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GENERAL FISHERIES COMMISSION
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GENERAL FISHERIES COMMISSION FOR THE MEDITERRANEAN

SCIENTIFIC ADVISORY COMMITTEE

Ninth Session

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REPORT OF THE EIGHTH SESSION OF THE SUB-COMMITTEE ON STOCK ASSESSMENT (SCSA)* ROME, ITALY, 11–14 SEPTEMBER 2006

***Available only in English**

OPENING OF THE MEETING

1. The eighth meeting of the SAC Sub-Committee on Stock Assessment was held at FAO headquarters in Rome from 11 to 14 September 2006.

2. The meeting was attended by 49 scientists from 9 Members. The list of participants is attached as Annex A.

ADOPTION OF THE AGENDA

3. The Agenda of the Sub-Committee was modified and adopted (Annex B) and the list of documents was updated (Annex C).

4. The meeting was chaired by Ms Constantina Karlou-Riga, Coordinator of SCSA. Mr Enrico Arneri and Mr Stelios Somarakis served as rapporteurs.

SESSION 1: RESULTS OF RECENT STOCKS ASSESSMENT

Presentation and discussion of new assessment on demersal stocks

5. No. 13 technical papers were presented and discussed.

6. Assessments for n° 8 stocks were presented covering n° 3 Geographical Sub-Areas (GSAs), n° 5 species, and n° 1 shared stock. See Annex D.

7. Two types of documents were presented: (i) assessment documents and (ii) assessment-related documents. The conclusions and recommendations of the assessment documents presented and endorsed by the Sub-Committee are listed below.

- Demersal assessment documents

8. **Document n° 1: Assessment of red shrimp (*Aristeus antennatus*) exploited by the Spanish trawl fishery (1992–2005) in the Geographical Sub-Area 05 (Balearic Islands). A. Carbonell, M. Gaza, F. Ordinas, M. Valls, A. Felpete**

Summary: Updated information on landings and effort has been done on annual basis (1992-2005). Throughout the late 1990s, landing decreased to a minimum value of 100 t. During early 1990s and from 2000s landings fluctuated between 200-250 t. Females predominate in the landings nearly 70-80% of the total. Discards of the red shrimp are null.
The number of red shrimp vessels for the whole GSA 05 area has been decreased steadily from the early 90's. For the period 2002-2005, the registered red shrimp fleet is estimated to be 36% inferior to the former fleet. The fleet fish in single daily hauls by vessel.
The estimated effort figures were made based in hours by haul information obtained from on board sampling programme. The LPUES fluctuated around long-term average of 6.4 Kg/hour. Effort data indices (Landings/LPUE) remain fairly stable.
Annual age compositions by sex of landings were obtained from the respective length compositions by mean of "slicing", using von Bertalanffy growth parameters. Catch numbers at age for each sex were summed to provide a combined sex age compositions. In the same way catch numbers at age for tuning were obtained. Catch weight at age for combined sex were calculated weighing the number and weight at age by sex.
Total biomass (TB) decreased from 898 t in 1992 to 533 t in 1997. Since then, there has been an increase to 628 t in 2005. For the overall TB time series, the stock is still 30% lower to the beginning of the time series.
Recruitment shows a decreasing trend from 1992 (45 million) to 1996 (25 millions) recovering from 1997 to 2000 (30 millions) and decreasing again to a value of 22 millions in 2002. From to 2003 recruitments appear stable at 30 millions.
FBar has fluctuated mainly between 0.2 and 0.5 from 1992 to 1999, after which it remained fairly stable around 0.3. The average FBar across the time series is 0.39.
Compared to the last year assessment the present figure shows slight differences. Biomass and recruitment appear to be higher. The Separable VPA and Extended Survivor analysis (XSA) show similar figures, and correspond to a stable fishery and resource, with slight variations in the reference period.
The resource in the GSA-5 appears close to the maximum yield and fully exploited. A reduction of 30% of the present effort is proposed using a F35%spr biological reference point. The reduction of the effort by technical measures concerning the gear, such as increase the mesh size or shift to a square mesh design can improve the exploitation.

Source of management advice: Separable VPA and Extended Survivor Analysis (XSA) of VPA Lowestoft Stock Assessment suite (Darby and Flatman, 1994). Y/R analysis was based on outputs of the XSA combined sex.

Stock status: The resource in the GSA 05 appears close to the maximum yield and fully exploited.

Management advice and recommendations: not to increase the fishing effort. Preferably a reduction of 30% of the present effort is proposed using a F35%spr biological reference point. The reduction of the effort by technical measures concerning the gear, such as increasing the mesh size or shift to a square mesh design can improve the current Y/R[1].

[1] See general comment on square mesh.

9. **Document n° 2: Assessment of red shrimp (*Aristeus antennatus*) exploited by the Spanish trawl fishery (1996–2005) in the Geographical Sub-Area 06 (Northern Spain). A. Carbonell J. L. Pérez Gil, A. Fernández, A. Esteban, M. García-Rodríguez**

Summary: Updated information on landings and effort has been done on annual basis (1996-2005). Throughout the time series landings fluctuated between 300 and 400 tonnes. Throughout the late 1990s, landing decreased bellow 300 t. From 2002 landing recover the initial values over 300 tonnes. Females predominate in the landings nearly 70-80% of the total. Discards of the red shrimp are null.
The number of harbours with red shrimp fleets is 14 for the whole area. The estimated effort figures was made based on daily vessels sale sheets information obtained through the National Sampling Programme available for the Santa Pola fleet. The LPUES fluctuated around long-term average of 30 Kg/day. Effort data indices (Landings/LPUE) remain fairly stable.
Annual age compositions by sex of landings were obtained from the sex length compositions by means of slicing method, using the corresponding growth parameters (García-Rodríguez, 2003). Catch numbers at age for each sex were summed to provide a combined sex age compositions. In the same way catch numbers at age for tuning were obtained. Catch weight at age for combined sex were calculated weighing the number and weight at age by sex.
The assessments were carried out using the Separable VPA and Extended Survivor Analysis (XSA) of VPA Lowestoft Stock Assessment suite program (Darby and Flatman, 1994). Y/R analysis were based on outputs of the XSA combined sex.
Total biomass (TB) fluctuated between 3500 and 4500 t. The minimum TB was estimated in 2002 at 3594 t and the maximum was estimated in 2005 at 4442 t.
Recruitment fluctuated without trend, average recruitment estimation was 115 t. Lower values correspond to 1998, 2000 and 2002 (80-90 million). Maximum recruitment estimation of 177 millions individuals corresponds to 2003 year.
FBar has fluctuated mainly between 0.1 and 0.4. The average FBar along the time series is 0.2.
Compared to the last year assessment the present figure shows slight differences. Biomass and recruitment appear to be higher. The Separable VPA and Extended Survivor analysis (XSA) show similar figures, and correspond to a stable fishery and resource, with slight variations by the reference period.

Source of management advice: Separable VPA and Extended Survivor Analysis (XSA) of VPA Lowestoft Stock Assessment suite program (Darby and Flatman, 1994). Y/R analysis were based on outputs of the XSA combined sex.

Stock status: The resource was considered fully exploited from the previous assessments, and at the present the diagnostic of a fully exploited resource is confirmed.

Management advice and recommendations: not to increase the fishing effort from the level defined in the assessment forms for the fleet.

10. **Document n° 3: Preliminary Assessment of Deep-water pink shrimp Parapenaeus longirostris from the trawl fishery off the geographical sub-area Northern Spain GSA - 6. J. L. Pérez-Gil, M. García-Rodriguez, A. Fernández, and A. Esteban**

Summary: Deep-water pink shrimp (Parapenaeus longirostris) is one of the most important crustaceans species for the trawl fisheries developed along the GFCM geographical sub-area Northern SPAIN (GSA 06). This resource is an important component of commercial landings in some ports of the Mediterranean Northern Spain and occasionally a target specie of the trawl fleet, around 260 vessels, which operate on the upper slope. During the last years, a sharp increase in landings was observed, starting in 1998 and reaching the maximum value in 2000, followed by a decreased trend during the period 2001-2005. In 2005 the annual landings of this species amounts 63 tons in the whole area, which it has been the lowest value of the historical series.

The state of exploitation was assessed for the period 1992-2005 by means of a LCA and yield-per-recruit (Y/R) analysis (VIT program; Lleonart and Salat, 1992) on the mean pseudo-cohort 2001-2005 for the GFCM geographical sub-area Northern Spain (GSA-06). In addiction, a VPA Separable, tunned with standardised CPUE from commercial fleet and abundance indices from two trawl surveys, was carried out applying the Extended Survivor Analysis (XSA) method (Lowestoft program; Darby and Flatman, 1994) over the period 2001-2005. Both methods were performed from size composition of trawl catches (obtained from on board and on port monthly sampling) and official landings, transforming length data to age data by slicing. Available CPUE data series, both of commercial fisheries, from Santa Pola fleet, and scientific surveys (MEDITS – LEDER) were used.

The results show a decreasing trend, both in landings and total biomass of the stock, along the studied period. The SSB-R relationship also shows a decreasing trend in both components. Fishing mortality (Fbar) increases in the last year. It can be concluded that the resource is seriously over-exploited, with a clear risk of recruitment over-exploitation. On the contrary, the results of the Y/R analysis show a scheme not so close to the overexploitation, as in others short-lived species occurs, such as the deep-water shrimp *Aristeus antennatus*.

In the GSA 06 area, this resource is characterized by high temporal variability, due probably to both biotic and abiotic factors. However trends diminish heavily: currents indicators represent only a 10% of the values observed five years ago.

Source of management advice: LCA and yield-per-recruit (Y/R) analysis (VIT program; Lleonart and Salat, 1992). In addiction, a VPA Separable, tunned with standardised CPUE from commercial fleet and abundance indices from two trawl surveys, was carried out applying the Extended Survivor Analysis (XSA) method (Lowestoft program; Darby and Flatman, 1994) over the period 2001-2005.

Stock status: Decreasing biomass trend, resource fully exploited probably close to overexploitation.

Management advice and recommendations: This is a preliminary assessment and the results of the various analyses are somehow in contradiction. The fact that the biomass (through VPA assessments) is seriously declining should be considered an important warning signal, but for this year there is no specific recommendation. It would be in any case unwise to let the effort increase.

11. Document n° 4: Stock assessment of striped red mullet (*Mullus surmuletus*) from the trawl fishery off the GSA 05 (Balearic Islands) A. Quetglas, F. Ordinas and E. Massutí

Summary: Striped red mullet (*Mullus surmuletus*) is one of the most important target species for the trawl fishery developed by around 40 vessels off Mallorca (Balearic Islands, GFCM-GSA05). The annual trawl landings of this species, which represents 80–90% of red mullets (Mullus spp.) landings, have oscillated between 73 and 117 tons in the last decade. The assessment of this stock has been carried out applying tuned VPA (Extended Survivor Analysis, XSA) on a data series covering 6 years (2000–2005) and both VPA and Y/R analysis on mean pseudo-cohorts from that period. These approaches were performed using monthly size composition of catches, official landings and the biological parameters estimated in the framework of the Data Collection Programme (2003–2004). The VPA was tuned with CPUE from commercial trawl fleet (2000–2005) and bottom trawl surveys (2001–2005). The vector of natural mortality by age was calculated from Caddy´s (1991) formula using the PROBIOM Excel spreadsheet (Abella et al., 1997).The software used were the Lowestoft VPA program (Darby & Flatman, 1994) for the XSA analysis and the VIT program (Lleonart & Salat, 1992) for the cohort and Y/R analysis. The results from this assessment indicate that the M. surmuletus resource is fully exploited in the Balearic Islands (GFCM-GSA 05).

Source of management advice: Tuned VPA (Extended Survivor Analysis, XSA) on a data series covering 6 years (2000–2005) and both VPA and Y/R analysis on mean pseudo-cohorts from that period.

Stock status: resource is fully exploited.

Management advice and recommendations: not to increase the fishing effort.

12. **Document n° 5: Stock assessment of red mullet (*Mullus barbatus*) from the trawl fishery off the Geographical Sub-Area 06 (Northern Spain). A.M. Fernández, M. García-Rodríguez, J. L. Pérez Gil, A. Esteban**

Summary: Red mullet (*Mullus barbatus*) is one of the target species of the trawl fishery in the GSA 06. The trawl fleet operating in this area is composed by 647 boats averaging 47 TRB, 58 GT and 297 HP. Some of these units (smaller vessels) operate almost exclusively on the continental shelf, targeting red mullet, octopus and sea breams. According to official data, landings increased considerably between 1973 and 1982 and from this year until now a decreasing trend has been observed. The average landings of this species in the period 1998-2005 reached 1291 t.

