November 2010

**GENERAL FISHERIES COMMISSION FOR
THE MEDITERRANEAN
COMMISSION GÉNÉRALE DES PÊCHES
POUR LA MÉDITERRANÉE**

Viale delle Terme di Caracalla, 00153 Rome, Italy. Tel: + 39 0657055730. www.gfcm.org

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GENERAL FISHERIES COMMISSION FOR THE MEDITERRANEAN
SCIENTIFIC ADVISORY COMMITTEE (SAC)
Thirteen Session
Marseille, France, 7-11 February 2011
Report of the SCSA practical session on stock assessment of demersal species.
Istanbul, Turkey, 18-23 October 2010

INTRODUCTION

1.   The meeting of the SCSA Working Group on Demersal species (WG) was held in Instanbul, Turkey, from 18 to 23 October 2010 at Green Park Hotel. It was attended by 35 participants from Cyprus, Egypt, France, Greece, Italy, Malta, Morocco Spain, Tunisia, Turkey as well as representatives of the GFCM Secretariat (see list of participants in Appendix I).

2.   Mr. Vahdettin Kurum Head of Fisheries Department of the Turkish Ministry of Agriculture and Rural Affairs welcomed the participants and thanked them for attending this meeting.

3.   Mr Srour, Deputy Executive Secretary of the (GFCM), welcomed the participants and thanked the Turkish Authorities for their kindness in hosting and arranging the meeting.
He stressed the importance to reach as many assessments as possible and of contrasted and agreed quality.

4.   Mr. Ernesto Jardim, fisheries scientist from the Instituto Nacional de Recursos Biologicos, L-IPIMAR in Lisbon, Portugal is the Moderator whose terms of reference are presented in Appendix II. This report represents the culmination of those Terms of Reference.

5.   The moderator highlighted that the main objective of the meeting is to give advice on the management of fisheries/stocks, based on assessments supported by data, biological parameters and methods agreed by the participants. Such assessments must have quality and consistency to provide relevant information for management. In the case of assessments which, for some reason, were considered to be preliminary, no advice is given but a strong

effort will be done to identify paths to sort out problems with the aim of having agreed assessments on the near future (1 or 2 years).

6.   Ms Pilar Hernández assisted by Angélique Jadaud, Othman Jarboui and Alvaro Abella during the different subgroups sessions were appointed as rapporteurs.

7.   In order to organize the large amount of work expected during the practical session, the moderator presented a detailed work program (Fig 1.1) to tackle all the points stated in the Draft Agenda (Annex IV). Advantages and disadvantages of the work division were commented and finally the Draft Agenda and the work program were agreed by the Group. In order to help on the elaboration of the report, an outline of the structure (Fig 1.2) and a template for the presentation of assessment results (fig 1.3) were also proposed and agreed by the group.
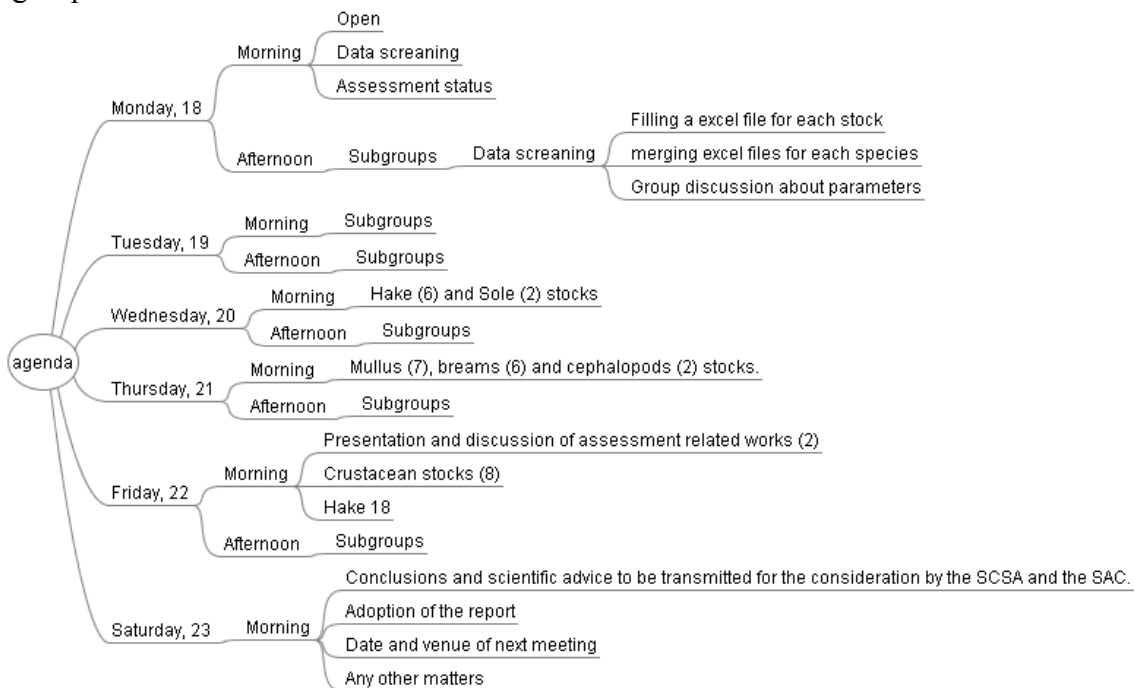

Figure 1.1 – Work program of SCSA practical session on the assessment of demersal stocks

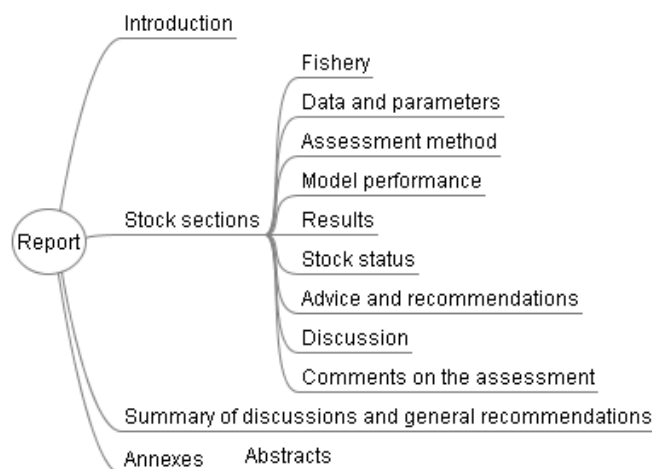8.   The report structure presented to the group and adopted is shown in Figure 1.2.

Figure 1.2 – Report structure for the SCSA practical session on the assessment of demersal stocks.

9. The guidelines for assessment presentations were presented and accepted by the group (Figure 1.3). Having into account the large number of assessments, it was accepted as a general rule to use a maximum of 30 minutes for each stock.
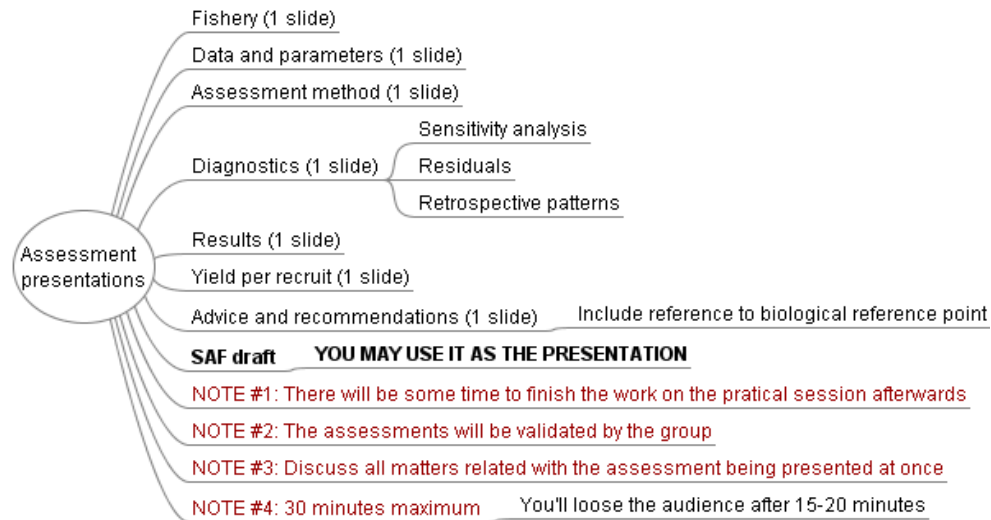

Figure 1.3 – Presentation guidelines for the assessment results of SCSA practical session on the assessment of demersal stocks.

10. The group adopted $F_{0.1}$ as the reference point to compare the current fishing mortality and evaluate the exploitation status of the stock. Such approach assumes that $F_{0.1}$ is the best available proxy to F_{msy}, which, having into consideration the shape of the Y/R curve seemed the best choice available to the group. This decision should be discussed and agreed at higher instances within GFCM.

11. It is important to bare in mind that some stock dynamics could be strongly driven by environmental and ecological factors (e.g. water temperature, predatory release effect) which makes it difficult to evaluate the effect of fishing on the stock.

OVERVIEW OF ASSESSMENTS PERFORMED AND STOCK STATUS

12. An overview of the stock assessments performed during the demersal working group meeting, and a summary of the resulting scientific advice is provided in Table 2.1. Most assessments had preparatory work done before the meeting to different levels, some with full assessments already run, others just with data processing. In all cases, except hake in GSA 18, some extra analysis, namely sensitivity, transition and residuals analysis, were carried out during the practical sessions. All the methods and results by stock were discussed and scrutinized by the participants and the advice approved in plenary sessions. Further summary details of the assessments performed are subsequently provided, including the methodologies used, the general results, reference points and stock status observations. It does not intend to be a detailed description; readers should see the separate stock assessment forms for more information, which are published on the GFCM website.

Table 2.1 - Overview of the assessments performed and resulting scientific advice to managers, by GSA and species.

GSA	Species	Data type	Yrs data	Methodology used	Stock status	Fmsy/Fcurr	Fmsy	Proxy
5	*A.antenatus*	Catch, effort, CPUE, Lfreq, Survey	1992-2009	XSA, Y/R	over-exploited	0.540453074	0.334	F0.1
3	*B.boops*	Lfreq	2000-2009	LCA, Y/R	over-exploited	0.677025527	0.61	F0.1
26	*B.boops*	Lfreq	2007-2008	LCA, Y/R	over-exploited	0.54	0.59	F0.1
3	*M.barbatus*	Lfreq	2000-2009	LCA, Y/R	over-exploited	0.810014728	0.55	F0.1
5	*M.barbatus*	Catch, effort, CPUE, Lfreq, Survey	2000-2009	XSA, Y/R	over-exploited	0.4	0.328	F0.1
6	*M.barbatus*	Catch, effort, CPUE, Lfreq, Survey	1998-2009	XSA, Y/R	over-exploited	0.5099	0.389	F0.1
7	*M.barbatus*	Catch, Lfreq	2004-2009	LCA, Y/R	over-exploited	0.57	0.398	F0.1
9	*M.barbatus*	Catch, effort, CPUE	1995-2009	Schaefer, Y/R	over-exploited	0.876712329	0.64	
5	*M.merluccius*	Catch, effort, CPUE, Lfreq, Survey	1980-2009	XSA, Y/R	over-exploited	0.235294118	0.2	F0.1
6	*M.merluccius*	Catch, effort, CPUE, Lfreq, Survey	1995-2009	XSA, Y/R	over-exploited	0.35	0.595	F0.1
7	*M.merluccius*	Catch, CPUE, Lfreq, Survey	1998-2009	XSA, Y/R	over-exploited	0.23	0.201	F0.1
9	*M.merluccius*	Lfreq	2004-2008	LCA, Y/R	over-exploited	0.157142857	0.22	F0.1
18	*M.merluccius*	Lfreq, Survey	2009; 1996-2009	SURBA,LCA,ALADYM Projections	over-exploited	0.350877193	0.2	F0.1
5	*M.surmulettus*	Catch, effort, CPUE, Lfreq, Survey	2000-2009	XSA, Y/R	over-exploited	0.63	0.378	F0.1
5	*N.norvegicus*	Catch, effort, CPUE, Lfreq, Survey	2002-2009	LCA, Y/R	over-exploited	0.661434978	0.295	F0.1
3	*P.bogaraveo*	Lfreq	2005-2007	LCA, Y/R	over-exploited	0.453400504	0.18	F0.1
9	*P.erytrinus*	Catch, Survey	1994-2009; 1990-2009	Y/R	over-exploited	0.358126722	0.13	F0.1
26	*P.erytrinus*	Lfreq	2007-2008	LCA, Y/R	over-exploited	0.52	0.34	F0.1
3	*P.longirostris*	Catch, effort, CPUE	2000-2009	Schaefer	over-exploited	0.255102041		
5	*P.longirostris*	Catch, effort, CPUE, Lfreq, Survey	2001-2009	XSA, Y/R	over-exploited	Unk	Unk	F0.1
6	*P.longirostris*	Catch, effort, CPUE, Lfreq, Survey	2001-2009	XSA, Y/R	over-exploited	0.218978102	0.3	F0.1
9	*P.longirostris*	Catch, Survey	1994-2008; 1990-2008	LCA, Y/R	harvest sustainable	1.166666667	0.7	F0.1
12-16	*P.longirostris*	catch, Lfreq	2007-2009	LCA, Y/R, ANALEN	over-exploited	0.796460177	0.9	F0.1
17	*S.solea*	Catch, effort, CPUE, Lfreq, Survey	2005-2009	XSA, SURBA, LCA, Y/R	over-exploited	0.475409836	0.29	F0.1
26	*S.solea*	Lfreq	2006-2007	LCA, Y/R	over-exploited	0.62	0.41	F0.1
25	*B.boops*	Lfreq	2005-2009	LCA, Y/R	preliminary			
15	*M.barbatus*	Catch, effort, CPUE, Survey	2005-2009; 2002-2009	SURBA	preliminary			
25	*M.barbatus*	Lfreq	2005-2009	LCA, Y/R	preliminary			
3	*M.merluccius*	Catch, effort, CPUE	2000-2009	Schaefer	preliminary			
25	*M.surmulettus*	Lfreq	2005-2009	LCA, Y/R	preliminary			
25	*P.erytrinus*	Lfreq	2005-2009	LCA, Y/R	preliminary			
25	*S.smaris*	Lfreq	2005-2009	LCA, Y/R	preliminary			
6	*C.rubrum*				related work			
9	*N.norvegicus*				related work			

Session 1. Stocks of Hake and Sole

GSA03 *Merluccius merluccius.* Morocco

(By Sadia Belcaid)

Fishery

In Morocco the landings are made in 7 ports and 86 artisanal fishery sites.
Hake (*Merluccius merluccius*) is one of the most targeted demersal species in the Moroccan Mediterranean. It is operated exclusively by trawlers.

The trawl fleet of GSA3 at the end of 2009 accounted for 121 vessels; on average, 50 TRB, and 325 HP, most of them catch hake. The main landing is in the ports Nador, Al Hoceima and M'diq. An increase of the mean number of vessels from 114 to 121 was observed in the last years because the migration of some boats of Atlantic to Mediterranean.

Most of bottom trawlers of GSA3 perform daily fishing trips; only in some cases vessels stay out for a maximum of 2-3 days.

In 2009, the annual production in common hake is estimated at 198 tons. The main species targeted with the *Merluccius merluccius* are: *Parapenaeus longirostris*, *Pagellus acarne, Mullus spp., Boops boops*, *Gadus poutassou*, *Octopus vulgaris* and *Sepia* spp.

Data and parameters

Catch, effort and CPUE from trawl coastal fishery (Official data from ONP and data from INRH).

Assessment method

Dynamic production Schaefer model using dynamic CECAF Schaefer model (FAO, CECAF Shaeffer production model, 2007).

In order to give a better assessment of MSY, BMSY et FMSY, the model calculate the reference points Bratio = (the ratio between the biomass estimated for the last year of the data and BMSY), and Fratio = (the ratio between the fishing mortality for the last year and the fishing mortality which should produce a sustainable catch for the same year).

Model performance

The results show that the model does not fit well with the CPUE used (coastal fishery) most likely due to the short time series available and the low contrast on the data.

Results

$B/B_{0.1} = 43\%$
$Fcur/F_{0.1} = 108\%$
$Fcur/FSYCur = 64\%$

References points : $B0,1 = 37,7$

The current biomass represent only 43% of the target Biomass. The current fishing mortality is under the sustainable fishing mortality by 36% and exceeds the target fishing mortality by 108%. Abundance indices are stable except in 2006, when a high value was estimated which may be due to a stronger recruitment.

Stock status
Overexploited with high fishing mortality and low abundance.

Advice and recommendation
The assessment was considered preliminary.

Discussion

Schaefer model was the only method which could be used (one year of length frequencies).

The group underline that this stock is a shared stock but with partial data (Spanish and Algerian data not included) and that there is a necessity of performing a joint assessment between the different partners.

The WG considers the assessment as preliminary.

GSA05 *Merluccius merluccius.* Balearic Islands
(By Beatriz Gujarro)

Fishery
Hake catches from the Balearic fleet comes exclusively from bottom trawl (total number of boats = 38). Fleet and catch data correspond to average 2000-2009 from Mallorca island and represent approximately 70 and 90% of the Balearic Islands, respectively. The trawlers develop up to four different fishing tactics, which are associated with the shallow shelf (50-80 m), deep shelf (80-250 m), upper slope (350-600 m) and middle slope (600-750 m).

Data and parameters
Size composition of commercial trawl catches and official landings, CPUE data from survey and commercial fleet.

Growth parameters from L/W and Age/L relationships from otolith readings (from Spanish National Data Collection Programme, 2003-2006).

M vector from Probiom (Caddy and Abella, 1999).

Assessment method
Separable VPA, Extended Survivor Analysis (XSA), retrospective analysis, Yield per recruit analysis.

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

Results

Stock abundance, biomass and recruitment showed oscillations for the entire data series, without any clear trend.

1980-89: $F_{max} = 0.2305$, $F_{0.1} = 0.1424$, $Y/R = 22.3$, $Y/R_{0.1} = 26.2$
1990-99: $F_{max} = 0.3154$, $F_{0.1} = 0.1986$, $Y/R = 25.7$, $Y/R_{0.1} = 26.7$
2000-09: $F_{max} = 0.3060$, $F_{0.1} = 0.1955$, $Y/R = 22.8$, $Y/R_{0.1} = 26.7$

Stock status

Overexploited. The fishery is being exploited at above a level which is believed to be sustainable in the long term, with no potential room for further expansion and a higher risk of stock depletion/collapse. It presents Moderate fishing mortality and intermediate abundance

Advice and recommendation

To reduce fishing mortalities by 30 to 50% which can be achieve with reducing the effort activity and improving the selection pattern of the fishery.

Discussion

Vector mortalities should be checked.

The parameterization of the XSA model may have an impact on the results obtained. To identify the extension of such decisions, further work must be done to explore different parameterizations of the model (*e.g.* the contribution of each tuning fleet in the model) and run sensitivity analysis on its effects.

The WG endorses the assessment and the related recommendations.

GSA06 Merluccius merluccius Northern Spain

(By Angel Fernández)

Fishery

Hake is exploited by bottom trawl, gillnet and longline, each fishing gear targeting a given length range. Highest landings, both in weight and in numbers, correspond to bottom trawling. Fishing is carried out five days a week. Exploitation is based on very young age classes, mainly 0 and 1 year old individuals, with immature fish dominating the landings.

From official data, the total trawl fleet of the whole geographical sub-area 06 (Northern Spain) is made up by 647 boats: on average, 47 TRB, 58 GT and 297 HP. Some of these units (smaller vessels) operate almost exclusively on the continental shelf (targeted at red mullet, octopus, hake and sea breams), others (bigger vessels) operate almost exclusively on the continental slope (targeted at decapod crustaceans) and the rest can operate indistinctly on the continental shelf and slope fishing grounds, depending on the season, the weather conditions and also economic factors (e.g. landings price). The percentages of these trawl fleet segments have been estimated around 30, 40 and 30% of the boats, respectively.

Data and parameters

Size composition of commercial landings from I.E.O. Sampling and Information Network. Official landings data from CC.Aas. (Regional Governments).

The biological data sets used for the analysis are those from García and Esteban (1995-2002). Fast growth hypothesis was considered. M is mean of a Natural mortality vector, from PROBIOM (Caddy and Abella, 1999).

Assessment method

Extended Survivor Analysis (XSA) and Yield per recruit

Model performance

Additional XSA analysis using different options in the model are needed in order to reduce log catchability residuals and improve retrospective analysis.

Results

The general results are similar to those obtained in previous assessments. Exploitation is based on very young age classes, mainly 0 and 1 year old individuals, with immature fraction dominating the landings. There is a decreasing trend, both in landings and yields along the studied period, with a small recovery since 2007. Total biomass of the stock decreases slowly, being fluctuating at around the 7 300 t. The SSB represents only a 16 % of the total biomass in average, showing a decreasing trend along the period. Recruitments are declining since 1996 onwards, meanwhile F increasing in the last three years especially for the 2- 4 age classes.

Stock status

Overexploited. The fishery is being exploited at above a level which is believed to be sustainable in the long term, with no potential room for further expansion and a higher risk of stock depletion/collapse. With high fishing mortality and low abundance.

Advice and recommendation

Reduce growth overfishing through:
- Reduce the effort of trawl.
- Improve the fishing pattern of the trawl fleets.

To avoid recruitment overfishing:
- Reduce effort in trawl 70%
- Especial surveillance in the use of 40 mm square mesh size in the cod end in trawl gears.
- Encourage studies to allocate area closures to fishing (Fishing Reserves).

Discussion

Y/R analysis show a clear status of growth overexploitation, due both to a high fishing mortality and an exploitation of the fishery based on juveniles under the minimum legal size. Also, the stock is in danger of recruitment overexploitation due to the decreasing trend in recruitment and very low levels of the spawning stock.

The parameterization of the XSA model may have an impact on the results obtained. To identify the extension of such decisions, further work must be done to explore different

parameterizations of the model (*e.g.* the contribution of each tuning fleet in the model) and run sensitivity analysis on its effects.

The WG endorses the assessment and the related recommendations.

GSA07 *Merluccius merluccius.* Gulf of Lions

(By Angélique Jadaud)

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 230 boats are involved in this fishery and, according to official statistics, total annual landings for the period 1998-2009 have oscillated around a mean value of 2160 tons (2260 tons in 2009). The fishing capacity of the GSA 07 has shown in these last 10 years a progressive decrease considering the French trawlers. The number of these trawlers decreased of about 30% on the period.

Most fleets and catches correspond to French trawlers (49 and 70%, respectively). Trawlers catches range between 3 and 92 cm total length (TL), with an average size of 20 cm TL, followed by French gillnetters (~32 and 15% respectively, ranging 13-86 cm TL and average size 39 cm TL), Spanish trawlers (~12 and 8%, respectively, ranging 5-87 cm TL, and average size 25 cm TL), and Spanish long-liners (~7 and 7%, respectively, ranging 23-96 cm TL and average size 54 cm TL). Hake trawlers fishery exploits a highly diversified species assemblage: Striped mullet (*Mullus barbatus*), Red mullet (*Mullus surmuletus*), 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*) are among the most important species in the accompanying species.

Data and parameters
Growth parameters, especially the estimation of K, come from tagging experiments developed by IFREMER Sète in the Gulf of Lions (Mellon-Duval et al., 2010.) and considering Linf from Aldebert & Recasens (1996). M vector from PRODBIOM (Abella et al., 1997).

Assessment method
Extended Survivors Analysis (XSA) tuned by MEDITS abundance indices.

Model Performance
Considering the retrospective analysis, trends of F are low and SSB are high.

Results
Current YR = 0,067
Maximum Y/R = 0,091
$Y/R_{0.1} = 0,090$
Fcurrent = 0.88

Fmax = 0.29 (absolute value)
$F_{0.1}$ = =0.2 (absolute value)

The effects of reduction of F (by 10, 20 and 40 % and also to reach the Fmax and $F_{0.1}$) have been calculated to see the impact on SSB/R and Y/R. A decreasing of the current F by 10 % or 40 % would respectively improve the SSB/R by 36% and 286% and the Y/R respectively by 6% and 26%.

Stock status
Overexploited, High fishing mortality, Low abundance.

The stock is characterized by growth overexploitation and by periodically good recruitments (1998, 2002 and 2008) which ensure the sustainability of the exploitation. The trend of the SSB does not show any risk of stock depletion or collapse.

Advice and recommendation
Reduce fishing mortality by 60% to 70% to reach the Fmsy proxy $F_{0.1}$.
To reduce growth overfishing:
- Improve the fishing pattern of the trawl to arise the minimum length of catches equal 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

Discussion
The Yield per Recruit analysis was performed using 3 different Reference F (mean F for ages 0-3 and (I) the 5 last years, (II) the 3 last years), (III) the last year).

The group decided to take into account the Y/R analysis performed with the referent F calculated by the means of the last 3 years.

The parameterization of the XSA model may have an impact on the results obtained. To identify the extension of such decisions, further work must be done to explore different parameterizations of the model and run sensitivity analysis on its effects.

The WG endorses the assessment and the related recommendations.

GSA09 Merluccius merluccius Ligurian and North Tirrenian Sea

(By Alvaro Abella)

Fishery

The trawl fleet of GSA9 at the end of 2006 accounted for 361 vessels, most of them catch hake. The main landings in the ports of Viareggio, Livorno, Porto Santo Stefano (Tuscany), Fiumicino, Terracina, Gaeta (Latium).

Most of bottom trawlers of GSA9 perform daily fishing trips; only in some cases vessels stay out for a maximum of 2-3 days, especially in summer.

A little decrease of the mean number of fishing days/year per vessel from 187 to 177 was observed in the last years.
Fishing grounds of bottom trawlers comprise the soft bottoms of continental shelf and the upper part of the continental slope. Some geographical differences on distribution of fishing pressure inside the GSA9 according to the fleets and availability.

