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Scientific, Technical and Economic Committee for Fisheries (STECF)

Report of the SGMED-08-02 Working Group on the Mediterranean Part II

21 – 25 APRIL 2008, ATHENS, GREECE

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WORKING GROUP ON THE MEDITERRANEAN PART II

Athens 21 – 25 April 2008

STECF OPINION EXPRESSED DURING THE PLENARY MEETING HELD IN HELSINKI 7-11 JULY 2008

1. BACKGROUND

With the aim of establishing the scientific evidence required to support development of long term management plans for selected fisheries in the Mediterranean, consistent with the objectives of the Common Fisheries Policy, and to strengthen the Community's scientific input to the work of GFCM, the Commission made a number of requests to STECF. In order to meet these requests, a series of STECF Subgroups on the Mediterranean were initiated. The second and third of these (SGMED-08-02 and SGMED-08-03) met in Athens from 21-25th April and in Ispra from 9-13th June 2008.

The specific terms of reference for SGMED-08-02 were:

1. Define an official data call through DCR regarding all fisheries and survey data at the level of aggregation considered necessary for scientific assessments of fisheries and stocks in the Mediterranean Sea. Specifically, the defined official data call should support assessments of hake, red mullet and other main associated species in their fisheries during the third meeting of SGMED-08-03, and sardine, anchovy and other main associated species in their fisheries during the fourth meeting of SGMED-08-04 in 2008, respectively.
2. Compile and review fisheries and survey data availability as defined in the report of SGMED-08-01 in order to enable these future assessments of hake, red mullet, sardine and anchovy, and other main associated species.
3. Continue and complete the detailed review of existing fish stock assessments of hake, red mullet, anchovy and sardine in the Mediterranean Sea started during SGMED-08-01, to identify appropriate stocks delimitations and assessment methods.
4. Provide and evaluate fishing effort and landings data for 2006 to a specified aggregation.
5. Review, define and conduct indicator assessments regarding the estimation of fishery impacts in the Mediterranean Sea. In particular assessments of demersal assemblages should be elaborated and reviewed.
6. Compile and review social-economic indicators of Mediterranean fisheries.

2. STECF OBSERVATIONS

All Terms of Reference for SGMED-08-02 were performed or initiated to underpin the assessment work to be undertaken at SGMED-08-03 and 08-04. A data call under the DCR was defined in order to gather information on key species (hake (*Merluccius merluccius*), red mullet (*Mullus barbatus*), one decapod species (*Parapenaeus longirostris*), anchovy (*Engraulis encrasicolus*) and sardine (*Sardina pilchardus*) prior to the SGMED-08-03 (demersal) and 08-04 meeting (small pelagics). The data requested will be used to perform trial assessments in the different GFCM GSAs or stock units defined at the SGMED-08-02 meeting. 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. The data requested include landings, effort, size distribution, age distribution, maturity, growth parameters, sex ratio, discards and discards size distribution from data collected by indirect methods. From direct methods such as trawl and small pelagic surveys the data requested includes MEDITS and small pelagic surveys size distribution, age distribution and maturity at age.

Commercial effort and landings data for 2006 available at the meeting were examined by GFCM GSA. It was the opinion of experts attending the meeting that commercial information available by GSA is a reflection of the landing port for sampled vessels. Therefore, the provided effort data does not necessarily reflect the true effort exerted in each specific GSA. While data for a particular GSA may realistically (but not necessarily) reflect the location of fishing for smaller vessels, it may not reflect the actual location of fishing effort or catch for larger vessels that can steam large distances for fishing opportunities. For some GSAs, effort and landings data from non-EU member-states fleets were not available. Thus, in these GSAs the effort and the landings provided in this report represent only a part of the effective effort and total landings. Further concern was noted over the comparability of effort measured as days at sea, as for example one day at sea from a large tuna long liner would be counted equally as a day at sea of a small artisanal vessel. Also in some GSAs there are regulations that restrict fishing time per day for OTB to 12hr, while in other GSAs trawlers may operate 24hr a day, i.e. the effective effort of “one day at sea” may be different among GSAs, even for the same type of gear.

Despite these issues, data were collated and analysed to investigate the quality of the information available. Figures were created of the spatial distribution of effort (fishing days and Kw*days) and landings (hake, red mullet, sardine and anchovy) by GSA. Methods used to collect the data within each GSA were described. It was noted that there is substantial variability among GSAs in the way effort and landings data are collected. This lack of standardization made the compilation of data harder, while comparisons among GSAs were not always straightforward. These issues must be taken into account when using commercial data in stock assessments. It is hoped that the call under the DCR will lead to an improvement in the consistency and scope of commercial fisheries data for stock assessments.

The need to gather all information available on the species of key interest at the subsequent meetings was stressed, through the DCR call, from national studies, and EU Framework project reports (to be supplied by the EC). Even if the time series of data are limited, they are useful as prior information for parameter estimation or assessments.

The Working Group noted some concern over the quality of data on catch and effort by area, gears and fishing strategies. It is anticipated that the quality and range of data will be improved through the DCR data call for the next meeting. However, reduced data quality and time series may render impossible the utilization of certain assessment methods in all GSAs. For example, the lack of long time series for some species precludes the utilization in most of the areas of assessment approaches such as VPA. Discussion also reflected concerns on the reliability of the model outputs when they are fed with biased data and/or parameters.

It is also necessary to include in the models the most realistic biological parameter estimates for growth, stock recruitment, mortality, etc in order to obtain more reliable results. Assumptions on natural mortality at age values are critical in assessments, particularly for Mediterranean fisheries with an early age of first capture. Scientists needed to consider species interactions, since values of natural mortality used in assessments of hake were often larger than those used in pelagic assessments, despite the fact that pelagic species are a prey of hake.

The Working Group noted that sensitivity analyses for different M values in stock assessments should be performed. The use of an agreed common M value for a species/geographic area, and use of a common methodology to estimate it, is recommended. The Working Group noted that, particularly for demersal species with a small size at first capture, a vector of natural mortality at age or length, based on approaches such as that of Abella and Caddy, should be used.

A list of potential stock assessment approaches was developed during SGMED-08-01, considering the expected available data and fishery characteristics. Potential methods for use at future SGMED meetings include those based on size structure of the catches (i.e. VPA) when available, on catch and effort (i.e. production models) when demographic structure of the catch is not well known, or more simple assessments based on surveys data (i.e. SURBA, composite models, simulations, indicators) or on survey data and population/harvesting parameters (e.g. simulation models as Aladym, Yield) when only such information is available. The Working Group decided that participants should be free to use one or more of them for performing assessments. Indeed, participants of the Working Group agreed that when uncertainty is high, it is preferable to use different assessment approaches and reference points for the definition of stock status and for assessing the likely consequences of alternative management actions, as well as investigating model uncertainty. In turn, reference points should either be set at precautionary levels when uncertainty is high, or reference points be selected that are robust to the uncertainties.

For demersal species, the Working Group proposed to trial a number of alternatives at SGMED-08-03, namely:

- F0.1 – Fmax (as a proxy for MSY)
- FMSY
- 20-30% of SSB0
- 0.4-0.5 exploitation rate
- Maximum biological production level

In addition, the use of biological and social indicators will be tested where possible. It should be noted that the proposal is not to perform a full testing of the robustness of these reference points to uncertainty in biological parameters (e.g. natural mortality), nor to evaluate their performance as one part of the data collection, assessment and management framework through Management Strategy Evaluation. This is too extensive a process for SGMED-08-03, and should be the subject of further meetings.

The Working Group noted that fry fisheries were a potential source of considerable uncertainty for pelagic stock assessments of sardine. Given the fact that sardine fry fishery is based upon certain Management Plans (MP), experts consider that these MPs may contain useful information about fry fisheries and therefore invite the Commission to make these MPs available to the group prior to the SGMED-08-04 meeting focusing on assessments of small pelagics.

As noted for demersal species, the selection, estimation and testing of candidate reference points is a topic of high priority, and there is a need to agree procedures and methodologies. In addition to the opportunity represented by SGMED-08-04, workshops and study groups may be needed to progress this matter. Reference Point refers to biological and fishing pressure limits generally defined as values of Biomass (B) and/or fishing mortality (F). Experts consider that exploitation rate (F/Z) could be a useful candidate to indicate some pressure state of the fishery. The exploitation rate of 0.4 (as suggested by Patterson, 1992) was proposed during SGMED-08-01 meeting. Some concerns about the use of such exploitation rate as a reference point were also expressed, and hence there is a need to investigate these candidates further.

The Working Group recommended the spatial scale at which to perform assessments for the selected demersal and pelagic species in future SGMED meetings. Assessments were proposed at the scale of the GFCM GSA. For hake and red mullet, GSAs 22 and 23 will be merged, and for hake only, GSAs 15 and 16. The Working Group noted the need for investigations of stock distributions to continue.

The approach to undertake indicator assessments based upon MEDITS survey data was agreed and will be implemented at SGMED-08-03. Indicators for socio-economic parameters in the Mediterranean were expanded upon.

3. STECF COMMENTS AND CONCLUSIONS

1. STECF notes that TORs 1-4 have been completed, while for TORs 5 only preliminary work has been initiated and TORs 6 has not been dealt with at all during the meeting. Data and assessment methods will constitute the base for assessment to be performed in the next SGMED meetings.

2. Also, data on effort for different fleets were collated during the meeting. However, the lack of standardization between different fleets targeting the same species and within the same fleet in different years (i.e. unbalanced sampling design) made the compilation and use of data difficult. Also, if CPUE from commercial fisheries is used as supplementary information for stock assessment, STECF is of the opinion that if possible, technological creep (efficiency improvements) should be taken into account and appropriate standardization of CPUE series be undertaken.

3. The working Group proposed to trial a number of alternative reference points at SGMED-08-03, namely:

F0.1 – Fmax (as a proxy for MSY)
FMSY
20-30% of SSB0
0.4-0.5 exploitation rate (F/Z)
Maximum biological production level.

STECF agrees with this approach.

4. The Working Group recommended the spatial scale at which to perform assessments for the selected demersal and pelagic species in future SGMED meetings. Assessments were proposed at the scale of the GFCM GSA. For hake and red mullet, GSAs 22 and 23 will be merged, and for hake only, GSAs 15 and 16. The Working Group noted the need for investigations of stock distributions to continue. STECF agrees with this approach.

SGMED-08-02 WORKING GROUP REPORT

THE MEDITERRANEAN PART II

Athens, 21 – 25 April 2008

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

With the aim of establishing the scientific evidence required to support development of long-term management plans for selected fisheries in the Mediterranean, consistent with the objectives of the Common Fisheries Policy, and to strengthen the Community's scientific input to the work of GFCM, the Commission made a number of requests to STECF. In order to meet these requests, a series of STECF Subgroups on the Mediterranean were initiated. The second of these (SGMED-08-02) met in Athens from 21-25th April 2008. In summary, the specific terms of reference for SGMED-08-02 were:

1. Define an official data call through DCR regarding all fisheries and survey data at the level of aggregation considered necessary for scientific assessments of fisheries and stocks in the Mediterranean Sea. Specifically, the defined official data call should support assessments of hake, red mullet and other main associated species in their fisheries during the third meeting of SGMED-08-03, and sardine, anchovy and other main associated species in their fisheries during the fourth meeting of SGMED-08-04 in 2008, respectively.
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All Terms of Reference for SGMED-08-02 were performed or initiated to underpin the assessment work to be undertaken at SGMED-08-03 and 08-04. A data call under the DCR was defined in order to gather information on key species (hake (*Merluccius merluccius*), red mullet (*Mullus barbatus*), one decapod species (*Parapenaeus longirostris*), anchovy (*Engraulis encrasicolus*) and sardine (*Sardina pilchardus*) prior to the SGMED-08-03 (demersal) and 08-04 meeting (small pelagics). The data requested will be used to perform trial assessments in the different GFCM GSAs or stock units defined at the SGMED-08-02 meeting (see below). 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. The data requested include landings, effort, size distribution, age distribution, maturity, growth parameters, sex ratio, discards and discards size distribution from data collected by indirect methods. From direct methods such as trawl and small pelagic surveys the data requested includes MEDITS TA, TB, TC, files, and small pelagic surveys size distribution, age distribution and maturity at age.

