GENERAL FISHERIES COMMISSION FOR THE MEDITERRANEAN

COMMISSION GÉNÉRALE DES PÊCHES POUR LA MÉDITERRANÉE

GENERAL FISHERIES COMMISSION FOR THE MEDITERRANEAN

SCIENTIFIC ADVISORY COMMITTEE (SAC)

Fourteen Session
Sophia, Bulgaria 20-24 February 2012

REPORT OF THE WORKING GROUP ON STOCK ASSESSMENT OF DEMERSAL SPECIES
Chania, (Crete) Greece, 24-29 October 2011

INTRODUCTION

1. The meeting of the SCSA Working Group on Demersal species (WG) was held in Chania (Crete) Greece, from 24 to 29 October 2011 at the Thales and Heraclitus conference rooms of the Mediterranean Agronomic Institute of Chania (MAICh).

2. The session started with the presentation of all 30 participants (including the moderator) from 13 countries (see Appendix A). Out of the 30 participants, 6 were from Italy, 4 from Spain, 3 from Tunisia, 2 from Cyprus, 2 from Romania, and 1 from each of the remaining 8 countries (Albania, Algeria, Egypt, France, Greece, Lebanon, Montenegro and Morocco), 4 representatives of FAO, FAO EastMed Project, and FAO MedSudMed Project, and Ms Pilar Hernandez from GFCM Secreteriat.

3. Mr. Kostas Stergiou Proffessor at the University Aristotle at Thesaloniki, Greece, was the Moderator. The meeting Terms of Reference are presented in Appendix B.

4. The moderator stressed that the main objective of the meeting is to give advice on the management of fisheries and stocks, based on assessments that must be supported by the available data, biological parameters and methods agreed by the participants. Such assessments must have quality and consistency to provide relevant information for management. For assessments characterized by the WG as preliminary, no advice is given.

5. Then, there was a brief presentation of the agenda (see Appendix C), which was adopted.

6. Consequently, there was a brief discussion on the structure of the report, which includes, three general sections: (i) Introduction, (ii) progress on the last year conclusions and recommendations, (iii) the stock assessment section and (iv) general discussion and recommendations. The stock

assessment section includes the individual stock assessments reports, for all species, structured according to a circulated template, which provides necessary information on: stock, GSA, authors, fishery, data parameters, assessment method, diagnosis of stock status, results, advice and recommendations, and discussion. The report was adopted by the WG.

7. Finally, the following participants were nominated as rapporteurs: Angélique Jadaud, for the assessments and discussion concerning Hake, Giuseppe Scarcella, for the assessments and discussions concerning all remaining fish species, Beatriz Guijarro, for the assessments and discussions concerning all crustacean species, and Alvaro Abella for general discussion and recommendations.

8. **Matters arising:** Two participants, Drs Maximov and Radu, from the National Institute for Marine Research and Development 'Grigore Antipa', Constanta, Romania, informed the WG that they will deliver a short presentation on Romanian fisheries. There were not any other matters arising.

PROGRESS ON THE LAST YEAR CONCLUSIONS AND RECOMMENDATIONS

9. The moderator reminded to the WG the conclusions and recommendations from the last year's report and requested from the participants to provide inputs, and insights on the progress done, if any, as well as their opinion on either adopting or discuss them again.

10. The WG briefly discussed the importance to follow up on such issues and decided to discuss some of the points raised in the last's year report in the general discussion and recommendation section.

STOCK ASSESSMENTS

11. Consequently, the participants presented their available data and assessments. A summary table with all the stocks assessed is presented in Appendix D.

Synopsis of assessments

12. Overall, 30 assessments were presented of which 21 refereed to stocks of 9 fish species and 9 to stocks of 4 crustacean species. Of the 21 assessments on fish stocks, 6 refereed to *Merluccius merluccius*, 5 to *Mullus barbatus*, 3 to *Mullus surmuletus*, 2 to *Pagellus erythrinus* and 5 to five fish stocks (1 for each of the following species: *Solea solea, Sphyraena sphyraena, Galeus melastomus, Spicara smaris and Boops boops*). From the 9 assessments on crustacean stocks 4 referred to *Parapenaeus longirostris*, 3 to *Aristaeus antennatus*, 1 to *Nephrops norvegicus* and 1 to *Aristaemorpha foliacea*.

13. With respect to assessments by GFCM subarea, 23 assessments were confined within one subarea (7 assessments referred to GSA 09, 4 to GSA 25, 3 to GSA 05, 3 to GSA 06, 2 to GSA 07, 1 to GSA 01, 1 to GSA 17, 1 to GSA 18, and 1 to GSA 26) and 7 assessments spanned more than one GSA (3 for GSAs 15-16, 1 for GSAs 01-03, 1 for GSAs 12-13, 1 for GSAs 12 to 16, and 1 for GSAs 12,15,16), a fact which is very encouraging.

14. It is very important to stress that many alternative approaches have been used for the assessments (i.e. VPA, LCA, XSA, Y/R, production models, methods based on life history traits) in order to cope with the different characteristics of species and the availability of data. Maintaining

such a strategy is the only way for enhancing our knowledge on the dynamics and exploitation status of Mediterranean stocks.

15. The majority of the assessments had all the work required (i.e. full assessment) done before the meeting. In only one case, the analysis was redone during the practical session (Red mullet in GSA 07), following suggestions by the WG. Finally, for three stocks the assessment was done during the practical session (Red mullet and Striped red mullet in GSA 25 and Solea in GSA17).

16. The different methods used as well as the results of the individual stock assessments were discussed and scrutinized by the participants and the advice was approved in during the session. The general aspects of the assessments performed, including the methods and data used, the stock status and a summary of the resulting scientific advice are provided in Table 1. The individual stock assessment reports are below whereas the separate stock assessment forms (published on the GFCM website) must be consulted for more information.

Synopsis of stock status and recommendations

17. Out of the 30 stocks assessed, **28 stocks were in overfishing status,** 1 stock only was assessed to be underexploited (*Parapenaeus longirostris* in GSA 9) whereas one assessment (hake in GSAs 12, 15 and 16 combined) was considered preliminary.

18. The WG endorsed all assessments, that were not considered as preliminary, and the corresponding recommendations.

The following acronyms are used in the assessment reports:

CPUE: Catch Per Unit of Effort
F: Fishing Mortality
FLR: Fisheries Libraries in R
LCA: Length Cohort Analysis
LFD: Length Frequency Distribution
M: Natural Mortality
MSY: Maximum Sustainable Yield
RP: Reference Points
SSB: Spawning Stock Biomass
SSB/R: Spawning Stock Biomass per Recruit
TRP: Target Reference Points
VPA: Virtual Population Analysis
Y/R: Yield per Recruit
XSA: Extended Survivor Analysis
Z: Total Mortality

1.Stock: European hake, *Merluccius merluccius*

GSA: 01

Author(s): Pérez Gil J.L., Gonzalez M., Torres P., Garcia T., Garcia C., Baro J. and Melendez J.

Fishery: European hake, *Merluccius merluccius*, is one of the target demersal species of the Mediterranean fishing fleets, largely exploited in GSA01 almost exclusively by trawl (88% of landings) on the shelf and slope and by small-scale vessels using gillnets (9%) and long lines (3%). The trawling fleet in GSA01 comprised an average of 183 boats, averaging 35 GRT and 176 HP. In 2003–2010 the annual landings averaged 448 t in the whole area.

Data and parameters: The state of exploitation was assessed for the period 2003-2010 for the Northern Alboran Sea (GSA01). This assessment was 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.

Assessment method: A VPA tuned with CPUE from the commercial fleet and abundance indices from MEDITS trawl surveys was carried out applying the XSA method over the whole period. A retrospective analysis and a Y/R analysis based on the exploitation pattern resulting from the XSA model and population parameters for the entire period was carried out.

Diagnosis of stock status: The stock is in overfishing status and intermediate level of abundance.

Results: The results show a decreasing trend in the last year both in biomass and SSB of the stock. Current recruitment in numbers represents a 26% of the value observed two years ago (the highest in the series). F increased from 2008 to 2009, and decreased slightly in the last year. The Y/R analysis showed that the F_{ref} (1.33) exceeds the Y/R $F_{0.1}$ reference point (0.2 absolute value).

Advice and recommendation: To reduce the F of trawl 80%.; ensure compliance of the use of 40 mm square or 50 mm diamond mesh size in the bottom trawl cod-end is recommendded.

Discussion: It is not necessary to mention recruitment overexploitation, because of the low participation of long-liners and gillnetters (e.g. 12% of the catches). No other particular comment was made on this assessment.

The WG endorsed the assessment and recommendations.

2.Stock: European hake, *Merluccius merluccius*

GSA: 05

Author(s): Guijarro B., Valls M. and Massutí E.

Fishery: The trawl fishery off Mallorca (Balearic Islands; GFCM-GSA05) is developed by around 40 vessels whose total annual landings are approximately 1400 t. The European hake, *Merluccius merluccius*, is a target species for this fishery, mainly exploited on the deep shelf and upper slope, with annual landings oscillating between 50 and 190 t during the last decades. All hake catches are derived exclusively from bottom trawlers.

Data and parameters: Size composition of commercial trawl catches and official landings (1980-2010), CPUE data from bottom trawl surveys (2001-2010) and from the commercial fleet (2000-

2010). Growth parameters from Mellon-Duval *et al*. (2009), maturity ogive from Spanish National Data Collection Programme. M vector from PRODBIOM.

Assessment method: XSA, retrospective analysis and Y/R analysis.

Model performance: The retrospective analysis did not show any trend for SSB, recruitment and F.

Results: Stock abundance, biomass and recruitment showed oscillations for the entire data series, without any clear trend.
1980-89: $F_{current}$ = 1.57, F_{max} = 0.235, $F_{0.1}$ = 0.157, Y/R = 27.3 g, Y/R 0.1= 53.4 g
2008-10: $F_{current}$ = 1.21, F_{max} = 0.242 , $F_{0.1}$ = 0.157, Y/R = 29.3 g, Y/R 0.1= 57.0 g

Diagnosis of stock status: The stock is in overfishing status.

Advice and recommendation: Reduce fishing mortality by reducing the effort activity and improving the selection pattern of the fishery. The use of the information from the vessel monitoring system will help to improve the knowledge about the spatial distribution of the fishing effort.

Discussion: there were no comments.

The WG endorsed the assessment and recommendations.

3.Stock: European hake**,** *Merluccius merluccius*

GSA: 07

Author(s): Jadaud A., Guijarro B., Massutí E. and Farrugio H.

Fishery: Hake, *Merluccius merluccius*, is one of the most important demersal target species of the commercial fisheries in the Gulf of Lions (GFCM-GSA07). In this area, hake is exploited by French trawlers, French gillnetters, Spanish trawlers and Spanish long-liners. Around 220 boats are involved in this fishery and, according to official statistics, total annual landings for 1998-2010 oscillated around a mean value of 2250 t (1980 t in 2009). The fishing capacity of the GSA07 has shown in these last 10 years a progressive decrease considering the French trawlers. The number of these trawlers decreased by about 30% on the period. Most fleets and catches correspond to French trawlers (44 and 72%, respectively). Trawl catches range between 3 and 92 cm total length (TL), with an average size of 20 cm TL, followed by French gillnetters (~39 and 14% respectively, ranging 13-86 cm TL and average size 39 cm TL), Spanish trawlers (~11 and 8%, respectively, ranging 5-87 cm TL, and average size 25 cm TL), and Spanish long-liners (~6 and 6%, respectively, ranging 23-96 cm TL and average size 54 cm TL). Hake trawl fishery exploits a highly diversified species assemblage: Striped mullet (*Mullus surmuletus*), Red mullet (*Mullus barbatus*), Angler (*Lophius piscatorius*), Black-bellied angler (*Lophius budegassa*), European conger (*Conger conger*), Poor-cod (*Trisopterus minutus capelanus*), Fourspotted megrim (*Lepidorhombus boscii*), Soles (*Solea spp*.), Horned octopus (*Eledone cirrhosa*), squids (*Illex coindetii*), Gilthead seabream (*Sparus aurata*), European seabass (*Dicentrarchus labrax*), Seabreams (*Pagellus spp.*), Blue whiting (*Micromesistius poutassou*), Tub gurnard (*Chelidonichtys lucerna*).

Data and parameters: The information used for the assessment of the stock consisted of annual size composition of catches (estimated from monthly or quarterly sampling in the main landing ports), official landings and biological parameters estimated from data collected in the GSA7 (2003-2010) by IFREMER for the DCF. These parameters were L-W relationship, sex-ratio and maturity ogive and were computed using inbio (R scripts developed by IEO). The growth coefficient (K) comes from tagging experiments developed by IFREMER in the area (Mellon-Duval et al, 2010). The vector of natural mortality by age was calculated from Caddy´s formula, using the PROBIOM Excel spreadsheet (Abella et al., 1997).

Assessment method: For the period of the study (1998-2010), the methodology applied was a tuned VPA, applying the XSA method considering as tuning fleet French MEDITS campaign indices. The software used was FLR. For 2010, a Y/R analysis was performed.

Model performance: The retrospective analysis did not show any trend.

Results:

Current Y/R	0.05
Maximum Y/R	0.10
Y/R 0.1	0.09
Fcurrent	1.43
F_{max}	0.29
$F_{0.1}$	0.19
Current B/R	0.09
Maximum B/R	0.78
B/R 0.1	1.27

Diagnosis of stock status: Stock is in overfishing status and low abundance. The stock is characterized by growth overexploitation with periodically higher recruitments (1998, 2002 and 2008) which ensure the sustainability of the stock at a low level of abundance.

Advices and recommendation (in terms of research and, when possible in terms of management).
To reduce growth overfishing:
- Improve the fishing pattern of the trawl to arise the minimum length of catches equal to the minimum legal landing size
- close nursery areas at least temporally (see doc. "Nursery area for hake for the Gulf of Lions" - p33, SAC 2010 report)
- Reduce the effort of trawl, from reducing time at sea, number of fishing boats, engine power, Bollard pull and/or trawl size

To avoid recruitment overfishing:
- Reduce the effort of longline and gillnets in order to increase (or at least maintain) the SSB.
- Establish temporal closures for longline and gillnet during the period of maximum spawning (end of autumn and beginning of winter, main peak of spawning period)
- Freezing of the effort in the Fishery Restricted Area

Discussion: The moderator noticed that the minimum legal landing size was smaller than the size at first maturity, a fact that is ecologically not acceptable. The Subcommittee Coordinator commented

that this species is caught within a multispecies fishery (trawlers). No other comments were made on this assessment.

The WG endorsed the assessment and recommendations.

4.Stock: European hake, *Merluccius merluccius*

GSA: 09

Author(s): Colloca, F., Abella A., Ligas M., Mannini A. and Sbrana M.

Fishery: Hake is caught mainly with bottom trawl nets on a wide depth interval. Catch is mainly composed by juveniles. Catch from small-scale fisheries (gillnets, long lines) is also important and the structure of the catch is composed by larger sized individuals.

Data and parameters: Data used proceed from commercial catch (time series of landings and age composition of the catch, etc) and from trawl surveys.

Assessment method: A VPA (XSA) analysis was performed for defining an F by year and numbers and biomass changes in time. Surveys data was used for tuning the model. Trawl survey data were used for an alternative estimation of Z done using SURBA, after the reconstruction of the demographic structure of the stock and slicing among age classes. A Y/R was used for estimating the lifetime yield and biomass from a cohort subjected to varying levels of F and for estimating $F_{0.1}$ and $F_{max.}$

Model performance: The XSA performed quite well as demonstrated with the quality checking (i.e. retrospective analysis).