Data and parameters

Commercial catches, size structure of the catch by gear, trawl surveys size structure and catch rates catch assessment surveys.

The surveys show strange patterns on the last two years due to changes in sampling design that we're not possible to identify. These data were considered of poorer quality than the rest of the series.

For the VIT runs the data comes from the European Union Data Collection Framework (DCF) with information on hake landings and the respective size/age structure for 2005-2008; discard size structure was also included. Data were available for the two main fishing gears exploiting hake in GSA9: trawling and set nets (gillnets). Official and adjusted data were used.
Juvenile growth rate from daily growth increments on otoliths (Belcari et al., 2006). This growth rate seems to follow the pattern estimated in the NW Mediterranean (Garcia-Rodriguez and Esteban, 2002)

Reproductive biology and fecundity of hake have been studied in northern Tyrrhenian Sea (Biagi et ;al 1995; Nannini et al., 2001; Recasens et al., in press) by monthly samplings of adults caught by trawling and gillnets.

M vector from Probiom.

Assessment method

Length cohort analysis; Yield forecasting. SURBA, ICES software for HCR, Yield software, VIT, excel spreadsheets.

Equilibrium YPR reference points for the stock were estimated through the "Yield" software (Hoggarth et al., 2006).

Results
Current YR = 33,7
Maximum Y/R = 46,42
Fmax = 0,35
$F_{0.1}$ = 0,22

Stock status
Overexploited, High fishing mortality, Low abundance.

Landings per unit effort show an increasing trend in the last 3-4 years in some ports. It is too early for stressing that this phenomenon is a signal of recovering of the stock that was (or is still) almost depleted

Advice and recommendation
The current SSB is estimated as 5 and 10% of the virgin SSB, nevertheless, the stock productivity does not appear to be impaired and able to still produce relatively large year classes.

The stock appears to be highly overexploited with a need of F reduction of about 40-80%.

Discussion

The group noticed a decreasing trend of the SSB for both assessments performed with SURBA on 2 different surveys (MEDITS and GRUND).

The group underlined the necessity to perform the assessment without the year 2009 since the SSB seems to decrease drastically at the end of the series (F very high).
Some remarks were made about the efficiency of the method used based on survey indices.

The WG endorses the assessment and the related recommendations.

GSA17 Solea solea. North Adriatic Sea

(By Giuseppe Scarcella)

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. Landings fluctuated between 1,000 and 2,300 t in the period 1996-2006 (data source: FAO-FishStat, IREPA-SISTAN time series, ISMEA).

Data and parameters
Italian catch at age data were obtained from on board observations (rapido trawlers and set netters) and auction documents of the principal markets of the Italian coast (2005-

2009). Slovenian landings were provided by official DCF data for the period 2005-2009. Concerning Croatian fishery, landings of 200 t of *S. solea* per year have been suggested for the period 2005-2008. In 2009, 150 tons were considered a good estimation on the base of the Croatian fishery data presented in the report of the 12th session of the Scientific Advisory Committee (GFCM: XXXIV/2010/Inf.9). The age frequency distributions from 2005 to 2009 of the Croatian and Slovenian catches derived from the demography of common sole observed in the hauls performed close to the eastern waters during the SoleMon survey.

Abundance indices were provided by the fishery-independent SoleMon survey (2005-2009). The survey indices were computed using ATrIS software (Gramolini et al., 2005) which also allowed GIS maps of the spatial distribution of the stock, of spawning females and of juveniles. Underestimation of small specimens in survey catches due to the gear selectivity was corrected using the selectivity parameters given by Ferretti and Froglia (1975).

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 (2004-2008). A natural mortality vector (M) was estimated using Caddy's method (1991) (PROBIOM Excel spreadsheet; Caddy and Abella, 1999; Abella et al. 1997, 1998). Maturity ogive and length-weight relationship parameters were calculated using biological samples collected in the period 2005-2007.

Assessment method

Three alternative assessment approaches were used:
- eXtended Survivors Analyses (XSA; Lowestoft packages);
- SURBA model;
- VIT model based on the average cathes of the period from 2007 to 2009.
Yield-per-recruit (Y/R) analyses were performed with Yield software (version 1.0, see Hoggarth et al., 2006), FLR scripts and VIT model, in order to estimate the limit and target reference points.

Model performance

Log catchability residual plots were produced both for XSA and SURBA analyses and no major conflict between ages and trends in catchability seem to appear. However the short time series available jeopardizes the results of the analytical models XSA and SURBA.

Results

From XSA: exploitation decreased from 2005 to 2006, was constant in 2006-2007 and increased in 2008-2009. The most recent estimate of fishing mortality ($F_{bar\ 0-4}$) is 1.33, the highest values of relative F are for ages 1 and 2. Recruitment varied without any trend in the years 2005-2009, reaching a minimum in 2006. The total biomass regularly decreased from 2005 to 2007 and increased in 2008 reaching the maximum value, but decreased again in 2009. The SSB reached the minimum value in 2005, was constant in 2006 and 2007, increased in 2008 and decreased in 2009.

The results of the SURBA model are in general accordance with the previous method providing the same perception of the state of the stock ($F_{bar\,0-4}$ in 2008: 0.92).

The VIT model was also applied considering the short data series. Smaller values of mean F (0.61) and F_{bar0-4} (0.71) were calculated.

Yield per recruit analyses provided the following values of reference points:

	Y/R (Yield software)	Y/R (XSA)	VIT model
$F_{0.1}$	0.26	0.19	0.29
Fmax	0.46	0.35	0.42

Stock status

Considering the results of the assessments and $F_{0.1}$ as target reference point it can be concluded that the resource is over-exploited and subject to growth overfishing.

Advice and recommendation

A reduction of F of 50-80%, 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 risk of stock depletion.

A two–months closure for rapido trawling inside 11 km off-shore along the Italian coast, after the biological fishing ban (August), would be advisable to reduce the portion of juvenile specimens in the catches. For the same reason, specific studies on rapido trawl selectivity are necessary. In fact, it is not certain 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 (48 mm or more) than the legal one. The same uncertainty regards the adoption of a square mesh.

SSB was practically constant over the 5 years, maybe because in late fall - winter the main spawning area is only partially exploited by Italian fleets. The safeguard of such area (identified by SoleMon survey) to prevent a possible future exploitation might be crucial for the sustainability of the Adriatic sole stock.

Moreover, 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 and biological information of sole and other benthic species that in the following working group will be analyzed. 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 underlines that the series is really short for assessing with XSA and SURBA. A general agreement was made about using VIT results for the recommendations. Moreover, the group underlines the need to include in the future assessments biological samples data from the eastern fishery as well as to extend the rapido trawl survey inside the 12 nm from the Croatian coast, as was performed in 2005 and 2006. Such requirements could be attained in the framework of ADRIAMED regional project.

The WG endorses the assessment and the related recommendations.

GSA26 *Solea solea*. South Levant Sea

(By Sahar Mehanna)

Fishery

The Egyptian Mediterranean coast is about 1100 km with a mean annual fish production of 55 thousand ton (1990 - 2008). The main fishing gears are trawling, purse-seining and lining especially long and hand lining. The number of trawlers in the Egyptian Mediterranean ranged between 1100 and 1500 during the period from 1990 to 2008. The vessel length varied between 18 and 22 m and its width varied from 4 to 6 m. Each vessel is powered by main engine of 150 to 600 hp but the majority of 250 hp engines. The fishing trip is about 7 to 10 days and the number of crew is about 6 to 15 persons.
Soles (*Solea solea* and *Solea aegyptiaca*) assume a very important place in the Egyptian Mediterranean waters (GSA 26). Soles are exploited by bottom trawlers and contributed about 4% of the total trawl catch. From the official data records, the catch of soles fluctuated between 645 and 1094 tons during the period 1997-2008 with a mean of 870 tons.

Data and parameters
The assessment was done using the length frequency data from biological samples. Based on otolith readings, the age was determined and the growth parameters (K, L_∞, and t_0) were estimated. M was estimated as the geometric mean of two methods. The general power equation ($W= aL^b$) was applied to estimate the length-weight relationship. Maturity ogive was fitted using the biological samples.
Growth parameters

L_∞	44.36 cm TL
K	0.33 yr^{-1}
t_0	-0.45 year

Length-weight relationship parameters

a	0.0148
b	2.861
M	0.63

Assessment method

LCA, VIT, Y/R, Excel sheets

Results

Y/R results

Current Y/R	48.11

Maximum Y/R	48.38
$Y/R_{0.1}$	44.79
F_{max}	0.81
$F_{0.1}$	0.41
Current B/R	56.52
Maximum B/R	238
$B/R_{0.1}$	81.24

Yield per recruit analyses using Beverton and Holt model gave $F_{max}= 0.83$, $F_{0.1}= 0.45$ (the estimated current F was 1.11)

Stock status

Overexploitation situation with high fishing mortality

Advice and recommendation

To reduce fishing mortality by about 40-60% to achieve $F_{0.1}$.
To regulate mesh sizes and improve the trawl selectivity.
To identify and protect the nursery grounds.
To improve the fishery data collection system.

Discussion

As the assessment was done at first using three years 2006-2008 and it was found that the length composition of year 2008 is greatly different from the two others, the group underlined performing the assessment using the mean number of years 2006-2007. A general agreement about using VIT results for the recommendations was done.
The group detected a problem with the year 2009.

The WG endorses the assessment and the related recommendations.

General comments.

Considering management advice and recommendations, a lot of the stocks were mentioned as growth overfished with a risk of recruitment overfishing. The definition of recruitment and growth over fishing was sometimes misunderstood. The group emphasize the fact that growth overfishing is an overfishing of juveniles and that recruitment overfishing is an overfishing of spawners that can be reflected by a decreasing trend in recruitment.

Some other general comment was made also considering recommendations about mesh size. In case of growth over fishing, the group agreed not to put in the recommendations some reference to a size of a mesh (50 mm diamond or 40 mm square mesh cod end), but some general comments about the improvement of the fishing pattern of the trawl to arise the minimum length of catches equal to the minimum legal landing size. This decision is based on the fact that the group did not tackle this issue in the scope of stock assessment and has not the required scientific support to give a precise advice. Some studies about selectivity have been performed (Guijarro & Massutí, 2006, and Ordines

et al., 2006). The results shown that a change of diamond to square mesh in the cod-end could produce an increase of length at first capture for hake from 11 to 15 cm, respectively, without a significant decrease in commercial yields. In addition, discards on the deep shelf, where hake it is mainly exploited, could be reduced by 50%.

Another comment was made regarding the necessity of introducing in the diagnosis of the assessment form the possibility to define some stocks status as "**Overexploited without risk of collapse**". This definition of the status would be an intermediate between the two current ones which are:

F - Fully exploited. The fishery is operating at or close to an optimal yield level, with no expected room for further expansion; and

O - Overexploited. The fishery is being exploited at above a level which is believed to be sustainable in the long term, with no potential room for further expansion and a higher risk of stock depletion/collapse.

The rationale is that a stock may be overexploited in the sense that it is not exploited at its maximum sustainable yield, but it reached an equilibrium level regarding SSB, which is capable of replacing the biomass removed by fishing and natural mortality. In this case the stock may not be in risk of collapse, it is however in a higher risk situation than being at the SSB level generated by exploring the stock at MSY.

Session 2. Stocks of mullets, sparids and cephalopods

GSA03 *Boops boops.* Southern Alboran Sea
(By Najib Elouamari)

Fishery

La pêche des espèces demersales en méditerranée marocaine est pratiquée principalement par une flottille chalutière composée de 121 unités, mais également par une flotte de pêche artisanale quoique d'une manière nettement moins importante. La puissance motrice des chalutiers est très variable, oscillant entre un minimum de 80 CV et un maximum de 520 CV avec une moyenne de 339 CV. Aussi, le TJB est très variable oscillant entre 9.19 et 125 tonnes. La valeur moyenne de TJB est de 52 tonnes.

D'une manière générale, l'évolution des captures demersales a connue une augmentation, passant de 7680 tonnes en 2000 à plus de 17000 tonnes en 2009. Les débarquements de la bogue Boops boops ont fluctué considérablement avec une hausse spectaculaire en 2008 où on a enregistré un pic de 4213 soit une augmentation de plus de 200% par rapport à l'année 2007. La capture annuelle moyenne de cette espèce est de l'ordre de 2848 tonnes.

L'évolution de nombre de sorties annuelles montre une tendance à la hausse avec une augmentation plus significative au cours des dernières années. Le nombre de sorties réalisées varie entre 9070 et 12705 sorties/année, avec une moyenne annuelle de l'ordre de 10676 sortie/année. Cette évolution est due essentiellement à l'augmentation de nombre de bateaux en provenance des ports atlantiques.

Data and parameters

Les données de fréquences de tailles utilisées dans cette étude proviennent de l'échantillonnage des débarquements de la bogue réalisés par la flotte chalutière opérationnelle en méditerranée marocaine, et plus particulièrement, les chalutiers opérants à partir des ports de Nador et d'Al-Hoceima.

Une matrice de données annuelles a été constituée puis les données annuelles sont regroupées pour la construction d'une pseudocohorte.

Les paramètres de croissance utilisés dans cette étude (L_{oo}, k, to, a et b) sont résumés dans le tableau suivant :

Tableau 1 : paramètres biologiques relatifs à la bogue et le rouget de vase

	a	b	L_{00}	K	t_0(an)	Références
Bogue	0.00722	2.9369	31.5	0.28	-0.96	Zoubi.A, 2001. rapport interne

Il a été retenu une valeur de mortalité naturelle M= 0,59. Cette valeur de mortalité a été supposée constante pour toutes les classes de tailles et pendant toute la période considérée.

Plusieurs estimations du stock ont été essayées avec différentes valeurs de F terminales (0,4 < Fterm> 0,7) pour comparer les résultats. La valeur de F terminale adoptée est de l'ordre de 0.5.

Assessment method

Le niveau d'exploitation du stock de la bogue a été déterminé à travers l'analyse de la courbe de rendement par recrue et le calcul des points de référence biologique F max et F0,1.

Les traitements de données ont été réalisés moyennant le logiciel VIT (LEONART & SALAT, 2000) conçu spécialement pour les analyses virtuelles des populations (VPA) et de rendements par recrue (Y/R) à partir de pseudocohortes en tailles.

Results

Current YR	8,368
Maximum Y/R	8,38
$Y/R_{0.1}$	8,29
F_{max}	0,75
$F_{0.1}$	0,61
Current B/R	11,171
Maximum B/R	12,825
$B/R_{0.1}$	14,262

Stock status

Les valeurs des points de référence biologique Fmax et F0,1 obtenues indiquent une situation de surexploitation de cette ressource. Toutefois, cette situation ne présente aucun signe de dégradation ou d'effondrement.

La mortalité par pêche est exercée particulièrement sur les individus dont la taille est comprise entre 15 et 24 cm.

L'analyse des données des campagnes de prospection en mer obtenues durant les 4 dernières années indiquent que les indices d'abondance de cette ressource sont estable.

Advice and recommendation

Réduction de la mortalité par pêche exercée sur le stock dans le but d'améliorer le rendement par recrue.

Veiller a appliqué la réglementation existante concernant les zones de pêche et le maillage de l'engin de pêche utilise. En effet, la réglementation impose la pêche dans les zone au delà de 3 miles a l'Est d'Al-Hoceima et au delà de 80 mètres de profondeur a l'Ouest.

Standardisation des méthodologies appliquées pour l'estimation des paramètres de croissance et de mortalité, ainsi que les méthodes d'évaluation des stocks méditerranéens.

Discussion

Le groupe a signalé que cette ressource ne présente aucun signe de dégradation ou d'effondrement.

La réduction de la mortalité par pêche peut être réalisée en limitant la migration des bateaux chalutiers de l'Atlantique vers la méditerranée durant certaines périodes de l'année.ç

The WG endorses the assessment and the related recommendations.

GSA25 *Boops boops.* Cyprus

(By Marios Josephides)

Fishery

Bogue in GSA 25 is exploited by the artisanal fishing fleet, using set nets (basically gillnets) and the bottom otter trawlers. In the years 2003-2005, bogue was also exploited by a single purse seiner.
The artisanal fleet consists of 500 boats between 6 and 12 meters in length. Artisanal fishery in GSA 25 is a multi-species fishery. Accompanying species in the artisanal catches are *Sparisoma cretense*, *Mullus surmuletus*, *Mullus barbatus*, *Octopus vulgaris*, *Sepia officinalis*, *Serranus cabrilla*, *Scorpaena* spp. Labridae, *Diplodus* spp, *Pagellus erythrinus* and *Siganus* spp.

Since 2006 the number of licensed bottom trawlers operating in GSA 25 has been reduced from 8 to 4. The trawl fishery in GSA 25 is also a multi-species fishery. Accompanying species in the trawl catches are *Spicara smaris*, *Mullus surmuletus*, *Mullus barbatus*, *Pagellus erythrinus*, *Octopus vulgaris*, *Loligo vulgaris*, *Sepia officinalis*, *Eledone moschata*, *Octopus macropus*, *Pagellus acarne*, *Serranus cabrilla*,

Synodus saurus, Scorpaena spp., *Trigloporus lastovisa, Uranoscopus scaber, Pagrus pagrus* and *Merluccius merluccius*.

Data and parameters
The biological data used were collected within the framework of the Cyprus National Data Collection Programme, according to EC Data Collection Regulation. Data used were length composition of landings per gear, official landings data and biological parameters from age reading. The data covered a period of 5 years (2005-2009).

Assessment method
The assessment of this stock has been carried out by means of LCA and Y/R analysis (VIT) on a mean pseudo-cohort for the period 2005-2009. The stock assessment was performed during the Working Group on Demersal Species of the SAC-SCSA meeting (October 2010).

Results
Current YR = 30.77
Maximum Y/R = 45.52
$Y/R_{0.1}$ = 43.89
F_{max} = 0.25
$F_{0.1}$ = 0.17

Stock status
Preliminary assessment.

Advice and recommendation
Preliminary assessment.

Discussion
The group spotted some abnormalities in the fishing mortality rates for some length classes and showed doubts about the robustness of the assessment.

The group underlines the need to re-perform the assessment, focusing on the next points:
- Check equilibrium in the fishery from residuals of length frequencies by year before using VIT (VIT assumes equilibrium).
- Catch weight should be compared to weight from L-W relationship.
- Age readings should cover all length classes.
- Should try different values of t_0 (sensitivity analysis)
- Recalculate Terminal F by sensitivity analysis (thumb rule: value similar to M).
- Avoid working with lengths - slice length data to ages.
- Try to replace the last age classes with a plus group, especially where some classes are missing from the catch.
- Check for any subdivisions of each fleet (gear) that target different parts of the stock (case of abnormal trend of total fishing mortality).

The WG considers the assessment as preliminary.

GSA26 *Boops boops* South Levant Sea

(By Sahar Mehanna)

Fishery

The Egyptian Mediterranean coast (GFCM-GSA 26) is about 1100 km extending from El-Salloum in the West to El-Arish in the East. The mean annual fish production from this area was about 55 thousand ton (1990-2008). The main fishing gears operated in this area are trawling, purse - seining and lining especially long and hand lining. The fishing grounds along the Egyptian Mediterranean coast are divided into four regions; Western region (Alexandria and El-Mex, Abu-Qir, Rasheed, El-Maadiya and Mersa Matrouh), Eastern region (Port Said and El-Arish), Demietta region and Nile Delta region (GAFRD, 2004). The trawl fishery contributed about 33% of the total fish production from Egyptian Mediterranean. It is a multispecies fishery targeting a number of commercial important fish species; red mullet, soles, triglid fish, breams, lizardfish, snappers, barracuda and elasmobranches. Invertebrates are represented by shrimp, cuttlefish, squid, crab and bivalves.

The number of trawlers operated in the area ranged between 1100 and 1500 during the period from 1990 to 2008. The vessel length varied between 18 and 22 meter and its width varied from 4 to 6 meter. Each vessel is powered by main engine of 100 to 600 hp. Some of them are equipped with echo-sounders.

Porgies (family: Sparidae) are among the most abundant demersal fishes inhabiting the Egyptian Mediterranean. They represented by more than 10 species and exploited by more than one fishing gears. *Boops boops* is the most abundant sparid species in the area contributing an annual catch of 2330 ton (1991-2008) and exploited by bottom trawlers.

Data and parameters

Based on the biological samples from the commercial catch, the stock of Bogue was assessed and some reference points were identified. Length frequency of two years was used (2007-2008). Based on otolith readings, the age was determined and the growth parameters (K, L_∞, and t_0) were estimated. M was estimated as the geometric mean of two methods. The general power equation ($W = aL^b$) was applied to estimate the length-weight relationship. Maturity ogive was fitted using the biological samples.

Growth parameters

L_∞	27.24 cm TL
K	0.54 $year^{-1}$
t_0	-0.33 year

Length-weight relationship

a	0.0061
b	3.1529

Natural mortality

M	0.6

Assessment method

LCA, VIT, Y/R, Excel sheets

Results

VIT results

Current YR	19.845
Maximum Y/R	19.955
Y/R $_{0.1}$	18.93
F_{max}	0.94
$F_{0.1}$	0.59
Current B/R	17.3
Maximum B/R	72
B/R $_{0.1}$	29.08

The VPA was done using different values for terminal F to choose the most appropriate for this stock.
Also, Yield per recruit analyses using Beverton and Holt model gave F_{max}= 1.05 and $F_{0.1}$= 0.45 (the estimated current F was 1.5)

Stock status

Overexploitation situation with high fishing mortality

Advice and recommendation
It is recommended that fishing effort must be controlled and decreased. The available assessment suggests a target reference point of about 40-60% of the current effort. Defining nursery areas of important species should be taken into account for recommending closed areas and the link between spawning and recruitment in the area should be studied. Also, improving the fisheries data recording system and facilitating data and information exchange are highly recommended.

Discussion
A general agreement about using VIT results for the recommendations was done.
The WG endorses the assessment and the related recommendations

GSA05 Mullus surmuletus Balearic Islands
(By Beatriz Guijarro)

Fishery
In the Balearic Islands (GSA05), commercial trawlers employ up to four different fishing tactics (Palmer et al. 2009), which are associated with the shallow and deep continental shelf, and the upper and middle continental slope (Guijarro and Massutí 2006; Ordines et al. 2006). Vessels mainly target striped mullet (*Mullus sumuletus*) and European hake (*Merluccius merluccius*) on

the shallow and deep shelf respectively. However, these two target species are caught along with a large variety of fish and cephalopod species. The Norway lobster (*Nephrops norvegicus*) and the red shrimp (*Aristeus antennatus*) are the main target species on the upper and middle slope respectively. The Norway lobster is caught at the same time as a large number of other fish and crustacean species, but the red shrimp fishery is the only Mediterranean fishery that could be considered monospecific.

The species assessed, the striped red mullet, is one of the most important target species in the trawl fishery working on the continental shelf off Mallorca (35-40 vessels). A fraction of the small-scale fleet (~100 boats) also directs to this species during the second semester of the year (July-December), using both trammel nets and gillnets.

Data and parameters

Landings time series from 2000 to 2009 of the two fleets exploiting this species (trawl and small-scale fleet). Length frequency distributions from monthly on port (small-scale) and on board (trawling) samplings developed during the entire time series.

The biological parameters used for the assessment were the following: 1) growth parameters obtained from otholit readings carried out in the framework of the Spanish National Data Collection (L_{inf}= 40.05, K= 0.164, t_0= S1.883); 2) length-weight relationships obtained from the Spanish National Data Collection (a= 0.0084, b= 3.118); 3) natural mortality at age calculated using the PROBIOM spreadsheet (Abella et al. 1997); and 4) maturity at age obtained from the Spanish National Data Collection in GSA05.

Assessment method

- Extended Survival Analysis (XSA)

The length of the data series available (10 years, from 2000 to 2009) together with the availability of data from two different fleets (trawl and small-scale vessels) allowed the use of a VPA tuned with two sources (XSA), fishery data and surveys data. The software used was the Lowestoft suite (Darby and Flatman, 1994). A separable VPA (Pope and Sheperd, 1982) was also used as exploratory analysis.

- Yield per Recruit analysis (Y/R)

This was conducted based on the exploitation pattern resulting from the XSA model and population parameters. Minimum and maximum ages for the analysis were 0 and 5 years, respectively. Stock weight at age and catch weight at age were estimated as mean values on a long term basis (2000-2009). Natural mortality by age was from PROBIOM (Abella *et al.*, 1997) as recommended in the report of the SG-ECA/RST/MED09-01. Fishing mortalities were estimated in a short term basis (F in 2009). Reference F was considered to be mean F for ages 1 to 5.

Model Performance

A retrospective analysis was performed which showed that F was underestimated and SSB overestimated.

The parameterization of the XSA model may have an impact on the results obtained. To identify the extension of such decisions, further work must be done to explore different parameterizations of the model (*e.g.* the contribution of each tuning fleet in the model) and run sensitivity analysis on its effects.

Results

- From Extended Survival Analysis (XSA)

Terminal fishing mortality (Ft) was obtained from the catch curve, using the FLEDA package (Jardim & Azevedo 2004), and adjusted afterwards with a previous VPA followed by a Separable VPA. Different trials were done to obtain the best results from the Separable VPA changing both the reference age and the terminal selection value. The best fit was obtained with a reference age of 2 and a terminal selection value of 0.80. Residuals were always smaller than 1 (most of them <0.5) and did not show any tendency throughout the years. Finally, the vector of F by age, including the Ft, obtained with this Separable VPA was used as input parameters.

Several XSA trials were performed where the age at which catchability (q) is independent of stock size and the age at which q is independent of age were adjusted. Since results were similar in all these trials, the option finally used was considering q independent of stock size for ages <1 (recruits) and q independent of age for ages >= 4 because these values reflect very well the selection curve obtained in the Separable VPA. Given that the residuals of the MEDITS data series for age 5 of the entire series and also for age 4 in 2009 were very high, these ages were removed for the final XSA run.