The state of exploitation was assessed by VPA, tunned with standardised CPUE from the commercial fleet and abundance indices from MEDITS and LEDER trawl surveys. The Extended Survivor Analysis (XSA) method (Lowestoft programme; Darby and Flatman, 1994) and Yield-per-recruit (Y/R) analysis (VIT programme; Lleonart and Salat, 1992) on a mean pseudo-cohort 1998-2004 was also applied. Both methods were performed using size composition of trawl catches from 1998 to 2005. Biological parameters of growth and maturity were the same used in previous assessments, but a M-at-age vector has been used in the current assessment. Transition analysis was carried out considering two different management strategies aimed at improving the state of this resource: (1) a 20% reduction in current effort and (2) a change of mesh type in cod-end, from the current 40 mm diamond shape to 40 mm square.

Results of LCA show a growth overfishing, with Fmax = 0.26 as a factor of current F. Important increment in Y/R could be obtained reducing fishing effort but, specially, with the use of square mesh in the cod-end.

Source of management advice: VPA, tunned with standardised CPUE from the commercial fleet and abundance indices from MEDITS and LEDER trawl surveys. The Extended Survivor Analysis (XSA) method (Lowestoft programme; Darby and Flatman, 1994) and Yield-per-recruit (Y/R) analysis (VIT programme; Lleonart and Salat, 1992) on a mean pseudo-cohort 1998-2004 was also applied.

Stock status: growth overexploitation.

Management advice and recommendations: Important increment in Y/R could be obtained reducing fishing effort by 20% and/or with the use of square mesh in the cod-end[2].

13. **Document n° 6: Stock assessment of hake (*Merluccius merluccius*) from the trawl fishery GSA 05 (Balearic Islands). Beatriz Guijarro, Enric Massutí, Francecs Ordines, María Valls and Joan Moranta**

Summary: Hake (*Merluccius merluccius*) is a target species for the trawl fishery developed by around 40 vessels off Mallorca (GSA 05 – Balearic Islands), which annual landings have oscillated between 50 and 190 tons in the last decades. The assessment of this stock has been carried out using tuned VPA (applying the Extended Survivor Analysis method; XSA) on the period 1980-2005, and VPA and Y/R analysis on a

[2] See also general comment on square mesh.

mean pseudo-cohort from the period 2000-2005. These approaches were performed using monthly size composition of catches, official landings and the biological parameters estimated from the Data Collection Programme (2003-2004). The natural mortality was estimated by age class. The VPA was tuned with CPUEs from commercial trawl fleet (2000-2005) and bottom trawl surveys (2001-2005). Transitional analysis was also applied to simulate different management strategies, based on effort reduction and the improvement of gear selectivity.

XSA results showed high variability (without significant tendency) in population parameters, such as biomass, fishing mortality, recruitment and spawning stock biomass, which range were 40-200 tons, 0.5-2, 0.5-3.5 millions and 10-60 tons, respectively. The mean pseudo-cohort analysis estimated a mean F of 0.9, a current stock mean and critical age of 0.6 and 1 years, respectively, and a mean biomass of the stock around 8% of its virgin biomass. The current Y/R (33 g/recruit) is lower than the maximum Y/R (47 g/recruit). It could be concluded that: (i) the resource is over-exploited (growth over-fishing, a reduction of about 60% in the current effort is necessary to reach maximum Y/R); (ii) the use of 40 mm square mesh in the cod-end or the reduction of 20% in the fishing effort could improve in a similar way both yields and the state of the stock.

Source of management advice: Tuned VPA (applying the Extended Survivor Analysis method; XSA) on the period 1980-2005, and VPA and Y/R analysis on a mean pseudo-cohort from the period 2000-2005.

Stock status: the resource is over-exploited by growth over-fishing.

Management advice and recommendations: the use of 40 mm square mesh in the cod-end of the trawl or the reduction of 20% in the fishing effort could improve both yields and the state of the stock[3].

14. Document n°7: Assessment of hake (*Merluccius merluccius*) in the GSA 06. M. García-Rodriguez, J. L. Pérez-Gil, A. Fernández and A. Esteban

Summary: Hake (*Merluccius merluccius*) is one of the most important target species for the trawl fisheries developed by around 647 vessels along the GSA 06 (Northern Spain). In last years, the annual landings of this species, which are mainly composed by juveniles living on the continental shelf, were situated around 3900 tons in the whole area.

The state of exploitation was assessed for the period 1992-2005 by means of a LCA and yield-per-recruit (Y/R) analysis (VIT program; Lleonart and Salat, 1992) on the mean pseudo-cohort 1992-2005 for the GFCM geographical sub-area Northern Spain (GSA-06). In addiction, a VPA Separable, tunned with standardised CPUE from commercial fleet and abundance indices from two trawl surveys, was carried out applying the Extended Survivor Analysis (XSA) method (Lowestoft program; Darby and Flatman, 1994) over the period 1992-2005. Both methods were performed from size composition of trawl catches (obtained from on board and on port monthly sampling) and official landings, transforming length data to age data by slicing. Transitional analyses were also made to simulate different management strategies for the improvement of the state of this resource. In this assessment a natural mortality vector (Caddy and Abella, 1999) was considered.

The general results are quite similar to those obtained for the 1992-2004 period. Figures of recruitments and biomass result higher, especially in the 0 and 1-year-old classes, when applying natural mortality vector. A decreasing trend may be observed, both in landings and total biomass of the stock, along the studied period. On the contrary, fishing mortality (Fbar) increases. The SSB-R relationship also shows a decreasing trend in both components. The current Y/R value represents a 35% of Y/Rmax, meanwhile B/R represents a 12.5 % of the B/Rmax, being necessary a reduction of 65% in the current effort to reach the Y/Rmax values.

Changes in cod end mesh size would result more effective than effort reductions. Only a change of mesh shape in the cod end would result in a significant increment in the Y/R and B/R. If this management measure were applied, there would be gains in the second year.

[3] See also general comment on square mesh.

It can be concluded that the resource is over-exploited (growth over-fishing), with a clear risk of recruitment over-exploitation. The use of 40 mm square mesh in the cod-end could improve yields and the state of the stock. The resource should be object of a special surveillance on fishing activities related with hake. To reduce the growth over fishing, the objective is to improve the fishing pattern of the trawl to arise the minimum length of catches equal the minimum legal landing size, avoiding commercialisation of undersized fish, as well as to reduce the effort of trawl.
To avoid recruitment overfishing risk, it is necessary to reduce the effort of longline and gillnets in order to increase (or at least maintain) the SSB. Establish temporal closures for long line and gillnet during the period of maximum spawning, as well as for trawling in recruitment period, will be needed.
The first step must be the strictly observance and fulfilment of the actual fishery regulations, specially in terms of minimum length of landings, accompanied by a reduction on effort, the change in the cod end mesh type and a scientific surveillance.

Source of management advice: LCA and yield-per-recruit (Y/R) analysis (VIT program; Lleonart and Salat, 1992) on the mean pseudo-cohort 1992-2005; a VPA Separable, tuned with standardised CPUE from commercial fleet and abundance indices from two trawl surveys, was carried out applying the Extended Survivor Analysis (XSA).

Stock status: the resource is clearly over-exploited (growth over-fishing), current biomass lower than 10% of virgin biomass, with a possible risk of recruitment over-exploitation. Decreasing trend in landings, total biomass and SSB is observed.

Management advice and recommendations: the final target effort level would be about half the current level. The adoption of the square mesh size is recommended[4]. It is suggested to establish temporal closures for long line and gillnet during the period of maximum spawning and for trawling in the recruitment period[5].

15. **Document n° 8: Assessment of hake (*Merluccius merluccius*) exploited by the French and Spanish fisheries in GSA 07 (Gulf of Lions). Capucine Mellon, Angélique Jadaud and Henri Farrugio, Enric Massutí, Beatriz Guijarro, María Valls, Francesc Ordinas and Antoni Quetglas**

Summary: Hake (*Merluccius merluccius*) is one of the most important demersal target species of the commercial fisheries in the Gulf of Lions (GFCM geographical sub-area 7). In this area, hake is exploited by French trawl, French gillnet, Spanish trawl and Spanish long-line. Around 250 boats are involved in the fishery. According to the official statistics the total annual landings decreased from 2571 tons in 2003 to 1431 tons in 2004 (this is mainly due to the decrease of the French trawlers landings (from 2024 to 1023 tons) and of the Spanish trawlers landings (from 207 to 101 tons).

This year, the objectives of the Joint French-Spanish Working Group were: (i) to assess the multi-gear shared fishery of the Gulf of Lions hake stock by performing a tuned VPA (Extended Survivor Analysis; XSA) and a Y/R on the 1998-2004 data series; (ii) to compare the results obtained considering two sets of growth parameters (slow growth from traditional studies, used in previous assessments, and fast growth hypothesis from recent studies on otolith daily increments and tagging experiments); (iii) and to compare the results with previous assessments of this stock for the period 1988-1991 (Aldebert & Recasens, 1996; French-Spanish Working Group, 2002, 2005).

Data used were: (i) commercial hake catches by fishery, registered in seven French harbours and three Spanish harbours; (ii) size composition of landings, obtained from monthly length sampling in the main landing ports; (iii) and available CPUE data series, both of commercial fisheries (French trawl, Spanish trawl and Spanish long-line) and scientific survey (MEDITS_FR). Distribution length was weighted to

[4] See general comment on square mesh.

[5] See general comment on spatio-temporal area closures.

annual catches and sex-ratio, calculated for the species in the area (Aldebert & Recasens, 1996), was applied to obtained annual length frequency distributions of hake catches by gear and sex. The assessment of the stock has been carried out using the methods of cohort analysis (Darby & Flatman, 1994) and length cohort analysis (Lleonart & Salat, 1992).

Source of management advice: tuned VPA (Extended Survivor Analysis; XSA) and a Y/R on the 1998-2004 data series.

Stock status: Growth overexploitation with a risk of recruitment overexploitation; a declining trend in average recruitment was detected.

Management advice and recommendations: There is a need to run the assessment with two different growth rates, given the present incertitude on hake growth rate. The following recommendations were given:

A) To reduce growth overfishing:

• Improve the selectivity of the trawl to raise the minimum length at capture equal the minimum legal landing size[6].

• Reduce the fishing mortality of trawl: in view of the uncertainty on growth parameters, it is considered difficult to establish a concrete percentage according to the different growth hypothesis. However previous transition analysis showed that the improvement of trawl selectivity could be the most appropriate management measure. Moreover the respect of the minimum legal landing size of 20 cm should be enforced.

B) To avoid the risk of recruitment overfishing:
• Reduce the fishing mortality of longline and gillnets in order to increase (or at least maintain) the SSB. This could be done by reducing the effort and/or establishing temporal closures for longline and gillnet during the period of maximum spawning.[7]

- Assessment related documents

16. **Document n° 9: Preliminary results on stock assessment of *Solea solea* in GSA 17 (Northern and Central Adriatic Sea) through rapido trawl surveys (Solemon project). G. Fabi, M. De Mauro, O. Giovanardi, F. Grati, I. Isajlović, P. Polidori, S. Raicevich, G. Scarcella, N. Vrgoć**

Summary: Two surveys using rapido trawls were carried out in spring and fall 2005 to assess the stock of common sole Solea solea, in the northern and central Adriatic sea. They were a part of a 3-year research project funded by the Italian Ministry for Agricultural and Forestry Policies (MiPAF), started in 2004 and aimed to: a) assess distribution and biomass of S. solea stock in the northern and central Adriatic sea through direct (surveys at sea) and indirect methods (catch and effort); b) identify the spawning areas of this species; and 3) evaluate the incidence of different fishing activities (rapido trawl, otter trawl and gillnet) on the resource. It involves two Italian Operative Units (CNR-ISMAR Ancona and ICRAM-Chioggia) and the Institute of Oceanography and Fisheries of Split.
Two years of survey at sea (2005-2006) have been forecasted in the area extending from Trieste to the Pomo Pit northern limit and from the Italian coast to the Croatian one, for a total trawlable area of 44,880 km2 at depths ranging from 5 to 143 m.

[6] See general comment on the square mesh.

[7] See general comment on spatial and temporal closure to fishing)

A systematic design was adopted in the first survey year to get a picture of the spatial distribution of the common sole. It included 67 sampling sites in spring and 62 in fall placed at 15 nm from each other along horizontal transects 15 nm apart and extending from the Italian to the Croatian coast. One haul was carried out at each sampling site towing 4 rapido trawls at the same time at a speed of about 5.5 knots. The hauls lasted from 5 to 30 minutes, depending on the bottom type. The rapido trawls were standardized between the Operative Units. They were 3.5 m wide, weighed 225 kg each one and had a 48-mm codend mesh size (stretched). Weight of the total catch, individual length, sex, gonadic maturity stage and total weight of S. solea specimens, individual length and total weight of all the other commercial species as well as total weight of discards were recorded at each haul, separately for each rapido trawl.

