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Scientific, Technical and Economic Committee for Fisheries (STECF)

Report of the Workshop on Mediterranean Stock Assessment Standardization SGMED workshop 09-01 (formerly labeled as SG-ECA/RST/MED 09-01)

2-6 March 2009, Murcia, Spain

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San Pedro del Pinatar, Murcia, 2-6 March 2009

STECF OPINION EXPRESSED DURING THE PLENARY MEETING HELD IN GALWAY 20-24 APRIL 2009

STECF is requested to review the report of the **SGMED workshop 09-01** of March 2 – 6, 2009 (Murcia) meeting, evaluate the findings and make any appropriate comments and recommendations.

Terms of Reference

The STECF (SG-ECA/RST/MED 09-01) is requested to

- to derive and agree on appropriate values for M and growth parameters for stocks of demersal and small pelagic species.
- to explore alternative stock units and to investigate the possibility of combining stock-specific data from adjacent GSAs based on ecological, biological and fishery features.
- to standardize the MEDITS and GRUND surveys time series to account for unbalanced sampling design and appropriate data distribution. Specific work has been initiated to allow for estimation of standardized MEDITS and GRUND surveys.
- to define a DCF call for biological and economic data to support the work of SGMED in 2009.
- to define Terms of Reference for the two subsequent SGMED assessment working groups in 2009 dealing with Mediterranean stocks. The first meeting, SG-MED 09-02 (8-12 June 2009), should focus on the estimation of historic and recent stock parameters. The second meeting, SGMED 09-03 (30 November-4 December 2009) should provide predictions of catch and biomass under different management scenarios in short and medium term and should also aim to and derive reference points for economic sustainability and provide economic advice of the various management scenarios simulated.

STECF comments and conclusions

The Workshop addressed all items, with the exception of (c). On item (c), SG-MED concluded that the required data standardization to account for unbalanced sampling designs and appropriate data distributions will be a very time consuming exercise and proposed to defer this task to a later meeting. STECF commented that due to the specific expertise needed it is unlikely that the standardization of the MEDITS and GRUND datasets could be completed within the scope of an SG-MED meeting. The task requires examination of the various survey designs and results to assess the most appropriate methods of data analysis and selection of efficient statistical estimators for key outputs. STECF agreed that this task could be completed more effectively through the establishment of an *ad hoc* contract, ideally to be concluded as soon as possible in 2009. The outputs should be considered by SG-MED-09-02 and SG-MED-09-03 as they become available.

With respect to item (a) of the ToR, the Workshop reviewed in detail the most frequently applied methods used to estimate the natural mortality of exploited marine species and initiated discussion about the growth parameters for demersal and small pelagic stocks in the Mediterranean Sea. After considerable discussion, the Workshop agreed on the need to use vectors of M that have decreasing values with age/size. Two preferred methods for estimating ***M*** were proposed and this conclusion was endorsed by STECF. Providing there is a reasonable degree of confidence in growth parameter estimates STECF recommends the use of either one of the two following methods to calculate ***M***:

1. Gislason *et al.* (Gislason *et al.*, 2008a; Gislason *et al.*, 2008b):

$$\ln M = a + b \ln L + c \ln L_{\infty} + d \ln K$$

or

2. ProdBiom (Abella *et al.*, 1997) based on considerations about production and losses of biomass due to natural mortality which uses the Caddy (1991) equation:

$$M_{(t)} = M_a + \left(\frac{\beta}{t} \right)$$

where ***Ma*** is the asymptotic ***M*** and ***β*** is the curvature parameter.

STECF did not express a preference for one or other of these methods. STECF agreed that when uncertainty in the estimates of growth parameters is high, scientists should consider using alternative methods that are less sensitive to these parameters, providing these methods are feasible, reliable and well documented.

STECF noted the conclusion of SG-MED that discrepancies in estimates of growth parameters for several demersal (hake and red mullet) and small pelagic (anchovy and sardine) species and stocks in the Mediterranean are likely to be attributable more to differences in methods used to estimate mean length at age and interpretation of ring patterns on otoliths than to genuine differences in growth patterns. STECF agreed that the best way to resolve such differences would be to hold regional meetings aimed at harmonizing analytical methods and standardizing techniques for reading otoliths to improve accuracy and reduce uncertainty. STECF notes that a proposal for conducting a workshop on methodological aspects of data collection, age reading or maturity staging ideally would be discussed and recommended by a stock assessment working group or other relevant expert group, e.g. STECF and its sub-groups, or a Regional Co-ordination Meeting (RCM) within the EU Data Collection Framework (DCF). The need for the workshop should be addressed to ICES PGCCDBS (Planning Group on Commercial Catches, Discards and Biological Sampling) or PGMed (Mediterranean Planning Group for Methodological Development), taking place in parallel in early March each year. At these PGs, workshop proposals are (usually) endorsed and forwarded to ICES ACOM (Advisory Committee) for adoption and inclusion in next year’s work programme. If accepted as eligible for funding under the DCF by the EU Commission, Member States can include the travel costs for these workshops in their National Programmes. STECF asks SGMED 09-03 to define the specific Terms of Reference for a methodological workshop to be held in 2011. STECF requests SGMED-09-03 also to explore the possibility to hold the workshop under the umbrella of the scientific advisory committee SAC of GFCM.

With respect to item (b) of the ToR, SG-MED agreed a series of changes to the current stock boundaries to be used for the next stock assessments of European hake (*Merluccius merluccius*), red mullet (*Mullus barbatus*) and deep water rose shrimp (*Parapenaeus longirostris*). Several of the existing divisions were based on geopolitical boundaries and had no basis in biology, ecology or fishery patterns. Recommendations for changes were based on a range of factors, including observed similarities in trends of recruitment indices estimated from MEDITS surveys, levels of similarity in biological parameters of relevant species, environmental trends and expert experience. The proposed changes should enable SG-MED to accomplish its work in a more consistent way within respect to basic stock parameters and thereby improve its support to the GFCM.

STECF recommends the following:

1. European Hake (*Merluccius merluccius*)
    - Merge the following GSAs[1]:
        - GSAs 05+06;
        - GSAs 12+13+14+15+16;
        - GSAs 17+18;

2. Red mullet (*Mullus barbatus*)

    Maintain the current GSAs boundaries or investigate smaller areas.In this context, a splitting of GSA09 into two sub-units should be investigated further by SGMED: GSA09a (north) and GSA09b (south).

3. Deep- water rose shrimp (*Parapenaeus longirostris*)
    - Merge the following GSAs:
        - GSAs 01+06+07
        - GSAs 12+13+14+15+16.

SG-MED also considered the possibility of merging GSA 05 (Balearic Islands) with GSAs 01, 06 and 07. The merging of GSAs 01, 06 and 07 was based on similar trends in MEDITS survey data. The catches in GSA 05 are relatively low (approximately 200 tonnes), however, there were insufficient survey data from this area to support the option of merging it with the other three GSAs. STECF agreed that while it may be a reasonable option to include GSA 05 in the merged area, it would be best to maintain the separation until more information becomes available.

In addition to the conclusions of SG-MED, STECF discussed the possibility of merging GSAs 06 and 07 for small pelagic species, based on knowledge of larval transport between the Gulf of Lions and the Catalan Sea. SG-MED had not examined the survey data for small pelagics in this context. STECF agreed that the existing proposals from SG MED were only the start of the process, and further options for merging GSAs for different species could be considered in the future.

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[1] GSAs 22 and 23 were merged for European hake and deep-sea rose shrimp during previous SG-MED meetings in 2008.

STECF noted the recommendation of SG-MED that a specific SGECA meeting be held before the SG-MED-09-03 to develop an agreed methodology for SG-MED regarding the use of bioeconomic models and development of economic advice for Mediterranean fisheries. STECF noted that such a methodology would have application for other regions, not just the Mediterranean. STECF concluded that due to time constraints it would not be possible to hold a SGECA meeting prior to SG-MED-09-03 (scheduled for 30/11/09 to 4/12/09). An alternative option to make progress this year would be to establish for identified geographical units *ad hoc* contracts to develop advice on short-term and long-term economic consequences of selected harvesting strategies. The economic and social effects of the harvesting strategies proposed should be assessed using a bio-economic approach. To this end, the methodology adopted should take into account the following:

- the results of the Study FISH/2007/07, "Survey of existing bio-economic models";
- biological outputs in terms of landings and fishing mortality by species, estimated for each of the selected harvesting strategies and for each geographical sub-area or division; and
- DCR data as requested from MS by the JRC.

To complement these analyses and make use of the results specifically for the Mediterranean region, STECF also proposed to include in the ToR of the SG-MED-09-02 and -03 meetings the development of specific case studies for Mediterranean fisheries (e.g. anchovy, sardine and *Nephrops*). This would require attendance by biologists and economists with suitable expertise in the development of bio-economic models. This should be part of the broader goal of a more integrated approach, bringing together ecology, biology and economics in the development of management advice, and might require the identification of data requirements over and above those already identified through the DCF data call. (see agreed ToR for SG-MED-09-02 and -03 below).

STECF noted the DCF call for biological and economic data prepared by SG-MED and the urgent need to issue this call to support the work of SG-MED in 2009 (ToR d).

STECF noted the mistakes identified by SG-MED in the names of the species, either common or scientific, listed in the Appendix VII of the Commission Decision (2008/949/EC) for the Mediterranean and the Black Sea. Considering the fact that this list is the base for the data collection on the various stocks of Community interest, that the various versions of the list of stocks were previously checked by STECF in several meetings, and that it is necessary to eliminate any possible sources of confusion, STECF recommends the following list of corrections:

a) to amend the common name of *Pagellus erythrinus*, and substitute "Pandora" with the correct name adopted by FAO and Fish-base, "Common Pandora", because the actual one might generate confusion if not supported by the scientific name.
b) to amend both the common name and substitute "Sole" with the correct name adopted by FAO and Fish-base, "Common sole", and the related scientific name, substituting "*Solea vulgaris*", which is now a synonym, with the valid name "*Solea solea*".
c) to amend the common name and substitute "Picarels" with "Picarel", because the actual one might generate confusion if not supported by the related scientific name; Picarels might be intended as all the species belonging to the genus *Spicara*.

d) to amend the scientific name for Tub gurnard, and substitute "*Trigla lucerna*" with the correct name adopted by FAO and Fish-base, "*Chelidonichthys lucerna*".
e) to amend the common name and substitute "Dolphinfish" with "Common dolphinfish", because the actual one might generate confusion if not supported by the related scientific name of *Coryphaena hippurus*.
f) to amend the common name for *Parapenaeus longirostris* and substitute "White shrimp" with "Deep-water rose shrimp", which is the common name adopted by FAO, because the actual one might generate confusion if not supported by the related scientific name.
g) to amend the scientific name of the Norway lobster and substitute "*Langoustine norvegicus*" with the correct name adopted by FAO and all scientific references, "*Nephrops norvegicus*".
h) to amend the scientific name of the Giant red shrimp and substitute "*Aristeomorpha foliacea*" with the correct name adopted by FAO "*Aristaeomorpha foliacea*".

Regarding the ToR for SG-MED-09-02 and SG-MED-09-03 (ToR e), STECF noted the proposals of SG-MED and agreed the following ToR:

The Terms of Reference for the STECF/SGMED-09-02 (8-12/6/2009) were defined as follows:

a) Update and assess the status and trends of the stocks by all relevant GSAs, or, if the case, by bigger areas merging adjacent GSAs, in the Mediterranean Sea, taking into account the recommendations of the SGMED workshop in March and the following STECF comments. Advise on the status of the exploited stocks of the species listed below, with respect to high yields harvesting strategies and to maintain their reproductive capacity and ensure a low risk.

- Sardine (*Sardina pilchardus*)
- Anchovy (*Engraulis encrasicolus*)
- European hake (*Merluccius merluccius*)
- Red mullet (*Mullus barbatus*)
- Deep-water rose shrimp (*Parapenaeus longirostris*)

b) Assess the status and trends of the stocks by all relevant GSAs, or, if the case, by bigger areas merging adjacent GSAs, in the Mediterranean Sea. Advise on the status of the following exploited stocks of the species listed below, with respect to high yields harvesting strategies and to maintain their reproductive capacity and ensure a low risk.

- Red shrimp (*Aristeus antennatus*)
- Giant red shrimp (*Aristaeomorpha foliacea*)
- Norway lobster (*Nephrops norvegicus*)

c) Review and propose biological reference points related to high yields and low risk of fishery collapse in long term of each of the stocks assessed.

d) Update and assess historic and recent trends (capacity, technological creep, nominal fishing effort) in the major fisheries by GSAs or, if the case, by bigger areas merging adjacent GSAs exploiting the stocks assessed. The trends should be interpreted in light of management regulations applicable to them.

e) Review the applicability and fully document all applied methodologies for the assessments and determination of the proposed biological reference points.

f) Fully document the data used and their origin for the assessments and determination of the proposed biological reference points.

g) To review proposed methodologies to standardize the MEDITS and GRUND surveys time series to account for unbalanced sampling designs and appropriate data distributions. Specific work has been initiated in this regard.

h) Investigate the requirements for reorganising the MEDITS database that result from the recommendations of STECF for combining some GSAs for some species.

i) Based on the "Survey of existing bio-economic models" under Studies and Pilot Projects for carrying out the Common Fisheries Policy No FISH/2007/07 and data made available by MS, develop specific case studies for Mediterranean fisheries (e.g. anchovy, sardine and *Nephrops*), and advise on possible short-term and long-term economic consequences of the selected harvesting strategies. Evaluate the possibility to use existing bioeconomic models for comparing the proposed harvesting strategies with long-term economic profitability (MEY) of the main fisheries exploiting the assessed stocks (to be continued in SGMED-09-03).

The Terms of Reference for the STECF/SGMED-09-03 (30/11-4/12/2009) were defined as follows:

a) Provide short term and medium term forecasts of stock biomass and yield for the stocks assessed during the SGMED 09-02 meeting in June for the species listed below, under different management options, by fleets where possible:

- Sardine (*Sardina pilchardus*)
- Anchovy (*Engraulis encrasicolus*)
- European hake (*Merluccius merluccius*)
- Red mullet (*Mullus barbatus*)
- Deep water rose shrimp (*Parapenaeus longirostris*)
- Red shrimp (*Aristeus antennatus*)
- Giant red shrimp (*Aristaeomorpha foliacea*)
- Norway lobster (*Nephrops norvegicus*)

b) Advise on stock-size dependent harvesting strategies and slope-based approaches decision control rules to avoid risk situations for the stocks while ensuring high fisheries productivity, taking into account the recommendations of the SGMED 09-02 meeting in June and the following STECF comments. Such advice should consider mixed fisheries effects and ecosystem approach to fisheries management.

c) Identify any needs for management measures required to safeguard the stocks assessed.

d) Review the applicability and fully document all applied methodologies for the projections and determination of management approaches.

e) Fully document the data used and their origin for the projections and determination of the proposed biological reference points.

f) Provide and review marine population and community indicators.

g) Based on the "Survey of existing bio-economic models" under Studies and Pilot Projects for carrying out the Common Fisheries Policy No FISH/2007/07 and data made available by MS, review existing bio-economic models for producing advice on possible short-term and long-term economic consequences of the selected harvesting strategies. Evaluate the possibility to use existing bioeconomic models for comparing the proposed harvesting strategies with long-term economic profitability (MEY) of the main fisheries exploiting the assessed stocks.

h) Define the specific ToR for a methodological workshop to be held in 2011 with the aim of improving the precision and accuracy of individual ageing of wild caught species as a prerequisite to age based stock assessments. Such ToR should be forwarded to PGMed or ICES PGCCDBS in March 2010 for review and endorsement. In particular, SGMED 09-03 should also consider the alternative approach to hold the workshop under the umbrella of SAC of GFCM.

i) Suggest adjustments and provide guidance on data needs and quality, on methods and on interpretations, so that SGMED work can further progress in 2010 towards the goals of the overall mandate given to STECF, focusing its attention, in particular, on the various stocks of the following species, all included in Appendix VII of the Commission Decision (2008/949/EC) for the Mediterranean and the Black Sea: European hake (*Merluccius merluccius*), red mullet (*Mullus barbatus*), blue whiting (*Micromesistius poutassou*), common Pandora[2] (*Pagellus erythrinus*), Blackspot seabream[3] (*Pagellus bogaraveo*), Axillary seabream[4] (*Pagellus acarne*), Common sole (*Solea solea*)[5], Horse mackerel (*Trachurus trachurus*), Greater forkbeard (*Phycis blennoides*)[11], Poor cod (*Trisopterus minutus*)[3], Sargo breams (*Diplodus* spp.)[11], Picarel[6] (*Spicara smaris*), Bogue (*Boops boops*), Sea bass (*Dicentrarchus labrax*), Anglerfish (*Lophius piscatorius*), Black-bellied angler (*Lophius budegassa*), Gilthead seabream (*Sparus aurata*), tub gurnard (*Trigla lucerna*)[7], Mackerel (*Scomber* spp.), Common dolphinfish[8] (*Coryphaena hippurus*), Sardine (*Sardina pilchardus*), Anchovy (*Engraulis encrasicolus*), Sprat (*Sprattus sprattus*)[11], Deep-water rose shrimp[9]

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[2] STECF/SG ECA/RST/MED 09-01 recommends amending the common name reported in the Appendix VII by the Commission Decision (2008/949/EC) for the Mediterranean and the Black Sea and substitute "Pandora" with the correct name adopted by FAO and Fish-base, "Common Pandora", because the actual one might generate confusion if not supported by the scientific name.