XSA results showed that except the SSB (r= 0.777; p= 0.064), all other parameters showed a significant trend with time: both SB and the number of recruits showed a decreasing trend (r= 0.918; p= 0.002; r= 0.874; p= 0.010, respectively). In spite of this, the SSB/SB relationship showed an increasing trend with time (r=0.800; P= 0.046).

- From Yield per Recruit analysis (Y/R)

Y/R results were $F_{0.1}$=0.378; F_{max}=0.744; and F_{ref}=0.6.

SSB and stock biomass consistently declined over the time series since 2000 to the lowest value of the time series in 2009. Recruitment showed a clear a decresing trend along the series; the number of recruits decreased from 9 to $5 \cdot 10^6$ between 2000 and 2008. Also the 2009 recruitment is estimated at a low level, consistently with the survey information.

Stock status

The F_{ref} (0.6) in 2009 is above the Y/R $F_{0.1}$ reference point (0.378) which indicates that striped red mullet in GSA05 is overexploited.

Advice and recommendation

To reduce fishing mortalities by 30% to 50% which can be achieved with reducing effort capacity and improving the selection pattern of the fishery.

Discussion

The WG endorses the assessment and the related recommendations

GSA25 *Mullus surmuletus.* Cyprus

(By Marios Josephides)

Fishery

Striped red mullet in GSA 25 is exploited by the artisanal fishing fleet, using set nets (basically trammel nets) and the bottom otter trawlers.

The artisanal fleet consists of 500 boats between 6 and 12 meters in length. Artisanal fishery in GSA 25 is a multi-species fishery. Accompanying species in the artisanal catches are *Sparisoma cretense*, *Mullus barbatus*, *Octopus vulgaris*, *Sepia officinalis*, *Serranus cabrilla*, *Scorpaena* spp. Labridae, *Diplodus* spp, *Boops boops*, *Pagellus erythrinus* and *Siganus* spp.

Since 2006 the number of licensed bottom trawlers operating in GSA 25 has been reduced from 8 to 4. The trawl fishery in GSA 25 is also a multi-species fishery. Accompanying species in the trawl catches are *Spicara smaris*, *Boops boops*, *Mullus barbatus*, *Pagellus erythrinus*, *Octopus vulgaris*, *Loligo vulgaris*, *Sepia officinalis*, *Eledone moschata*, *Octopus macropus*, *Pagellus acarne*, *Serranus cabrilla*, *Synodus saurus*, *Scorpaena* spp., *Trigloporus lastovisa*, *Uranoscopus scaber*, *Pagrus pagrus* and *Merluccius merluccius*.

Data and parameters

The biological data used were collected within the framework of the Cyprus National Data Collection Programme, according to EC Data Collection Regulation. Data used were length composition of landings per gear, official landings data and biological parameters from age reading. The data covered a period of 5 years (2005-2009).

Assessment method

The assessment of this stock has been carried out by means of LCA and Y/R analysis (VIT) on a mean pseudo-cohort for the period 2005-2009. The stock assessment was performed during the Working Group on Demersal Species of the SAC-SCSA meeting (October 2010).

Results

Current YR = 34.42
Maximum Y/R = 67.41
$Y/R_{0.1} = 64.96$
$F_{max} = 0.21$
$F_{0.1} = 0.14$

Stock status

The assessment is preliminary.

Advice and recommendation

The assessment is preliminary.

Discussion

The group spotted some abnormalities in the fishing mortality rates for some length classes and showed doubts about the robustness of the assessment.

The group underlines the need to re-perform the assessment, focusing on the next points:

- Check equilibrium in the fishery from residuals of length frequencies by year before using VIT (VIT assumes equilibrium).
- Catch weight should be compared to weight from L-W relationship.
- Age readings should cover all length classes.
- Should try different values of t_0 (sensitivity analysis)
- Recalculate Terminal F by sensitivity analysis (thumb rule: value similar to M).
- Avoid working with lengths - slice length data to ages.
- Try to replace the last age classes with a plus group, especially where some classes are missing from the catch.
- Check for any subdivisions of each fleet (gear) that target different parts of the stock (case of abnormal trend of total fishing mortality).

- The WG considers the assessment as preliminary.

GSA03 *Mullus barbatus.* Southern Alboran Sea

(By Najib Elouamari)

Fishery

La pêche des espèces demersales en méditerranée marocaine est pratiquée principalement par une flottille chalutière composée de 121 unités, mais également par une flotte de pêche artisanale quoique d'une manière nettement moins importante. La puissance motrice des chalutiers est très variable, oscillant entre un minimum de 80 CV et un maximum de 520 CV avec une moyenne de 339 CV. Aussi, le TJB est très variable oscillant entre 9.19 et 125 tonnes. La valeur moyenne de TJB est de 52 tonnes.

D'une manière générale, l'évolution des captures demersales a connue une augmentation, passant de 7680 tonnes en 2000 à plus de 17000 tonnes en 2009. Les débarquements de rouget de vase ont montré une tendance à la stabilisation autour de 350 tonnes avec un pic enregistré en 2005 de l'ordre de 795 tonnes. La valeur annuelle moyenne de la capture est de l'ordre de 405 tonnes.

L'évolution de nombre de sorties annuelles montre une tendance à la hausse avec une augmentation plus significative au cours des dernières années. Le nombre de sorties réalisées varie entre 9070 et 12705 sorties/année, avec une moyenne annuelle de l'ordre de 10676 sortie/année. Cette évolution est due essentiellement à l'augmentation de nombre de bateaux en provenance des ports atlantiques.

Data and parameters

Les données de fréquences de tailles utilisées dans cette étude proviennent de l'échantillonnage des débarquements de rouget de vase réalisés par la flotte chalutière opérationnelle en méditerranée marocaine, et plus particulièrement, les chalutiers opérants à partir des ports de Nador et d'Al-Hoceima.

Une matrice de données annuelles a été constituée puis les données annuelles sont regroupées pour la construction d'une pseudocohorte.

Les paramètres de croissance utilisés dans cette étude (Loo, k, to, a et b) sont résumés dans le tableau suivant :

Tableau : paramètres biologiques relatifs à la bogue et le rouget de vase

	a	b	L_{00}	K	t_0(an)	Références
Rouget de vase	0.00993	3.154	29	0.37	-0.308	Slimani.A et al, 2001

Il a été retenu une valeur de mortalité naturelle M=0,72. Cette valeur de mortalité a été supposée constante pour toutes les classes de tailles et pendant toute la période considérée.

Plusieurs estimations du stock ont été essayées avec différentes valeurs de F terminales (0,4 < Fterm> 0,7) pour comparer les résultats. La valeur de F terminale adoptée est de l'ordre de 0.5.

Assessment method
Le niveau d'exploitation du stock de la bogue et de rouget de vase a été déterminé à travers l'analyse de la courbe de rendement par recrue et le calcul des points de référence biologique F max et F0,1.

Les traitements de données ont été réalisés moyennant le logiciel VIT (LEONART & SALAT, 2000) conçu spécialement pour les analyses virtuelles des populations (VPA) et de rendements par recrue (Y/R) à partir de pseudocohortes en tailles.

Results

Current YR	16,533
Maximum Y/R	16,11
Y/R $_{0.1}$	16,058
F_{max}	0,56
$F_{0.1}$	0,55
Current B/R	15,419
Maximum B/R	25,714
B/R $_{0.1}$	26,114

Stock status
Les valeurs des points de référence biologique Fmax et F0,1 obtenues indiquent une situation de surexploitation de cette ressource avec une individus dont la taille est comprise entre 13 et 18 cm.

La mortalité par pêche est exercée particulièrement sur les
4 dernières années indiquent que l'abondance de cette ressource est en diminution progressive.

The abundance indices are decreasing very fast.

Advice and recommendation
Réduction de la mortalité par pêche exercée sur le stock dans le but d'améliorer le rendement par recrue.

Veiller a appliqué la réglementation existante concernant les zones de pêche et le maillage de l'engin de pêche utilise. En effet, la réglementation impose la pêche dans les

zone au delà de 3 miles a l'Est d'Al-Hoceima et au delà de 80 mètres de profondeur a l'Ouest.

Standardisation des méthodologies appliquées pour l'estimation des paramètres de croissance et de mortalité, ainsi que les méthodes d'évaluation des stocks méditerranéens.

Discussion

Le groupe a signalé que la valeur de mortalité naturelle "M" utilisée dans cette étude est relativement élevée. Dans ce cas une analyse de sensibilité de ce paramètre doit être effectuée pour tester le degré d'incertitude. Toutefois, on a enregistré un dysfonctionnement de cette option sur le logiciel VIT sur lequel ont été effectuées les analyses d'évaluation. En effet, cette opération est réalisable uniquement lorsque les analyses sont effectuées sur une matrice de données en age.

La réduction de la mortalité par pêche peut être réalisée en limitant la migration des bateaux chalutiers de l'Atlantique vers la méditerranée durant certaines périodes de l'année.

The values given for F01 and Fmax are very close, after looking at the curve they shouldn't be so similar. The group advices to review it as well as the value of M.

The WG endorses the assessment and the related recommendations.

GSA05 *Mullus barbatus.* Balearic Islands

(By Beatriz Guijarro)

Fishery

In the Balearic Islands (GSA 5), commercial trawlers employ up to four different fishing tactics (Palmer et al. 2009), which are associated with the shallow and deep continental shelf, and the upper and middle continental slope (Guijarro & Massutí 2006; Ordines et al. 2006).
The two species of red mullet inhabiting the Mediterranean, *Mullus surmuletus* and *M. barbatus*, are present in the GSA 5. However, *M. surmuletus* predominates in this area where the species is targeted by both the artisanal and trawl fleet working along the continental shelf. On the contrary, *M. barbatus* is exclusively caught as a by-catch species by trawlers operating mainly on the deep shelf.

Data and parameters

The length of the data series available (10 years, from 2000 to 2009) allowed the use of a VPA tuned with data from surveys (XSA). The software used was the Lowestoft suite (Darby & Flatman 1994). A separable VPA (Pope & Sheperd 1982) was also used as exploratory analysis.

Landings time series from 2000 to 2009. Length frequency distributions from on board monthly samplings developed during the entire time series. The biological parameters used for the assessment were the following: 1) growth parameters agreed in the SGMED 09-01 meeting (L_{inf}= 26.0, K= 0.41, t_0= S0.40); 2) length-weight relationships obtained from the Spanish National Data Collection (a= 0.0062, b= 3.1597); 3) natural

mortality at age calculated using the PROBIOM spreadsheet (Abella et al. 1997); and 4) maturity at age obtained from the Spanish National Data Collection in GSA05.

Assessment method

- Extended Survival Analysis (XSA)

The length of the data series available (10 years, from 2000 to 2009) allowed the use of a VPA tuned with data from surveys (XSA). The software used was the Lowestoft suite (Darby & Flatman 1994). A separable VPA (Pope & Sheperd 1982) was also used as exploratory analysis.

- Yield per Recruit analysis (Y/R)
Y/R was conducted based on the exploitation pattern resulting from the XSA model and population parameters. Minimum and maximum ages for the analysis were 0 and 5 years, respectively. Stock weight at age and catch weight at age were estimated as mean values on a long term basis (2000-2009). Natural mortality by age was from PROBIOM (Abella et al. 1997) as recommended in the report of the SG-ECA/RST/MED09-01. Fishing mortalities were estimated in a long term basis (2000-2009). Reference F was considered to be mean F for ages 1 to 5.

Model performance

A retrospective analysis was performed without showing any trend.

The parameterization of the XSA model may have an impact on the results obtained. To identify the extension of such decisions, further work must be done to explore different parameterizations of the model (*e.g.* the contribution of each tuning fleet in the model) and run sensitivity analysis on its effects.

Results

Both SB and SSB showed a clear decrease from 2000 to 2003; SB decreased from 75 to 45 tons and SSB from 45 to 25 tons. Subsequently, both parameters remained rather constant or even increased slightly until 2007. However, SB showed a marked decreasing trend between 2007 and 2009, which was also followed by SSB; in both cases the lowest historical values were obtained in the last assessed year. Next assessments should analyse if this decreasing trend continues or rather the resource recovers. In spite of this, SSB remained constant between 55 and 65% of the SB throughout the entire time series.

With the exception of 2001, recruitment remained rather constant between 1.3 and $1.5 \cdot 10^{6}$ during 2002-2006. Since then, however, the number of recruits has decreased progressively to the point that the lowest historical values were reached during 2008-2009. As before, next assessments should evaluate if the number of recruits recovers from this historical dip.

Fishing mortality has ranged between 0.5 and 1.4 during the entire series and it is noticeable the abrupt decrease in 2003 coinciding with the lowest historical landings. Although fishing mortality has decreased progressively from 2004 to 2007, it has increased during the last two years. The vector of fishing mortality by age depictures a

typical selection curve and shows that the highest fishing exploitation is suffered by individuals between 2 and 3 years old and also that there is no exploitation of the recruits (age 0).

Y/R results were $F_{0.1}$=0.328; F_{max}=0.533; and F_{ref}=0.82.

The current F_{ref} (0.82) is above the Y/R $F_{0.1}$ reference point (0.328), which indicates that red mullet in GSA05 is subject to overfishing.

Stock status
Overexploited

Advice and recommendation
To reduce fishing mortalities by 40% to 60% which can be achieved with reducing effort capacity and improving the selection pattern of the fishery

Discussion
It would be necessary to further explore the parameterisation of the model (the contribution of each tuning fleet in the model).

The WG group detected some inconsistencies on biological parameters and noticed that while SSB appears increasing, recruitment time series suggest an increasing trend.

The WG suggest performing sensitivity tests for defining the influence of input biological parameters in the results.

The WG endorsed the assessment and recommendations.

GSA06 *Mullus barbatus.* Northern Spain

(By Angel Fernández)

Fishery
Both species of red mullet, Mullus surmuletus and M. barbatus, are exploited by trawl and artisanal fisheries fleets in GSA 06, although small gears (trammel nets and gillnets) account only for 5% of the total landings of these species (Demestre et al., 1997). Trawl fisheries developed along the continental shelf and upper slope are multi-specific. Small vessels operate almost exclusively on the continental shelf targeting on red mullets, octopus, cuttlefish and sea breams. Medium and large vessels usually operates 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. An important fraction (28% of individuals) of M. barbatus is 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 1998-2009. Annual catch in number by size class. Abundance index from commercial fleet & MEDITS surveys. Two sets of growth parameters from SGMED-08-03. Natural mortality vector (M) from Probiom.

Assessment method

VPA - Extended Survivor Analysis (XSA) and Yield per recruit analysis (Y/R).

Results

Catch in number of individuals are based on younger ages (0 and 1). Average fishing mortality for ages 0-2 show a general decreasing trend over the studied period. Recruitment has remained more or less constant between 1998-2007 although some fluctuations are observed. Nevertheless, in the last two years (2008-2009) recruitment is under the mean for the period 1998-2007. SSB has recovered after the minimum observed in 2004 and in the last four years is above the average for the whole period. Total biomass show wide fluctuations but any trend is observed.

Trends in recruitment, Fbar, stocks biomass and SSB are similar for both set of parameters used (fast and slow from SGMED-08-03).

Stock status

Overexploited. The fishery is being exploited at above a level which is believed to be sustainable in the long term, with no potential room for further expansion and a higher risk of stock depletion/collapse.

Advice and recommendation

To reduce the fishing effort 70%.

More effective control in shelf areas above 50 m depth should reduce the   catch of small individuals under the minimum legal size.

According to transition analysis (MUT0608Fer) the compulsory use of the 40 mm square mesh in the cod-end from 2010 onwards should improve trawl exploitation pattern and Y/R by 24%, but a close supervision of the observance of this measure is needed.

Discussion

Results of the analysis show that recruitments are under the mean level in the last two or three years depending on the two growth sets of parameters used. Nevertheless, spawning stock abundance do not shows a decreasing trend and even an increasing trend is observed according to MEDITS surveys. Although these drops in recruitment could be due to environmental conditions a surveillance of recruitment in the forthcoming years is advisable.

Catch per unit effort for Age 0 do not necessarily reflects changes in recruitment, but it shows a general declining trend and a strong drop in 2009. Whether this scarcity of small individuals in catches were due to the changes in the sampling scheme introduced in 2009, and/or to the fact that in this year the temporal closure for fishing coincided with the seasonal increase of juveniles abundance should be analysed.

The WG noted that while SSB appears to increase, recruitment decreases, which is not the expected trends in an overfished stock and may reflect a case of recruitment overfishing.

The WG endorses the assessment and the related recommendations.

GSA07 *Mullus barbatus.* Gulf of Lions

(By Angélique Jadaud)

Fishery

In the Gulf of Lions 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 2004-2009 have oscillated around a mean value of 193 tons. Most boats and catches correspond to the French trawling fleet (77% and 86% respectively). In French and Spanish landings, modal lengths are 13 and 14 cm, respectively.

In GSA 7, the trawl fishery is a multi-specific fishery. In addition to M. barbatus, the following species can be considered important by-catches: Merluccius merluccius, Lophius sp., Pagellus sp., Trachurus sp., Mullus surmuletus, Octopus vulgaris, Eledone sp., Scyliorhinus canicula, Trachinus sp., Triglidae, Scorpaena sp. Length at first capture is about 7 cm. Catch is mainly composed by individuals of age 0 and 1, while the oldest age class (5+ group) is poorly represented. Catch rates decreased a little along the analysed period. The number of French boats decreased also about 30 % during that period.

Data and parameters

The information used for the assessment of the stock consisted in annual size composition of French and Spanish trawler landings and biological parameters used by the EU SGMED-08-03 Subgroup on the Mediterranean (June 2008). A vector of natural mortality by age was calculated from Caddy's formula, using the PROBIOM Excel spreadsheet (Abella *et al.,* 1997).

Assessment method

The assessment of this stock has been carried out by means of VPA (VIT) on a mean pseudo-cohort for the period 2004-2009, considering French and Spanish trawl and yield-per-recruit (Y/R). VPAs were also performed for each year of the period, in order to have a first approach of the temporal trends of the results. Since no exceptional year was observed in the time series, results based on the mean pseudo-cohort are the base for the diagnostics and recommendation.

Model performance

Sensitive analysis was performed. Changing of M and F by 20% +/- didn't impact a lot the Y/R, B and SSB, changing of K and F by 20% +/- have impact on the Y/R, B and SSB especially with a higher K.

Results

Current YR   13.58
Maximum Y/R 14.06

Y/R $_{0.1}$	13.85
Fcurrent	0.7
F$_{max}$	0.49 (absolute value)
F$_{0.1}$	0.4 (absolute value)
Current B/R	17.67
Maximum B/R	23.71
B/R $_{0.1}$	31.01

F shows a slight decreasing trend from 2004.

Transition analysis was performed and didn't show any significant change on the Y/R when reducing the current F. This is due to the fact that the Y/R max (14.06) is not very far from the current Y/R (13.58).

Stock status

Slightly overexploited, Moderate fishing mortality, Intermediate abundance.

In this case, fishing mortality is shifted towards larger sizes than in other stocks of M.barbatus in the Mediterranean

Advice and recommendation

Current F has to be reduced by 30-40% to reach F$_{0.1}$.**Discussion**

The WG endorsed the assessment and recommendations.

GSA09 *Mullus barbatus.* Ligurian and North Tyrrhenian Sea

(By Alvaro Abella)

The assessment of red mullet was carried out using a Non-equilibrium Surplus Production Model assuming Schaeffer equation. Time series of catch and effort were combined with scientific cruises indices of abundance.

The analysis suggests a condition of overexploitation using Fmsy as a Reference Point.

From a forecast analysis a reduction of about 10% is considered necessary in order to reach the Fmsy level.

The WG endorsed the assessment and recommendations.

GSA15 *Mullus barbatus.* Malta

(By Leyla Knittweis)

Fishery

The fisheries resources in GSA 15 are shared by three main member countries namely Malta, Italy and Cyprus. 23 Maltese trawlers operate within this GSA. Only 12 of them are allowed to fish inside the Maltese 25 nautical mile Fisheries Management Zone 5 of which target red mullet on the continental shelf throughout the year while the rest target deepwater rose shrimp and giant red shrimps on the continental slope. Apart from the Maltese trawling fleet a number of Sicilian trawlers fish outside the 25 nautical mile zone targeting red mullet, red shrimp and pink shrimp. 3 Cypriot vessels also fish outside the 25 nautical mile zone which target exclusively red mullet on the continental shelf.

Data and parameters

Data available for the assessment of red mullet in GSA 15 is restricted to landings / efforts data from 2005-2009 (excluding commercial LFD), and data from the annual MEDITS trawl surveys from 2002-2009.

Assessment trials were performed both using a set of growth parameters showing relatively fast growth (SAMED 2002), and a set of parameters showing slower growth (SGMED 2009). The length weight relationship was calculated from GSA 15 survey data (2002-2008). Females (fast): $L\infty = 26$, k = 0.62, t0 = -0.2, a = 0.008, b = 3.067; females (slow): $L\infty = 26$, k = 0.41, t0 = -0.4, a = 0.008, b = 3.067. A vector of natural mortality was calculated using the ProdBiom method for both sets of parameters. Females (fast): 1.09, 0.49, 0.37, 0.32, 0.29; females (slow): 0.79, 0.36, 0.28, 0.24, 0.22. Where a vector of natural mortality could not be used, M = 0.43 was used. Maturity at age was also calculated twice from a maturity at length curve based on MEDITS survey data: females (fast): 0.23, 0.88, 0.97, 0.99, 1; females (fast): 0.17, 0.69, 0.91, 0.96, 0.98.

Assessment method

Age frequency distributions were calculated using the Beverton and Holt age splicing function of the LFDA programme based on standardised LFD from MEDITS surveys. Several trial runs were performed with the SURBA programme, varying: growth parameters, catchabilities, age weightings and mean F range. It was not possible to obtain a good model fit. Data was not available to apply other stock assessment models.

In order to nonetheless get an idea of stock status, plots of MEDITS DI and BI from 2002-2009 were generated, and a simple Beverton and Holt Z estimator approach based on MEDITS LFD 2002-2009 and average LFD 2007-2009 was performed.

Results

Not conclusive

Advice and recommendation

Since this assessment is preliminary, no advice and recommendations can be given at present.

Discussion

The survey data plots indicate and increase in DI/BI in 2006 – 2009, whilst the preliminary analysis of Biological Reference Points and total fishing mortality using the Beverton and Holt estimator indicates a state of overfishing. A longer time series of survey data / catch and effort data, as well as LFD from commercial catches in GSA 15, are needed in order to perform a full stock assessment and ascertain stock status. In addition a joint stock assessment should be performed by all the countries exploiting red mullet in GSA 15, i.e. Malta, Italy and Cyprus.

The group do not consider this as a complete assessment it is considered as preliminary. The current status is considered unchanged as regards the situation in 2008.

The WG considers the assessment as preliminary.

GSA25 *Mullus barbatus.* Cyprus

(By Marios Josephides)

Fishery
Exploited by the artisanal fishing fleet, using set nets (basically trammel nets) and the bottom otter trawlers. The artisanal fleet consists of 500 boats between 6 and 12 meters in length. Artisanal fishery in GSA 25 is a multi-species fishery. Accompanying species in the artisanal catches are *Sparisoma cretense, Mullus surmuletus, Octopus vulgaris, Sepia officinalis, Serranus cabrilla, Scorpaena spp.*, Labridae, *Diplodus* spp,. *Boops boops*, *Pagellus erythrinus* and *Siganus* spp.

Since 2006 the number of licensed bottom trawlers operating in GSA 25 has been reduced from 8 to 4. The trawl fishery in GSA 25 is also a multi-species fishery. Accompanying species in the trawl catches are *Spicara smaris, Boops boops, Mullus surmuletus, Pagellus erythrinus, Octopus vulgaris, Loligo vulgaris, Sepia officinalis, Eledone moschata, Octopus macropus, Pagellus acarne, Serranus cabrilla, Synodus saurus, Scorpaena* spp., *Trigloporus lastovisa, Uranoscopus scaber, Pagrus pagrus* and *Merluccius merluccius*.

Data and parameters
The biological data used were collected within the framework of the Cyprus National Data Collection Programme, according to EC Data Collection Regulation. Data used were length composition of landings per gear, official landings data and biological parameters from age reading. The data covered a period of 5 years (2005-2009).

Assessment method
The assessment of this stock has been carried out by means of LCA and Y/R analysis (VIT) on a mean pseudo-cohort for the period 2005-2009. The stock assessment was performed during the Working Group on Demersal Species of the SAC-SCSA meeting (October 2010).

Results
Current YR = 18.71
Maximum Y/R = 39.52
$Y/R_{0.1} = 37.96$

$F_{max} = 0.17$
$F_{0.1} = 0.11$

Stock status
Preliminary assessment.

Advice and recommendation

Preliminary assessment.

Discussion
The group spotted some abnormalities in the fishing mortality rates for some length classes and showed doubts about the robustness of the assessment.

The group underlines the need to re-perform the assessment, focusing on the next points:
- Check equilibrium in the fishery from residuals of length frequencies by year before using VIT (VIT assumes equilibrium).
- Catch weight should be compared to weight from L-W relationship.
- Age readings should cover all length classes.
- Should try different values of t_0 (sensitivity analysis)
- Recalculate Terminal F by sensitivity analysis (thumb rule: value similar to M).
- Avoid working with lengths - slice length data to ages.
- Try to replace the last age classes with a plus group, especially where some classes are missing from the catch.
- Check for any subdivisions of each fleet (gear) that target different parts of the stock (case of abnormal trend of total fishing mortality).

- The WG considers the assessment as preliminary.

