



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



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GENERAL FISHERIES COMMISSION FOR THE MEDITERRANEAN

SCIENTIFIC ADVISORY COMMITTEE (SAC)

**Working Group on stock assessment of demersal species
(Istanbul, Turkey 18th – 23rd October 2010)**

LIST OF ABSTRACTS

***As received by the GFCM Secretariat**

Assessment of sustainability of by-catch in *Nephrops norvegicus* fishery (GSA9 1990-2009)

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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 boscii*, *Helicolenus dactylopterus*. These stocks show a benthic or benthic-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.

Assessment of Red Seabream *Pagellus bogaraveo* GSA3-GSA1 – Strait of Gibraltar

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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 (Leonart 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.

Assessment of the shared stock of deep water pink shrimp (*Parapenaeus longirostris* Lucas, 1841) in the MedSudMed area

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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 slightly 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).

Assessment of *Parapenaeus longirostris*, *Merluccius merluccius* and *Octopus vulgaris*

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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.

Assessment of red shrimp (*Aristeus antennatus*) exploited by the Spanish trawl fishery (1992–2009): GFCM geographical sub-areas 05 (Balearic Islands)

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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 $F_{35\%SPR}$ 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.

Stock assessment of *Mullus barbatus* from SGA 06 Northern Spain

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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).

Assesment of hake (*Merluccius merluccius*) in the GFCM -GSA06

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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, tuned 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 Rodríguez, 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.

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

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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.

Stock assessment of Norway lobster (*Nephrops norvegicus*) from GFCM-GSA05 (Balearic Islands)

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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 (Leonart and Salat, 1992) and Excel.

Stock assessment of pink shrimp (*Parapenaeus longirostris*) from GFCM-GSA05 (Balearic Islands)

Guijarro B., N. González and E. Massutí

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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.

Assessment of European hake (*Merluccius merluccius* - HKE) from GFCM-GSA 07 (Gulf of Lions)

Jadaud A., B. Guijarro, M. Valls, H. Farrugio and E. Massutí

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.

Assessment of Red mullet (*Mullus barbatus* - MUT) from GFCM-GSA 07 - Gulf of Lions

Jadaud A., A. Quetglas, B. Guijarro, H. Farrugio and E. Massutí

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.

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

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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 echosounders. 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.

Stock assessment of *Mullus surmuletus* from GFCM GSA-05 (Balearic Islands)

Quetglas A., F. Ordines and N. González

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, using 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 (Leonart 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.

Stock assessment of *Mullus barbatus* from GFCM GSA-05 (Balearic Islands)

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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 (Leonart 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.

Assessment of Deep-water pink shrimp *Parapenaeus longirostris* from the trawl fishery (2001-2009) off the geographical sub-area Northern Spain GSA06

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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.

Stock assessment of *Merluccius merluccius* in GSA9 (1990-2008)

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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 F_{max} , $F_{0.1}$ and $F_{30\%B_0}$ 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.

Stock assessment of *Parapenaeus longirostris* in GSA9 (1990-2008)

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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 F_{max} , $F_{0.1}$ and $F_{30\%B_0}$ 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.

Stock assessment of *Mullus barbatus* in GSA9 (1990-2009)

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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 F_{msy} 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 F_{msy} and f_{msy} were estimated. Moreover, a lower value of the proxy of F_{msy} ($F_{0.1}$) 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 F_{msy} (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 B_{msy} .

Stock assessment *Pagellus erythrinus* (GSA9 1990-2009)

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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 $F_{40\%SSB} = 0.14$ 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.

Stock assessment of common sole (*Solea solea*) in GSA 17

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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.

Assessment and predictions of stock productivity and fisheries sustainability under different growth and harvest scenarios for European Hake in GSA 18 – South Adriatic Seas

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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 highlighted 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 ($L_{\infty}=96$ cm, $K=0.129$, $t_0=-0.73$) and the fast growth ($L_{\infty}=104$ 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 ($L_c=12$ cm; $SR=1$ 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.

Red Coral (*Corallium rubrum*) stock and fishery data at the Costa Brava (Spain)

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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.