[3] STECF/SG ECA/RST/MED 09-01 notes that the ToRs for the previous SGMED meeting in 2008 reported this species as "Red Sea Bream"; no one known species has this common name. It was also noted that this species is not included in the Appendix VII of the Commission Decision (2008/949/EC) for the Mediterranean and the Black Sea, but data could be possibly available from surveys or from those areas where a recovery plan is in place.

[4] STECF/SG ECA/RST/MED 09-01 notes that this species is not included in the Appendix VII of the Commission Decision (2008/949/EC) for the Mediterranean and the Black Sea, but data could be possibly available from surveys or from other data sources.

[5] STECF/SG ECA/RST/MED 09-01 recommends to amend both the common name reported in the Appendix VII by the Commission Decision (2008/949/EC) for the Mediterranean and the Black Sea and substitute "Sole" with the correct name adopted by FAO and Fish-base, "Common sole", and the scientific name, substituting "*Solea vulgaris*" which is now a synonym, with the valid name "*Solea solea*".

[6] STECF/SG ECA/RST/MED 09-01 recommends to amend the common name reported in the Appendix VII by the Commission Decision (2008/949/EC) for the Mediterranean and the Black Sea and substitute "Picarels" with "Picarel", because the actual one might generate confusion if not supported by the related scientific name. Picarels might be intended as all the species belonging to the genus *Spicara*.

[7] STECF/SG ECA/RST/MED 09-01 recommends to amend the scientific name reported in the Appendix VII by the Commission Decision (2008/949/EC) for the Mediterranean and the Black Sea and substitute "*Trigla lucerna*" with the correct name adopted by FAO and Fish-base, "*Chelidonichthys lucerna*" for Tub gurnard.

[8] STECF/SG ECA/RST/MED 09-01 recommends amending the common name reported in the Appendix VII by the Commission Decision (2008/949/EC) for the Mediterranean and the Black Sea and substitute "Dolphinfish" with "Common dolphinfish", because the actual one might generate confusion if not supported by the related scientific name.

[9] STECF/SG ECA/RST/MED 09-01 recommends to amend the common name reported in the Appendix VII by the Commission Decision (2008/949/EC) for the Mediterranean and the Black Sea (but also for other areas) and substitute "White shrimp" with "Deep-water rose shrimp", which is the common name adopted by FAO, because the actual one might generate confusion if not supported by the related scientific name.

(*Parapenaeus longirostris*), Norway lobster (*Nephrops norvegicus*)[10], Red shrimp (*Aristeus antennatus*), Giant red shrimp (*Aristaeomorpha foliacea*)[11], Atlantic bonito (*Sarda sarda*), Skipjack tuna (*Katsuwonus pelamis*)[12], bullet tuna (*Auxis rochei*).

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[10] STECF/SG ECA/RST/MED 09-01 recommends to amend the scientific name reported in the Appendix VII by the Commission Decision (2008/949/EC) for the Mediterranean and the Black Sea and substitute "*Langoustine norvegicus*" with the correct name adopted by FAO, "*Nephrops norvegicus*" for the Norway lobster.

[11] STECF/SG ECA/RST/MED 09-01 recommends to amend the scientific name reported in the Appendix VII by the Commission Decision (2008/949/EC) for the Mediterranean and the Black Sea and substitute "*Aristeomorpha foliacea*" with the correct name adopted by FAO "*Aristaemorpha foliacea*" for the Giant red shrimp.

[12] STECF/SG ECA/RST/MED 09-01 notes that the ToRs for the previous SGMED meetings in 2008 reported this species as "Stripe-bellied bonito"; no one known species has this common name in English.

ANNEX I

SG-ECA/RST/MED 09-01 WORKING GROUP REPORT
San Pedro del Pinatar, Murcia, 2-6 March 2009

This report does not necessarily reflect the view of the European Commission and in no way anticipates the Commission's future policy in this area

1. EXECUTIVE SUMMARY AND RECOMMENDATIONS

With the aim of establishing the scientific evidence required to provide a better scientific support SGMED, and to strengthen the Community's scientific input to the work of GFCM, consistent with the objectives of the Common Fisheries Policy, the Commission made a number of requests to STECF. The Terms of Reference for SG-ECA/RST/MED 09-01 were very specific and are listed in section 2.1.

During the meeting, in particular, it was possible to critically scrutinize, review and discuss the most frequently applied methodologies to estimate the natural mortality of marine exploited species and to initiate the discussion about the growth parameters for demersal and small pelagic stocks in the Mediterranean Sea (ToR a), to explore alternative stock units and to investigate the possibility of combining stock-specific data from adjacent GSAs based on ecological, biological and fishery features (ToR b), reaching a consensus about a list of recommendations, that will be proposed to STECF for the possible adoption and endorsement. These should allow the SGMED to accomplish its future work in a more consistent way within an agreed framework as concerns some basic parameters and, in that way, to improve its support to the GFCM.

The Working Group defined the proposal for the DCF call for biological and economic data to support the work of SGMED in 2009 (ToR d) and the proposed ToRs for SGMED-09-02 and SGMED-09-03 (ToR e), as described in the following parts of this report.

The major recommendations of the Working Group are the following:

- If scientists are confident with the estimates of the growth parameters, needed for using age/size based M models, SGMED recommends to use either one of the two following methods to calculate M:
  1. Gislason *et al.* (Gislason *et al.*, 2008a; Gislason *et al.*, 2008b): $\ln M = a + b \ln L + c \ln L_\infty + d \ln K$, or
  2. ProdBiom (Abella *et al.*, 1997) based on Caddy (1991): $M_{(t)} = M_a + \left(\frac{\beta}{t}\right)$

  where M_a is the asymptotic M and β is the curvature parameter.
- Only in the case where there is a high uncertainty on growth parameters, scientists are invited to use alternative feasible, reliable and well documented alternative approaches to estimate M.
- Based on the observed similarities on trends of recruitment indexes estimated from MEDITS surveys, on various points examined during the meeting and on the current knowledge on the selected demersal species, STECF/SG-ECA/RST/MED 09-01 recommends the following changes to the current stock boundaries to be used for the next stock assessments by SGMED:

  1. European Hake (*Merluccius merluccius*)
     It is recommended to merge the following GSAs[13]:
     - GSAs 05+06;
     - GSAs 12+13+14+15+16;
     - GSAs 17+18;

  2. Red mullet (*Mullus barbatus*)
     - It is recommended to maintain the current GSAs boundaries or investigate smaller areas.
     - GSA09 could be split into two sub-units: GSA09a (north) and GSA09b (south).

  3. Deep- water rose shrimp (*Parapenaeus longirostris*)
     It is recommended to merge the following GSAs:

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[13] Stocks of European hake and Deep-sea rose shrimps have been already merged in GSAs 22and 23 during the previous SGMED meetings in 2008.

- GSAs 01+06+07, on the basis of survey data; at the moment there are not sufficient data from GSA05 to support the possibility to merge it together with the other three GSAs, even if this could be regarded as a future opportunity.
- GSAs 12+13+14+15+16.

Data from MEDITS should be examined also to eventually improve the data availability for small pelagic species. The situation of small pelagic species should be further examined in terms of stock boundaries.

SGMED recommends a specific SGECA meeting be held before the SGMED-09-03 to make available an agreed methodology to be used by SGMED in producing economic advice for Mediterranean fisheries.

STECF/SG-ECA/RST/MED 09-01 agreed on the necessity to improve the standardization in age reading for the selected fish species in order to reduce uncertainty in the estimation of growth parameters. STECF/SG-ECA/RST/MED-09-01 recommends to organize regional meetings aimed at improving the accuracy and standardization of otolith readings for the most relevant small pelagic (anchovy and sardine) and demersal fish species (i.e.: hake and red mullet).

Furthermore, while checking the reference EC Regulations for preparing the ToRs for the next SGMED meetings in 2009, STECF/SG-ECA/RST/MED 09-01 noted several mistakes concerning the name of the species, either common or scientific, listed in the Appendix VII of the Commission Decision (2008/949/EC) for the Mediterranean and the Black Sea, but also in other parts of the same Appendix. Considering the fact that this list is the base for the data collection on the various stocks of Community interest, that the various versions of the list of stocks was previously checked by STECF in several meetings, and that it is necessary to eliminate any possible confusion, STECF/SG-ECA/RST/MED 09-01 recommends a list of amendments, as detailed in section 9 of this report.

2. INTRODUCTION

The European Community is expected to establish long-term management plans (LTMP) for relevant Mediterranean demersal and small pelagic fisheries, based on the precautionary approach and adaptive management in taking measures designed to protect and conserve living aquatic resources, to provide for their sustainable exploitation and to minimise the impact of fishing activities on marine ecosystems.

STECF can play an important role in focusing greater contributions for European scientists towards stocks and fisheries assessment, in identifying a common scientific framework regarding specific analyses to advise on Community plans, to be then brought into or completed by the GFCM working groups.

STECF was requested at its November plenary session to continue the work already initiated in 2008 for the Mediterranean resources, with a view to update the status of the main demersal and small pelagic stocks and evaluate the exploitation levels with respect to their biological and economic production potentials and the sustainability of the stock by using both trawl surveys and commercial catch/landing data as collected through the Community Data Framework (2008/949/EC) as well as other scientific information collected at national level. STECF was also requested to find agreed methods and approaches about basic parameters to be used for the stock assessments.

With the aim to examine the possible scientific alternatives, agree on selected scientific approaches, to set–up the operational framework for 2009, and to strengthen the Community's scientific input to the work of GFCM, the Commission requested STECF to preliminary address the methodological point, to define the data call for 2009 and to define the proposed ToRs for the next SGMED meetings in 2009.

To address the request, the STECF/SG-ECA/RST/MED 09-01 met in the Instituto Español de Oceanografia in San Pedro del Pinatar, Murcia (Spain) from 2-6th March 2009. The meeting was opened at 09:00 on the 2nd, and closed at 17:30 on the 6th. The meeting built upon the work performed during SGMED-08-01 (10 - 14th March 2008), SGMED-08-02 (21-25th April 2008), SGMED-08-03 (9 - 13th June 2008) and SGMED-08-04 (6 - 10th October 2008) to pursue the Commission's requests.

2.1. Terms of Reference for SG-ECA-RST-MED-09-01

The specific terms of reference for SG-ECA-RST-MED-09-01 were the followings:

a. To derive and agree on appropriate values for M and growth parameters for stocks of demersal and small pelagic species.
b. To explore alternative stock units and to investigate the possibility of combining stock-specific data from adjacent GSAs based on ecological, biological and fishery features.
c. To standardize the MEDITS and GRUND surveys time series to account for unbalanced sampling design and appropriate data distribution. Specific work has been initiated to allow for estimation of standardized MEDITS and GRUND surveys.
d. To define a DCF call for biological and economic data to support the work of SGMED in 2009.
e. To define Terms of Reference for the two subsequent SGMED assessment working groups in 2009 dealing with Mediterranean stocks. The first meeting, SG-MED 09-02 (8-12 June 2009), should focus on the estimation of historic and recent stock parameters. The second meeting, SGMED 09-03 (30 November-4 December 2009) should provide predictions of catch and biomass under different management scenarios in short and medium term and should also aim to and derive reference points for economic sustainability and provide economic advice of the various management scenarios simulated.

After a preliminary discussion about the various items, particularly taking into account the need to deeply analyze the available methods to estimate the natural mortality and the number of documents presented at the meeting, in agreement with the STECF Secretariat it was decided to delay the ToR c. to a next STECF/SG-MED 09-02 meeting, because further preliminary work was needed to better respond to this point.

2.2. Nomination of Rapporteurs

Due to the huge amount of revision work to be carried out, the chairman decided to share the workload and, after a short discussion, appointed the following rapporteurs:

- ToR a – natural mortality: Alvaro Abella; growth parameters: Francesco Colloca;
- ToR b – Paloma Martin;
- ToR d – biological aspects: Stelios Katsanevakis; economic aspects: Paolo Accadia;
- ToR e – George Petrakis.

2.3. Participants

The full list of participants at SG-ECA-RST-MED-09-01 is presented in Appendix 1.

3. SUMMARY OF PRESENTATIONS AND DOCUMENTS PROVIDED DURING THE WORKSHOP

An impressive list of interesting presentations and documents were provided during the initial part of the STECF/SG-ECA/RST/MED 09-01, on scientific basis.

It was decided to provide a summary of each presentation in this part of the report, while the full documents will be made available on the STECF web side.

Alvaro Abella presented a wide spectrum of alternative methods potentially useful for estimating M, some of them using empirical equations based on growth parameters or longevity, others that use data from the commercial fisheries and trawl surveys, combining estimates of Z and catches or effort, and finally some approaches that allows estimating vectors of M with age/size. Vectors that show higher values of M in early stages and for juveniles, followed by a progressive decline of M with age in the adult phase, were considered as the most realistic and useful, especially in the case of the Mediterranean stocks exploited at a very early age of first capture. Some simulations show how the alternative hypothesis (low constant value for M or a declining M value with age) may hardly condition the perception of the current status of exploitation as well as the choice of the more suitable values for some reference points, along with the evaluation of the consequences of alternative management choices. It has been stressed that the existence of reciprocal relationships between age and M are the only ones that can explain the actual demographic structure at sea and also the persistence of some stocks that have suffered a very strong fishing pressure since many years and where the exploitation of early life stages occurs.

Hans-Joachim Rätz, Anna Cheilari and Josep Lloret presented a sensitivity analysis regarding the effects of various assumptions about the magnitude of natural mortality M on resulting stock assessment parameters and derived references for sustainable fisheries management revealed that the estimated exploitation rate decreases and the stock size increases with increasing M. The recommended and internationally agreed fisheries management references of sustainable exploitation $F_{0.1}$ and F_{msy} are also found to sensitively react to changes in M. Both $F_{0.1}$ and F_{msy} increase with increasing M. All simulations are based on data from the Baltic sprat (Sub-divisions 22-32), which has historically undergone quite large changes in M. Nevertheless, the maximum sustainable yield MSY is demonstrated to be a rather robust estimator over a wide range of M, including species at a rather low trophic level. The trend to underestimate fishing mortality and to overestimate the stock size with high M might deliver, in comparison with actual catches, a positively biased perception of the state of the stock and its productivity. The elevated risk for sustainable fisheries even increases when underestimated fishing mortalities are compared with overestimated management references of exploitation, like $F_{0.1}$ and F_{msy}. For the assessment of exploited resources and the advisory process to fisheries management, it is recommended to base M assumptions on the longevity of the species concerned, if no quantitative information about M is available. Furthermore, M should account for the different ontogenetic stages (particularly from juveniles to adults) and for changes in fish condition (health) if observed.