Results: F1-3 derived from SURBA shows a clear increasing trend ($p<0.01$) from 0.8 (1994) to 2.4 (2008), decreasing to 1.77 in 2009. Relative SSB decreased significantly showing the lowest values in 2009-2010. Recruitment fluctuated from year to year without a clear temporal pattern during MEDITS. The strongest year classes were observed in 1998 and 2009. A low recruitment index occurred in 2010.

Diagnosis of stock status: The following mean values were obtained: F_{max} = 0.35; $F_{0.1}$= 0.22 and $F_{40\%SSB}$ = 0.28. The comparison of the current F (between 1.5 to 2.0) with the RPs suggests that the stock is in overfishing status with current F about six times higher than the limit and target RPs F.

Advice and recommendation: A reduction in F is recommended.

Discussion: No special comments were made on this assessment.

The WG endorsed the assessment and recommendations.

5.Stock: European hake, *Merluccius merluccius*

GSA: 12,15,16

Author(s): Ben Meriem M., Fiorentino F., Gangitano V., Widian K., Mifsud R., Knittweis L., Arneri E. and Ceriola L.

Fishery: Catch of 2132 t are landed in the studied area (GSAs 12, 13, 15, 16). Five operational units were identified and used as metiers for the analysis: OpUnit 1* ITA 99 E 03 34 – HKE, or large and distant trawlers (1041 t); OpUnit 2* ITA 99 F 03 34 – HKE, or small and coastal trawlers (446 t); OpUnit 4* TUN 99 H 03 34 – HKE, or trawlers (600 t); Tunisia trammel net (80 t) OpUnit 5* MLT 99 E 03 34 – HKE (6 t).

Data and parameters:
Growth model: $L\infty = 100$, $K = 0.116$, $T_o = -0,5$; $L\infty = 69,5$, $K = 0,176$, $T_o = - 0,6$
Length-weight relationship: a=0,0048 b=3,1252
Size at first maturity = 33,6 cm
Total catch and length frequency distribution for 2010 (Italy, South Sicily, GSA 16; North Tunisia, GSA 12; Malta, GSA 15)

Assessment method: LCA was applied to estimate the F and abundance vectors by length class and Y/R**.** The ventilation by operational unit or fleet component according to the following assumption: each fleet component participating in the fishery has its own exploitation pattern. Therefore, exploitation pattern has been estimated both per fleet component and as total for the area. The estimation of the fishing mortality per fleet component is based on the following equation. $F_{i,j}/F_i = C_{i,j}/C_i$

Model performance: the analysis with the 2 options of growth parameters set showed a significant difference in the results probably due to the fact that L_+ used was much lower than L_{inf}

Results: F in global balance and separated/ventilated by fleet segment was estimated. Y/R according the effort variations and length at first capture changes were also computed.

Diagnosis of stock status: F is relatively high (0.60) and a high fraction of this F is oriented to juveniles. The Y/R analysis showed that the stock is in overfishing status with growth and recruitment overfishing. F_{max} and F_{01} would be reached if current F (F_{curr}) is reduced by around 80 and 90% respectively.

Advice and recommendation: Overall, F should be reduced according to a multiple-year strategy. Length at first capture should be increased by both improving selectivity and protecting nurseries grounds.

Discussion: Although the wide coverage of the data used (data accounts for most of the fisheries of *M. merluccius* in the south-central Mediterranean), the analysis should be considered a first step toward a complete stock assessment. A distinction by sex was not considered and only one year of data was used (2010). In addition, the importance of the L_+ class used in the analysis should be mentioned as it can cover the effects of the fisheries in the highest size class independently of the growth parameters used as input. In addition, a cut off size class may also mask the similarities and differences between the results obtained using the two sets of growth parameters. A more accurate analysis considering at least the division by sex and a longer time series has been planned.

The WG considered the assessment preliminary.

6.Stock: European Hake, *Merluccius merluccius*

GSA: 18

Author(s): Spedicato M.T., Bitetto I., Lembo G., Carbonara P., Casciaro L., Facchini M.T., Milone N., Ceriola L., Joksimovic A., Ikica Z., Kasalica O., Kolitari J., Gjurgji I. and Kroqi G.

Fishery: Hake is one of the most important species in GSA18 representing about 20% of trawl landings. In 2010 the landings of hake were about 4020 t in the west side with the higher production from trawlers (3400 t) followed by longliners (601 t) and by gillnets (19 t). Along the east side the production from trawlers in 2010 was about 276 t (36 t from Montenegro and 240 t from Albania).

Data and parameters: Standardized LFD abundance indices (N/km^2), whole GSA18 (MEDITS data 1996-2010, Data Collection Framework). Length structure of landings and production by fishing segment (for west side from data CF, east side within a pilot study in the framework of Adriamed project). Two scenarios of growth for sexes combined: slow (L_∞ = 95, K = 0.14 and t_0 = -0.4) and fast growth (L_∞ = 104 cm, K = 0.2, t_0 = -0.01). M was adjusted accordingly. Length-weight relationship: a = 0.0043, b = 3.155 sexes combined. Maturity ogive with $L_{m50\%}$ = 33.4 cm ± 0.15 cm. For the ALADYM model simulations: fleet selectivity L_c = 12cm; SR = 1 cm (ogive), from 1994 to 2010; L_c = 16 cm SR 1 cm from 2011 to 2030 plus deselection ogive with 50% deselection size at 50 cm.

Assessment method: SURBA software, ALADYM model, VIT software and the R-routine developed at SGMED working group. In addition, the Y/R analysis implemented in the VIT for the calculation of $F_{0.1}$ and F_{max}. A transition analysis with VIT was performed, to evaluate the objectives of reaching $F_{0.1}$ and F_{max} through a multiannual reduction of the F. Eight scenarios ($F_{0.1}$ and F_{max} in 2015 and 2020 for slow and fast growth scenarios) have been explored. The scenarios were projected until 2030. In ALADYM harvesting strategies are used to forecast the effects on the population metrics (accounting for cohort structure) and simulated catches. ALADYM was applied using hindcasting and predictive approaches. The Z and the recruitment estimated by VIT for 2007-2010 were used as inputs. To estimate Z and recruitment in 2011 a geometric mean among 2008-2010 was calculated. These estimates were used for projections to 2030. Four scenarios were tested: simulation from 2007 to 2030 (slow and fast growth scenarios), with increase Lc from 12 to 16 cm (status quo). Simulation from 2007 to 2030, enforcing mesh size, reducing fishing activity by month (40% of the current levels) and during two months for trawlers (additional 5%) and further reducing fishing mortality (15%) on 2014 (slow and fast growth scenario). The R-routine developed at SGMED was used to project two scenarios, starting from a fishing level equal to the F current in the fast scenario for 2010 (F = 0.86) in order to achieve $F_{0.1}$ (=0.21) until 2015 (annual reduction of 30%, scenario1) and until 2020 (annual reduction of 15%, scenario 2).

Model performance: the methods were used in a complementary and integrated way. Consistency between results and inputs and life history parameters was cross-checked among methods and with inputs.

Results: MEDITS data showed a sharp increase in recruitment in 2005 and thereafter a level similar or higher than that in the past years. In 2008 a new though lower peak was observed. No trends were detected. SURBA Z and F mortality showed a decreasing trend to 2004 and than an increasing in 2005 and 2006. Thereafter the level was similar to the beginning of the time series. VIT catches and mortality are dominated by the trawl fishing system. In the fast growth scenario the Y/R analysis indicates a current level F of 0.87. The limit reference point F_{max} is 0.27 and the target

reference point $F_{0.1}$ is 0.21. ALADYM simulations show that after a decrease of the catches in the short terms the yield trend is increasing and reach levels higher than the values in the beginning of the time series with an improvement of stock productivity. The SPR is at very low levels in the status quo scenarios, but shows a remarkable increase (approaching 30%) following the reduction of F. Regardless of the growth scenario an increase in the mean length of catches in 2011was observed and then the value remains quite constant around 25 cm. R routine SGMED showed a catch reduction till 2015 (annual reduction of F=30%) to achieve $F_{0.1}$ until 2015, whilst catches slowly increase in scenario 2 with a annual reduction of F of 15% to 2020.

Diagnosis of Stock status: The stock is in overfishing status and thus it is necessary to consider a considerable reduction of the F to allow the achievement of $F_{0.1}$ and F_{max}.

Advice and recommendation: The BRPs can be gradually achieved by multiannual management plans requiring a more sharp reduction in the short term than in the medium term. However, a more gradual reduction will very likely imply lower social and economic costs, without hampering the sustainability objective. The objectives of a more sustainable harvest strategy could be achieved with a multiannual plan based on a reduction of fishing mortality through fishing activity limitations and possibly fishing capacity decreasing. It is however necessary to consider that most of the F is derived from the Italian bottom trawlers, that represent about 85% of the total F in the GSA, and from the Italian longliners, accounting for about 7-8% (overall 92-93% of F). In contrast, Montenegrin trawlers account for about 1% of the F exerted on the GSA and Albanian trawlers for about 6.5%. The production of hake in GSA 18 is split in 14% caught by Italian longlines, 79% by Italian trawlers, about 1% by Montenegrin trawlers and about 6% by Albania trawlers.

Discussion: The WG congratulated the research group for the huge amount of work that was done within the ADRIAMED project. The discussion highlights that it is worth mentioning the recovery of productivity in the medium-long term as consequence of the reduction of F and mesh size increase. It is important to receive by the relevant Committee and experts also economic considerations on the forecasts performed under different management scenarios. The assessment provides a wide range of analysis useful to managers for assisting the decision process.

The WG endorses the assessment and the related recommendations.

7.Stock: Red mullet**,** *Mullus barbatus*

GSA: 06

Author(s): Fernández, A.M.

Fishery: Both *Mullus surmuletus* and *M. barbatus* are exploited by trawl and artisanal fisheries fleets in GSA6, although small gears (trammel nets and gillnets) account only for 5% of their total landings (Demestre et al., 1997). Trawl fisheries developed along the continental shelf and upper slope are multi-species. Small vessels operate almost exclusively on the continental shelf targeting on red mullets, octopus, cuttlefish and sea breams. Medium and large vessels usually operate on the slope areas targeting on hake and decapod crustaceans, but some of these units can also operate on the continental shelf depending on the season (e.g. red mullet is more intensively exploited from September to November; Martín et al., 1999), the weather conditions or market prices. Landings of M. barbatus increased continuously from the earliest 1970's until 1982. From this year until now a general decreasing trend with fluctuations is observed. Important fractions (28% of individuals) of

M. barbatus are under the minimum legal size. The total number of boats (trawl fleet) in the GSA6 has been reduced 30% from 1998.

Data and parameters: Total annual landings 1995-2010. Annual catch in numbers by size class. Abundance index from commercial fleet and MEDITS surveys. Growth parameters are those obtained by Demestre et al. 1997. Length-weight relationships and oogive of maturity were obtained within the framework of the Spanish Data Collection Programme. The vector of natural mortality-at age was obtained from Caddy´s (1991) formula using the PROBIOM Excel spreadsheet (Abella et al. 1997).

Assessment method: VPA-XSA and Y/R analysis.

Diagnosis of stock status: The stock is in overfishing status and in low level of abundance.

Results: Catch in number of individuals are based on younger ages (0 and 1). Average F for ages 0-2 shows a general decreasing trend over the studied period reflecting the continuous reduction observed in the fleet. Recruitment shows a slight decreasing trend, being under the average of the whole period in the last two years. There isn't any trend in the total biomass whereas SSB shows a slight increasing trend. Transition analysis indicates that a 24% increase in Y/R is expected with the square mesh in the cod-end. A 32% increase in Y/R is expected with both the square mesh and a 20% decrease in fishing effort and a 44% increase in Y/R is expected with a 40% decrease in fishing effort and the use of the square mesh.

Advice and recommendation: (1) To reduce F by about 70%. (2) More effective control in shelf areas above 50 m depth should reduce the catch of small individuals under the minimum legal size.

Discussion: The discussion was focused on the convenience of including in the stock status diagnostics that the biomass is at a low level when the results of the analysis show no trend in the studied period and there is not any reference about the biomass level in the years before. Nevertheless, the high level of exploitation suggests that the biomass should necessarily be low.

The WG endorsed the assessment and recommendation.

8.Stock: Red mullet, *Mullus barbatus*

GSA: 07

Author(s): Jadaud A., Guijarro B., Massutí E. and Farrugio H.

Fishery: In the Gulf of Lions (GFCM-GSA7), red mullet (*Mullus barbatus*) is exploited by both French and Spanish trawlers. Around 120 boats are involved in this fishery. According to official statistics, total annual landings for the period 2004-2010 have oscillated around a mean value of 157 t. Most boats and catches correspond to the French trawling fleet (80% and 85% respectively). In Frech and Spanish landings, modal length is 14 cm. In GSA7, the trawl fishery is a multi-species fishery. In addition to *M. barbatus*, the following species can be considered important by-catch: *Merluccius merluccius*, *Lophius sp*., *Pagellus sp*., *Trachurus sp*., *Mullus surmuletus*, *Octopus vulgaris*, *Eledone sp*., *Scyliorhinus canicula*, *Trachinus* sp., Triglidae, *Scorpaena* sp.

Data and parameters: The information used for the assessment of the stock consisted in annual size composition of French and Spanish trawl landings and biological parameters from GSA9 (growth, natural mortality, maturity ogive). The other biological parameters were obtained from the French National Data Collection Programme (L-W parameters).

Assessment method: The assessment of this stock has been carried out by means of XSA for the period 2004-2010, and Y/R for the period 2008-2010, considering French and Spanish trawl. This year, the assessment has been improved by applying an XSA, instead of a pseudo-cohort analysis as done in previous years.

Model performance: The residuals of the tuning fleets were low.

Results: Current Y/R 0.0108, Maximum Y/R 0.0112, Y/R0.1 0.0097, Fmax 1.68, F0.1 0.45, Current B/R 0.031, Maximum B/R 0.026, B/R 0.1 0.04, F ref 0.846 (Absolute values)

Diagnosis of stock status: This stock is in overfishing status and in intermediate level of abundance

Advice and recommendation: In consideration of the $F_{0.1}$ reference point F should be reduced.

Discussion: A discussion was opened about the K value used for the assessment. The assessment has been rerun by using fast growth parameters (GSA9) instead of slow growth parameters (GSA7). The status of the stock as resulted from this analysis was almost the same. The SSB was found to increase, so there was some doubt about the XSA results. The MEDITS trend was the same with that of SSB and thus it is rather odd that with so high overexploitation the trend of SSB is increasing.

The WG endorsed the assessment and recommendations.

9.Stock: Red mullet, *Mullus barbatus*

GSA: 09

Author(s): Abella A., Colloca F., Ligas M., Mannini A. and Sbrana M.

Fishery: The species in GSA9 is mainly caught by bottom trawlers. Small-scale fisheries target bigger individuals, but their landings are quite limited. In the period 2002-2010, annual landings varied between 620 and 1,100 tons. Landings from demersal bottom trawlers dominate. Discard occur for trawlers but only represent about 5% of the catch and is exclusively composed by small sized individuals. In the last 15 years, a general decrease in the number of vessels operating in the GSA9 targeting demersal species was observed. The reduction continued up to 2010. Trawl survey data show an increasing trend (from 7.3 to 24 kg/km2 in 2002, with a steadier situation in recent years with values between 15 and 20 kg/km2.