Commercial effort and landings data for 2006 available at the meeting were examined by GFCM GSA. It was the opinion of experts attending the meeting that commercial information available by GSA is a reflection of the landing port for sampled vessels. Therefore, the provided effort data does not necessarily reflect the true effort exerted in each specific GSA. While data for a particular GSA may realistically (but not necessarily) reflect the location of fishing for smaller vessels, it may not reflect the actual location of fishing effort or catch for larger vessels that can steam large distances for fishing opportunities. For some GSAs, effort and landings data from non-EU member-states fleets were not available. Thus, in these GSAs the effort and the landings provided in this report represent only a part of the effective effort and total landings. Further concern was noted over the comparability of effort measured as days at sea, as for example one day at sea from a large tuna long liner would be counted equally as a day at sea of a small artisanal vessel. Also in some GSAs there are regulations that restrict fishing time per day for OTB to 12hr, while in other GSAs trawlers may operate 24hr a day, i.e. the effective effort of “one day at sea” may be different among GSAs, even for the same type of gear.

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For demersal species, the Working Group proposed to trial a number of alternatives at SGMED-08-03, namely:

- $F_{0.1}$ – F_{max} (as a proxy for MSY)
- F_{MSY}
- 20-30% of SSB_0
- 0.4-0.5 exploitation rate
- Maximum biological production level

In addition, the use of biological and social indicators will be tested where possible. It should be noted that the proposal is not to perform a full testing of the robustness of these reference points to uncertainty in biological parameters (e.g. natural mortality), nor to evaluate their performance as one part of the data collection, assessment and management framework through Management Strategy Evaluation. This is too extensive a process for SGMED-08-03, and should be the subject of further meetings.

The Working Group noted that fry fisheries were a potential source of considerable uncertainty for pelagic stock assessments of sardine. Given the fact that sardine fry fishery is based upon certain Management Plans (MP), experts consider that these MPs may contain useful information about fry fisheries and therefore invite the Commission to make these MPs available to the group prior to the SGMED-08-04 meeting focusing on assessments of small pelagics.

As noted for demersal species, the selection, estimation and testing of candidate reference points is a topic of high priority, and there is a need to agree procedures and methodologies. In addition to the opportunity represented by SGMED-08-04, workshops and study groups may be needed to progress this matter. Reference Point refers to biological and fishing pressure limits generally defined as values of Biomass (B) and/or fishing mortality (F). Experts consider that exploitation rate (F/Z) could be a useful candidate to indicate some pressure state of the fishery. The exploitation rate of 0.4 (as suggested by Patterson, 1992) was proposed during SGMED-08-01 meeting. Some concerns about the use of such exploitation rate as a reference point were also expressed, and hence there is a need to investigate these candidates further.

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The approach to undertake indicator assessments based upon MEDITS survey data was agreed and will be implemented at SGMED-08-03. Indicators for socio-economic parameters in the Mediterranean were expanded upon.

With the overall aim of progressing work against the overall terms of reference given to STECF, and in light of the work undertaken during the meeting, the SGMED-08-02 group recommended a number of tasks be considered in the Terms of Reference for SGMED-08-03. These were:

a) assess the status of the stocks of hake by all relevant GSAs (15 and 16, 22 and 23 combined) in the Mediterranean Sea and provide short term, medium term and long term forecasts of stock biomass and yield under different management options, by fisheries if possible.
b) assess the status of the stocks of red mullet by all relevant GSAs (22 and 23 combined) in the Mediterranean Sea and provide short term, medium term and long term forecasts of stock biomass and yield under different management options by fisheries if possible.
c) assess the status of the stocks of *Parapenaeus longirostris* by all relevant GSAs (15 and 16, 22 and 23 combined) in the Mediterranean Sea and provide short term, medium term and long term forecasts of stock biomass and yield under different management options by fisheries if possible.

d) assess historic and recent trends (capacity, technological creep, nominal fishing effort) in the major fisheries by GSAs (22 and 23 combined) exploiting the stocks assessed. The trends should be interpreted in light of management regulations applicable to them.
e) review and propose biological reference points related to high yields and low risk in long term of each of the stocks assessed.
f) identify any needs for management measures required to safeguard the stocks assessed.
g) review the applicability and fully document all applied methodologies for the assessments, projections and determination of the proposed biological reference points.
h) fully document the data used and their origin for the assessments, projections and determination of the proposed biological reference points.
i) review social economic reference points.
j) provide and review population and community indicators.

2. INTRODUCTION

The European Commission is planning to propose long-term management plans for selected fisheries in the Mediterranean, consistent with the objectives of the Common Fisheries Policy. With the aim of establishing the scientific evidence that will be required to support the development of such plans and to strengthen the Community's scientific input to the work of GFCM, the Commission requested STECF to:

- Evaluate whether available data allow for stock assessments to be conducted and scientific management advice to be formulated.
- Set up operational frameworks for stock assessment and edification of economic indicators.
- Evaluate if age-based assessment methods (VPA type models) are adequate assessment tools for Mediterranean stocks.
- Identify adequate empirical modelling approaches.
- Identify decision-making support modelling.
- Consider the precision and accuracy of estimated parameters.
- Provide information on data requirements.

To progress work to address these requests, the STECF Subgroup on the Mediterranean (SGMED-08-02) met in Athens from 21-25th April 2008. The meeting was opened at 09:00 on the 21st, and closed at 16:00 on the 25th. The meeting built upon the work performed during SGMED-08-01 (10 – 14th March 2008).

3. TERMS OF REFERENCE FOR SGMED-08-02

The overall terms of reference for the SGMED meetings are listed in Appendix 1. The specific terms of reference for SGMED-08-02 were:

1. Define an official data call through DCR regarding all fisheries and surveys data at the level of the aggregation of the minimum Community program considered strictly necessary for the scientific assessments of the fisheries and the stocks in the

Mediterranean Sea. In particular the defined official data call should support the assessments of hake, red mullet and other main associated species in their fisheries (e.g. deepwater rose shrimp; Norway lobster; common pandora; common sole; horse mackerel; blue whiting; red shrimps) during the third meeting of SGMED-08-03, and sardine, anchovy and other main associated species in their fisheries (e.g. sprat, mackerel) during the fourth meeting of SGMED-08-04 in 2008, respectively.

2. Compile and review fisheries and survey data availability as defined in the report of SGMED-08-01 in order to enable assessments of hake, red mullet and other main associated species during SGMED-08-03, and sardine, anchovy and other main associated species during SGMED-08-04, respectively. Trial assessments for hake, red mullet, anchovy and sardine should be conducted during SGMED-08-02.
3. Continue and complete the detailed review of existing fish stock assessments of hake, red mullet, anchovy and sardine in the Mediterranean Sea which was conducted during SGMED-08-01 in order to identify appropriate stocks delimitations and assessment methods.
4. Provide and evaluate fishing effort and landings data for 2006 in the following aggregation:
   - Gear specific fishing effort data:
     - i. Level 1, Fishing activity: active
     - ii. Level 2, Gear classes: dredge, trawl, hooks_line, trap, net, seine, other, misc
     - iii. Level 3, Gear groups: dredge, bottom_trawl, pelagic_trawl, rod_line, longline, trap, net, surrounding_net, seine, other, misc
     - iv. Level 4, Gear type: DRB, OTB, OTT, PTB, TBB, OTM, PTM, LHP, LHM, LTL, LLD, LLS, FPO, FYK, FPN, GTR, GNS, GND, PS, LA, SSC, SDN, SPR, SB, SV, GEF (Glass eel fishing)
   - Nation: CYP, ESP, GRE, FRA, ITA, MAL, SLO and CRO
   - GSA: 1-27 (FB COMMENT 28 no EU vessels fish there and it pertains already to the Black Sea area)
   - Year: 2006
   - Nominal effort:
     - i. kW*days at sea
     - ii. Days at sea
   - Gear specific landings data:
     - i. Level 1, Fishing activity: active
     - ii. Level 2, Gear classes: dredge, trawl, hooks_line, trap, net, seine, other, misc
     - iii. Level 3, Gear groups: dredge, bottom_trawl, pelagic_trawl, rod_line, longline, trap, net, surrounding_net, seine, other, misc
     - iv. Level 4, Gear type: DRB, OTB, OTT, PTB, TBB, OTM, PTM, LHP, LHM, LTL, LLD, LLS, FPO, FYK, FPN, GTR, GNS, GND, PS, LA, SSC, SDN, SPR, SB, SV, GEF (Glass eel fishing)
   - Nation: CYP, ESP, GRE, FRA, ITA, MAL, SLO and CRO
   - GSA: 1-27 (see comment above)
   - Year: 2006

- Species: Hake, Red Mullet, Anchovy and Sardine
- Landings: t
- Length (unit according to DCR), No. raised to landings

5. Review, define and conduct indicator assessments regarding the estimation of fishery impacts in the Mediterranean Sea. For this purpose, MEDITS survey data in the international format of TA, TB and TC files by years 1994-2006 and by GSA should be provided. In particular assessments of demersal assemblages should be elaborated and reviewed.
6. Compile and review social-economic indicators of Mediterranean fisheries.

4. PARTICIPANTS

The full list of participants at SGMED-08-02 is presented in Appendix 2.

5. RECOMMENDATION OF AN OFFICIAL DRC DATA CALL (TOR 1)

In SGMED-08-01 the group recognised the need to launch an official data call through DCR regarding all fisheries and surveys data at the level of aggregation of the Community program considered strictly necessary for the scientific assessments of the fisheries and the stocks in the Mediterranean Sea. In particular it was agreed at SGMED-08-02 that the defined official data call should support assessments of demersal fish species including hake (*Merluccius merluccius*) and red mullet (*Mullus barbatus*) and one decapod crustacean species (*Parapenaeus longirostris*) during the SGMED-08-03 meeting, and two small pelagic species anchovy (*Engraulis encrasicolus*) and sardine (*Sardina pilchardus*) during the SGMED-08-04 meeting, respectively.

The submission of data through the official DCR data call is essential to support trial assessments of the demersal species during the SGMED meetings 08-03 and extend the assessments done in the GFCM working group on small pelagics in the 08-04 meeting. The supporting data from the DCR should be officially called for all GFCM GSAs relevant for European Community fisheries. Given the short time period between publication of the call and deadline for data submission, the call will be made in two steps. The first will be issued to obtain the data on demersal species and fisheries necessary for the work proposed within SGMED-08-03, and a second separate call issued for data on small pelagics fisheries.

The data call under the DCR should cover information on the biological aspects of the fishery from both indirect (e.g. landings, effort) and direct methods (trawl surveys and small pelagic surveys) from the Mediterranean. The data should be delivered to JRC at least two weeks before the SGMED-08-03 meeting which is going to be held from the 9th – 13th of June 2008. The data call will be issued to all EU member states having demersal and small pelagic fishing activities in the Mediterranean. The data calls 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 group to consider the data originating from these studies to be included in stock assessments. Data aggregations should also be requested which are not in the current regulations but as detailed in the new draft implementing regulation of EC 199/2008.

The data requested will be used to make trial assessments in the different GFCM GSAs or stock units defined in the SGMED-08-02 meeting. 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.

The 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 and small pelagic surveys the data requested includes MEDITS TA, TB, TC, files, and small pelagic surveys length distribution, age distribution and maturity at age. Details of the parameters requested for the future SGMED meetings, together with the aggregations used, can be found in Appendix 3 (Section 14).

The official data call may allow standardised assessments to be performed for the different areas of the Mediterranean Sea. However, experts pointed out that this official data call will not include data from non-EU countries, and other channels should be explored to have relevant information from non-EU countries. For example, 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 borne in mind during assessments.

6. EVALUATION OF FISHING EFFORT AND LANDINGS FOR 2006 (TOR 4)

It was the opinion of the experts attending the meeting that the commercial information available by GSA is in most cases a reflection of the home port for the vessels. Therefore, the provided effort and landings data in most cases represent the exerted effort and achieved landings by vessels registered in these GSAs and not the true effort exerted and landings achieved in each specific GSA. While data for a particular GSA may realistically (but not necessarily) reflect the location of fishing for smaller vessels, it may not reflect the actual location of fishing effort or catch for larger vessels that can steam large distances for fishing opportunities, which may be outside the GSA of their home port. For some GSAs, effort and landings data from non-EU member-states fleets were not available. Thus, in these GSAs the effort and the landings provided in this report represents only a part of the effective effort and total landings. Furthermore, effort measured as days at sea, when combined for all gears should be treated with caution as e.g. one day at sea from a large tuna long liner would be counted equally as a day at sea of a small artisanal vessel. Also in some GSAs there are regulations that restrict fishing time per day for trawlers to 12hr, while in other GSAs trawlers may operate 24hr a day, i.e. the effective effort of “one day at sea” may be different among GSAs even for the same type of gear.

Data available from Cyprus was also supplied for fishing by Cypriot vessels outside GSA-25. For display, these data were aggregated into GSA-25 to ensure consistency with data for other GSAs.

Data summary

The data that were made available by the experts participated in SGMED-08-02 are summarized in Table 1.