GSA09 *Pagellus Erythrinus.* Ligurian and North Tyrrhenian Sea
(By Alvaro Abella)

A preliminary assessment of the common Pandora was presented. Considering the available data, the non-equilibrium estimator for Z of Gedamke and Hoenig was used and the Y/R analysis for estimating the reference point $F_{0.1}$ and F40%SSBo. According to the uncertainty derived by the quality of data, the WG decided to not accept such assessment and invite authors to improve the data quality in order to perform a more robust analysis. Moreover, the group, after observing discrepancies between authors on the surviving fraction of the Spawning Stock Biomass considered as a sustainable minimum, stressed the need of deciding if it is advisable certain percent of the pristine SSB to be used as a reference value for the assessment of the status of the stocks.

GSA25 *Pagellus erythrinus.* Cyprus

(By Nikolas Michaelides)

The fishery

Common pandora in GSA 25 is exploited by the artisanal fishing fleet, using set nets (basically trammel nets) and the bottom otter trawlers. The artisanal fleet consists of 500 boats between 6 and 12 meters in length. Artisanal fishery in GSA 25 is a multi-species fishery. Accompanying species in the artisanal catches are *Sparisoma cretense, Mullus surmuletus, Mullus barbatus, Octopus vulgaris, Sepia officinalis, Serranus cabrilla, Scorpaena spp.*, Labridae, *Diplodus* spp., *Boops boops* and *Siganus* spp.

Since 2006 the number of licensed bottom trawlers operating in GSA 25 has been reduced from 8 to 4. The trawl fishery in GSA 25 is also a multi-species fishery. Accompanying species in the trawl catches are *Spicara smaris, Boops boops, Mullus surmuletus, Mullus barbatus, Octopus vulgaris, Loligo vulgaris, Sepia officinalis, Eledone moschata, Octopus macropus, Pagellus acarne, Serranus cabrilla, Synodus saurus, Scorpaena* spp., *Trigloporus lastovisa, Uranoscopus scaber, Pagrus pagrus* and *Merluccius merluccius*.

Data and parameters

The biological data used were collected within the framework of the Cyprus National Data Collection Programme, according to EC Data Collection Regulation. Data used were length composition of landings per gear, official landings data and biological parameters from age reading. The data covered a period of 5 years (2005-2009).

Assessment method

The assessment of this stock has been carried out by means of LCA and Y/R analysis (VIT) on a mean pseudo-cohort for the period 2005-2009. The stock assessment was performed during the Working Group on Demersal Species of the SAC-SCSA meeting (October 2010).

Results

Current YR = 20.97
Maximum Y/R = 24.66
$Y/R_{0.1}$ = 23.38
F_{max} = 0.37
$F_{0.1}$ = 0.22

Stock status

Preliminary assessment.

Advice and recommendation

Preliminary assessment.

Discussion

The group spotted some abnormalities in the fishing mortality rates for some length classes and showed doubts about the robustness of the assessment.

The group underlines the need to re-perform the assessment, focusing on the next points:
- Check equilibrium in the fishery from residuals of length frequencies by year before using VIT (VIT assumes equilibrium).
- Catch weight should be compared to weight from L-W relationship.
- Age readings should cover all length classes.
- Should try different values of t_0 (sensitivity analysis)
- Recalculate Terminal F by sensitivity analysis (thumb rule: value similar to M).
- Avoid working with lengths - slice length data to ages.
- Try to replace the last age classes with a plus group, especially where some classes are missing from the catch.
- Check for any subdivisions of each fleet (gear) that target different parts of the stock (case of abnormal trend of total fishing mortality).

- The WG considers the assessment as preliminary.

GSA26 *Pagellus Erythrinus*. South Levant Sea

(By Sahar Mehanna)

Fishery

The trawl fishery in the Egyptian Mediterranean GSA 26 contributed about 33% of the total fish production from Egyptian Mediterranean. It is a multispecies fishery targeting a number of commercial important fish species; red mullet, soles, triglid fish, breams, lizardfish, snappers, barracuda and elasmobranches. Invertebrates are represented by shrimp, cuttlefish, squid, crab and bivalves. The number of trawlers operated in the area ranged between 1100 and 1500 during the period from 1990 to 2008. The vessel length varied between 18 and 22 meter and its width varied from 4 to 6 meter. Each vessel is powered by main engine of 100 to 600 hp. Some of them are equipped with echo-sounders.

Porgies (family: Sparidae) are among the most abundant demersal fishes inhabiting the Egyptian Mediterranean. They represented by more than 10 species exploited by more than one fishing gears and contributed about 7% of the total Mediterranean catch. *Pagellus erythrinus* is one of the most popular food fish in the area and exploited by the bottom trawl fishery. The annual catch is about 250 ton which gives income of about 3.8 million LE annually (Mehanna and Fattouh, 2009).

Data and parameters
Based on the biological samples from the commercial catch, the stock of common pandora was assessed. Length frequency of two years was used (2007-2008). Based on scales' readings, the age was determined and the growth parameters (K, L∞, and t0) were estimated. M was estimated according to Djabali et al. (1993). The general power equation (W= aLb) was applied to estimate the length-weight relationship. Maturity ogive was fitted using the biological samples.

Growth parameters
L∞	33.4 cm TL
K	0.37 year-1
t0	-0.23 year
Length-weight relationship	
a	0.0096
b	3.1181
Natural mortality	
M	0.46

Assessment method
LCA, VIT, Y/R, Excel sheets

Results
VIT results
Current YR	32.39
Maximum Y/R	33.4
$Y/R_{0.1}$	26.34
Fmax	0.57
$F_{0.1}$	0.34
Current B/R	74.48
Maximum B/R	207
$B/R_{0.1}$	115.96

The VPA was done using different vales for terminal F to choose the most appropriate value for this stock.

Also, Yield per recruit analyses using Beverton and Holt model (1957) gave Fmax= 0.55 and $F_{0.1}$= 0.33 (the estimated current F was 0.83)

Stock status
Overexploitation situation with high fishing mortality

Advice and recommendation
It is recommended that fishing effort must be controlled and decreased. The available assessment suggests a target reference point of about 40-60% of the current effort. Defining nursery areas of important species should be taken into account for recommending closed areas. Also, improving the fisheries data recording system and facilitating data and information exchange are highly recommended.

Discussion

The assessment suggests an overexploitaion condition and suggests as necessary a reduction on F. The WG endorsed the assessment and recommendations.

GSA03 *Pagellus bogaraveo*. Southern Alboran Sea

(By Sadia Belcaid)

Cette étude est rélisée avec l'appui du projet Copemed II. Elle a pour objectif l'évaluation de ce stock partagé entre le Maroc et l'espagne.

Fishery

Le *Pagellus bogaraveo* du Détroit de Gibraltar est une sparidé à haute valeur économique, elle forme un stock partagé entre le Maroc et l'Espagne.

Ce stock est exploité par une flottille composé de 204 palangriers, dont 99 palangriers attachés aux ports de Tarifa et Algesiras en Espagne et 104 attachés au port de Tanger, et environ 435 canots opérationnels aux différents sites de la pêche artisanale du détroit de Gibraltar des côtes marocains. Le principal engin de pêche utilisé est la palangre de fond à hameçons. La capture totale en cette espèce est de 401 tonnes (82% de la capture vient de l'Espagne (soit 330 tonnes) et 28% du Maroc).
La taille commerciale adoptée est de 33 cm (longueur totale).

Data and parameters

Les données utilisées sont la moyenne des fréquences de taille de la période 200 -2007, collectées auprès des débarquements commerciales des palangriers des deux pays. Alors que les paramètres biologiques utilisés (croissance et mortalité) sont ceux estimés par J. GIL Herrera, 2010 (doc Copemed). La Fterminal adopté est 0,5.
Les fréquences de tailles du Maroc ont été collectées en longueur à la fourche alors que les paramètres espagnols sont collectés en longueur totale. Une transformation des tailles marocaines de la longueur à la fourche à la longueur totale a été réalisée par la relation estimée par Czerwinski *et al.* (2008): FL=-0.731 + 0.910*TL.
Les deux séries de fréquences de taille sont testées par le test statistique K-S (Kolmogorov - Smirnoff); et puis sont combinées et introduites comme impute pour les analyses d'évaluation.

Assessment method

Les trois approches alternatives d'évaluations utilisées sont: LCA, VPA et Y/R en utilisant le logiciel VIT (Lleonard et Salat, 1997). Le Model de VIT est basé sur la moyenne des fréquences de tailles des trois années ; 2005, 2006 et 2007.
Ces analyses sont tournées dans l'objectif d'estimer des limites et des points de référence, tels que, Fmax et F0,1.

Results

Current YR	46,496
Maximum Y/R	46,529
Y/R $_{0,1}$	42,999

F_{max}	0,37
$F_{0.1}$	0,18
Current B/R	139,069
Maximum B/R	147,541
$B/R_{0.1}$	243,649

Stock status

Si on se réfère à Fmax (0, 37), le modèle de rendement par recrue montre une plein exploitation de l'état du stock. Mais si référent on se réfère à F0, 1 (0,18), le modèle Y/R montre que le stock est surexploité. Le principal problème des courbes à sommet plat est la difficulté de définir la valeur Fmax qui n'est pas actuellement considéré comme référence de précaution parce que si l'effort de pêche augmente le courbe du Y/R ne montre pas d'augmentation alors que la courbe du SSB/R montre une diminution.

Et comme la valeur $F_{0.1}$ est généralement adoptée. Donc, en conclusion le stock est surexploité.

Advice and recommendation

Diminuer l'effort de pêche (nombre de bateaux).
Avoir la même mesure de gestion dans les deux GSA.

Standardiser les méthodes d'échantillonnage entre le Maroc et l'Espagne.
Maintenir l'évaluation conjointe.

Discussion

Renforcer l'échantillonnage biologique de cette espèce dans le but de couvrir toutes les catégories de tailles débarqués dans les sites de débarquement et avoir des informations sur la distribution des juvéniles.

The WG endorsed the assessment and recommendations. However, it was requested to estimate the importance of the catches of juveniles that occur in more shallow areas by trawlers in order to improve the assessment in the case such removal be assessed as not negligible.

Session 3. Assessments related works

GSA06 *Corallium rubrum.* Northern Spain

(By Georgios Tsounis)

Fishery

The fishery in the studied stock for red coral allows only manual collection harvest by SCUBA divers (as is typical in all the Mediterranean). Most of the harvesters use traditional air SCUBA and work in depths less than 60 m most of the time. The number of dives per year using mixed breathing gasses in 60 - 130 m is very low (Tsounis et al.

2007). Poachers outnumber legal divers and seem to work exclusively shallow, without respecting size limits.

Licensed harvesters are allowed to work during summer only, and to harvest a 400 kg quota per year. The minimum size in Spain is 7 mm of base diameter. There are usually about 10-12 licenses active. Size of landed coral is not recorded, and stock assessment surveys were conducted in 1986 and 2003.

Data and parameters
Population size structure, obtained through fishery independent survey (Tsounis et al 2007). Growth rates, by correlating number of growth rings with colony diameter (Marschal et al. 2004). Total mortality value, expressed as the slope of part of the age frequency distribution (Tsounis et al. 2007). Natural mortality value, calculated from the survival rate of recruits in a 22 year experiment using artificial substrate settlement plates (Garrabou & Harmelin 2002; Tsounis et al. 2007). Diameter-Weight curve established through measuring and weighing colonies (Garcia-Rodrigues & Massó 1986).

Assessment method
A fishery independent population survey using photosampling provided total mortality estimates, and allowed to assess the reproductive potential of the population. A weight – diameter relationship from a study on the same stock, as well as natural mortality values and growth rates derived from separate studies were used to produce a Beverton & Holt model that specified MSY (the methodology is described in detail in Tsounis et al. 2007).

Results
89 % of the red corals in the harvested Costa Brava area are less than 10 years old and 96 % of all colonies have not yet grown more than second-order branches. 91 % of the colonies in shallow water populations (< 60 m depth) are not 100 % sexually mature. MSY occurs at ca. 33 years of age, or 21 mm base diameter.

Stock status
Population structure in the study area is extremely young due to over harvesting, reducing the populations' reproductive potential to alarming levels. The size limit of 7 mm corresponds to an age of first harvest that is dramatically lower than age at Maximum Sustainable Yield (MSY).

Advice and recommendation
The following management advises are not the results of the present assessment, are those agreed upon during recent red coral consultation meetings by NOAA, the Italian Government, and the GFCM:

Revision of minimum size limits for each fishery in different geographic regions using scientific models. Until then, a new size limit of at least 10mm base diameter is proposed (which may not be sufficient for all regions due to geographical variation).
Colony height and number of branches should be used as an additional descriptor.
Shallow water populations in practical air diving depth need to be fully protected from harvesting 0-50m or 0-80m.
Set appropriate quotas and number of licenses for deep stocks beyond 60m.

Do not use of new technology (remote harvesting) without prior impact assessment. Improved monitoring of the fisheries, collecting size data of landed corals. Daily control of quotas.

Improved enforcement against poaching.

Establishing permanent no take areas as recruitment reservoirs

Annual revision of management measures in an adaptive management approach

Further research:

Stock assessment prior to harvesting, and ongoing scientific monitoring, especially of deep populations beyond 60 meters: Population structure, abundance and stock size. Studying the use of more advanced models. Robust estimates for factors of use in advanced fishery models: Maximum age, mortality values, growth rates in function of environmental parameters, coral morphology, alternative size descriptors. Size of landed corals. Connectivity of populations. Identification of potential unfished virgin populations (biodiversity hotspots). If such populations exist, a fraction of them should be protected, for example, as UNESCO World Heritage Sites. These sites would serve as a base line reference for scientific research.

Discussion
Author's comments:
This assessment relies most of all on a thorough survey of the population structure in 0-60m depth. Using parameters from various studies, including growth and mortality values from studies on other populations, a Beverton & Holt model could be applied. Abundance of corals in the study area and total stock size and therefore yield recommendations are not very reliable, due to the extreme patchy distribution of red coral. However, the age at MSY is an important and more useful result. Another issue is the extremely geographical variation of growth rates, dependent on environmental conditions in different locations.

Depending on what parameters are trusted and chosen, MSY occurs at an age between 33-98 years. The most probable combination of parameters (low growth, and low mortality) results in a MSY of colonies that are of 21 mm base diameter. The weaknesses of the model are precise estimates of mortality and growth rates over the entire (unknown) life span of this species. However, even after discarding the extreme values, and even accounting for a margin for error, it becomes obvious that the current harvesting limit of 7 mm is not adequate. Conversely the fishery in Sardinia stared using 10 mm as a minimum size.

However, morphology varies according to environmental conditions, thus it is difficult to specify precise a minimum harvest size in terms of basal diameter for the whole Mediterranean. Instead, number of branches is likely to become a more practical and universal descriptor for proper management, given further research in this direction. It may not be that well correlated to age, but is more relevant ecologically in a colonial organism, enabling managers to more reliably predict the reproductive potential of the population.

Given that dredging was practiced for centuries until 1994, it can be assumed that populations down to 180 m depth have not yet significantly recovered. The species has been found in 5-800 m depth, but is considered more common in 50-200 m.

Some few isolated hotspots of biodiversity might exist in sheltered in topographically locations of the Mediterranean, such as submarine canyons that are too deep for divers and difficult to access by dredges. These should be protected as reference populations for research and patrimony of biodiversity.

Finally, current management considerations and models do not consider the species' role as ecosystem engineer increasing productivity and diversity of its habitat.

Working group discussion

The WG highlight the interest of this kind of stock assessment dealing with coral.
The WG discuss the methodology adopted in the study of Coral stock, particularly the use of the Von Bertalanffy model to study the growth of such as sedentary species. Also the WG discuss the adequacy to use the Beverton and Holt model to assess the coral stock due to a lot of assumptions (constraints) (recruitment must be continual and constant, the use of the VB growth parameters, length-weigh relationship must be isometric, M must be constant, ….). It seems that given the type of data this was the only applicable method.

The group advises the author to use the techniques regularly used for deep sea resources.

The group considers the assessment preliminary.

GSA9 Bycatch species of *Norway lobster* fishery

(By Alvaro Abella)

It was performed an assessment of the sustainability of by-catch species in the Norway lobster fishery. The fishery utilises bottom trawl nets with very low vertical opening and small mesh size at the cod end. A quantitative stock assessment is not feasible in this case because there is a general shortage on the historical and biological information on those species. As an alternative, the assessment of the sustainability of the by-catch species was done using the software PSA (Productivity and Susceptibility Analysis) aimed at examining the impact of the Norway lobster fishery on the fishery's by-catch.

The species were ranked with respect to their importance in the catches and commercial interest and assessed as regards their level of susceptibility to be captured with the consequent mortality impact and on their capacity to recover after depletion based on considerations on productivity. The status of each species related to these characteristics determined its relative capacity to sustain different levels of fishing pressure.

The analysis was done for the 15 species that represent about the 85% of the total landings of the fishery in weight. The analysis has shown that the stocks considered least likely to be sustainable were *Galeus melastomus, Merluccius merluccius* followed by *Phycis blennoides, Lepidorhombus bosci, Helicolenus dactylopterus.* These stocks

show a benthic or bentho-demersal behaviour and a low turnover, and hence they are more vulnerable to the used gear and are less productive. On the other hand, *Lepidopus caudatus* and *Trachurus trachurus* are pelagic species that often swim above the head rope, and so being the species with major potential capability to sustain the current level of effort of the fleet, followed by the three stocks of cephalopods.

Discussion
The WG considers that approaches as PSA (Productivity-Susceptivity Analysis) presented and discussed in the WG can be useful when we deal with multispecies fisheries, especially for the assessment of the risk of collapse of the stocks that constitute the by-catch of the different fisheries. In situations like in the Mediterranean, where there is a general shortage of biological information and on the impact of fishing activity on most of the species, such approach, as other similar used in other areas, can be useful for giving advice on which species are more vulnerable and that need a major attention (data collection, assessment, management measures, etc) by scientists and managers.

Session 4. Crustaceans and hake in GSA 18

GSA18 *Merluccius merluccius*. Southern Adriatic Sea
(By M. Teresa Spedicato)

Assessment performed within the framework of an AdriaMed Project Activity.

Fishery
Merluccius merluccius is a high-score priority species in the Geographical Sub Area 18 that remarkably contribute (around 4100 tons in the western side) to the fishery production. This is mainly based on trawlers (71% of the landings in the western side) and to a lesser extent by small scale fisheries using nets and bottom long-lines. According to Osmani et al. (2003) the production from the west side account for about 97% of the total production of the whole GSA18.

Data and parameters
The data used in the analyses were from the trawl surveys conducted in the whole GSA. Time series of Medits abundance indices by size (from 1996 to 2009 for Italian and Albanian coasts and 2008 only for Montenegro) were used and structure of landings of the west side of 2009 by fleet (data from the EU Data Collection Framework, DCF).

In the DCF framework the growth has been studied ageing fish by otolith readings. Length frequency distributions were also analyzed using techniques as Batthacharya for separation of modal components.

The estimates of von Bertalanffy growth parameters were obtained for sex combined from average length at age using an iterative non-liner procedure that minimises the sum of the square differences between observed and expected values.

Two scenarios of growth rate were tested for sex combined: the slow (L_{inf}=96 cm, K=0.129, t_0= -0.73) and the fast growth pattern (L_{inf}=104 cm, K=0.2, t_0= -0.01) scenarios, to account for uncertainty in life history profile of European hake.
Natural mortality was assumed variable at age, according to the Caddy and Abella paradigm (Abella et al., 1997),

Assessment method

We applied a suite of models and methods to face the uncertainty in the estimation process, hence the assessment was conducted using SURBA, ALADYM and VIT models in a complementary way.

Estimates of total mortality and recruitment from SURBA were used to feed ALADYM model with a hindcasting approach. ALADYM routines re-estimated the total and fishing mortality using the whole information on the population parameters and a simulated exploitation pattern from the fishery. To simulate this pattern the selectivity of the fleet was approximated using an ogive model with the following parameters: Lc=12cm; selection range (SR) 1 cm. This was coupled with a deselection ogive with 50% deselection size at 40 cm and a deselection range of 1 cm, to account for possible avoidance/reduced availability of older fish (Abella and Serena, 1998). Also the coefficient of monthly activity of the fleet was considered in the simulation.

VIT model was applied for validation purposes, to get an approximate estimate of the fishing mortality, the level of magnitude of recruitment and an indicative estimate $F_{0.1}$.
A simulation was also performed to forecast the possible effects of the newly enforced mesh size regulation (from 40 mm to 50 mm diamond mesh opening in the cod-end) on stock biomass, catches and other relevant population indicators in the medium-term.

Results
Fcurrent(year) = 0.57-0.58
$F_{0.1}$=0.2
Fmax=0.3

Stock status
Overexploited, High fishing mortality.

After the exceptional peak of recruitment observed in 2005, the recruit abundance reached comparable levels as in the years before 2005. However, given the results of the present analysis, the stock of hake appears overexploited since the current fishing mortality is higher than $F_{0.1}$ and Fmax. Thus a fishing mortality reduction is necessary in order to avoid future loss in stock productivity and landings.

Advice and recommendation
A more sustainable exploitation in the long-term can be partly achieved following the newly enforced regulation on the mesh size. The forecast regarding this technical measure evidenced poor lost for the catches in the short term and a stable situation in the future when the present levels of catches should be maintained if the fishing pressure will not be increased.

In addition, the higher average size of catches would increase of about 20% resulting in more valuable yields. However, given the uncertainty of the effectiveness of mesh size regulation, especially regarding fish survival, spatial and temporal management measures could valuably complement such technical measure.

Advice for scientific research: Supporting of tagging experiments of hake in different Mediterranean areas to improve knowledge on the species growth at larger scale. Introduce a second annual scientific survey campaign in autumn to improve temporal resolution of survey data, in particular data on recruitment and mortality.

Discussion
The WG discuss the use of the slow or fast growth parameters to assess the hake stock. It recommends proceeding usually with a sensitive analysis based on the growth parameters and analyze if they impact or not the result on stock status. The WG highlight that for this assessment, the out puts of SURBA are better than those coming from VIT (only one year data). The results from VIT are used as indicative.

The WG endorses the assessment and the recommendations.

GSA05 *Aristeus antennatus.* Balearic islands

(By B. Guijarro)

Fishery
The number of vessels was reduced from the initial census in 1992, which for the deep water shrimp fishery fleet was estimated in 49 trawl vessels, while the Fishing fleet census in 2008 was 34 trawl vessels, for the whole GSA 5 area. Annual landings in the Mallorca Island in nineties (1992-1999) were around 200 tonnes and were produced by a total effort of between 3500-4400 fishing days*vessel (number of days*vessel). From 2000 years landing arise around 150 tonnes and total effort between 3200-4200 fishing days, with a mean value of 3900 trips at year.

Data and parameters
Size composition of commercial trawl catches and official landings, CPUE data from survey and commercial fleet.

Growth parameters from L/W and Age/L relationships from Carbonell et al. (1999)

Assessment method
LCA-Pseudochohort and Y/R, VPA- Separable Virtual Analysis and XSA- Extended Survivor Analysis. It was run a single VPA of males and females combined, using VPA package. The male and female length distributions for year (1992-2009) were split using L2Age, slicing ICES package to ages. The catch-at-age for the two sexes was then summed to do a separable VPA and XSA for Sex combined data. Effort in days represents effort by trip. Tuning data series was made using the Palma harbour reference fleet, and BALAR_MEDITS trawl surveys

Results
The comparison between VPA and XSA of 2008 and 2009 assessments showed small differences with continuous slight decreasing values for the Spawning Stock Biomass,

while Fishing mortality shows a slight increasing trend for recent years. Correlation coefficients for regression points of the XSA catchability model were very low (close to 0) which make difficult to fit catchability model. The slopes of regression model are not significantly different from 1 for ages 0 and 4 (no direct proportionality) and slopes are negative for ages 1-3 (with the meaning of increasing catchability with decreasing population abundance).

Yield per Recruit analysis were made for the average size distribution landings by sex for the years 2000-2009, assuming the current steady state exploitation pattern. Results of equilibrium Y/R and SSB/R estimated the current exploitation close to the maximum. Yield per Recruit curves the predicted small long-term gains upon a reduction of current F at $F_{0.1}$ would be 54% of the current. Pseudocohort Yield per Recruit analysis, using 2000-2009 average size distribution by sex. (VIT software).

Fcurrent= 0.618 Fmax= 0.767 $F_{0.1}$= 0.334

Status of the stock
Overexploited, Moderate fishing mortality, Low abundance.

Advice and recommendation
To reduce fishing mortalities by 30% to 50% which can be achieved with reducing effort capacity and improving the selection pattern of the fishery. Implementing area closures for fishing in the nursery areas during the recruitment period.

Discussion
XSA should be performed separately for males and females, joining the final results and comparing them with a XSA performed with sex combined.

Sensitivity analysis should be performed for both k and M simultaneously.

It is necessary to check the consistency between M and k: when parameters for both sexes are considered, k refers to females and M to males. In this sense, growth parameters should be reviewed.

The parameterization of the XSA model may have an impact on the results obtained. To identify the extension of such decisions, further work must be done to explore different parameterizations of the model (*e.g.* the contribution of each tuning fleet in the model) and run sensitivity analysis on its effects.

The WG endorses the assessment and the related recommendations.

GSA03 *Parapenaeus longirostris*. Southern Alboran Sea
(By Sadia Belcaid)

Fishery
The activity of the demersal fishery in the Mediterranean is important in Moroccan socio-economic. The landings of this activity take place at 7 ports and 86 artisanal fishing   sites.

The fishing fleet in the region is mixed. It consists of trawlers, longliners and artisanal

boats. The deep pink shrimp is exploited by the trawlers; the number of trawlers operating in the Mediterranean in Morocco amounted to 121.

The annual total production of this fishery has averaged 17,011 tons (2009) for an average of 117 million dirham. The main species targeted by these fisheries are Parapenaeus longirostris, pagellus acarne, Mullus sp, Merluccius merluccius, boops boops, Octopus vulgaris, Trachurus trachurus, cuttlefish, Pagelus commun. These species represent approximately 84% of the catches of demersal.

