdriaMed Projects. With reference to the relevance of international cooperation within the Mediterranean, particularly to address the resources assessment and fishery management of shared small pelagic stocks, the WG appreciated and considered desirable the further development of scientific cooperation projects such as the FAO Regional Projects as CopeMed (Western Mediterranean), AdriaMed (Adriatic Sea) and the recent MedSudMed (Strait of Sicily). Also, the importance of this kind of international initiatives was underlined, as they foster the scientific cooperation among EU-member and non-member States of the Mediterranean.

DATE AND PLACE OF THE NEXT MEETING

The next meeting will be held in March 2003 at the Istituto di Ricerche Sulla Pesca Maritima in Ancona, Italy.

ADOPTION OF THE REPORT

The report of the 3rd W.G on small pelagic species of the Sub Committee on Stock Assessment was adopted on 22 March 2002.

ANNEX 7

Reporting on the status and trends of stocks under the GFCM mandate as part of FIRMS (the global fishery resources monitoring system)

Mr M. Taconet presented the Fisheries Global Information System (FIGIS[1]) from FAO, together with one of its subsystem of direct concern to the SAC/SCSA, the Fisheries Resources monitoring System (FIRMS[1]), and the FIRMS-GFCM case study developed with the assistance of the COPEMED information system expert Mr A.Bench.

The objective of the case study were (i) test the integration of GFCM information in FIGIS through the FIRMS, (ii) collaborate to the improvement of the FIGIS Document Type Definition (DTD) for stock, (iii) formulate recommendations for the inventories and observations related to stocks and fisheries in the Mediterranean.

The work consisted in integrating 2 SAC/SCSA reports (2001 session report, assessment of Hake in Gulf of Lions 2001 working group report).

The benefits of the methodology have been underlined: streamlining information flows, reusability of information for multiple usage, structured exchangeable information, realisation of structured inventories (Stocks, Fisheries), availability of tools to publish up-to-date observations by regular reporting from the data-owner, links the information to related information owned by other partners and information domains (species identification, vessels types and fishing techniques, etc...).

The results of this case study showed that the FIGIS system is compatible with the information currently prepared by GFCM in its Stock assessment working groups and SCSA reports, although it was recognised that further participation of GFCM in setting up harmonised formats at international level would facilitate the process of integrating GFCM information into FIRMS.

In order to facilitate the preparation of a possible agreement between FIGIS and the GFCM, it is recommended to establish the list of stocks and fisheries monitored under the Commission's mandate, for which the Commission or its subsidiary bodies would have full reporting responsibility and ownership in the FIRMS system. The GFCM should also co-ordinate the extension of this inventory to reflect those stocks, resources, and fisheries monitored at national level. Finally, it was proposed that the draft FIRMS partnership agreement be transmitted to the GFCM Secretariat for consideration.

[1] For detailed description of FIGIS and FIRMS interacting with the web prototype, a pdf document has been prepared and can be downloaded from the following URL http://193.43.36.85/fi/figis/about2.jsp

Document prepared by COPEMED to be presented at the SAC/GFCM meeting in Rome on 1-4 July 2002

ANNEX 8

Methods for Assessing Mediterranean Fisheries

by

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Summary

Existing methods, their data needs (appropriate quality, coverage and mainly their availability) and expected outputs (effort-based control system in the context of the Precautionary Approach as management objective) are revised to find the most suitable method for establishing a harmonised assessment methodology in the Mediterranean. Considering the lack of reliable data bases, the Length Cohort Analysis (LCA) proves to be the best, if not the only existing method adapted to the current characteristics of the region. Furthermore, the software called VIT[1], especially applied to analyse Mediterranean fisheries, is identified as the most suitable software to assess and provide advice for the management of Mediterranean fisheries.

1. Rationale

The GFCM, in its Twenty-Sixth Session, held in Lacco Ameno, Ischia, Italy, from 10 to 13 September 2001, asked to its Scientific Advisory Committee (SAC) to review **existing stocks/fisheries assessment methods** highlighting data needs, expected outputs and pros and cons and their suitability to Mediterranean stocks and fisheries. On the results of this review the SAC will have to define, at their Fifth Session to be held next June 2002, a set of the most appropriate assessment methods which should result in the establishment of a harmonised assessment methodology, agreed by scientists of member countries.

One of the FAO COPEMED Project objectives is to offer support to the works of the General Fisheries Commission for the Mediterranean (GFCM) and of it Scientific Advisory Committee (SAC) to allow the formulation of recommendations and the definition of scientific criteria for a better

[1] **The program VIT** (**Lleonart, J., and Salat, J.** 1997. VIT: Software for fishery analysis,. User's manual. FAO Computerised Information Series. Fisheries, 11: 107 pp.) is designed for the analysis of marine populations, exploited by one or several gears, based on single species' catch data (structured by age or size). The main assumption underlying the model is that of steady state, because the program works with pseudo-cohorts and it is therefore not suitable for historical data series. The program uses the catch data and ancillary parameters for rebuilding the population of the species and the mortality vectors affecting it by means of Virtual Population Analysis (VPA). Once the virtual population has been rebuilt, an analysis of the fishery can be carried out with the aid of several tools: Comprehensive VPA results, Yield-per-Recruit analysis based on the fishing mortality vector, analysis of sensitivity to parameter values and transition analysis. The latter permits non-equilibrium analysis of how a shift in exploitation regime is reflected in the fisheries. All these tools can be applied to specific studies of competition among fishing gears. The program can be used to carry out the numerical analysis, the edition of data and parameters, to obtain an age-structured data file from a size-structured data file and to visualise results. The results can also be exported to other Windows applications to refine specific details of the analysis or for the final presentation of the results. http://www.ua.es/copemed/en/index.htm

management of the exploited resources in the Mediterranean. In this context COPEMED in close agreement with the SAC President decided to finance the preparation of this document.

2. Background

2.1. Stock assessment methods and their use in the Mediterranean

There are currently three dominant approaches to fisheries stock assessment:

1. Simple models of biomass dynamics (often called surplus production models or global models) that rely only on catch and some index of abundance.
2. Analytical models: Analysis of length frequency data of catches (often called Length Cohort Analysis – LCA).
3. Analytical models: Analysis of catch-at-age data (often called Virtual Population Analysis – VPA).

There is an abundant literature on these methods and many manuals have been published to describe them and to facilitate their use. Among them the Manual of Fish Stock Assessment (Cadima, 2002), recently published by FAO is recommended to find out more about these methods. The possibilities of applying these different population dynamics methodologies to the Mediterranean are also discussed by Lleonart (1993).

Since remote antiquity, the Mediterranean has been the object of observations and descriptions in which maritime activities and fishing occupy a paramount place. The very rich Mediterranean fauna and the highly multispecific nature of catches certainly favoured the fact that the **first works were mainly oriented towards attempts exhaustive descriptions of the vital cycles and biological parameters of a given species** (Demiere,1979, Quesada, 1991)[2].