Table 1. Commercial fisheries data available at SGMED-08-02.

GSA	Effort Data		Landings Data (HKE, MUT)	Landings Data (ANE, PIL)	Length Data (HKE, MUT)	Length Data (ANE, PIL)
	Unit	Level	Level	Level		
1	days at sea	4 (a)	4	4	n.a.	PS
5	days at sea	4 (a)	4	4	OTB (HKE)	n.a.
6	days at sea	4 (a)	4	4	GNS, OTB	PS
7	days at sea	4 (b)	n.a.	n.a.	n.a.	n.a.
9	days at sea, kW*days	4 (c)	4 (c)	4 (c)	n.a.	n.a.
10	days at sea, kW*days	4 (d)	4 (d) HKE 4 (c) MUT	4 (d)	n.a.	n.a.
11	days at sea, kW*days	4 (c)	4 (c)		n.a.	
15	days at sea	4	4	4	n.a.	
16	days at sea, kW*days	4 (c)	4 (c)	4	n.a.	n.a.
17	days at sea, kW*days (i)	4 (e)	4 (e)	4 (e)	n.a.	n.a.
18	days at sea, kW*days (i)	4 (e)	4 (e)	4 ANE 4 (e) PIL	n.a.	n.a.
19	days at sea, kW*days	4 (c)	4 (c)	4 (c)	n.a.	n.a.
20	days at sea, kW*days	4 (f)	4 (g)	4 (h)	n.a.	n.a.
22**	days at sea, kW*days (i)	4 (f)	4 (g)	4 (h)	n.a.	n.a.

25	days at sea, kW*days (only for OTB)	4	4		n.a.	

Notes:
LEVEL = DCR data aggregation level
** GSA 23 is also included within GSA 22
(a) MIS category includes polyvalent
(b) except longlines, which are given in Level 3
(c) passive polyvalent and small scale vessels as MIS
(d) passive, mobile polyvalent and small scale vessels as MIS
(e) small scale vessels as MIS
(f) except nets and longlines, which are given at Level 3
(g) passive (nets and longlines) as MIS
(h) except nets, which are given at Level 3
(i) data from EU fishing fleets (i.e. western part of area) only

In all GSAs effort was available in days at sea, whereas kW*days at sea was not available in GSA 1, 5, 6, 7, 15; in GSA-25 kW*days at sea was available only for OTB. Member States have the obligation to collect data according to appendix III of the current DCR. This segmentation is based on the "dominance" criteria, which means that if a vessel spends more than 50% of its time using a specific type of fishing technique, it should be included in the corresponding segment. In the other cases, the vessel is classified as "polyvalent". In some cases this has made it difficult to disaggregate effort data at Level 4. For trawls, dredges, seines and traps, data were submitted at Level 4 in all GSAs. However, in GSA 9, 10, 11, 16, 17, 18, 19, it is possible that the effort for these gear types is underestimated, because some vessels classified as MIS utilize part of their effort using the above gear types. Nets and longlines were reported at Level 3 in GSA 20, 22. Some gear types in GSA 9, 10, 11, 16, 17, 18, 19 were combined under the category MIS. Length data were submitted only in GSA 5 and 6 for demersal species and GSA 1 and 6 for small pelagics.

Data set descriptions

There is substantial variability among GSAs in the way effort and landings data are collected. This lack of standardization made the compilation of data difficult, while comparisons among GSAs were not always straightforward. Moreover, effort and landings data of all fleets operating in a specific GSA should be included in order to assess total landings and total effort in the Mediterranean Sea. However, comparability and standardization of all datasets was not a prerequisite, as the aim of this task was to test the ability of SGMED group to collect and analyze a simple set of data. A short description of each dataset provided by experts at SGMED-08-02 is given below.

Dataset provided for GSAs 1, 5, and 6

The Secretariat of Marine Fishing (S.G.P.M.) of Spain is the responsible for collecting landings and effort data, both by logbooks information and by sales voucher. As a general rule, from the start of the National Programme until now, all data sets (landings, discards, length composition, etc.) were collected by area FAO 1.1 instead of GSAs. The data made available to SGMED-08-02 for GSA 1, GSA 5 and GSA 6 come from logbooks of landings and effort records. The data set comprises only boats larger than 10 m length and catches greater than 5 kg. Fishing effort in kW*days at sea was not submitted because technical characteristics of vessels were not available.

Length distribution for hake in GSA 5 and 6, for red mullet in GSA 6, and for sardine and anchovy in GSAs 1 and 5 were available raised to landings.

Dataset provided for GSAs 9, 10, 11, 16, 17, 18 and 19

For fishing carried out in the Italian territory, landings (quantity and value) of all stocks (including those listed in appendix XII of the EC Regulation n.1639/01) and effort per segment are assessed on the basis of a sampling procedure. The methodology of the survey was approved by Eurostat during the meeting of the working group "fishery statistics" and it is based on a complex-type sampling design using a single-stratified-stage sample with two variables. The stratification is designed to maximise the homogeneity of the strata, and it based on two parameters, one geographical and one technical (fishing systems), in accordance with the disaggregation of the results.

Estimates of overall annual commercial landings and effort data are provided according to level 2 of geographical disaggregation of Appendix I of the EC Regulation n.1639/01. Commercial landings for all stocks and effort data are reported on a quarterly basis.

Landings by species (weight and value) and effort by technique are disaggregated in accordance with the basic segmentation of vessels for capacities (appendix III of the EC Regulation n.1639/01). This segmentation is based on the "dominance" criteria, which means that if a vessel spends more than 50% of its time using a specific type of fishing technique, it should be included in the corresponding segment. In the other cases, the vessel is classified as "polyvalent".

Italian fleet landings and effort data are provided for **GSAs 9, 10, 11, 16, 17, 18** and **19**. Data is reported at level 4 of gear stratification for OTB, PS, DRB, LLD, TBB, PTM.

Passive polyvalent (pp) and small scale (ss) vessels use a number of fishing gears which includes set gillnet (GNS), trammel net (GTR), drifting longline (LLD), hand and pole lines (LHP), pots and traps (FPO), fyke nets (FYK). Passive polyvalent vessels LOA is larger than 12 m, while small scale vessels LOA is smaller than 12 m. Mobile polyvalent (mp) vessels use mobile gears, like bottom otter trawl (OTB), mid-water pair trawl (PTM), beam trawl (TBB), purse seine (PS) and dredges (DRB).

Dataset provided for GSA 15

Fisheries of **GSA-15** are of a typically Mediterranean artisanal type which are not species selective and are frequently described as multi-species and multi-gear fisheries, with fishermen switching from one gear to another several times throughout the year.

In **GSA-15**, data on commercial catches and landings are collected for all stocks as mentioned in Appendix XII (EC 1639/2001; EC 1581/2004), and according to subdivisions as defined in that Appendix. Data on landings by weight and value are collected for each segment by species, by quarter and by geographical origin of the catch, at the level of geographical disaggregation 2 according to Appendix I (EC 1639/2001; EC 1581/2004). Landing figures are based on exhaustive data reported in logbooks (for vessels over 10 m LOA), by sampling landings (for vessels under 10 m LOA) and on sales notes/vouchers (>10m and <10m) from the official fish market.

By using information from logbooks, it is possible to have data on commercial landings (both within and outside GSA-15) and total catch, including landings (in value and weight) for the stocks mentioned in Appendix XII (EC 1639/2001; EC 1581/2004) according to the disaggregation and precision requested, relating to over 10 m fleet. Moreover, the Fish Market Sales Notes Scheme is used together with the logbooks to provide data according to the Regulation. All information on sold fish is registered and stored in the Sales Notes database and includes among others the following information: vessel registration number; landing place; date and buyer; species; weight; and value. The Sales Notes Scheme obtains data on landings values and estimates of fishing effort for vessels greater than 10 m and less than 10m for those landings that are sold at the official fish market.

A specific sample survey is carried out in **GSA-15** to estimate landings relating to the artisanal fishery, i.e. < 10 m fleet. Data is collected to estimate overall annual commercial landings by species, distinguish the geographical origin of the catches according to level 2 of the geographical disaggregation of Appendix I (EC 1639/2001; EC 1581/2004), for all stocks as mentioned in Appendix XII (EC 1639/2001; EC 1581/2004) and according to the subdivisions defined in that Appendix.

Landings by weight and value are estimated also by segment as defined in Appendix III (EC 1639/2001; EC 1581/2004), individualised by species, by quarter, and with regard to the geographical origin of the catch, at the level of geographical disaggregation 2 according to Appendix I (EC 1639/2001; EC 1581/2004), at precision level 2 as requested.

The fleet in **GSA-15** consists of all Maltese fishing vessels less than 10 m during the survey reference period, i.e. a quarter. The complete list of vessels comes from the Malta Vessel Register. Three ports in the island of Malta and three ports in the island of Gozo are sampled one week (7 days) per month throughout the whole year. The three ports have different levels of fishing activity including a very active port, a moderately active port, and a low activity port. Data from these ports is entered into databases and statistical procedures used to raise the sampled catch to the total catch by the small scale fishery. Using this methodology about 10% of the fishing activity is sampled. Some Italian trawlers are known to operate in the GSA 15 outside the Maltese Management Fishing Zone, which includes the waters within 25nm of the Maltese islands.

Dataset provided for GSAs 20, 22 and 23

Effort data (for year 2006) are given for **GSA-20** (East Ionian Sea) and for the areas **GSA-22** and **GSA-23** combined (Aegean Sea and Crete). Effort is given at level 4 for the following gear types: OTB (otter trawl), PS (purse seine), and SV (boat seine). For GTR (trammel nets), GNS (gill nets) and LLS (set long lines), LLD (drifting long lines) effort is given at level 3. Effort is provided in both kW*days and days at sea.

Gear specific landings data are given for hake, red mullet, anchovy, and sardine for **GSA-20** and for the areas **GSA-22** and **GSA-23** combined. Landings are given at level 4 for the following gear types: OTB, PS, and SV. For GTR, GNS and LLS, LLD landings are given at level 3.

Effort and landings data were collected in the framework of DCR and are based on stratified random sampling in Greek ports. This is a systematic sampling procedure on a monthly basis, occurring in 30 major sites including 209 landing ports. The Greek fleet had 17,920 registered vessels in 2006, which is approximately 45% of the total EU fleet. The vast majority (> 92%) of the fishing fleet consists of small artisanal vessels (GNS, GTR, LLS, LLD, polyvalent artisanal) engaged in a variety of different métiers. Each vessel shifts among several métiers during the year. These characteristics of the Greek fleet complicate sampling and introduce a large variance in the estimations of effort and landings.

It has to be mentioned that the reported values of effort and landings in **GSA**s **20**, **22** and **23** refer to the Greek fleet. However, the Turkish fleet operates in **GSA-22** and some Italian bottom trawlers are known to operate in **GSA-20** and **GSA-23**.

Dataset provided for GSA 25

The methodology used for collecting data on landings and effort in **GSA-25** is based on the following data collection practices:

- Direct Reports (logbooks and daily reports)
- Sampling at landing sites

Logbooks are issued to all fishing vessels with an overall length exceeding 10 m, in accordance with the provisions of Regulation (EC) 2807/83. It is noted that for the Mediterranean, landings data are required to be recorded only for species included in a specific list (Annex VII of Regulation 2807/1983), and only for quantities exceeding 15kg. However, fishermen in **GSA-25** are requested to record all quantities, for all species.

Landings and effort data from the inshore fishery fleet in **GSA-25** are collected by providing daily reports to a 15-20% sample of the fleet. It is noted that since 2007, in view of the fleet-fishery based approach required by the new DCR, the reports provided to the fishermen have been adjusted for recording landings and effort data per fishing activity.

Landings and effort data from the inshore fishery are also collected at landing sites by Department of fisheries and Marine Research (DFMR) personnel; since 2007 these data are collected per fishing activity.

The 2006 effort and landings data for **GSA-25** that were provided during the meeting, at level 4 of the Mediterranean matrix, were obtained using the following methods:

For the inshore fishery in **GSA-25**, in order to assign the 2006 combined effort data (days) to the metiers at level 4, rough estimations were made on the percentage of days spent by the fleet on each metier and also the percentage of days during which the fleet was involved in more than one metier (polyvalent activity). The estimations were based on the information collected through the application of the annual fishing calendar approach during 2006; with this approach, individual information was collected in the total number of working days, the number of working days per metier, and the percentage of the polyvalent activity of the fishermen. Effort days were assigned per metier in two ways: i) taking into account the polyvalent activity of the vessels (i.e. for vessels using several gears on the same day, one effort day was assigned to each of these gears while one day is attributed to the vessel), and ii) without taking into account the polyvalent activity of the vessels (i.e. one effort day was assigned only to the main gear). For comparability with the other GSA data sets, the polyvalent activity in the GSA 25 was not taken into account in the data analysis. However, considering that the polyvalent activity is a common practice for inshore vessels, and that some of the gears are mainly used in combination with a main gear, the values used do not reflect the real fishing activities of the inshore fleet.