The data of catch and effort used are the official data collected between 2000 and 2009. Noting that, the National Office of Fisheries (ONP) was established since 2003 the MAIA system, this system is the performed for data capture and archiving.

In the last ten years the average annual production in Parapaneus longirostris is 574 tons, also the evolution of his capture mounts a decrease from 2000 until 2006, after, it mark a slight increase until 2009. In 2009, production in prawn represents 5.5% of the total production of the demersal fishery.

The evolution of fishing effort shows a trend towards an increase in fishing effort between 2000 and 2002, followed by a slight decrease between 2003 and 2006 and increase again to wait 12705 fishing trips in 2009.

The trend of abundance index during the period 2000 to 2006 shows a steady decline, going from 111 kg to 26 kg per fishing trip, to borrow again in a slight increase to wait 47 kg / fishing trip.

Data and parameters
Catch - effort - CPUE trawl coastal fishery (Officiel data from ONP and data from INRH).

The stock of Parapenaeus longirostris was assessed by the Dynamic Schaeffer Production Model. The model uses a basic parameters: virgin biomass K, Growth rate of the population r, Initial appauvrissement D (initial biomass corresponding to K). In order to give a better assessment of MSY, BMSY et FMSY, the model calculate the reference points Bratio = (the ratio between the biomass estimated for the last year of the data and BMSY), and Fratio = (the ratio between the fishing mortality for the last year and the fishing mortality which should produce a sustainable catch for the same year).

Assessment method
Dynamic production Schaefer model using dynamic CECAF Schaefer model (FAO, CECAF Schaeffer production model, 2007).

Results
B/B0,1= 17%
Fcur/F0.1 = 392%
Fcur/FSYCur = 353%
References points : B0,1=1627

The results show that the model fitted well with the CPUE used (coastal fishery). The current Biomass represents only 17% of the target Biomass $B_{0.1}$. The current fishing effort is 392% upper than the target fishing mortality $F_{0.1}$ and 353% higher than the current sustainable fishing mortality (see results and graphs).

Status of the stock

Overexploited, High fishing mortality, Low abundance.

Advice and recommendation

The current biomass represents only 17% of the target Biomass. The current fishing mortality is under the sustainable fishing mortality by 36% and exceeds the target fishing mortality by 392%. The abundance indices observed during surveys indicate a decrease of this resource
This result shows that the stock of *Parapenaeus longirostris* is overexploited.

It was recommended to decrease the fishing mortality by 60-80%.

Discussion

The model is fitted well adjusted. Schaefer model was the only method which could be used (one year of length frequencies).

The group underline that this stock is a shared stock but with partial data (Spanish and Algerian data not included) and that there is a necessity of performing a joint assessment between the different partners.

The WG recommend extending the assessment of the *Parapenaeus* stock including the data from other adjacent areas (Spanish and Algerian areas).

The WG endorses the assessment and the related recommendations

GSA05 *Parapenaus longirostris*. Balearic Islands

(By Beatriz Guijarro)

Fishery

In the Balearic Islands (GSA 5), commercial trawlers employ up to four different fishing tactics (Palmer et al. 2009), which are associated with the shallow and deep continental shelf, and the upper and middle continental slope (Guijarro & Massutí 2006; Ordines et al. 2006). Vessels mainly target striped red mullet (Mullus sumuletus) and European hake (Merluccius merluccius) on the shallow and deep shelf respectively. However, these two target species are caught along with a large variety of fish and cephalopod species. The Norway lobster (Nephrops norvegicus) and the red shrimp (Aristeus antennatus) are the main target species on the upper and middle slope respectively. The Norway lobster is caught at the same time as a large number of other fish and crustacean species, but the red shrimp fishery is the only Mediterranean fishery that could be considered monospecific. The pink shrimp is caught as a by-catch in the upper slope.

Data and parameters

The information used for the assessment of the stock consisted in annual size composition of catches (estimated from monthly sampling) and official landings for the period 2001-2009. Biological parameters used were obtained in previous studies in this area (Guijarro et al., 2009). The vector of natural mortality by age was calculated from Caddy´s formula, using the PROBIOM Excel spreadsheet.

Assessment method

The methodology applied was: (i) a tuned virtual population analysis (VPA), applying the Extended Survivor Analysis (XSA) method on the period 2001-2009 and considering bottom trawl surveys (2001-2009) as tuning fleet; and, (ii) a yield per recruit (Y/R) analysis based on the exploitation pattern resulting from the XSA model and population parameters for the entire period. The software used was the Lowestoft VPA program and Excel.
Model performance
Residuals showed some trends for some of the ages. Retrospective analysis under-estimated F. For these reasons, the assessment is not very strong and there is certain uncertainty.

Results

The results showed a clear decreasing trend in SSB, total biomass and recruitment, although it seems that during last two years there is a certain recovering.
Fref= 0.82; Fmax= 1.64; F0.1= 0.31

Stock status

Overexploited.

Advice and recommendation

The problems found with the residuals and the retrospective analysis makes not possible to provide a full management advice.

Discussion

It should be considered the possibility to apply different assessment models, like production models.

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

Although the stock is overexploited, it is important to remark than the CPUEs (both from surveys and commercial fleet) oscillations found for this species are in agreement with other areas in the Mediterranean and probably caused not only by the fishing effort but also by environmental changes. For this reason, it is important to follow the evolution of this stock, especially because it seems it has started to recover during the last two years. It is also important to consider that pink shrimp in GSA 5 is only caught as a by-catch in the trawl fishery and a management of this species should be undertaken in the framework of a multispecific approach.

The WG notes that the stock is overfished, the survey gives a very low biomass (for a short time series) and the stock status is not very clear estimated. So, the WG, didn't

trust the overall figure of the stock status, can't suggest an available value to reduce the actual fishing mortality.

The WG endorses the assessment as a source of general information's on the stock.

GSA06 *Parapenaus longirostris*. Northern Spain

(By José Luis Pérez Gil)

Fishery

Deep-water pink shrimp (Parapenaeus longirostris) is one of the most important crustaceans species for the trawl fisheries developed along the GFCM geographical sub-area Northern SPAIN (GSA-06). This resource is an important component of commercial landings in some ports of the Mediterranean Northern Spain and occasionally a target specie of the trawl fleet, around 260 vessels, which operate on the upper slope. During the last years, a sharp increase in landings was observed, starting in 1998 and reaching the maximum value in 2000, followed by a decreased trend during the period 2001-2004. During de period 2005-2009 stabilization in catches is observed whit an average of 110 t for this period. In 2009 the annual landings of this species amounts 116 tons in the whole area.

Data and parameters

The state of exploitation was assessed for the period 2001-2009 for the GFCM geographical sub-area Northern Spain (GSA-06).

This methods were performed from size composition of trawl catches (obtained from on board and on port monthly sampling) and official landings (from regional governments) transforming length data to age data by slicing.

Available CPUE data series, both of commercial fisheries, from Santa Pola fleet, and scientific survey MEDITS were used

Assessment method

The state of exploitation was assessed for the period 2001-2009 for the GFCM geographical sub-area Northern Spain (GSA-06). A VPA tunned with CPUE from commercial fleet and abundance indices from MEDITS trawl surveys, was carried out applying the Extended Survivor Analysis (XSA) method (Lowestoft program; Darby and Flatman, 1994) over the period 2001-2009. In addition Y/R analysis and Retrospective analysis was carried out during the same period. Available CPUE data series, both of commercial fisheries, from Santa Pola fleet, and scientific survey MEDITS were used.

Results

Exploitation is based on very young age classes, mainly 2 and 1 year old individuals, indicating a dependence on recruitments. Fishing mortality shows a decreasing trend from 2001 to 2004 but increasing in the 2005-2009 period.

The fisheries of Parapenaeus longirostris in the study area show important inter-annual variations in landings, biomass and SSB. Currents indicators represent a 35%, 59% and 54% respectively of the values observed eight years ago (the highest in the series).The Y/R analysis shows that the Fref (1.37) exceeds the Y/R $F_{0.1}$ reference point (0.30).

Stock status

Overexploited. The fishery is being exploited at above a level which is believed to be sustainable in the long term, with no potential room for further expansion and a higher risk of stock depletion/collapse;

Advice and recommendation

Objectives:
To reduce growth overfishing:
- Reduce the effort of trawl.
- Improve the fishing pattern of the trawl.
Recommendations:
- To reduce effort in trawl 70%

Discussion

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

The WG notes that there are only two picks in length frequency distribution (2001 and 2002). In another hand, the recruitment curve shows that it is stable during all the period of the study. The WG recommend verifying the t_0 value but it didn't have a big effect on the results.

The parameterization of the XSA model may have an impact on the results obtained. To identify the extension of such decisions, further work must be done to explore different parameterizations of the model (*e.g.* the contribution of each tuning fleet in the model) and run sensitivity analysis on its effects.

The WG endorses the assessment and the related recommendations.

GSA9 *Parapenaeus longirostris* fishery

(By Alvaro Abella)

This stock could be strongly driven by environmental and ecological factors (e.g. water temperature, predatory release effect) that can make difficult to evaluate the effect of fishing on the stock.

The WG endorses the assessment and the related recommendations but notes that only the reference points computed by VIT should be considered for management.

GSA12, 13, 14, 15, 16 *Parapenaeus longirostris* Strait of Sicily Tunisia and Malta

(By S. Ben Meriem, F. Fiorentino, M. Dimeck, V. Gancitano, L. Knittweis, O. Jarboui, L. Ceriola, E. Arneri; presented by Leyla Kneitweis)

Assessment performed within the framework of an MedsudMed Project Activity.

Fishery

Sicilian trawlers between 12-24m LOA which target deep water pink shrimp are based in seven harbours along the southern coasts of Sicily. These trawlers (about 250 boats in 2009) operate mainly on a short-distance trawl fishery basis, with trips from 1 to 2 days at sea, fishing on outer shelf and upper slope. The distant trawlers (about 140 boat in 2009), mainly based in Mazara del Vallo 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 (LOA>24m) are employed on long fishing trips (3 – 4 weeks) in offshore waters. These vessels thus operate in both national and international waters in the Strait of Sicily.

In the Maltese Islands 16 small vessels (LOA12- 24m) target pink shrimp at depths of about 600m, with fishing grounds located to the north / north-west of Gozo, as well as to the west / south-west of Malta. Catches are primarily destined for the local market.

About 70 Tunisian vessels fish deepwater rose shrimp primarily in Northern Tunisia, with 90% of the country's total P. longirostris catches originating here. The great majority of these catches are landed in the town of Bizerte.

Data and parameters

Data used in this assessment derived from indirect (fisheries monitoring) sources. Landings data as well as length frequency distributions from Tunisia, Malta and Sicily for the years 2007, 2008 and 2009 were used. Length frequency distributions from Malta were only available for 2009.

The parameters used were an average of growth parameters and length-weight relationships from SAMED (2002) and Ben Meriem (unpublished). Females: $L\infty = 42.705$, $k = 0.67$, $t0 = -0.208$, $a = 0.0029$, $b = 2.48185$. Male: $L\infty = 33.56$, $k = 0.73$, $t0 = -0.13$, $a = 0.00345$, $b = 2.4096$. Combined sex: $L\infty = 44.59$, $k = 0.6$, $t0 = -0.118$, $a = 0.0033$, $b = 2.4572$. The M range between 1.05 (Females) and 1.20 (Males).

Assessment method

The assessment was performed using length cohort analysis (LCA) and yield and spawning stock biomass per recruit (Y/R), as implemented in the packages ANALEN and VIT. Some analyses were also done with the package YIELD. Analyses were performed separately on length frequency distributions of males and females and by keeping fleet segments separate. Biological reference points (BRP) for females were also estimated using the YIELD Package. All the linear parameters were converted in TL (cm), using conversions made by using the relationship reported by Crosnier et al.,(1970): TL (mm) = 3,646+4,436 CL (mm). Probability distribution of F_{max}, $F_{0.1}$ and $F_{SPR0.3}$ were estimated by 2000 simulations, and incertitude was added to all parameters as a CV of 20%.

Current mean F and exploitation pattern were assessed using the steady state LCA by length on LFD of 2007, 2008 and 2009 raised to the total landings. LCA and Y/R values by sex and year were combined to obtain a single value for both the sexes by using an average, weighed by sex ratios. Current fishing mortalities were compared with the optimal ones, identified by $F_{0.1}$. Some management scenarios were also proposed, by different options of different variation of current F of separate operational units operating in the area.

Results

The main assessment results are reported in the following table:

Criterion	Current value	Units	Reference Point
B/R	2.35	g	2.74
SSB/R	1.49	g	1.86
Y/R	2.47	g	2.33
F	1.13		0.90

All biomass and yield values given above are per recruit. A reduction of 20% is thus advised in order to reach the target reference point of $F_{0.1}$. An increase of SSB/R and B/R of 25% and 15%, respectively, was estimated as consequence of this reduction of F. Conversely the decrease of Y/R was estimated of about 5%.

Stock status

Taking into account $F_{0.1}$ as a reference point, the assessment results revealed an overexploited stock, with high fishing mortality and intermediate abundance. However, no risk of depletion was recognised by the working group.

Advice and recommendation

Current fishing mortality should be reduced by around 20% for deepwater rose shrimp in the Central Mediterranean.

A reduction in fishing capacity should primarily target 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 spawning stock biomass, as well as a gain of 6% in sustainable yield for large trawl fleet. However, the fleet of small trawlers would suffer long-term losses around 7%.

A protection of key nursery areas in the Strait of Sicily is also recommended in order to improve the status of this fishery. Stable nurseries of this species have been identified on the Adventure and Malta Banks in the Strait of Sicily (Fortibuoni et al. 2010).

Discussion

The results of the sensitivity analysis showed that a change in M and k has pronounced effect on Y/R when the variation was applied in opposite directions. On the other hand B/R and SSB/R are not strongly affected when the change is in the same direction.

The working group would like to underline the fact that the assessment made use of length cohort analysis to assess the effect of fishing on yield per recruit, a method which assumes equilibrium conditions. In order to increase the robustness of the assessment and thus the management advice, alternative methods such as global production methods / virtual population analysis etc. should be used in the future. Moreover the present work was based purely on data from commercial fishing; the use of survey data to confirm the trends witnessed in commercial data will be an important improvement in the future.

The WG recognize the necessity to perform different scenario of changing fishing effort, selectivity and natural mortality and the obtained result not only in Y/R but also on SSB. The WG suggest giving management advices based on the three years combined stock assessment results. The WG highlight some difficulties to fulfil correctly the SAF (particularly for the component "exploitation rate" (sheet D).

The WG endorses the assessment and the related recommendations.

GSA05 *Norway lobster.* Balearic Islands

(By Beatriz Guijarro)

Fishery

This species is one of the target species of the bottom trawl fishery developed off Mallorca by a fleet of around 40 vessels, being captured on the upper slope, between 350 and 600 m depth, jointly with other by-catch species such as *Merluccius merluccius*, *Lepidorhombus* spp., *Micromesistius poutassou* and *Lophius* spp. Annual landings from 1986 to 2008 fluctuated between 3 and 20 tons.

Data and parameters

Data covered 2002-2009. For that period average annual catches were 10 tons (3.5 for females and 6.5 for males). It has been used monthly size composition of catches by sex, estimated from on board sampling between 2002 and 2009, and official landings (daily sale bills). The biological parameters for both sexes (growth, length-weight and first maturity) were the same than previous assessment of this species in the Catalan Sea (GSA-06; Sardà et al., 1998). Natural mortality was estimated from Pauly's method (1980) and a terminal fishing mortality (F) of 0.36 for females and 0.22 for males were used.

Assessment method

The assessment of this stock has been carried out by means of virtual population analysis (VPA) and yield-per-recruit (Y/R), on a mean pseudo-cohort for the period 2002-2008.

Results

Population numbers for the pseudocohort 2002-2009 were 25 thousands and population biomass was near 35 t.

$F_{current}$= 0.446; F_{max}= 0.634; $F_{0.1}$= 0.295

Status of the stock

Overexploited, Moderate fishing mortality, Intermediate abundance.

Advice and recommendation

Decrease fishing mortality by 20-30% by
      Reducing effort, both in capacity and/or activity
      Improving the selection pattern of the fishery
      Implementing area closures for fishing

Discussion

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

As a general comment, the WG that notes that the sensitivity analysis should be done on the parameters to be needed in making management recommendations as the ratio between $F_{curren}t$ and $F_{0.1}$.

The WG endorses the assessment and the related recommendations.

SUMMARY OF DISCUSSIONS AND GENERAL RECOMMENDATIONS

13. The group performed a first analysis on the consistency of the parameters used for different stocks of the same species in order to look for possible errors and evaluate the consistency between stocks. The results are presented in Figures 3.1-3.8.

14. In general the parameters were consistent within stocks. Some inconsistencies were found, e.g. for *M. barbatus*. The group recommends such differences should be sorted out in the future, but for the purpose of the exercises carried out in this practical session the parameters presented were accepted. In the cases that was possible the group decided to run sensitivity analysis on these parameters.
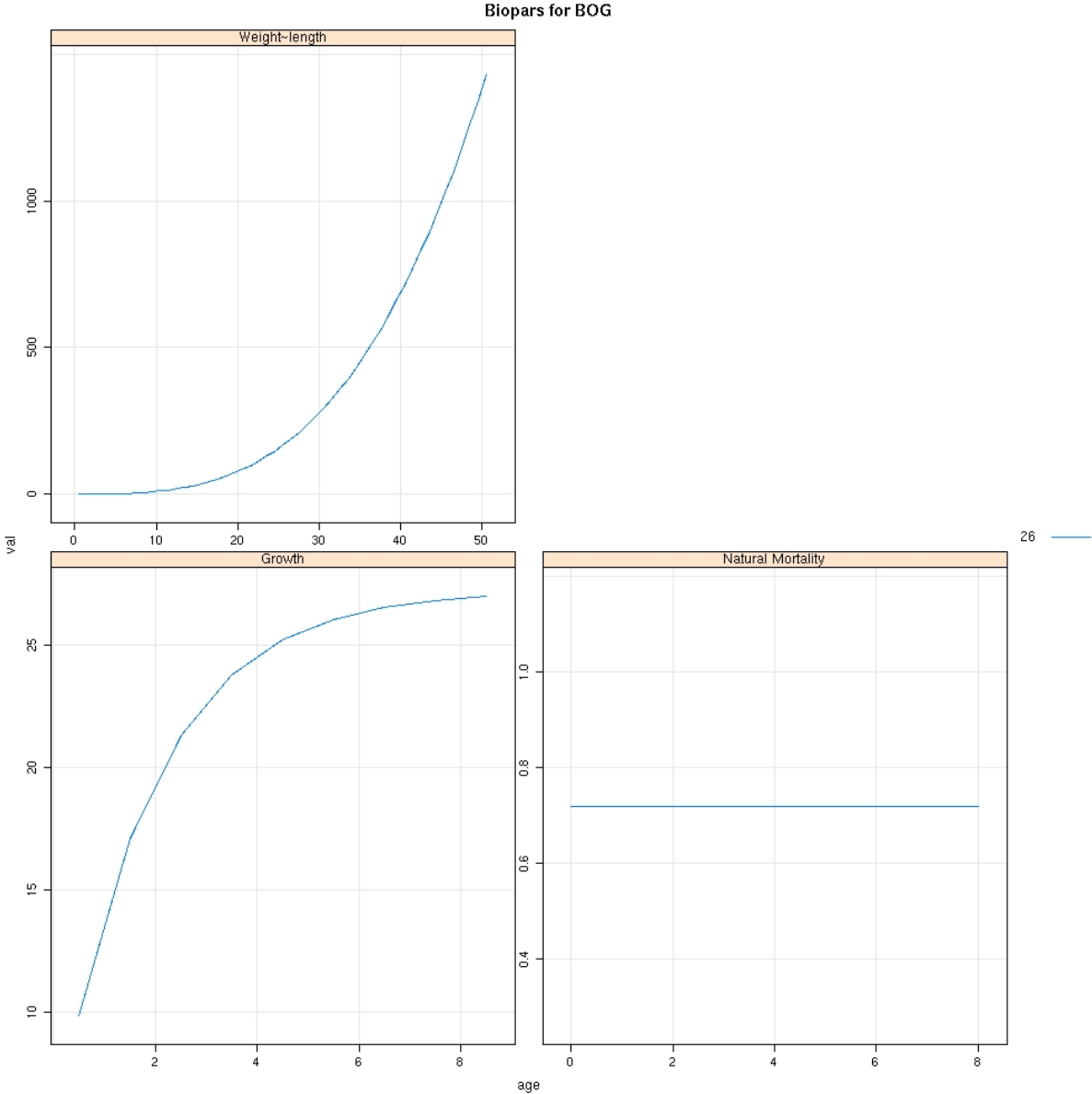
Figure 3.1 – Biological parameters for bogue (Boops boops) by area
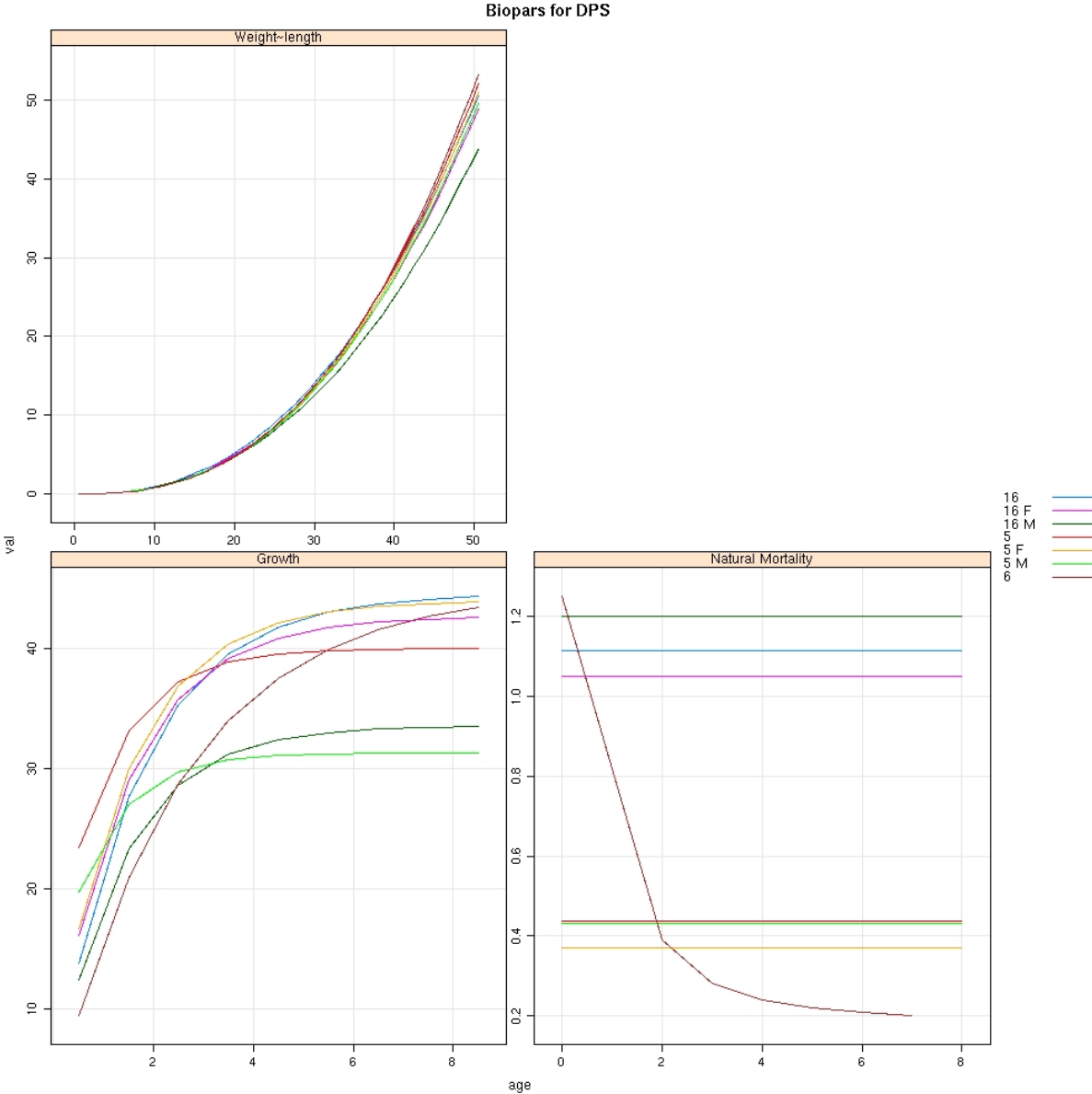
Figure 3.2 – Biological parameters for rose shrimp (Parapenaeus longirostris) by area and sex (M- male, F- female)
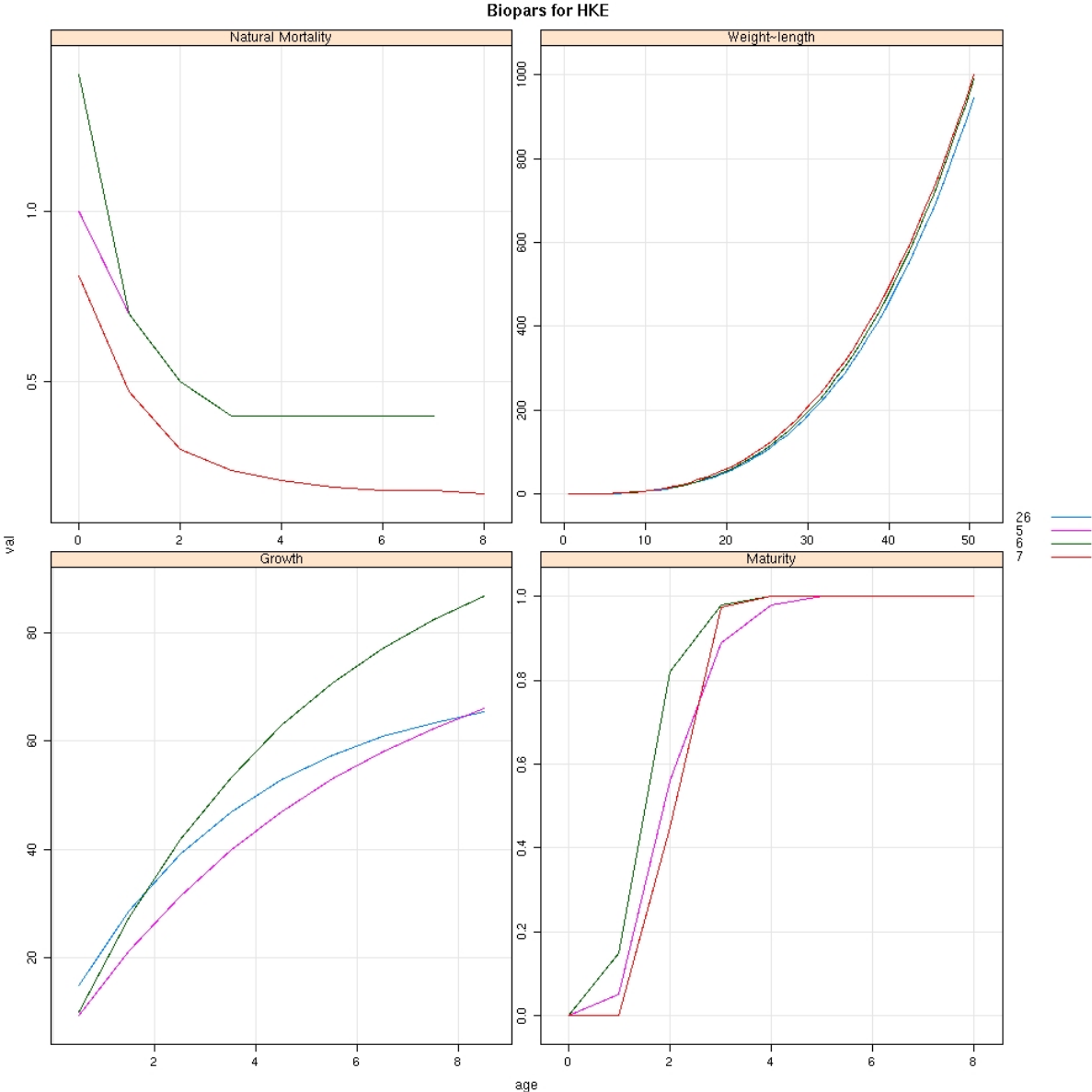
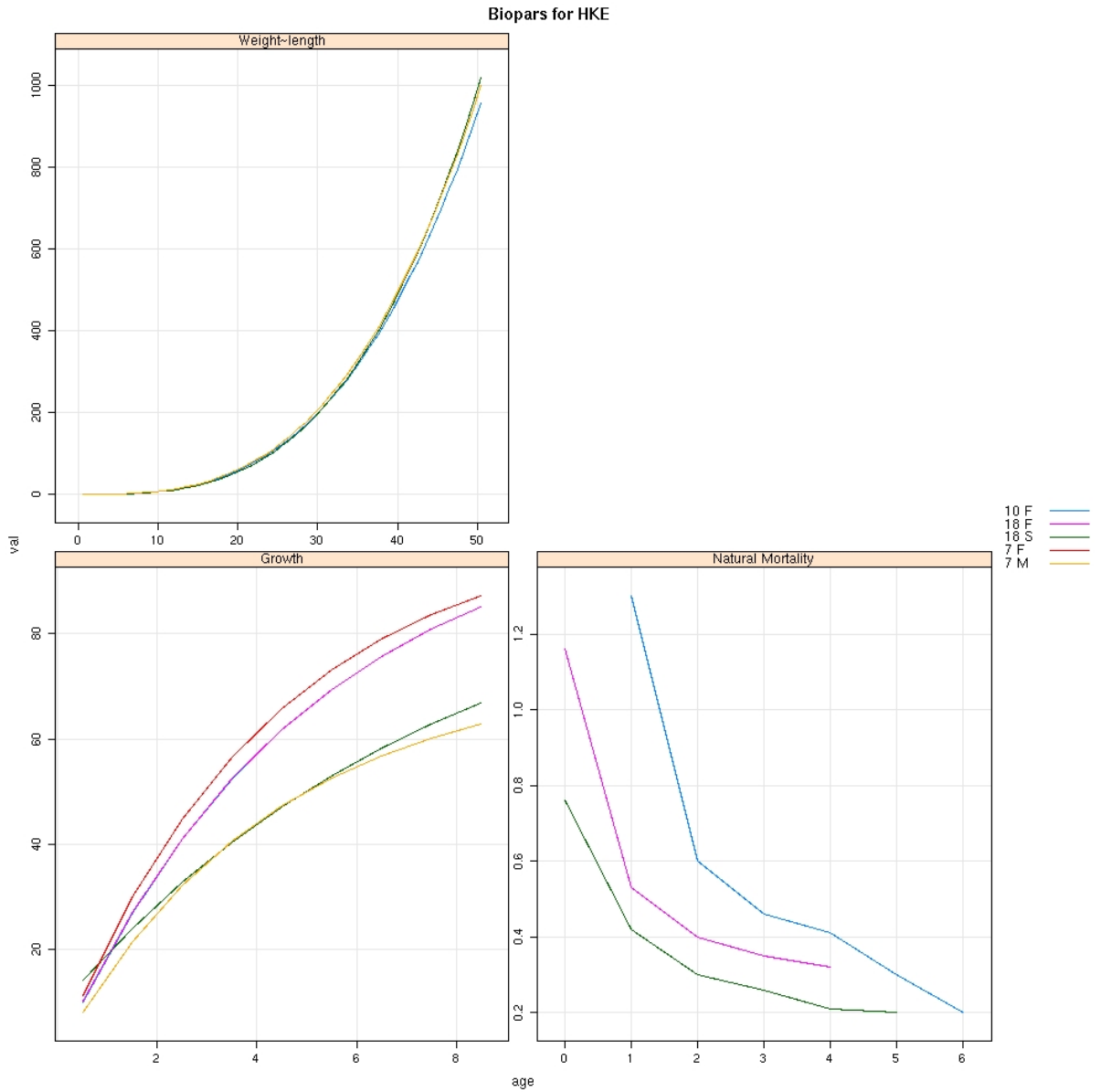*Figure 3.3 – Biological parameters for hake (Merluccius merluccius) by area*