Prior to performing data analysis we applied a post-stratification based on the observed abundance and relative variance of S. solea and 4 other commercially important benthic species which are efficiently caught by rapido trawl: *Chelidonichthys lucernus*, *Melicertus kerathurus*, *Sepia officinalis* and *Squilla mantis*. Three depth strata were identified: 0-30 m (10,558 km2), 30-50 m (10,047 km2) and >50 m (18,275 km2). The area delimited by the Croatian islands was considered as a further stratum (stratum 4; ~6,000 km2) and was surveyed only in fall. Data analysis was carried out using the software AdriaMed Trawl Information System (ATrIS; Gramolini et al., 2005). Total mortality rate (Z) was estimated through the linearized length-converted catch curve method, using the Von Bertalanffy growth parameters $L\infty$ and t0 given by Froglia and Giannetti (1985, 1986) and a K of 0.34 obtained as average of 45 values reported by FishBase for S. solea.

The caught specimens had a Total Length ranging from 12.5-38 cm, corresponding to the age interval 0+/9. The spatial distribution of S. solea appeared strictly related to the bottom depth: the smallest specimens concentrate along the Italian coast up to 30 m depth and gradually move offshore towards deeper waters as they grow. The largest individuals (TL> 28 cm) mostly inhabit the grounds between 40 and 70 m depth and the channels among the Croatian islands.

The size-frequency distributions were characterized by a wide range and two cohorts in strata 1 and 2, while fell in narrower intervals and were uni-modal in strata 3 and 4. A shift of the cohorts towards larger size classes was observed from spring to fall, and it was particularly evident in strata 1 and 2. A new cohort made up by individuals aged 0+/1 appeared in fall in stratum 1. Its range was 12.5-21.0 cm TL with an average size of 17.5±1.7 cm TL and was mainly constituted by recruits, considering as recruits all specimens smaller than 19 cm TL (mean TL of the cohort + s.d.).

Sex ratio (females/females + males) was 0.6 both in spring and fall. Spawning females (25-38 cm TL) were observed only in fall and were mostly concentrated in a wide area overlapping strata 2 and 3 and falling within meridians 13°00’ and 14°20’ E and parallels 44°10’ and 45°20’ N.

In spring density (ind km-2) and biomass (kg km-2) were 340.7 (CV=13.5) and 30.7 (CV=11.8) respectively in stratum 1; 200.6 (CV=23.8) and 34.0 (CV=28.6) in stratum 2; 42.9 (CV=35.3) and 9.2 (CV=34.6) in stratum 3. In fall these values practically doubled in stratum 1 according to the recruitment, decreased of about 30% in stratum 2 and remained stable in stratum 3. Finally, density and biomass observed in stratum 4 were 54.3 ind km-2 (CV=90.8) and 17.1 kg km-2 (CV=82.9) respectively. The total abundance and biomass (catchability coefficient assumed as 1) estimated for the whole area were 6,396,535 ind. and 834 t in spring and 11,281,869 ind. and 1,157 t in fall.

In the latter season recruits amounted to 583.8 ind. km-2 (CV=30.3) and 8.7 ind. km-2 (CV=66.2) in stratum 1 and 2 respectively and the estimated relative recruitment was 6,251,169 ind. representing about 55% of the overall population recorded at sea at that time.

Total mortality (Z) computed on age classes 1-8 (neglecting age class 9) was 0.90. Considering M equal to 0.46, computed as the average value of M values estimated with three different methods [relationships between: M and the growth parameters Linf. and K (Djabali et al., 1994); M and K (Jensen, 1996); M and maximum life span (Hoenig, 1983)], it results an F value of 0.44.

17. **Document n° 10: Preliminary catch curve analysis of common sole (*Solea solea*) in GSA 17 (Northern and Central Adriatic Sea). A. Santojanni, N. Cingolani, S. Colella, M. De Mauro, F. Donato, G. Fabi, F. Grati, P. Polidori, G. Scarcella**

Summary: Estimates of the annual total mortality rate, Z, were obtained for the common sole (Solea solea) stock in the northern and central Adriatic Sea (GSA 17). These estimates were obtained by means of catch curve analysis, performed on catch data of rapido and otter trawlers operating in two Italian ports (Ancona and Rimini), both characterized by high landings of this species. The analysis was also

performed on data from trawl survey carried out from the western side of Adriatic to the Croatian islands. All data sets employed were relative to the year 2005 and, thus, catch curve analysis was applied on pseudo-cohorts.

Fish length was converted into age by means of the inverse von Bertalanffy growth equation. Three different combinations of parameters were evaluated: case (1) Linf = 38.25, k = 0.49, t0 = -0.30; case (2) Linf = 38.25, k = 0.34, t0 = -0.30; case (3) Linf = 37.23, k = 0.34, t0 = -1.15. These values were derived from the curve obtained by Froglia and Giannetti (1985, 1986) for the Adriatic and Fishbase web site.

The values of the annual fishing mortality, F, were obtained by subtracting M from Z, with M being equal to the average of three values obtained by means of different methods, i.e. relationships between a) M and the growth parameters Linf and k (Djabali et al. 1994), b) M and k (Jensen 1996), c) M and maximum life span (Hoenig 1983). In the case (1) of von Bertalanffy parameters, this average M was 0.57, while it was equal to 0.46 in both case (2) and (3).

The values of Z obtained using the catch data of Ancona and Rimini were similar and higher than the values of Z obtained using trawl survey data. For example, in the case (2) of von Bertalanffy parameters, on the basis of catch of Ancona and Rimini, Z was around 1.80, against 0.90 from trawl survey. Such a difference between the two sources of data seems to be due to the different length frequency distributions analyzed. In fact, in the catches of Ancona and Rimini trawlers, specimens with length over 24-25 cm resulted to be poorly represented in comparison with trawl survey, as the professional fishing vessels did not cover exactly the same area of trawl survey, which, instead, included more off-shore areas where individuals with the highest length can be found. The length distribution caused, in the former case, a sharper negative slope of the line fitted and, thus, a higher estimate of Z.

As a consequence, the estimate of Z from trawl survey data should be thought as more reliable. The values so obtained were 1.32, 0.90 and 0.83 for the case (1), (2) and (3) of von Bertalanffy parameters, respectively. The two last values were not statistically different ($p < 0.05$). Their corresponding estimates of F were 0.75, 0.44 and 0.37, while the exploitation rates F/Z were 0.57, 0.49 and 0.45.

The exploitation rates obtained are not particularly high. Since the threshold above which stock collapse is relatively probable was estimated equal 0.4 for small pelagics (Patterson 1992), a higher threshold could be hypothesized for a demersal fish like sole, with a lower number of natural predators. However, the estimates of M employed here are quite towards the upper limit of the values used for this species: lower estimates of M would have implied higher values of both F and F/Z than those reported above. Moreover, according to some recent management advice for sole stocks given by ICES working groups (http://www.ices.dk, STECF 2005), a precautionary value of F is 0.3, while upper limits of F which should not be reached or exceeded are around 0.4 - 0.5.

In conclusion, even if the present work should be considered as a first step towards a more accurate stock assessment (Length Cohort Analysis), these preliminary analysis suggest that the Adriatic stock of sole could be close to fully exploitation and an increase of fishing effort could be unwise.

Comment on documents 9 and 10: These two documents presented a preliminary assessment of an important shared stock in GSA 17 using a combination of trawl survey data and commercial catch sampling data. Although at this stage it is not possible to draw definitive evaluation of the status of the stock and consequently to produce a recommendation, the preliminary indication is that the stock is at least fully exploited.

18. **Document n° 11: GSA 18 – Shared Demersal Stock in Montenegrin Waters. S. Regner, A. Joksimović, O. Kasalica. M. Đurović, A. Pešić, M. Mandić.**

Summary: Permanent control of the state of marine fisheries started in 1997. Estimated population dynamics parameters of important species: Pandora, *Pagellus erythrinus,* Red Mullet, *Mullus barbatus,* Hake, *Merluccius merluccius,* Pink shripmp, *Parapaeneus longirostris.* Estimated total biomass of economical important demersal resources on the shelf area (hake, red mullet, red pandora, squid, octopus, pink shrimp) was about 2 700 tons. Estimated MSY of demersal resources was 600 tons per year. Estimated average catch per unit effort (CPUE) of demersal resources last four years was about 19.47 kg/h. In October 2004 in frame of FAO Adriamed Project has been performed AdriMed trawl survey (MEDITS protocol) in Montenegrin territorial and adjacent waters. In 1997 CPUE has fallen to 20 kg/h and for the last few years this value did not change. This indicates that some kind of the state of equilibrium was reached between fishing effort and resources. The fact is that Montenegrin fleet is small (17 vesels) and ineffective. Therefore the probability that it has provoked such a sharp decrease of CPUE

is small. It is more likely the consequence of increase of fishing effort of neighbouring fleets, particularly that from Croatia, which also has abruptly increased since the beginning of nineties, and also Italian and Albanian one.

19. Document n° 12: Les indices d'abondance et la répartition spatiale des principales ressources démersales de la Méditerranée marocaine. Laboratoire des Ressources Halieutiques, Centre Régional de l'INRH (Nador)

Summary: Les ressources démersales de la Méditerranée marocaine font l'objet d'une exploitation multispécifique assurée principalement par les chalutiers et en second lieu par la pêche artisanale. Cette exploitation génère une production annuelle moyenne de l'ordre de 8 500 tonnes.

Outre la collecte et l'analyse des données bio-statistiques pour la détermination de l'état d'exploitation des principales ressources démersales, des campagnes de prospection par chalutage de fond sont réalisées moyennant le navire de recherche de l'INRH Charif Al Idrissi.

Les résultats de la dernière campagne de prospection réalisée en mars 2006 ont permis de constater l'existence d'une diversité des espèces benthiques des fonds chalutables mais de faibles rendements dans toutes les strates bathymétriques. La distribution de ces espèces varie de l'ouest à l'est et en fonction de la profondeur.

Deux grands groupes d'espèces sont distingués : un groupe d'espèces côtières, relativement abondantes à moins de 100 m de profondeur (la besugue, le rouget de vase, la bogue, le saurel, la seiche, et le pageot commun) et un deuxième groupe d'espèces de profondeurs, qui abondent jusqu'à 500 m de profondeur, il s'agit du merlu, le merlan bleu et la crevette rose.

20. Document n° 13: Time series analysis of rays in the south Ligurian and north Tyrrhenian sea with some notes on trends in landings of *Raja asterias* Delaroche, 1809. C. Mancusi, A. Abella, M. Ria, M. Barone, F. Serena

Summary: Data on abundance and distribution of skates collected from 1985 to 2004 during scientific trawl surveys as part of the Italian national GRUND project (GRUppo Nazionale risorse Demersali) and from 1994 to 2004 during the European Community MEDITS project (MEDIterranean Trawl Survey) were analysed. Despite of the objective difficulties in the identification at specific level of the skates, especially due to a high morphological interspecific variability, in the study area were recorded 11 of the 15 skates species assumed to be present in the Mediterranean Sea. 5 958 skates specimens were captured (4 964 during the Grund and 994 in the MEDITS). The total catch in weight and number calculated for km^2 of the specimens caught during the scientific bottom trawls showed that some species (*Raja clavata, Raja miraletus*) are very abundant in the catches, while others can be considered rare (*Raja circularis, Raja fullonica*).
Multivariate statistical techniques were utilized for the analysis of catches and time series regarding the more abundant species, *Raja asterias, R. clavata, R. miraletus, Raja polystigma* and *Dipturus oxyrinchus*. Although the analysis of the annual trends of the total Biomass Index and Density Index for all the strata in the whole area highlight clear fluctuations, the time series suggest a positive trend. Univariate seasonal ARIMA models were used for the analysis and forecast of LPUE (landings per unit effort) of *R. asterias*. Data from commercial landings of beam trawl and bottom trawl nets were collected and recorded on a monthly basis, from July 1990 to December 2004. The LPUE series of the beam trawl, the main gear targeting the species, shows seasonality and a steady situation over time.

21. Document n° 14: Consistency between trawl surveys trends of abundance and fishing pressure for the demersal assemblages exploited in the southern Ligurian sea. A. Abella, M. Ria, C. Mancusi, R. Baino, F. Serena

Summary: Time series of abundance indexes of species belonging to three exploited fish assemblages were analysed using the min/max autocorrelation factor analysis (MAFA) in order to detect the presence of common trends. Data proceeding from trawl surveys and catch assessment surveys carried out from

1985 to 2004. An overall positive trend of catch rates for the coastal and slope assemblages and a fluctuating (even if increasing as a whole) trend for the assemblage exploited at intermediate depth were observed. While the increase in catch rates for many species living on the coastal grounds and over the shelf was expected, considering the reduction of effort occurred in the mentioned areas, the fishing pressure on the slope increased since 1997 and in consequence the increase for many species of this assemblage, especially since the mentioned year appears inconsistent. Some reasonable hypotheses useful for the explanation of the observed results are furnished.

Presentations to and discussions in the Working group on small pelagics species

22. 14 technical papers were presented and discussed by the Working Group. Assessments were presented covering 5 species, 8 Geographical Sub-Areas (GSAs) and 5 shared stocks (See Annex D).

23. Two types of documents were presented: (i) assessment documents and (ii) assessment related documents. The conclusions and recommendations related to the assessments endorsed by the SCSA are listed below.