Fabio Fiorentino presented information on longevity, growth and mortality of the red mullet (*Mullus barbatus*) collected in the Gulf of Castellammare (N. Sicily). This area is relevant to have information on natural cycle and parameters of fish stock because full banning for trawling has been enforced since 1990 (Pipitone *et al.*, 2000, Fiorentino *et al.*, 2008). Data concerned only females, which reach larger size and represent up to 80-90% of the capture of artisanal fishery (trammel nets). Adult females from the spring trawl survey, carried out in May 2005 (n=92) and from monthly samples of artisanal fisheries (N=581), from April 2006 to June 2007, were aged by reading the whole and thin transverse section of otoliths. The maximum estimated age from artisanal fishery was 6 (whole otolith age reading), whereas those estimated by trawl surveys, which explored a wider area than the artisanal fishery one, was 7 (whole) and 9 (thin section). On the basis of the VBGF derived from otolith (L_{inf}=23 cm TL; K=0.31; t0=-1.56) and the "steady state" female LDF, obtained by summing the 4 seasonal trawl surveys carried out from summer 2004 to spring 2005, a Length Converted Catch Curve was prepared, giving a total mortality rate (Z) value of 0.73 (CI=0.70-0.77). Scalar natural mortality rate (M) was estimated by using the methods of Hoenig (1983), Beverton & Holt's Invariant method (Jensen, 1996), Pauly (1980) and Charnov (1993). Natural mortality rates obtained by different methods are reported in table 1. The most reliable estimates, marked by an asterisk in the Table 1, range between 0.48 and 0.57. Adopting the median value (0.54) as representative of M for red mullet stock in the area, the F (Z-M) value was 0.19, corresponding to an exploitation rate E (F/Z) of 0.26.

Table 1. Natural mortality rates (M) for red mullet in the Gulf of Castellammare (N. Sicily) according to different methods.

Method	Value	Reliability	Remarks
Hoenig	0.72		6 y old ; artisanal fisheries (2006-2007) & whole otolith readings
IBH	0.57	*	K= 0.31 and beta=1.8
Pauly 1	0.75		Linf=230, K=0.31 and 19 <SWT in C°< 20
Charnov	0.54	*	K=0.31 Charnov's variant of Pauly
Hoenig	0.62		7 y old ; trawl surveys (2004-2005) & whole otolith reading
Hoenig	0.48	*	9 y old; trawl surveys (2004-2005) & thin section otolith reading
LCCC	0.73	*	Total Mortality from Steady state LFD by trawl surveys Linf=230, K=0.31 (CI=0.70-0.77)

On the basis of available information, the natural mortality rate vector (M_i) was estimated according to the methods proposed by Gulland (1987), Lorenzen (1996), Abella et al., (1997), Beyer (1999) and Gislason et al., (2008). Results for length classes exploited by artisanal fishery are shown in Figure 1.

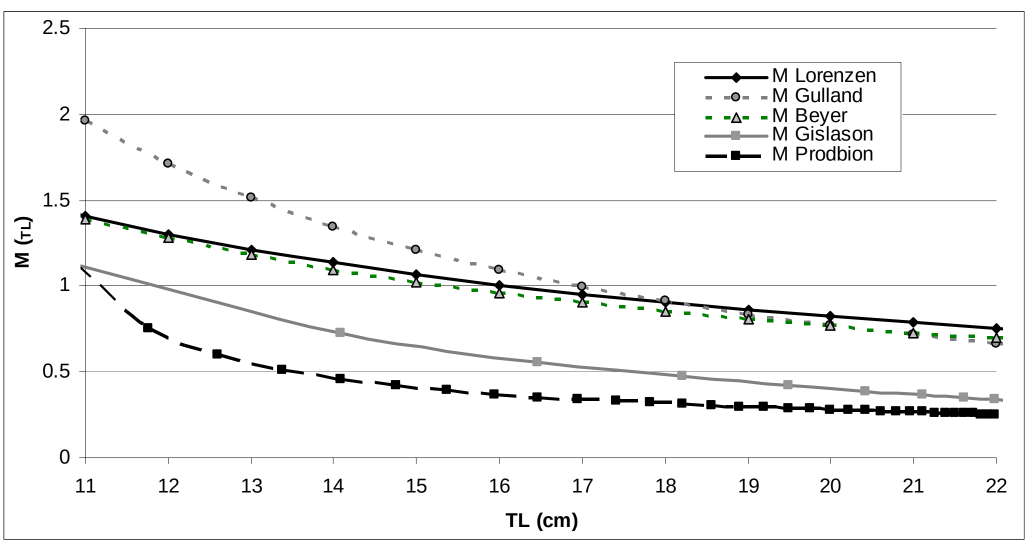

Figure 1. Vector of natural mortality (M_{TL}) according to different methods.

Results show that Gislason's and Prodbion (Abella *et al.*, 1997) methods give values at size lower than the other ones. Vector based on Beyer and Lorenzen methods are almost coincident, whereas M values by Gulland's method are the highest up to 16 cm TL. After this size they are very close to the Beyer and Lorenzen approaches.

Maria Teresa Spedicato referred about observations conducted on *Diplodus sargus sargus* population inside and outside a MPA, that were used for comparing different methods to estimate natural

mortality. Inside the MPA there is no fishing, thus it was assumed that the total mortality (Z) affecting the *D. sargus* population reflects almost exclusively the rate of natural mortality (M). Outside the MPA few vessels of artisanal fishing operate. Sampling was conducted inside and outside the MPA along three years (May and August 2004, June and September 2005, May and September 2006), applying visual census techniques. Number of individuals and length were recorded at each sampling occasion. Average distributions per year were analysed for estimating vital traits (growth and mortality). Total mortality inside and outside the MPA was estimated using Sinclair's (2001) method between ages 1 and 7 and results compared with point estimates of M obtained from the following different equations, in some cases applying the Taylor approximation (~3/K) of longevity ~ 8 years:
B&H invariant =cost*K (costant =1.6 or 1.8 for fish); M~0.56 - 0.63
Alagaraya = $-\text{Ln}(0.01/t_{max})$; M=0.54
Charnov $\ln(M) = 0.5 + 0.95 * \ln(K)$; M=0.61
Hoenig $\ln(M) = 1.44 - 0.982 \times \ln(t_{max})$; M=0.55
Pauly $\ln(M) = -0.0152 - 0.279 \ln(L_\infty) + 0.6543 \ln(K) + 0.463 \ln(T)$; M=0.68 (t 18°).
All the applied methods for calculating point M gave comparable results with Sinclair's method for estimating Z, which inside the MPA was ranging between 0.55-0.57 (1.62-2.13 outside the MPA) depending on the year. The only method which estimates slightly diverged from the other ones was Pauly's method.

The presentation given by Vjekoslav Ticina provided a short review of different existing procedures for estimating M and compared their outcomes for different small pelagic fish species. For this purpose, different methods such as those described by Taylor (1959), Beverton and Holt (1959), Rikhter and Efanov (1976), Pauly (1980; 1983), Hoenig (1983), Alagaraja (1984), Peterson and Wroblewski (1984) and Jensen (1996) and their outcomes regarding small pelagic fish were presented. In addition, an alternative methodology developed by Caddy (1991) for estimating M over different life history stages (gnomonic time-intervals) has been mentioned. Outcomes of M estimate obtained by Martinez-Aguilar et al. (2005) using this, so called GIM method, for Pacific sardine (*Sardinops caeruleus*) were presented. Despite the fact that it cannot be recommended for estimate M for single species, it was highlighted that approach described by Peterson and Wroblewski (1984) might give us a rough idea about M values for small pelagic fish (forage species) within pelagic ecosystem. Furthermore, it was suggested that use of M-vectors in analytical stock assessment methods should be better choice than the use of fixed M value, and that the use of GIM or similar method could be the right choice if data needed are available. Finally, having in mind the need to make comparable the assessments made within Mediterranean area, it has been suggested that scientists dealing with this issue should harmonize their approaches in estimating natural mortality rates. The need to consider the role of prey species in marine ecosystem and consequently chose M estimators that take ecosystem issues (i.e. interspecies relations) has been pointed out.

Francesco Colloca showed a methodological approach aimed to the estimation of natural mortality for fish prey species due to hake predation rate, using different sources of information: stomach contents data, depth distribution information, consumption rate estimations, catch data and estimated population at sea. Hake stomachs contents have been collected during seasonal trawl surveys carried out in 2006 over the central Tyrrhenian continental shelf. Anchovy between 8 and 12 cm TL is the most important prey for hake between 10 and 20 cm TL. Consumption rate of hake has been estimated using a bioenergetic model developed within the BECAUSE project (EU project n. 502482) for hake and other species. The estimated daily consumption rate ranges between 3.2 and 2.3% (% body weight) for hake between 10 and 40 cm TL. The estimated daily consumption of anchovy by hake has been estimated using the following.
Average annual consumption of anchovy have been preliminary calculated for the period 2004-07, taking into account diet change in relation to body size, size-depth distribution and season as follows:

$$\sum_{depth}\sum_{length} C_i \, p_{kis} \, w_{is} \, n_{is}$$

where: C_i is the estimated daily consumption for length i; p_{kis} is the proportion of prey k in the stomach of predator of length class i in the depth strata s; w_i is the weighting factor of the length class i (n_i/N_t);

n_i is the number estimated of fish of length *i* in the depth strata *s*. Information on the total number of individuals of each length class has been derived from LCA run on 2006 landing data collected in the GSA 9 and presented in previous SGMED meetings. The impact of hake predation on anchovy stock was calculated run a LCA model on anchovy landing data for 2006 and adding the estimates of number of anchovy removed by each hake length class in the VIT input catch data. The estimation of anchovy consumed by hake was estimated to be of about 400 tons corresponding to the 5% of the total estimated anchovy biomass (8565 tons). Pelagic fishery removed 2922 tons (42% of total anchovy biomass). The estimated mortality rate of anchovy due to hake predation was 0.05.

Graham Pilling provided a presentation with the aim to demonstrate how the growth parameter values selected for a species can influence the results of stock assessments, and hence management decisions based upon those results. The simulations were for a tropical fish species, examining the impact of using different methods to estimate growth parameters (length- or age-based methods) on the results of simple stock assessments. Results demonstrated how the level of fishing mortality influenced the accuracy of growth parameter estimates. At high fishing mortality levels, larger individuals were absent from the population due to gear selectivity effects, and this limited the information available L_∞ and hence the value of K (due to the negative relationship between them). This had knock-on effects on the estimates of total, natural, and hence fishing mortality (F=Z-M), and reference points such as $F_{0.1}$, which led to biased management decisions. However, it was shown that estimating a single parameter (such as growth parameters) as well as possible does not remove biases that arose later in the system. Therefore while scientists should aim to estimate parameters as accurately as they can, using all the information available (ensuring that values are consistent with data and knowledge), they should be mindful of the impacts of exploitation on stock structure, and the knock-on effects of the use of parameters within the process of stock assessment and generation of management advice, where additional, unexpected biases, could arise. Ultimately, where feasible, assessment and management approaches should be simulation tested to ensure robustness to uncertainties within the fishery system.

Josep Lloret and Hans-Joachim Rätz illustrated how fish condition indices may be used to improve natural mortality (M) estimates. While there are several techniques to estimate the magnitude of M, they tell us little about the underlying causes of M. This is where physiological knowledge (analysis of fish condition or health) comes into play. Several examples in both marine and freshwater ecosystems illustrate how poor conditioned individuals of different fish species (e.g. cod, roach, walleye pollock or brook trout) undergo high natural mortality. Very poor conditioned cod in Canadian waters coincided with the collapse of the stock. The link between M and condition is also due to the fact that some of the causes that impinge on M (e.g. poor nutritional status, diseases and spawning stress) are the same affecting fish condition. The presentation also showed several examples on how fish condition (and so must occur with M) varies with area/stock, year, ages and life stages. Condition usually increases as fish gets older, and particularly increases during sexual maturity when there is a considerable increase of condition. Then, given sufficient information on fish condition, it may be possible to evaluate more exactly M and to forecast temporal changes in M. The presentation also hypothesized on what could be the trend in M for Mediterranean fish species: because in some areas fish diseases (particularly parasitism) seem to be increasing and substantial food web changes have occurred due to invasive species or jellyfish outbreaks, M for some species could have increased in recent years. On the contrary, the documented overall decline of the mean trophic level in the Mediterranean could be decreasing the overall M of many fish species. The presentation finished by providing several recommendations from which the most important one is that fishery agencies and research centres should incorporate condition indices into their routine assessment and research programs for the most important target species in order to use them to improve M estimates, even though the model linking M with fish condition has not been developed.

Henrik Gislason presented a theoretical fish community model from which estimates of the scaling of natural mortality with size and von Bertalanffy growth parameters could be derived (*Gislason et al.*, 2008a)[14]. The model is based on the principle that for a fish community to persist over time, both large and small species must be able on average to replace themselves on a one-for-one basis over their lifetime. This principle, and a size-based equilibrium model where asymptotic length, L_∞, is used as a functional trait, is used to predict how natural mortality should scale with length and asymptotic length within and across pelagic and demersal species of fish. To generate the same replacement for species of different sizes the model showed that natural mortality should scale with body length raised to a power of -1.66 at current levels of exploitation, and, for demersal species, be proportional to asymptotic length raised to a power of 0.80, so generating a higher natural mortality at a given length for large species than for small ones. Using alternative models of natural mortality, e.g assuming natural mortality to scale only with body size as done by Lorenzen (1996), produced differences in replacement between large and small species so large that coexistence seemed unlikely. The results were tested by analysing independent estimates of predation mortality derived from a North Sea MSVPA, the scaling of maximum recruitment per unit of spawning-stock biomass with asymptotic length, and the general relationship between *K* and asymptotic length for demersal and pelagic families of fish. All tests were consistent with the modelling results (Gislason *et al.*, 2008a).

A further test was made by extending the model of natural mortality with K and temperature terms and fitting it to 164 empirical estimates of natural mortality for marine fish obtained by critically screening the literature (Gislason *et al.* 2008b[15], Gislason *et al.* submitted[16]). The results from this analysis show that natural mortality is significantly related to individual length, to assymptotic length and to *K*, but not to temperature (R-square=0.63, p<.0001, Root MSE=0.72):

$$\ln(M) = 0.66 - 1.69\ln(L) + 1.45\ln(L_\infty) + 0.90\ln(K)$$

The scaling of natural mortality with length of -1.69 was not significantly different from the value of -1.66 derived in the theoretical model. Temperature and *K* was shown to be significantly correlated and removing K from the model made the temperature term significant, suggesting that the effect of temperature on natural mortality is through its effect on *K*. Replacing *K* by temperature reduced the fit of the model (R-square=0.45, p<.0001, Root MSE=0.88), but did not affect the scaling with length which was still -1.69. However, the scaling of natural mortality with asymptotic length changed from 1.45 to 0.93 with confidence limits including the 0.80 estimated by the theoretical model described above. Assuming natural mortality to be measured at a constant fraction of asymptotic length produced values of natural mortality not different from those predicted by the model of Pauly (1980) and a scaling with length equal to -0.76, also in line with the findings of others (e.g. Peterson and Wroblewsky 1984). Note, however, that even though the full model provided in the equation above explains 63% of the variance, the predicted ln(M) has a root mean square error of 0.72 showing that the confidence limits of a predicted M value are wide.