Data and parameters: Data derive from commercial catches and trawl surveys. Growth parameters used for *M. barbatus* in the GSA9 for analyses were: L_∞=29, K=0.6, t_o=-0.1. L-W relationship a=0.00053, b=3.12. An M vector (age1=1.30, age2 0.79, age 3 0.62, age 4= 0.54) and a weighted mean value of M of 0.65 were used. The species reaches massively the sexual maturity at one year old. The length of first capture was estimated as L_C=7.4cm.

Assessment methods: For the assessment of the stock it was used a non-equilibrium production model. Data proceed from commercial catch and effort in two of the main ports of the GSA combined with a time series of abundance index derived from trawl surveys implemented in the ASPIC.5.3 software (a Stock-Production model Incorporating Covariates) (Prager, 1994, 2005) assuming a Schaefer (1954) model. The available information covers the period 1994-2010. The model allowed the estimation of several parameters, in particular F_{MSY} and the current rate of F.
Also a LCA was used for the estimation of the current F rate using commercial catch composition by size. The approach was implemented on an Excel spreadsheet. The annual catch by size was used in order to derive an *F* vector and mean numbers by size.

Model performance: The production model was able to fit very well the time series that resulted with high correlations. The time series proceeding from a port where the species is not a target have shown higher residuals.

Results: ASPIC furnished a decreasing trend of F rate with starting values of about 0.8 and a value of 0.54 for year 2010. The F rate at MSY was estimated as F_{MSY}= 0.474. The current ratio: B_{2010}/B_{msy} was estimated as 0.584 and for F_{2010}/F_{msy} = 1.14. The mean F estimated with the LCA was of 0.59. F can be attributed almost completely to trawlers for the smaller sizes while small scale fisheries are responsible of only a small fraction of F for large-sized individuals. A Thompson & Bell type analysis performed YPR software (NOAA stock assessment toolbox) allowed to estimate $F_{0.1}$, F_{max} and $F_{40\%SSB}$. The estimated values were respectively 0.48, 1.02, and 0.63.

Diagnosis of stock status: The stock is considered overexploited (B_{curr}/B_{MSY} of about 0.6), and in overfishing status with estimates of the current fishing mortality F_{2010} of 0.54 (derived from ASPIC) higher than the values considered a limit reference point obtained with the same approach (F_{MSY}=0.47**).** The Y/R RP (**$F_{0.1}$** =0.48) is lower than the current F estimated by LCA (0.59). Y/R analysis suggests that the size of first capture is too low (growth overfishing). An increase in yield is expected in the case a reduction of fishing effort does occur and/or more selective gears are used.

Advice and recommendation: A reduction in fishing mortality is recommended.

Comments: no particular comments were done

Discussion: The WG endorsed the assessment and recommendations.

10.Stock: Red mullet, *Mullus barbatus*

GSA: 15,16

Author(s): Fiorentino F., Knittweis L., Gancitano V., Mifsud R., Gravino F. and Garofalo G.

Fishery: Red mullet (*M. barbatus*) is one of the main demersal resources of the coastal areas in the Mediterranean, fished by otter trawl and trammel and gill-net, together with other several species (Voliani, 1999). In GSA15 and 16 red mullet is caught almost exclusively by inshore trawlers operating on shelf fishing-grounds of GSA16 and 15. The Italian landing represents more than 95% of total yield, which decreased from 1409 t in 2005 to 770 t in 2010. The artisanal catch is about 1-2% of the total catch in Italian vessels and 3-7% in the Maltese ones.

Data and parameters: Data was derived both from indirect (fisheries monitoring) sources from EU Data Collection Framework. The biological parameters used were: L_{inf}=23.61; k=0.45; t_0= -0.8; a= 0.0134; b= 2.9419; M-at-age vector (PROBIOM sheet): 0.56 (0.5); 0.34 (1.5); 0.29 (2.5); 0.27 (3.5); 0.27 (4.5); 0.26 (5.5); 0.26 (6.5); 0.25 (7.5) and L_{inf}=20.16; k=0.57; t_o=-0.8 and M-at-age vector: 0.73 (0.5); 0.41 (1.5); 0.35 (2.5); 0.32 (3.5); 0.31 (4.5); 0.3 (5.5); 0.29 (6.5); 0.29 (7.5); a=0.0176; b=2.8226 for male respectively.

Assessment method: Five complete years (2006-2010) of LFD from GSA16 commercial landings data (fished in GSA15 as well as GSA16) were available, so an approach under steady state (pseudocohort) assumptions was used. Cohort (VPA equation) and Y/R analysis as implemented in the package VIT4win were thus used. In addition, fishery independent information regarding the state of the red mullet in GSA16 was derived from the international survey MEDITS and the Italian survey GRUND. Trends in abundance and biomass indices as well as LFD were plotted. Assessment was previously carried out at STECF EWG 11-12.

Model performance: The VIT results showed a high consistency among years.

Results: According to VIT analysis, absolute estimations of SSB (combined sex) in the 2006-2010 was 1070 t in 2006, 1307 t in 2007, 1046 t in 2008, 905t in 2009 and 1072 t in 2010. Biomass indices derived from scientific surveys in spring-summer (MEDITS), which is representative of SSB, show a clear increasing trend of spawners'abundance since early 1990s. The estimates of absolute recruitment in millions of individuals (age class 0) from VIT analysis in 2006-2010 were 39.3 in 2006, 57.7 in 2007, 48.0 in 2008, 31.6 in 2009 and 40.2 in 2010. The time series of recruitment indices from trawl surveys in autumn (GRUND surveys) carried out in GSA16 (individuals smaller than 11 mm CL) showed high values in 2003-2004 and in 2007-2008. Considering the overall time series an increasing trend of recruitment seems to occur, with peaks in 2003 and 2007 that were years affected by strong positive anomalies of the seawater surface temperature.

Diagnosis of stock status: The stock of red mullet in the Northern sector of the Strait of Sicily is in overfishing status since the current F (mean 0.84) is higher than $F_{0.1}$ and lower than F_{max}. However SSB showed an increasing trend from nineties onward and recruitment in last years was higher than that in the nineties.

Advice and recommendation: A reduction of about 45% of the F (F_c=0.81) needs to reach the technical TRF $F_{0.1}$=0.45 (F values estimated as median of the 2006-2010 results).

Discussion: A discussion on the growth parameters used was carried out, comparing the parameters from different areas. In any case, the perception of the stock status is the same (i.e. stock in overfishing status). Practically, it might be better to use growth parameter derived from young ages because generally catches are dominated by juveniles in the Mediterranean. However, it was stressed that it is also important to consider the growth after the size at first maturity, because in the last years the exploitation pattern is changing towards bigger sizes. The latter is the result of an increase in surveillance and nursery grounds are now protected more than in the 1980s or 1990s.

The WG endorses the assessment and the related recommendations.

11.Stock: Red mullet, *Mullus barbatus*

GSA: 25

Author(s): Charilaou C.

Fishery: Red mullet in GSA25 is exploited by the artisanal fleet using trammel nets and by the bottom otter trawlers. The species is exploited with a number of other demersal species for both fisheries. For the assessment period (2005-2010) the average landings by each fleet was around 15-16 tons. The most exploited age classes by both fleets are the age classes 1 and 2.

Data and parameters: Catch-at age data derived from landings of each fishing gear exploiting the stock (trammel net and bottom trawl) and discards data from bottom trawl. The assignment of catches in ages was based on Age Length Keys. M vector for each age class was used, estimated by PRODBIOM (Abella et al., 1997). The L-W relationship and the maturity at age used were estimated within the framework of the Cyprus National Data Collection Programme. The growth parameters used were the ones adopted by the STECF SGMED-08-03 meeting for slow growth (estimated from otolith reading).

Assessment method: Separable VPA for the period 2005-2010, VPA-pseudocohort and Y/R analysis for 2009 and 2010 separately.

Model performance: The Separable VPA model fitted well with the data (CV=0.16).

Results: The recruitment can be considered constant for the period 2005-2010. Average F for ages 1-3 shows a decreasing trend from 2007, while for the last years of the studied period (2009-2010) F seems to be constant. There is a decreasing trend in the SSB, although in the last two years the SSB remains constant. Based on the Y/R analysis for 2010 the current fishing mortality (0.434) is 24% higher than the $F_{0.1}$ reference point (0.33), but smaller than F_{max} (0.51). Based on the Y/R analysis for 2009 the current F (0.461) is 28% higher than the $F_{0.1}$ reference point (0.33), but smaller than F_{max} (0.51).

Diagnosis of Stock status: The stock is in overfishing state, considering that the current F should be reduced by 24% (based on 2010 Y/R analysis) or by 28% (based on 2009 Y/R analysis) for reaching the $F_{0.1}$ reference point. The stock abundance seems to be in low levels, on the basis of available data and considering the decrease in official landings and the LPUE of the stock throughout the years.

Advice and recommendation: A re-evaluation of the growth parameters of the stock is advised, as well as the adoption of acceptable ranges of the species' growth parameters and natural mortality for the Eastern Mediterranean. F from both fleets should be reduced. This could be achieved with the following measures that have been recently implemented/will be implemented in the near future in Cyprus (in accordance with the 2011 Cyprus Management Plan for Bottom Trawls fishing in territorial waters): a reduction on the number of licensed trawlers, reduction of the number of licensed small scale vessels, increase of the selectivity of passive and trawler nets and restriction of two areas from fishing with trawl nets on a rotational basis (northwest part of Cyprus from 8 November – 15 February, southeastern part from 16 February – 31 May every year).

Discussion: It was agreed that the diagnosis of low abundance of the stock does not derive from the stock assessment results, but is based on the available time series.

The WG endorsed the assessment and the recommendations.

12.Stock: Striped red mullet, *Mullus surmuletus*

GSA: 05

Author(s): Quetglas A, Ordines F. and González N.

Fishery: Striped red mullet (*Mullus surmuletus*) is one of the most important target species in the trawl fishery developed by around 37 vessels off Mallorca (Balearic Islands, GFCM-GSA05). A fraction of the small-scale fleet (~50 boats) also directs to this species during the second semester of the year, using both trammel nets and gillnets. During the last decade, the annual landings of this species have oscillated between 74-117 and 16-29 tons in the trawl and small-scale fishery, respectively.

Data and parameters: The stock of *Mullus surmuletus* of the GFCM-GSA05 has been assessed using data from both the trawl and the small-scale fishery on a time series covering ten years (2000-2010). Monthly size composition of catches, official landings and the biological parameters estimated within the framework of the Data Collection Programme (2003-2004) were used. CPUE from commercial trawl fleet (2000-2010) and bottom trawl surveys (2001–2010) were also used. The vector of natural mortality by age was calculated from Caddy´s (1991) formula, using the PROBIOM Excel spreadsheet (Abella et al., 1997).

Assessment method: The assessment has been carried out applying tuned VPA (XSA) on the cohorts present during 2000-2010 and both VPA and Y/R analysis on a mean pseudo-cohort from that period. The XSA were run using the Lowestoft VPA program (Darby and Flatman, 1994) and the Y/R was done in an Excel spreadsheet.

Model performance: the residuals did not show any trend.

Results: Although stock abundance and biomass did not show any significant trend, both recruitment and SSB showed a significant decreasing trend ($p<0.05$).
2000-2010: $F_{current} = 0.55$, $F_{max} = 1.10$, $F_{0.1} = 0.26$, Y/R = 15.71 g.

Diagnosis of stock status: The stock is in overfishing status.

Advice and recommendation: (in terms of research and, when possible in terms of management). Reduce F by reducing the effort and improving the selection pattern of the fishery.

Discussion: A trend line should be fitted to the stock abundance and recruitment in order to evaluate the possibility of recruitment overexploitation. No other comments were made comments.

The WG endorsed the assessment and the recommendations.

13.Stock: Stripped red mullet, *Mullus surmulletus*

GSA: 09

Author(s): Sbrana M., Abella A., Colloca F., Ligas M. and Mannini A.

Fishery: The species in GSA9 is caught by bottom trawlers and in small-scale fisheries mainly using trammel nets and gillnets which are more selective and catch bigger individuals.

Data and parameters: Data derive from commercial catches and trawl surveys.
L_{∞}=32, K=0.42, t_o=-0.7 a=0.01 b=3.103
M vector: age0=0.49, age2=0.26, age3=0.22, age4=0.20, > age 4=0.18.

Assessment methods:
A length cohort analysis was used for the estimation of the current fishing mortality rate using commercial catch composition by size. The used approach was the software VIT. The annual catch by size was used in order to derive an *F* vector and mean numbers by age.

Model performance: The two years show a similar behaviour as regards the distribution of F by age, but in 2010 mean F is much lower. It is difficult to find a explanation of such difference that may be related to data quality or to a real reduction of F (which is unlikely).

Results: The mean F estimated with the LCA was of 0.71 for 2009 and 0.56 for 2010 .Most of the F can be attributed to trawlers for the smaller sizes while small scale fisheries are responsible of an important fraction of F for big-sized individuals. The Y/R model was used for estimating a value for $F_{0.1}$ and F_{max}. The estimated values were respectively 0.35 and 1.0.

Diagnosis of stock status: The stock is considered in overfishing status because the current F estimated by LCA for 2009 and 2010 were higher than the reference point $F_{0.1}$=0.35.

Advice and recommendation: A reduction in F is recommended.

Discussion: No particular comments were done.

The WG endorsed the assessment and recommendations.

14.Stock: Stripped red mullet, *Mullus surmuletus*

GSA: 25

Author(s): Charilaou C.

Fishery: Stripped red mullet in GSA25 is exploited mainly by the artisanal fleet using trammel nets and also by the bottom otter trawlers in a minor extent. The species is exploited with a number of other demersal species for both fisheries. For the assessment period (2009-2010) the average landings were less than 40 tons, of which the 96% was caught by the artisanal fleet. The most exploited age classes by the artisanal fleet are the ages 1and 2, while the bottom trawl fishery exploits mainly the age classes 2 and 3.

Data and parameters: Catch-at age data derived from landings for each fishing gear exploiting the stock (trammel net and bottom trawl), using Age Length Keys. M vector for each age class was used, estimated by PRODBIOM (Abella et al., 1997). The L-W relationship, the maturity at age and

the growth parameters used were estimated within the framework of the Cyprus National Fisheries Data Collection Programme.

Assessment method: VPA-pseudocohort and Y/R analysis for the years 2009 and 2010 separately.

Model performance: -

Results: Based on the Y/R analysis of 2010 the current F (0.492) is 53% higher than the $F_{0.1}$ reference point (0.23). Based on the Y/R analysis of 2009 the current F (0.422) is 48% higher than the $F_{0.1}$ reference point (0.22).

Diagnosis of stock status: The stock is in overfishing state, considering that the current F should be reduced by 53% (2010 results) or 48% (2009 results) for reaching the $F_{0.1}$ reference point. The stock abundance seems to be in low levels, on the basis of available data and considering the decrease in official landings and the LPUE of the stock throughout the years.

Advices and recommendations: A re-evaluation of the growth parameters of the stock is advised, as well as adoption of acceptable ranges of the species growth parameters and natural mortality for the Eastern Mediterranean. F by the artisanal fleet should be reduced. This could be achieved with the following measures that have been recently implemented/will be implemented in the near future in Cyprus: reduction of the number of licensed small scale vessels and increase of the selectivity of passive nets from 32mm to 38mm.

Discussion: The Group suggested the use of alternative growth parameters for comparison reasons, considering that the K value used for the current assessment is quite low. It was clarified though that in the present assessment the age structure of the landings was based on Age Length Keys and not the growth parameters used. It was agreed that the diagnosis of low abundance of the stock does not derive from the stock assessment results, but is based on the available time series.