- Pelagic assessment documents

24. **Document n° 15: Anchovy (*Engraulis encrasicolus*) stock assessment in GSA 01 (Northern Alboran Sea). A. Giráldez, P. Torres, L. Quintanilla & J. Baro**

Summary: The annual landings of anchovy (*Engraulis encrasicolus*) in the Northern Alboran Sea for the last fifteen years ranged between 0.2 and 3000 tons. Anchovy was the species with the highest economical value.
Málaga Bay is the most important recruitment and fishery area. Only this area, which represents 85% of total landings, has been considered.
During the period from 1990-2005, the anchovy stock of the Alboran showed great fluctuations in the catch. A successful recruitment as estimated by echo-acoustic tracking was observed during 2001 in the Alboran Sea (13210 tons) producing a strong increment of landings in 2002, besides to an increase of CPUE. Nevertheless, the catch dropped in 2003 and 2004 and 2005 it has continued at low level (700 tons). This decline is consistent with the echo-acoustic evaluation (550 tons in 2003, 2013 tons in 2004 and 1921 tons in 2005).
Management recommendations:
-Not to increase the actual level of fishing effort.
-To adjust minimum legal size to first maturity size.

Source of management advice: Acoustic surveys and commercial landings and CPUEs.

Stock status: Low levels of biomass, recruitment and catch from 2003 to 2005.

Management advice and recommendations:

- Not to increase the actual level of fishing effort
- Length at first capture should not be less than length at first maturity, and adjust minimum legal size accordingly.
- Monitoring of the stock should be continued.

25. **Document No° 16: Anchovy (*Engraulis encrasicolus*) stock assessment in GSA 06 (Northern Spain). A. Giráldez, P. Torres, L. Quintanilla & J. Baro**

Summary: The annual landings of anchovy (*Engraulis encrasicolus*) in GSA 06 for the last fifteen years ranged between 6 000 and 23 000 tons. Anchovy was the species with the highest economical value.

The studied area was divided in two regions (Tramontana Region, C. Creus-C. La Nao and Levantine Region, C. La Nao-C. Palos), in order to use the historical series of acoustic evaluation data (survey ECOMED), it is recorded in the Tramontana Region since 1990.
The period in which the surveys were carried out corresponds to the recruitment season of the species (November – December). The acoustic evaluation provides an estimation of the recruitment of the species. They are two recruitment areas: one located between Barcelona and the south of the Ebro River Delta (the most important) and other in Rosas Bay.
The studied area was divided in two regions (Tramontana Region, C. Creus-C. La Nao and Levantine Region, C. La Nao-C. Palos),
1.- *Tramontana region*. The estimated total biomass for the whole area in 2005 (9 000 tons) is three times less than in 2004. There is no trend in calculated biomass since 1996. For this area, the surveys suggested that the recruitment was very low from 1996 to 2000, the population appeared to recover in 2001 and 2003, but it declined for 2004–2005.
The landings, although with a light increase in 2002 (unfortunately, no acoustic data during 2002 were provided), present negative trend. CPUE in 2005 is higher than in 2004.
2.- *Levantine Region*. The estimated biomass for 2005 was very low and the landings show the strongest negative trend for all the Mediterranean regions.
It is important to note that for the last three years there was a gradual increase in the estimated biomass of other small pelagic species (mainly the three species of horse mackerel and bogue) which are either eggs and larvae predators or compete for the resources with anchovy. As regards 2005, the biomass of sardine and anchovy represented 40% of the total estimated biomass, in contrast to 63% and 83% in 2004 and 2003, respectively.
Management recommendations:
-Not to increase the actual level of fishing effort.
-To maintain the current closed areas and seasons established for the small pelagic fisheries.
To adjust minimum legal size to first maturity size.

Source of management advice: Time series of acoustic surveys. Landings, CPUEs.

Stock status: Declining trends in catches and CPUEs and low levels of recruitment in the last two years indicate that the state of the stock is worrying.

Management advice and recommendations:

- Not to increase the actual level of fishing effort
- Length at first capture should not be less than length at first maturity.
- Monitoring of the stock should be continued.

26. Document No° 17: Sardine (*Sardina pilchardus*) stock assessment in GSA 01 (Northern Alboran Sea). A. Giráldez, P. Torres, L. Quintanilla & J. Baro

Summary: The annual landings of sardine (*Sardina pilchardus*) in GSA 01 for the last fifteen years ranged between 4 000 and 11 000 tons. This species is the most fished one, although its economical value is low.
The period in which the surveys were carried out corresponds to the beginning of the species reproduction season (November – December).
The estimated biomass from Gata Cape to Fuengirola in 2005 is four time higher than in 2004. The landings and CPUE present a strong annual fluctuation with an increase in their both.
Management recommendations
Not to increase the actual level of fishing effort.

Source of management advice: Time series of acoustic surveys. Landings, CPUEs.

Stock status: Biomass, catches and CPUEs higher in 2005 than 2004.

Management advice and recommendations:

- Since there is not in-year assessment and considering the high fluctuation of the pelagic fish stocks, it is considered advisable not to increase the actual level of fishing effort.

27. **Document No° 18: Sardine (*Sardina pilchardus*) stock assessment in GSA 06 (Northern Spain). A. Giráldez, P. Torres, L. Quintanilla & J. Baro**

Summary: The annual landings of sardine (*Sardina pilchardus*) in GSA 06 for the last fifteen years ranged between 19 000 and 53 000 tons. This species is the most fished one, although its economical value is low.
In order to use the historical series of acoustic evaluation data (survey ECOMED), it is recorded in the Tramontana Region since 1990.
The period in which the surveys were carried out corresponds to the beginning of the species reproduction season (November – December).
1.- *Tramontana Region*. From 1990 to 2005, the estimated biomass fluctuated from 200 000 tons in 1992 to 37 000 tons in 2005. The estimate for 2005 appeared stable with respect to year 2004, but there is a negative trend in biomass from 1992. The same trend was observed in abundance of juvenile.
Landings show the same negative biomass trend, but there is an increase in the CPUE, which is recorded for the main ports in the region.
2.- *Levantine Region*. The estimated biomass for 2005 was 9 000 tons, nearly similar to that of 2003 (8 000 tons).
Landings show the strongest negative trend for all the Mediterranean regions. There is a strong CPUE increase in 2005.
Management recommendations:
Taking into account the actual level of biomass and catches and negative trend, it would be recommended not to increase the actual level of fishing effort.

Source of management advice: Time series of acoustic surveys. Landings, CPUEs.

Stock status: Declining trend in catches during the last decade. Declining trends in biomass and recruitment from 1992 onwards.

Management advice and recommendations :

- Not to increase the actual level of fishing effort
- Monitoring of the stock should be continued.

28. **Document No° 19: Anchovy (*Engraulis encrasicolus*), 1993-2005. GSA 07 (Gulf of Lions) – Acoustic surveys. B. Liorzou**

Summary: The annual landings of anchovy in the last years are between 2000 and 7000 tons in the Gulf of Lions. The landings are regulated by the market prices. When market price is low, the trawl fleet directs its activities towards demersal resources. Fifty trawlers target their activity on anchovy. The size structure from landings of 2002-2004 shows a lack in big fish in the last year, but in 2005 there were no fish from age 1. The evaluation of the resource is carried out through yearly echo-acoustic surveys since 1993. The anchovy resources in GSA 07 seem to decline for the last four years, averaging 37 000 t in the period from 2003 to 2005. There is no trend in mean weight calculated from acoustic evaluation from 1999 to 2004, but an increase in 2005, due to a lack of age 1 individuals. Mackerel biomass (*Scomber scombrus*) is increasing since 2004 and could have an effect on anchovy stock as predator of this species. The 2005 biomass estimate was very low but preliminary results of 2006 survey show that the anchovy stock is at the mean level of the past years before 2005.

Source of management advice: Time series of acoustic surveys, landings, CPUEs.

Stock status: Declining trend in biomass and catches from 2002 to 2005 and very low level of recruitment of the 2004 year-class. However, preliminary data from the 2006 survey suggest that the 2005 recruitment was good so an increase of biomass can be expected.

Management advice and recommendations:

- Not to increase the actual level of fishing effort
- Monitoring of the stock should be continued.

29. **Document No° 20. Sardine (*Sardina pilchardus*), 1993-2005. GSA 07 (Gulf of Lions) – Acoustic surveys. B. Liorzou**

Summary: The sardine landings in GSA 07 averages 8 000 t for the period 2003-2005. The landings and fishing effort have been monitored since 1985 but the most reliable values have been collected since 1999. The production is less regulated by fishing market compared to anchovy, but trawlers can easily shift to demersal resources.
The acoustic evaluation has been carried out since 1993 in the Gulf of Lions during the summertime. Sardine biomass is very variable but remains in 2004 quite at the same level as in 2002, that is up to 110 000 t. Biomass explode in 2005 up to 231000 t. There is a downward trend in mean weight calculated from acoustic evaluation till 2004 but a higher value in 2005. The survey series provide also data on resources variability for other small pelagic species (mackerel, horse mackerel, sardinella and sprat).

Source of management advice: Time series of acoustic surveys, landings, CPUEs.

Stock status: Increasing from 2003 to 2005. However, preliminary data from the 2006 acoustic survey indicate a decrease in 2006.

Management advice and recommendations:

- Monitoring of the stocks should be continued.

30. **Document No° 21: Multispecies assessment of biomass of small pelagic fish (*Engraulis encrasicolus, Sardina pilchardus, Scomber japonicus, Trachurus trachurus*) in GSA 03 (Waters off Morocco). May 2006. Acoustic survey. Kada O., Serghini M.**

Summary: La pêche pélagique est considérée comme l'une des principales activités menée sur les côtes méditerranéennes marocaines. Elle cible particulièrement les espèces de petits pélagiques, comme la sardine, l'anchois, le maquereau et le chinchard, assurant une production moyenne de l'ordre de 14 000 tonnes/an. Celle-ci est l'œuvre d'une flotte sardinière composée de 147 unités, réalisant plus de 15 000 sorties de pêche/an.
Outre la collecte et l'analyse des données bio-statistiques pour la détermination de l'état d'exploitation des ressources de petits pélagiques, des évaluations directes de la biomasse de ces ressources sont réalisées par le navire de recherche « Al Amir Moulay Abdellah » de l'INRH.
Pour la campagne de prospection réalisée en mai 2006, l'outil de prospection par échosondage utilisé était le EK60. L'intégrateur BI60 a été utilisé pour l'analyse et l'allocation des valeurs d'intégration S_A (m^2 /nm^2) pour chaque espèce sur la base des caractéristiques des écho traces et de la composition spécifique des captures réalisées lors des pêches de contrôle.
La valeur de l'indice de réflexion TS appliqué pour convertir les données d'intégration S_A en nombre de poissons est celle du poisson « Hareng » de la mer du Nord : $TS= 20Log\ L - 72\ (dB)$
Les biomasses instantanées des différentes espèces ciblées ont été estimées à 80 000 tonnes pour la sardine, 71 000 tonnes pour le chinchard, 3 700 tonnes pour l'anchois et 3 000 tonnes pour le maquereau.

Source of management advice: Acoustic survey

Stock status: Not identified.

Management advice and recommendations: Monitoring of the stocks should be continued.

31. **Document No° 22: Anchovy (*Engraulis encrasicolus*), Sardine (*Sardina pilchardus)*, 1998-2005. GSA 16 (Strait of Sicily) – Acoustic surveys. A. Bonanno, G. Basilone**

Summary: Acoustic biomass estimates and spatial distribution of sardine (*Sardina pilchardus*) and anchovy (*Engraulis encrasicolus*) for the year 2005 were analyzed. Acoustic data were collected during an echosurvey carried out from 24 June to 7 July 2005 on board the R/V "G. Dallaporta" in GSA 16 (South of Sicily). The studied area corresponds to the area extending on the continental shelf from the southern Sicily coast up to a depth of about 200 m. The time series of acoustic biomass estimates for anchovy and sardine for the period 1998 – 2005 in the Strait of Sicily were also considered. The sardine biomass time series shows a sharply decreasing trend in the period 1999 – 2002 followed by increasing biomass values from 6 000 t in 2002 to 21 219 t in 2005. Anchovy biomass in the period 1998 – 2005 oscillated between a minimum level of 7 000 t in 1998 to a maximum value of 22 950 t in 2001. In the last two years anchovy biomass increased, reaching a level of 20 702 t in 2005.
The last two echosurveys were carried out both in GSA 16 and in Maltese continental shelf area (GSA 15) in the framework of the FAO MedSudMed Project. Even though the presented biomass estimates do not include the small pelagics biomasses from Maltese area, the analysis of acquired data singled out the importance of conducting joint echosurvey in GSA 15 and 16 in order to assess small pelagics distribution patterns in relation to sea water circulation.

Source of management advice: Acoustic survey estimates.

Stock status: Increased biomass values during the last two years.

Management advice and recommendation: Monitoring of the stocks should be continued.