Umberto D'Ancona's observations on Mediterranean fisheries and variations in fish populations as a result of changing fishing patterns after the first World War allowed Lotka and Volterra to establish the mathematical foundations of population dynamics in the 1920s. However, the transition from marine biology *sensu stricto* to fisheries research is relatively recent in the Mediterranean. We can consider that the first practical attempts to apply some mathematical population dynamic models to exploited stocks were carried out in France and Spain in the late 1960s. Most of these first analyses used **global production models**. However, these models of classic use in fisheries exploiting monospecific resources by means of a single type of gear, and for which they

[2] **Cadima, E.L.** (2002). Manual of fish stock assessment. FAO Fisheries Technical, 393: 170p.
Lleonart, J. (1993). Methods to analyse the dynamics of exploited marine populations: Use and development of models. Sci. Mar., 57(2-3): 261-267.
Quesada, M.A. 1991. Parametros biolódgicos de peces, crustaceos y moluscos del Mediterraneo occidental. Recopilación bibliografica (1950-1990). Inf. Tec. Inst. Esp. Oceanogr., 102: 173 pp.
Dremiere, P.Y. 1979. Parametres biologiques et dynamiques disponibles sur les principaux stocks halieutiques du Goife du Lion: sous-zone 37.2 du CGPM. FAO Fish. Rep., 227:111-127 p.

were designed, **prove to be quite disappointing when applied in the Mediterranean Sea.**
These models have a sort of "black box" vision of fisheries in which only one data entry, the fishing effort and only one data output, the catch, are observable. Moreover, they require long data series and a calibrated measure of the fishing effort, which must present a certain range of variation to facilitate the analysis of catch variation. This being so, and given the characteristics of Mediterranean fisheries and available data bases, **production models are considered to have limited applicability** for evaluation in this case. In the late 1980s and early 1990s, the limitations of production models induced a group of north western Mediterranean fisheries scientists to adapt **Virtual Population Analysis** (VPA) techniques to Mediterranean fisheries.

The **Length Cohort Analysis** (LCA) is a simplification of the Virtual Population Analysis (VPA) which assumes that the stock is in a state of equilibrium. The LCA is currently the most widely used method in the Western Mediterranean. It requires a knowledge of catch distribution by size classes and by gear and some estimation of the biological parameters of the species, and currently **represents a clear line of progress for population dynamics in the Mediterranean.**

We shall cite also the **Yield per Recruit** (Y/R) analysis used on various occasions in the western Mediterranean throughout the 1980s. It makes use of simple estimates of the requisite dynamic and biological parameters (Oliver, 1983). It can also use the more solid estimates of fishing mortality provided by VPAs and LCAs, together with length/weight and length/age relationships, estimating the yield (in biomass) of each recruit brought into the fishery for different vectors of mortality. Y/R curves can thus be built by varying effort (fishing mortality) or gear selectivity (length at first capture), providing an enormously useful overview of the state of the stock. However,

Direct evaluations of biomass have also been carried out to provide useful information when statistical information of fisheries is missing. However, **the results obtained until now using this methodologies have been very limited.**

2.2. An historical overview on the last 25 years

The early applications of stock assessment methods in the Mediterranean were promoted in the 1970s by the scientific Working Groups of the General Fisheries Council for the Mediterranean (GFCM). These were **Global Models** under equilibrium, also called production models (GFCM, 1972; Charbonier and Caddy, 1986; Pereiro and Fernandez, 1974; Oliver, 1983) [3]. However, they

[3] **Charbonier, D. & J.F. Caddy**.- 1986. Report of the technical consultation of the General Fish Council for the Mediterranean on the methods of evaluating small scale fisheries in the Western Mediterranean. Sète, France, 13-16 may, 1986. *FAO Fish. Techn. Rep.*, 362, 155 pp.
GFCM. 1972. Rapport de la troisieme session du Groupe de travail du CGPM sur 1'evaluation et 1'exploitation des ressources demersales. Athenes, 6-11 mars, 1972.
Oliver, P. 1983. Los recursos pesqueros del Mediterraneo. Primera parte: Mediterraneo occidental.Etud.Rev.CGPM, 59:135 p.

proved to be **not very useful for the analysis of Mediterranean fisheries,** mainly due to their severe theoretical restrictions, but also to the impossibility of distributing the effort among the different species to which the model is simultaneously applied that constituting an additional problem. To solve it, there were various attempts to apply the so-called **Composite Production Models** (GFCM, 1972; GFCM, 1980; Garcia, 1983; Caddy and Garcia, 1984; Chavance and Girardin, 1985; GFCM, 1988).

The normal use of **analytical models** in the Mediterranean, actually LCA, was due to a co-operative research project of France, Italy and Spain, funded by the European Union, called "FARWEST - Study for assessment and management of fisheries in the western Mediterranean" and carried out in the period 1990-1994. As a consequence of this co-operative activity, in 1993 a Working Group on Population Dynamics (DYNPOP) was established in the framework of the International Commission for the Scientific Exploration of the Mediterranean (ICSEM/CIESM) with the support of the International Centre for Advanced Mediterranean Agronomic Studies (CIHEAM). DYNPOP incorporated, in the period 1992-1996 (CIHEAM, 1995; CIHEAM, 1998) scientists from the eastern and mainly southern parts of the Mediterranean. Thanks to that, **Length Cohort Analyses have been used during the last ten years to assess the main stocks and increasingly complete and reliable assessments are available.**

However, **the availability of reliable data is again the main problem to use Virtual Population Analysis** (VPA) based on long series of catch-at-age data and it was only possible to use Length Cohort Analysis (LCA) based on pseudocohorts built using length frequency data.

For this reason, a group of Spanish fishery scientists developed a **programme package based on LCA and Y/R analysis adapted to Mediterranean fisheries** called VIT (Lleonart and Salat, 1992). The program and the models underlying VIT software are conceived for the analysis of fisheries where the time depth of the information available is limited and where the technical interaction among fishing gears is an important factor to account for. Data management routines (input), and tables and graphics output have also been conceived to analyse and to provide advice of Mediterranean fisheries. This software, designed to analyse the important competitive gear situation in the Mediterranean, was updated and translated into English in 1997 (Lleonart and Salat, 1997)[4] and recently it has also been adapted to a more friendly version for

Pereiro, J.A. and Femandez, A. 1974. Aplicacidn de los modelos de produccidn de Schaefer y Fox a las pesquerfas de Palinurus, Aristeus, Mullus, Pagellus y Solea de la plataforma balear. Bol. Inst. Esp. Oceanogr., 181: 27 pp.

[4] **Caddy, J.F. and Garcia, S.** 1982. Production modelling without long data series. FAO Fish. Rep., 278: 309-313.
Chavance, P. and Girardin, M. 1985. Niveaux d'exploitation en 1982 et potentialites regionales de la pecherie chalutiere algerienne. Application d'un modele de production composite. FAO Fish. Rep., 347:113-125 p.
Ciheam, 1995. Cahiers Options Mediterraneennes, 10 :
Ciheam, 1998. Cahiers Options Mediterraneennes, 35 :
Garcia, S. 1983. Un exemple de 1'utilisation des modeles de production composites en Mediterranee espagnole. FAO Fish. Rep., 305: 97-105 p.
GFCM. 1972. Rapport de la troisieme session du Groupe de travail du CGPM sur 1'evaluation et 1'exploitation des ressources demersales. Athenes, 6-11 mars, 1972.

PC thanks to the COPEMED support. All that has facilitated research on the population dynamics of many Western Mediterranean stocks (Lleonart, 1993; Farrugio et al, 1994). VIT software can also be downloaded and installed from the COPEMED homepage or installed from the CD-Rom published by CIHEAM-COPEMED in 2001 (Franquesa and Lleonart ed., 2001) [5].

The sampling effort of the 1980s has also enabled a few conventional VPAs to be applied to some stocks (Oliver, 1993; Aldebert et al, 1994). In this analysis the results obtained when using and VPA or an LCA on annual pseudocohorts were compared, and in general, good agreement has been found between them (Oliver, 1994, Oliver et al, 1995).

We must also mention that **these analyses are highly sensitive to the estimates and biological parameters used.** Uncertainty about the Von Bertalanfy Growth Function parameters and particularly, natural mortality (Caddy, 1991) hinders correct stock assessment. Special efforts have therefore been made to improve the accuracy of these estimates (Lleonart, 1993; Farrugio et al, 1994; Djabali et al 1993). Abella et al. (1997) have analysed the problem of different natural mortality at age on LCA assessments. These methods have been applied to all kinds of species (demersals, large and small pelagics) but only to a quite limited number because of the lack of proper data.