It was concluded that:

- Natural mortality is significantly related to body length and to von Bertalanffy growth parameters.
- Temperature is only significant when *K* is removed.
- The scaling of natural mortality with length and asymptotic length is not significantly different from the scaling estimated in the theoretical fish coexistence model or from output from a North Sea MSVPA.
- However, the residual error is large and make predictions of M for other stocks highly uncertain.
- It was strongly encouraged using the primary literature and not secondary sources and databases in further analyses of empirical estimates of natural mortality.

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14 Gislason, H., Pope, J. G., Rice, J. C., and Daan, N. 2008a. Coexistence in North Sea fish communities: implications for growth and natural mortality. ICES Journal of Marine Science, 65: 514–530.

15 Gislason, H., Daan, N., Rice, J. C., and Pope, J. G. 2008b. Does natural mortality depend on individual size? ICES CM 2008/F:16 (mimeo.)

16 Gislason, H., Daan, N., Rice, J. C., and Pope, J. G. (submitted). Size, growth, temperature and the natural mortality of marine fish. Submitted to Fish and Fisheries.

Anna Cheilari and Hans-Joachim Rätz presented a discussion paper about how the correct stock unit definition is crucial and considered a prerequisite for any scientific stock assessment approach and reliable fisheries advice derived from it. In the Mediterranean Sea, definition of unit stocks has been largely absent and in most cases has not been based on genetic variation. The current assessment approach has led to numerous stock assessments of rather small stock units by the limits of the different Mediterranean basins. The trends in relative survey abundance estimates from catch data derived from the MEDITS surveys were calculated and compared for three demersal species, European hake, red mullet and deep-water rose shrimp. The underlying assumption was that similar abundance trends may be due to the same year classes of fish recruiting to the stock units defined. Similar trends were found for hake in Northern and Southern Adriatic and Eastern Ionian Sea. Strong positive associations have been calculated for deep-water pink shrimp for Corsica, Ligurian and Northern Tyrrhenian Sea, South and Central Tyrrhenian Sea and Sardinia, the waters South of Sicily and Malta, for Northern and Southern Adriatic Sea and Eastern Ionian Sea. On the contrary, no similar trends in abundance have been observed for red mullet. It was discussed if the similarities in survey abundance could be interpreted as an objective criterion to join neighbouring stock areas from a management perspective.

Paolo Accadia provided a presentation about a possible methodology to produce economic advice. The use of bio-economic simulation models is the prevalent approach to provide biological and economic advice of management measures based on effort control. A number of bio-economic models are available to simulate the effects of management measures on fisheries. Even if models present different structures and different internal relationships, it is possible to identify some components common to most of the models. The main economic components can be listed as follows:

- Price dynamics;
- Costs dynamics;
- Fleet dynamics;
- Fishers behaviour.

Price dynamics by species and fleet segment for a specific geographical area are generally simulated as a function of the level of corresponding landings. Linear, exponential, and by flexibility coefficient are the most used functions used in bio-economic simulation models.

Costs by fleet segment are generally disaggregated in fixed and variable costs. Variable costs are estimated as a function of days at sea, or days at sea and the level of revenues, while fixed costs are estimated as a function of the number of vessels or GT (Gross Tonnage).

Fleet dynamics are mostly affected by management measures, but the economic performance of fisheries can determine fleet entry and exit choices increasing or decreasing the number of vessels active in specific fisheries. In bio-economic models, fleet dynamics are generally based on Random Utility Model or micro economic theory.

Fishers behaviour generally includes fleet entry-exit rules, decisions on the re-allocation of fishing effort, on the level of investment in technology, and on the level of compliance (or level of violation) with fisheries regulation. The implementation of management measures, as well as any change in other external factors, can determine variations in fishers behaviour, which can result in variations in fishing mortality.

SGMED 08-03 had already identified two economic and two social sustainability indicators. The economic indicators are the ROI (Return on Investment) and the Ratio between Current Revenue and Break-Even Point. The social indicators are the Average Wage per Full-Time Equivalent and the Gross Added Value. The effects of a management plan on economic and social indicators can be estimated by using bio-economic models and an example of a possible bio-economic model structure to estimate the ROI for a fleet segment given the implementation of a new management measure was provided. The bio-economic structure presented with the purpose to evaluate the effects of management on the profitability of fishing activities highlighted some relevant questions to be answered for producing economic advice:

- What reduction in fishing effort will be produced by the management scenarios to be simulated?
- How fishing effort will be reduced (in terms of capacity, activity, or by other management tools)?

- Which production function for target species?
- How management scenarios will affect the landings of non-target species?
- Which link between fishing mortality and fishing effort should be used for demersal and pelagic stocks?
- Which price function?
- Which costs functions?

All these points have been discussed for inclusion in the TORs for the next SGMED meetings. However, as most of them are related to the economic features of the fisheries under analysis, the planning of a specific SGECA meeting to discuss these and other relevant points in producing economic advice has been considered more appropriate. The suggested SGECA meeting should be held before the SGMED-09-03 to make available an agreed methodology to be used by SGMED in producing economic advice for Mediterranean fisheries.

4. APPROPRIATE VALUES FOR M FOR STOCKS OF DEMERSAL AND SMALL PELAGIC SPECIES.

As concerns the first part of ToR a, STECF/SG-ECA/RST/MED-09-01 expressed concern regarding the extremely different values used for M for the same species in the assessments presented by different GSA's in the frame of the previous SGMED meetings. Participants of this workshop of Murcia were requested to define, using all the available information, the most reliable methods to derive natural mortality rates for the main commercial species. Many participants brought written documents or power point presentations regarding this matter (see attached abstracts).

Rätz's contribution was used as a basis for discussion. It dealt with the sensitivity of some reference points ($F_{0.1}$ and F_{max}) and of Fishing mortality and Biomass to the chosen M values. The main consequences of choosing a value for M, regards changes in the level of biomass and F at different M rates value. $F_{0.1}$ and F_{max} are also sensitive to the input value of M being these rates more restrictive (lower values) in the case a lower value of M is assumed. MSY is in general considered less sensitive to the hypotheses on M with the only exception of the case of extremely high M values. Its was discussed the potential use of some empirical equations based on longevity, supposed to furnish reliable estimates and needing of few information that can be derived in some cases from the analysis of demographic structure in protected areas or alternatively from literature. Doubts were raised by several participants regarding the possibility of obtaining reliable estimates of longevity for most of the species, particularly considering the high exploitation rates at which most of the Mediterranean stocks are exposed.

Pilling highlighted the consequences of wrong definition of biological parameters for stock assessment. Biased parameters should drive to wrong estimates of M and also related to the expected performance of alternative strategies of exploitation.

Aspects as the health condition of individuals that may reduce survival were raised during the discussion. Condition factor, hepato-somatic indexes, parasites, lipids contents, etc., are useful variables to routinarily collect which are potentially useful for improving the estimates of M. Even though this influence of condition on natural mortality rates has been demonstrated in several areas, it is still difficult to find a way to correct the estimates of M through the use of some function or coefficient, taking into consideration such phenomena.

Predation data based on stomach contents are important elements to be taken into account and studies on this aspect are strongly encouraged.

The direct estimates of M in protected areas where an almost complete absence of fishing mortality can be assumed were considered as very useful because they represent rare opportunities to have reliable values of M for some demersal species having a well-defined distribution, but however, this information is rare. Anyway, different predation rates or age class composition are relevant factors to be considered to better assess M. Such studies allowed to perform survival analyses and to estimate Z inside and outside these MPAs, that in the first case can be almost completely attributed to natural causes. In addition, point M values or vectors derived in MPAs can be helpful for the comparison of alternative methods for the estimation of natural mortality.

A wide spectrum of other alternative methods potentially useful for estimating M were presented, some of them using empirical equations based on growth parameters or longevity, others using data from the commercial fisheries and trawl surveys, in other cases by combining estimates of Z and catches or effort, and finally some approaches that allows estimating vectors of M with age/size (see attached table). Some simulations have shown how the alternative hypotheses (low constant value for M or a declining M value with age) may hardly condition the perception of the current status of exploitation as well as the choice of the more suitable values for some Reference points and the evaluation of the consequences of alternative management choices. It has been stressed that the existence of reciprocal relationships between age and M are the only that can explain the actual demographic structure at sea and also the persistence of some stocks that for many years have suffered a very strong fishing pressure and which are usually exploited too early in their lives.

Simple, size-based approach for estimate M for small pelagic fish in pelagic ecosystem (i.e. Peterson and Wroblowski, 1984) has been presented, accounting for predation causes of M. Despite the fact that outputs of this approach were in relatively close agreement with some other approaches (i.e. Rikhter and Efanov, 1976; Lorenzen, 1996; Gislason, this meeting), the SGMED realized that such relatively high estimates of M (>1/year) are not suitable for the models currently used.

The fish community model presented by Gislason, from which estimates of the scaling of natural mortality with size and von Bertalanffy growth parameters could be derived, was deeply discussed. The model is based on the principle that for a fish community to persist over time, all species must be able on average to replace themselves on a one-for-one basis over their lifetime. This principle and a size-based equilibrium model where asymptotic length, $L\infty$, is used as a functional trait were used to predict how natural mortality should scale with size and asymptotic size within and across pelagic and demersal species to provide coexistence. The model predicts M as a function of length and asymptotic length. The results show that natural mortality should scale with body length raised to a power of -1.66 at current levels of exploitation. Additionally, the natural mortality of demersal species should be proportional to asymptotic length raised to a power of 0.80, so generating a higher natural mortality at a given length for large species than for small ones. The results of the theoretical model were tested by analysing independent estimates of predation mortality derived from a North Sea MSVPA, the scaling of maximum recruitment per unit of spawning-stock biomass with asymptotic length, and the general relationship between K and asymptotic length for demersal and pelagic families of fish. All tests were consistent with the modelling results (Gislason *et al.*, 2008a[17]). Using alternative models of natural mortality produced differences in net reproductive rate of large and small species so big that their coexistence seemed unlikely. In particular the model of Lorenzen (1996) was found unable to produce coexistence.

A further test of the theoretical model was made by Gislason *et al*. (2008b, submitted[18]), fitting it to 164 values of natural mortality for marine fish obtained by critically screening the literature. The result of the empirical analysis shows that natural mortality is significantly related to individual length, to asymptotic length and to K (R-square=0.63, p<.0001, Root MSE=0.72):

$$\ln(M) = 0.66 - 1.69\ln(L) + 1.45\ln(L_\infty) + 0.90\ln(K)$$

Furthermore, the scaling of natural mortality with length of -1.69 is not significantly different from the theoretical value of -1.66 derived above. Removing K from the model did not affect the scaling with length, but changed the scaling of natural mortality with asymptotic length to 0.93 with confidence limits including the 0.80 estimated by the theoretical model described above. It is to be noted, however, that even though the full model explains 63% of the variance, a root mean square error of 0.72 signifies that the confidence limits of predicted M values will be wide.

STECF/SG-ECA/RST/MED 09-01 agreed that it is necessary to define one or more approaches for the estimation of M as more reliable and robust as possible and this could be derived from the available information, considering the stocks and fisheries characteristics. STECF/SG-ECA/RST/MED 09-01 applied for some Mediterranean species many approaches based on growth parameters, GSI, maximum weight, etc., that produced values apparently not realistic. This may be explained by the fact that these approaches were mostly defined for certain high latitude resources characterised by different dynamics and exposed to different external forces that may condition the M values. According to the participants, models exclusively

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[17] Gislason, H., Pope, J. G., Rice, J. C., and Daan, N. 2008a. Coexistence in North Sea fish communities: implications for growth and natural mortality. ICES Journal of Marine Science, 65: 514–530.

[18] Gislason, H., Daan, N., Rice, J. C., and Pope, J. G. (submitted). Size, growth, temperature and the natural mortality of marine fish. Submitted to Fish and Fisheries.

based on longevity (i.e. Hewitt & Hoenig) are very simple, but longevity in stocks hardly exploited for a long time is however difficult to know.

Considering that most of the stocks in the Mediterranean start to be exploited at very early phases of their lifetime, in which the low value of M that can be attributed to adults is unlikely, STECF/SG-ECA/RST/MED-09-01 recommends the use of Natural Mortality vectors that describe a declining value of M with age. Several approaches that allow the construction of a vector of M have been proposed. In some cases, values of M at age/size obtained with such models were compared for few species with estimates derived from trawl surveys with fine mesh gears or with data from literature in order to test the performance of such models.

Table 2, provides a general overview of the methods considered, including a ranked list of the reviewed methods, ordered by the number of parameters that need to be estimated and also by the level of difficulty for obtain them.

Table 2 – Overview of the methods examined by STECF/SG-ECA/RST/MED-09-01.

Par (n)	Method	Parameter	Formula	Parameter/data type	Notes
1	Alagaraja	Tmax	$M_{0.01} = \frac{-\ln(0.01)}{T_{\max}}$	1	
1	Gunderson and Dygert	GSI	M = 0.03 + 1.68 * IGS	1	GSI=Gonad-Somatic Index
1	Hoenig	Tmax	ln M = 1.44 – 0.984 * ln tmax $\ln Z = a + b \ln * T_{\max}$	1	Tmax=longevity; a and b assume “common” values equal to 1.44 and 0.984 respectively (r2=0.82).
1	Rikhter and Efanov	Tm	$M = \frac{1.521}{t_m^{0.72}} - 0.155$	1	Tm= age of massive maturity
1	Jensen’s Equation	K	$t_m = t_0 + \frac{1}{K} * \ln\left(\frac{3*K+M}{M}\right)$	1	Empirical equation. K is a parameter of the von Bertalanffy growth function
1	Hoenig’s variant (Hewitt)	Tmax	M ≈ 4.22 / tmax	1	Tmax=longevity
1	Taylor	L∞	$M=0.996/A_{0.95}$	1	$A_{0.95}$ =Age at which the organisms reach 95% L∞
1	Gulland	L∞	$\log M = \log M' - 0.5 \log (W/W_\infty)$ or $\log M = \log M' - 1.5 \log (1/L_\infty)$, or $M = M' (1/L_\infty)^{-1.5}$	1	Gulland, 1987
1	Peterson e Wroblewsky	W	$M_{Wdry}^{(day^{-1})} = \upsilon * W_{dry}^{-0.25}$		For pelagic fish constant *v* assumes the value of 1.92/yr
1	Lorenzen	W	$M_w=M_uW^b$	W	Mortality at unit weight Mu/year = 3.13 (C.I. 90%, 2.79-3.46) Weight exponent b =-0.309 (C.I. 90%, 2.79-3.46) Lorenzen, 1996
2	Csirke and Caddy	Z Y	$P_{(t)} = B_{(t)} * Z_{(t)} = B_\infty * \left(1+\frac{M}{r_m}\right) * Z_{(t)} - \left(\frac{B_\infty}{r_m}\right) * Z_{(t)}^{2}$ $Y_i = a + b * Z_i + c * Z_i^2$ $M = \frac{-b+\sqrt{b^2-4a*c}}{2*c}$	2	