For vessels over 12 m length, the 2006 effort data (days) were derived from logbook records. The polyvalent activity of vessels using only passive gears was taken into account, as above.

For the inshore fishery, in order to assign the 2006 combined landings data to the gear types at level 4, the following rough estimations were made:

- For each species, a combination of gears that may catch the species was selected
- The landings of each species were assigned to the gear types selected, in percentages that were roughly calculated based on a combination of i. the percentage of the total number of days during which the relevant gears were used during 2006, and ii. the “probability” of the species to be caught by the gears.

For vessels over 12m length, the 2006 landings data per gear type at Level 4 derived from the logbook records.

Data Analysis

Fishing effort in the Mediterranean Sea per gear type is provided both as ‘days at sea’ and ‘kW*days at sea’ (Figure 1 and Figure 2). In GSA 7, 20, 22 and 25, the fishing effort (measured as ‘days at sea’) is attributed mainly to nets, in GSA 9, 10, 11, 17 and 19 to miscellaneous, in GSA-15 to longlines, and in GSA 1, 5, 6 and 16 to trawls. It should be noted that the high total effort values (measured as ‘days at sea’) in GSA 20 and 22 are attributed to the very large number of small fishing vessels (12,539 and 4,297 vessels <12 m, respectively). In GSA 1, 5 and 6, there are no data available for vessels < 10 m, which explains the high proportion of bottom trawls in total effort, in contradiction with the other GSAs.

When fishing effort is expressed as kW*days at sea, the contribution of bottom trawls and purse seines increased in all GSA, as these vessels are generally large with high engine power.

Hake landings (Figure 3) come mainly from bottom trawls (OTB). In some GSA (1, 5, 6, 16, 17, 18 and 19) the proportion of OTB landings exceeds 75%. In GSAs 20 and 22, the main part of hake catches is attributed to the ‘miscellaneous’ gear type, representing the passive gear groups nets and long lines. In GSA 9, 10 and 11, a substantial part of the landings comes from the ‘miscellaneous’ gear type. In GSA 25, more than 50% of landings come from the longline fishery.

Red mullet (Figure 4) landings in GSA 1, 5, 6, 9, 10, 11, 15, 16, 17 and 18 come almost exclusively from bottom trawls, whereas in GSA 20, 22, and 25 more than 50% of the landings come from the ‘miscellaneous’ gear type. In the areas 20 and 22, the miscellaneous. In GSA 19, an important part of the landings originates from the ‘miscellaneous’ gear type. The fact that in GSA 1, 5 and 6, landings from vessels < 10 m and catches <5 kg were not recorded is likely to cause an underestimation of red mullet total landings and also an underestimation of the contribution of net fisheries.

Anchovy (Figure 5) is mainly caught by purse seiners (PS), except in GSA 17 and 18, where the main contribution in total landings comes from pelagic pair trawls (PTM). In GSAs 10 and 19, there is substantial contribution in total landings by ‘miscellaneous’ gear type (includes pelagic pair trawlers). About 10 pelagic pair trawlers are known to operate along the southern coast of Sicily (GSA 16).

Sardine (Figure 6) is also mostly caught be purse seiners in all GSA, except in GSA 17 and 18, where the main contribution in total landings comes from pelagic pair trawls (PTM) and in GSA 15 where landings come exclusively by ‘lampara’ as a bycatch. In GSA 20 there is also a substantial contribution in total landings by nets and in GSA 10 and 19 by the ‘miscellaneous’ gear type (includes pelagic pair trawlers).

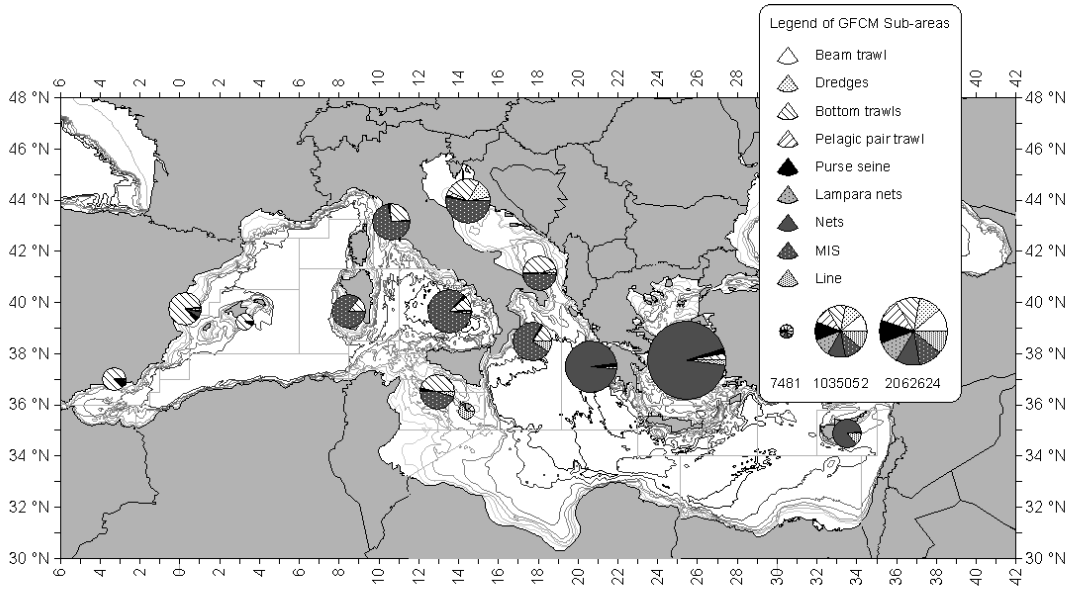

Figure 1. Fishing Effort of EU fleet by GSA and gear type in the Mediterranean Sea as Days at sea. 'MIS' are polyvalent in Italy and Spain; 'Nets' are gillnets and trammel nets; 'Line' are all line fisheries, i.e.demersal, surface, handline etc. French data were not available at the meeting

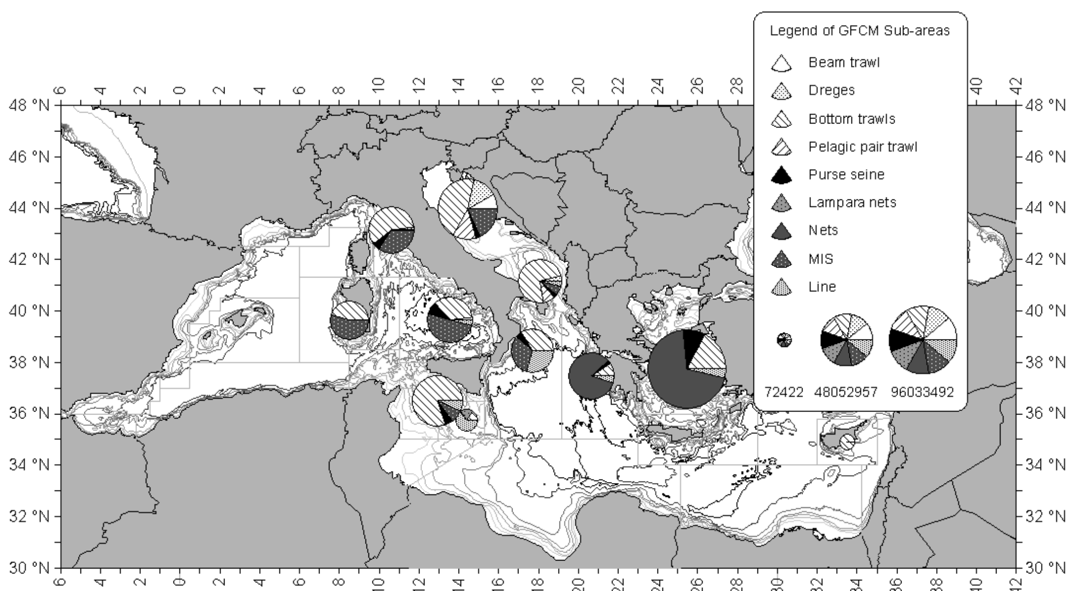

Figure 2. Fishing Effort of EU fleet by GSA and gear type in the Mediterranean Sea as kW*Days at sea. 'MIS' are polyvalent in Italy and Spain; 'Nets' are gillnets and trammel nets; 'Line' are all line fisheries, i.e.demersal, surface, handline etc. Spanish, French and data from Cyprus were not available at the meeting, or are incomplete.

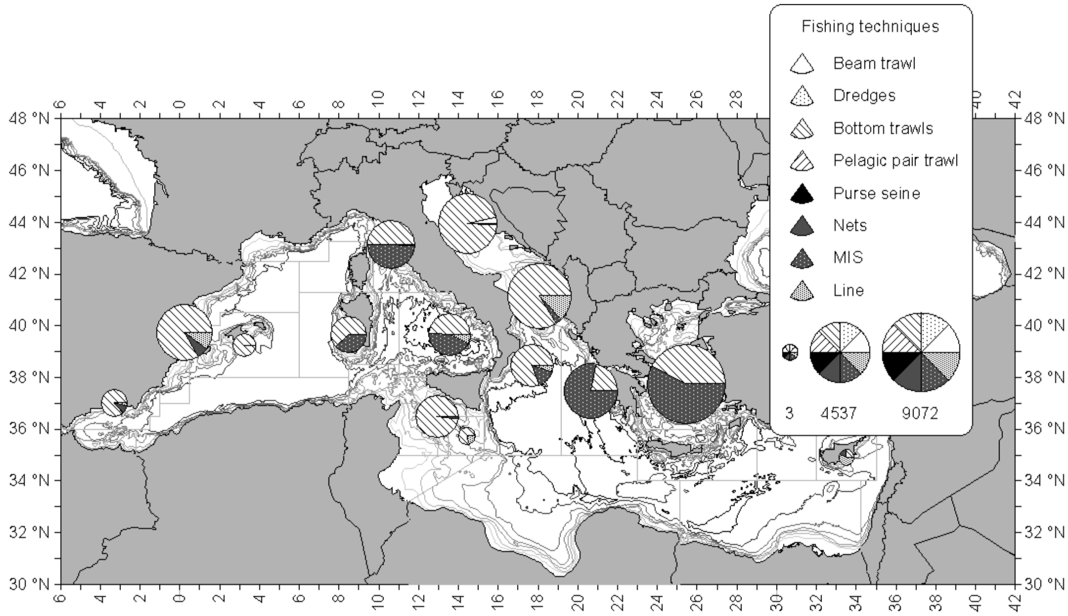

Figure 3. Hake landings (t) of EU fleet by GSA and gear type in the Mediterranean Sea. 'MIS' are polyvalent in Italy and Spain; 'Nets' are gillnets and trammel nets; 'Line' are all line fisheries, i.e.demersal, surface, handline etc. French landings were not available at the meeting.

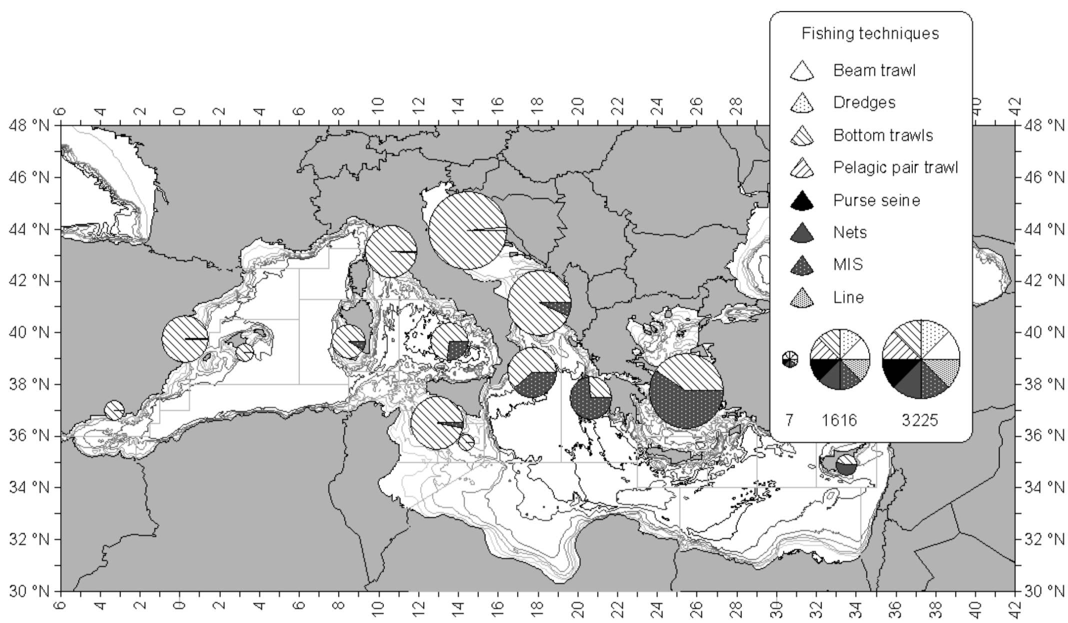

Figure 4. Red mullet landings (t) of EU fleet by GSA and gear type in the Mediterranean Sea. 'MIS' are polyvalent in Italy and Spain; 'Nets' are gillnets and trammel nets; 'Line' are all line fisheries, i.e.demersal, surface, handline etc. French landings were not available at the meeting.