A special meeting of the Working Group on Population Dynamics (DYNPOP) was held in Zaragoza (Spain) in January 1998 to analyse the impact of the mortality rates for different age-classes on population dynamics and stock assessment in the Mediterranean (CIHEAM, 1998) [6].

GFCM. 1980. Rapport de la Consultation technique pour revaluation des stocks dans les divisions statistiques Baleares et Golfe du Lion. GFCM. FAO Fish. Rep., 227.

GFCM. 1988. Rapport du groupe de travail ad hoc sur 1'amenagement des stocks dans la Mediterranee occidentale. FAO Fish. Rep., 386.

Lleonart, J., and Salat, J. 1992. VIT un programa para analisis de pesquerfas. Inf. Tec. Sci. Mar., 168-169: 116pp.

Lleonart, J., and Salat, J. 1997. VIT: Software for fishery analysis,. User's manual. FAO Computerised Information Series. Fisheries, 11: 107 pp.

[5] http://www.ua.es/copemed/en/index.htm . **Franquesa, R. and J. lleonart** (editors). 2001. Bioeconomic Management Tools for Mediterranean Fisheries. ISBN 84-669-5494-6.

[6] **Abella, A.J., J.F. Caddy & F. Serena**.- 1997. Do natural mortality and availability decline with age? An alternative yield paradigm for juvenile fisheries, illustrated by the hake *Merluccius merluccius* fishery in the Mediterranean. *Aquat. Living Resourc*. 10:257-269.

Aldebert, Y. and Recasens, L. 1994. Methodes d'approche du stock de merlu du Goife du Lion. Premiers resultats. In Farrugio et al. (1994).

Ciheam, 1998. Rapport technique sur la Réunion DYNPOP sur l'impact des taux de mortalité par âge sur la dynamique des populations et le diagnostique des stocks exploités en Méditerranée.

Caddy, J. 1991. Perspectives sur les activités futures en matière d'évaluation des stocks dans le Méditerranée occidentale. FAO Rapportvsur les pêches, 227: 149-154 p.

Djabali, F., Mehailia, A., Koudil, M. and Brahmi, B. 1993. Empirical equations for the estimation of natural mortality in Mediterranean teleosts. NAGA, the ICLARM quarterly, January 1993.

Oliver P. 1993 – Analysis of fluctuations observed in the trawl fleet landings of the Balearic Islands. Scientia Marina, 57 (2-3): 219 - 227.

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Oliver P. ,E. Massuti & O. Reñones, 1995. Methods of approach on the population dynamics of hake (Merluccius merluccius) in Majorca (NW Mediterranean). Cahiers Options Mediteraneennes, 10: 25-26p.

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Two species of crustaceans (norway lobster and red shrimp) have also been studied (Yahiaoui et al., 1986; Demestre and Lleonart, 1993; Sardà and Lleonart, 1993; Demestre and Martin, 1993; Spedicato et al., 1995; Ragonese and Bianchini, 1996; Colloca et al., 1998; Fiorentino et al., 1998; Orsi-Relini and Relini, 1998).

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Small pelagics such as sardine and anchovy have also been the object of analysis through population dynamics procedures (Bouchereau et al., 1986; Chavance et al., 1986; Djabali et al., 1990; Pertierra and Perrotta, 1993; Gingolani et al., 1996; Gingolani et al., 1998; Sinovcic, 1998; Santojanni et al., 1999; Vidoris and Kallianiotis, 2000).

However**, these assessment methods prove not to be very suitable for assessing the coastal pelagic stocks**. These stocks vary greatly at different times and places as recruitment fluctuates for biotic or abiotic reasons. This makes it extremely difficult or impossible to predict either the biomass or the recruitment of these stocks. On the other hand the assessments show, in general, a lack of pressure on the stocks of sardine, which is probably due to low market demand.

For this reason, some scientists, critical of the evaluation methods based on fishing data, are opting for the application in the Mediterranean of **Direct Methods of evaluation** such as ichthyoplankton surveys applying the **Daily Egg Production Method** to evaluate the Spawning Stock Biomass of fish stocks and **biomass hydro-acoustical surveys**. (Chavance, 1980, GFCM 1982; Oliver and Pastor 1986; Chavance and Girardin, 1986; Lazar et al., 1986; Miquel and Alvarez 1990; Regner, 1990, Miquel et al. 1991; Abad et al 1991; Abad et al 1992; Rubin et al 1992; Garcia 1992; Palomera and Pertierra 1993; Garcia and Palomera, 1996; Abad et al., 1996, Somarakis and Tsimenides, 1997; Casavola et al., 1998; Casavola, 1999; Quintanilla et al., 2000, Patti et al., 2000; Guennegan et al., 2000). A comparison between the DEPM, acoustic surveys and population dynamics models showed that their results appear to be quite consistent (Pertierra and Lleonart, 1996) [8].

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Trawl surveys constitute also a useful tool in assessment of demersal fisheries and have been used in several Mediterranean countries (Ardizzone and Corsi, 1997; Campillo et al. 1989, Gil de Sola 1992,). The main source of error in this case is due to intercalibration problems for the trawl surveys between the different surveys, vessels and countries. The most appropriate sampling methods, the coverage issues and the cost are additional problems to be taken into account. Since 1994 the MEDITS project is being carried out in the four European Mediterranean countries with extensive trawl surveys at the end of spring carried out in all European waters (Bertrand and al., 1998, Abella et al. 1999). The main target of this project was to get abundance indices comparable between the different areas studied. This has been made possible by the standardisation of the methodology (location of the trawl stations, same gear operated in the same way by each participant, common format for the computer files, etc...). Some results have been published and gathered in monographic issues (Bertrand and Relini, 1998; Relini et al., 1999).

These direct methods have been used to assess biomass but **few or no scientific advice for management or management actions are taken from these assessments**

We must also mention that different **statistical methodologies** of regression analysis, generalised linear modeling (GLM) and time series analysis, have been used by several authors to analyse various fisheries, in particular series of catches and CPUEs (Stergiou and Christou, 1996; Stergiou et al., 1997a; Daskalov, 1998; Goñi and al., 1999; Lloret et al., 2000a)[9]. Actually, these methodologies have not been sufficiently used in the Mediterranenan, taking into account that appropriate data bases could probably be identified in some areas.

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The methods referred to above analyse stocks alone, ignoring **interspecies relationships** and the **environment**, even though the need for analytical systems to describe these interactions is increasingly evident. Such systems would introduce new data into the findings of monospecies analyses, which ignore the limits imposed by the carrying capacity of the system. Likewise, the existence of marked fluctuations in captures apparently independent of exploitation (Astudillo and Caddy, 1988; Oliver, 1993), and which point to the concept of recruitment windows (Pauly, 1987; Bakun and Agostini, 2000, Agostini and Oliver 2002), further complicate the situation, stressing the need to observe marine systems as a whole and pointing out the limitations of "conventional" population dynamics modelling

Actually, catches are often made up of a large number of species, making calculations for a single species of limited value for management. For this reason an **integrated multispecies approach** is needed (Caddy, 1993; Lleonart and Recasens, 1996; Caddy, 1997; Merella et al, 1998; Stergiou, 1999; Lloret et al., 2000b). Because of the oligotrophic character of the Mediterranean, local events like wind-driven mixing, river discharge and advection of waters from adjacent areas can play an important role in local fertilisation (Estrada, 1996) and fishery productivity (Lloret et al., 2000b; Daskalov, 1999; Regner, 1996; Caddy et al., 1995). There are some attempts to carry out **ecosystem simulation on Mediterranean fisheries** (Stergiou and Koulouris (2000), Tudela (2000)) [10].