32. **Document No° 23: Anchovy (*Engraulis encrasicolus*, L.) stock assessment in GSA 17 (Northern and Central Adriatic Sea) – 1975–2005. N. Cingolani, A. Santojanni, E. Arneri, A. Belardinelli, S. Colella, F. Donato, G. Giannetti, I. Leonori, A. De Felice, B. Marceta**

Summary: Anchovy (*Engraulis encrasicolus*, L.), together with sardine, is one of the most important commercial species of the Adriatic Sea. Stock of anchovy living in the northern and central Adriatic Sea, is shared between Italy, Slovenia and Croatia. The present assessment concerns the anchovy stock of northern and central Adriatic Sea, pooling together data coming from Western and Eastern Adriatic countries. It has been carried out in the ambit of an extension of the AdriaMed-SP research programme. The annual catches of anchovy were obtained for the period 1975-2005. For the same time interval, fishing effort data and length frequency and age-length data were available. These data were combined into fish age classes, so that catch-at-age data were available. That represented the basic input of Virtual Population Analysis (VPA), used for the present stock assessment.
Two different data sets were employed for the Laurec-Shepherd tuning of VPA: a) the Porto Garibaldi CPUE as in the past assessments and b) abundance index from echo-survey, representing an attempt of improving the VPA calculations, which, otherwise, would be exclusively based on fishery-dependent input data. The use of a fishery-independent source for tuning VPA also agrees the suggestions coming from the last SCSA (Rome, 26–30 September 2005).
The average fishing mortality, F_{mean}, for the period 1976-2005 is 0.28 (average for the age interval 0-3), while the minimum value of F (F_{min}), 0.16, was estimated for the year 1976. Maximum value of F (F_{max}), 0.61, was obtained for the year 1986, the year before the anchovy collapse. The biomass estimated by VPA (tuned with echo-survey data) shows a value of about 110,000 tons (average of the period 2003-2005), against an average catches of the last three years of the 31,000 tons. Stock biomass of anchovy dropped at very low level in 1987. After this collapse slow biomass recovery took place. Recent assessments show stronger recovery. Nevertheless, due to high biomass fluctuations of small pelagic, it is recommended not to increase the fishing effort. It should be noted that small pelagic fishery is multispecies so effort on anchovy cannot be separated from effort on sardine.

Source of management advice: VPA with Laurec-Shepherd tuning on commercial CPUEs and on abundance index from acoustic surveys.

Stock status: moderately exploited.

Management advice and recommendation: Not to increase the fishing effort

33. **Document No° 24: Sardine (*Sardina pilchardus*, Walb.) stock assessment in GSA 17 (Northern and Central Adriatic Sea) – 1975–2005. N. Cingolani, A. Santojanni, E. Arneri, A. Belardinelli, S. Colella, F. Donato, G. Giannetti, I. Leonori, A. De Felice, B. Marceta**

Summary: Sardine (*Sardina pilchardus*, Walb.), together with anchovy, is one of the most important commercial species of the Adriatic Sea. Stock of sardine living in the northern and central Adriatic Sea, is shared between Italy, Slovenia and Croatia. The present assessment concerns the sardine stock of northern and central Adriatic Sea, pooling together data coming from Western and Eastern Adriatic countries. The assessment has been carried out in the ambit of an extension of the AdriaMed-SP research programme. The annual catches of sardine were obtained for the period 1975-2005. For the same time interval, fishing effort data and length frequency and age-length data were available. These data were combined into fish age classes, so that catch-at-age data were available. That represented the basic input of Virtual Population Analysis (VPA), used for the present stock assessment.
Two different data sets were employed for the Laurec-Shepherd tuning of VPA: a) the Porto Garibaldi CPUE as in the past assessments and b) abundance index from echo-survey, representing an attempt of improving the VPA calculations, which, otherwise, would be exclusively based on fishery-dependent input data. The use of a fishery-independent source for tuning VPA also agrees the suggestions coming from the last SCSA (Rome 26-30 September 2005).
The average fishing mortality, F_{mean}, for the period 1975-2005 is 0.29 (average for the age interval 0-5), while the minimum value of F (F_{min}), 0.11, was estimated for the years 1994 and 1995. Maximum value of F (F_{max}), 0.76, was obtained for the year 2003. The biomass estimated by VPA (tuned with echo-survey data) shows a value of about 84,000 tons (average of the period 2003-2005), against an average catches of the last three years of the 19,000 tons. Even though 2004 and 2005 show an increase of biomass, it would be unwise for fishing effort to be allowed to rise, because decline of stock biomass is observed after the peak in the first half of 1980s and lowest values of this series correspond just to recent years. It should be noted that small pelagic fishery is multispecies and effort on sardine cannot be separated from effort on anchovy.

Source of management advice: VPA with Laurec-Shepherd tuning on commercial CPUEs and on abundance index from acoustic surveys.

Stock status: Fully exploited: the mean ratio between catch and the estimated biomass in the last three years is about 0.23. Since 1998 Croatian sardine catches increased from about 7500 t to about 17500 t. In the mean-time Italian sardine catches decreased from about 13500 t to 2200 t.

Management advice and recommendation:

- Not to increase the fishing effort.

34. **Document No° 25: Multispecies assessment of biomass of small pelagic fish (*Engraulis encrasicolus*, S*ardina pilchardus, Sprattus sprattus)* in GSA 17 (north-western Adriatic Sea) – Summer 2005. Acoustic survey. Iole Leonori, Massimo Azzali, Andrea De Felice**

Summary: An echosurvey was performed in the summer season 2005 covering the western part of GSA 17 (from Trieste to Vieste). Acoustic data on small pelagic fish were logged by an EK500 scientific echosounder working at three frequencies: 38, 120 and 200 kHz. Biological information on fish

acoustically monitored was derived from net samplings made with a mid-water trawl. In addition temperature, salinity and other environmental parameters were measured by means of CTD samplings made in correspondence of net samplings.
Pelagic biomass as a whole and per species (Anchovies, Sardines and Sprats) estimates are presented; total pelagic biomass spatial distribution is illustrated and also the most probable spatial distributions for the target species of this research are reported. Anchovy biomass = 249688 tons. Sardine biomass = 38105 tons. Sprat biomass = 20724 tons. Trends for total pelagic biomass and for the biomass of the target species referred to an area of about 2/3 of western GSA 17 (from Trieste to Giulianova) were analyzed; this area corresponds to that of the historical surveys made since 1976.

Source of management advice: echo survey in the western part of Adriatic Sea.

Stock status: The low biomass of sardine is also evident by this assessment.

Management advice and recommendation: Echo-surveys in the Adriatic should be applied in a standardized way by different countries to cover all the Adriatic (east and west). Acoustic estimates could be integrated with the catch-at-age estimates.

35. **Document No° 26: Multispecies assessment of biomass of small pelagic fish (*Engraulis encrasicolus*, S*ardina pilchardus*) in GSA 18 (south-western Adriatic Sea) –Summer 2005. Acoustic survey. Iole Leonori, Massimo Azzali, Andrea De Felice**

Summary: An echosurvey was performed in the summer season of 2005 covering the north-western part of GSA 18 (from Vieste to Brindisi). Acoustic data on small pelagic fish were logged by an EK500 scientific echosounder working at three frequencies: 38, 120 and 200 kHz. Biological information on fish acoustically monitored was derived from net samplings made with a mid-water trawl. In addition temperature, salinity and other environmental parameters were measured by means of CTD samplings made in correspondence of net samplings.
Pelagic biomass estimates, as a whole and per species (Anchovies and Sardines), were analyzed. Anchovy biomass = 29072 tons. Sardine biomass = 6683 tons. Total pelagic biomass spatial distribution is illustrated and also the most probable spatial distributions for the target species of this research are reported. Trends for total pelagic biomass and for the biomass of the target species of north-western GSA 18 were reviewed; this area was studied since 1987.

Source of management advice: echo survey in the western part of Adriatic Sea.

Stock status: Not identified.

Recommendations: None.

36. **Document No° 27: Anchovy (*Engraulis encrasicolus*, L.) stock biomass assessment in GSA 18 (south-eastern Adriatic Sea) – August 2005. S. Regner, A. Joksimović, O. Kasalica. M. Đurović, A. Pešić, M. Mandić.**

Summary: A survey was done from 14 to 18 August 2005 with the R/V "Dalaporta" (ISMAR – CNR). Twenty stations were sampled. A modified CalVet net was used for ichthyoplankton sampling. At every station data on temperature, salinity, etc. were measured with CTD probe from surface to bottom. In the same time, simultaneously with the egg survey, an echo-survey was performed. Total surface of the surveyed area was 5 401 km2 (1 674 Nm2). Acoustic-DEPM estimates ratio was 6:1.

Source of management advice: DEPM and echo survey in the western part of Adriatic Sea.

Stock status: Not identified.

Management advice and recommendation: DEPM surveys should be combined with acoustic surveys and cover the entire area of distribution of the Adriatic anchovy in GSA 18.

37. **Document No° 28: Ichthyoplanktonic and acoustic biomass estimates of the anchovy (*Engraulis encrasicolus*) in GSA 22 (Aegean Sea) – June 2003; June 2004; June 2005. Somarakis S., Sxismenou E., Machias A., Giannoulaki M., Siapatis A., Stamataki C., Torre M., Anastasopoulou K., Vassilopoulou V., Kalianiotis A., Papaconstantinou C.**

Summary: The biomass of Aegean Sea anchovy stock was estimated in June 2003, June 2004 and June 2005 with the concurrent application of the Daily Egg Production (DEPM) and the Acoustic methods. Spawning stock biomass (SSB) based on the DEPM was estimated at 40 042 t in 2003, 22 799 t in 2004 and 20 533 t in 2005. Stock biomass based on acoustics was estimated at 47 838 t, 46 508 t and 31 852 t in 2003, 2004 and 2005, respectively. Results showed a remarkable decline of anchovy biomass in the eastern part of the Aegean Sea between 2003 and 2004 and in the western part of the surveyed area between 2004 and 2005.

Source of management advice: Acoustic and DEPM biomass estimates.

Stock status: Decreased biomass during the last two years, especially in the western part of the Aegean in 2005.

Managament advice and recommendations:

- The yearly biomass estimates obtained by the acoustics and DEPM should be continued in order to obtain a clearer picture of the stock. These estimates could be integrated with concurrent estimates of catch-at-age to improve the assessment of the stock
- As this stock is shared between Greece and Turkey close collaboration between scientists of these countries is recommended.
- A shift in the existing closed season (December-February) to autumn or spring is recommended.

- Assessment related documents

38. **Document No° 29: Spatial modeling of the European anchovy habitat in GSA 22 (Aegean Sea) using GAMs and GIS technology. Anchovy (*Engraulis encrasicolus*). Giannoulaki M., Machias A., Valavanis V., Somarakis S., Palialexis A., Papacostantinou C**.

Summary: Acoustic survey data were combined with oceanographic parameters to investigate the relationship between the spatial distribution of European anchovy and environmental features of the Greek seas (Eastern Mediterranean basin). Acoustic sampling was carried out in the northern Aegean Sea (the main fishing ground of the species in the area) in June 2004 and June 2005. Environmental data (i.e., sea surface temperature, chlorophyll-a and sea surface salinity) were derived from satellite imagery using GIS procedures. Generalized Additive Models (GAMs) were then applied in a presence/absence approach in order to identify the link of anchovy's presence with environmental variables. The estimated model was subsequently used to predict the extent and spatial location of potential anchovy habitat in all Greek Seas by applying GIS techniques. The resulting picture was compared with information on actual fish distributions as derived from past acoustic surveys, i.e, within the peak of the spawning period of anchovy in Greece.

Results of the Adriamed working group on small pelagic species (Ancona, Italy, May 2006)

39. A brief overview of the main conclusions reached in the Adriamed working group on small pelagic species was given by Mr Enrico Arneri, the chairman of that meeting.

Summary: Results from the stock assessment and biomass evaluation presented show that the situation of the two main stocks appears quite different, at least for GSA 17.
The anchovy stock shows a rather healthy situation in the entire Adriatic Sea.
The sardine stock shows, at least for the western part, a strong decreasing trend with all the methodologies employed. Acoustic estimates made in the period 2002-2004, as well as catch statistics data show a rather stable sardine stock biomass on the eastern part of GSA 17. Nevertheless this drop of sardine biomass for the western part should be taken into account. Reasons for this decline could be multiple and the WG feels that the environment is probably the first cause, as fishing effort has been quite constant in the last twenty years and taking into account the fact that small pelagic fish species tend to fluctuate alternately.
Furthermore a series of scientific priorities were identified as follows:

- To improve the integration of the different methodologies for tuning, as is already partially being carried out in the Adriatic between VPA and Echosurvey.
- To create reliable time data series the existing research activities should be continued and extended;
- To strengthen the cooperation among the scientific institutions on data analysis;
- To plan and organize a joint survey exercise using both acoustic methods and DEPM covering the entire Adriatic Sea area.
- To strengthen the standardization of the methodologies and scientific protocols of echosurvey and DEPM (converge area and time), to be used in the region. Particular attention should be paid to the possibility of carrying out DEPM and echo-survey simultaneously. The priority identified by the WG is to cover the entire Adriatic with an echo-survey and to establish a team for DEPM (at least locally). Vessel logistics and human resources should be taken into account when considering DEPM and echosurveys to be carried out simultaneously.
- To continue developing the socio-economic data collection in the area also taking into consideration the recent EU regulations.
- To create a multiple biological and socioeconomic indicator system in GSA 17 and GSA 18 which could be helpful in the creation of a monitoring scheme in support of the decision making process. The indicator system should also take into consideration the environmental parameters to be coherent with the ecosystem approach to fisheries management.