Figure 3.4 – Biological parameters for hake (Merluccius merluccius) by area and sex (M- male, F- female), except in area 18 where S-slow and F-fast growth.
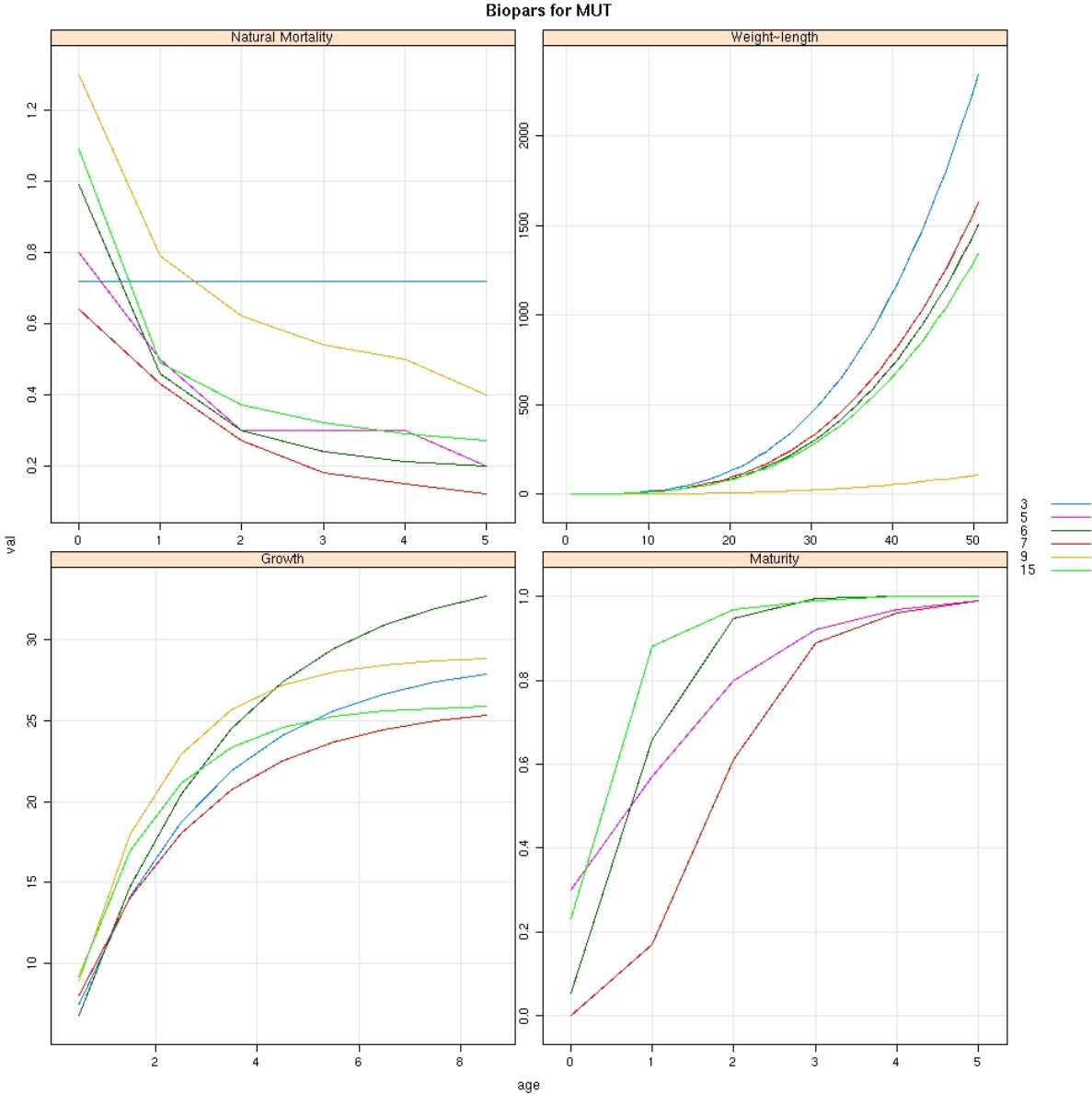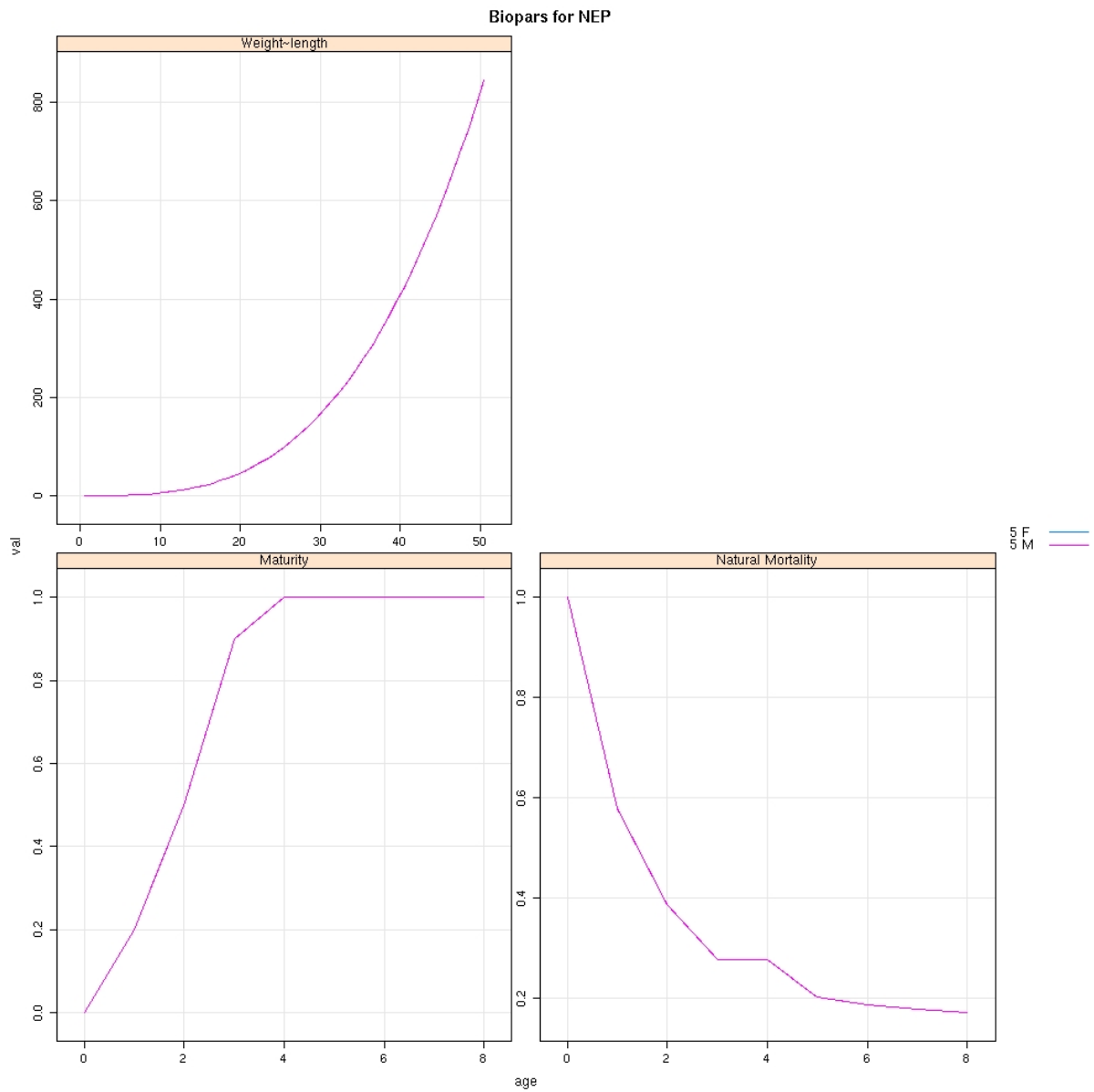
Figure 3.5 – Biological parameters for red mullet (Mullus barbatus) by area

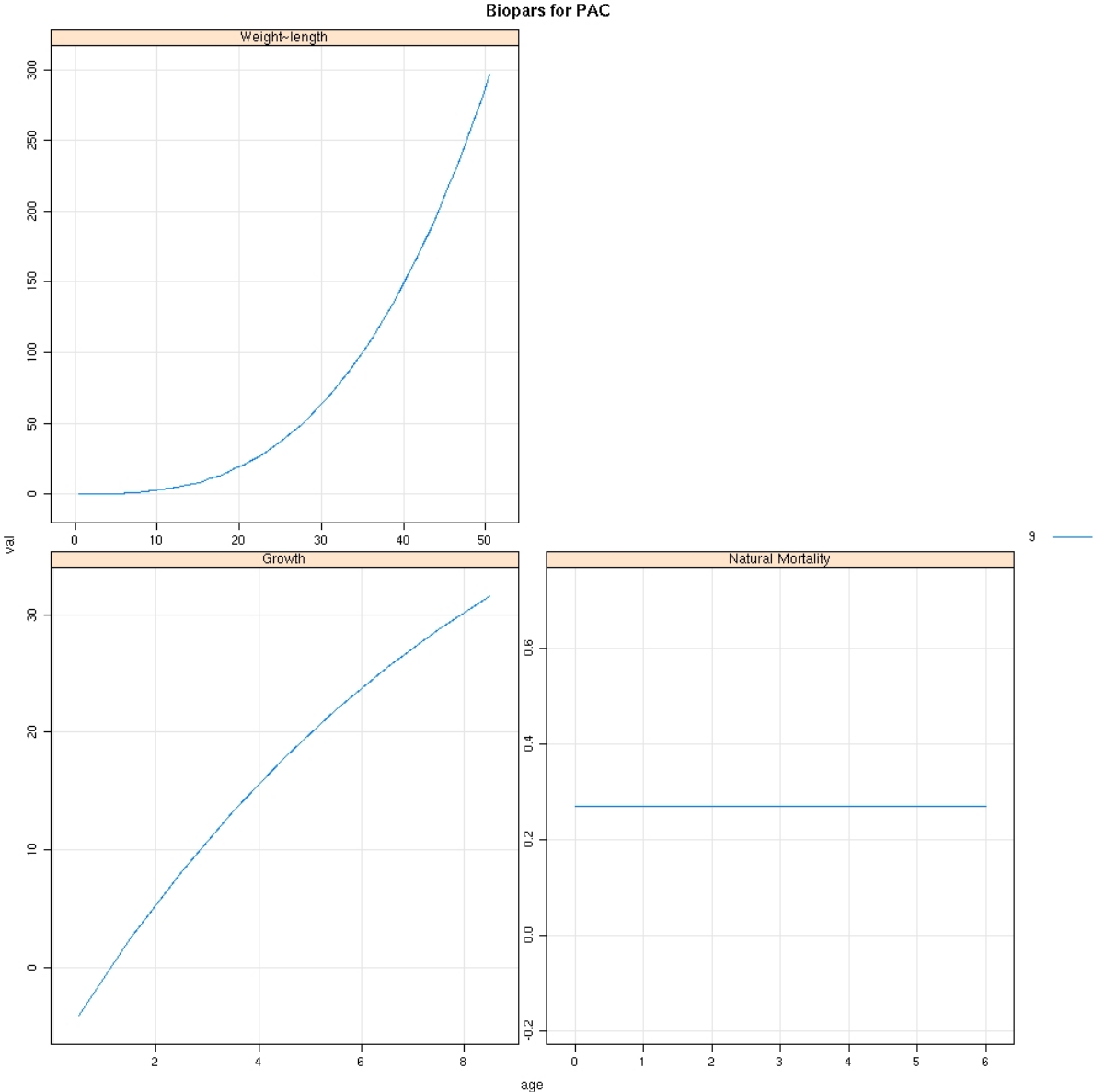*Figure 3.6 – Biological parameters for nephrops (Nephrops norvegicus) by area and sex (M-male, F-female)*

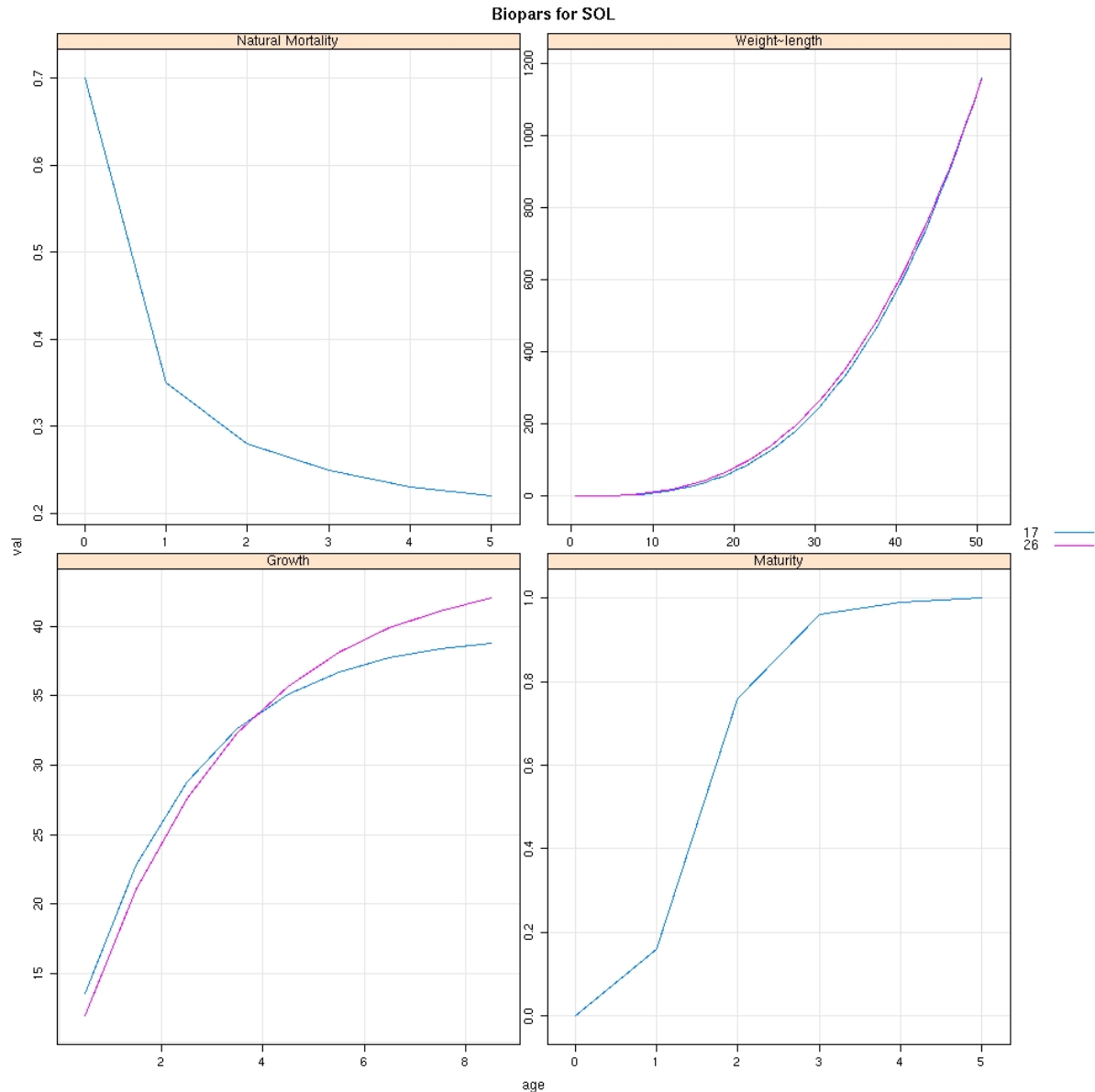*Figure 3.7 – Biological parameters for common pandora (Pagellus erythrinus) by area*

Figure 3.8 – Biological parameters for sole (Solea solea) by area

15. The group discussed the effect of dealing with species that have a marked dimorphism in a sex combined assessment. It was **RECOMMENDED** to explore the effects such decision may have and try distinct ways of combining these data. Several possibilities were mentioned, (i) combining the biological parameters and aggregate length frequencies, (ii) apply the biological parameters to convert each sex length frequencies to age and aggregate afterwards, (iii) run assessments for each gender and merging the results.

16. Several stocks were submitted for preliminary assessments using the equilibrium model implemented by VIT. The group had dedicated a session to such approach and several analysis were suggested. A full description of such suggestions can be found in the report sections of the stocks of GSA 25 above. In general the group **RECOMMENDS** that VIT should be applied for average conditions and not for single years, as such approach assumes an extreme equilibrium situation where each single year could represent the overall fishery and stock dynamics. The opposite should also

be avoided. If there are long time series, a period of stable catches may be a better option than using the full time series, depending on the life span of the species. The group suggests that the steady state conditions should be verified before applying the model, namely by looking at yearly residuals of the length frequencies. Such preliminary analysis should be further developed, expanded, and described in guidelines for assessment under equilibrium conditions.

17. The group **RECOMMENDS** to carry out a simulation study to test VIT, with the objective of identifying in which situations the model gives good results and in which it does not. Also it will be important to learn in which conditions the model estimates are biased and in which direction such bias occurs.

18. Regarding the usage of XSA the group **RECOMMENDS** the parameterization of the model be explored and the effects of the model settings to be evaluated by sensitivity analysis.

19. The group discussed the usage of several models applied to the same stock as a method to support the decisions made and evaluate the robustness of the advice being given. In general it was always tried to support the advice with all the information available, including scientific survey information as source of external information of the biomass trends, in particular to check for possible downwards trends on recent years.

20. The group identified some situations, e.g. hake stocks, where the definition of the stock units may be not well defined and having impact on the stock assessment results.

21. Specific recommendations regarding research to be developed for each stock are included on the stock sections of this report.

SUGGESTION TO IMPROVE CURRENT SAFs and NEW SAFs FOR DIRECT METHODS
(By Fabio Fiorentino)

22. Some improvements of the current version of SAF (GFCM Stock Assessment Forms) were presented by scientists during the presentation of the assessments. After a wide discussion the following points were agreed:
- In sheet D, the current definition of overexploitation should be modified eliminating the phrase referring to high risk of depletion or collapse.
- Although the current F is reported in sheet D, the addition of a new cell reporting current F should be useful on sheet Y.
- Concerning the uni-dimensional criterion for assessing the stock status, stocks showing current F higher than $F_{0.1}$ were considered overexploited. $F_{0.1}$ is widely used as Target Reference Point (TRP) proxy of F_{MSY}. It is considered a good TRP to prevent growth overfishing.
- In order to facilitate the assessments, the participants agreed that the chose of the adequate TRP should be taken at a more general meeting and before the WG.
- Concerning the bi-dimensional criterion for assessing the stock status, a scale of exploitation rate and abundance should be agreed in order to make effective and not controversial the assessment of the stock status. Similarly the uni-dimensional criterion, these scales should be agreed before the WG:

- Management advices should be standardized in order to make more clear them to managers. This standardization should be discussed at the GFCM and SAC level prior to the WG meetings.

23. The proposals for the 6 new stock assessment forms concerning the trawl surveys source of information (direct methods) were presented by F. Fiorentino.

24. After a short review and discussion, the group agreed some improvements to make more clear and consistent the 6 forms and decided to refine them by checking with real data and send them back to the Coordinator before the Subcommittees. M.T. Spedicato and S. Ben Mariem offered their assistance to do the test with data set from MEDITS and national surveys.