2	Paloheimo	Z f	$\ln\left(\frac{C_{1t}}{f_t}\right)-\ln\left(\frac{C_{2t+1}}{f_{t+1}}\right)=M+\frac{f_t+f_{t+1}}{2}*q+e_t$ $\bar{Z}_t=M+q*\bar{f}_t$	2 time series data estimation	natural mortality estimation from regression of Z and fishing effort time series
2	Silliman	Z f	$M=\frac{(Z_2*f_1)-(Z_1*f_2)}{f_1-f_2}$	2	Natural mortality estimate based on a comparison of Z and fishing effort at two different levels of exploitation.
2	Caddy	Z Y	$M_{(t)}=M_a+\left(\frac{\beta}{t}\right)$	2 time series data estimation	Integrated information from trawl surveys and commercial catches
2	Forem	Mean Life Fecundity Mean Parental Age		2	Abella et al., 1997
3	Pauly's first	L∞ k/year T°C	log M = -0.0066 – 0.279 log L∞ + 0.6543 log K + 0.4634 log T°C	3	L∞ and K are von Bertalanffy growth parameters T is the mean annual temperature in °C
3	Pauly's second	L∞ k/year T°C	$T_{\max}=\frac{-\log_e\left[1-\left(\frac{L_{\max}}{L_\infty}\right)\right]}{K}+t_0=\frac{2.9957}{K}+t_0=\frac{3}{K}+t_0$	3	L∞ and K are von Bertalanffy growth parameters T is the mean annual temperature in °C
3	Roff	L∞ k/year T°m	$\ln M=\ln 3+\ln L_\infty+\ln K+\ln\left(1-\frac{L_m}{L_\infty}\right)-\ln L_m$ $M=\frac{3*K*\exp-K*t_m}{1-\exp-K*t_m}$	3	Relationship between mortality, Brody Coefficient K and age ot sexual maturity taking under consideration reproductive costs in life cycle.
3	Beyer	L∞	$Y=A+B*X$ $Y=\ln(C_i*\bar{L}_i)$ $X=\ln\left[\left(\frac{L_\infty}{L}\right)-1\right]$ $M_{(L)}=M_\infty*\left(\frac{L_\infty}{L}\right)$ $B=\left(\frac{M_\infty}{K}-1\right)$	2+ 1 data estimation	As soon as M∞ is estimated, it is possible to estimate M at size

3	Chen & Watanabe	L∞ k/year t_0	$M_{(t)} = \frac{K}{1-\exp-K(t-t_0)}$ for $t=t_M$ $M_{(t)} = \frac{K}{a_0 + a_1(t-t_M)+a_2(t-t_M)^2}$ for $t>t_M$	3	bathtub curve as a function of vB growth equation
3	ProBiom	L∞ k/year Tmax		3	Abella et al., 1997
4	Munro	L∞ k/year Catch x size selectivity	1) $\Delta t_{(i;i+1)} = \frac{-\log_e\left[\left(\frac{L_\infty - L_i}{L_\infty - L_{i+1}}\right)\right]}{K}$ 2) $R_i = (C_i / p_i)/\Delta t_i$ 3) $Z_{i,i+1} = -\frac{1}{\Delta t_{i,i+1}}\cdot\left[\log_e\left(\frac{R_{i+1}}{R_i}\right)\right]$ 4) $Z_{i,i+1} = M + F \cdot p_{i,i+1}$	2+ 2 data estimation	
4	Gnomonic (GIM)	Mean Life Fecundity Mean Parental Age alfa G		4	based on caddy, 1991 (Martinez-Aguilar et al., 2005) - Sardine
4	Caddy-Abella Tuning	L∞ k/year catch x size (commercial) catch x size (survey)		2+ 2 data estimation	Caddy-Abella, 1999
4	Gislason	L∞ K L(avg) T (Kelvin)	$\ln M = a + b\ln L + c\ln L_\infty + d\ln K$ $\ln M = a + b\ln L + c\ln L_\infty + d\ln K - eT^{-1}$	3 or 4	Gislason et al., 2008
#	Andersen and Ursin		$M_{predation}(i) = \left(\frac{1}{N_i w_i}\right) * \sum_j \frac{dR_j}{dt} N_j \frac{\phi_{ji}}{\phi_j}$ $M=M_0+M_1+M_2$	lots of	

#	Myers and Doyle	$$\max_{u_1 \ldots u_{T-1}} \sum_{x=2}^{T} e^{-rx} l_x m_x \left(w_{x-1}, u_{x-1}\right)$$	lots of	
*	Beverton & Holt's Invariants (BHI)		-	
*	Tagging and Recapture		-	

All the experts agreed about the opportunity to use a declining value of M with age instead of a constant value, considering the early age of first capture and the massive catch of juveniles characterised by higher M rates in most of the Mediterranean fisheries. It is supposed that this choice, in general, will produce more reliable assessments on stocks status and on the consequences of alternative management options.

If scientists are confident with the estimates of the growth parameters, needed for using age/size based M models, STECF/SG-ECA/RST/MED-09-01 recommends to use the method provided by Gislason *et al.* (Gislason *et al.*, 2008a; Gislason *et al.* 2008b[19]): $\ln M = a + b \ln L + c \ln L_{\infty} + d \ln K$
or ProdBiom (Abella *et al.*, 1997[20]) based on Caddy (1991[21]):

$$M_{(t)} = M_a + \left(\frac{\beta}{t}\right)$$

where M_a is the asymptotic M and β is the curvature parameter.

In all the cases were there is a high uncertainty on growth parameters, scientists are invited to use alternative feasible, reliable and well documented alternative approaches.

5. GROWTH PARAMETERS FOR STOCKS OF DEMERSAL AND SMALL PELAGIC SPECIES.

As concerns the second part of ToR a, STECF/SG-ECA/RST/MED-09-01 discussed differences in growth parameters used to assess different species and stocks in the Mediterranean (Figs. 2, 3, 4 and 5). Some of the observed growth differences can be hardly explained with spatial differences in factors affecting growth rate (e.g. genetic, environment, population density). These discrepancies seem mostly due both to differences in methodological approaches used to obtain mean length at age (modal progression analysis and otolith reading) and interpretation of ring pattern on otoliths.

In particular, it has been underlined the need to reduce differences in L_{inf} and K parameters in order to make assessments and figures comparables and to standardize the estimation of M. It has been suggested to revise all the information concerning hake growth in the Mediterranean and then it has been agreed to define a range of size between 90 to 100 cm TL for L_{inf}. Due to the lack of time and to the higher differences in the estimated values, the discussion about K was postponed to a next opportunity.

In the case of red mullet the group discussed the reliability of differences in growth pattern between the east and the western basin. Concerning L_{inf}, a range between 27 to 31 cm TL was assumed as realistic and recommended to be adopted for the estimation of natural mortality.

In the case of deep-water rose shrimp the variation observed in L_{inf} among areas seem to be low. The group recommends using the following growth values: for L_{inf} a range between 43 to 45 mm (CL) and for K values within a range between 0.45 to 0.6.

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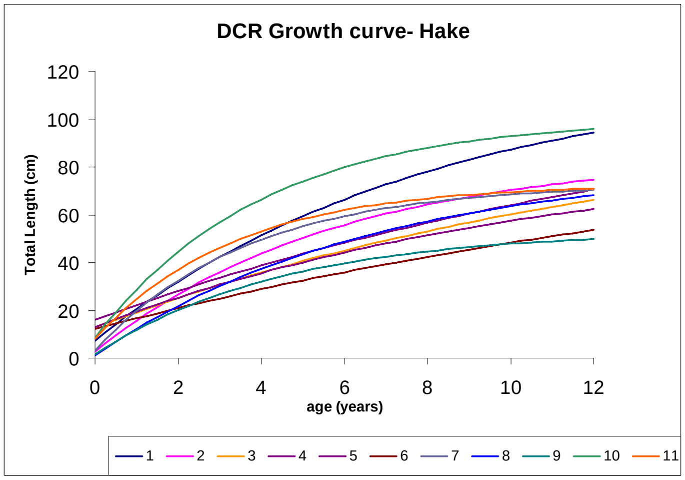
[19] Gislason, H., Daan, N., Rice, J. C., and Pope, J. G. 2008b. Does natural mortality depend on individual size? ICES CM 2008/F:16 (mimeo.)

[20] Abella A., Caddy J.F., Serena F. (1997) Declining natural mortality with age and fisheries on juveniles: a Mediterranean demersal fishery yield paradigm illustrated for *Merluccius merluccius*. Aquatic Living Resources 10: 257–269.

[21] Caddy, J.F. (1991). Death rates and time intervals: Is there an alternative to the constant natural mortality axiom? Rev. Fish Bio/. Fisheries, 1: 109-13 8.

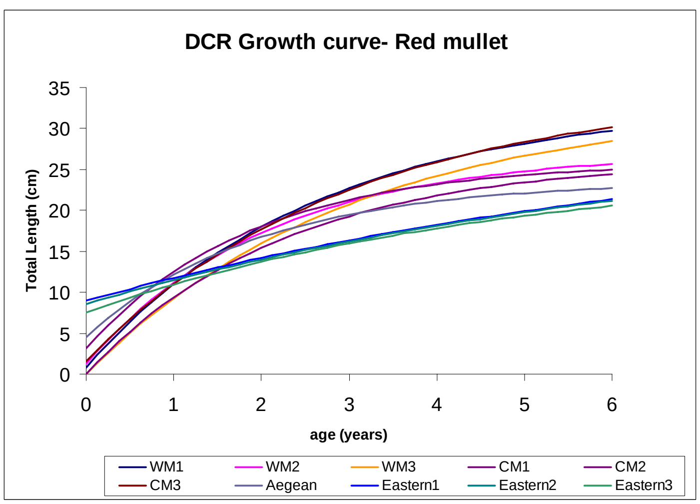
In the case of small pelagic fish was agreed to use a L_{inf} value ranging from 20 to 22 cm for sardine and from 19 to 20 cm for anchovy. Due to the restricted time available, a deeper discussion about K was postponed to a next opportunity.



WM= Western Mediterranean; CM= Central Mediterranean; EM= Eastern Mediterranean
C= males + females; M= males; F= females
1=WM(C); 2=WM(C); 3=EM(F); 4=EM(M); 5=EM(F); 6=EM(M); 8=CM(F); 9=CM(M); 10=WM(F); 11=WM(M)

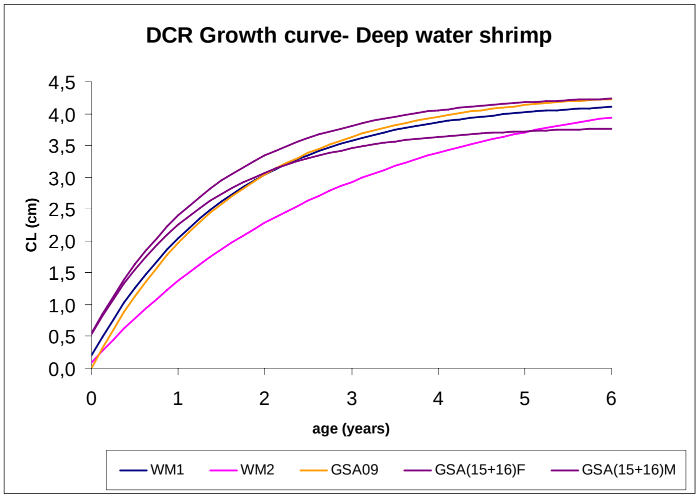
	1	2	3	4	5	6	7	8	9	10	11
L_INF	120	85	106,9	87,9	122,5	104,1	73,12	81,54	53,58	100,7	72,8
K	0,123697	0,17294	0,07	0,09	0,06	0,05	0,2725	0,15	0,22	0,248	0,298
T0	-0,514671	-0,177	-1,82	-1,77	-2,34	-2,48	-0,15	-0,08	-0,13	-0,35	-0,383

Fig. 2. Von Bertalanffy growth curves and growth parameters of hake estimated in different Mediterranean areas.



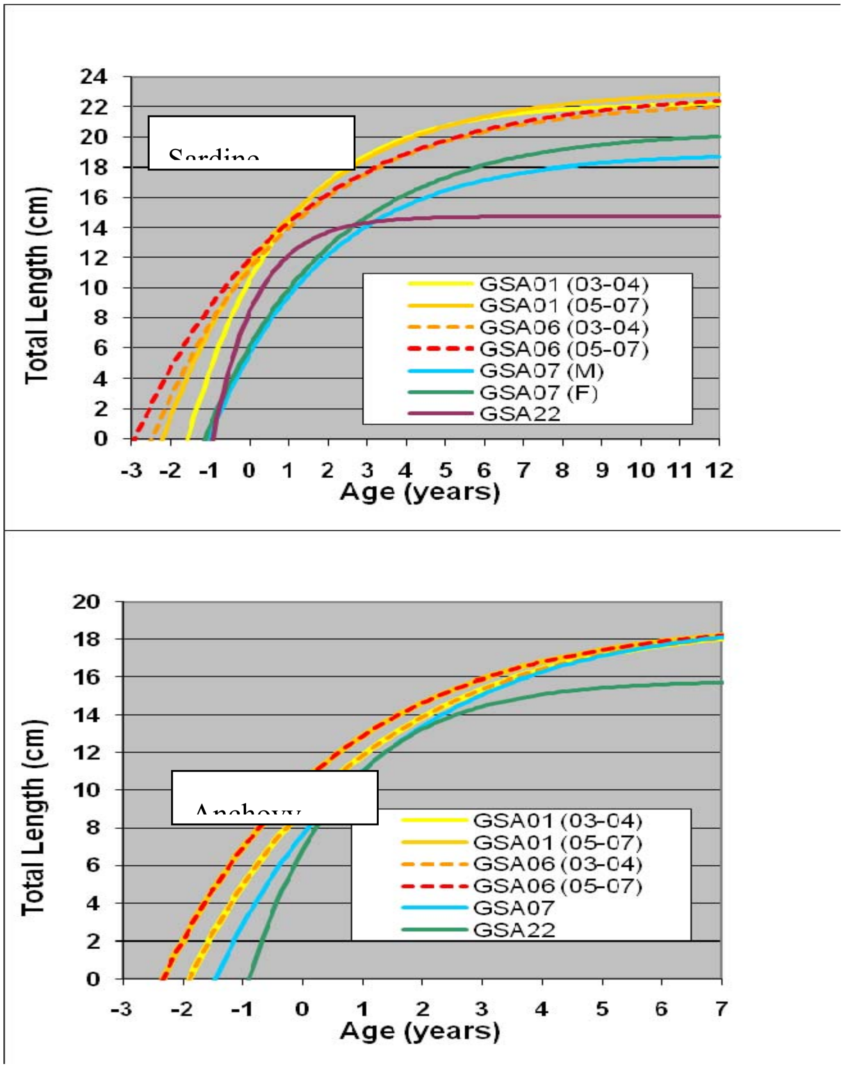
	WM1	WM2	WM3	CM1	CM2	CM3	Aegean	Eastern1	Eastern2	Eastern3
L_INF	33	27,12	33	25,9	26,33	34,5	23,6	31,8	30,8	26,01
K	0,38	0,48	0,33	0,533	0,44	0,336	0,51	0,13	0,14	0,203
T0	-0,068	-0,1	0,001	-0,239	0	-0,143	-0,42	-2,55	-2,33	-1,688

Fig. 3. Von Bertalanffy growth curves and growth parameters of red mullet estimated in different Mediterranean areas.



	WM1	WM2	GSA09	GSA(15+16)F	GSA(15+16)M
L_INF	4,2	4,5	4,35	4,3	3,8
K	0,618511	0,344	0,6	0,68	0,75
T0	-0,0785	-0,057	0	-0,2	-0,2

Fig. 4. Von Bertalanffy growth curves and growth parameters of deep-water rose shrimp estimated in different Mediterranean areas.



Sardine

	GSA01 (03-04)	GSA01 (05-07)	GSA06 (03-04)	GSA06 (05-07)	GSA07 (Male)	GSA07 (Female)	GSA22 (Males)
L_INF	22.3	23.1	22.4	22.9	18.9	20.4	14.8
K	0.4043	0.3127	0.2820	0.2506	0.3400	0.3100	0,9
T0	-1.5856	-2.2205	-2.4849	-2.926	-1.0470	-1.1580	-0,9360

Anchovy

	GSA01+06 (03-04)	GSA01+06 (05-07)	GSA07	GSA22
L_INF	19.0	19.0	19.1	15.9
K	0.3395	0.3419	0.3500	0.6260
T0	-1.8815	-2.3210	-1.450	-0.8870

Fig. 5. Von Bertalanffy growth curves and growth parameters of sardine and anchovy adopted in different GSAs.