Finally the WG, discussed and agreed on the creation of a document entitled "Research on small pelagic fisheries resources - Recommendations on the integration of methodologies and assessment" in which pragmatic suggestions and indications should be put forward for management purposes.
In particular in the document for each research activity useful indications should be given such as the methodology to apply for reading the echograms, the period and the time during which DEPM surveys should be carried out (e.g. yearly basis, biannual basis), the utility to carry out simultaneously DEPM and echosurveys, the involvement at national level or at regional level of VPA data analysis (Technical annex). Moreover technical specifications regarding the implementation of methodologies and research should be indicated (e.g training requirements, establishment of WG for data analysis). This practical scientific protocol for monitoring should also incorporate economic monitoring.

Progress on undertaking pilot multispecies stock assessments in selected GSAs

40. No documents were presented.

SESSION 2: METHODOLOGIES FOR STOCK ASSESSMENT AND DATA COLLECTION RELATED TO THE FISHING EFFORT AND THE OPERATIONAL UNITS

Review and analysis of the report of the Permanent Working Group on Stock Assessment Methodology (PWGAM)

41. The facilitator of the PWGAM, Mr Kallianiotis, presented the report of the 1st PWGAM held in Istanbul, Turkey, 8–10 March 2006. The SCSA took note with satisfaction of the conclusions.

Revision of the terms of reference for the PWGAM

42. New terms of references for the PWGAM were presented and discussed but the SCSA did not endorse the proposal.

Review and analysis of the report of the Transversal Workshop on Measurement and Standardization of Fishing Effort and follow-up by SCSA

43. The SCSA coordinator presented the report of the Workshop held in Malaga, Spain, 30–31 May 2006. The SCSA took note of the conclusions. The amended terms of references for the workshop on disaggregated data were approved by the SCSA and are presented in Annex E.

Review and analysis of the report of the Transversal Workshop on Stock Assessment and Operational Units and follow-up by SCSA

44. The SCSA coordinator presented the report of the transversal workshop held in Rome, Italy, 26–28 June 2006. The assessment forms will be updated according to the recommendations of this workshop.

Review of assessment methods

45. **Document n° 30: Red mullet assessment in the GSA 10 using Aladym simulation model. G. Lembo and M.T. Spedicato**

Summary: A case study on the assessment of red mullet in the GSA 10 was presented. It focused on the applied methodology and the implemented harvest control rules (HCRs). ALADYM (Age-Length Based Dynamic Model) is an age-length based simulation model developed in the conceptual framework of biomass pool dynamic models. The simulation approach was used as a tool to convert survey biological information, and relative assessment, into quantitative HCRs. The two options implemented in the simulation model were based on two technical aspects: gear selectivity and fishing activity (alone or in combination). Fishing selectivity pattern (size at first capture Lc and selection range) and fishing activity were inputs used to simulate different exploitation scenarios. The effects of HCRs (based on total mortality and selectivity) were then analysed in terms of sustainability for the population in the long-term.

Comment: the model is sensitive to the assumption on stock/recruitment relationship. The software will be available very soon to be downloaded from the web site of the project FISBOAT.

46. **Document No° 31: Underwater television as a fishery-independent method for stock assessment of Norway lobster (*Nephrops norvegicus)*, in GSA 17 (central Adriatic Sea) Elisabetta B. Morello, Enrico Arneri, Carlo Froglia, and R. James A. Atkinson**

Summary: Norway lobster (*Nephrops norvegicus*) is of major commercial importance throughout its NE Atlantic and Mediterranean distribution where it occurs in burrows within muddy sediments. The fact that the species is caught by commercial gear only when it emerges from its burrow and the lack of hard structures available for ageing complicate the application of normal fishery-dependent stock assessment methodologies. The study provided a preliminary investigation into the possibility of using underwater

TV surveys as a fishery-independent technique to assess the Nephrops stocks of the Adriatic Sea. The results were compared with previous studies and the advantages and disadvantages of using such methodology were reviewed in an Adriatic context.

Comment: The SCSA discussed advantages and limitation of the method which shall be used as an independent index of biomass in association with other assessment procedures as currently done in the North Sea and North East Atlantic.

47. **Document No° 32: Use of direct survival analysis from trawl survey data. Eduardo Ferrandis**

Summary: not available

Comment: The method has been previously presented to the SCSA. It is expected to be published soon and the software will be made available.

General comment on new methodologies for stock assessment based on trawl survey data

The SCSA noted that important progress was taking place in this area of investigation and stressed the need for ad hoc training courses on these new methodologies.

48. **Document 33: ECOMED acoustic surveys: methodology, results and scope. Magdalena Iglesias**

Summary: Pelagic fish species in front of Spain have been evaluated by means of acoustic methods since 1990. Surveys have been developed with a standard methodology although some improvements have been made. The results of these surveys showed an increase in the number of pelagic species in the area during the last decade. Although, anchovy and sardine are the target species, info from at least nine different species has been acquired. Schools characteristics have shown a change in the size of the schools, being smaller in the last years. The multiespecificity of the area has made necessary to start working with multifrequencies and virtual echograms to improve the scrutinizing of the echograms.

Comment: Standardisation is needed between different echo surveys in the Mediterranean

SESSION 3: BIOLOGICAL PARAMETERS AND INDICATORS

Pursuing activities on the identification of biological indicators, establishing reference points and testing them on selected fisheries or GSAs

The SCSA provided general comments (see below) based on the presentations.

49. **Document n° 34: The influence of oceanographic scenarios on the population dynamics of demersal resources in the western Mediterranean: hypothesis for hake and red shrimp off in GSA 05 (Balearic Islands). Enric Massutí, Sebastià Monserrat, Pere Oliver, Joan Moranta, José Luis López-Jurado, Marta Marcos, José Manuel Hidalgo, Beatriz Guijarro, Aina Carbonell and Pilar Pereda**

Summary: The aim of the present paper was to study the relationships between some climatic indices and parental stock, recruitment and accessibility to trawl fishery of hake (*Merluccius merluccius*) and red shrimp (*Aristeus antennatus*) off Balearic Islands. Available annual catch per unit effort, recruitment and spawning stock biomass have been used as biological data. As environmental data, the meso-scale IDEA index and the large-scale North Atlantic Oscillation (NAO) and Mediterranean Oscillation (MO) indices have been used. To analysis possible links between these indices with the population dynamics of

demersal resources, two non-linear approaches have been applied: (i) stock-recruitment relationships from Ricker and Beverton-Holt models, by incorporating sequentially environment factors; (ii) generalized additive modelling, both classical general and threshold non-additive models were considered, which simulate an abrupt change in explicative variables across different phases (time periods or climatic index values). The results have shown as two oceanographic scenarios around the Balearic Islands, associated with macro and meso-scale climate regimes, can influence the population dynamics of hake and red shrimp. Specially for recruitment, which seems to be enhanced during low NAO and IDEA indices periods, when colder-than-normal winters, producing high generation of cold Winter Intermediate Waters in the Gulf of Lions, which flow southwards and reach the Balearic Islands channels in spring, increasing the productivity in the area. This oceanographic scenario could also be favourable to the distribution of hake on the fishing grounds where trawl fleet target to this species, increasing its accessibility to the fishery. Both spawning stock and abundance of red shrimp seems to be also enhanced by high MO index periods, which could reflect the major presence of the saline and warm Levantine Intermediate Waters (LIW) in the study area, which extends over the fishing grounds of this species. These proposed interactions between external and internal variables on hake and red shrimp populations off Balearic Islands can be useful to assess and manage these demersal resources: (i) allowing to promote the identification of reliable environmental indices and their integration into stock assessment models; (ii) and enhancing our ability for recruitment forecasting, which is of great importance in the Mediterranean trawl fishery, since a large proportion of catches consists of young specimens.

50. Document n° 35: Recent progress towards the elaboration of population and community indicators from the MEDITS surveys. Presented by J.A. Bertrand (MEDITS co-ordinator)

Summary: An ecosystem approach to fisheries management entails the need to monitor the whole fishery systems. Such development implies the availability of sets of indicators related to the different components of the managed systems. Systematic trawl surveys such as performed by MEDITS constitute a source of data (among others) especially useful to contribute to the elaboration of comprehensive dashboards.

Since recently, the MEDITS group is developing an approach to elaborate diagnoses on the impact of fishery on the marine ecosystem. The principle is to apply statistical methods to draw up multi-species dynamic indicators to assess the impact of fishing on fish populations and communities, to characterize the variability between areas and identify potential trends in the time series. Finally, the aim is to propose a integrated diagnosis taking into account the initial state of the study systems.

The conceptual framework is based on the method proposed by Rochet et al. (2005). The application is made with the MEDITS data from 1994 to 2004 for the whole MEDITS area (from Gibraltar to the Aegean Sea) split into 13 GSAs.

The MEDITS group has (i) selected sets of indicators available in the literature and relevant to assess population and fish communities in the Mediterranean, (ii) applied them to the whole MEDITS series in order to evaluate their potential as assessment tools, and (iii) produced preliminary assessments.

The species considered for the community analyses are the 58 MEDITS reference species. The 36 species studied for biological parameters in MEDITS have been considered for population analyses, In both cases, species with low mean occurrence were excluded.

A set of ten indicators were tested: 4 for populations (population growth rate, average total mortality, average length, length at maturity (50% mature)) and 6 for communities (total biomass, total abundance, average weight, average length, proportion of large individuals, average individual weight).

The results obtained in the 13 GSAs covered by the MEDITS surveys show a trend to increasing of the number of smaller fish in most regions of the North-Western Mediterranean during the last decade. This was due to a combination of abundance increase of small species and high recruitment for others. They also highlighted the high variability of the recruitment between years for a lot of species (most often without strong link with the spawning stock biomass). In general, no trend was detected with the community indicators for the period 1994-2004. This global stability is often due to compensatory phenomena inside the systems. Some trends detected by the population indicators may be related to the life span of the species, e.g. increase of small life span species (crustaceans and cephalopods) vs. decrease of gadoids in the south Adriatic Sea, due to a combined effect of fishing pressure and environmental conditions.

In the methodological field, the approach has given a very large amount of indices by species and GSA, calculated with a standardized method, allowing for between GSA comparisons. It has also underlined the sensitivity of some indices to the quality of initial data (e.g. survey timing vs. recruitment peak,

interpretation of the biological stages, von Bertalanffy growth parameters, for maturity length and mortality estimates).
In addition to the progress in the elaboration of indicators, the study indicated the main specific works in progress in the MEDITS group, apart from the standard management of the yearly surveys. For instance, specific efforts are devoted to improve the quality of the observations on biological parameters during the survey (refining the maturity scales, elaboration of an atlas of the maturity stages, review of the species coding, etc.). Furthermore, six scientific working groups have been defined during a recent MEDITS meeting in Kavala (Greece). The main objective of these groups is the development of common scientific knowledge at the whole MEDITS scale, with a view to application for management purposes.
Finally, various recommendations adopted by the MEDITS group were reported. A special attention is given to the proposal for the creation of a multi-annual working group on the following topic: "Survey based monitoring for fishery management in the Mediterranean" within the SAC-GCFM.

51. **Document n°36: Defining a reference state of an exploited ecosystem. A proposal based on fuzzy sets. M.J. Rochet & J.A. Bertrand**

Summary: To assess human impacts on an exploited ecosystem, ecosystem components have first to be identified and the impacts of various human actions to be diagnosed as weakly to strongly impacted. This results in a list of impact indicators across of series of themes like fishing impacts on populations, habitat degradation, and so forth. This study examines methods to integrate these indicators within and across themes. Any integration requires i) standardising indicators ii) weighting them and iii) combining them. We classify integration methods by the way they deal (or do not deal) with each of these components. Fuzzy sets method is selected as it is consistent, flexible and allows for uncertainty, and a trial application to assess human impacts on the Gulf of Lions fish community is proposed.
Standardisation is obtained by scoring indicators along an acceptability gradient by partial membership: the probability of membership to the set "impacted". Weights have to be the result of a political decision. A range of combination rules to go from a list of partial membership to total membership is available. The simplest ones like minimum, arithmetic mean and geometric mean are demonstrated here. These combination rules contrast by their sensitivity to uncertainty (variability in partial membership), their understandability, and the compensation they provide: how far a high membership on one indicator does compensate for a low membership on another indicator.
Applying this, we find that the membership of the Gulf of Lions to the "human impacts" set ranges from 0.58 to 0.82 depending on the combination rule selected. Many other combination rules available and the most appropriate to a given situation can be selected according to the desired risk-aversion, transparency, and quality of information available. Fuzzy sets provide a formal framework to make each element transparent and to decide about the elements of the integration method, taking into accounts their influence on the final outcome.