DATE AND VENUE FOR THE NEXT MEETING:

25. The working group took note of the suggestion made by Ms Constantina Karlou Riga to host the next coming meeting on Demersal species Stock Assessment Working Group in Syros island in Greece. The date will be defined at later stage.

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Appendix I

List of participants

Alvaro **ABELLA**
ARPAT Area Mare
Via Marradi 114
57126 Livorno, Italy
E-mail: a.abella@arpat.toscana.it

Orhan **AK**
Trabzon Centre of
Fisheries Research Institute
Vali Adil Yaşar cad. No: 4
Trabzon Yomiz, Turkey
E-mail: Orhanak57@gmail.com

Sadia **BELCAID**
Biologiste des pêches
Centre Régional de Tanger
Institut National de
Recherche Halieutique
BP 5268 Dradeb,
Tangiers Morocco
E-mail: sadiabelcaid@hotmail.com

Said **BENCHOUCHA**
Marine Resources Laboratory Chef
INRH, Tangier, Morocco
E-mail: bench2468@yahoo.fr

Sadok **BEN MERIEM**
Institut National des Sciences
et Technologies de la Mer
INSTM centre de Sfax,
BP 1035, 3018 Sfax, Tunisia
E-mail: sadokbm@yahoo.fr

Tomris **DENİZ BÖK**
İstanbul Üniversitesi
Su Ürünleri Fakültesi.
Ordu cad. N: 200,
Laleli, Istanbul, Turkey
E-mail: tomrisdeniz@hotmail.com

Abdullah **EKREM KAHRAMAN**
Istanbul University,
Faculty of Fisheries
Ordu cad. N: 200,
Laleli, Istanbul, Turkey
E-mail: kahraman@istanbul.edu.tr

Najib **EL OUAMARI**
Institut National de
Recherche Halieutique,
Centre Régional de Nador
Bd Zerktouni, BP 493,
62000 Nador, Maroc,
E-mail: n.elouamari@inrhnador.gov.ma

Henri **FARRUGIO**
IFREMER
BP 171 avenue Jean Monnet 34203
Sete Cedex, France
E-mail: henri.farrugio@ifremer.fr

Angel M. **FERNÁNDEZ**
Instituto Español de Oceanografía
(IEO).
Varadero, 1. 30740 S. Pedro del Pinatar
Murcia, Spain
E-mail: angel.fernandez@mu.ieo.es

Fabio **FIORENTINO**
IAMC CNR
Via L. Vaccara 61
91026 Mazara del Vallo (TP), Italy
E-mail: fabio.fiorentino@iamc.cnr.it

Eyüphan **FIRAT**
Fisheries Engineer,
Ministry of Agriculture
and Rural Affairs,
Istanbul Provincial
Agriculture Directorate,
Bagdat C. No: 307-309
Erenkoy, Istanbul, Turkey
Tel: +90 216 3024100-1225
Fax: +90 216 3553715
E-mail: eyuphanfirat@hotmail.com

Yaşar **GENÇ**
Trabzon Centre of
Fishery Products Research Institute,
Vali Adil Yazar cad. Kaşüstü,
Trabzon, Turkey
E-mail: yasargenc@gmail.com

Didem **GÖKTÜRK**
Istanbul University,
Faculty of Fisheries
Ordu St. N: 200
Laleli, Istanbul, Turkey
E-mail: didemgokturk@gmail.com

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

Elif Seda **GÜRCAN**
Sinop Üniversitesi
Sinop Su Ürünleri Fakültesi
57000 Akliman,
Sinop, Turkey
E-mail: su.perisi1905@hotmail.com

Pilar **HERNANDEZ**
Information Management Officer
GFCM Secretariat
Fisheries and Aquaculture Department
Viale delle Terme di Caracalla,1
00153 Rome Italy
Tel: + 39 06 57054617
Fax: + 39 06 57056500
E-mail: pilar.hernandez@fao.org

Angélique **JADAUD**
IFREMER
BP 171 avenue Jean Monnet
34203 Sete Cedex, France
E-mail: angelique.jadaud@ifremer.fr

Othman **JARBOUI**
Institut National des Sciences
et Technologies de la Mer
INSTM centre de Sfax,
BP 1035, 3018 Sfax, Tunisia
E-mail: othman.jarboui@instm.rnrt.tn

Ernesto **JARDIM**
IPIMAR, Instituto Nacional
de Recursos Biologicos,
Av. Brasilia, 1400-006
Lisboa, Portugal
E-mail: ernesto@ipimar.pt

Marios **JOSEPHIDES**
Department of Fisheries
and Marine Research / Ministry Of
Agriculture, Natural Resources and
Environment, 101 Vithleem,
1416 Nicosia, Cyprus
E-mail: mjosephides@dfmr.moa.gov.cy

Saadet **KARAKULAK**
Istanbul University,
Faculty of Fisheries
Ordu St. No.200
Laleli, Istanbul, Turkey
E-mail: karakul@istanbul.edu.tr

Constantina **KARLOU-RIGA**
FAO-EastMed
Project Coordinator
Viale delle Terme di Caracalla,1
00153 Rome, Italy
Tel: +30 210 8847960
Fax: +30 210 8837600
E-mail: Konstantina.Riga@fao.org

Hanane **KENNOUCHE**
CNRDPA,
11, bd Colonel Amirouche,
Bou Ismail,
Tipaza, Algerie
E-mail: kennouchehanane@yahoo.fr

Çetin **KESKIN**
Istanbul University,
Faculty of Fisheries
Ordu cad. N: 200,
Laleli, Istanbul, Turkey
E-mail: seahorse@istanbul.edu.tr

Leyla **KNITTWEIS**
Ministry for Resources and Rural
Affairs
(MRRA), Government of Malta,
Fort San Lucjan, Marsaxlokk,
BBG 1283, Malta
E-mail: leyla.knittweis@gov.mt

Vahdettin **KÜRÜM**
Head of Fisheries Department,
Ministry of Agriculture
and Rural Affairs,
Akay Cad. N 3 Bakanliklasl,
Ankara, Turkey
E-mail: vahdettink@kkgm.gov.tr

Sahar Fahmy **MEHANNA**
National Institute of
Oceanography and Fisheries,
P. O. Box 182, Suez, Egypt
E-mail: sahar_mehanna@yahoo.com
       sahar_mehanna@hotmail.com

Nikolas **MICHAILIDIS**
Department of Fisheries
and Marine Research / Ministry Of
Agriculture, Natural Resources and
Environmen, t101 Vithleem,
1416 Nicosia, Cyprus
E-mail: nmichailidis@dfmr.moa.gov.cy

Roberta **MIFSUD**
Ministry for Resources and Rural
Affairs (MRRA), Government of Malta,
Fort San Lucjan, Birzebbuga,
BBG 1283, Malta
E-mail: roberta.mifsud@gov.mt

Özcan **ÖZEN**
Çanakkale Onsekiz
Mart University,
Faculty of Fisheries,
Su Ürünerli Fakültesi
Çanallake 17100, Turkey
E-mail: oozen@yahoo.com

Bayram **ÖZTÜRK**
Istanbul University,
Faculty of Fisheries
Ordu cad. N: 200,
Laleli, Istanbul, Turkey
E-mail: ozturkb@istanbul.edu.tr

José Luis **PÉREZ GIL**
IEO − Instituto Español De
Oceanografía, Centro Oceanográfico De
Málaga,
Puerto Pesquero S/N, Fuengirola
29640, Málaga, Spain
E-mail: joseluis.perez@ma.ieo.es

Mariano García **RODRÍGUEZ**
Instituto Español de Oceanografía,
Servicios Centrales,
Corazón de María 8,
28002, Madrid, Spain
E-mail: mariano.garcia@ md.ieo.es

Mustafa **SAVUT**
Directory of Mediterranean
Fisheries Research Institute,
Beymelek, Demre,
Antalya, Turkey
E-mail: mustafasavut@yahoo.com

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 e Ricerca
Via dei trulli 18-20,
70126 Bari, Italy
E-mail: spedicato@coispa.it

Abdellah **SROUR**
Executive Secretary ad interim
GFCM Secretariat
General Fisheries Commission
for the Mediterranean
Viale delle Terme di Caracalla,1
00153 Rome, Italy
Tel: + 39 06 57055730
Fax: + 39 06 57056500
E-mail: abdellah.srour@fao.org

Adnan **TOKAÇ**
Ege University
Fisheries Faculty,
35100 Bornova,
Izmir, Turkey
E-mail: adnan.tokac@ege.edu.tr

Georgios **TSOUNIS**
Institut de Ciencies del Mar, ICM
Passeig Marítim de la Barceloneta, 37-49,
08003 Barcelona, Spain
Tel: +34 932 309 555
E-mail: georgios@icm.csic.es

Tarim **UFUK**
Directory of Mediterranean
Production and Training Institute,
Demre, Antalya, Turkey
E-mail: Utarim552@gmail.com

Taner **YILDIZ**
Istanbul University,
Faculty of Fisheries
Ordu cad. N: 200,
Laleli, Istanbul, Turkey
E-mail: tlivaney@yahoo.com

<div align="right">**Appendix II**</div>

Terms of Reference for the Moderator of the practical stock assessment sessions of the SCSA Working Groups

One of the objectives of SCSA, is to progress in the enhancement of joint practical stock assessment. "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.

During the two last SCSA Working Group meetings on demersal and small pelagic species (2008 and 2009) a joint practical session to assess, in particular the stocks of hake (*Merluccius merluccius*) and associated species, as well as those of sardine and anchovy were performed. At its 34th session, the commission endorsed the SAC's proposal to extend the duration of the meeting in order to include practical sessions on stock assessment as well as the possibility to review assessment works made prior the meeting. The Commission also approved the principle that meeting be moderated by a qualified expert. The 9th meeting of the CMSC (Rome, June 2010) established the following mandate for the moderator:

Under the supervision of the GFCM Secretariat and in cooperation with the SCSA Coordinator, the Moderator will:

1. Define the methods to be followed and provide the theoretical background (papers) as well as the software to be used. This information must be communicated to the GFCM Secretariat well in advance of the meeting;
2. Prepare the agenda for the practical session;
3. Determine the data and information needs, including the standard format to be used, and prepare all material and tools to be used by the participants before the meeting;
4. Moderate the session, providing adequate assistance to the participants;
5. Write a report describing the methods and data used together with the results of the assessment. A section of the report must include recommendations for the next joint practical stock assessment session. The GFCM standard assessment forms should also be included as an appendix.

The consultant will take into account some specific items such as:

- Propose the appropriate methodologies (i.e for demersal species: VPA tuning (using trawl survey results when possible), LCA; SURBA; for small pelagic: VPA and/or XSA and/or ICA or alternative methods.....)
- Assist in the determination of main indicators and their corresponding reference points;
- Assist in the production of a diagnosis of the state of the stock;
- Supervise the process which aims to fill and analyze the data and information provided through the SCSA stock assessment forms
- Supervise the process concerning the formulation of management advice, considering different alternatives.

- Assist in the identification of a set of biological reference parameters to be used in stock assessments
- Elaboration of the final report of the Working Group meeting

List of abstracts

S. Belcaid, J.Gil, J. Baro, J.L. Perez et O. Kada
Assessment of Red Seabream " *Pagellus bogaraveo*" GSA3-GSA1 – Strait of Gibralatar.

Institut National de Recherche Halieutique (INRH)

Le stock de la dorade rose (*P. bogaraveo*) du détroit de Gibraltar est considéré comme un stock unique et partagée entre le Maroc et l'Espagne. L'exercice de l'évaluation a utilisé les données communes de la pêche en Espagne et au Maroc (distribution de longueurs des débarquements de 2005 à 2007). L'analyse de cohorte de longueur (LCA) et le modèle de rendement par recrue (Y/R), ainsi une analyse de population virtuelle (VPA) ont été tournés par le logiciel VIT (Lleonart et Salat, 1997) pour l'évaluation de l'état du stock de cette espèce. Le résultat du modèle de rendement par recrue montre que l'état de ce stock est en pleine exploitation.

S. Benchoucha
Assessment of *Parapenaeus longirostris*, .*Merluccius merluccius* and *Octopus vulgaris*

INRH, Regional Center of Tanger, Morocco

The assessment includes 3 species, *Parapenaeus longirostris*, *Merluccius merluccius* and *Octopus vulgaris*. The models used are the Schaefer dynamic model and Analytic model (VIT). The results show that the stocks are over or moderately exploited.

A. M. Fernández
Stock assessment of *Mullus barbatus* from SGA 06 Northern Spain

Instituto Español de Oceanografía (IEO)

The stock of *Mullus barbatus* in the GFCM-GSA06 has been assessed using a time series data from the trawl fishery covering twelve years (1998-2009). The assessment has been carried out applying tuned VPA (Extended Survivor Analysis, XSA) and Y/R analysis on the pseudo-cohort 1998-2009. Software used was the Lowestoft VPA program for the XSA (Darby and Flatman, 1994) and the VIT program (Lleonart and Salat, 1997) for the Y/R analysis. Catch in number of individuals are based on younger ages (0 and 1). Results suggest a slightly decreasing trend in the average fishing mortality for ages 0-2 along the studied period. Recruitment has remained more or less constant between 1998-2007, but in the last two years recruitment is under the mean for the period 1998-2007. After the minimum observed in 2004 SSB has recovered and in the last three years is above the average for the whole period.
Trends in recruitment, Fbar, stocks biomass and SSB are similar for both set of parameters used (fast and slow growth from SGMED-08-03).

B. Guijarro, F. Ordines and E. Massutí

Stock assessment of hake (*Merluccius merluccius*) from the trawl fishery off the GFCMGSA05(Balearic Islands)

Instituto Español de Oceanografía – Centre Oceanogràfic de les Balears

The trawl fishery off Mallorca (Balearic Islands; GFCM-GSA05) is developed by around 40 vessels, which total annual landings are approximately 1400 tons. 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 tons during the last decades. The information used for the assessment of the stock consisted in annual size composition of catches (estimated from monthly sampling), official landings and the biological parameters estimated from the Data Collection Programme (2003-2007). The vector of natural mortality by age was calculated from Caddy´s formula, using the PROBIOM
Excel spreadsheet. The methodology applied was: (i) a tuned virtual population analysis (VPA), applying the Extended Survivor Analysis (XSA) method on the period 1980-2009 and
considering catch per unit effort (CPUE) from commercial trawl fleet (2000-2009) and bottom trawl surveys (2001-2009) as tuning fleets; and, (ii) a yield per recruit (Y/R) analysis based on the exploitation pattern resulting from the XSA model and population parameters for
the periods 1980-89, 1990-99 and 2000-09. The software used was the Lowestoft VPA program and Excel.

A. Quetglas, F. Ordines and N. González
Stock assessment of *Mullus surmuletus* from GFCM GSA-05 (Balearic Islands)

Instituto Español de Oceanografía – Centre Oceanogràfic de les Balears

Striped red mullet (*Mullus surmuletus*) is one of the most important target species in the trawl
fishery developed by around 40 vessels off Mallorca (Balearic Islands, GFCM-GSA05). A fraction of the small-scale fleet (~100 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 73-117 and 17-29 tons in the trawl and smallscale fishery, respectively. 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 (2000-2009). The assessment has been carried out applying tuned VPA (Extended Survivor Analysis, XSA) on the cohorts present during 2000-2009 and both VPA and Y/R analysis on a mean pseudocohort from that period. These approaches were performed using monthly size composition of catches, official landings and the biological parameters estimated within the framework of the Data Collection Programme. The VPA was tuned with CPUE from commercial trawl fleet (2000-2009) and bottom trawl surveys (2001–2009). The vector of natural mortality by age was calculated from Caddy´s (1991) formula, sing the PROBIOM Excel spreadsheet (Abella et al., 1997). The softwares used were the Lowestoft VPA program (Darby and Flatman, 1994) for the XSA and the VIT program (Lleonart and Salat, 1992) for the VPA and Y/R analysis from a mean pseudo-cohort. Results showed

that the stock is fully exploited, being the fishery operating close to the optimal yield level since the current Y/R is very close to the maximum.

A. Quetglas, F. Ordines and N. González
Stock assessment of *Mullus barbatus* from GFCM GSA-05 (Balearic Islands)

Instituto Español de Oceanografía – Centre Oceanogràfic de les Balears

The two species of red mullet inhabiting the Mediterranean, *Mullus surmuletus* and *M. barbatus*, are present in the Balearic Sea. However, *M. surmuletus* predominates in this area where the species is targeted by both the artisanal and trawl fleet working along the continental shelf. On the contrary, *M. barbatus* is caught as a by-catch species by trawlers operating mainly on the deep shelf. In the Balearic Islands, *M. surmuletus* and *M. barbatus* represent about 80% and 20% of the total red mullet catches respectively. During the 2000- 2009 period, the landings of *M. barbatus* from Mallorca have ranged between 10.5 and 27.8 tons. The stock of *Mullus barbatus* of the GFCM-GSA05 has been assessed using data from the trawl fishery on a time series covering ten years (2000-2009). The assessment has been carried out applying tuned VPA (Extended Survivor Analysis, XSA) on the cohorts present during 2000-2009 and both VPA and Y/R analysis on a mean pseudo-cohort from that period.

These approaches were performed using monthly size composition of catches, official landings and the growth parameters accorded in the SGMED-08-03 meeting. Other biological parameters (length-weight relationships, oogive of maturity) were obtained within the framework of the Spanish Data Collection Programme. The VPA was tuned with CPUE from bottom trawl surveys carried out around the Balearic Sea during 2001–2009. The vector of natural mortality by age was calculated from Caddy´s (1991) formula, using the PROBIOM Excel spreadsheet (Abella et al., 1997). Terminal fishing mortality was obtained from the catch equation using the FLeda package (Jardim and Azevedo, 2004) and the vector of fishing

mortality by age from a separable VPA. The software used to run the assessments were the Lowestoft VPA program (Darby and Flatman, 1994) for the XSA and the VIT program (Lleonart and Salat, 1997) for the VPA and Y/R analysis from a mean pseudo-cohort. Results showed that the stock is fully exploited, being the fishery operating close to the optimal yield level since the current Y/R is very close to the maximum.

A. Carbonell, B. Guijarro, M. Gazá, F. Ordines, M. Valls and V. Rubio
Assessment of red shrimp (*Aristeus antennatus*) exploited by the Spanish trawl fishery (1992–2009): GFCM geographical sub-areas 05 (Balearic Islands)

Instituto Español de Oceanografía – Centre Oceanogràfic de les Balears

The assessment of the red shrimp (*Aristeus antennatus*) using data from trawl fishery in the GSA-5 was carried out by length cohort analysis (LCA, VPA and Y/R) for short time series covering the last five years 2005-2009, and by age cohort analysis by a Separable VPA and Extended Survivor Analysis (XSA) performed for the whole time series (1992-2009). The VPA was tuned with CPUE from commercial trawl fleet (1992-2009) and bottom trawl surveys (2001–2009). These approaches were performed from monthly size composition of catches, official landings, effort in trips (days at sea) and the biological parameters estimated for the area in 2003. The assessment analysis of the red shrimp in the GSA 5 shows a slight decreasing trend of spawning and total biomass

with an average value for the whole time series of 410 t, and for the last six years of 389 t. Global fishing mortality was estimated at 0.62 increasing for the recent years. Recruitment shows a sinusoidal pattern and was in average of 28 millions of individuals. Yield per recruit analysis and Fishing mortality reference points are close to the maximum yields. $F_{0.1}$ is about 28 % of the current F, F_{max}, and F35%SPR are close of the current effort. The fishery is considered fully exploited, under this premise fishing effort should not increase beyond the current levels and biological management measures would be appropriate seen the recent results.

B. Guijarro, M. Valls and E. Massutí
Stock assessment of Norway lobster (*Nephrops norvegicus*) from GFCM-GSA05 (Balearic Islands)

Instituto Español de Oceanografía – Centre Oceanogràfic de les Balears

The Norway lobster (*Nephrops norvegicus*) is one of the target species of the bottom trawl fishery developed off Mallorca by a fleet of around 40 vessels, being captured on the upper slope, between 350 and 600 m depth, jointly with other by-catch species such as *Merluccius merluccius*, *Lepidorhombus* spp., *Micromesistius poutassou* and *Lophius* spp. The assessment of this stock has been carried out by means of virtual population analysis (VPA) and yield per-recruit (Y/R), on a mean pseudo-cohort for the period 2002-2009 and for three different years, one at the beginning of the data series (2002), one in the middle (2005) and the last one at the end (2009). It has been used monthly size composition of catches by sex, estimated from on board sampling between 2002 and 2009, and official landings (daily sale bills). The biological parameters for both sexes (growth, length-weight and first maturity) were those computed in GSA 09 (Ligurian and North Tyrrhenian Sea). The vector of natural mortality by age was calculated from Caddy´s formula, using the PROBIOM Excel spreadsheet. Analysis were performed using VIT software (Lleonart and Salat, 1992) and Excel.

B. Guijarro, N. González and E. Massutí
Stock assessment of pink shrimp (*Parapenaeus longirostris*) from GFCM-GSA05 (Balearic Islands)

Instituto Español de Oceanografía – Centre Oceanogràfic de les Balears

The deep-water rose shrimp (*Parapenaeus longirostris*) is a valuable by-catch species of the bottom trawl fishery developed off Mallorca by a fleet of around 40 vessels, being captured on the upper slope, between 350 and 500 m depth, in which the target species is the Norway lobster *Nephrops norvegicus*. The information used for the assessment of the stock consisted in annual size composition of catches (estimated from monthly sampling) and official landings for the period 2001-2009. Biological parameters used were obtained in previous studies in this area (Guijarro et al., 2009). The vector of natural mortality by age was calculated from Caddy´s formula, using the PROBIOM Excel spreadsheet. The methodology applied was: (i) a tuned virtual population analysis (VPA), applying the Extended Survivor Analysis (XSA) method on the period 2001- 2009 and considering bottom trawl surveys (2001-2009) as tuning fleet; and, (ii) a yield per recruit (Y/R) analysis based on the exploitation pattern resulting from the XSA model and population parameters for the entire period. The software used was the Lowestoft VPA program and Excel.

A. Jadaud, B. Guijarro, M. Valls, H. Farrugio and E. Massutí
Assessment of European hake (*Merluccius merluccius* - HKE) from GFCM-GSA 07 - Gulf of Lions

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 the period 1998-2009 have oscillated around a mean value of 2160 tons (2260 tons in 2009). The fishing capacity of the GSA 07 has shown in these last 10 years a progressive decrease considering the French trawlers. The number of these trawlers decreased of about 30% on the period.Most fleets and hake catches correspond to French trawlers (49 and 70%, respectively), whose catches range between 3 and 92 cm total length (TL), with an average size of 20 cm TL. The second most important fleet is French gillnetters whose fleets and catches represent ~32 and 15% respectively, ranging 13-86 cm TL and average size 39 cm TL. They are followed by Spanish trawlers, (~12 and 8% in fleet and catch, respectively), whose catches range is 5-87 cm TL, and average size 25 cm TL and finally Spanish long-liners (~7 and 7%, in fleet and catches, respectively), ranging 23-96 cm TL with an average size of 54 cm TL. Hake trawl fishery exploits a highly diversified species assemblage, including Striped mullet (*Mullus barbatus*), Red mullet (*Mullus surmuletus*), Angler (*Lophius piscatorius*), Black-bellied angler (*Lophius budegassa*), European conger (*Conger conger*), Poor-cod (*Trisopterus minutus capelanus*), Fourspotted megrim (*Lepidorhombus boscii*), Soles (*Solea* spp.) and horned octopus (*Eledone* sp.). The information used for the assessment of the stock consisted in annual size composition of catches (estimated from monthly or quarterly sampling in the main landing ports), official landings and biological parameters estimated by Aldebert and Recasens (1996). 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). For the period of the study (1998-2009), the methodology applied was a tuned virtual population analysis (VPA), applying the Extended Survivor Analysis (XSA) method considering, as tuning fleet French MEDITS campaign indices. The software used was Lowestoft VPA program (Darby and Flatman, 1994). For 2009, a yield per recruit (Y/R) analysis was also performed. Exploitation rate: High fishing mortality. Stock abundance: Low abundance. The stock is characterized by growth overexploitation and by periodically good recruitments (1998, 2002 and 2008) which ensure the sustainability of the exploitation. The trend of the SSB does not show any risk of stock depletion or collapse. To avoid growth overfishing, the management advice and recommendations are to
- Improve the fishing pattern of the trawl to arise the minimum length of catches equal 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 reduce recruitment overfishing, the management advice and recommendations are (i) to reduce the effort of longline and gillnets in order to increase (or at least maintain) the SSB, (ii) to establish temporal closures for longline and gillnet during the period of maximum spawning. It is

considered necessary the development of further studies on the biology of hake in the area, to verify the maximum length for males and to estimate new parameters on reproduction (e.g. sex-ratio, length of first maturity, spawning seasons and spawning areas), and to improve national statistics on catches and effort. We reiterate the importance of VMS as a valuable source of data for having precise information on effort distribution.