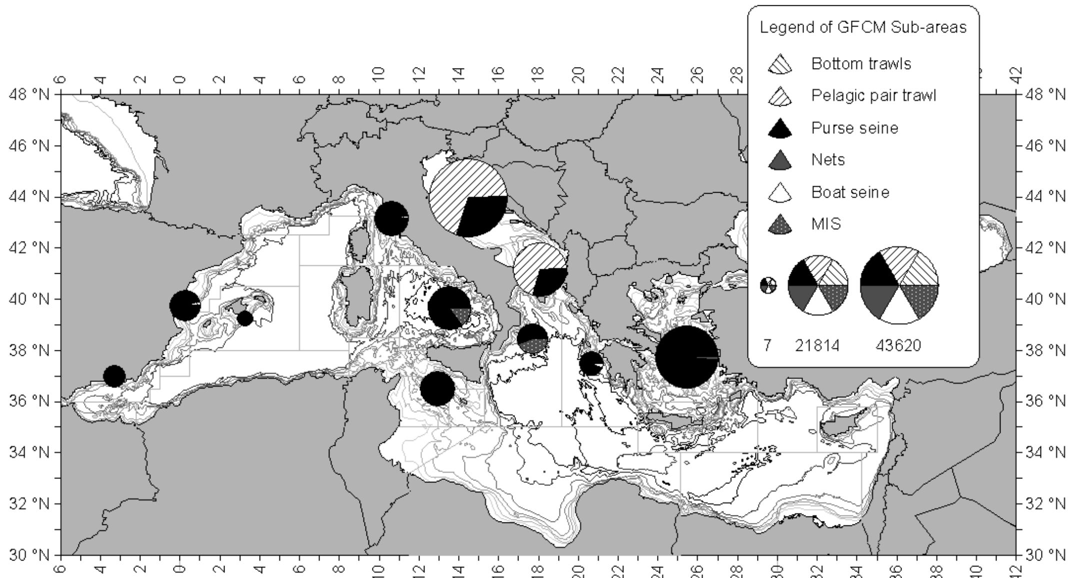

Figure 5. Anchovy landings (t) of EU fleet by GSA and gear type in the Mediterranean Sea. 'MIS' are polyvalent in Italy and Spain; 'Nets' are gillnets and trammel nets. French landings were not available at the meeting.

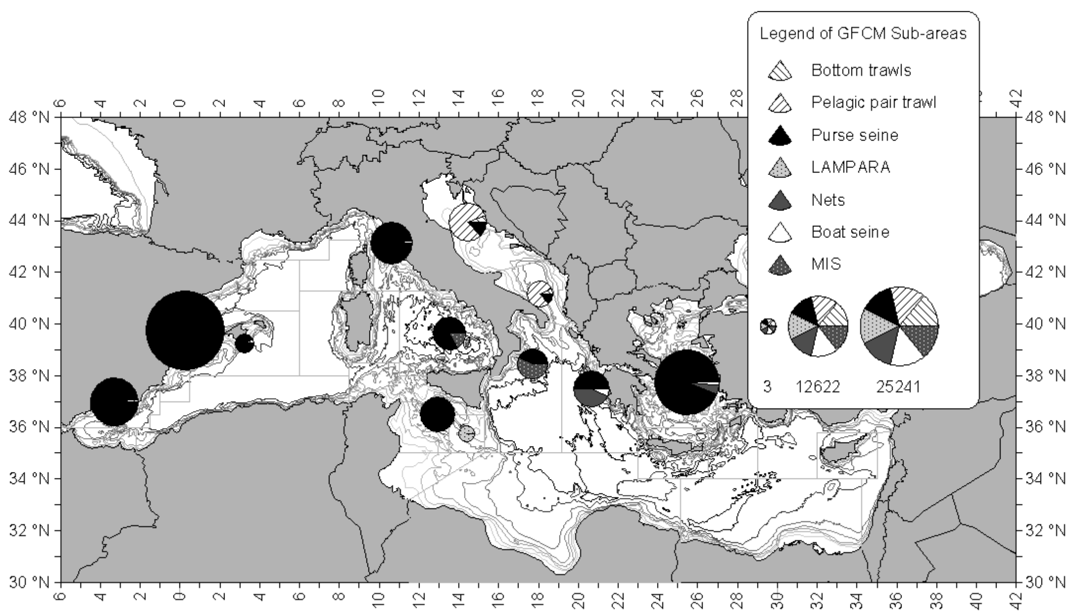

Figure 6. Sardine landings (t) of EU fleet by GSA and gear type in the Mediterranean Sea. 'MIS' are polyvalent in Italy and Spain; 'Nets' are gillnets and trammel nets. French landings were not available at the meeting.

7. AVAILABLE FISHERY AND SURVEY DATA AND STOCK ASSESSMENTS (TORS 2 AND 3)

Fishery data

Fishery data collected under the DCR from 2006 that were available at the meeting were collated and analysed as described in section 6. More complete data should be available for subsequent SGMED meetings to allow stock assessments to be performed (see section 0).

Scientific surveys

Demersal and pelagic surveys are carried out as part of a co-ordinated programme across the EU Mediterranean countries (MEDITS and upcoming MEDIAS, respectively). These are supplemented by both regular and *ad hoc* surveys performed by individual countries (e.g. GRUND survey in Italy). Table 2 lists the surveys carried out in the EU Mediterranean waters according to information provided by experts. The type of data made available during the meeting by GSA and species is also shown. Appendix 4 (section 15) shows the list of target species of MEDITS (Bertrand *et al*., 2000) and GRUND (Relini, 1998) surveys. A description of the MEDITS survey (specifically) follows.

MEDITS survey

The MEDITS project started in 1994, aimed at the standardisation of survey methodology among the different countries (France, Greece, Italy and Spain). Since 1996 and 1999 data has also been available from the eastern side of the Adriatic Sea (Slovenia, Croatia and Albania) and from Morocco, respectively. More recently Malta and Cyprus became part of the program. Details on sampling scheme and sampling protocol can be found in Bertrand *et al*. (2002). The survey is carried out yearly since 1994 in late spring-early summer. Shorter time series are available for GSAs 15 (2000-07), 22-23 (1994-2006, 2002 lacking), and 25 (2005-07).

Table 2. List of surveys by country, GSA, period, sampling method and target species.

Survey	Country	GSA	Years	Method	Season	Target species	Available data for the meeting		
							Time series	Stock assessment and population indicators	Community indicators
Medits	Spain	1	1994-2007	trawl	May-July	*	1994-2007	hake, red mullet	target+ non target demersal sp. (TA, TB, TC)
ECOMED	Spain	1	1990-2006	acoustics	November-December	anchovy&sardine		anchovy&sardine	
Medits	Spain	2	1994-2007	trawl	May-July	*			
Balar	Spain	5	2001-2006	trawl	May-July	*	2001-2006	hake, red mullet	target+ non target demersal sp. (TA, TB, TC)
Medits	Spain	5	2007	trawl	May-July	*		hake, red mullet	target+ non target demersal sp. (TA, TB, TC)
Medits	Spain	6	1994-2007	trawl	May-July	*	2007	hake, red mullet	target+ non target demersal sp. (TA, TB, TC)
Leder	Spain	6	2001-2005	trawl	May-July	*	2001-2005	hake, red mullet	target+ non target demersal sp. (TA, TB, TC)
DEPM Cat	Spain	6	1990, 1993, 1994, 2007	DEPM	May - Jul	Anchovy		anchovy	
ECOMED	Spain	6	1990-2006	acoustics	November-December	anchovy&sardine		anchovy&sardine	
Medits	France	7	1994-2007	trawl	May-July	*			
DEPM GulfLy	France	7	1993, 1994	DEPM	May-July	Anchovy		anchovy	
PELMED	France	7	since 1995	acoustics	July	anchovy&sardine		anchovy&sardine	
Medits	France	8	1994-2007	trawl	May-July				
Medits	Italy	9	1994-2007	trawl	May-July	*	1994-2007	hake, red mullet	target+ non target demersal sp. (TA, TB, TC)
Grund	Italy	9	1994-1998, 2000-2006	trawl	September-November	*			
DEPM Lig	Italy	9	1993	DEPM	July	Anchovy		anchovy	
Medits	Italy	10	1994-2007	trawl	May-July	*	1994-2006	hake, red mullet	target+ non target demersal sp. (TA, TB, TC)
Grund	Italy	10	1994-1998, 2000-2006	trawl	September-November				
Medits	Italy	11	1994-2007	trawl	May-July	*			
Grund	Italy	11	1994-1998, 2000-2006	trawl	September-November	*			
Medits	Malta	15	2000-2007	trawl	May-July	*	2000-2007	hake, red mullet, deep water pink shrimp, red shrimp	target+ non target demersal sp. (TA, TB, TC)
Medits	Italy	16	1994-2007	trawl	May-July	*	1994-2007	hake, red mullet, deep water pink shrimp, red shrimp	target+ non target demersal sp. (TA, TB, TC)
Grund	Italy	16	1994-1998, 2000-2006	trawl					
DEPM Sic	Italy	16	1998, 1999, 2000	DEPM	Jun-Jul	Anchovy		anchovy	
	Italy	16	since 1998	acoustics	June-September	anchovy&sardine		anchovy&sardine	
Medits	Italy	17	1994-2007	trawl	May-July	*			
Grund	Italy	17	1994-1998, 2000-2007	trawl	September-November				
SoleMon	Italy	17	2005-2006	rapido trawl	Spring, Autumn	Solea solea			
Pelmon	Croatia	17 (east part)	since 2002	acoustics	September	anchovy&sardine		anchovy&sardine	
	Italy	17 (west part)	since 1976	acoustics	June-September	anchovy&sardine		anchovy&sardine	
Adriamed	Italy	18		trawl					
Medits	Italy	18	1994-2007	trawl	June-August	*	1994-2006	hake, red mullet	target+ non target demersal sp. (TA, TB, TC)
Grund	Italy	18	1994-2006	trawl	September-November	*	1994-2006	hake, red mullet	target+ non target demersal sp. (TA, TB, TC)
DEPM Adr	Italy	18	1994	DEPM	July	Anchovy		anchovy	
	Italy&Malta	18	since 1998	acoustics	June-September	anchovy&sardine		anchovy&sardine	
Medits	Italy	19	1994-2007	trawl	May-July	*			
Grund	Italy	19	1994-1998, 2000-2006	trawl	September-November				
Medits	Greece	20	1994-2006 (2002 lacking)	trawl	May-September	*			
DEPM Ion	Greece	20	1999	DEPM	Jun	Anchovy		anchovy	
DEPM Ion	Greece	20	2001	DEPM	Jan-Feb	Sardine		sardine	
Sardine & Anchovy Hydroacoustics	Greece	20	1998, 1999, 2000	acoustics	June, July, December	anchovy & sardine			
Medits	Greece	22	1994-2006 (2002 lacking)	trawl	May-September	*	1996-2001 (Jun-Jul)	hake, red mullet (sardine, anchovy)	target+ non target demersal sp. (TA, TB, TC)
DEPM Aeg	Greece	22	1993, 1995 & 2003-2006	DEPM	Jun	Anchovy		anchovy	
DEPM Aeg	Greece	22	2000	DEPM	Dec	Sardine		sardine	
Sardine & Anchovy Hydroacoustics	Greece	22	1995, 1996, 1998-2000, 2003-2005	acoustics	June, July, December	anchovy & sardine		anchovy & sardine	
Medits	Greece	23	1994-2006 (2002 lacking)	trawl	May-September	*			
Medits	Cyprus	25	2005-2007	trawl	May-July	*	2005-2007		target+ non target demersal sp. (TA, TB, TC)

Note: The list of Medits and Grund target species can be found in Appendix 4

Pelagic Surveys

Many acoustic surveys are funded by current DCR, although none of them are of priority 1. Next DCR is thought to change this situation throughout MEDIAS, i.e. a pan-mediterranean standardised echo-acoustic survey. This will also produce agreed protocols for data collection. Experts note that Mediterranean DEPM (Daily Egg Production Method) surveys are currently not part of the DCR, and hence availability of this data is not ensured. Experts recommend that DEPM surveys be considered for funded under future DCRs to ensure the continuity of the data set.