The usefulness of different methodological approaches for the estimation of age-length keys was discussed taking into account the results obtained in different studies (red mullet in Castellammare Gulf, anchovy in Gulf of Cadiz). STECF/SG-ECA/RST/MED-09-01 agreed on the necessity to improve the standardization in age reading for the selected fish species in order to reduce uncertainty in the estimation of growth parameters. STECF/SG-ECA/RST/MED-09-01 recommends to organise regional meetings aimed to improve the accuracy and standardization of otolith readings for the most relevant small pelagic (anchovy and sardine) and demersal fish species (i.e.: hake and red mullet).

The necessity to validate age-length keys derived from otolith readings (e.g using length-at-age estimated through modal progression analysis) was also discussed and recommended.

6. EXPLORE ALTERNATIVE STOCK UNITS AND TO INVESTIGATE THE POSSIBILITY OF COMBINING STOCK-SPECIFIC DATA FROM ADJACENT GSAS BASED ON ECOLOGICAL, BIOLOGICAL AND FISHERY FEATURES.

As concerns the ToR b, raised during the previous STECF/SGMED meetings, STECF/SG-ECA/RST/MED-09-01 had the opportunity to explore the available knowledge about several stocks and to discuss more general approaches, to be applied in future stock assessments.

A good base for the discussion was provided by the working paper by Cheilari and Rätz on the "Review of possible stock units of European hake, red mullet and deep-water shrimp in the Mediterranean Sea by means of trends in survey abundance" which examined the possibility of merging adjacent GSAs or, when necessary, dividing a given GSA into sub-units, in case available scientific evidence supports this decision. The underlying assumption was whether similar trends in relative survey abundance estimates from catch, derived from MEDITS surveys for the three species taken into account, could be interpreted as an objective criterion to join neighbouring stock areas from a management perspective. The STECF/SG-ECA/RST/MED-09-01 considered this proposal, although very preliminary, as a useful indication for neighbouring GSAs. Despite the fact that MEDITS trawl is not the appropriate gear for sampling small pelagic fish, due to the significant amount of these species in the samples in some areas, it has been suggested to explore the possibility to perform this analysis for the sardine and anchovy also, when sufficient data are available.

About the results regarding the GSA05, the question was raised on whether data collected before 2007 from this GSA can be used for comparison with other GSAs, given the low number of hauls carried out in previous MEDITS surveys exclusively around Ibiza island. Since 2007 the survey covers a wider area including all the Balearic islands and the full GSA05 and therefore STECF/SG-ECA/RST/MED-09-01 concluded that these data can be used for comparison with other GSAs.

A number of questions addressed the need to consider factors other than similarities in trends in recruitment indexes, detected in surveys carried out by the end of spring and summer:

- Because of the timing of MEDITS surveys, similarities in recruitment trends among adjacent GSAs can be detected only in European hake and deep-sea rose shrimp (species widely distributed, protracted spawning period). No similar trends in recruitment were observed in red mullet (recruitment takes place by the end of summer and early autumn).
- For the definition of stock boundaries of a given species it is necessary to know the species distribution. Thus, it is necessary to build a conceptual spatial model for the species, which should include both basic information on its biology and behaviour (for example, spawning and recruitment areas) and oceanographic structures and dynamics. MEDITS data cover only part of the life span (limited in space and time).
- Hake stocks definitions in GSAs 19, 20, 21, 22: The Greek part of the Ionian Sea (GSA 20) is characterized by a generally narrow continental shelf, which is much narrower in the southern than in the northern part, and the existence of the deep Hellenic Trench (with depths reaching 5000 m), lying along the western and southwestern Hellenic coast and the islands of the Cretan Arc. The deep Hellenic Trench constitutes a barrier to any possible migration of demersal species between GSAs

19 and 20. Additionally, no correlation in relative abundance trends of hake was evident between GSAs 19 and 20 (based on MEDITS data series), further supporting the hypothesis that the hake stocks in these areas should be treated separately. GSAs 22 and 23 were combined as there was no evidence (mostly due to the lack of GSA specific data) that they should be treated separately. Hake spatial distribution and nursery grounds in Hellenic Seas (GSAs 20, 22, 23) were identified based on MEDITS data (Tserpes *et al*., 2008[22]). Total hake abundance was relatively higher in the central western part of GSA 22 (Saronikos and Evvoikos Gulfs), in the eastern part of the Cretan Sea (GSA 23), and in the central part of GSA-20 (mostly Korinthiakos and Patraikos Gulfs). The most important nursery grounds were also identified in the same areas. Thus, hake abundance was generally low in the area around the boundary between GSA-20 and GSAs 22-23 and no nursery ground was identified in this area. In addition, a low correlation in relative abundance trends of hake (MEDITS data series) was apparent between GSA 20 and GSAs 22-23. For these reasons and in the absence of any opposing evidence, hake stocks in GSA 20 and GSAs 22-23 is recommended to continue to be assessed separately. There was a positive correlation in relative abundance trends of hake in GSA 20 and in GSAs 17 and 18, suggesting that these GSAs might be treated as a single stock. However, to make such a decision, further evidence is necessary that there is a flow of recruits and/or adults between the eastern Ionian Sea and the Adriatic Sea. A thorough investigation of the hydrodynamics and geomorphology of the area would be helpful. Whether these GSAs could be combined should be examined in the future after analyzing the oceanographic features of these areas.

- Data from MEDITS should be examined also to eventually improve the data availability for small pelagic species. The situation of small pelagic species should be further examined in terms of stock boundaries.
- The boundaries should be used for well defined stocks or populations (when recruitment areas are known and adults do not migrate).
- For stock assessment to be performed based on biological and fishing features, international cooperation needs to be strengthened. In this regard, the possibility of organising a joint meeting with GFCM-SAC or one of its WG should be considered.
- Differences in growth factors may not necessarily reflect differences among stocks, because these can be observed within a given stock.
- Taking into account the biology and distribution of the species, the areas considered for European hake and deep-water rose shrimp stock assessment could be larger than one GSA and those for red mullet smaller than one GSA. This situation should be also possibly applied to other species.

Based on the observed similarities on recruitment indexes estimated from MEDITS surveys, on the above mentioned points and on the current knowledge on the selected species, STECF/SG ECA/RST/MED 09-01 recommends the following changes to the current stock boundaries to be used for the next stock assessments by SGMED:

a. European Hake (*Merluccius merluccius*)
   It is recommended to merge the following GSAs[23]:
   - GSAs 05+06;
   - GSAs 12+13+14+15+16;
   - GSAs 17+18;

b. Red mullet (*Mullus barbatus*)
   - It is recommended to maintain the current GSAs boundaries or investigate smaller areas.
   - GSA09 could be split into two sub-units: GSA09a (north) and GSA09b (south).

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[22] Tserpes G, Politou C-Y, Peristeraki P, Kallianiotis A, Papaconstantinou C, 2008. Identification of hake distribution pattern and nursery grounds in the Hellenic seas by means of generalized additive models. Hydrobiologia 612:125–133.

[23] Stocks of European hake and Deep-sea rose shrimps have been already merged in GSAs 22and 23 during the previous SGMED meetings in 2008.

c. Deep- water rose shrimp (*Parapenaeus longirostris*)
   The overall abundance of the species in the western Mediterranean is very low.
   It is recommended to merge the following GSAs[1]:
   - GSAs 01+06+07, on the basis of survey data; at the moment there are not sufficient data from GSA05 to support the possibility to merge it together with the other three GSAs, even if this could be regarded as a future opportunity.
   - GSAs 12+13+14+15+16.

7. DEFINE A DCF CALL FOR BIOLOGICAL AND ECONOMIC DATA TO SUPPORT THE WORK OF SGMED IN 2009.

According to the ToR d, STECF/SG ECA/RST/MED 09-01 discussed all the necessary details to define the biological and economic data to support the work of STECF/SGMED in 2009. It was necessary to consider the possible needs and a realistic working plan for 2009, then the discussion was reconsidered after the definition of the ToRs for the two meetings planned in 2009.

To properly fulfil the requirements to support the STECF/SGMED workplan in 2009, there is a need to launch an official data call through DCF regarding all available fisheries and survey data that are necessary for the scientific assessments of the stocks scheduled to be undertaken during 2009 and to respond to the relevant ToRs. In particular it was agreed that the defined official data call should support the effort to:

I. update the previous available assessments and assess the status and trends of the stocks of sardine (*Sardina pilchardus*), anchovy (*Engraulis encrasicolus*), European hake (*Merluccius merluccius*), red mullet (*Mullus barbatus*), and deep-water rose shrimp (*Parapenaeus longirostris*) in all relevant Mediterranean GSAs.
II. assess the status and trends of the stocks of three species not previously assessed by SGMED, i.e. Norway lobster (*Nephrops norvegicus*), red shrimp (*Aristeus antennatus*) and giant red shrimp (*Aristaeomorpha foliacea*) in all relevant Mediterranean GSAs.

The supporting data from the DCF should be officially called for all GFCM GSAs relevant for European Community fisheries in the Mediterranean. The defined official data call should support the provision of advice on possible short-term and long-term economic consequences of long-term harvesting strategies during the SGMED-09-02 and SGMED-09-03 meetings. As a methodological approach to provide economic advice has not yet been defined, a comprehensive official data call is needed.

The data call under the DCR should cover information on the biological and economic aspects of the fisheries from both indirect (e.g. landings, effort) and direct methods (trawl surveys and acoustic or DPEM small pelagic surveys) from the Mediterranean. The data should be delivered to JRC at least two weeks before the SGMED-09-02 meeting which is planned to be held between 8 to 12 of June 2009. However, data from surveys conducted in 2009 should be provided to JRC at least two weeks before the SGMED-09-03 meeting which is planned to be held between 30 November and 4 December 2009. The data call will be issued to all EU member states having demersal and small pelagic fishing activities in the Mediterranean. The data call will cover requests for data according to the segmentation and aggregation in the EC1639/2001 amended by EC 1581/2004, however data will also be requested which is not specifically mentioned in the EC 1639/2001 but which may be collected within the DCR framework or other data collection schemes within the framework of national and EU research programs or studies. It is advisable that supporting documents from EU research projects are made available to allow the STECF/SGMED to consider the data originating from these studies to be included in stock assessments.

The data requested will allow standardized assessments in the different Mediterranean GFCM GSAs or in wider stock units by merging adjacent GSAs, as defined in this report (see the previous paragraph 6). The methodologies used for stock assessment will depend on the data submitted and this is the main reason why a large number of variables have been requested. Different stock assessment methodologies (STECF PLEN-

07-03 report) can also be used for the same stock if enough data are available. Experts pointed out that this official data call will obviously not include data from non-EU countries, and other channels should be explored to have relevant information from non-EU countries. For example, data are needed from Turkey to assess stocks of GSAs 22-23. Large differences exist within GSA 17 (eastern and western part) regarding data collection obligations. There are also different perceptions of anchovy and sardine stock status, as well as different management and fishing practices. These complexities must be considered during assessments.

As reported by SGMED-08-03, bio-economic models are the desired tool to assess the biological, economic and social impact of implementing new management measures or changing the current fisheries regulations. A short review of bio-economic models developed for Mediterranean fisheries has been produced by SGMED-08-02. Notwithstanding, which model should be used to provide economic advice for Mediterranean fisheries has not been established.

Under “Studies and Pilot Projects for Carrying Out the Common Fisheries Policy No FISH/2007/07”, a survey of existing bio-economic models has been produced. This study was aimed to review the models currently being used for bio-economic assessments in European fisheries, their advantages and limitations, and their usability for simulating the effects of a set of possible management strategies. In addition, the consistency between DCR and bio-economic models data requirement has been explicitly explored.

The submission of biological and economic data through the official DCF data call is essential to verify the possible use of bio-economic models to provide economic advice on the long-term harvesting strategies during the SGMED-09-03 meeting. Based on the survey of existing bio-economic models and on data that will be made available by EU member states, SGMED-09-02 is then requested to define an appropriate methodology to provide economic advice of the various management scenarios to be simulated.

The data requested will be used to estimate the economic indicators reviewed by SGMED-08-03. In SGMED-08-03 meeting, a first attempt to estimate a number of economic indicators was made at country level. As biological advice is provided at GSA level, a consistency between biological and economic advice is desirable. The economic data requested at GSA level will be used by SGMED during the 2009 meetings to estimate economic and social indicators at GSA level for the fleet segments mainly involved in demersal and pelagic fishing activities in the Mediterranean Sea.

In the previous year, SGMED-08-02 developed two official data calls designed to obtain consistent and necessary information to underpin the assessments proposed for SGMED-08-03 and SGMED-08-04. A summary of the data provided to both SGMED-08-03 (demersal stocks, i.e. European hake, red mullet, deep-sea rose shrimp) and SGMED-08-04 (small pelagic stocks, i.e. anchovy and sardine) meetings by country is presented in Tables 3 and 4, respectively. No member state managed to provide all the fisheries data for all species, at the requested aggregation level for fishing techniques, for the full time range requested. The gaps in the data provided, especially in length and age distributions of landings and discards, rendered stock assessments of some stocks difficult or impossible. In some member states (e.g., Cyprus and Malta) very short time series were available, restricting the set of usable assessment methods. In Greece, DCR was not implemented in 2007, and this gap in the time series of data will seriously affect the quality of future stock assessments. Slovenia provided no data after the previous data call. The group stresses the need that Member States provide all the requested data in order to effectively conduct the requested stock assessments for 2009.

Biological data requested include landings, effort, length distribution, age distribution, maturity, growth parameters, sex ratio, discards and discards length distribution from data collected by indirect methods. From direct methods, such as trawl surveys, the data requested include MEDITS TA, TB, TC files, and the data requested for small pelagic surveys include length distribution, age distribution and maturity at age. Economic data include capacity, revenues, employment, costs and fuel consumption, financial situation and prices. Specific time period for the requested data are given in the Appendix 2. Details of the parameters requested for the future SGMED meetings, with the segmentation and aggregation used, can be found in Appendix 2.

Table 3 - Overview of data provided by country from the 2008 Data Call for SGMED-08-03 (demersal stocks). Lx is the level of aggregation of fishing techniques. For Italy the stated data coverage does not include all relevant GSAs.

REQUESTED FILES	FILENAME	DESCRIPTION	CYPRUS	FRANCE	GREECE	ITALY	MALTA	SLOVENIA	SPAIN
Fisheries Data									
FILE_1	M01_MED_LAN	LANDINGS	2005-2007, L5, MUT HKE only	2002-2007 HKE 2006-2007 MUT, L5	2003-2006, L5	2002-2007, L2	2005-2007, L5		2002-2007, L5
FILE_2	M02_MED_EFF	EFFORT	2005-2007, L5	2004-2006, L5	2003-2006, L5	2002-2007, L2	2005-2007, L5		
FILE_3	M03_MED_LAN_LEN	LENGTH_DISTRIBUTION_LANDINGS	2005-2007, L5, MUT only	2002-2007 HKE 2006-2007 MUT, L5		2002-2007			2002-2007, L5
FILE_4	M04_MED_LAN_AGE	AGE_DISTRIBUTION_LANDINGS	2005-2007, L5, MUT only	2006-2007 MUT, L5		2002-2007			2002-2007, L5
FILE_5	M05_MED_MAT	MATURITY_AT_LENGTH	2005-2007, MUT only	2006-2007	2003-2005, MUT HKE only, F only	2002-2007	2002-2007		2002-2007
FILE_6	M06_MED_GRO	GROWTH_PARAMETERS	2005-2007, MUT only	2005-2007 MUT only	2003-2005, MUT HKE only	2002-2007			2002-2007
FILE_7	M07_MED_SEX	SEX_RATIO	2005-2007, MUT only	2006-2007		2002-2007	2002-2007		2002-2007
FILE_8	M08_MED_DIS	DISCARDS	2006, L5	2003-2007 HKE 2006-2007 MUT, L5	2003-2005, MUT HKE only, F only	2005-2006, L2			2002-2007, L5
FILE_9	M09_MED_DIS_LEN	LENGTH_DISTRIBUTION_DISCARDS		2003-2007 HKE 2007 MUT, L5		2006, HKE and MUT only			2002-2005, L5, HKE only
Survey Data									
FILE_10	M10_MED_TA	MEDITS_TA	2005-2007	1994-2007	1994-2006	1994-2007	2002-2007		1994-2007
FILE_11	M11_MED_TB	MEDITS_TB	2005-2007	1994-2007	1994-2006	1994-2007	2002-2007		1994-2007
FILE_12	M12_MED_TC	MEDITS_TC	2005-2007	1994-2007	1994-2006	1994-2007	2002-2007		1994-2007

Table 4 - Overview of data provided by country from the 2008 Data Call for SGMED-08-04 (small pelagics). Lx is the level of aggregation of fishing techniques. For Italy the stated data coverage does not include all relevant GSAs.