A. Jadaud, A. Quetglas, B. Guijarro, H. Farrugio and E. Massutí
Assessment of Red mullet (*Mullus barbatus* - MUT) from GFCM-GSA 07 - Gulf of Lions

In the Gulf of Lions (GFCM-GSA07), 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 2004-2009 have oscillated around a mean value of 193 tons. Most boats and catches correspond to the French trawling fleet (77% and 86% respectively). In French and Spanish landings, modal lengths are 13 and 14 cm, respectively. In GSA 7, the trawl fishery is a multi-specific fishery. In addition *to M. barbatus*, the following species can be considered important by-catches: *Merluccius merluccius, Lophius sp., Pagellus sp., Trachurus sp., Mullus surmuletus, Octopus vulgaris, Eledone sp., Scyliorhinus canicula, Trachinus sp., Triglidae, Scorpaena sp.* Length at first capture is about 7 cm. Catch is mainly composed by individuals of age 0 and 1, while the oldest age class (5+ group) is poorly represented. Catch rates decreased slightly along the analyzed period. The number of French boats decreased also about 30 % during that period. The assessment of this stock has been carried out by means of virtual population analysis (VPA) and yield-per-recruit (Y/R), on a mean pseudo-cohort for the period 2004-2009, considering French and Spanish trawl using the software VIT. VPAs were also used for each year of the period, in order to have a first approach of the temporal trends of the results. The information used for the assessment of the stock consisted in annual size composition of French and Spanish trawler landings and biological parameters used by the EU SGMED-08-03 Subgroup on the Mediterranean (June 2008). A vector of natural mortality by age was calculated from Caddy's formula, using the PROBIOM Excel spreadsheet (Abella et al., 1997). Exploitation rate: Moderate fishing mortality. Stock abundance: Intermediate abundance. This stock is slightly overexploited, with no risk of stock depletion or collapse. F shows a slight decreasing trend from 2004. The management advice and recommendation are not to increase the fishing effort. To improve the biological and growth parameters. We reiterate the importance of VMS as a valuable source of data for having precise information on effort distribution.

H. Kennouche
Evaluation des captures de la crevette rouge *Aristeus antennatus* **et de la seiche**
Sepia officinalis **dans la région d'Alger**

CNRDPA - Algerie

The trawlers of Algiers, in number of 55, being characterized by an average length of 22m, catch the red shrimp *A. antennatus* essentially by night, throughout the year on bottom between 200 in 400m. The rate of capture of this shrimp represents more than 34 % of trawler's catches recorded in 2008 in the region from Algiers. In the same region, in 2009, individuals were measured from the landings of the commercial fishing. The analysis is realized from a distribution of the frequencies-sizes of 9029 individuals for both sexes separately. The parameters of growth and the indications of exploitation are calculated to estimate the stock and the reference points by a VPA analysis. The common cuttlefish *Sepia officinalis* is captured by trawl net or of a trémail net in the region from Algiers where its capture registered 1.5 % of trawler's catches (2008). During year 2009, 3502 individuals are measured and treated in sex confused to realize an analysis of virtual population.

Les chalutiers du port d'Alger, en nombre de 55, se caractérisant par une longueur moyenne de 22m, capturent la crevette rouge essentiellement la nuit, tout le long de l'année sur des fonds allant de 200 à 400m. Le taux de capture de cette crevette représente plus de 34% des captures chalutières enregistrées en 2008 dans la région algéroise. Dans cette même région, en 2009, des individus ont été mesurés à partir des pêches des débarquements de la pêche commerciale. L'analyse est réalisée à partir d'une distribution des fréquence-tailles de 9029 individus pour les deux sexes séparément. Les paramètres de croissance et les indices d'exploitation sont ainsi calculés afin d'aboutir à une estimation du stock et les points de références par une analyse de la VPA. La seiche commune *Sepia officinalis* est capturée à l'aide d'un chalut ou d'un filet trémail dans la région algéroise où sa capture a enregistrée 1.5% des captures chalutières (2008). Au cours de l'année 2009, 3502 individus sont mesurés et traités à sexe confondus afin de réaliser une analyse de population virtuelle.

S. F. Mehanna
Stock assessment of three economic important demersal species from GSA 26
(*Solea solea, Pagellus erythrinus* **and** *Boops boops***)**

National Institute of Oceanography and Fisheries

The Egyptian Mediterranean coast (GFCM-GSA 26) is about 1100 km extending from El-Salloum in the West to El-Arish in the East. The mean annual fish production from this area was about 55 thousand ton (1990-2008). The main fishing gears operated in this region were trawling, purse - seining and lining especially long and hand lining. The number of trawlers operated in the area ranged between 1100 and 1500 during the period from 1990 to 2008. The vessel length varied between 18 and 22 meter and its width varied from 4 to 6 meter. Each vessel is powered by main engine of 100 to 600 hp. Some of them are equipped with echo-sounders. The trawl fishery contributed about 33% of the total fish production from Egyptian Mediterranean. The most dominant fish species in the catch are red mullet, soles, triglid fish, sparid fish, lizard fish, snappers,

barracuda and elasmobranches. Invertebrates are represented by shrimp, cuttlefish, squid, crab and bivalves. Based on commercial catch, population dynamics parameters of three important demersal species (common sole, common Pandora and Bogue) were estimated and some reference points were identified. The Egyptian management system of the marine fisheries is mainly based on limitation of licenses, time and area closures, mesh size regulations but unfortunately these measurements still not enough to recovery our fisheries. It is recommended that effort must be controlled and decreased. Really, it is not clear how much the reduction should be, but the available assessment suggests a target reference point of about 40-60% of the current effort. Defining nursery areas of important species should be taken into account for recommending closed areas and the link between spawning and recruitment in the area should be studied. Also, using of the surveys data for stock assessment and management purposes should be established, improving the fisheries data recording system and facilitating data and information exchange are highly recommended.

J. L. Pérez-Gil[1*],M. García-Rodriguez[2], A.M.Fernández[3], and A. Esteban[3]
Assessment of Deep-water pink shrimp *Parapenaeus longirostris* from the trawl fishery (2001-2009) off the geographical sub-area Northern Spain GSA06

[1] IEO-Centro Oceanográfico Málaga,29640 Fuengirola (Spain)
[2] IEO- Servicios Centrales Madrid, 28002 Madrid (Spain)
[3] IEO-Centro Oceanográfico Murcia, P. O. Box 022. 30740 San Pedro del Pinatar (Spain)
(*) Corresponding author: joseluis.perez@ma.ieo.es

Deep-water pink shrimp (*Parapenaeus longirostris*) is one of the most important crustaceans species for the trawl fisheries developed along the GFCM geographical sub-area Northern SPAIN (GSA-06). This resource is an important component of commercial landings in some ports of the Mediterranean Northern Spain and occasionally a target specie of the trawl fleet, around 260 vessels, which operate on the upper slope. During the last years, a sharp increase in landings was observed, starting in 1998 and reaching the maximum value in 2000, followed by a decreased trend during the period 2001-2004. During de period 2005-2009 stabilization in catches is observed whit an average of 110 t for this period. In 2009 the annual landings of this species amounts 116 tons in the whole area. The state of exploitation was assessed for the period 2001-2009 for the GFCM geographical sub-area Northern Spain (GSA-06). A VPA tunned with CPUE from commercial fleet and abundance indices from MEDITS trawl surveys, was carried out applying the Extended Survivor Analysis (XSA) method (Lowestoft program; Darby and Flatman, 1994) over the period 2001-2009. This methods were performed from size composition of trawl catches (obtained from on board and on port monthly sampling) and official landings (In this assessment has been used a new catch data set from regional governments) transforming length data to age data by slicing. Available CPUE data series, both of commercial fisheries, from Santa Pola fleet, and scientific survey MEDITS were used. 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 6 years whit light fluctuations. Although these values are low compared with 2001 values (the highest in the series). Exploitation is based on very young age classes, mainly 2 and 1 year old individuals, indicating a dependence on recruitments. Fishing mortality shows a decreasing trend from 2001 to 2004 but increasing in the 2005-2009 period. The

fisheries of Parapenaeus longirostris in the study area show important inter-annual variations in landings, biomass and SSB. Currents indicators represent a 35%, 59% and 54% respectively of the values observed eight years ago,(the highest in the series).The Y/R analysis shows that the Fref (1.37) exceeds the Y/R $F_{0.1}$ reference point (0.30). It can be conclude that pink shrimp in GSA06 is overexploited. The oscillation found for this species is in agreement with other areas of the Mediterranean. Is assumed that environmental conditions can affect the stock in addition the fishing mortality. A reduction of the fishing effort and especial surveillance in the use of 40 mm square mesh size in the bottom trawl cod-end is recommended.

García-Rodriguez[*1] M., A. Fernández[2] J. L. Pérez-Gil[3] and A. Esteban[2]
Assesment of hake (*Merluccius merluccius*) in the GFCM -GSA06

[1]IEO- Servicios Centrales Madrid, 28002 Madrid (Spain)
[2]IEO-Centro Oceanográfico Murcia (Spain)
[3]IEO-Centro Oceanográfico Málaga (Spain)
(*) Corresponding author: mariano.garcia@ md.ieo.es

Hake (*Merluccius merluccius*) is one of the most important target species for the trawl fisheries developed by around 650 vessels along the GFCM geographical sub-area Northern SPAIN (GSA-06). In last years, the average of the annual landings of this species, which are mainly composed by juveniles living on the continental shelf, were situated around 3350 tons in the whole area. The state of exploitation was assessed for the period 1995-2009 by means of a VPA Separable, tunned with CPUE from commercial fleet and abundance indices from trawl survey (MEDITS). Analysis was carried out applying the Extended Survivor Analysis (XSA) method (Lowestoft suite; Darby and Flatman, 1994) over the period 1995-2009. Analysis were performed from size composition of trawl catches (obtained from on board and on port monthly sampling) and official landings, transforming length data to age data by slicing (L2AGE program). In this assessment, a new set of parameters (fast growth hypothesis; García Rodriguez, 2002) were considered and a natural mortality vector (PROBIOM, Caddy and Abella, 1999) was applied. The general results are similar to those obtained in previous assessments. Exploitation is based on very young age classes, mainly 0 and 1 year old individuals, with immature fraction dominating the landings. On observe a decreasing trend, both in landings and yields along the studied period, with a small recovery since 2007. Total biomass of the stock decreases slowly, being fluctuating at around the 7 300 t. The SSB represents only a 16 % of the total biomass in average, showing a decreasing trend along the period. Recruitments are declining since 1996 onwards, meanwhile F increasing in the last three years especially for the 2- 4 age classes. It can be concluded that the resource is over-exploited (growth over-fishing), with a risk of recruitment over-fishing, that can be avoided by reducing effort. The use of 40 mm square mesh in the cod-end could improve yields and the state of the stock. The resource should be considered object of a special surveillance. The first step must be not to increase fishing mortality at all, both for trawl as well as for artisanal, being accompanied by a change in the cod end mesh type, being recommended a yearly 10% reduction of effort to ensure the increment in SSB *. Changes in cod end mesh geometry, result effectiveness than effort reductions. Only a change of mesh shape in the cod end would result in a significant increment in the Y/R and SSB/R. If this management measure were applied, there would be gains in the second year. The

influence of the interaction between trawl and artisanal fishery, mainly gill net, can endanger the forecasted SSB increase, due to the expansion since 1996 of this fishery *.

G. Scarcella, O. Giovanardi, N. Vrgoc, B. Marceta, G. Fabi, F. Grati, S. Raicevich, P. Polidori, F. Domenichetti, L. Bolognini, I. Celic, L. Sabatini
Stock assessment of common sole (*Solea solea*) in GSA 17

The common sole *Solea solea* (Linnaeus, 1758) is one of the most important valuable species in the FAO GFCM area, which provides for 13% of the word overall catches of this species. Around 22% of the GFCM area landings comes from the Adriatic Sea, especially the northern and central basins (GSA 17) representing an important spawning and aggregation area for sole. Taking into consideration the importance of sole in GSA 17 and the lack of scientific data for sustainable managing the stock, the SoleMon project was initiated in 2005. The aims of the project are to provide a stock assessment of *S. solea* through surveys at sea, carried out by the *rapido* trawl, and analysis of landings of the fleets catching the common sole either as target species (*rapido* trawl and set nets) or as a portion of a multi-species catch (otter trawl).
The assessment is based on VPA (XSA) methods. VPA Lowestoft software suite (Darby and Flatman 1994) was used and XSA was the assessment method. A separable VPA (Pope and Sheperd, 1982) was also run as exploratory analysis for this stock. In addition, a yield-per-recruit (Y/R) analysis was carried out (Yield program; Branch et al., 2000).
Data used for XSA:
•   Catch numbers at age from 2005-2009 from all fishing harbors of GSA 17.
•   Biological sampling 2005-2009 for maturity at age and length-weight relationships.
•   M vector, estimated using PROBIOM.
•   Tuning data from *rapido* trawl surveys for years 2005 to 2009.
Catch data and catch length composition from the Italian and Croatian coasts were obtained from on board observations and auction documents of the principal markets. Discard of *S. solea* is negligible (also damaged specimens are sold at a lower price) and information on the level of mis-reporting for this stock has been provided in the framework of the SoleMon project. The stock was also assessed by SURBA methods. Both XSA and SURBA methods gave the same perception of the state of the stock.
After the minimum value observed in 2005 the SSB was constant in 2006 and 2007, increased in 2008 and decreased in 2009 going below the 200 tons. The recruitment varied without any trend in the years 2005-2008, reaching a minimum in 2006. The value estimated in 2009 was lower than 2008. Exploitation decreased from 2005 to 2006, was constant in 2006-2007 and increased in 2008-2009. The most recent estimate of fishing mortality (F_{0-4}) is F=1.36. With $F_{0.1}$=0.26 and F_{max} =0.46, the stock is considered being subject to overexploitation.

G. Tsounis, S. Rossi, J.M. Gili
Red Coral (*Corallium rubrum*) stock and fishery data at the Costa Brava (Spain)

Instituto de Sciencies de Mar (CSIC)

The Mediterranean red coral (*Corallium rubrum*, L. 1758) is a slow growing longevous gorgonian that produces a red calcium carbonate skeleton which is in high demand by the jewellery industry. Its long history of intensive commercial dredging has resulted in

a well documented decline of its stocks throughout the Mediterranean, becoming especially apparent during the last two decades, after which dredging was banned in favour of manual collection by SCUBA divers. Recent studies on the population status of *Corallium rubrum* brought international concern over the sustainability of coral fisheries. One of the few detailed stock assessments made, reveals that at the Costa Brava (NW Spain), 98 % of all shallow water colonies show a juvenile size and branching pattern as a result of harvesting. Recent data on the reproductive biology of the species show that 91 % of the colonies in shallow water populations (< 60 m depth) are not 100 % sexually mature. The remaining populations consist of extremely young colonies, forcing fishermen and poachers to harvest immature colonies in order to stay in business. These populations are clearly at the limit of their recoverability potential. The available data state with confidence that shallow water stocks in air diving range have been overexploited, so that expert consultations recommend a Mediterranean-wide protection of shallow water populations, and a management based on stock assessment and scientific monitoring. The necessary revisions of current management measures include most importantly a larger minimum size limit, as the existing one is in most cases based on outdated practical considerations, rather than being based on recent scientific studies. Maximum sustainable yield (estimated using the Beverton–Holt model) is reached at an age of first capture as high as 98 years. Yet current regulations allow harvesting of approximately 11 year old colonies (corresponding to a basal diameter of 7 mm). In any case, geographic variability in environmental parameters influences coral growth rates and morphology to an extent that adequate size limits are likely to vary between 10 - 20 mm in base diameter. For this reason, number of branches and minimum height should be used as additional age limits. A sufficiently large part of the deep populations needs to be conserved through permanently protected areas (MPAs), as corals play a significant role in the ecosystem. Daily catch limits, as well as number of licenses must be carefully set, in order to avoid overharvesting from which the stocks likely take decades or centuries to recover. The key to set adequate harvesting guidelines are stock surveys prior to exposing an area to harvesting, and ongoing monitoring, yet most stocks have not been studied. Furthermore, control of illegal harvest and poaching is of urgent priority, as it is responsible for a large part of the observed overexploitation. Finally, it is recommendable that a cross-national management umbrella is established to support individual countries in the revision of their management.

P. Sartor, F. Colloca, A. Abella, A. Mannini
Stock assessment of *Merluccius merluccius* in GSA9 (1990-2008)

An assessment of the status of the stock of *Merluccius merluccius* was carried out. The species is exploited by bottom trawlers and in small scale fisheries. Mortality rates were estimated using data of commercial catches by running a Length Cohort Analysis and of trawl surveys using SURBA. Reference points Fmax, $F_{0.1}$ and F30%Bo have been defined with a Yield-per-recruit analysis. The estimated current F=1.25 is too high and an important reduction of the fishing effort is recommended as well as a better exploitation pattern in order to avoid the massive catch of small-sized individuals.

P. Sartor, F. Colloca, A. Abella, A. Mannini
Stock assessment of *Parapenaeus longirostris* in GSA9 (1990-2008)

An assessment of the status of the stock of *Parapenaeus longirostris* was carried out. The species is exploited by bottom trawlers operating mainly on the depth range 100-400m. Mortality rates were estimated using data of commercial catches by running a Length Cohort Analysis and of trawl surveys using SURBA. Reference point Fmax, $F_{0.1}$ and F30%Bo have been defined with a Yield-per-recruit analysis. The estimated current F obtained with the LCA (VIT) was F=0.65 that is lower than the estimated $F_{0.1}$=0.7 derived from a yield-per-recruit analysis. SURBA, on the other hand, suggest a higher value of F of about 1.0, but this result appears less reliable. In conclusion, the stock is considered exploited at an adequate rate. SGMED WG advice relies on the LCA and considers the stock has been harvested sustainably consistent with high long term yields.

P. Sartor, F. Colloca, A. Abella, A. Mannini
Stock assessment of *Mullus barbatus* in GSA9 (1990-2009)

An assessment of the status of the stock of *Mullus barbatus* was carried out. The species is mainly exploited by bottom trawlers and also with set nets. The assessment was carried out estimating Fmsy using historical data of commercial catch and effort combined with time series of abundance indices running the non-equilibrium Surplus Production Model ASPIC. Reference points as Fmsy and fmsy were estimated. Moreover, a lower value of the proxy of Fmsy ($F_{0.1}$) was estimated with a Yield-per-recruit analysis (0.49). The estimated current F of 0.73 derived from the SPM is lightly higher than Fmsy (0.64) and a reduction of about 12% of the fishing effort is recommended. With such reduction it is likely that the biomass will increase in a medium term at levels close to the Bmsy.

A. Abella
Assessment of sustainability of by-catch in Nephrops norvegicus fishery (GSA9 1990-2009)

It was performed an assessment of the sustainability of by-catch species in the Norway lobster fishery. The fishery utilises bottom trawl nets with very low vertical opening and small mesh size at the cod end. A quantitative stock assessment is not feasible in this case because there is a general shortage on the historical and biological information on those species. As an alternative, the assessment of the sustainability of the by-catch species was done using the software PSA (Productivity and Susceptibility Analysis) aimed at examining the impact of the Norway lobster fishery on the fishery's by-catch. The species were ranked with respect to their importance in the catches and commercial interest and assessed as regards their level of susceptibility to be captured with the consequent mortality impact and on their capacity to recover after depletion based on considerations on productivity. The status of each species related to these characteristics determined its relative capacity to sustain different levels of fishing pressure. The analysis was done for the 15 species that represent about the 85% of the total landings of the fishery in weight. The analysis has shown that the stocks considered least likely to be sustainable were *Galeus melastomus, Merluccius merluccius* followed by *Phycis blennoides, Lepidorhombus bosci, Helicolenus dactylopterus,* These stocks show a benthic or bentho-demersal behaviour and a low turnover, and hence they are more vulnerable to the used gear and are less productive. On the other hand, *Lepidopus caudatus* and *Trachurus trachurus*, pelagic species that often swims above the head

rope height, resulted the species with major potential capability to sustain the current level of effort of the fleet followed by three stocks of cephalopods.

P. Sartor, F. Colloca, A. Abella, A. Mannini
Stock assessment *Pagellus erythrinus* (GSA9 1990-2009)

An assessment of the status of the stock of *Pagellus erythrinus* was carried out. The species is mainly exploited by bottom trawlers and also with set nets. For this species, information is not complete. Historical data of commercial catch and trends of catch rates were analysed but the assessment was carried out mainly using trawl surveys data. A value for the Reference Point $F_{0.1} = 0.13$ and of F40%SSB = 0.14 were estimated with a Yield-per-recruit analysis. The estimated current F of 0.36 derived from the use of the Gedamke & Hoenig non-equilibrium estimator method SEINE based on mean size of the catch resulted higher than $F_{0.1}$. A reduction of the fishing effort is recommended.

M.T. Spedicato[1], I. Bitetto[1], P.Carbonara[1], L. Casciaro[1], J.Kolitari[2], A. Joksimovic[3] and G. Lembo[1]
Assessment and predictions of stock productivity and fisheries sustainability under different growth and harvest scenarios for European Hake in GSA 18 – South Adriatic Sea*s*

[1]COISPA Tecnologia & Ricerca, Bari, Italy
[2]University of Agriculture, Tirana, Albania
[3]Institute of Marine Biology, Kotor, Montenegro

Merluccius merluccius is a high-score priority species in the GSA 18 that remarkably contribute to the fishery production. This is mainly based on trawlers. Past assessments highlithed an overexploitation condition for the European hake stock. Thus, in the framework of the Adriamed project (Working Group of Demersals) a new assessment was conducted to monitor the stock situation and provide fishery advice. The data used were from the trawl surveys conducted in the whole GSA (time series of Medits from 1996 to 2009 for Italian and Albanian coasts and 2008 only for Montenegro) and from the 2009 structure of landings of the west side (data from Data Collection Framework, DCF). We applied a suite of models and methods to face the uncertainty in the estimation process; hence the assessment was conducted using SURBA, Aladym and VIT models in a complementary way. Two scenarios of growth rate were tested for sex combined: the slow (L =96 cm, K=0.129, t_0= -0.73) and the fast growth (L =104 cm, K=0.2, t_0= -0.01) scenarios, to account for uncertainty in life history profile. Natural mortality was assumed variable at age, according to the Caddy and Abella paradigm. Estimates of total mortality and recruitment from Surba were used to feed Aladym model with a hindcasting approach. ALADYM routines re-estimated the total and fishing mortality using the population parameters and a simulated exploitation pattern from the fishery. Selectivity of the fleet was simulated using an ogive (Lc=12cm; SR=1 cm) coupled with a deselection ogive with 50% deselection size at 40 cm and a deselection range of 1 cm. The size at first maturity was set at 33.2 (±0.27 cm), according to recent estimates gathered in the GSA within the DCF. A simulation was also performed to forecast the possible effects of the newly enforced mesh size regulation on stock biomass, catches and other relevant population indicators in the medium-term. Outcomes from ALADYM converged with the Z estimates from SURBA

and catches simulated using ALADYM well approximated the observed ones. Regardless of the method used a slightly decreasing trends of total and fishing mortality were observed from 1996 to 2005 when increasing mortality values were recorded. These were maintained in 2006, while afterwards mortality went back to the levels before 2005. In this year also a remarkable increase of recruitment was observed that sustained the fishery in the subsequent years, as evidenced by the increasing western landings. However, regardless of the growth scenarios the current fishing mortality notably exceed the level of $F_{0.1}$ and a conspicuous reduction would be necessary to guarantee a more sustainable exploitation in the long-term. This can be partly achieved following the newly enforced regulation on the mesh size. However, spatial and temporal management measures could valuably complement such technical measure.

S. Ben Meriem[1], F. Fiorentino[2], M. Dimeck[3], V. Gancitano[2], L. Knittweis[3], O. Jarboui[1], L. Ceriola[4], E. Arneri[4]
Assessment of the shared stock of deep water pink shrimp (Parapenaeus longirostris Lucas, 1841) in the MEDSUDMED area

[1] Institut National des Sciences et Technologies de la Mer (INSTM), Tunisia;
[2] IAMC-CNR Mazara del Vallo, Italy;
[3] Ministry for Resources and Rural Affairs (MRRA), Malta;
[4] MEDSUDMED project, FAO, Italy

The stock status of P. longirostris in the Strait of Sicily and adjacent seas (GSA 12, 13, 14, 15 and 16) was assessed analysing the size structure of the landing in 2007, 2008 and 2009. Sex were kept separate and a set of common biological parameters were used. Data were analysed by a steady state Length Cohort and Yield per recruit analyses, as implemented in the VIT and ANALEN packages. In order to verify and approximate the steady state assumption data were processed both keeping separate years and combining them. The Y/R curves were flat, with no clear maximum in males. In order to give advices, results including Fishing mortality (F) estimates obtained by separate sex were combined. In the long-term, an increase of the current F would lead to a sligtly increase of the production when the minimum length limit is not modified. An increase of 50% of current F would lead to an increase only 4% of the long term yield but the SSB decrease significantly 20%. The F variation affects differently the various fleet components. Any increase in F would result in a reduction of the long term yield of larger shrimp trawlers and an increase of the long term catches of small shrimp trawlers; an opposite pattern would be obtained if fishing mortality is reduced. A moderate increasing in the minimum length limit in catches would not have a substantial effect on the long term catches keeping the fishing effort unchanged. If the minimum length limit is increased by 20%, the long term catch would be increased only by around 1% but spawning stock biomass will be increased significantly; the gain in SSB for an increase by 20 and 50% will be respectively 38 and 49%. The moderate increase (20%) in minimum length limit leads to a gain of 6% in sustainable yield for the fleet, constituted by larger trawlers while small trawlers fleet would suffer long-term losses (around 7%). Considering $F_{0.1}$ as target reference point (TRP), the whole stock appears overexploited. In order to reach this TRP the current F should be reduced by around 20%. A moderate reduction (20%) of current F would not lead to a sensitive change in the long term yield. However, this reduction would improve significantly the spawning stock biomass (SSB).

Appendix IV

Agenda

1. **Opening, arrangement of the meeting and adoption of the agenda**

2. **Admission of documents and review of available data**

3. **Performance of joint assessments by GSA or group of GSAs.**
   3.1. Realization of stock assessments
   3.2. Review and analysis of the results of different assessments.

4. **Presentation and discussion of new assessments carried out before the working group meeting**

5. **Presentation and discussion of assessment related works**

6. **Formulation of conclusions, recommendations and management advice**

7. **Any other matters**

8. **Conclusions and scientific advice to be transmitted for the consideration by the SCSA and the SAC.**

9. **Date and venue of next meeting**

10. **Adoption of the report and closure of the meeting**