Recently, acoustic surveys have been performed in the Mediterranean area in GSA 1 and GSA 6 (by Spain), GSA 7 (by France), GSA 16 (by Italy and Malta), GSA 17 (by Italy and Slovenia – western part; and by Croatia – eastern part) GSA 18 (by Italy – western part only, although sometimes including the waters of Montenegro), GSA 20 and GSA 22 (by Greece) (Table 2). Common protocol for data collection during all these acoustic surveys carried out by EU-member countries will be developed within EU MEDIAS project framework. With aim to cover all of GSA 17 within the MEDIAS study area, participation of Croatia in this EU project is recommended by experts.

There remain some issues within the pelagic survey structure that require attention when using these data. Stocks of anchovy and sardine extend outside certain GSAs (i.e. GSA 6 and 7, GSA 17 and 18), and therefore only a part of the stock is assessed within a particular GSA. Large differences also exist within GSA 17 (eastern and western part), regarding to different data collection obligations, different management and fishing practices, and different perception of anchovy and sardine stock status.

DEPM surveys in the Mediterranean area have been performed from 1990 to 2007 (Table 2). DEPM applications in the Mediterranean are very intermittent, performed within the framework of National and European projects, and mostly focus on anchovy. Seven GSAs were covered by these surveys: the Aegean Sea (GSA 22 – 10 surveys), NW Spain (GSA 06 – 4 surveys), South Sicily (GSA 16 – 3 surveys), and GSAs 07 (Gulf of Lyon), 09 (Ligurian and North Tirrenian), 18 (Southern Adriatic) and 20 (Ionian) with one or two applications.

A literature review on the applications of DEPM to Mediterranean waters was made. Table 3 shows estimates for the different parameters from DEPM to be used in survey methods. The experts at SGMED-08-02 encourage scientists to fill gaps in the table in order to complete the information coverage.

Some of these DEPM applications have been experimental, with the aim of developing and testing the method, rather than providing estimates of SSB for stock assessment. Different techniques for several aspects of the method have been used in different areas, with no among-area standardisation (see a complete review in Somarakis *et al*., 2004). Consequently, the parameters estimated may vary greatly among stocks and year of application. Experts suggest the standardisation of DEPM surveys in the future.

Beyond estimates of spawning stock biomass (SSB) used in assessment, DEPM surveys also provide detailed biological and ecological information for small pelagic fish: essential habitats (spawning grounds and nursery areas), reproductive potential of the adult population (Daily Egg Production -P0-, Batch Fecundity -B-, Spawning Fraction -S-, Mean Females Weight -W-, Sex Ratio -R-, Relative Fecundity -RF=F/W-, Daily Specific Fecundity -DSF=FSR/W-) and biotic and abiotic environmental conditions (throughout plankton hauls targeting different size fractions and CTD profiles). This information may be useful to gain an in depth knowledge of the biology, ecology and population dynamics of small pelagic species (e.g. relationship between reproductive potential and age structure of the population, stock-recruitment relationship and its relation to environmental factors), to provide indicators of the health of the population (e.g. relationship between the size of the spawning stock and the size of the spawning area), as well as to discriminate stocks.

Table 3. Estimates of DEPM parameters and spawning stock biomass (SSB, t) for sardine and anchovy in the Mediterranean Sea. CVs in parentheses.

Survey	GSA	Year	Season	Target sp	Survey A	Positive A	P_0	F	S	W	R	RF	DSF	SSB
DEPM Cat 90	6 (North)	1990	May	Anchovy	17,081	8,095	57.16 (0.29)	8 006 (0.02)	0.36 (0.10)	14.3 (0.04)	0.54 (0.09)	562	109	4 199 (0.26)
DEPM Cat & GulfLy 93	6 (North) & 7	1993	July	Anchovy	44,554	33,012	64.30 (0.15)	4 958 (0.11)	0.31 (0.13)	14.3 (0.07)	0.64 (0.05)	347	69	30 849 (0.30)
DEPM Cat & GulfLy 94	6 (North) & 7	1994	May-Jun	Anchovy	42,085	31,692	61.53 (0.21)	7 039 (0.02)	0.21 (0.20)	22.9 (0.06)	0.59 (0.19)	307	38	52 557 (0.36)
DEPM Cat 07	6 (North)	2007		Anchovy										
DEPM Lig 93	9 (North)	1993	July	Anchovy	15,424	8,221	49.87 (0.22)	4 894 (0.10)	0.32 (0.11)	14.2 (0.07)	0.63 (0.05)	345	70	5 829 (0.36)
DEPM Sic 98	16	1998	Jun-Jul	Anchovy	13,295	5,329	65.55 (0.21)	4 835 (0.16)	0.14 (0.12)	15.2 (0.07)	0.59 (0.12)	319	26	13 224 (0.22)
DEPM Sic 99	16	1999	Jun	Anchovy	5,878	2,692	43.99 (0.26)	5 871 (0.11)	0.17 (0.10)	14.1 (0.08)	0.55 (0.10)	417	39	3 010 (0.36)
DEPM Sic 00	16	2000	Jun-Jul	Anchovy	11,812	4,505	34.98 (0.15)	8 379 (0.06)	0.20 (0.28)	18.9 (0.04)	0.62 (0.08)	443	55	2 851 (0.46)
DEPM Adr 94	18 (SW)	1994	July	Anchovy	14,790	9,244	50.11 (0.16)	11 866 (0.03)	0.16 (0.08)	18.6 (0.03)	0.55 (0.05)	639	57	8 129 (0.24)
DEPM Ion 99	20 (Central)	1999	Jun	Anchovy	12,362	12,362	8.88 (0.24)	9 428 (0.08)	0.06 (0.26)	15.6 (0.05)	0.53 (0.07)	604	19	5 588 (0.33)
DEPM Ion 01	20 (Central)	2001		Sardine										
DEPM C Aeg 99	22 (Central)	1999	May-Jun	Anchovy	8,604	8,604	13.29 (0.39)	4 725 (0.06)	0.13 (0.21)	15.8 (0.03)	0.47 (0.09)	300	18	6 273 (0.44)
DEPM C Aeg 00	22 (Central)	2000		Sardine										
DEPM NE Aeg 93	22 (NE)	1993	Jun	Anchovy	9,354	9,354	109.22 (0.27)	12 451 (0.05)	0.29 (0.21)	24.9 (0.03)	0.51 (0.05)	500	74	14 002 (0.34)
DEPM NW Aeg 93	22 (NW)	1993	Jun	Anchovy	8,042	8,042	87.19 (0.33)	10 474 (0.04)	0.26 (0.20)	20.9 (0.03)	0.60 (0.05)	502	78	9 030 (0.38)
DEPM NE Aeg 95	22 (NE)	1995	Jun	Anchovy	9,354	9,354	25.21 (0.23)	7 781 (0.06)	0.15 (0.11)	25.6 (0.03)	0.51 (0.08)	303	23	10 282 (0.22)
DEPM NW Aeg 95	22 (NW)	1995	Jun	Anchovy	8,042	8,042	19.75 (0.26)	5 128 (0.10)	0.13 (0.23)	22.7 (0.03)	0.61 (0.03)	226	18	8 948 (0.36)
DEPM Aeg 03	22	2003		Anchovy										
DEPM Aeg 04	22	2004		Anchovy										
DEPM Aeg 05	22	2005		Anchovy										
DEPM Aeg 06	22	2006		Anchovy										

Assessments presented at SGMED-08-02

A number of presentations were given at SGMED-08-02 to illustrate the methods used and issues encountered when assessing Mediterranean fish stocks. In addition, a new assessment was developed during the meeting for hake in the North Aegean (GSA 22), and in Tyrrhenian-Ligurian seas (GSA 9), which were presented and discussed. A first assessment trial on *P. longirostris* in the GSA 16 was also presented, including the simulation (using Aladym) of the consequences of different management scenarios on model-based population indicators and yield. Summaries of these assessments are presented in Appendix 5 (section 14). This was not intended to be a comprehensive list of assessments across GSAs (the purview of SGMEDs 08-03 and 08-04), but as trial assessments as per ToR 2.

Discussion of assessment approaches and reference points for Mediterranean Stocks

The experts at SGMED-08-02 discussed potential assessment approaches and reference points for Mediterranean stocks in light of the available data and their knowledge. These discussions concentrated upon the issues for demersal and pelagic species. However, it became clear that there were particular areas of commonality.

Issues common to demersal and pelagic species

The Working Group noted that the most appropriate biological parameters (growth, stock recruitment, mortality, etc.) should be used when performing stock assessments. The assumptions made on the values of natural mortality at age are particularly critical, especially for the Mediterranean fisheries with an early age of first capture. This fact may have important consequences on the estimates of fishing mortality vectors, numbers at age at sea, on recruitment strength as well as for the assessment of the consequences of management actions in competing fisheries that exploit different demographic fractions of the population. Discussions at SGMED-08-02 noted that scientists needed to consider species interactions, since values of natural mortality used in assessments of hake were often larger than those used in pelagic assessments, despite the fact that pelagic species are a prey of hake.

As an example,

Table 4 presents the range of possible scientifically based M estimates for sardine within GSA 17, while Table 5 shows the M estimates for sardine provided by different authors and GSAs in the Mediterranean. The range is very large.

Table 4. Examples of possible estimates of natural mortality for sardine in GSA 17.

Estimated M	Method used	References
M = 0.5	Taylor's equation (Taylor, 1959)	Sinovčić, 1983; 1986
M = 0.3	Taylor's equation	Sinovčić, 1991
M = 1.2 x 0.46 = 0.552	According to Beverton and Holt, M=1.2xK (for clupeoids)	(from: Sinovčić, 1986)
if longevity is 10 years, thus $M_{(1\%)}$= 0.46 and $M_{(0.1\%)}$= 0.77	M related to longevity	from: Spare and Venema, 1992
if age of massive maturation ($Tm_{(50\%)}$) is 1 year, thus M = 1.4	Rikhter and Efanov's formula	from: Spare and Venema, 1992
if T=14.16°C L_∞=20.5cm and K=0.46 thus M = 0.696 ~ 0.70;	Pauly's empirical equation corrected (-20%) for schooling behaviour	from: Spare and Venema, 1992; L_∞ and K after Sinovčić, 1983; 1986
if T=15.24°C L_∞=20.5cm and K=0.46 thus M = 0.72	Pauly's empirical equation corrected (-20%) for schooling behaviour	from: Spare and Venema, 1992; L_∞ and K after Sinovčić, 1983; 1986

Table 5. Natural mortality estimates (M) for sardine provided by different authors and GSAs in the Mediterranean

GSA	Area	*M*	Author
04	Algerie	0,40 - 0,50	Djabali *et al* ., 1990
06	CW Mediterranean	0.36	Larrañeta *et al* ., 1958
	CW Mediterranean	0.50	Murphy, 1977
	CW Mediterranean	0.36 - 0.50	Penas, 1978
	CW Mediterranean	0.36, 0,8 - 1,0	Larrañeta, 1979
	NW Mediterranean	0.29 - 0.62	Pertierra & Perrota, 1993
17	Adriatic Sea	0.55	Piccinetti *et al* ., 1981
	E Adriatic Sea	0.74	Alegría-Hernandez, 1984
	NC Adriatic Sea	0.32 - 0.52	Levi *et al.* , 1984
	C Adriatic	0.50	Sinovcic, 1986
	EC Adriatic Sea	0.30	Sinovcic, 1991
	Adriatic Sea	0.50	Santojanni *et al* ., 2005
22	NW Aegean	1.34	Voulgaridou & Stergiou, 2003

Consequently, the Working Group noted that sensitivity analyses for different M values in stock assessments should be performed. To overcome this problem, use of an agreed common M value or use of common method for estimation of M value was also suggested.

This work should be performed in the subsequent SGMED meetings, where agreement on the methodology and biological parameters should be sought and agreed for use in stock assessment models. However, if necessary, experts recommend further specific workshops be held to deal with the issues on biological parameters, for instance standardisation of otolith reading, growth parameters, maturity stages and natural mortality among others.

The Working Group noted that, particularly for demersal species with a small size at first capture, a vector of natural mortality at age or length, based on approaches such as that of Caddy and Abella (1999), should be considered.