The WG endorsed the assessment and the recommendations.

16.Stock: Common Pandora, *Pagellus erythrinus*

GSA: 15,16

Author(s): Fiorentino F., Knittweis L., Gancitano V., Mifsud R., Gravino F. and Gristina M.

Fishery: Common pandora is an important demersal resource through the Mediterranean, including the Strait of Sicily. The mean yield in 2006-2010 was 486 t per year, ranging from 917 in 2006 to 295 in 2009. Most of the catch is due to Sicilian fisherman (94-99%). Sicilian catch is due almost exclusively to trawlers while in Maltese islands the catch by artisanal fishery may be more important than the trawlers' ones.

Data and parameters: Data derived both from indirect (fisheries monitoring) sources from EU Data Collection Framework. The biological parameters used were: L_{inf}=40.0; k=0.176, t_0=-1.0; a=0.0220; b=2.8300; M=0.29; maturity fixed at 2 yr and F_{term}=0.5.

Assessment method: Five complete years (2006, 2007, 2008, 2009 and 2010) of length frequency distributions from GSA16 commercial landings data (fished in GSA 15 as well as GSA 16) were available, so an approach under steady state (pseudocohort) assumptions was used. Cohort (VPA equation) and Y/R analysis as implemented in the package VIT4win were thus used. The LFDs by sexes combined were derived from the EU Data Collection Framework for GSA 16 and then converted in numbers by age group using the "age slicing" by LFDA package. Total landing included the yield of both the Italian and Maltese fleet. This assessment was previously carried out at STECF EWG 11-12.

Model performance: Data and results for 2009 are very different from the other years. This year was not considered for the stock diagnose and management advice.

Results: According to VIT analysis, absolute estimations of SSB (combined sex) in the 2006-2009 was 1070 t in 2006, 1307 t in 2007, 1046 t in 2008, 905t in 2009 and 1072 t in 2010. The 2009 estimate was considered not reliable. The estimates of absolute recruitment in millions of individuals (age class 1) from VIT analysis in 2006-2009 were 15.2 in 2006, 8.1 in 2007, 7.1 in 2008, 5.1 in 2009, and 3.9 in 2010. Considering that the estimate of 2009 was deemed unreliable, the strength of recruits remained quite stable along the time series. During the MEDITS survey higher numbers of recruits were found in GSA 15 in 2006-2010 than in GSA16.

Diagnosis of stock status: On the basis of the VIT analyses a provisional reference point was given, corresponding to $F_{0.1}$= 0.30. Since the current fishing mortality is higher than $F_{0.1,}$ the stock of Common pandora in the Northern sector of the Strait of Sicily is assessed in overfishing status. However, there is no sign of decrease in SSB and recruitment indices from trawl surveys.

Advices and recommendations: Considering the current F (F_c) in 2010, to reach the proposed TRP a reduction of F_c of about 50% is advisable.

Discussion: there were no comments on this assessment.

The WG endorses the assessment and the related recommendations.

15.Stock: Common Pandora**,** *Pagellus erythrinus*

GSA: 26

Authors: El-Haweet A.A.K., El-Ganiny A.A. and Mahmoud H.H.

Fishery: The present study deals with the fisheries of *Pagellus erythrinus* (Common pandora) in the Egyptian Mediterranean coast from Port Said in the east to El-Sallum in the west (GSA26). Genus *Pagellus* is represented in the Egyptian Mediterranean waters by two species: *Pagellus erythrinus* (red or common pandora) and *Pagellus acarne* (auxiliary sea bream). Both species are usually found with *Pagrus* species in the catch and all the landed catch of these species were recorded together in one category. *Pagellus erythrinus* consider about 60% of this category. The trawl fishery exploits the common Pandora using 22-30 mm diamond mesh size in the codend, thus the catches are dominated by juvenile specimens. Most than 85% of the *Pagellus erythrinus* landings is taken by trawlers.

Data and parameters: Fish samples collected from trawl survey along the Egyptian Mediterranean coast and the commercial catch from Port-Said area during two years (2006 and 2007). The length frequency was analyzed by the Bhattacharya method in order to estimate the age composition.

Assessment method: Z was estimated by the length converted catch curve and M was estimated by the Pauly equation. Beverton and Holt Y/R model and relative Y/R analysis (knife edge selection) were performed with FiSAT software, in order to estimate also the reference points.

Results: For Port-Said area F_{cur}= 0.724, F_{max}= 0.536 and $F_{0.1}$=0.275

For all the Egyptian coast F_{cur} = 0.554, F_{max}= 0.567 and $F_{0.1}$=0.297

Diagnosis of the stock status: The species is in overfishing for both areas (based on $F_{0.1}$).

Advice and recommendations: Improvement of the trawl exploitation pattern (40 mm square mesh size or 50 mm diamond mesh size) and reduction F up to 60% in Port-Said area and up to 45% for the entire Egyptian coast to reach $F_{0.1}$are recommended.

Discussion: It will be useful to use the nonlinear regression to calculate the VBGP. However the growth parameters used are very similar to other parameters published on Fishbase for the same species, especially in areas with high sea water temperatures (22^{o}C) like in Egypt.

The WG endorsed the assessment and the recommendations.

17.Stock: Sole, *Solea solea*

GSA: 17

Authors: Scarcella G., Giovanardi O., Vrgoc N., Marceta B., Fabi G., Grati F., Raicevich S., Polidori P., Domenichetti F., Bolognini L., Celic I. and Sabatini L.

Fishery: Sole (*Solea solea*) is one of most important target species of rapido trawl and set net fleets in GSA 17. The stock is shared between the Adriatic countries (Italy, Croatia and Slovenia). The Italian fleets exploit this resource with rapido trawl and set nets (gill nets and trammel nets), while only trammel net is used in the countries of the eastern coast. More than 90% of catches come from the Italian side.

Data and parameters: Two sets of input data regarding the catch at age matrix and total landings series were used. The first set of data has been provided in the framework of SoleMon project from 2005 to 2009, plus 2010 data coming from 2011 Italian official data call. The second set of data has been provided by the 2011 Italian official data call from 2006 to 2010. Slovenian landings were provided by Slovenian official DCF data for the period 2005-2010. Concerning Croatian fishery, landings of around 200 t of *S. solea* per year have been suggested for the period 2005-2010 (MAFRD CRO; Ministry of agriculture, fisheries and rural development). The age/lenght frequency distributions from 2005 to 2010 of the Croatian and Slovenian catch derived from the composition observed by preliminary data collection started in 2010 by Croatian colleagues in the framework of Primo project (Monitoring of commercial coastal fisheries in the RC; IOF Split). Several projects carried out in GSA17 highlighted that the discard of sole both by rapido trawl and set net fisheries is negligible as the damaged specimens are also commercialized. Growth parameters were obtained through the analyses of length distributions obtained during the Solemon survey (2005-2010). A natural mortality vector (Ma) was estimated using Caddy's method (1991) (PROBIOM). Maturity ogive and L-W relationship parameters were calculated using biological samples collected in the period 2005-2007.

Assessment method: Two XSA runs; SURBA; LCA (VIT Model); Y/R.

Model performance: A separable VPA was run as exploratory analysis for both sets of data. Log catchability residual plots were produced and no major conflict between ages seems to appear. XSA diagnostics did not show trends in the residuals. Diagnostic plots of SURBA models show an adequate fitting of the model in sole data in GSA17.

Results: XSA first run: Exploitation decreased from 2005 to 2006, was constant in 2006-2007 and increased in 2008-2010. The most recent estimate of fishing mortality (F_{0-4}) is 1.34. Recruitment varied without any trend in the years 2005-2010, reaching a minimum in 2009, and increasing in 2010. The SSB regularly increased until 2009 and decreased in 2010. XSA second run: Exploitation was constant in the period analysed expect for the lower value observed in 2008. The most recent estimate of fishing mortality (F_{0-4}) is 1.20. Recruitment varied without any trend in the years 2006-2009, reaching the maximum in 2010. After the decrease observed from 2006 to 2007 the SSB regularly increased from 2007 to 2009, and decreased again in 2010. The results of SURBA are in general accordance with the previous method providing the same perception of the exploitation of the stock (F0-4=1.15). Moreover a clear decreasing trend in SSB is showed as well as the low recruitment in the last year (cohort effect). LCA is also in general agreement with the previous results with a mean F of 0.88, evidencing that the main contribution is provided by the rapido trawl fleet. Target and limit reference points from Y/R analysis are $F_{0.1YIELD} = 0.26$, $F_{0.1\ VIT} = 0.24$; $F_{MAX\ YIELD} = 0.46$; $_{MAX\ VIT} = 0.38$.

Diagnose of Stock status: The stock is in overfishing. A reduction in fishing mortality, especially by rapido trawling, would be recommended, also taking into account that the exploitation is mainly orientated towards juveniles and the success of recruitment seems to be strictly related to environmental conditions. Hence, in the case of both increasing fishing effort and yearly bad recruitment, there could be a high risk of stock depletion.

Advices and recommendations: The limit and target BRPs $F_{0.1}$ and F_{max} can be gradually achieved by multiannual management plans focusing especially on the rapido trawl fishing activity. A two–months closure for rapido trawling inside 11 km (6 nm) off-shore along the Italian coast, after the biological fishing ban, would be advisable to reduce the portion of juvenile specimens in the catches. From this point of view is really important to consider the information available from the VMS of the Italian rapido trawl fleet. Moreover, specific studies on rapid trawl selectivity are necessary. In fact, it is not sure that the adoption of a larger mesh size would correspond to a decrease of juvenile catches, considering that the mesh opening currently used by the Italian rapido trawlers is larger than the legal one. The same uncertainty regards the adoption of a square mesh. Finally, considering the results presented at the GFCM meetings since 2005, it can be concluded that the rapido trawl survey is a very efficient tool for providing useful data for the stock assessment, spatial distribution of sole and other benthic species that in the following working group will be analysed. From this point of view the prosecution of such survey is strongly advisable also with the support of the regional projects (e.g. ADRIAMED).

Discussion: The group highlights the use of data from the eastern side of the basin as was suggested in the previous WG (Istanbul, 2010). Moreover, the group underlines the need to extend the rapido trawl survey inside the 12 nm from the Croatian coast, as was performed in 2005 and 2006. Such requirement could be attained in the framework of ADRIAMED regional project.

The WG endorsed the assessment and recommendations.

18.Stock: Barracuda*, Sphyraena sphyraena*

GSA: 12,13

Author(s): Chemmam-Abdelkader B. and Ezzeddine-Najai S.

Fishery: this species is exploited by gill nets and purse seiners. The fishing was exerted on spawners in both cases during April to August.

Data and parameters: Sampling from the landings points and during surveys. Size frequency data. Size classes: North: Lower limit: 17cm last limit: 73cm East: Lower limit: 17cm last limit: 48cm. Biological parameters (for both areas): L_{inf}= 103,5cm, K= 0,076, t_0=-2.342, L_{50}= 26cm, a= 6,40E-03, b= 2,86. Demographic parameters**:** M (North): 0.173, M (East): 0.180 Terminal F (North): F_{term}=1.7, Terminal fishing mortality (East): F_{term}=1.4.

Assessment method: VPA, VIT.

Model performance: -

Results: F in northern sector exceeds F_{max} by 40%. F in eastern sector exceeds F_{max} by 64%.

Diagnosis and stock status: Northern population is in overfishing status. Eastern population is in overfishing status.

Advice and recommendation: (In terms of research and, when possible in terms of management). In term of research: A simulation in short and long term would be realised in order to predict the impact on the stock. To check the barracuda stock unit in different Tunisian areas, especially between the northern and eastern ones. The arrival of the invasion species *Sphyraena viridensis* in the northern part requires a control of statistic data separately by species. In terms of management: Reduce F by about 40% in the northern areas and 60% in the eastern one. However, *Sphyraena sphyraena* is lowly represented in the small scale fishing (0.1%) and so all reduce of effort would have an impact on the target coastal species. So we advice to reduce the fishing area in spawning season because in this period the spawners were target by gears.

Discussion: The discussion was about the difference of estimated mean age: 2.2y (in the North; 1.5y in East). The response: the difference is in relation to the fishing profile: the purse seine fishing is directed to small individuals but the gillnets (in the North) catch mainly large individuals.

The WG endorsed the assessment and recommendations.

19.Stock: Blackmouth catshark*, Galeus melastomus*

GSA: 09
Author(s): Abella A., Colloca F., Ligas M., Mannini A. and Sbrana M**.**

Fishery: The stock is exploited by trawlers as the species is a by-catch in Nephrops and red shrimps fisheries. The blackmouth catshark *Galeus melastomus* is a deep sea species, with low commercial interest. It is only caught with bottom trawl nets, as a by-catch of the Norway lobster and red

shrimps fisheries. Only relatively big-sized individuals are landed. Most of the catch in size and in weight is discarded and only big-sized individuals are landed.

Data and parameters: The species is slow growing. Growth parameters for sexes combined were used due to the lacking of important sexual dimorphism in growth. Von Bertalanffy's growth parameters $L_\infty = 64$; $K = 0.15$; $t_o = 0$ for both sexes. L-W relationship a = 0.0025 b = 3.02. A constant rate of natural mortality M = 0.20 was adopted based on lifespan and growth parameters. The species reaches the sexual maturity at 6 years old. Available information on fecundity at age (max production of number of eggs/year/ age) was used in the analyses.

Assessment method: A LCA was performed using commercial data aimed at the estimation of a vector of F-at-size, using data on total annual catches by size for the year 2010, including discards. An age-based Thompson-Bell model was used for estimating reference points $F_{0.1}$ and F_{max} and the expected lifetime yield and biomass from a cohort subjected to varying levels of F. A demographic analysis was used for the definition of the status of the stock regarding its capacity of self-renewal (Caswell, 1989). A Leslie Matrix that allows modelling changes in F at specific ages or in the reproductive schedule was used. An elasticity analysis was used for assessing the influence of changes in the estimates of the vital rates (fecundity at age and mortality).

Model performance: The used methods furnished consistent results and expected considering the life history traits of the species

Results: The length cohort analysis provided a mean F of about 0.35 (weighted by numbers). Y/R analysis allowed the estimation of $F_{0.1}$=0.35. The current *F* was estimated as 0.35. The Leslie matrix analysis suggests a slow rate of increase of the population and turnover, consistent with the species characteristics (slow individual growth, late age of maturity and low fecundity). The current combination of *Lc* and *F* is considered unable to guarantee sustainability. Fishing with the current pattern (*Lc*=<1yr), an *F* of about 0.08 was estimated as the upper limit in order to ensure the stock self-renewal. The dominant Eigen value (λ) was 1.193 ($r = L_{n\lambda} = 0.176$/year) for the unexploited cohort, the mean age of parents of the offspring of 5.77 years and the generation time G corresponding to the weighted mean age of spawners was estimated to be 5.69 years. The elasticity analysis suggests that is in the first ages where smallest changes in vital rates are likely to produce bigger changes in the population growth rate.

Diagnosis of stock status: The species is in overfishing status, with consistent diagnosis of the current exploitation status obtained with the 2 used approaches aimed at the definition of precautionary reference points which values are much lower than the current estimate of F rate of F=0.35. The size of first capture is too low (growth overfishing) and an increase in yield and a more safe situation for the stock can be expected in the case a reduction of fishing effort, avoidance of fishing grounds where juveniles are concentrated and the utilization of more selective gears are used. Management measures aimed at protecting juveniles should provide greater benefits than a strategy aimed at protecting adults, might be facilitated by an increase of the age of entry to the fishery of the species.