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Lleonart,J. 1999. Precautionary approach and Mediterranean fisheries. CIESM Workshop Seruies, 7: 15-24.

Lleonart, J. & L. Recasens.- 1996. Fisheries and the Environment in the Mediterranean Sea. In: J.F. Caddy (ed.) Resource and environmental issues relevant to Mediterranean. *General Fisheries Council for the Mediterranean.* No. 66. Rome, FAO, 142 pp. 5-18.

Lloret, J., J. Lleonart, I. Solé and J.M. Fromentin.- 2000b. Fluctuations of landings and environmental conditions in Northwest Mediterranean Sea. *Fisheries Oceanography* 000195 (in press).

Merella, P.,P.Oliver,F.Alemany & E.Massuti,1998. Approach to a multiespecies VPA considering hake-anchovy trophic interaction in the north-western Mediterranean. Cahiers Options mediterraneennes, 35: 261-272.

Oliver P. 1993 – Analysis of fluctuations observed in the trawl fleet landings of the Balearic Islands. *Scientia Marina*, 57 (2-3): 219 - 227.**Pauly,D.** 1987. Managing the peruvian upwelling ecosystem: a synthesis, p.325-342. In D.Pauly and L.Tsukayama (Eds.) The peruvian anchoveta and its upwelling ecosystem: Three decades of change. ICLARM Studies and Reviews, 15: 351p.

Stergiou, K.I.- 1999. Precaution in fisheries within the context of ecological and environmental changes. CIESM Workshop Series nº7: 33-36

The **Scientific Advisory Committee of GFCM** met for the first time in Rome in 1999. The fishery scientists of SAC at their third meeting held in May 2000 in Madrid (Spain) introduced important new elements to assess and manage Mediterranean fisheries. SAC recognised the opportunity to establish biological reference points in order to **improve fisheries management within a Precautionary Approach** (CIESM, 1999), pointing out that **biological reference points can help decision makers in defining the action to be taken in order to reach management objectives** (GFCM, 2000). Regarding SAC activity in relation to assessment and advice for management, the work carried out by the Subcommittee of Stock Assessment (SCSA) is particularly relevant. There is an ftp page[11] where all documents of SCSA and its working groups are available. This information is also available at the COPEMED website.

Furthermore, and considering that **the Code of Conduct for Responsible Fisheries establishes that conservation and management measures should be based on the best scientific evidence available. SAC** analysed all available scientific information in the region, produced in the period 1985-1999. More than 100 evaluations were selected and analysed. It has to be indicated that most of the evaluations correspond to the stocks of the northern and western part of the region. In general, the assessments are based on the application of Length Cohort Analysis (LCA) together with a Yield per Recruit Analyses (Y/R) based on short series of data. SAC also pointed out that important non-published information, relevant to stock assessment and already existing in some countries, were not available.

SAC recommended *inter alia*, to update and improve the quality and coverage of fishery data and statistics, to increase the number of assessments in the southern and eastern areas and make sure that all the assessments will be **carried out on a regular basis.**

Since 1996 the **FAO COPEMED Project** is working in the field to advise, technically support and establish networks to facilitate co-ordination to support fisheries management in the Western and Central Mediterranean. COPEMED have faced the main issues related to stock assessment through their activities producing relevant results in the context of information and data (Coppola, et al, 1999, Coppola, 2000) and in the study of socio-economic indicators in some specific areas (Alboran Sea and Gulf of Gabes). COPEMED has also been

Stergiou, K.I. and Koulouris, M.- 2000. Fishing down the Hellenic marine food waters. CIESM Workshop Series 12 (in press)

Tudela, S.- 2000. Assessment of the primary production required to sustain a fully exploited NW Mediterranean fishery: implications for the exploited ecosystem. CIESM Workshop Series 12 (in press)

[11] **FTP://CUCAFERA.ICM.CSIC.ES/PUB/SCSA.**

training regional experts and developing new tools to assess and manage Mediterranean fisheries (Franquesa and Lleonart, 2001) [12].

Finally, we must comment on the fact that while it may be difficult to understand resource behaviour prior to exploitation, using monospecific methods and ignoring environmental factors, it is equally difficult to comprehend the fishery system as a whole if we leave out the **socio-economic factors** of exploitation.

2.3. Some relevant events regarding Mediterranean stock assessment and management to be taken into consideration

After the previous items, it is evident that the applicability of current exploited fish population dynamic models to the particular problems of Mediterranean fisheries, constitutes a matter of major concern for fishery scientists in the Mediterranean. This matter has been discussed continuously over the last 30 years. The following quotations, refer to relevant meetings where the major problems related to stock assessment in the Mediterranean were discussed. Perhaps in some cases the problems considered are on the borderline between assessment and management, however these issues have to be considered essential when we are trying to select the most suitable assessment methods.

Mediterranenan scientists faced this problem probably for the first time **in October 1979. The First Technical Consultation of GFCM on Stock Assessment in the Balearic and Gulf of Lyons Statistical Divisions** was held in Palma de Mallorca (Spain). During that meeting a Critical Analysis of assessment Methods in the Mediterranean (FAO, 1980) was carried out. The discussion was based on a document prepared by John Caddy (1980) on *"Perspectives sur les activités futures en matiere d'evaluation des stocks dans la Mediterranee occidental".* This document established three different succesive stages when analytical models are used depending on the data available:

1. *Des estimations ponctuelles de la valeur des paramètres provenant **d'échantillons occasionnels** de composition per taille/âge permettent l'application de modèles de rendement simples.*

[12] **CIESM,** 1999. Precautionary Approach to local fisheries in the Mediterranean Sea. CIESM Workshop Series, 7:89 pp.
GFCM, 2000. GFCM, 2000. Report of the Second Session of the GFCM Scientific Advisory Committee. Madrid, 2000. FAO Fisheries Report No. 602.
Coppola, R., 2000. Inventory of the Artisanal Fishery Communities in the Wstern and Central Mediterranean. Informes y Estudios Copemed, 6 (CD-Rom)
Coppola, R., I. De Leiva and P. Oliver. 2000. Enciclopaedia of living marine resources of the Mediterranean. Informes y Estudios Copemed, 3 (CD-Rom)
Franquesa, R. and J. lleonart (editors). 2001. Bioeconomic Management Tools for Mediterranean Fisheries. Ciheam-Copemed (CD-Rom). ISBN 84-669-5494-6.

2. ***Plusieurs années successifs*** *(5+?) d'estimations ponctuelles se sont accumulées, permettant une certaine analyse séquentielle des données*.

3. ***Le reffinement des estimations*** *de mortalité, de biomasse et de composition d'âge permet de développement de prédictions quantitatives plus exactes*.

At that moment, it was considered to be in the first stage, due to the lack of appropriate data. Unfortunately, more than 20 years later, it is not so clear that this first stage had been overcome.

Regarding the difficulties found at that time, the Technical Consultation made the following comments:

- ***L'imprécision des données*** *de base en ce qui concerne tant les statistiques de capture et d'effort que les paramètres biologiques utilisés dans les modèles analytiques*.

- *La nécessité de ne pas se contenter d'analyses ponctuelles de l'état d'exploitation des pêcheries; au contraire* ***il convient de donner une continuité aux programes*** *en tenant toujours en considération la normalisation des méthodes de travail dans le temps et dans l'espace*.

- *L'intérêt particulier pour* ***les évaluations résultant de campagnes de prospection*** *... on peut obtenir, grâce à une normalisation adécuate des méthodes, des indices de biomasses fiables plutôt que des valeurs absolues. Une avantage de cette méthode est qu'elle est relativement indépendante d'autres sources de données, comme par example les statistiques officielles; il convient cependant de ne pas sous-estimer l'intérêt de ces dernières*.