REQUESTED FILES	FILENAME	DESCRIPTION	CYPRUS	FRANCE	GREECE	ITALY	MALTA	SLOVENIA	SPAIN
Fisheries Data									
FILE_1	M01_MED_LAN	LANDINGS		2003-2007, L5	2003-2006, L5	2002-2007	2006-2007, L5		2002-2007, L5
FILE_2	M02_MED_EFF	EFFORT		2004-2006, L5	2003-2006, L5	2002-2007, L2	2002-2007, L5		2002-2007, L5
FILE_3	M03_MED_LAN_LEN	LENGTH_DISTRIBUTION_LANDINGS		2002-2007, L5	2003-2006, L5	2006-2007			2002-2007, L5
FILE_4	M04_MED_LAN_AGE	AGE_DISTRIBUTION_LANDINGS		2002-2007, L5	2003-2006, L5	2006-2007			2002-2007, L5
FILE_5	M05_MED_MAT	MATURITY_AT_LENGTH		2005-2007 ANE only	2003-2005	2002-2005 ANE only			2002-2007
FILE_6	M06_MED_GRO	GROWTH_PARAMETERS		2002-2007	2003-2005	1994-2007			2002-2007
FILE_7	M07_MED_SEX	SEX_RATIO		2002-2007		2007			2002-2007
FILE_8	M08_MED_DIS	DISCARDS		2006-2007					2004-2006, L5
FILE_9	M09_MED_DIS_LEN	LENGTH_DISTRIBUTION_DISCARDS		2007					
Survey Data									
FILE_11	M11_MED_TB	MEDITS_TB	2005-2007	1994-2007		1994-2007			1994-2007
FILE_12	M12_MED_TC	MEDITS_TC	2005-2007	1994-2007 no length classes		1994-2007			
FILE_13	M13_MED_SP_LEN	LENGTH_DISTRIBUTION_SURVEY		1998-2007	2003-2006				2003-2007
FILE_14	M13_MED_SP_AGE	AGE_DISTRIBUTION_SURVEY		2002-2007 ANE only	2003-2006				2003-2007
FILE_15	M13_MED_SP_MAT	MATURITY_AT_AGE_SURVEY		2005-2007 ANE only					2003-2007

8. Define the Terms of Reference for the two subsequent SGMED assessment working groups in 2009 dealing with Mediterranean stocks.

Following the ToR e of the meeting, STECF/SG ECA/RST/MED 09-01 defined the Terms of Reference for the two subsequent SGMED assessment working groups in 2009 dealing with Mediterranean stocks. According to the Commission's request, the first meeting, SG-MED 09-02 (8-12 June 2009), should focus on the estimation of historic and recent stock parameters, while the second meeting, SGMED 09-03 (30 November-4 December 2009) should provide predictions of catch and biomass under different management scenarios in short and medium term and should also aim to and derive reference points for economic sustainability and provide economic advice of the various management scenarios simulated.

The discussion took into account what is reported in the previous paragraph 7 and the initial request by the Commission when the STECF/SGMED had started to work on stock assessments based on the results obtained through the Data Collection framework.

As an appropriate and agreed methodology to provide economic advice of the various management scenarios to be simulated is not yet available, the planning of a specific SGECA meeting is suggested. The SGECA meeting should be held before the SGMED-09-03 to make available an appropriate methodology to be used by SGMED in producing economic advice for Mediterranean fisheries.
Possible terms of reference for the suggested SGECA meeting can be as follows:

a) Identify the link between fishing mortality and fishing effort in multi-fleet and multi-species fisheries.
b) Analyse price dynamics by species and by fleet segment in each region or fishing area to include potential changes in prices in the economic advice.
c) Analyse costs dynamics by fleet segment in each region or fishing area to include potential changes in costs in the economic advice.
d) Suggest appropriate methodologies to consider fleet dynamics in providing economic advice.
e) Suggest appropriate methodologies to consider fishers behaviour in providing economic advice.

The Terms of Reference for the STECF/SGMED-09-02 (8-12/6/2009) were defined as follows:

a) Update and assess the status and trends of the stocks by all relevant GSAs, or, if the case, by bigger areas merging adjacent GSAs, in the Mediterranean Sea, taking into account the recommendations of the SGMED workshop in March and the following STECF comments. Advise on the status of the following exploited stocks of the species listed below, with respect to high yields harvesting strategies and to maintain their reproductive capacity and ensure a low risk.

- **Sardine** (*Sardina pilchardus*)
- **Anchovy** (*Engraulis encrasicolus*)
- **European hake** (*Merluccius merluccius*)
- **Red mullet** (*Mullus barbatus*)
- **Deep-water rose shrimp** (*Parapenaeus longirostris*)

b) Assess the status and trends of the stocks by all relevant GSAs, or, if the case, by bigger areas merging adjacent GSAs, in the Mediterranean Sea. Advise on the status of the following exploited stocks of the species listed below, with respect to high yields harvesting strategies and to maintain their reproductive capacity and ensure a low risk.

- **Red shrimp** (*Aristeus antennatus*)
- **Giant red shrimp** (*Aristaeomorpha foliacea*)
- **Norway lobster** (*Nephrops norvegicus*)

c) Review and propose biological reference points related to high yields and low risk of fishery collapse in long term of each of the stocks assessed.

d) Update and assess historic and recent trends (capacity, technological creep, nominal fishing effort) in the major fisheries by GSAs or, if the case, by bigger areas merging adjacent GSAs exploiting the stocks assessed. The trends should be interpreted in light of management regulations applicable to them.

e) Review the applicability and fully document all applied methodologies for the assessments and determination of the proposed biological reference points.

f) Fully document the data used and their origin for the assessments and determination of the proposed biological reference points.

g) To standardise the MEDITS and GRUND surveys time series to account for unbalanced sampling design and appropriate data distribution. Specific work has been initiated to allow for estimation of standardised MEDITS and GRUND surveys.

The Terms of Reference for the STECF/SGMED-09-03 (30/11-4/12/2009) were defined as follows:
a) Provide short term and medium term forecasts of stock biomass and yield for the stocks assessed during the SGMED 09-02 meeting in June for the species listed below, under different management options, by fisheries if possible:

- **Sardine** (*Sardina pilchardus*)
- **Anchovy** (*Engraulis encrasicolus*)
- **European hake** (*Merluccius merluccius*)
- **Red mullet** (*Mullus barbatus*)
- **Deep water rose shrimp** (*Parapenaeus longirostris*)
- **Red shrimp** (*Aristeus antennatus*)
- **Giant red shrimp** (*Aristaeomorpha foliacea*)
- **Norway lobster** (*Nephrops norvegicus*)

b) Advise on stock-size dependent harvesting strategies and slope-based approaches decision control rules to avoid risk situations for the stocks while ensuring high fisheries productivity, taking into account the recommendations of the SGMED 09-02 meeting in June and the following STECF comments. Such advice should consider mixed fisheries effects and ecosystem approach to fisheries management.

c) Identify any needs for management measures required to safeguard the stocks assessed.

d) Review the applicability and fully document all applied methodologies for the projections and determination of management approaches.

e) Fully document the data used and their origin for the projections and determination of the proposed biological reference points.

f) Provide and review marine population and community indicators.

g) Based on the "Survey of existing bio-economic models" under Studies and Pilot Projects for Carrying Out the Common Fisheries Policy No FISH/2007/07 and data made available by MS, review existing bio-economic models for producing advice on possible short-term and long-term economic consequences of the selected harvesting strategies. Evaluate the possibility to use existing bio-economic models for comparing the proposed harvesting strategies with long-term economic profitability (MEY) of the main fisheries exploiting the assessed stocks.

h) Suggest adjustments and provide guidance on data needs and quality, on methods and on interpretations, so that SGMED work can further progress in 2010 towards the goals of the overall mandate given to STECF, focusing its attention, in particular, on the various stocks of the following species, all included in Appendix VII of the Commission Decision (2008/949/EC) for the Mediterranean and the Black Sea: European hake (*Merluccius merluccius*), red mullet (*Mullus barbatus*), blue whiting (*Micromesistius poutassou*), common Pandora[24] (*Pagellus erythrinus*),

[24] STECF/SG ECA/RST/MED 09-01 recommends to amend the common name reported in the Appendix VII by the Commission Decision (2008/949/EC) for the Mediterranean and the Black Sea and substitute "Pandora" with the

Blackspot seabream[25] (*Pagellus bogaraveo*), Axillary seabream[26] (*Pagellus acarne*), Common sole (*Solea solea*)[27], Horse mackerel (*Trachurus trachurus*), Greater forkbeard (*Phycis blennoides*)[11], Poor cod (*Trisopterus minutus*)[3], Sargo breams (*Diplodus* spp.)[11], Picarel[28] (*Spicara smaris*), Bogue (*Boops boops*), Sea bass (*Dicentrarchus labrax*), Anglerfish (*Lophius piscatorius*), Black-bellied angler (*Lophius budegassa*), Gilthead seabream (*Sparus aurata*), tub gurnard (*Trigla lucerna*)[29], Mackerel (*Scomber* spp.), Common dolphinfish[30] (*Coryphaena hippurus*), Sardine (*Sardina pilchardus*), Anchovy (*Engraulis encrasicolus*), Sprat (*Sprattus sprattus*)[11], Deep-water rose shrimp[31] (*Parapenaeus longirostris*), Norway lobster (*Nephrops norvegicus*)[32], Red shrimp (*Aristeus antennatus*), Giant red shrimp (*Aristaeomorpha foliacea*)[33], Atlantic bonito (*Sarda sarda*), Skipjack tuna (*Katsuwonus pelamis*)[34], bullet tuna (*Auxis rochei*).

9. OTHER MATTERS: RECOMMENDATION FOR AMENDMENTS TO THE APPENDIX VII OF THE COMMISSION DECISION (2008/949/EC).

While checking the reference EC Regulations for preparing the ToRs for the next SGMED meetings in 2009, STECF/SG-ECA/RST/MED-09-01 noted several mistakes concerning the name of the species, either common or scientific, listed in the Appendix VII of the Commission Decision (2008/949/EC) for the Mediterranean and the Black Sea, but also in other parts of the same Appendix.

Considering the fact that this list is the base for the data collection on the various stocks of Community interest, that this list was previously checked by STECF and that the mistakes present in the official version were

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correct name adopted by FAO and Fish-base, "Common Pandora", because the actual one might generate confusion if not supported by the scientific name.

[25] STECF/SG ECA/RST/MED 09-01 notes that the ToRs for the previous SGMED meeting in 2008 reported this species as "Red Sea Bream"; no one known species has this common name. It was also noted that this species is not included in the Appendix VII of the Commission Decision (2008/949/EC) for the Mediterranean and the Black Sea, but data could be possibly available from surveys or from those areas where a recovery plan is in place.

[26] STECF/SG ECA/RST/MED 09-01 notes that this species is not included in the Appendix VII of the Commission Decision (2008/949/EC) for the Mediterranean and the Black Sea, but data could be possibly available from surveys or from other data sources.

[27] STECF/SG ECA/RST/MED 09-01 recommends to amend both the common name reported in the Appendix VII by the Commission Decision (2008/949/EC) for the Mediterranean and the Black Sea and substitute "Sole" with the correct name adopted by FAO and Fish-base, "Common sole", and the scientific name, substituting "*Solea vulgaris*" which is now a synonym, with the valid name "*Solea solea*".

[28] STECF/SG ECA/RST/MED 09-01 recommends to amend the common name reported in the Appendix VII by the Commission Decision (2008/949/EC) for the Mediterranean and the Black Sea and substitute "Picarels" with "Picarel", because the actual one might generate confusion if not supported by the related scientific name. Picarels might be intended as all the species belonging to the genus *Spicara*.

[29] STECF/SG ECA/RST/MED 09-01 recommends to amend the scientific name reported in the Appendix VII by the Commission Decision (2008/949/EC) for the Mediterranean and the Black Sea and substitute "*Trigla lucerna*" with the correct name adopted by FAO and Fish-base, "*Chelidonichthys lucerna*" for Tub gurnard.

[30] STECF/SG ECA/RST/MED 09-01 recommends to amend the common name reported in the Appendix VII by the Commission Decision (2008/949/EC) for the Mediterranean and the Black Sea and substitute "Dolphinfish" with "Common dolphinfish", because the actual one might generate confusion if not supported by the related scientific name.

[31] STECF/SG ECA/RST/MED 09-01 recommends to amend the common name reported in the Appendix VII by the Commission Decision (2008/949/EC) for the Mediterranean and the Black Sea (but also for other areas) and substitute "White shrimp" with "Deep-water rose shrimp", which is the common name adopted by FAO, because the actual one might generate confusion if not supported by the related scientific name.

[32] STECF/SG ECA/RST/MED 09-01 recommends to amend the scientific name reported in the Appendix VII by the Commission Decision (2008/949/EC) for the Mediterranean and the Black Sea and substitute "*Langoustine norvegicus*" with the correct name adopted by FAO, "*Nephrops norvegicus*" for the Norway lobster.

[33] STECF/SG ECA/RST/MED 09-01 recommends to amend the scientific name reported in the Appendix VII by the Commission Decision (2008/949/EC) for the Mediterranean and the Black Sea and substitute "*Aristeomorpha foliacea*" with the correct name adopted by FAO "*Aristaemorpha foliacea*" for the Giant red shrimp.

[34] STECF/SG ECA/RST/MED 09-01 notes that the ToRs for the previous SGMED meetings in 2008 reported this species as "Stripe-bellied bonito"; no one known species has this common name in English.

already corrected by STECF and, consequently, that it is necessary to eliminate any possible confusion, STECF/SG-ECA/RST/MED-09-01 recommends the following amendments to the Appendix VII of the Commission Decision (2008/949/EC) for the Mediterranean and the Black Sea:

i) to amend the common name of *Pagellus erythrinus*, and substitute "Pandora" with the correct name adopted by FAO and Fish-base, "Common Pandora", because the actual one might generate confusion if not supported by the scientific name.
j) to amend both the common name and substitute "Sole" with the correct name adopted by FAO and Fish-base, "Common sole", and the related scientific name, substituting "*Solea vulgaris*", which is now a synonym, with the valid name "*Solea solea*".
k) to amend the common name and substitute "Picarels" with "Picarel", because the actual one might generate confusion if not supported by the related scientific name; Picarels might be intended as all the species belonging to the genus *Spicara*.
l) to amend the scientific name for Tub gurnard, and substitute "*Trigla lucerna*" with the correct name adopted by FAO and Fish-base, "*Chelidonichthys lucerna*".
m) to amend the common name and substitute "Dolphinfish" with "Common dolphinfish", because the actual one might generate confusion if not supported by the related scientific name of *Coryphaena hippurus*.
n) to amend the common name for *Parapenaeus longirostris* and substitute "White shrimp" with "Deep-water rose shrimp", which is the common name adopted by FAO, because the actual one might generate confusion if not supported by the related scientific name.
o) to amend the scientific name of the Norway lobster and substitute "*Langoustine norvegicus*" with the correct name adopted by FAO and all scientific references, "*Nephrops norvegicus*".
p) to amend the scientific name of the Giant red shrimp and substitute "*Aristeomorpha foliacea*" with the correct name adopted by FAO "*Aristaeomorpha foliacea*".