Advice and recommendation: Reduce F. Reduce the catch in areas where juveniles are concentrated.

Discussion: Pedro Barros pointed out the importance of using simple approaches such as the one used here. Demographic models can be very useful in such circumstances for short living and low fecund species like *G. melastomus.*

The WG endorses the assessment and the related recommendations.

20.Stock: Picarel, *Spicara smaris*

Author(s): Josephides M.

GSA: 25

Fishery: Picarel (*Spicara smaris*) in GSA25 is exploited mainly by the bottom trawl fleet comprising 4 vessels OAL 12-24m since 2006 operating in the territorial waters. The main species caught with picarel in bottom trawl are: *Mullus barbatus*, *Pagellus erythrinus*, *Serranus cabrilla* and cephalopods (*Octopus vulgaris*, *Loligo vulgaris* and *Sepia officinalis*) while in gill nets are: *Boops boops*, *Spicara maena* and *Sardina pilchardus*. The percentage of bogue in the overall landings for bottom trawl fishery for the period 2005-2010, has a range of 44.8 - 65.9% while for artisanal fishery is 3.2-10%. Bottom trawl fishery exploits mostly age classes 2 and 3 while artisanal fishery exploits 3 and 4 age classes.

Data and parameters: Catch-at-age data from two three year periods (2005-2007 and 2008-2010) derived from landings for each fishing gear exploiting the stock (bottom trawl and gillnet), and discards data from bottom trawl. A combined ALK for 2006-2008 and annual length distributions from 2005-2010 were used. M- Vector for each age class was used, estimated by PROBIOM (Abella et al 1997). The biological parameters used are growth parameters and L-W relationship.

Assessment method: Standard VPA in VIT software.

Model performance: -

Results: 2005-2007: F_{cur}= 0.19, F_{max}= 0.38 and $F_{0.1}$=0.19; 2008-2010: F_{cur}= 0.37, F_{max}= 0.40 and $F_{0.1}$=0.24.

Stock status: 2005-2007: in fully-exploitation status (F_{cur}= $F_{0.1}$). Intermediate abundance ; 2008-2010: in overfishing status and intermediate abundance

Advice and recommendation: F must be reduced in both gears as in the second period (2008-2010) it seems that both gears cause almost the same fishing mortality levels with the difference that bottom trawl fleet targets mainly age classes 2 and 3 of the population, while artisanal fleet targets age classes 3 and 4. According to transition analysis, an approximate reduction of 15% (10-20%) of the current F could lead to $F_{0.1}$. This could be achieved with the reduction of licensed fishing vessels OAL 6-12m and trawlers OAL 12-24m. The increase of selectivity is also important.

Discussion: As the time series of catch-at-age data is increasing, it will be useful in the next assessments to use methods that do not require the equilibrium assumption that is made by the VIT model.

The WG endorsed the assessment and recommendations.

21. Stock: Bogue, *Boops boops*

Author(s): Josephides M.

GSA: 25

Fishery: Bogue (*Boops boops*) in GSA25 is exploited mainly by the artisanal fleet comprising 500 vessels OAL 6-12 m using gillnets and secondly by the bottom otter trawlers that comprise 4 vessels OAL 12-24 m. The main species caught with bogue in gillnets are: *Spicara smaris*, *Spicara maena* and *Sardina pilchardus*, while in bottom trawl are: *Spicara smaris*, *Mullus barbatus*, *Mullus surmuletus*, *Pagellus erythrinus* and cephalopods (*Octopus vulgaris*, *Loligo vulgaris* and *Sepia officinalis*). The percentage of bogue in the overall landings for artisanal fishery for the period 2005-2010, has a range of 20-28.7% while for bottom trawl fishery is 5.7-9.4%. Both gears exploit mostly age classes 3 and 4 years.

Data and parameters: Catch-at-age data from two three year periods (2005-2007 and 2008-2010) derived from landings for each fishing gear exploiting the stock (gillnet and bottom trawl), and discards data from bottom trawl. A combined ALK for 2006-2008 and annual length distributions from 2005-2010 were used. M- Vector for each age class was used, estimated by PROBIOM (Abella et al,1997). The biological parameters used are growth parameters and L-W relationships.

Assessment method: Standard VPA in VIT software.

Model performance: -

Results: 2005-2007: F_{cur}= 0.57, F_{max}= 0.38 and $F_{0.1}$=0.24; 2008-2010: F_{cur}= 0.37, F_{max}= 0.39 and $F_{0.1}$=0.24.

Diagnosis of stock status: 2005-2007: overfishing status and intermediate abundance; 2008-2010: overfishing status and intermediate abundance.

Advice and recommendation: F must be reduced in the case of artisanal fishery. According to transition analysis, an approximate reduction of 15% (10-20%) of the current F could lead to $F_{0.1}$. This could be achieved with the reduction of licensed fishing vessels OAL 6-12m and increasing the selectivity.

Discussion: As the time series of catch-at-age data is increasing, it will be useful in the next assessments to use methods that do not require the equilibrium assumption that is made by the VIT model.

The WG endorsed the assessment and recommendations.

22.Stock: Deep-water rose shrimp, *Parapenaeus longirostris*

Author(s): Elouamari N., Perez Gil J.L, Benchoucha S., Garcia T. and Ainouche N.

GSA: 01,02,03

Fishery: *Parapenaeus. longirostris* is caught mainly by trawlers on sandy–muddy bottoms, and peaks of abundance have been recorded between 70 and 400 m depth (Fischer et al., 1987). In the central and western Mediterranean*, P. longirostris* has been of great importance in terms of both

total landing and economic value. The influence of the Atlantic waters in the Alboran sea is related with the high crustacean species richness that is considered (Abelló, Carbonell and Torres, 2002) a possible independent management area for demersal fisheries. The trawling fleet in the GSAs 1,2 and 3 (Spain and Morocco) areas comprised an average of 110 boats. In 2009-2010 period the annual landings of this species averaged 325 tons in the whole area (175 tons Spain, 447 tons Morocco).

Data and parameters: The assessment was carried out with joint data series from Morocco and Spain (2009-2010) with the "combined sexes" assumption. Two growth parameters sets (fast growth, Guijarro et al, 2008) and low growth (García et al, 2009) were used.

Assessment method: The state of exploitation was assessed applying a LCA, VPA by slicing and Y/R analysis on a mean pseudo-cohort (2009-2010) for Spain and Morocco in GSA01-2 and GSA03, based on size composition of trawl catches (obtained from on board and on port monthly sampling) and official landings, using VIT program (Lleonart and Salat, 1992).

Results: The results of the Y/R analysis show that the F_{ref} (1.22 – 1.13) exceeds the Y/R $F_{0.1}$ reference points (0.33 - 0.28). However, fishing mortalities obtained during this joint assessment exercise showed anomalous trends, they should be considered as preliminary and not used for management advice.

Diagnosis of stock status: The stock status is in overfishing.

Advice and recommendation: It is recommended to held a joint stock assessment to be presented at the next Working Group of Demersal Species. In addition to complete information on *P. longirostris* stock in Algeria GSA04 Algerian data can be joined to the next stock assessment to cover all the study area.

Discussion: there were no particular comments.

The WG endorses the assessment and the related recommendations.

23.Stock: Deep-water rose shrimp, *Parapenaeus longirostris*

Author(s): Pérez J.L., Gil L., Quintanilla E., Herrera and Vivas M.

GSA: 06

Fishery: Deep-water rose shrimp is one of the most important crustacean species for the trawl fisheries developed along the GFCM geographical sub-area Northern Spain (GSA6). This resource is an important component of commercial landings in some ports of the Mediterranean Northern Spain and occasionally a target species 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 2001-2004. During de period 2005-2010 stabilization in catches is observed whit an average of 138 tons for this period. In 2010 the annual landings of this species amounts 141 tons in the whole area.

Data and parameters: The state of exploitation was assessed for the period 2001-2010 for the GFCM geographical sub-area Northern Spain (GSA-06). VPA analysis was 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.

Assessment method: A VPA tuned with CPUE from commercial fleet and abundance indices from MEDITS trawl surveys, was carried out applying the XSA method and FLR over the period 2001-2010. A Y/R analysis based on the exploitation pattern resulting from the XSA model and population parameters for the entire period was carried out.

Diagnosis of stock status: The stock is in overfishing status and low abundance.

Results: The results show a decreasing trend both in landings and total biomass of the stock from 2001 to 2004 and 2003 respectively. Landings, biomass and SSB values remain stabilized for the last 7 years with light fluctuations. Although these values are low compared to 2001 (the highest in the series). Exploitation is based on very young age classes, mainly 1 and 2 year old individuals, indicating a dependence on recruitments. F shows a decreasing trend from 2001 to 2004 but increasing in the 2005-2010 period.

Advice and recommendation:

Objectives : To reduce growth overfishing:
- Reduce the effort of trawl.
- Improve the fishing pattern of the trawl to arise the minimum length of catches equal the minimum legal landing size.

Recommendations:
- To reduce fishing mortality by about 70%
- Ensure compliance of the use of 40 mm square or 50 mm diamond mesh size in the bottom trawl cod-end is recommended.

Discussion: The oscillation found for this species is in agreement with other areas of the Mediterranean. It is assumed that environmental and ecological factors (e.g. water temperature, predatory release effect) can affect the stock in addition to the fishing mortality and difficult to evaluate the status of the stock.

The WG endorses the assessment and the related recommendations.

24.Stock: Deep-water rose shrimp*, Parapenaeus longirostris*

GSA: 09

Author(s): Colloca F., Abella A., Ligas M., Mannini A. and Sbrana M.

Fishery: The deep-water rose shrimp is caught exclusively with bottom trawl nets mainly in the depth range 100-400m. It is the target of the fishery only for some fleets in GSA9 while in others it is part of the species mix that target some fleets fishing in the shell slope.

Data and parameters: Data used proceed from commercial catch (time series of landings and age composition of the catch, etc) and from trawl surveys.

Assessment method: A VPA (XSA) analysis was performed for defining a F vector by year and numbers and biomass changes in time. Survey data was used for tuning the model. Trawl survey

data were used for an alternative estimation of Z using SURBA, after the reconstruction of the demographic structure of the stock and slicing among age classes.
A Y/R model was used for estimating the lifetime yield and biomass from a cohort subjected to varying levels of fishing mortality and for estimating $F_{0.1}$ and $F_{max.}$

Model performance: The XSA performed quite well as demonstrated with the quality checking (i.e. retrospective analysis).

Results: The F rate has shown a decreasing trend up to from 2004 to 2010, while recruitment and SSB increased. Current F for years 2009 and 2010 was estimated as 0.4 and 0.29 respectively. From the Y/R analysis it was derived a reference point value for fishing mortality ($F_{0.1}$) of 0.78.

Diagnosis of stock status: The comparison of the current F (0.29) with the RPs suggest an under-exploitation state for the stock with current F much lower than the RP based on F.

Advices and recommendation: The current F is considered low and appears to ensure good yields and a safe situation. In any case, considering the shortness of the time series and the not well known influence of environment on abundance, as well as that this species is caught along with many other species together it is advisable, within the precautionary framework, to keep the fishing pressure on this stock at the current level.

Discussion: no special comments were done on this assessment.

The WG endorsed the assessment and recommendations.

25.Stock: Deep-water rose shrimp, *Parapenaeus longirostris*

GSA: 12,13,14,15,16

Author(s): Ben Meriem S., Fiorentino F., Dimech M., Gancitano V., Jarboui O., Knittweis L., Arneri A., and Ceriola L.

Fishery: Sicilian trawlers between 12-24m LOA which target deep water rose shrimp are based in seven harbours along the southern coasts of Sicily. These trawlers (about 150 boats in 2009) operate mainly on a short-distance basis, with trips of 1 to 2 days, on outer shelf and upper slope. The distant trawlers of Mazara Del Vallo (about 140 boats in 2009) represent the main commercial fleet of trawlers in the area, and are one of the most important fleets in the Mediterranean. In contrast to the other Sicilian fleets, the large trawlers of the Mazara fleet (LOA>24m) are employed on long fishing trips (3 – 4 weeks) in offshore waters. Distant trawlers operate in both national and international waters in the Strait of Sicily. In the Maltese Islands small vessels measuring 12- 24m in length target rose shrimp at depths of about 600m, with fishing grounds located north/north-west of Maltese archipelagos, as well as to the west/south-west of Malta. Catches are primarily destined to the local market. Tunisian vessels target *P. longirostris* primarily in Northern Tunisia, with 90% of the country's total catches originating in this region. The most part of the Tunisian catch is landed in Bizerte Sicilian trawlers between 12-24m LOA which target deep water rose shrimp are based in seven harbours along the southern coasts of Sicily. These trawlers (about 150 boats in 2009) operate mainly on a short-distance basis, with trips of 1 to 2 days, on outer shelf and upper slope. The distant trawlers of Mazara Del Vallo (about 140 boats in 2009) represent the main commercial fleet of trawlers in the area, and are one of the most important fleets in the

Mediterranean. In contrast to the other Sicilian fleets, the large trawlers of the Mazara fleet (LOA>24m) are employed on long fishing trips (3–4 weeks) in offshore waters. Distant trawlers operate in both national and international waters in the Strait of Sicily. In the Maltese Islands small vessels measuring 12-24m in length target pink shrimp at depths of about 600m, with fishing grounds located north/north-west of Maltese archipelagos, as well as to the west/south-west of Malta. Catches are primarily destined to the local market. Tunisian vessels target *P. longirostris* primarily in Northern Tunisia, with 90% of the country's total catches originating in this region. The most part of the Tunisian catch is landed in Bizerte.

Data and parameters: Data was derived from indirect (fisheries monitoring) sources, the Tunisian National Data Collection Program and the EU Data Collection Framework. The biological parameters used were: L_{inf} = 42.71; k = 0.67; t_0 = -0.208; a = 0.0029; b = 2.4818; M = 1.05 for females; 33.56; 0.73; -0.13 and M = 1.2; a = 0.0034; b = 2.4096 for males and L_{inf} = 44.56; k = 0.6; t_o = -0.118 and M = 1.115 a = 0.0033 and b = 2.4572 for combined sexes respectively. Also, a vector price according the commercial categories has been prepared. This price vector is incorporated in the data base in order to diagnosis the value per recruit (income) of the fishery according some management scenarios. The analysis is carried out by sex and by fleet segments.

Assessment method: Stock status was assessed by using a Y/R and SSB/R analysis with the VIT, ANALEN and Yield packages. Analyses were based on LFD by sexes. Current F was assessed using a steady state VPA with VIT by length on mean LFD of 2007, 2008, 2009 and 2010 raised to the total landings. VPA and Y/R values by sex were combined to obtain single values (mean weighted by sex ratio in number) for both the sexes.

Model performance: Changing M and K has a pronounced effect on Y/R when the variation is in the opposite direction; while B/R and SSB/R are strongly affected when the change is in the same direction.

Results: Current fishing mortality (F_c) for both sexes is 1.2. Target Reference Point $F_{0.1}$ is 0.92. The analysis of the income per recruit showed that a further reduction in F is necessary for increasing the overall income per recruit. Assuming that the exploitation pattern of the small trawlers remains the same, this reduction will decrease the income of the Italian small trawlers.

Diagnosis of stock status: Since F_c is higher than $F_{0.1}$ the stock is in overfishing status. However, taking into account $F_{0.1}$ as reference point, no risk of depletion was recognized by the WG.