In October 1992, the Committee of Marine Vertebrates and Cephalopods of the International Commission for the Scientific Exploration of the Mediterranean Sea (ICSEM/CIESM) organised and held a Workshop on Methods for analysing fish population dynamics in the Mediterranean Sea in Trieste (Italy). The main conclusions of this workshop (Lleonart, 1993) were:

- **The age (or length)-structured models are more useful and appropriate to the Mediterranean** than those based on catch-effort data analysis.

- However the same workshop stated that the models used to analyse the dynamics of fish populations must be suited to the real catch data and biological and demographic parameters. In this regard, **the availability of reliable data was identified as the main shortcoming** in the assessment of Mediterranean fisheries.

In September 1994, the **Seventh and last meeting of the GFCM Technical Consultation of Stock Assessment in the Balearic and Gulf of Lyons Statistical Divisions** was held in Sete (France). This Technical Consultation carried out an analysis of the state of the art of stock assessment in the Western Mediterranean. A report (Oliver, 1996) was presented where some relevant issues were pointed out. Among them, and independently of other aspects already mentioned, two important additional issues can be highlighted:

First, concerning **Catch Composition**, and despite the inherent complexity of multi-species landings in Mediterranean ports, **there is an identifiable series of around 15 target species** which, in biomass or in economic terms, constitute the basis of production. These species represent 70-80 percent of all landings, the landings of at least eight of them are over 2 percent of the total catch, and in two cases over 15 percent. This situation allows us to establish that, in the Mediterranean, **the applicability of the current stock assessments methods, whose validity has sometimes been put in doubt due to the complexity of multispecies landings, can be fully accepted.**

Secondly, fisheries administrators (and it is they who are supposed to be responsible for fisheries management) **sometimes fail to set clear Management Objectives** with clear priorities (e.g. increasing the extracted biomass, maintaining specific fish sizes in the market, increasing the economic value of catches, maintaining or raising employment levels, etc.), which makes it very hard for fisheries scientists to formulate sound scientific management criteria.

In May 1995 The Twenty-first Session of the General Fisheries Council for the Mediterranean (GFCM) was held in Alicante (Spain). In this meeting the issue of the **Effort-Based Management System** was discussed providing very useful elements regarding the definition of **Management Objectives.**

Several paragraphs from the report of this meeting have been selected:

39. " **The Council agreed that choosing direct effort control, as opposed to a control of landings as a method of limiting fishery impacts on the stocks,** was often necessary because of the small-scale nature and diversity of Mediterranean fisheries which was not conducive to real time monitoring of catches in a catch quota control framework."

54. The Chairman **noted the evident deficiencies of the current FAO database on fleet sizes and characteristics operating in the Mediterranean**, and the need for transparency and burden sharing of the costs and restraints required by a system of effort control. This should also be shared by distant-water vessels operating in the Mediterranean. Adherence of all States fishing in the Mediterranean to the key provisions of the Compliance Agreement, especially those relating to the preparation and updating of vessel registries for

all boats over 15 m was important, even prior to ratification of that Agreement, and would constitute a de facto commitment to flag State responsibility.

55. **The Secretariat was requested to prepare a simple and comprehensive questionnaire to collect data on fishing vessels and distribute it immediately to all member countries.** The Council agreed to a deadline for submission to the Secretariat of complete data on national fishing fleets operating in the Mediterranean in 1994-5 by the time of the October 1995 meeting of the FAO Council. The data should be broken down into vessel categories over and under 15m OAL (overall length), and these two categories should in turn, be divided into sub-categories of vessels predominantly operating active and passive fishing gear respectively. Each sub-category should include a breakdown of vessels by total HP and/or total Gross Registered Tonnage (GRT) as available.

At this meeting the following resolution was also adopted:

GFCM Resolution 95/4

The Council calls on its member countries to prepare a list of fishing boats in operation from national ports in the Mediterranean and provide this information to the GFCM Secretariat by October 1995 in the form specified in the report of the Twenty-first Session of the General Fisheries Council for the Mediterranean.

Unfortunately, seven years later the list of fishing boats in operation from national ports in the Mediterranean has still not been completed.

In July 1995 a **Group of Independent Experts to Advise the European Commission on the Fourth Generation of Multi-annual Guidance Programmes** was established to report to the European Commission. The work carried out by this group is relevant regarding the establishment of an effort-control system in Mediterranean fisheries, based on the assessment of levels of fishing mortaly.

Effort is a measure of the activity of the fishing fleet. The term is, however, ambiguous as it is used in two different contexts: As a **measure proportional to the fishing mortality** (Fisheries biology), **but also as a measure proportional to the variable costs of the fishing vessel** (Fisheries economics).

One of the key problems in reducing fishing mortality through effort control is to ensure that the effort parameters which are selected for control are relevant to fishing mortality. There are numerous examples of attempts to control effort through decommissioning, reduction of allowable days at sea etc. which have failed to achieve the primary objective, to reduce fishing mortality.

The relation between fishing mortality and effort is usually expressed as a simple linear relationship :

$$F = q E$$

where E is effort and q is the slope, usually referred to as catchability. However, operational definitions of effort which are appropriate according to this criterion are hard to get at for two reasons :

- **the relation between individual input factors** (vessel size, power, gear characteristics, days at sea, etc.) **and fishing mortality has not been much investigated and is rarely known** (Alvarez et al, 1999)[13], even on a qualitative basis.

- **current data collection systems and data bases in many cases do not contain information on crucial effort parameters**. Vessel characteristics and basic type of main gear may be available, but parameters relating to dimensions or other gear characteristics are not, and relevant data on activity (days absent, trips, hauls) are quite often not available either.

In the context of the scientific advice for an effort-based management, effort can be considered as composed of two elements: a capacity element and an activity (utilisation) element. The capacity element can in turn be considered as composed of a capacity related to the vessels (numbers and size/power) and a capacity related to the gears used (including the fishing gear proper, gear handling equipment, catch handling equipment and equipment used to search). The activity element should express the utilisation of the available capacity in terms that are relevant to fishing mortality. The measures of activity that are relevant to fishing mortality are variable between fleets - it may be the time the fishing gear is in the sea, search time, number of sets etc. In some cases simple measures such as time at sea may be relevant. In brief :

E = Capacity (vessels) * capacity (gear) * activity

Management measures addressing one of these parameters without restraining others may therefore not be efficient in reducing effort and thus fishing mortality.

In consequence, to propose levels of fishing mortality. The fishing mortality to be used as reference points for medium term management are dependent on the objectives of the management.

[13] **F. Alvarez, F. Alemany, E. Ferrandis.** 1999. Modelling the Relationship between Fishing Effort and Effective Fishing Mortality in Western Mediterranean Trawl Fleets: The Case of Hake and Stripped Red Mullet Fisheries in Balearic Islands. Final report. Report of the Project EU-DG XIV, 96/025.

Furthermore, **Management objectives** can roughly be divided into two groups :

1. **Objectives concerned with the sustainability of stocks and fisheries**, e.g. maintenance of spawning stocks size above a critical minimum size.

2. **Objectives concerned with maximisation of output from the fisheries**, e.g. maximisation of yield or socio-economic benefits to society.

There is an increasing awareness that these two sets of objectives must be considered as hierarchical: **the sustainability of fisheries must be ensured before objectives concerning output maximisation can be pursued.** This hierarchy is implicit in the precautionary principle and is also the basis for the biological advice given by advisory bodies.

The fishing mortality associated with the two sets of objectives can be used as **reference points for medium term management** within a hierarchical framework corresponding to the hierarchy of the objectives. These reference points must be seen in close association with the objectives: **reference points relating to sustainability must not be regarded as targets but must be seen as upper limits to fishing mortality, whereas reference points relating to yield maximisation may be seen as targets provided that sustainability is ensured at these levels** (Oliver, 2001)[14].