A general concern was raised by the Working Group on the quality of input data necessary for particular assessment methods, in particular the information on catch and effort by gears and fishing strategies. Some exploration of these data was performed during the meeting (see section 6) and issues with the data were noted. Although it is noted that the quality of information is improving, in the case where the quality of this information is not improved through the DCR call for the next meeting, this will reduce, or even make impossible, the utilization of certain assessment methods in all GSAs. Discussion also reflected concerns on the reliability of the model outputs when they are fed with biased data, and analysis of available data will be critical to underpin assessments performed.

Potential assessment methods for use at future SGMED meetings include those based on size structure of the catches (i.e. VPA) when available, on catch and effort (i.e. Production models) when demographic structure of the catch is not well known, or more simple assessments based on surveys data (i.e. SURBA, composite models, simulations, indicators) or on survey data and population/harvesting parameters (e.g. simulation models such as Aladym, Yield), when only such information is available. A spectrum of potentially useful methods that can be used considering the expected available data and fisheries characteristics in the area were defined during the first meeting. The Subgroup decided that participants should be free to use one or more of them for performing assessments. It is stressed that the use of more than one method using the same set of data is advisable in order to compare results, thereby investigating model uncertainty.

Demersal species

The choice of a suitable assessment method is conditioned by the available information. In certain areas, at a national level or through local institutions data collection of commercial fishing activities and scientific surveys is started well before the enforcement of the national programs in the frame of the DCR. In these cases, information on the fisheries regarding demographic structure, total amount of catches by gear, fishing effort, etc. is available for the performance of techniques as VPA, XSA or Surplus Production models. In other cases, in particular when data collection started only in the last years, time series may be still not long enough for performing such kind of approaches. Where fisheries dependent information was absent or incomplete or time series too short, considering the need to give some preliminary advice on the status of the stocks, some attempts to utilize information exclusively from scientific cruises for stock assessment were made. In a smaller number of areas, information allowed the utilization of more complete and robust methods.

The lack of precise information of effective effort directed at each stock by fishing strategy and vessels's structural category in the current DCR does not allow the use of certain assessment models based directly on effort as an input parameter.

The lack of long time series precludes the utilization in most of the areas of assessment approaches such as VPA. Moreover, information is representative only of situations in which most of the stocks were already fully or overexploited. The absence of information of previous situations of lower fishing pressure also precludes the application of traditional surplus production models, due to the lack of enough contrasting situations regarding exerted fishing pressure. It has been stressed that the lack of data on spawning stock size and consequent recruitment strength for conditions of low fishing pressure may produce serious overestimations of a sustainable F rate related to the replacement concept as Fmed and/or related RP's based on the Shepherd-Sissenwine approach, such as Z_{med}. It also reduces the ability to estimate a realistic stock-recruitment relationship, including parameters such as steepness and virgin biomass. For the future meetings, alternative approaches are planned to be tested in order to evaluate their performance, and in particular their suitability for the assessment in the Mediterranean situation characterised by the lack of long time-series of data on commercial catches, a very complex dynamics of landings, high number of landing places, highly developed multi-gear and multi-species artisanal fisheries, with many commercially important species that are exploited by several gears that remove different fractions of the size (age) structure of the stocks. For the preparation of future exercises, formats for the presentation of basic data necessary for the assessments with the different alternative methods were prepared and reported in SGMED-08-01.

The precautionary approach for fisheries is related to the conservation, management and exploitation of the living resources in order to protect them and preserve the aquatic environment. In implementing a precautionary approach, member states' decision-making for resources conservation and management have to be based on sound scientific evidence allowing the definition of stock specific target and limit reference points as well as the actions to be taken if they are exceed. Reference points can be defined as conventional values of the state of a fishery or population that are considered the desirable objective to be reached or as a undesirable state of the fishery which needs to be avoided.

Several reference points were used during the presentation of some trial assessments presented during the SGMED-08-02 meeting (section 0). Participants of the Working Group agreed that when uncertainty is high, is preferable to use different assessment approaches and reference points for the definition of stock status and for assessing the likely consequences of alternative management actions.

Reference points based on reproduction considerations were used in some assessments. The rate between the current Spawning Stock Biomass and the pristine level of SSB is a useful reference point. According to literature, this value may not be lower than 0.3-0.4 according to the resilience of each specific species. There are uncertainties in estimating the unexploited state when data are only available from a heavily exploited population, however $F_{0.1}$ was also presented as a potential candidate although has no a strong theoretical basis behind it. Some reference values based in fishing mortality or in biomass has been already proposed in the frame of GFCM some years ago (SCSA 1999). Reference points derived from analysis of sets of data of Z and indices of abundance from trawl surveys allows the estimation of Z corresponding to the Maximum Biological Production, that is considered precutionary, and always lower than the Z value corresponding to MSY. From Catch and Effort information it is also possible to define the effort at MSY as well as the Maximum Sustainable Yield and some other more precautionary reference points considering uncertainty in the estimates.

The Working Group discussed potential reference points for use to manage Mediterranean stocks and fisheries. They decided to trial a number at SGMED-08-03, namely:

- $F_{0.1} - F_{max}$ (as a proxy for MSY)
- F_{MSY}
- 20-30% of SSB_0
- 0.4-0.5 exploitation rate
- Maximum biological production level

In addition, the use of indicators will be tested (section 8).

It should be noted that the proposal is not to perform a full testing of the robustness of these reference points to uncertainty in biological parameters, nor to evaluate their performance as one part of the data collection, assessment and management framework through Management Strategy Evaluation. This is too extensive a process for SGMED-08-03, and should be the subject of further meetings.

Demersal surveys

Information derived from trawl surveys (e.g. MEDITS and GRUND) is useful for mapping the spatial distribution of species that may not coincide with the economic or administrative boundaries defined by fishermen or fisheries managers. In addition, trawl surveys provide indices of relative abundance over space and time, and these estimates are assumed to reflect the effective situation at sea. Analysis of the information collected with such methodology allows an insight into variations across years, provided that sampling procedures and period do not change over time, and species behaviour is considered. In turn, the conduct of more than one survey per year may provide important information on several biological features (maturity, recruitment, ontogenetic migrations, etc.). However, for some species MEDITS does not allow important indexes (e.g. recruitment indexes, length-at-maturity, SSB, etc.) to be calculated due to the sampling period in which the survey is carried out during the year. The lack of data coming from other periods of the year reduces the use of potentially important information for the assessment of resource status. If information from different periods of the year on size distribution were available, they could be used to estimate growth and mortality rates, and at analyse distribution by size. This information, if associated with data on life history, allows the definition of boundaries and size of nursery areas or of any other aggregations due to sex, age and sexual maturity, useful for a more sound management of the fishing activity (Hilborn & Walters, 1992).

In the Mediterranean context, even if methods for using relative biomass index trends for stock assessment have not yet been well formalised, trends in abundance indices have been used as indicators of the state of the fishery, and can be used to tune stock VPA assessment methods.

Trawl survey data are potentially useful for the application of different length or age based assessment methodologies, analogous to the length- or age-structured stock analysis routinely applied when commercial catch data are available. In turn, the reconstructed size structure from trawl-surveys has been frequently used to estimate total mortality rates, and also to deriving several indicators on the exploitation of resources. The accuracy of these estimates is however linked to the representativeness of samples.

Trawl-surveys with fine-meshed gear is often the only source of information regarding the pre-recruited portion of demersal stocks, that can be combined with estimates of parental stock to detect stock/recruitment relationships. Having information in different periods of the year is likely to facilitate the collection of the data also regarding this phenomenon.

Pelagic species

The current DCR allows collection of small pelagics fishery data in a continuous and standardised manner. The EU DCR started in 2002 onwards and it prompted a sharp increase on small pelagics stocks assessments in Mediterranean waters. Previous to 2002 some data for assessment were also collected in a national basis, and also some EU Study Projects funded collection of relevant data to be used in stock assessment.

It is important to note that data for assessment should cover all components of the exploited resource (stock) and also all relevant fisheries related to this stock. A key area for small pelagics that needs improvement is that for fishing activities targeting the fries of sardine for human consumption (particularly in GSA 16, GSA 17 and GSA 18), which according the EU Regulation 1967/2006 have a legal exemption *"if caught by boat seines or shore seines and authorised in accordance with national provisions … provided that the stock of sardine concerned is within safe biological limits."* In these cases it is essential to establish accurate Biological Reference Points and to assess the effect of harvesting those rather sensitive population fractions in relation to the whole demographic structure of exploited stocks.

Based on the information available from the 2007 SCSA Report, and the fact that fry fisheries might strongly affect sardine spawning stock biomass, STECF already advised (SGRST-07-03) the reduction of larval mortality on sardine in GSA 16 and GSA 17. Given the fact that sardine fry fishery is based upon certain Management Plans (MP), experts consider that MP contains useful information about fry fisheries and therefore invite the Commission to make these MPs available to the group prior to the SGMED-08-04 meeting focusing on assessments of small pelagics.

Stock assessments of small pelagic species (anchovy and sardine) have been performed through both direct and indirect methods in several (but not all) GSAs.

The experts recommend the use of age-based methods tuned with direct methods (acoustic and/or DEPM surveys) to assess small pelagic stocks in the Mediterranean. Methodology should be standardised between the different scientists involved in assessments in the Mediterranean Sea.

Indirect methods require data collected through DCR and/or national data collection systems, as well as outputs of direct assessment methods (i.e. DEPM or acoustic surveys) for tuning purposes.

Tuned Indirect Methods have been shown suitable to assess sardine and anchovy stocks. VPA methods such as XSA and Catch-at-age methods such as ICA and AMCI should be preferred to LCA. Some LCA assessments were made in 2004. By these assessments LCA was consider less suitable to assess small pelagics, as this last method assumes a steady state.

Once current status has been assessed, simulations based on indirect methods can provide short and long-term predictions of abundance and catches, to evaluate situations at different levels of fishing pressure and recruitment. A special warning should be made when considering forecasts of fisheries highly dependent on the recruitment, particularly in the case of anchovy.

Small pelagic fisheries are highly dependent of the strength of the youngest classes. Indicators of the strength of the incoming year class are of vital importance for these species. They may come from two different sources: surveys targeting recruits or improved stock-recruitment relationships using environmental indexes. Experts highlight the importance to have such knowledge both for a proper assessment and then management of this kind of fisheries.

As noted for demersal species, the selection, estimation and testing of candidate reference points is a topic of high priority, and there is a need to agree procedures and methodologies. In addition to the opportunity represented by SGMED-08-04, workshops and study groups may be needed to progress this matter. Reference Point refers to biological and fishing pressure limits generally defined as values of Biomass (B) and/or fishing mortality (F).

Experts consider that exploitation rate (F/Z) could be a useful candidate to indicate some pressure state of the fishery. The exploitation rate of 0.4 (as suggested by Patterson, 1992) was proposed during SGMED-08-01 meeting. Some concerns about the use of such exploitation rate as a reference point were also expressed, and hence there is a need to investigate these candidates further.

Reference points are increasingly uncertain where biological and fishing parameters are uncertain (e.g. natural mortality as discussed earlier). Reference points should either be set at precautionary levels in this case, or reference points be selected that are robust to these uncertainties.

Definition of stock units in the Mediterranean Sea

The effective definition of stock boundaries is a key issue for stock assessment. The proper definition of stock boundaries is an essential task for data acquisition, assessment and management of fishing resources. Experts at SGMED-08-02 agreed that assessment does not have to be constrained by GSA spatial definition, but should be performed considering geographic limits of the stocks' distribution.

The Working Group discussed the scale at which assessments should be performed and its relation with the stock units that may be identified in different ways. The Working Group agreed that the definition of stocks based on genetic considerations was of limited usefulness in this context. An alternative definition was the operational concept of stock: individuals of a given species or species group sharing a certain area having similar life history characteristics and the same probability to die due to natural causes or by removal by fishing. Information on spatial distribution of resources and on fishing effort may be useful for defining such units that have to be managed, independently to arbitrary geographical divisions between GSAs or countries. The knowledge of distribution of resources and the distribution of the fishing fleets by gear is considered by the group potentially useful for the definition of more natural divisions based on this operational concept of stock. There is however the need of a prompt decision in order to allow the preparation of the data call that has to be prepared as soon as possible.

Experts therefore used existing knowledge and experience to define the spatial scale at which stock assessments for the four key species (hake, red mullet, sardine and anchovy) should be performed during SGMED-08-03 and 08-04.

Considered that fisheries data are organized by GSA, this fact suggests (and in some way conditions the choice) that assessments should be performed on a GSA level, either singly or by merging GSAs together if biologically relevant. For instance, fisheries information is available almost everywhere at a GSA level, and results very difficult, or sometimes impossible to split total catches or total effort among sub areas inside the GSAs. Therefore, the Working Group recommended the following geographic assessment scales for each species.