Advice and recommendations Current F should be reduced by around 20% for deepwater rose shrimp in the south-central Mediterranean. A reduction in F should primarily involve small trawl vessels (12-24m length), which target juvenile shrimp. In addition the selection pattern of the fishery should be improved. An increase in 20% of minimum catch length would lead to a significant increase in SSB, as well as a gain of 6% in sustainable yield for large trawl fleets. A protection of nursery areas in the Strait of Sicily is also recommended in order to improve the status of the stock and of the fisheries targeting it. Stable nurseries of this species have been identified on the Adventure and Malta Banks in the Strait of Sicily.

Discussion: In order to make the assessment more robust, a trawl survey covering the whole area (GSA 12; 13; 14; 15 and 16) should be planned. This activity would allow to better describe the spatial distribution of ontogenetic phases of *P. longirostris* in the area, including the position of nurseries and spawning areas. The results of the MedSudMed inter-calibration at sea among the vessels used by Italian and Maltese teams (Sant'Anna) and Tunisian team (Hannibal) for bottom

trawl surveys, successfully carried out in July2011 on Kelibia fishing-grounds, will be facilitate the planning and execution of a standardized trawl surveys in the whole area. Furthermore, data on spatial distribution of fishing effort for trawlers should be collected and made available for stock assessment and management purposes. Finally the assessment should be updated regularly in order to assess the effects of the implementation of the 40mm square/50mm diamond mesh size on trawlers as enforced by EU member states (i.e. Italy and Malta) and envisaged for the entire Mediterranean countries by the FAO GFCM (I will provide you the reference).

The WG endorsed the assessment and the related recommendations.

26.Stock: Deep-water red shrimp, *Aristaeus antennatus*

GSA: 05

Author(s): Carbonell A., Guijarro B., Gazá M. and Ordines F.

Fishery: Bottom trawl fleet fishing effort of the Majorca Island was quite stable for the period studied. Around 35 vessels operated in the area, whose lengths are between 12- 24 m. The cod end mesh size used was a diamond 40 mm of mesh opening until Jun 1st 2010, when (following EC Regulation) it was changed to a square 40 mm of mesh opening or (by derogation) to a 50 mm diamond mesh. Up to 60% of the trawl fleet in the Balearic Islands operates in the middle slope.

Data and parameters: LFDs between 1992-2010 were used. Other data series, such as landings (1978-2010), cpues (Kg/day~trip; 1992-2010) and fishing effort (in days) were also used.

Assessment method: The Separable VPA and XSA were made for the Annual Catch at Age for females and males summed to obtain the final sex combined matrix. The LCA (Pseudocohort analysis) was made for the average carapace length (CL mm) size distribution for the years 2005-2010, for females, males and total. Separable VPA and XSA was performed by the software provided by Darby and Flatman (1994). Pseudocohort analysis and Y/R was done using VIT (Lleonart and Salat, 1997).

Model performance: No trend was identified in the residuals.

Results: Stock abundance and biomass and recruitment showed oscillations for the entire data series, without any clear trend.
2005-2010: (F as factors) F_{max} = 0.41, $F_{0.1}$ = 0.25, Y/R = 7.104 g, Y/R 0.1= 7.772 g

Diagnosis of stock status: The stock is in overfishing status.

Advice and recommendation: (in terms of research and, when possible in terms of management). Since the mean size and landings appear close to the mean values for the whole time series, the monitoring of the fishery should continue carefully looking for the progress of the fishery. A decrease in F could be provided using complementary management measures like temporal fishing time reduction for some periods like at the beginning of the reproduction or spawning period and during the recruitment period at the beginning of autumn.

Discussion: There were no comments.

The WG endorsed the assessment and the recommendations.

27.Stock: Deep-water red shrimp, *Aristaeus antennatus*

Author: Esteban, A. And Fernández A.

GSA: 06

Fishery: Trawl fleets fishing effort of the Santa Pola port were quite stable for the period studied with small variations of the number of vessels in recent years. Vessel length was between 12 and 24 m. The gears used corresponded to a trawl net 60 and 100 longest ropes. The vertical opening was between 1-3 m. The cod end mesh size used was a diamond 40 mm of mesh opening. The net was rigged two doors between 500-800 kgs. Trawl fleet in Santa Pola port do daily trips with a unique haul directed to the red shrimp, with duration between 5-7 hours. The number of harbours with red shrimp fleets is 14 for the whole area, and the number of boats in this area is 130. Discards of the red shrimp are null. Total landings in the GSA6 (1996-2010) were around 8617 t and were produced by a total effort of 280862 fishing days*vessel (number of days*vessel). For this period, landings arise around 574 tonnes and total effort over 18724 fishing days by year.

Data and parameters: Size composition of commercial trawl catches and official landings, CPUE data from MEDITS surveys and commercial fleet. Growth parameters, L-W and age-length relationships were taken from Garcia-Rodríguez, M (2003).

Assessment method: LCA and Y/R, VPA and XSA. The male and female length distributions for year (1996-2010) were split using L2 age, slicing ICES package to ages. It was run a tuned VPA and XSA for male for male and for male and female together and a Y/R analysis. Effort in days represents effort by trip. Tuning data series was made using the Santa Pola harbor like a reference fleet and MEDITS GSA6 trawl surveys.

Diagnosis of stock status: The stock is in overfishing status. Exploitation rate show a high F and the stock abundance is low.

Results: The comparison between VPA and XSA of 2009 and 2010 assessments showed small differences with continuous slight decreasing values for the SSB, Recruitment and Fishing mortality. Using male and female together, log catchability residuals show small fluctuations more accused in first age class. The retrospective analysis doesn't show great dispersion over the years and in general, the structure is similar in all the cases (male, female and male-female together). Y/R analysis were made for the average size distribution landings for male and female together for the years 1996-2010, assuming the current steady state exploitation pattern. Results of equilibrium Y/R and SSB/R estimated the current exploitation close to the maximum. Y/R curves the predicted small long-term gains upon a reduction of current F at $F_{0.1}$ would be 72% of the current.
F_{ref}= 1.3343 F_{max}= 0.4937 $F_{0.1}$= 0.2802

Advice and recommendations: To reduce F by 72% this can be achieved with a reduction in effort capacity and improving the selection pattern. Implementing areas closed to fishing in the nursery areas during the recruitment period.

Discussion: XSA should be performed for males, females and males-females together, joining the final results and comparing them with a XSA performed with sex combined. It is necessary to check the consistency between M and K: when parameters for both sexes are considered. In this sense,

growth parameters should be reviewed. It would be necessary to further explore the parameterisation of the model (the contribution of each tuning fleet in the model).

The WG endorses the assessment and the related recommendations.

28.Stock: Deep-water red shrimp, *Aristaeus antennatus*

GSA: 09

Author(s): Mannini A., Abella A., Colloca F., Ligas A. & Sbrana M.

Fishery: The stock is caught exclusively by trawlers operating in grounds deeper than 500 m. The main concentrations in GSA9 are located in the northern part of the area.

Data and parameters: Commercial catch and trawl surveys; growth parameters L_∞ = 76.9(females), 46(males), K = 0.21(females), 0.213(males), t_o = - 0.019 (sexes combined);
Length-weight parameters: a = 0.0029(females), 0.005(males); b = 2.429(females), 2.286(males); M vector.

Assessment method: A LCA (using VIT software) was done using data for 2009 and 2010. Y/R analysis allowed the estimation of $F_{0.1}$ and F_{max}.

Model performance: The results for the two years are not very consistent, especially in the age composition and respective F rates at age.

Results: The mean current F estimated with the LCA was 0.62. The Y/R analysis provided an $F_{0.1}$= 0.32.

Diagnosis of stock status: Considering the reference value $F_{0.1}$=0.32, the current exploitation rate (F=0.62) is too high. The stock is in overfishing status.

Advice and recommendation: It is recommended to reduce the fishing mortality.

Discussion: Although there were differences in the exploitation patterns between the two years the mean current F and the related reference points were consistent.

The WG endorses the assessment and the related recommendations.

29.Stock: Norway lobster, *Nephrops norvegicus*

GSA: 09

Author(s): Ligas M., Abella A., Colloca F., Mannini A. and Sbrana M.

Fishery: The species in GSA9 is caught exclusively by bottom trawlers fishing in the slope of the continental shelf.

Data and parameters: Data proceed from commercial catches and trawl surveys.

L_∞=56(Females), 72.1(Males); K=0.21(Females), 0.17(Males); t_o=0 L/W: a=0.00027(Females),0.00026(Males), b=3.255(Females), 3.254(Males), M=0.4.

Assessment methods: A length cohort analysis was used for the estimation of the current fishing mortality rate using commercial catch composition by size. The used approach was the software VIT. Also SURBA was used for estimating total and fishing mortality and for analysing trends in Spawning stock and recruits. The annual catch by size was used in order to derive an *F* vector and mean numbers by age. The Y/R model was used for estimating a value for $F_{0.1}$ and F_{max}.

Model performance: The models performed well and furnished consistent estimates of F.

Results: The mean F estimated was of 0.35. The estimated values were $F_{0.1}$= 0.21 and F_{max}=0.36.

Diagnosis of stock status: The stock is in overfishing status. The current F estimated by LCA and SURBA were higher than the reference point $F_{0.1}$=0.21.

Advice and recommendation: A reduction in F is recommended.

Discussion: It is likely that the current abundances and demographic structures within the different fishing grounds that are present in the GSA 09, mainly depend on the fishing pressure exerted by the vessels that exploit such grounds, with exploitation rates that can be too different with a negligible influence on the abundance of the resource in other grounds. This hypothesis of independent evolution of at least most of the *Nephrops* grounds, has to be confirmed, but suggest that if this is the case, assessments and management should be done at a smaller scale. The merging of the information of the whole GSA area should provide only an average status that does not represent the local situations.

The WG endorsed the assessment and the recommendations.

30.Stock: Giant red shrimp, *Aristaeomorpha foliacea*

GSA: 15,16

Author(s): Knittweis L., Fiorentino F, Mifsud R., Gravino F., Gancitano V., Garofalo G. and Gristina M.

Fishery: Giant red shrimp are a relevant target species of the Sicilian and Maltese trawlers, caught on the slope ground throughout the year, but landing peaks are observed in summer. *A.foliacea* is fished exclusively by otter trawl, mainly in the central–eastern side of the Strait of Sicily, whereas in the western side it is substituted by the violet shrimp, *Aristaeus antennatus.* Giant red shrimps are frequently caught together with Norway lobster (*Nephrops norvegicus*), large sized deep water pink shrimp (*Parapenaeus longirostris*), the more rare violet shrimp (*Aristaeus antennatus*) as well as large hake (*Merluccius merluccius*). In the last years (2005-2010) mean total yield was 1428 t, ranging from 1287 in 2005 and 2008 to 1951 in 2009. The Sicilian landings are about 98-99% of the total yield.

Data and parameters: Abundance indices from trawl surveys in GSA16 from 1994 to 2010 were used to obtain information on demographic structure of stock at sea. Standardized LFD were converted in age structure by using the LFDA package. The assessment was carry out only on

females (more reliable biological parameters, larger size, and more than 60% of the landing in weight). Biological parameters used for slicing and assessment were: K=0.61; L_{inf} = 68.9 cm; t_0 = -0.2. Five complete years (2006, 2007, 2008, 2009 and 2010) of length frequency distributions from GSA16 commercial landings data (fished in GSA15 as well as GSA16) were available, as well as two years (2009 and 2010) from GSA15. The annual LFD of landing were transformed in age structure of catch as done for the trawl survey data. M-at-age vector (PROBIOM sheet): 0.62; 0.30; 0.23; 0.19; 0.17; 0.16. q vector = estimate: q(Age0)=0.4; q(Age1+)=1.0; q(Age2+)=1.0; q(Age3+);tq(Age4+)=1.0. Data were derived from European DCF data call for GSA15 and 16. Assessment was previously carried out at STECF EWG 11-12.

Assessment method: Estimations of F, SSB and recruitment indices derived from the SURBA software program. Cohort (VPA equation) and Y/R analysis by age as implemented in the package VIT4win. F_{max} and $F_{0.1}$ was estimated by VIT, with vector of M by size (PROBIOM sheet).

Model performance: SURBA retrospective analysis showed a good reconstruction of F, SSB and recruitment indices. The VIT results showed a high consistency among years.

Results: Based on VIT analysis, there were 1070 t of spawning stock biomass in 2006, 1370 in 2007, 1300 in 2008, 1580 in 2009 and 1260 in 2010. SURBA analysis of GSA16 data estimated highly fluctuating SSB indices from 1994 to 2001; from 2002 to 2010 spawning stock biomass remained stable at low levels. The estimates of absolute recruitment in millions of individuals (age class 1) from VIT analysis in 2006-2010 were 98.1 in 2006, 114 in 2007, 83 in 2008, 118 in 2009 and 123 in 2010. SURBA analysis of GSA16 data showed that from 1994 to 2001 recruitment biomass indices fluctuate highly, with the lowest number of recruits recorded in 2001. From 2002 to 2010 recruitment abundance remained at low levels.

Diagnosis of Stock status: The giant red shrimp stock in the Strait of Sicily is in overfishing status since the current fishing mortality is higher than both F_{max} and $F_{0.1}$. Low level of SSB in the available time series. Considering the high consistency of results with different methods, F_{max} = 0.70 were proposed as Limit Reference Points (LRP), and $F_{0.1}$=0.40 as the Target reference points (TRP).

Advice and recommendation: Considering $F_{0.1}$ as TRP, a reduction ranging between 50 and 60 % of the current F in 2009 and 2010 is recommended. To reach exploitation below F_{max}, a reduction of current F in the same years ranging between 20 and 40% should be pursued.

Discussion: The WG suggests examining the time series of SSB and recruitment indices in order to verify the existence of any trend. A negative liner trend was identified for SSB (r=0.5007; N=17; $\alpha<0.05$).

The WG endorses the assessment and the related recommendations.

DISCUSSION ON STOCK ASSESSMENTS PRESENTED

19. During the presentations several technical and methodological aspects were discussed. These comments/aspects are divided into those that were specific to a particular stock-GSA assessment and those that were general comments related to most of the assessments. The former are incorporated in the discussion section of the individual assessment reports (presented above). The general comments and/or points, referring to most assessments, discussed were:

(a) The WG recommends not to use the term 'overexploited' but 'in overfishing status' or in 'overexploitation' for the status of the stock. When the stock is in overexploitation/overfishing status the WG decided to enter 'none' in the assessment form.

(b) The WG pointed out that there is a necessity to identify reference points for the status of recruitment overfishing, which is difficult to identify with short time series, as well as for abundance, SSB and other fisheries time series. However, one has to bear in mind that most of the available time series begin in a period were the stocks are most probably already in overexploitation status and thus it is difficult to identify reference points on SSB, abundance and other fisheries time series (i.e. an effect of the shifting baseline: Pauly 1995).

(c) The selection of appropriate growth parameters for the development of the assessment is important.

(d) The WG discussed that for stocks with long data series it might be useful to test for a relationship between recruitment and SSB with a time lag of 1 year, in order to have a better insight for population trends.

(e) The WG also discussed that some of the shrimp species presented exhibited oscillations in catches a fact that might be an indication of an environmental effect. In fact, the effect of climate has been documented in earlier (e.g. *A. antennatus* in the Balearic Islands, Massutí et al. 2008) in the framework of the IDEA project (www.ba.ieo.es/idea). When a long data series is available then a trend can be fitted to the data, and the subsequent removal of this trend from the time series will result in a detrended series which can then be tested for relation with environmental variables and/or fishing effort. This should be applied when we the length of the time series is more than 10 data points.