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APPENDIX 2. PARAMETERS AND AGGREGATIONS RECOMMENDED FOR THE PROPOSED DCF CALL FOR DATA.

DATA AGGREGATION AND CODIFICATION

Area

The code AREA can have the following values

AREA	description
GFCM GSAs (Level 4, Appendix I, 2008/949/EC)	e.g. 1

Species

SPECIES should use the 3-letter FAO code

SPECIES REQUESTED FROM FISHERIES DATA	*Merluccius merluccius, Mullus barbatus, Parapenaeus longirostris, Aristeus antennatus, Aristaeomorpha foliacea, Nephrops norvegicus, Engraulis encrasicolus* and *Sardina pilchardus*
FAO CODE	HKE, MUT, DPS, ARA, ARS, NEP, ANE, PIL
Sex	
SEX CODE	M = male; F = female; C = combined (F+M); U = unidentified

Time Period

The time period is defined in terms of years

YEAR PERIOD (for some biological data)	e.g. 2003-2005
YEARS REQUESTED FOR FISHERIES DATA	2002–2008
YEARS REQUESTED FOR MEDITS DATA	1994-2009*
YEARS REQUESTED FOR SMALL PELAGICS SURVEYS (ECOMED, PELMED, DEPM, all hydro acoustic surveys)	1990-2009*

* Data for 2009 will be provided when available (before 24 November 2009)

Fleet Segment

The fleet segment is defined by the gear code and the vessel length category

FISHING TECHNIQUE (FT)	Gear - This may be aggregated at different levels (see below)
	Level of aggregation of fishing technique (FT LVL) should be 3, 4 or 5 according to the appendix IV on the new draft implementing Decision of EC Regulation 199/2008. List in priority order LVL 5, 4, 3.
VESSEL LENGTH	vessel length class (EC 1581/2004, appendix IV)

Aggregation of Fishing Techniques at various levels (FT_LVL)

Level 1	Level 2	Level 3	Level 4	Level 5
Activity	**Gear classes**	**Gear groups**	**Gear type**	**Target assemblage**
Fishing activity	Dredges	Dredges	Boat dredge [DRB]	Molluscs
	Trawls	Bottom trawls	Bottom otter trawl [OTB]	Demersal species
				Deep water species
				Mixed demersal species and deep water species
			Multi-rig otter trawl [OTT]	Demersal species
			Bottom pair trawl [PTB]	Demersal species
			Beam trawl [TBB]	Demersal species
		Pelagic trawls	Midwater otter trawl [OTM]	Mixed demersal and pelagic species
			Pelagic pair trawl [PTM]	Small pelagic fish
	Hooks and Lines	Rods and Lines	Hand and Pole lines [LHP] [LHM]	Finfish
				Cephalopods
			Trolling lines [LTL]	Large pelagic fish
		Longlines	Drifting longlines [LLD]	Large pelagic fish
			Set longlines [LLS]	Demersal fish
	Traps	Traps	Pots and Traps [FPO]	Demersal species
			Fyke nets [FYK]	Catadromous species
				Demersal species
			Stationary uncovered pound nets [FPN]	Large pelagic fish
	Nets	Nets	Trammel net [GTR]	Demersal species
			Set gillnet [GNS]	Small and large pelagic fish
				Demersal species
			Driftnet [GND]	Small pelagic fish
				Demersal fish
	Seines	Surrounding nets	Purse seine [PS]	Small pelagic fish
				Large pelagic fish
			Lampara nets [LA]	Small and large pelagic fish
		Seines	Fly shooting seine [SSC]	Demersal species
			Anchored seine [SDN]	Demersal species
			Pair seine [SPR]	Demersal species
			Beach and boat seine [SB] [SV]	Demersal species
	Other gear	Other gear	Glass eel fishing	Glass eel
	Misc. (Specify)	Misc. (Specify)		

Aggregation of vessel length

VL0012	Vessels less than 12 metres in length
VL1224	Vessels between 12 metres and 24 metres in length
VL2440	Vessels between 24 metres and 40 metres in length

VL40XX	Vessels greater than 40 metres in length

BIOLOGICAL VARIABLES REQUESTED AND UNITS

LANDINGS Aggregated on fishing technique, vessel length (for each FT LVL), species, year and area where fish were caught

Type	**Description**	**Units**
Number (LN)	Number of fish landed	In thousands
Weight (LW)	Weight declared on landing	t
Value (LV)	Value of landings	Euro
Comments	Any relevant comments (Text max. 250 characters)	

EFFORT (EF) Aggregated on fishing technique, vessel length (for each FT LVL), target assemblage, year and area where fish were caught

Type	**Description**	**Units**
Days	Number of days each vessel spends at sea over the time period in question - sum for whole fleet segment	days at sea
KWDays	Sum of effort for each vessel in segment over time period in question. KWDAYS of each vessel is number of days at sea multiplied by engine power in kW	kW*Days
GTDays	Sum of effort for each vessel in segment over time period in question. GTDAYS of each vessel is number of days at sea multiplied by gross tonnage	GT*Days
Comments	Any relevant comments (Text max. 250 characters)	

LENGTH DISTRIBUTION Aggregated by fishing technique, species, length class, sex, number of individuals per length class, year and area where fish were caught

Type	**Description**	**Units**
Length distribution	Annual length structure of the total landings (numbers per length class raised to landings per length class). Aggregation to length classes with length interval 1-2 cm should be made to the cm below; for example for red mullet length class 1, the range is from 1.00 – 1.99 cm. For species with length class interval 0.5 cm or 0.1 cm, aggregation should be made to the 0.5 cm or 0.1 cm below, respectively. All length classes should be represented in the data file including zero values (no individuals in the length class of the length ranges in the table below)	LN, number in thousands LW, weight in t

Species	Length type	Length class interval (cm)	Length range (cm)
Merluccius merluccius	Total length	2.0	0 to 90
Mullus barbatus	Total length	1.0	0 to 30
Engraulis encrasicolus	Total length	0.5	0 to 20
Sardina pilchardus	Total length	0.5	0 to 25
Parapenaeus longirostris	Carapace length	0.1	0 to 3.5

	Aristeus antennatus	Carapace length	0.2	0 to 10
	Aristaeomorpha foliacea	Carapace length	0.2	0 to 10
	Nephrops norvegicus	Carapace length	0.2	0 to 10
Mean weight by length class				g
Comments	Any relevant comments (Text max. 250 characters)			

AGE DISTRIBUTION LANDINGS Aggregated on fishing technique, species, year, age class, sex, and area where fish were caught

Type	**Description**	**Units**
Age distribution	Annual age structure of the total landings (number of individuals per age class raised to landings by age class). Aggregations to age classes should be made to the year below; for example for red mullet age class 0 the range is from 0 – 0.99 yr. All age classes should be represented in the data file including zero values (no individuals in the age class of the age ranges in the table below)	LN, number in thousands LW, in t

Species	Age class interval (yr)	Age range
Merluccius merluccius	1	0 to 20
Mullus barbatus	1	0 to 10
Engraulis encrasicolus	1	0 to 6
Sardina pilchardus	1	0 to 10
Parapenaeus longirostris	1	0 to 5
Aristeus antennatus	1	0 to 8
Aristaeomorpha foliacea	1	0 to 8
Nephrops norvegicus	1	0 to 20

Mean weight by age class		g
Comments	Any relevant comments (Text max. 250 characters)	

MATURITY OGIVE AT LENGTH Aggregated by species, length class, sex, year period, and area where fish were caught

Type	**Description**	**Units**
Maturity ogive (PrM)	The proportion of mature individuals per length class according to the classification of the length distribution file (landings)	Proportion (0 to 1)
Method used	Any relevant information (Text max. 250 characters)	

GROWTH PARAMETERS Aggregated by species, sex, year period and area where fish were caught

Type	**Description**	**Units**
Linf	Von Bertalanffy growth parameters	cm
k	Von Bertalanffy growth parameter	$year^{-1}$
t_0	Von Bertalanffy growth parameter	year
a	Length- weight relationship parameter	Units to be used (cm, g)
b	Length- weight relationship parameter	Units to be used (cm, g)

Method used	Method used for ageing and to calculate the growth parameters (text max 250 characters)
Spawning period	The spawning season in range of months e.g. April - June
Spawning peak	The peak of the spawning period with the highest proportion of spawners e.g. May
Comments	Any relevant comments (Text max. 250 characters)

SEX RATIO AT LENGTH Aggregated by species, length class, year period and area where fish were caught

Type	Description	Units
Sex ratio	Proportion of each sex to the total number of sex determined individuals in each length class according to the length distribution file (landings)	Proportion (0 to 1)
Comments	Any relevant comments	Text max. 250 characters

DISCARDS Aggregated on fishing technique, vessel length (for each FT LVL), species, year and area where fish were caught

Type	Description	Units
Number (DN)	Number of fish estimated	in thousands
Weight (DW)	Weight estimated	t
Comments	Any relevant comments (Text max. 250 characters)	

DISCARDS LENGTH DISTRIBUTION Aggregated by fishing technique, species, length class, sex, year and area where fish were caught

Type	Description	Units
Length distribution	Annual length structure of the discards (numbers per length class raised to discards per length class). Aggregation to length classes with length interval 1-2 cm should be made to the cm below; for example for red mullet length class 1, the range is from 1.00 – 1.99 cm. For species with length class interval 0.5 cm or 0.1 cm, aggregation should be made to the 0.5 cm or 0.1 cm below, respectively. All length classes should be represented in the data file including zero values (no individuals in the length class of the length ranges in the table below)	DN, number in thousands DW, weight in t
Mean weight by length class		g
Comments	Any relevant comments (Text max. 250 characters)	

Species	Length type	Length class interval (cm)	Length range (cm)
Merluccius merluccius	Total length	2.0	0 to 90
Mullus barbatus	Total length	1.0	0 to 30
Engraulis encrasicolus	Total length	0.5	0 to 20
Sardina pilchardus	Total length	0.5	0 to 25
Parapenaeus longirostris	Carapace length	0.1	0 to 3.5
Aristeus antennatus	Carapace length	0.2	0 to 10
Aristaeomorpha foliacea	Carapace length	0.2	0 to 10
Nephrops norvegicus	Carapace length	0.2	0 to 10

MEDITS DATA	Refer to the International Bottom Trawl Survey in the Mediterranean (MEDITS). The complete MEDITS dataset is requested, i.e. for all species recorded and not only for HKE, MUT, DPS, ARA, ARS, NEP, ANE, PIL.	
Type	**Description**	**Units**
TA, TB, TC	Instruction manual, Version 5 April 2007	

SMALL PELAGIC SURVEY	Refers to ECOMED, PELMED, DEPM, and all hydro acoustic surveys.	
Type	**Description**	**Units**
Length distribution	Length structure of the survey data (numbers and biomass per length class by species and sex). Aggregation to length classes should be made to the 0.5 cm below; for example for anchovy length class 1, the range is from 0.5 – 0.99 cm. All length classes should be represented in the data file including zero values (no individuals in the length class of the length ranges in the table below)	numbers in thousands, biomass in t

Species	Length type	Length class interval (cm)	Length range (cm)
Engraulis encrasicolus	Total length	0.5	0 to 20
Sardina pilchardus	Total length	0.5	0 to 25

SMALL PELAGIC SURVEY		
Type	**Description**	**Units**
Age distribution	Age structure of the survey data (numbers and biomass per age class by species and sex). Aggregation to age classes should be made to the year below; for example for anchovy age class 0, the range is from 0 – 0.99 yr. All age classes should be represented in the data file including zero values (no individuals in the age class of the age ranges in the table below)	numbers in thousands, biomass in t

Species	Age class interval (yr)	Age range
Engraulis engrasicolus	1	0 to 6
Sardina pilchardus	1	0 to 10

SMALL PELAGIC SURVEY		
Type	**Description**	**Units**
Maturity at age (PrM)	The proportion of mature individuals per age class according to the classification of the age distribution file.	Proportion (0 to 1)

ECONOMIC VARIABLES REQUESTED AND UNITS

Data of the following parameters for 2002-2007 (mandatory) and 2008 (if available) should be provided

Parameter	**Aggregation**

Capacity	Number of vessels, gross tonnage, engine power, average age	Yearly, area (GSA), fleet segment
Employment	Total, full-time, part-time, full-time equivalents	Yearly, area (GSA),fleet segment
Revenue, costs and fuel consumption	Income, cost (crew, fuel, operational, capital, repair and maintenance, fixed), fuel (volume)	Yearly, area (GSA), fleet segment
Financial position	Borrowing and investment	Yearly, area (GSA), fleet segment
Price	Live weight	Yearly, area (GSA), species, fleet segment

DETAILED DESCRIPTION OF ECONOMIC VARIABLES AND UNITS

Capacity

type	description	Units
NUMBER	Total number of vessels in the segment	numbers
KW	The maximum continuous engine power actually developed by the main engine, after derating if appropriate, expressed in kW as defined in Council Regulation (EC) No 2930/86. This is the total value summed over all the vessels in the segment	kW
GT	Gross tonnage. This is the total value summed over all the vessels in the segment	GT
AGE	Age of fleet. This is the AVERAGE of the vessels in the segment	years

Employment

type	description	Unit
TOTAL	Total number employed	number of individuals
FULLTIME	Number of crew employed full-time	number of individuals
PARTTIME	Number of full-time equivalents employed	number of individuals
FTE	Number of full-time equivalents	number of individuals

Revenues, costs and fuel consumption

The total cost of operating the fleet should be the sum of the six sub-parameters CREWCOST + FUELCOST + FIXEDCOST + CAPCOST + REPCOST + VARCOST listed below.

The parameter INCOME is the sum of all revenues of the company including landings, tourist trips, subsidies etc. This is not aggregated by species whereas the value parameter under landings only includes income from landings and is aggregated by species.

type	description	Unit
INCOME	Total income including subsidies, landings, renting vessel to tourists etc. Total value summed over all vessels in segment (not disaggregated by species)	Euro
CREWCOST	Crew share (including social security, health insurance, retirements and other related taxes) Total value summed over all vessels in segment	Euro
FUELCOST	Cost of fuel (summed over all vessels in segment)	Euro
REPCOST	Repair and maintenance (summed over all vessels in segment).	Euro
FUELCONS	Consumption of fuel by fleet segment. Total value summed over all vessels in segment	Liter
VARCOST	Operational costs - Sum of all costs (other than fuel and crew share) which ARE related to fishing effort. Does not include repair and maintenance that is counted separately. Total value summed over all vessels in segment	Euro
CAPCOST	Total costs related to invested capital (i.e. depreciation and interest) Depreciation and interest costs must be related to total	Euro

	invested capital, and not only to repayment of loans and/or interest payments. Every Member State can set their depreciation time and method and interest rate. Total value summed over all vessels in segment	
FIXEDCOST	Sum of all costs which ARE NOT related to fishing effort. Does not include repair and maintenance or capital costs that are counted separately. Total value summed over all vessels in segment	Euro

Financial position

type	description	Unit
BORROWING	Ratio of borrowed capital to total capital	0 to 1
INVESTMENT	Total investment (assets, including the value of leased equipment). Sum over all fleet segment.	Euro

Price

type	description	Unit
PRICE	Average price per kg calculated on a live weight equivalent basis	Euro

ANNEX II EXPERT DECLARATIONS

Declarations of invited experts are published on the STECF web site on https://stecf.jrc.ec.europa.eu/home together with the final report.

European Commission

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Abstract
SG-ECA/RST/MED 09-01 was held in San Pedro del Pinatar, Murcia (Spain), on 2-6 March 2009. The aim of the workshop was to agree about certain standardizations of the working procedures applied by the new STECF assessment working group regarding living marine resources in the Mediterranean. STECF reviewed the report during its Plenary meeting on 20-24 April 2009.

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