General comment on pursuing activities on the identification of biological indicators, establishing reference points and testing them on selected fisheries or GSAs

- The SCSA considered that the identification of environmental parameters and their integration into stock assessment modeling is extremely relevant under an EAF concept. Studies in this field were highly encouraged.
- The documents presented were of high general interest in the framework of an ecosystem approach to fishery management. The SCSA felt that they deserve a wider audience than only the SCSA. In the future, if a certain number of these documents will be presented it would be wise to establish in advance a joint session with SCMEE.

Progress on mapping the distribution of juveniles

52. **Document n° 37: Bayesian analysis of hake recruits density in GSA 9 (central Tyrrhenian-Ligurian Sea). V. Bartolino, F. Colloca, G. Iona Lasinio, L. Maiorano, G.D. Ardizzone**

Summary: Hake is the most important commercial species in GSA 9. This area also plays an important role for hake recruitment in Italian seas and western Mediterranean basin. The identification of hake hot spot areas (nurseries), can support future fishery management measures through the institution of closed areas. In this study, a Bayesian approach to analyse spatial distribution of hake recruits as implementation of standard kriging analyses was applied. In order to find hot spots we compute the Getis-Ord (G) statistics and we select grid cells with G values larger then the 95th percentile of the statistic distribution. The advantages of the new proposed procedure were synthesized as follows: (i) data can be used in a more efficient way and no year aggregation is required; (ii) an uncertainty map based on the estimated posterior variance can be easily created; (iii) analysis can be easily updated by running the same procedure on a following year using the current estimate as prior distribution; (iv) no post-processing of estimated values is necessary. Indeed we can easily find non significant cells and exclude them from the analysis. (v) This protocol provides a sensible base for prediction and easily allows adding covariate describing, for instance, climatological information influencing hake's population dynamic.

53. Document n° 38: Delineating habitats used by different life phases of hake in the Strait of Sicily. F. Fiorentino, M. Gristina, T. Fortibuoni, T. Bahri, M. Camilleri, A. Drago, M. Gristina and F. Massa

Summary: The authors presented the results of a spatial analysis by life stage of hake (*Merluccius merluccius*, L., 1758) in the Strait of Sicily (Central Mediterranean). The objective of the study was to delineate preferential habitats of young of the year, juveniles (immature hake older than 1 year) and spawning females. Data were collected from 1994 to 2004 during two series of bottom trawl surveys (GRUND and MEDITS programs). Density indices by haul were calculated to study abundance variability and spatial distribution of each life phase on the basis of fish length frequency distribution and information on maturity stage by sex. Critical areas for hake biology were investigated by applying diagnostics of both high abundance and high percentage occurrence together with ascertaining persistence in time.

The general spatial pattern in the whole region of investigation showed that hake occurs at any life stage in two distinct geographical areas, the Adventure and Malta Banks, well separated by a wide area where hake abundance is very scanty. Specifically, two areas where young of the year are highly and almost exclusively concentrated (nurseries) were identified on the eastern sides of both the Adventure Bank and Malta Bank respectively, at depths ranging mainly between 100 and 200m. The position of concentration areas of juveniles suggests their spreading from nurseries towards the shallower bottoms on both the Adventure and Malta Banks. As regards, mature females the highest abundances were found in two areas, sited up stream and west of the nurseries on both Banks. Overall, it appears that while young of the year and females occupy discrete grounds, differing both for bathymetry and bottom type, juvenile concentration areas are large and show partial overlap with those of the other life stages.

Available information on biotic and abiotic factors which could make the spawning, nursery and feeding areas "essential habitats" for hake in the Strait of Sicily are discussed. To improve the sustainability of hake exploitation in the Strait of Sicily ad hoc technical measures could be proposed such as the closure to trawling of areas consistently and exclusively inhabited by young of the year or mesh size regulation. In any case, for the application of such measures to be effective and sustainable, the social and economic dimension of the fisheries as well as the involvement of the relevant stakeholders, should be considered. Furthermore, to evaluate the impact and sustainability of such measures on the fishing community and on the conservation of the stocks, their application must be accompanied by an effective monitoring local programme that takes into consideration the spatial and temporal performance of the main biological and economic indicators.

54. Document n°39: A methodological contribution to the identification of recruitment relevant areas for some shared demersal fisheries resources in GSA 18 (Southern Adriatic Sea) N. Ungaro, R. Gramolini, K. Osmani, N. Milone

Summary: The identification of critical habitats, considered as fisheries habitat necessary for the production of a given resource (FAO, 2003) such as nursery and/or recruitment areas, is actually considered as one of the main issues for development of management plan for sustainable fisheries. The studies on the location of nursery and/or recruitment areas can be considered important tools to the proper assessment and management of fisheries resources. In contexts where shared stocks occur, as is the case

of the Adriatic Sea, the identification of such significant areas assumes critical importance for an effective support the sustainable fisheries management by the countries concerned. These issues were widely discussed during the AdriaMed Working Group (WG) meeting on Shred Demersal Fisheries Resources of the Adriatic Sea held in Fano, Italy, 2006. One of the tasks of the WG focused on the establishment of methodological criteria to be applied for the identification of such areas. Since, at the present, several criteria are used, this paper represents an exercise to assess the practicability of the methodology applied, thus contributing to the identification of the methodological criteria for the definition of nursery/recruitment areas. The nursery areas are, as a rule, zones characterised by the high concentration of juveniles. The threshold size for the juveniles is generally considered as the length attained at the first year age (Fiorentino *et al.,* 2003), but other metrics can also be considered. In this study, the presence and spatial distribution of recruitment areas of some demersal species in the Southern Adriatic Sea (Italian and Albanian waters only, GSA 18) were analysed on the basis of MEDITS data collection (1996-2004). The identification and mapping of nursery zones were performed through the applications of geostatistic methods in order to confirm the information available in literature. The study on the distribution and consistency of recruitment areas was carried out for the shared demersal species *Merluccius merluccius, Lophius budegassa, Loligo vulgaris* and *Parapenaeus longirostris.* According to Fiorentino *et al.* (2003), the individuals belonging to the 1st component of the poly-modal pooled length frequency distribution (LFD) by species and survey were considered recruits. The threshold size used to separate the recruits from the other fractions of the sampled stock was estimated as the mean length of the 1st component of LFD plus l standard deviation. The estimation was made for each survey. The following step was to establish and to identify objective criteria to define the recruitment areas by species, considering the recruits abundance value (n° of recruits/km^2) and the index of 'recruit exclusive richness' (RER), calculated as the ratio between the number of recruits and species total catch per haul (Fiorentino *et al.,* 2003). These two conditions are needed to respect the idea of the recruitment zones as "areas characterised by the largest and sole concentration of juveniles for a given species (or resource)". The minimum recruits density values as well as the optimal values of the RER index have been calculated for each species by means of 3rd quartile estimation in order to avoid any aprioristic or arbitrary choice.

The recruits' abundance data, the minimum recruits density values, and RER index values for each species were used to perform geostatistics analysis and mapping (Indicator Kriging or Probabilistic Kriging). The maps include at the same time both the two chosen criteria (minimum recruits density values and the optimal values of the RER index) as conditions to be respected for the representation of relevant recruitment areas.

The map representations confirm the presence of 'relevant recruitment areas' in the Southern Adriatic Sea (GSA 18) as reported in the literature. The distribution of the recruitment areas in the GSA 18 can be related for some species to the oceanographical features of the basin, as it was proposed for other geographical sectors (Sanchez & Gil, 2000; Fiorentino *et al.,* 2003). The Adriatic general circulation (cyclonical movements) and mostly the South Adriatic Gyre together with the different distribution of temperature layers (Artegiani *et al*., 1997) can affect the allocation of the observed recruitment relevant areas. The results obtained can improve the development of the rationale exploitation of the fisheries stocks in the Adriatic. In this context, the extension of this exercise to the whole GSA 18 area, and then to the entire Adriatic basin assumes critical importance. Moreover the possibility to compare the several methodologies applied, at basin level, is deemed necessary for the recognition of common criteria to be used for the identification of nursery/recruitment areas. Finally, because ecosystems and habitats are dynamic in both space and time, and because the identification of critical habitat was based on the best available current information, it is important to remember that the identification of these areas may be changed, when new data or other biotic/abiotic issues are considered. Therefore the need to constantly update this information is deemed relevant for the creation of sustainable fisheries management plans.

General SCSA comments on progress made for mapping the distribution of juveniles

55. The SCSA acknowledged the progress made in this field on the basis of the documents presented, noting that they were based on different methodologies. It further appreciated that it is now clear that for many species, it would be possible to produce reliable maps of nursery areas based on all the information collected up to now. This information could be used (as preliminary done in document 37 on the hake on the strait of Sicily) to investigate the effect of an area closure to the recruitment of a species. In order to evolve from a descriptive approach to a dynamic approach, it would be necessary that: first, a stock assessment is produced and, then

the information on area proposed to be closed or restricted to fishery be specified in terms of management advice[8].

Biological impact of different fisheries management options

56. No documents were presented.

REVISION OF THE SHARED STOCKS LIST

57. No new shared stocks were presented for inclusion in the list.

REVISION AND IDENTIFICATION OF CRITERIA FOR UPDATING THE PRIORITY SPECIES LIST OF THE SAC

58. The SCSA coordinator presented the species list, showing the species assessed up to now. A discussion on the criteria for inclusion was held.

GENERAL COMMENTS

General comment on the implementation of the square mesh in bottom trawling

59. The SCSA noted that several research projects have assessed the beneficial effect of the change from the current mesh type in the cod end with 40 mm square mesh size. This could produce, for many target species of the trawl fishery, an increase in landing size and long term yield with a limited short term decrease of commercial yields. During a GFCM Workshop on the standardization of the selectivity methods applied to trawling in the Mediterranean Sea (Sete, 9-11 February 2005), it was shown that square mesh is more selective than diamond mesh.

General comment on the assessment and management of small pelagic fish in the Mediterranean

60. Small pelagic fishes are short-lived and their populations are highly dependent on recruitment. The Working Group and the Subcommittee agreed that their stocks in the Mediterranean need to be closely monitored and an adaptive approach should be adopted in their management. Minimum precautionary levels of spawning stock biomass must be assured for these stocks. Direct surveys (acoustic and/or egg production) have been developed in several Mediterranean countries during recent years and are regularly applied on a yearly basis. Biomass estimates accumulated from these surveys are very useful for the assessment of the stocks, particularly so when integrated with the fisheries information. Further development and execution of recruitment surveys would greatly improve the quality of the scientific advice.

61. In many areas of the Mediterranean, small pelagics are fished when smaller than size-at-maturity. The SCSA considered that measures should be taken to minimize fishing mortality of undersized fish. Technical improvements of the gears and spatial and/or temporal closures to protect the juveniles are different options that should be investigated and either choice be supported by sufficient scientific information.

General comment on spatial and temporal closure to fishing

[8] See also general comment on spatial and temporal closure to fishing.

62. The SCSA stressed the fact that when a temporal and/or spatial closure is proposed to reduce fishing effort on a part of the exploited population, that area and time of the year of these proposed closures should be clearly specified in the assessment documents presented.[9]

General comment on growth parameters

63. Taking into account the substantial differences in the assessments originating by different growth hypothesis the SCSA stressed the need for validation studies of this parameter (see PWGAM report).

SPECIFIC RECOMMENDATIONS CONCERNING THE SCIENTIFIC ADVICE

64. These are the following:

- The SCSA recommended the implementation of 40 mm square mesh in the cod end of bottom trawls.
- The length at first capture for small pelagics should be higher than length at first maturity.

ANY OTHER MATTERS

65. The SCSA requested to the participants to send all the abstracts to the SCSA coordinator at least one month in advance of the forthcoming SCSA meeting.

66. The SCSA also noted:
- the lack of participation from many Mediterranean countries
- demersal assessments were presented only for three sub-areas from Western Mediterranean (GSA 05, 06 and 07)
- that the SC, including WGs, is practically a congress with no actual assessment work done during the session.

ADOPTION OF THE REPORT

67. The report was adopted on 14 September 2006.

[9] See also comment on progress made for mapping the distribution of juveniles.