(f) The use of $F_{0.1}$ as a reference point is strongly supported when comparing the results of two assessments performed with very different growth parameters. In contrast, F_{max} is not a good indicator because when the curve is flat the results are not realistic.

PRESENTATION AND DISCUSSION OF ASSESSMENT RELATED WORKS

20. There was only 1 presentation of assessment-related work, namely 'On the Dynamics of fisheries and fish population status of the main species of commercial importance in the Romanian Black Sea area in the last decade' (see Appendix E).

GENERAL DISCUSSION AND RECOMMENDATIONS

21. The WG extensively discussed and addressed several issues that were pointed out during the different session and made several recommendations. These issues are listed below.

- **Stock Assessment Forms (SAF).** The WG group stressed that current SAF are not further adequate to describe the information, results and advice on stock status. Although some proposals to add new forms on direct methods were presented and discussed last year inside the WGs and SC, before to modify the current SAF, the WG on demersal stocks recommends to clarify their objective. The current SAFs were conceived to describe fisheries and give information on data, methods, results and advice of the

assessment, with the purpose to allow anyone to check the whole assessment process. As a consequence of this broad objective, filling out SAFs is a very complex and laborious task. On the other hand, as the operations of copy and paste are made following different modalities, the data included in the sheets are seldom utilizable for new analyses. Taking into account these considerations, the WG suggests that, instead of new forms to added to the old ones, it is advisable to create a new 'informatic' tool allowing to integrate all the information that is included in SAFs and produce the selected outputs that are useful to support the description of fisheries, stock status and management advice to be included into the WG report. This new tool should be integrated with other GFCM databases on fisheries (catch and effort data, biological parameters).

- **Stock assessment, time series and trends.** A particular issue arising from the presentations of the individual stock assessment reports was the issue of dealing with trends in many typical time series of fisheries data (e.g. spawning stock biomass, recruitment, fishing mortalities, landings). In general, all time series, irrespectively of how long or short they are, have certain characteristics (e.g. trend, seasonality and/or periodicity, noise) that must be defined statistically (see Stergiou and Christou 1996, Stergiou et al. 1997). Thus, descriptions of trends in (any) fisheries time series based on visual examination is not appropriate. Thus, when one wants to see whether spawning stock biomass displays a trend during the study time period or not, a simple time-varying regression (i.e. regression between the data of the time series against time) can be used in order to check whether the slope of this regression is significantly different from zero (i.e. the time series displays a trend during this period) or not (i.e. the time series does not display any trend during the study period).
- **GFCM workshop on time series analysis**. Apart from point 2 above, simple (e.g. smoothing, simple or multiple regression, vector auto-regression) or complex time series techniques (e.g. ARIMA, multivariate ARIMA, X11 census) (e.g. Stergiou and Christou 1996, Stergiou et al. 1997)., especially when combined with other techniques such as general linear modeling, general additive modeling, are very useful for stock assessment in order, e.g., to identify periodicities in the implicated fisheries time series as well as the effect of other factors such as climate, economical, etc. Given the importance of time series analysis and the fact that the length of the GFCM stock assessment time series increases with time, the WG recommends the organizing of a several-day GFCM workshop on time series analysis, in which the participants will bring their own fisheries and fisheries-related time series and they will learn in practical sessions how to apply such techniques. The result of such a workshop can be a multi-authored GFCM report on Mediterranean fisheries time series.
- **Scatterplots of SSB vs. recruitment.** The WG discussed the need of finding some suitable methods for defining precautionary estimates of biomass limits related to the need of reducing the risk of recruitment overfishing. The WG considered that the use of scatter plots of SSB vs. recruitment can be very useful for providing insight and understanding the minimum levels of biomass that ensure a good (sufficient) recruitment, even when the length of the time series does not allow the fit of a proper SSB-R relationship. In addition, an empirical analysis of existing time series (e.g. lower quartile) as well as simple time series techniques (see also points 2 and 3 above) can be used.
- **The role of environmental parameters.** The influence of various environmental parameters on stock growth, survival and abundance can be important, depending on the species (e.g. small pelagic: Tsikliras 2008, Katara et al. 2011), and thus their incorporation into models is necessary for stocks that are sensitive to environmental

changes and exhibit large fluctuations in abundance. This point is also indirectly related to point 3 above.

- **Unit stock and GSA boundaries.** The traditional definitions of a unit stock are mostly based on, among other things, genetics, morphology, common growth parameters and existence of single spawning areas. Under a management point of view, in the framework of GFCM, it has been decided that, when there is no evidence allowing the suggestion of an alternative hypothesis, within the boundaries of each GSA inhabits a single, homogeneous stock that behaves as a single well-mixed and self-perpetuating population. The GSA boundaries are, however, most of the times arbitrary and certainly do not take into consideration neither the existence of any local biological life-history traits nor spatial differences in the allocation of fishing pressure within the GSA. Yet, the problem of assessment and management of stocks that extend beyond the arbitrary defined, geographic limits of GSAs has been faced and 'solved' gathering information from neighbouring GSAs. On the other hand, there are cases where more than one stock, each with its own dynamics, exploited with different rates and evolving independently (i.e. each having its own and distinct spawning and nursery grounds) exist within the GSAs' boundaries. The WG considers that in such situations it is advisable (under the precautionary principle) to work at a smaller scale, trying to assess and manage such stocks separately when possible.
- **Assessments and species with sex-specific growth.** In other geographical areas (e.g. North Sea), stock assessments are generally age-based, with individuals being aged, and consequently, size distributions are split by age using the age-length keys. When assessments are length-based, as is the case of certain Mediterranean stocks, a single set of growth parameters is used and size frequencies are most of the times transformed to age-structured frequencies using slicing techniques based on growth parameters. For species characterized by important differences in growth rates with sex, this procedure leads to an underestimation in the numbers of older individuals for the sex that grows slowly. This will necessarily produce an overestimation of mortality, because the approaches used for estimating mortality interpret the lack of older individuals as the result of a strong removal by the fishery. The WG discussed that it is necessary to pay particular attention on how sizes are transformed to ages, and recommends not using software that accepts as input length frequencies, without the user having the option of distinction by sex, and a specific set of growth parameters. The WG recommends, as a general rule, that when both sexes are caught to do the assessment separately and then combine results. When one sex makes up the main bulk of the catch of a species (e.g. the Red and violet shrimps – *Aristeus antennatus*) the WG recommends to use only this sex for the assessment. Finally, in the case of hermaphrodite species (e.g. the Common pandora - *Pagellus erythrinus*) there are no problems in using sexes combined biological parameters on sex combined structures of catch.
- **The problem of making assessments based only on one sex.** In certain occasions, assessments are performed only for one sex, assuming that the results of the assessment (stock status and measures necessary for a better exploitation) should apply to both sexes. Under such circumstances, it is necessary to make some assumptions that in certain cases are hard to support, namely that both sexes have the same dynamics (i.e. natural mortality, growth rates, and reproductive values). The question is if a female spawner has the same biological value than a male of the same age. Do they mature at the same age/size? Which are the consequences as surviving fractions and for ensuring the success of future recruitment of any change in fishing mortality or age/size of first capture?

- **Advice on relation between fishing mortalities and fishing effort.** The WG discussed that when a stock assessment is based on fishing mortality estimates and is intended to produce advice for driving the stock to more productive and safe status, the direct transformation of fishing mortality into fishing effort (assuming proportionality) must be avoided. This is because it is not necessarily true that fishing mortality and effort are directly proportional through a constant catchability coefficient q, following the classic equation (F=q*f): quite often, q changes with the level of biomass at sea as well as with time because of changes in various biotic or abiotic parameters.
- **Advice on fishing effort.** In many cases the fishing effort directed to a certain stock is largely unknown and such effort refers to aggregation of vessels of which only a fraction operates in specific areas and exerts fishing pressure on a certain species. The knowledge of the fishing effort directed to each stock is very important, not only because such information constitutes the basis for the performance of some models (i.e. Surplus Production Models), but also because we need this information in order to be able to provide advice on changes in effort. When the aggregation of the vessels is at very high level, it is impossible to split the effort among metiers or operational units. In general, the WG recommends that there must be an attempt to collect any information at the least aggregated level (i.e. métier, operational unit) in order to have a better insight on both fisheries and fishing impacts.
- **Definition of overexploitation.** The WG agreed with the proposal of the last SC to distinguish the status of the stock into two aspects, according the dynamics of fishing mortalities and biomass standing stock versus some agreed biological reference points.The WG discussed that it is necessary to clearly define the elements that have to be taken in consideration for such definition. The following definitions are expected to address the more critical issues: (i) **Overfished (or overexploited) -** A stock is considered to be overfished when its abundance is below an agreed biomass based reference target point, like $B_{0.1}$ or B_{MSY}. To apply this denomination, it should be assumed that the current state of the stock (in biomass) *arises from the application of excessive fishing pressure in previous years*. This classification is independent of the current level of fishing mortality. (ii) **Stock subjected to overfishing (or overexploitation**) - A stock is subjected to overfishing if the fishing mortality applied to it exceeds the one it can sustainably stand, for a longer period. In other words, the current fishing mortality exceeds the fishing mortality that, if applied during a long period, under stable conditions, would lead the stock abundance to the reference point of the target abundance (either in terms of biomass or numbers).
- **Consistency among parameters used for modelling.** The WG discussed that it is necessary to maintain consistency among the used parameters and rates that are functionally linked (i.e. von Bertalanffy K and M). This will make the assessment more reliable. Even if the absolute values obtained with different (but consistent) sets can be different, it is likely that the perception on the status of the stock will be similar (if such differences are not excessive).The same is also true when one estimates mortality rates with an approach assuming, for instance, different selectivities, or vulnerabilities, with age and M changing with age (e.g. LCA, VPA) and a reference value for fishing mortality rate (i.e. $F_{0.1}$) derived from approaches that assume constant F and M for all the ages recruited to the fishery (i.e. the classical selection pattern and vulnerability by age of the Beverton and Holt (1957) Yield per Recruit implemented in the YIELD routine of the MRAG package)**.**

- **Geographic variability of growth parameters.** The growth parameters of the vast majority of species differ from area to area both globally and within the Mediterranean Sea. The WG discussed that selection of growth parameters must thus be area-specific. In cases that such area-specific estimates are not available then appropriate values must be taken from nearby areas. FishBase (www.fishbase.org), the largest electronic encyclopedia online on fishes, provides area-specific growth parameters for an excessive number of stocks. The moderator informed the WG that there has been lately an attempt to incorporate in FishBase all available growth parameters from Mediterranean fishes (i.e. about 1400 sets for 164 species), whereas in a recent project (ECOKNOWS, www.ecoknows.eu) an attempt is made to attach Bayesian inference on various biological parameters, including growth parameters. Similarly, growth parameters for invertebrates can also be taken from SeaLifeBase (www.sealifebase.org).

ADOPTION OF THE REPORT/RECOMMENDATIONS

22. All Conclusions and Recommendations were adopted by the Working Group on the 29th of October 2011. The whole report was adopted after revisions and amendments by electronic correspondence within the following two weeks.

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Appendix A

List of participants

Alvaro **ABELLA**
ARPAT
via Marradi 114
57126 Livorno, Italy
Email: a.abella@arpat.toscana.it

Nawel **AINOUCHE**
CNRDPA
11 bvd colonel Amirouche Bouismail Tipaza, Algerie
Email: ainouchenawel@yahoo.fr

Pedro **BARROS**
FAO
Viale delle Terme di Caracalla1
00153 Rome Italy
Tel: +39 0657056469
Email: pedro.barros@fao.org

Said **BENCHOUCHA**
Institut National de Recherche Halieutique (INRH), BP: 5268
Dradeb, Tanger, Maroc
Email: bench2468@yahoo.fr

Sadok **BEN MERIEM**
National Institute of Marine Sciences and Technologies (INSTM)
Centre de la Goulette
La Goulette Port, Tunisie
Email: sadokbm@yahoo.fr

Isabella **BITETTO**
Coispa Tecnologia & Ricerca
Stazione Sperimentale per lo Studio delle Risorse del Mare
Via dei Trulli, 18/20
70126, Bari - Torre a Mare, Italy
Tel: +39 0805433596
Fax: +39 0805433586
Email: bitetto@coispa.it

Luca **CERIOLA**
FAO MedSudMed Project
Viale delle Terme di Caracalla,1
00153 Rome Italy
Tel: +39 0657054492
Fax: +39 0657055188
Email: luca.ceriola@fao.org

Charis **CHARILAOU**
Department of Fisheries and Marine Research (DFMR)
101 Vithleem, 1416 Nicosia, Cyprus
Email: ccharilaou@dfmr.moa.gov.cy

Bachra **CHEMMAM-ABDELKADER**
Laboratoire des Ressources Marines Vivantes (LRMV),
Institut National des Sciences et Technologies de la Mer (INSTM) 28, rue 2 Mars 1934,
Salammbô 2025, Tunisie
Email: bachra.chemmam@instm.rnrt.tn
bachra_chen@yahoo.fr

Federico **DE ROSSI**
GFCM Secretariat
Data Compliance Management Officer
Via Vittoria Colonna 1
00193 Rome
Tel: +39 0657053481
Mob: +39 3351980514
Fax: +39 0657056500
Email: federico.derossi@fao.org

Mark **DIMECH**
FAO EstMed Project
1, Androu Street
11257 Athen, Greece
Email: mark.dimech@fao.org

Antonio **ESTEBAN-ACÓN**
I.E.O. Instituto Español de Oceanografía
c/Varadero 1, 30740 San Pedro del Pinatar
Murcia, Spain
Email: antonio.esteban@mu.ieo.es

Soufia **EZZEDDINE-NAJAÏ**
Institut National des Sciences
et Technologies de la Mer (INSTM),
Centre de la Goulette
La Goulette Port, Tunisie
Email: Soufia.ezzeddine@instm.rnrt.tn

Ángel M. **FERNÁNDEZ**
I.E.O. Instituto Español de Oceanografía
c/Varadero 1, 30740 San Pedro del Pinatar
Murcia, Spain
Email: angel.fernandez@mu.ieo.es

Fabio **FIORENTINO**
SCSA Coordinator
IAMC CNR
via L. Vaccara 61
91026 Mazara del Vallo (TP), Italy
Email: fabio.fiorentino@iamc.cnr.it

Vita **GANCITANO**
IAMC CNR
via L. Vaccara 61
91026 Mazara del Vallo (TP), Italy
Email: vita.gancitano@iamc.cnr.it

Beatriz **GUIJARRO**
Instituto Español de Oceanografía
Centre Oceanogràfic de les Balears
Moll de Ponent s/n,
07015 Palma, Spain
Email: beatriz@ba.ieo.es

Mahmoud **HATEM HANAFY**
Associate Professor in
Fisheries Biology Laboratory,
National Institute of
Oceanography and Fisheries
El-Anfoshy, Alexandria, Egypt
Email: hatemhanafy@hotmail.com

Pilar **HERNANDEZ**
GFCM Coordinator
Information Management Officer
GFCM Secretariat
Via Vittoria Colonna1
00193 Rome Italy
Tel: +39 0657054617
Fax: +39 0657056500
Email: pilar.hernandez@fao.org

Zdravko **IKICA**
Institute of Marine Biology
Kotor, Dobrota b.b.,
85330 Kotor, Montenegro
Email: zdikica@ac.me

Angélique **JADAUD**
IFREMER
BP 171 Av. Jean Monnet
34203 Sete Cedex, France
Email: ajadaud@ifremer.fr