3. Suitability of different assessment methods

The main elements to be taken into account when the most suitable assessment methods to be used to provide advice for fisheries management have to be identified, are: The definition of clear **management objectives** with clear priorities and the availability and reliability of the **data at disposal**. **Vague management objectives and the lack of appropriate data constitute the real drawback for the establishment of a harmonised assessment methodology at regional level in the Mediterranean on a regular basis.**

The key elements related to these issues in a Mediterranean context can be extracted from the analysis performed in the previous paragraphs:

3.1. Management objectives

Fisheries administrators sometimes fail to set clear Management Objectives (see page 12). **The GFCM agreed to choose direct effort control, as opposed to a control of landings, as a method of limiting fishery impacts on stocks** (see page 13).

[14] **Oliver, P.** 2001. State of Mediterranean resources in relation to their sustainable management within the "Precautionary Approach to Fisheries". Recent initiatives and proposals to fill the gaps. CIESM Workshop Series, 12: 53-56 pp.

To assess levels of fishing mortality (F), **assessment methods has to estimate actual F and options of reference F**. The relation between fishing mortality (F) and effort (E) is usually expressed as a simple linear relationship:

$$F = q E$$

In relation to management, effort can be considered as composed of two elements : a capacity element and an activity (utilisation) element:

$$E = \text{Capacity (vessels)} * \text{capacity (gear)} * \text{activity}$$

Management measures addressing one of these parameters without restraining others may therefore not be efficient in reducing effort and thus fishing mortality (see page 15).

Furthermore, **management objectives can be divided roughly into Objectives concerned with the sustainability of stocks and fisheries and objectives concerned with maximisation of output from fisheries**. It seems evident that **sustainability of fisheries must be ensured before objectives concerning output maximisation can be pursued**. In consequence, fishing mortality associated with the mentioned two sets of objectives can be used as reference points for medium term management. Reference points relating to sustainability must not be regarded as targets but must be seen as upper limits to fishing mortality, whereas reference points relating to yield maximisation may be seen as targets provided that sustainability is ensured at these levels (see page 15).

Unfortunately, the relation between individual input factors and fishing mortality has been not much investigated and is rarely known and current data collection systems and data bases in many cases do not contain information on crucial effort parameters (see page 14).

3.2. Data needs

Administrators have to establish management objectives for scientists but also to provide data. In fact this has been a matter of concern for Mediterranean fishery scientists for a long time. Probably the failure to develop marine population dynamics for exploited stocks in the Mediterranean is mainly due to the lack of fishery statistics and databases.

In short, the data needed are: **historical series of catch data, catch-at-age data or length frequency data, effort data and some index of abundance** (for instance catch per unit effort) with at least minimal coverage and reliability.

However, catch and effort statistics remain a weak point, as the official statistical data are still often very far from reflecting the reality (see page 3).
SAC, to increase the number of assessments, is recommending inter alia, to update and improve the quality and coverage of fishery data and statistics carried out on a regular basis (see page 10). The availability of reliable data was identified as the main shortcoming in the assessment of Mediterranean fisheries. (see page 12)

On the other hand, one of the key problems in reducing fishing mortality through effort control is to ensure that the effort parameters which are selected for control are relevant to fishing mortality (page 14). In this context, in 1994, GFCM noted the evident **deficiencies of the current database on fleet sizes and characteristics operating in the Mediterranean**, and called on its member countries to prepare a list of fishing boats in operation from national ports. Unfortunately, seven years later the list has not still been completed (see pages 13-14).

3.4. Assessment Methods

At first, it is important to point out that **in the Mediterranean there is an identifiable series of target species** which, in biomass or in economic terms, constitute the basis of production. This fact allows us to establish that the applicability of the current stock assessment methods, whose validity has sometimes been put in doubt due to the complexity of multi-species landings, can be fully accepted (see page 12).

Global production models, based on catch-effort data analysis, prove to be quite disappointing when applied in the Mediterranean Sea and production models are considered to have limited applicability (page 2). In fact, Global Models are not very useful for the analysis of Mediterranean fisheries (page 3) and age (or length)-structured models are considered more useful and appropriate to the Mediterranean (see page 12).

As has already been said, the availability of reliable data is considered one of the main shortcomings in the assessment of Mediterranean fisheries. However, **scientists have tried to assess fisheries with several tools, using the data available**. In this context, the **Length Cohort Analysis (LCA) represents a clear line of progress for population dynamics in the Mediterranean** together with the Yield per Recruit Analysis using the estimates of fishing mortality provided by this method (page 2).

Actually, Length Cohort Analyses have been used during the last ten years to assess the main stocks and increasingly complete and reliable assessments are available. For this reason **a software called VIT has been developed, based on LCA and Y/R analysis adapted to Mediterranean fisheries and designed to analyse the enormously important competitive gear situation in the Mediterranean** (see pages 1 and 4). However, these assessment

methods prove not to be very suitable to assess the coastal pelagics stocks (see page 6).

Direct evaluations have also been carried out to provide useful information to allow the performance of these assessment methods when statistical information of fisheries is missing. However, the results obtained so far have been very limited. (see page 3). Direct Methods of evaluation such as ichthyoplankton surveys applying the Daily Egg Production Method to evaluate the Spawning Stock Biomass of fish stocks and biomass hydro-acoustical surveys are used to assess coastal pelagic resources. Trawl surveys are used on demersal resources. However, so far few or no management actions have been taken from these assessments (see page 7).

Moreover, in the context of stock assessment, from a methodological point of view, it is evident and there is wide agreement on **the need for analytical methods to observe marine systems as a whole**; to describe interspecies relationships in an integrated multispecies approach and the environment and on the limits imposed by the carrying capacity of the system (see page 9). It is equally difficult to comprehend the fishery system as a whole if we omit socio-economic factors of exploitation (see page 10).

Considering also that the **Code of Conduct for Responsible Fisheries establishes that conservation and management measures should be based on the best scientific evidence available** (see page 10) and that **SAC is recommending to improve fisheries management within a Precautionary Approach,** it is evident that when the suitability of assessment methodologies is under discussion the need for prompt action must be considered as a major condition.

4. Conclusion

GFCM asked SAC to review the data needs, outputs expected and pros and cons of existing stock assessment methods as well as their suitability to Mediterranean stocks and fisheries. As stated before, conservation and management measures should be based on the best scientific evidence available. Obviously this evidence has to be provided by a scientific assessment which will have to be performed using the data bases at disposal.

In summary, taking into consideration all issues already commented in previous items and assumed that Control of fishing effort is the method for limiting fishery impacts on the stocks in the Mediterranean, the Length Cohort Analysis (LCA) is, at present, the only current option available to assess and provide advice in a harmonised way and on a regular basis for the management of Mediterranean fisheries.

In the medium term, in order to improve the assessment based on LCA, the use of Virtual Population Analysis (VPA) is recommended as soon as

longer (around 10 years) and more reliable data bases are available. Permanent and long series of annual total catch by species, fisheries and gears together with sampling programs to distribute the catch by ages and obtain the strength of cohorts and fishing mortality by year should be built up as soon as possible.