Annex A

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ANNEX B

Agenda

1. Opening and arrangement of the meeting
2. Adoption of the agenda
3. **Session 1** : Results of recent stocks assessment
    - Presentation and discussion of new assessments on demersal stocks
        - Demersal assessment documents
        - Assessment related documents
    - Presentation and discussion of new assessments on small pelagic stocks
        - Pelagic assessment documents
        - Assessment related documents
    - Results of the Adriamed Working Group on small pelagic species (Ancona, May, 2006)
    - Progress on undertaking pilot multispecies stock assessments in selected GSAs

4. **Session 2** : Methodologies for Stock assessment and data collection related to the fishing effort and the Operational Units
    - Review and analysis of the report of the PWGAM (Dr. A. Kallianiotis)
    - Revision of the Terms of Reference for the PWGAM
    - Review and analysis of the report of the transversal Workshop on Measurement and Standardization of Fishing Effort and follow-up by SCSA
    - Review and analysis of the report of the transversal Workshop on stock assessment and Operational Units and follow-up by SCSA
    - Review of assessment methods

5. **Session 3** : Biological parameters and indicators
    - Pursuing activities on the identification of biological indicators, establishing Reference Points and testing them on selected fisheries or GSAs
    - Progress on mapping the distribution of juveniles
    - Biological impact of different fisheries management options
6. Revision of the shared stocks list.
7. Revision and identification of criteria for updating the priority species list of the SAC.
8. General Comments
9. Conclusions and recommendations concerning the scientific advice and the 2007 work program, addressed by the SCSA
    - to SCSA
    - to SAC
10. Any other matters
11. Adoption of the report

ANNEX C

List of documents presented

1. Assessment of red shrimp (*Aristeus antennatus*) exploited by the Spanish trawl fishery (1992–2005) in the geographical sub-area 05 (Balearic Islands). A. Carbonell, M. Gaza, F. Ordinas, M. Valls, A. Felpete
2. Assessment of red shrimp (*Aristeus antennatus*) exploited by the Spanish trawl fishery (1996–2005) in the geographical sub-area Northern Spain 06 (Spanish coast). A. Carbonell J. L. Pérez Gil, A. Fernández, A. Esteban, M. García-Rodríguez
3. Preliminary Assessment of Deep-water pink shrimp *Parapenaeus longirostris* from the trawl fishery off the geographical sub-area Northern Spain GSA - 6. J. L. Pérez-Gil, M. García-Rodriguez, A. Fernández, and A. Esteban
4. Stock assessment of striped red mullet (*Mullus surmuletus*) from the trawl fishery off the GFCM-GSA 05 (Balearic Islands) A. Quetglas, F. Ordinas and E. Massutí
5. Stock Assessment of red mullet *Mullus barbatus* from the trawl fishery off the geographical sub-area Northern Spain. A.M. Fernández, M. García-Rodríguez, J. L. Pérez Gil, A. Esteban
6. Stock assessment of hake (*Merluccius merluccius*) from the trawl fishery off Balearic Islands (GFCM GSA05). Beatriz Guijarro, Enric Massutí, Francecs Ordines, María Valls and Joan Moranta
7. Assessment of hake (*Merluccius merluccius*) in the GFCM -GSA06. M. García-Rodriguez, J. L. Pérez-Gil, A. Fernández and A. Esteban.
8. Assessment of hake (*Merluccius merluccius*) exploited by the French and Spanish fisheries developed in the Gulf of Lions (GFCM GSA07) Angélique Jadaud , Capucine Mellon, Henri Farrugio, Enric Massutí, Beatriz Guijarro, María Valls, Francesc Ordinas and Antoni Quetglas
9. Preliminary results on stock assessment of Solea solea in the northern and central Adriatic sea (GSA 17) through rapido trawl surveys (SOLEMON PROJECT). G. Fabi, M. De Mauro, O. Giovanardi, F. Grati, I. Isajlović, P. Polidori, S. Raicevich, G. Scarcella, N. Vrgoć
10. Preliminary catch curve analysis of common sole (*Solea solea*) in the northern and central Adriatic Sea (GSA 17). A. Santojanni, N. Cingolani, S. Colella, M. De Mauro, F. Donato, G. Fabi, F. Grati, P. Polidori, G. Scarcella
11. GSA 18 Shared Demersal Stock in Montenegrin Waters. S. Regner, A. Joksimović, O. Kasalica. M. Đurović, A. Pešić, M. Mandić.
12. Les indices d'abondance et la repartition spatiale des principales ressources demersales de la Mediterranee marocaine. Laboratoire des Ressources Halieutiques Centre Régional de 'INRH-Nador
13. Time series analysis of rays in the south Ligurian and north Tyrrhenian sea with some notes on trends in landings of Raja asterias Delaroche, 1809. C. Mancusi, A. Abella, M. Ria, M. Barone, F. Serena
14. Consistency between trawl surveys trends of abundance and fishing pressure for the demersal assemblages exploited in the southern Ligurian sea. A. Abella, M. Ria, C. Mancusi, R. Baino, F. Serena.

15. Anchovy (*Engraulis encrasicolus*) stock assessment in the GFCM Geographical Sub-Area GSA 01, Northern Alboran Sea. A. Giráldez, P. Torres, L. Quintanilla & J. Baro
16. Anchovy (*Engraulis encrasicolus*) stock assessment in the GFCM Geographical Sub-Area GSA 06, Northern Spain. A. Giráldez, P. Torres, L. Quintanilla & J. Baro
17. Sardine (*Sardina pilchardus*) stock assessment in the GFCM Geographical Sub-Area GSA 01, Northern Alboran SeaA. Giráldez, P. torres, L. Quintanilla & J. Baro
18. Sardine (Sardina pilchardus) stock assessment in the GFCM Geographical Sub-Area GSA 06, Northern Spain A. Giráldez, P. torres, L. Quintanilla & J. Baro
19. *Engraulis encrasicolus*, 1993-2004. Gulf of Lions – Acoustic surveys – GSA 07 B. Liorzou
20. *Sardina pilchardus*, 1993-2004. Gulf of Lions – Acoustic surveys. – GSA 07 B. Liorzou
21. Multispecies assessment of biomass of small pelagic fish (*Engraulis encrasicolus, Sardina pilchardus, Scomber japonicus, Trachurus trachurus*) in the Mediterranean waters of Marocco. May 2006. GSA 03. Acoustic survey. Kada O., Serghini M.
22. *Engraulis encrasicolus, Sardina pilchardus*, 1998-2005. Strait of Sicily – Acoustic surveys. – GSA 16 A. Bonanno, G. Basilone
23. Anchovy (*Engraulis encrasicolus*, L.) stock assessment in the Adriatic Sea: 1975-2005. – GSA 17. N. Cingolani, A. Santojanni, E. Arneri, A. Belardinelli, S. Colella, F. Donato, G. Giannetti, I. Leonori, A. De Felice , B. Marceta
24. Sardine (*Sardina pilchardus*, Walb.) stock assessment in the Adriatic Sea: 1975-2005. – GSA 17. N. Cingolani, A. Santojanni, E. Arneri, A. Belardinelli, S. Colella, F. Donato, G. Giannetti, I. Leonori, A. De Felice , B. Marceta
25. Multispecies assessment of biomass of small pelagic fish (*Engraulis encrasicolus, Sardina pilchardus, Sprattus sprattus*) in the north-western part of the Adriatic Sea (GFCM Geographical Sub-Area 17) summer 2005. GSA 17. Acoustic survey. Iole Leonori, Massimo Azzali, Andrea De Felice
26. Multispecies assessment of biomass of small pelagic fish (*Engraulis encrasicolus, Sardina pilchardus*) in the south-western part of the Adriatic Sea (GFCM Geographical Sub-Area 18) summer, 2005. GSA 18. Acoustic survey. Iole Leonori, Massimo Azzali, Andrea De Felice
27. Anchovy (*Engraulis encrasicolus*, L.) stock biomass assessment in the south-eastern part of the Adriatic Sea: August 2005. – GSA 18 S. Regner, A. Joksimović, O. Kasalica. M. Đurović, A. Pešić, M. Mandić.
28. Ichthyoplanktonic and acoustic biomass estimates of the anchovy (*Engraulis encrasicolus*) in the Aegean Sea (June 2003, June 2004, June 2005). – GSA 22 by Somarakis S., Sxismenou E., Machias A., Giannoulaki M., Siapatis A., Stamataki C., Torre M., Anastasopoulou K., Vassilopoulou V., Kalianiotis A., Papaconstantinou C.
29. Spatial modeling of the European anchovy habitat in the Eastern Mediterranean basin using GAMs and GIS technology. Anchovy (*Engraulis encrasicolus*). – GSA 22. Giannoulaki M., Machias A., Valavanis V., Somarakis S., Palialexis A., Papacostantinou C..
30. Red mullet assessment in the GSA 10 using Aladym simulation model. G. Lembo and M.T. Spedicato.
31. Underwater television as a fishery-independent method for stock assessment of Norway lobster, *Nephrops norvegicus*, in the central Adriatic Sea (Italy) (GSA 17) Elisabetta B. Morello, Enrico Arneri, Carlo Froglia, and R. James A. Atkinson

32. Use of direct survival analysis from trawl survey data. Eduardo Ferrandiz
33. ECOMED acoustic surveys: methodology, results and scope. Magdalena Iglesias
34. The influence of oceanographic scenarios on the population dynamics of demersal resources in the western Mediterranean: hypothesis for hake and red shrimp off Balearic Islands. Enric Massutí, Sebastià Monserrat, Pere Oliver, Joan Moranta, José Luis López-Jurado, Marta Marcos, José Manuel Hidalgo, Beatriz Guijarro, Aina Carbonell and Pilar Pereda
35. Recent progress towards the elaboration of population and community indicators from the MEDITS surveys. Presented by J.A. Bertrand (MEDITS co-ordinator)
36. Defining a reference state of an exploited ecosystem. A proposal based on fuzzy sets. M.J. Rochet & J.A. Bertrand
37. Bayesian analysis of hake recruits density in the GSA 9 (central Tyrrhenian-Ligurian Sea) . V. Bartolino, F. Colloca, G. Iona Lasinio, L. Maiorano, G.D. Ardizzone
38. Delineating habitats used by different life phases of hake in the Strait of Sicily. F. Fiorentino, G. Garofalo, T. Fortibuoni, T. Bahri, M. Camilleri, A. Drago, M. Gristina and F. Massa
39. A methodological contribution to the identification of recruitment relevant areas for some shared demersal fisheries resources in the Southern Adriatic Sea (GSA 18) N. Ungaro, R. Gramolini, K. Osmani, N. Milone

ANNEX D

Stocks assessed in 2006

	GSA																							
Species	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	total
Aristeus antennatus					1	1																		**2**
Mullus barbatus						1																		**1**
Mullus surmuletus					1																			**1**
Merluccius merluccius					1	1	1*																	**3**
*Parapenaeus longirostris***						1																		**1**
Engraulis encrasicolus	1		1			1	1									1	2	2				2		**11**
Sardina pilchardus	1		1			1	1									1	2	1						**8**
Sprattus sprattus																	1							**1**
Scomber japonicus			1																					**1**
Trachurus trachurus			1																					**1**
total per GSA	**2**		4		**3**	**6**	**3**									**2**	**5**	**3**				**2**		**30**

*new assessment but with data up to 2004
** Preliminary, no recommendations

Assessments	
Total	**30**
GSAs	**9**
Species	**10**
Shared stocks	**6**

October 2006

ANNEX E

Proposal to hold a Workshop on methodology to analyze disaggregated fishery data with the following Terms of Reference[10]

There exist, for some Mediterranean areas, data series on landings and prices/revenues, disaggregated by day, vessel and species. The purpose of the workshop is to develop a common methodology to analyze and compare results from these different series.

Taking into account the progress made on operational units characterization and effort by SAC/GFCM, in the framework of the existing Permanent Working Group on Stock Assessment Methodology, the Workshop will propose for adoption standard methods to:

PRE-PROCESSAL ANALYSIS: FILTER DATA AND DETECT ERRORS AND BIASES.

DESCRIPTIVE ANALYSIS

- Identify clusters of vessels (potential OUs)
- Identify target species (by OUs or cluster of vessels)
- Identify species composition

TEMPORAL ANALYSIS

- Analyze variability of landings at different time scales.
- Identify and describe seasonality
- Identify and describe trends, both in fishing activity and in stock abundance
- Analyze prices, more specifically, price dynamics in time (season, years), in function of supply, maybe in function of size and imports

IDENTIFY FISHING STRATEGY AND TACTICS[11] (MÉTIERS), IN BASIS OF THE RESULTS OF THE POINTS 2 AND 3.

OTHER ANALYSES

- Define nominal effort and propose a method to obtain effective effort for each vessel/OU
- Explore methods to calibrate official landing statistics from sampling on board and field surveys.

A description of each data series, including: years covered, vessels and species, number of registers (vessel-day-species-catch-price/revenue) will be provided.

The workshop will be based on the computer work on data bases provided by the participants during the workshop. Examples of the results will be provided.

This workshop will take place on the condition that at least two relevant sets of data will be available before the workshop.

[10] This proposal has been modified (reorganized and completed) from those approved in the SCSI/SCSA/SCESS Transversal workshop on measurement and standardisation of fishing effort Fuengirola, Spain, 30-31 May 2006.

[11] A **strategy** is a general plan or set of plans intended to achieve something, especially over a long period. **Tactics** are the methods that you choose to use in order to achieve what you want in a particular situation. [(c) HarperCollins Publishers].