Marios **JOSEPHIDES**
Department of Fisheries
and Marine Research (DFMR)
101 Vithleem, 1416 Nicosia, Cyprus
Email: mjosephides@dfmr.moa.gov.cy

Jerina **KOLITARI**
Head of Aquaculture and Fishery
Laboratory Durres,
Agricultural University Tirana
Lagjia 4, Rruga “Skenderbeg”
Durres, Albania
Email: jerina_juka@yahoo.com

Imad R. **LAHOUD**
Ministry of Agriculture
Department of Fisheries and Wildlife
Bir Hassan, Embassies Street
Beirut, Lebanon
Tel: +961 1849622
Email: ilahoud@agriculture.gov.lb
imahoud@gmail.com

José Luis **PÉREZ-GIL**
I.E.O. Instituto Español de Oceanografía
C.O. de Málaga, Puerto pesquero S/N 29540
Fuengirola, Málaga, Spain
E-mail: joseluis.perez@ma.ieo.es

Gheorghe **RADU**
National Institute for Marine Research
and Developement "Grigore Antipa"
300 Mamaia Blvd., 900581
Constanta, Romania
Tel: +40 0724173294
Fax: +40 0241831274
Email: gpr@alpha.rmri.ro

Giuseppe **SCARCELLA**
CNR – ISMAR Ancona
Largo Fiera della Pesca,
60125 Ancona, Italy
E-mail: giuseppe.scarcella@an.ismar.cnr.it

Maria Teresa **SPEDICATO**
Coispa Tecnologia & Ricerca
Stazione Sperimentale per lo
Studio delle Risorse del Mare
Via dei Trulli, 18/20
70126, Bari - Torre a Mare, Italy
Tel: +39 0805433596
Fax: +39 0805433586
Email: spedicato@coispa.it

Kostas **STERGIOU**
Moderator
Aristotle University
Department of Biology
Section of Zoology
Laboratory of ichthyology
Box 134, Thessaloniki 54006, Greece
Tel: +30 31998268
Fax: +30 31998 279
Email: kstergio@bio.auth.gr

Maximoy **VALODIA**
National Institute for Marine Research
and Developement "Grigore Antipa"
300 Mamaia Blvd., 900581
Constanta, Romania
Tel: +40 0241543288
Fax: +40 0241831274
Email: vmaximoy@alpha.rmri.ro

Appendix B

Terms of Reference

One of the objectives of the Sub-Committee on Stock Assessment (SCSA) is to progress in the enhancement of joint practical stock assessment on small pelagic and demersal species. "Joint" refers to the participation of scientists from different countries providing their data and sharing them with their colleagues, using a standard method and analyzing together the results and options for fisheries management. The main objective of the annual meetings of the two Working Groups is to give advice on those stocks that are well assessed, "well" meaning agreed by the group on the type of data, on the parameters used and on the methodology applied. Specifically, the group will, on a stock by stock basis:

1. Analyse the data sets provided by the participants (Sampling frequency, time series, age structured, commercial vs. surveys data, …).
2. Check parameters used and methodology applied on the assessments already done "at home".
3. Resume the performance of the methods through sensitivity tests and residuals analysis.
4. Run stock assessments on the cases not previously done with the data sets available and with the agreed methodology on a practical session.
5. Get the actual values of the biological reference points (BRP) and compare with those agreed at the 13th SAC meeting, namely F_{MSY} or its proxy $F_{0.1}$ as the Target Reference Point and and F_{max} as provisional Limit Reference Point.
6. In cases where BRP cannot be obtained use an empirical approach based on standing stock as stock status indicator, the harvest ratio (catch/biomass from survey) as fishing impact, and some indicators (SST, Chlorophyll, condition factor,…) of environmental stress.
7. Produce diagnoses on the status of the stocks.
8. Present and discuss assessment related woks.
9. Complete the filling up of the SCSA stock assessment forms including, when available, those for direct methods.
10. Suggest management advice to the SAC considering different alternatives.

Appendix C

Agenda

Monday 24 October 2011
Morning Session, 9:00-13:00

1. **Opening session (joint session for the two Working Groups on Demersal and Small Pelagic Species)**
   - Opening, arrangement of the meetings
   - Logistical aspects
   - Structure of the report
   - Nomination of the rapporteur(s)

10:30-11:00 Coffee break

2. **Introductory session**
   - Matters arising
   - Progress on the last year conclusions and recommendations

3. **Presentation of assessment and review of available data** (presentations by national experts about 15 min each, followed by 15 minutes of discussion)
   - 4 presentations: Hake in GSAs 01,05, 07, 09

Lunch time (13:00-14:30)
Afternoon Session (14:30-17:30)

(*Cont'*) Presentation of assessment and review of available data
- 3 presentations: Hake in GSA combined 12,13,14,15 and 16; Sole in GSA 17, and Common pandora in GSA 26

16:00-16:30 Coffee break

(*Cont'*) Presentation of assessment and review of available data
- 2 presentations: Red mullet in GSAs 05 and 09

Tuesday 25 October 2011
Morning Session, 9:00-13:00

(*Cont'*) Presentation of assessment and review of available data
- 3 presentations: Stripped mullet in GSAs 06, 07 and 09

10:30-11:00 Coffee break

(*Cont'*) Presentation of assessment and review of available data
- 4 presentations: Red shrimp in GSAs 05, 06 and 09; Octopus in GSA 14

Lunch time (13:00-14:30)
Afternoon Session (14:30-17:30)

(*Cont'*) Presentation of assessment and review of available data

- 3 presentations: Deep Sea Shrimp in GSAs 6; combined GSAs 1,2,3,4; combined GSAs 12,13,14,15 and GSA 16

16:00-16:30 Coffee break

(*Cont'*) Presentation of assessment and review of available data

- 2 presentations: Deep Sea Shrimp in GSA 09

Wednesday 26 October 2011
Morning Session, 9:00-13:00

(*Cont'*) Presentation of assessment and review of available data

- 1 presentation: GSA 18 (species to be confirmed COISPA group)
- 2 presentations: GSA 25 (Bogue, Picarel)

4. Run new stock assessments on a practical session

- Stock assessment of red mullet (*Mullus barbatus*) and striped red mullet (*Mullus surmuletus*) in GSA 25

10:30-11:00 Coffee break

(*Cont'*) Run new stock assessments on a practical session (if needed)

Lunch time (13:00-14:30)
Afternoon Session (14:30-17:30)

(*Cont'*) Run new stock assessments on a practical session (if needed)

16:00-16:30 Coffee break

5. Review, analysis and validation of the results of different assessments

Thursday 27 October 2011
Morning Session, 9:00-13:00

(*Cont'*) Review, analysis and validation of the results of different assessments

10:30-11:00 Coffee break

(*Cont'*) Review, analysis and validation of the results of different assessments

Lunch time (13:00-14:30)
Afternoon Session (14:30-17:30)

(*Cont'*) Review, analysis and validation of the results of different assessments

16:00-16:30 Coffee break

6. Presentation and discussion of assessment related works (if any)

Friday 28 October 2011
Morning Session, 9:00-13:00

7. Formulation of conclusions, recommendations and management advices to be transmitted for the consideration by the SCSA and SAC

10:30-11:00 Coffee break

(*Cont'*) Formulation of conclusions, recommendations and management advices to be transmitted for the consideration by the SCSA and SAC

Lunch time (13:00-14:30)
Afternoon Session (14:30-17:30)

8. Summary of the conclusions and recommendations: (joint session for the two Working Groups on Demersal and Small Pelagic Species)

16:00-16:30 Coffee break

(*Cont'*) Summary of the conclusions and recommendations: (joint session for the two Working Groups on Demersal and Small Pelagic Species)

Saturday 29 October 2011
Morning Session, 9:00-13:00

9. Closing Session
- Any other matter
- Adoption of the draft Report
- Date and venue of the next meeting

Appendix D

Summary table of stocks assessed

No	Stock	GSA	Method & Software	Stock Status	Advice & Recommendation
1	*Merluccius merluccius*	1	VPA, XSA, Y/R	In overfishing status	Reduction of F of trawling 80%. Use of 40 mm square or 50mm diamond mesh size in the bottom trawl cod-end
2	*Merluccius merluccius*	5	XSA, retrospective analysis, Y/R	In overfishing status	Reduction of F.
3	*Merluccius merluccius*	7	VPA, XSA, Y/R, FLR	In overfishing status, low abudance	Reduction of growth overfishing
4	*Merluccius merluccius*	9	VPA, XSA, SURBA, Y/R	In overfishing status	Reduction of F
5	*Merluccius merluccius*	12, 15, 16	LCA, Y/R	The assessment was considered preliminary	
6	*Merluccius merluccius*	18	SURBA, ALADYM, VIT, R	In overfishing status	Reduction of F
7	*Mullus barbatus*	6	VPA, XSA, Y/R	in overfishing status low abudance	Reduction of F by 70%
8	*Mullus barbatus*	7	XSA, Y/R	In overfishing status, intermediate abudance	Reduction of F
9	*Mullus barbatus*	9	ASPIC.5.3, LCA	In overfishing status	Reduction of F
10	*Mullus barbatus*	15-16	LCA, Y/R, VIT4win	In overfishing status	Reduction of F by about 45%
11	*Mullus barbatus*	25	VPA, VPA-Pseudocohort, Y/R	In overfishing status, low abudance	Reduction of F
12	*Mullus surmuletus*	5	VPA, XSA, Y/R	In overfishing status	Reduction of F. Increase of selectivity.

No	Stock	GSA	Method & Software	Stock Status	Advice & Recommendation
13	*Mullus surmuletus*	9	VIT, Y/R	In overfishing status	Reduction of F
14	*Mullus surmuletus*	25	VPA-Pseudocohort, Y/R	In overfishing status	Reduction of F
15	*Pagellus erythrinus*	26	Y/R, FISAT	In overfishing status	Reduction of F. Use of 40 mm square or 50 mm diamond mesh size in the bottom trawl cod-end
16	*Pagellus erythrinus*	15-16	VIT4win, Y/R, VPA, LFDA	In overfishing status	Reduction of F by about 50%
17	*Solea solea*	17	XSA, SURBA, LCA, VIT, Y/R	In overfishing status	Reduction of F
18	*Sphyraena sphyraena*	12-13	VPA,VIT	In overfishing status	Reduction of F
19	*Galeus melastomus*	9	Thompson-Bell model, Leslie matrix, LCA	In overfishing status	Reduction of F
20	*Spicara smaris*	25	VPA, VIT	2005-2007: Fully exploited, intermediate abundance. 2008-2010: in overfishing status, intermediate abudance	Reduction of F by 15%
21	*Boops boops*	25	VPA, VIT	2005-2007: Fully exploited and intermediate abundance. 2008-2010: Overfishing status and intermediate abudance	Reduction of F by 15%
22	*Parapenaeus longirostris*	1 to 3	LCA, VPA, Y/R, VIT	In overfishing status	Avoid increasing F even though the stock seems at an overexploitation status. This advice is necessary considering the uncertainty and the lack of knowledge of the real effect of environmental issues on the assessement in order to be consistent with the precautionary
23	*Parapenaeus longirostris*	6	VPA, XSA, FLR	In overfishing status, low abudance	Reduction of F of trawling by 70%. Use of 40 mm square or 50mm diamond mesh size in the bottom trawl cod-end
24	*Parapenaeus longirostris*	9	VPA, XSA, SURBA,Y/R	Under-exploited	

No	Stock	GSA	Method & Software	Stock Status	Advice & Recommendation
25	*Parapenaeus longirostris*	12 to 16	Y/R, SSB/R, VIT, ANALEN, YIELD	In overfishing status	Reduction of F by 20%.
26	*Aristaeus antennatus*	5	Y/R, VIT, VPA, LCA, XSA	In overfishing status	Reduction of F.
27	*Aristaeus antennatus*	6	LCA, Y/R, VPA, XSA	In overfishing status, low abudance	Reduction of F by 72%
28	*Aristaeus antennatus*	9	LCA, VIT	In overfishing status	Reduction of F
29	*Nephrops norvegicus*	9	LCA, VIT, SURBA, Y/R	In overfishing status	Reduction of F
30	*Aristaemorpha foliacea*	15-16	SURBA, VPA, Y/R, VIT4win, VIT	In overfishing status	Reduction of F by 50-60%

Appendix E

Dynamics of fisheries and fish population status of the main species of economic interest in the Romanian black sea area in the last decade

Gheorghe Radu (gpr@alpha.rmri.ro) and Volodea Maximov (maxi@alpha.rmri.ro)
National Institute for Marine Research and Development "Grigore Antipa" Constanta, Romania

Paper presents some data about dynamics of fisheries and fish population status of the main species with commercial importance in the Romanian marine area (sprat, turbot, dogfish and whiting).

In Romania, marine fishing is conducted along the coastline, being limited to the areas up to 60-70 meters depth, as a consequence of the characteristics of the vessels and their limited autonomy. Generally, Romanian fleet operates up to 30–35 nautical miles out in the Black Sea. Trawl fishing has a seasonal pattern and is linked to the presence of the fish in the areas.

In the coastal zone of the Romanian marine sector with small depth, fishing with fixed gear is characterized by the concentration of activity mainly in the first three / four months of the season (April-July), when usually the turbot migrates to the coastal area for reproduction and other species migrate for feeding. In generally, total fishing season being of about eight months. The capture level and the level of fishing productivity differs from one year to another, depending on the fishing effort (number of pound nets, number of turbot nets and effective fishing days), and also depends on the evolution of hydro climatic conditions and at last but not least, the state of fish stocks.

The qualitative and quantitative structure of catches had a variable evolution, depending on the condition of fish populations, fishing effort deployed, the type of tool used and formation and preservation conditions of fish shoals, especially in the coastal area. As a general rule, the pelagic species, small-sized and short life cycle keep continue to be dominant in catch.

During 2000-2010 periods, the level of total catch declining from 2476 tons to 443.9 tons (2008), 330 tons (2009) and 258 tons (2010), official registered. The sprat was dominant species, with catches comprised between 91 and 1,800 tons/year.

The evolution of the catches of the main fish species from the Romanian marine waters was obtained by centralizing and systematizing, in time, catch and effort data obtained from the profile companies and through interviews with fishermen. The fishing effort (number of vessels, number of fishing nets etc.) is also obtained from data provided by the companies.

In the last two decades in the light of the new conditions of fishing practice with the ceasing of state subsidy to the principles of competitive economy, have led to radical changes in the national marine fisheries. In the same time, the competition created by the opening of imports on fishery products, especially imports of frozen fish, the lack of experience of exploitation under the new conditions, the high age of the vessels and especially the rising cost of fuel and maintenance have led to a drastic involution of active fishing in the Romanian Black Sea.

After 2001, economic operators working in the fishing sector from Romanian coast, have changed their options and interests, giving priority to the vessels equipped with equipment and fishing gears specialized in fishing of the species with commercial value, like turbot. In these conditions, the number of boats which are operating with gill nets and other fixe gears (hand lines, long lines, etc.) increasing.

The adopted methodology for collection, processing and evaluation of data at national level is similar to that used in the Black Sea area. Assessment of fishing agglomerations biomass was realized through swept area method which uses as parameters vessel speed, horizontal opening of the trawl and time of trawling. The assessment of the biomass of fishing agglomerations was made taking into account the surveyed area, the range of catch per surface unit and average catch per unit area. The obtained data was placed on distribution maps, bounding the areas with values ranged between some limits, each range of value having assigned a kind of color function of t/Nm2.

The presented data indicate seasonal changes of biomass values, the fishing agglomerations being very much influenced of environmental conditions.