ANNEX 9

Transition analysis ofMerluccius merluccius in the gulf of Lions

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Code	MGL9801
Page	1

TRANSITION ANALYSIS: methodology

Five simulations of different management strategies have been performed:

Simulation 1: decrease the trawl effort to 80% of their current value. Maintain the effort of the other gears.
Simulation 2: decrease the trawl effort to 90% of their current value. Maintain the effort of the other gears.
Simulation 3: decrease the effort to 80% of their current value for all gears.
Simulation 4: decrease the effort to 90% of their current value for all gears.
Simulation 5: modify the selectivity of trawl in order to enforce the 20 cm minimum legal size. It has been considered none catches in age 0 and 50% of catches in age 1 for females and 0.75% of catches in age 1 for males

The simulation conditions are the following:

- LCA, developed on a mean pseudocohort over 4 years (1998-2001)
- 15 years prediction
- Recruitment independent from stock (no stock-recruitment relationship)
- The analyses have been performed separately for sex and the results added for presentation
- Stochastics: lognormal distribution for recruitment, with variance = 0.17 (95% recruitments between 0.4 and 2 times the current recruitment) and 1000 iterations

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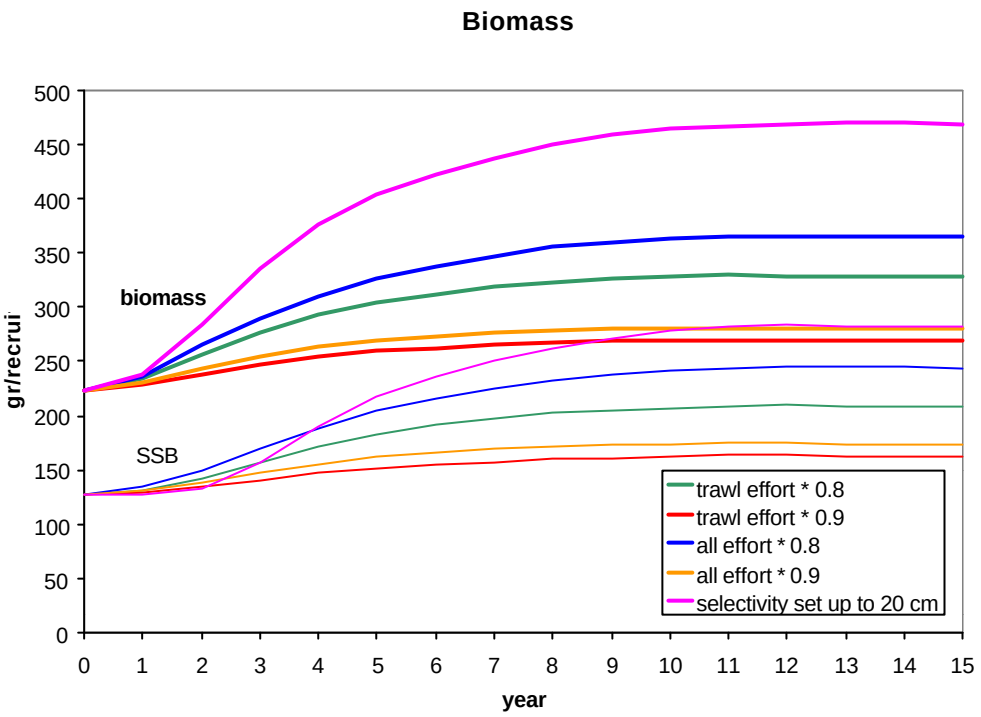
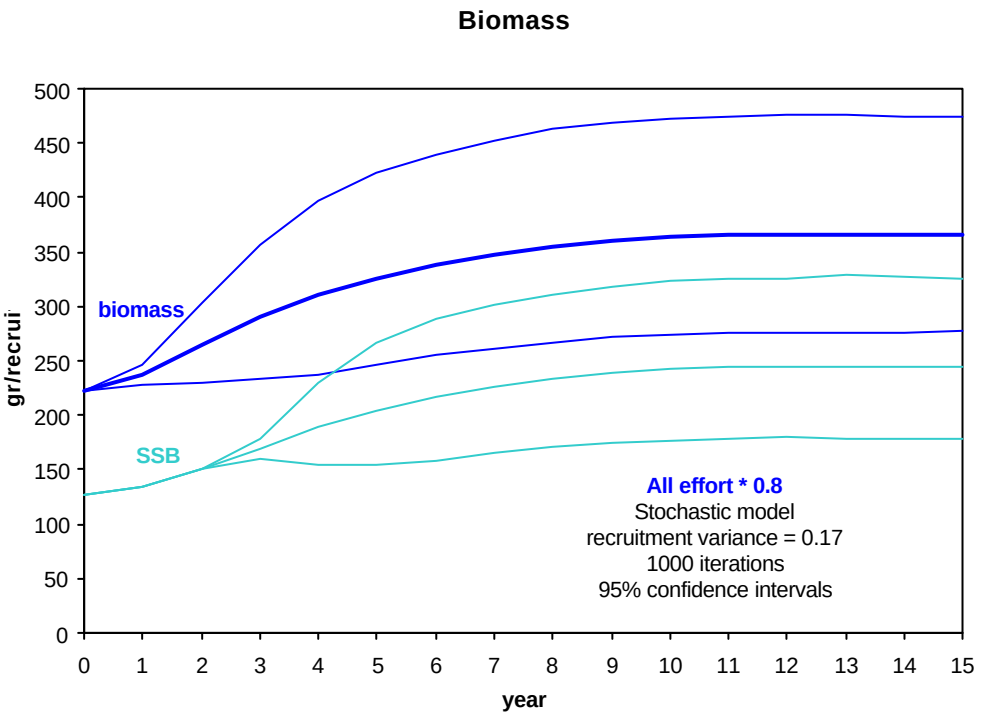
TRANSITION ANALYSIS: results (I)





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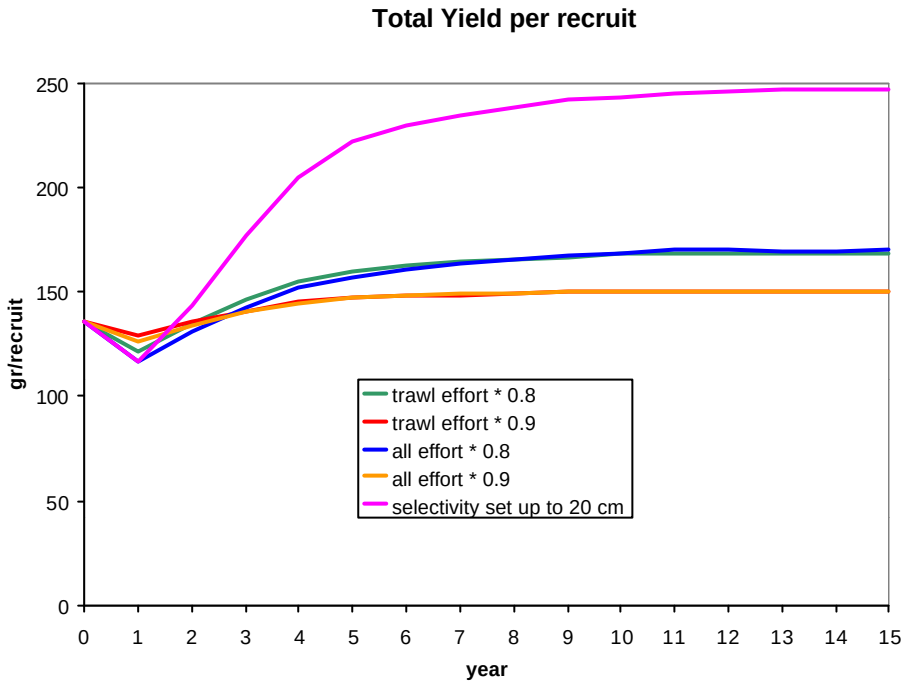
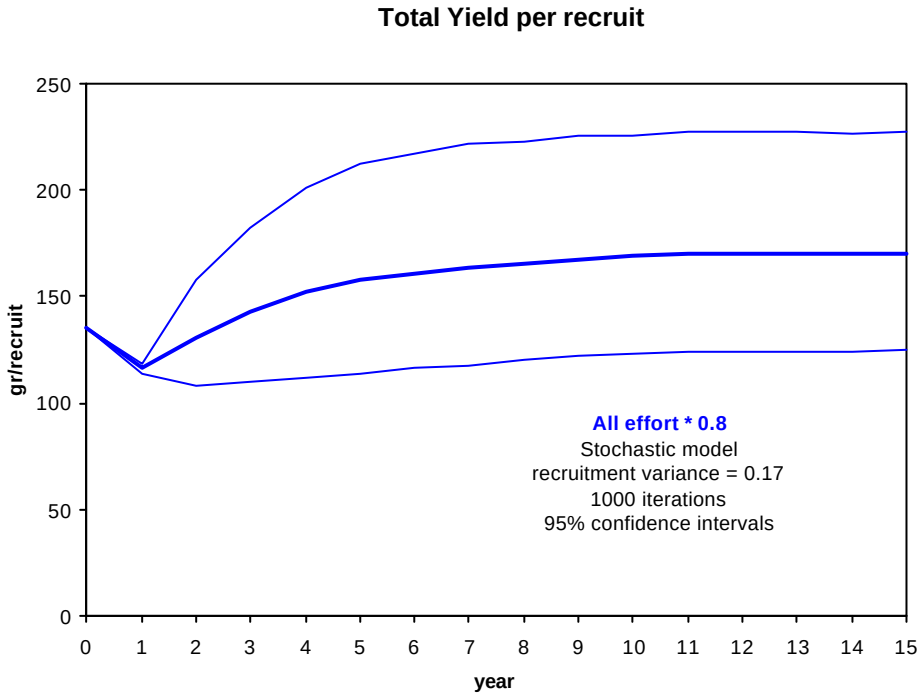
Page	3

TRANSITION ANALYSIS: results (II)





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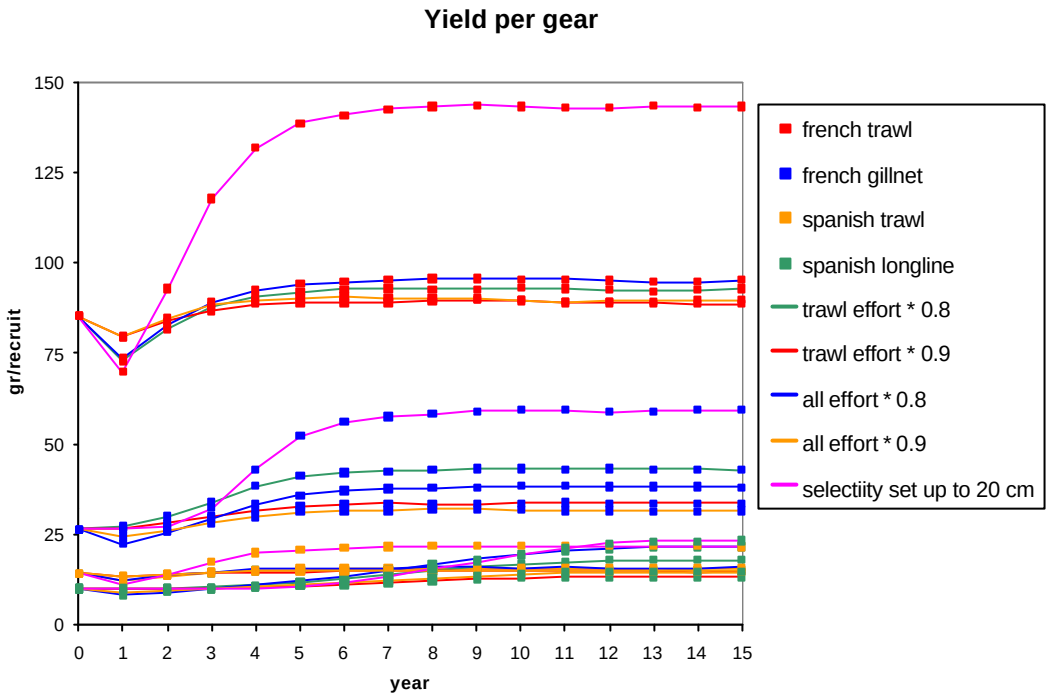
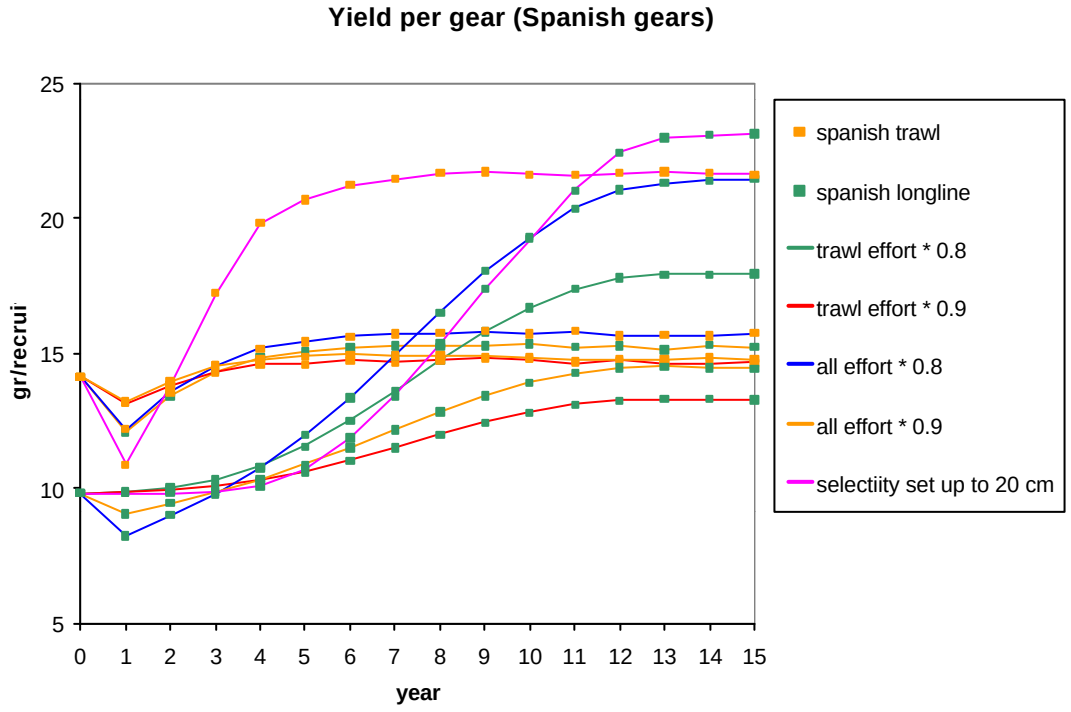
TRANSITION ANALYSIS: results (III)





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TRANSITION ANALYSIS: conclusions

1. In all cases (simulations and gears) there are losses at short term and gains at medium term
2. In 3-4 years (in the worst case) the initial production should be recovered
3. Improving trawl selectivity is more efficient than reduce effort (considering the parameters used)
4. Even taking into account a high level of recruitment uncertainty the all management measures tested have positive results.
5. Considering only the effort reduction, the simulation 3 (reduction of 20% of effort for all gears) appears to be the most effective

The following table shows the relative gains after 15 years maintaining the management measures. The initial values are 1 in all cases.

Simulation	Biomass	SSB	Total yield	French trawl	French gillnet	Spanish trawl	Spanish longline
1	1.48	1.63	1.24	1.09	1.63	1.08	1.83
2	1.20	1.27	1.11	1.04	1.27	1.04	1.35
3	1.64	1.92	1.26	1.12	1.44	1.11	2.18
4	1.26	1.37	1.11	1.05	1.20	1.04	1.47
5	2.11	2.23	1.82	1.68	2.26	1.53	2.35