Stock units of hake

Current knowledge on the hake population structure allowed experts to define stocks boundaries according to geographic and hydrographical features. According to these criteria, hake assessments should be carried out for each GSA separately, except for GSA 22 and 23 (Greece) and GSA 15 and 16 (Strait of Sicily), which should be combined.

Stock units of red mullet

Red mullet is mostly distributed in shallow coastal waters. Although separate red mullet stocks may exist in a single GSA, the data are collected on a GSA basis. Thus, experts at SGMED-08-02 decided that for the next meeting, GSA is the appropriate geographical unit to conduct stock assessments. Assessments will be conducted separately in every GSA except for GSA-22 and GSA-23, which will be combined. Thus, red mullet stock assessment will be carried out (dependent on data availability) for each GSA separately, except for GSA 22 and 23 (Greece), which should be combined.

Stock units of sardine and anchovy

The small pelagic stock assessments in the Mediterranean are accomplished by Geographical Sub-Areas (GSAs) as defined in the GFCM (Rome, 2006). The definition of these GSAs was mainly based on national or regional borders taking into account some scientific information.

Little specific work has been focused on the biological stock identification of small pelagic species in the Mediterranean and more study is needed in order to establish stock boundaries in a proper manner.

Until this information is available and taking into account practical considerations, the experts at SGMED-08-02 recommended performing assessments at a GFCM-GSA level, and encourage moving forward in relation to the stock identification of small pelagic species. The information shared in the STECF-SGMED meetings can be used to pursue this issue through a more detailed analysis of the currently available information from surveys and DCR (i.e. spawning areas, seasonal spawning period, biological parameters, species distribution, etc.) until studies based on both established and innovative approaches (such as life history traits -growth, reproduction and distribution-, genetic markers, other biological tags - morphometry, parasites - tagging experiments, etc.) are available to define stocks units.

8. INDICATOR ASSESSMENTS OF FISHERY IMPACTS (TOR 5)

The use of some indicators of fishing pressure on the ecosystem and bioeconomic indicators were briefly discussed and participants agreed regarding its potential usefulness, especially for the current situations of data shortage. The Working Group noted that the approach, as a standardized method for preliminary assessments in conjunction with the traffic light approach, as described in a recent STECF document regarding fishing capacity and resources potential production, was appropriate.

The Subgroup noted the need to examine further the issues of biological indicators to begin to develop an overall approach. Biological indicators can be obtained directly from survey results - i.e. MEDITS project - as "empirical" indicators, as well as derived from model analysis (Z, F, etc.). In the latter case they can be identified as "model based" indicators. The indicators' values can be used both for spatial and temporal comparison (inter and intra Mediterranean GSAs).

Different biological indicators, related to the target species as well as the overall community vulnerable to the fishing gear, have been shown to react to the fishing pressure in the Mediterranean area (Massutí and Moranta 2003; Rochet *et al*. 2005; Shin *et al*. 2005; Medits, 2007; Ceriola *et al*., in press).

To examine the utility of biological indicators, the Subgroup proposed the use of the FAO Software "AtrIS" (see also at documents: FAO-ADRIAMED, 2005; Ungaro *et al*., 2006; Ceriola *et al*., in press). This software offered a tool to both collate information from the MEDITS TA, TB, and TC files, and to rapidly process data to develop a range of empirical indicators (see below) to be examined in SGMED-08-03 using the collated MEDITS data available across GSAs. The indicators can be tested in a number of ways, including comparison against the different effort levels by GSA. In turn, the large number of indicators proposed is likely to lead to some redundancy. This can be examined by testing for correlations between indices over time and between GSAs. Model based indicators can help in analysing/understanding relationships between population state and pressure.

Empirical Indicators

Single species indicators:
Occurrence (%)*
Biomass index (arithmetic mean, geometric mean, 75th percentile)*
Abundance index (arithmetic mean, geometric mean, 75th percentile)*
Recruitment index (arithmetic mean, geometric mean, 75th percentile)*
Spawner index (arithmetic mean, geometric mean, 75th percentile)*
Body weight (mean)*
Body length (arithmetic mean, median, 75th percentile)*
Mean body length excluding recruits (arithmetic mean, median) *

Multi species indicators:
Total Biomass index (arithmetic mean, geometric mean, 75th percentile)*
Total Abundance index (arithmetic mean, geometric mean, 75th percentile)*
Total Biomass index excluding pelagic fish (arithmetic mean, geometric mean, 75th percentile)*
Total Abundance index excluding pelagic fish (arithmetic mean, geometric mean, 75th percentile)*

Biomass index of the main target species (arithmetic mean, geometric mean, 75^{th} percentile)*
Biomass index of Cephalopods (arithmetic mean, geometric mean, 75^{th} percentile)*
Biomass index of Small Pelagics (arithmetic mean, geometric mean, 75^{th} percentile)*
Biomass index of Elasmobranchs (arithmetic mean, geometric mean, 75^{th} percentile)*
Biomass index of Bony Fish (arithmetic mean, geometric mean, 75^{th} percentile)*
BOI*-**
Ecological Indices (Richness, Diversity, Evenness)*

*Calculated by the F.A.O. Software "AtrIS"
**From the paper: Fiorentino et al., 2003.

Model based Indicators

Single species indicators:
Total mortality (Z)
Fishing mortality (F)
Spawning Stock Biomass (SSB)
Strength of Recruitment
Mean body length of population relevant stages (all, spawners)
Mean body weight of population relevant stages (all, spawners)
Biomass
Biological Production
Yield

Other indicators can be added and estimated according to other existing scientific advice and methodologies. For example, the R-SUFI routine developed in the R environment by Rochet et *al.* (2004) uses Medits data to estimate several population and community indicators and has been widely applied at large Mediterranean scale (MEDITS, 2007). In addition, indicators and methods included in the new regulations from E.U. (new implementing draft of E.C. regulation 199/2008) will be considered and applied if calculation tools are available.

In the next tables (modified from Ceriola *et al*., in press) examples of the use of empirical indicators are presented. Some of the above listed indicators (single species and community) are displayed according to the 'Traffic Light' system (e.g. Caddy, 2006). For each biological indicator, the boundary values to assign a judgement/colour (positive = green, intermediate/neutral = yellow, negative = red) were set according to the percentile values (33rd and 66th, respectively, comparable to limit reference value and target reference values) in the time series. For indicators assumed to react positively to increases in fishing effort (i.e. cephalopods abundance and small pelagics abundance) green and red colours were reversed.

INDICATOR	ESTIMATOR	1996	1997	1998	1999	2000	2001	2002	2003
Merluccius merluccius									
Occurrence	%								
Biomass	Geometric mean								
	75° percentile								
Density	Geometric mean								
	75° percentile								
Recruitment index	Geometric mean								
	75° percentile								
Spawner index	Geometric mean								
	75° percentile								
Mean body weight	Ratio								
Mean body length	Arithmetic mean								
	Median								
Mean body lenght excluding recruits	Arithmetic mean								
	Median								
Mean body lenght Length at maturity^{-1}	Ratio								

INDICATOR	ESTIMATOR	1996	1997	1998	1999	2000	2001	2002	2003
Total biomass index	Geometric mean								
	75° percentile								
Total density index	Geometric mean								
	75° percentile								
Total biomass excluding pelagic species	Geometric mean								
	75° percentile								
Total density excluding pelagic species	Geometric mean								
	75° percentile								
Biomass of the main target species	Geometric mean								
	75° percentile								
Cephalopods biomass index	Geometric mean								
	75° percentile								
Small pelagics biomass index	Geometric mean								
	75° percentile								
Elasmobranches biomass index	Geometric mean								
	75° percentile								
BOI	Ratio								
Richness Index (Margaleff)	Index value								
Diversity Index (Shannon)	Index value								
Evenness Index (Pielou)	Index value								

9. SOCIAL-ECONOMIC INDICATORS OF MEDITERRANEAN FISHERIES (TOR 6)

Although the number of economists present at the meeting was highly limited (one scientist), the task of compiling and reviewing socio-economic indicators of Mediterranean fisheries was undertaken. In addition, the overall TOR pertaining to a review of bio-economic models and their requirements was also started (Appendix 6, section 17).

At the 25th Session of the GFCM (September 2000) it was recommended that the SCESS develop and use homogenous socio-economic indicators in each of the GFCM management units. At the GFCM level there is no official list of socio-economic indicators that need to be estimated. Different case studies (most funded by COPEMED and ADRIAMED) have therefore been using different sets of indicators. In this report, ADRIAMED socio-economic indicators have focused upon. Further work will continue on this subject at SGMED-08-03, dependent upon the attendance of socio-economists.

A list of 24 socio-economic indicators was proposed by FAO project AdriaMed for the analysis of demersal and pelagic fisheries in the Northern and Central Adriatic Sea (GSA 17). The list of indicators and methodology for its analysis was developed as contributions respectively for the AdriaMed Working Group on Biological and Economic Indicators for Adriatic Sea Demersal Fisheries, held in Fano, Italy, in 2005, and for the AdriaMed Working Group on Small Pelagic Fisheries Resources of Adriatic Sea, held in Ancona, Italy, in 2006.

A socio-economic analysis of demersal fisheries in the Italian GSA 17 by using the same list of indicators has been published in Accadia and Spagnolo (2006). The same socio-economic indicators together with a list of biological indicators have been used to analyse demersal fisheries in the Italian GSA 18 in Ceriola *et al*. (in press).

The approach followed in all these works suggests distinguishing indicators to evaluate the status of the fisheries from indicators to measure fisheries sustainability. The economic (Return on Investment and Ratio between Current Revenue and Break-Even Point) and social (Average Wage per Full-Time Equivalent and Gross Added Value) indicators recommended by the working groups SGRST-07-05 and SGECA/SGRST-08-01 belong to the second group of indicators.

Table I displays the list of the economic indicators on the status of fisheries proposed by AdriaMed project and their description. They include 6 indicators on economic performance, 8 on productivity and 4 related to the market (costs and prices). As for the evaluation of economic performance, traditional indicators based on the return on capital invested and indicators related to the quota of revenues directed to production factors are used. A number of indicators are also used in the evaluation of productivity. They can be divided into two groups, physical and economic productivity indicators, where the former are expressed in terms of landings and the latter in terms of revenues. The last four economic indicators, related to market variables, are to measure the evolution of landings prices and of the most relevant costs in demersal fisheries, specifically maintenance and fuel costs.

The indicator summarising economic sustainability is obtained comparing the profitability of investments in fishery (by the return on capital invested (ROI)) to the average rate of the Italian Treasury securities with a long term maturity (Buoni del Tesoro Pluriennali (BTP)). The rate of Italian BTP are used here as a limit reference point. It is one of the two economic indicators recommended by the working groups SGRST-07-05 and SGECA/SGRST-08-01.

From a social point of view, 4 indicators have been defined. As listed in Table II, two indicators on labour productivity, an indicator on the number of people employed and one on their average salary are used for the analysis of social aspects of Italian fisheries.

The indicator summarising social sustainability is obtained as a difference between the average salary per man employed and the minimum salary stipulated by Italian laws (Contratto Collettivo Nazionale di Lavoro (CCNL)). This level of salary can be considered as a limit reference point from a social point of view. It is one of the two social indicators recommended by the working groups SGRST-07-05 and SGECA/SGRST-08-01.

Trends of these indicators have been analysed using the 'Traffic Light' system. Reference values are set according to their percentile value in the following series:

- > 66th percentile
  - for productivity and performance indicators – 'good', green colour assigned
  - for costs indicators, 'bad', red colour
- 66th - 33rd, 'intermediate', yellow colour, and
- < 33rd percentile
  - for productivity and performance indicators – 'bad', red colour
  - for costs indicators – 'good', green colour assigned.

Some results obtained for demersal and pelagic fisheries in the Italian GSA 17 are reported in Tables III-VI. The analysis has been performed by using data available from the IREPA monitoring system along the Italian coastline for the period 1996 - 2004.

Table I: Economic indicators on the status of fisheries and description.

INDICATOR	DESCRIPTION
Added Value/Revenue	percentage of revenues which is directed to salary, profit, opportunity cost and depreciation.
Gross Operative Margin/Revenue	percentage of revenues which is directed to profit, opportunity cost and depreciation.
ROS (Return on Sale)	percentage of revenues which is directed to profit and opportunity cost.
ROI (Return on Investment) (%)	percent ratio of net profit plus the opportunity cost in relation with the investment.
Revenue/Invested Capital (%)	percent ratio of revenues in relation with the investment.
Net Profit per vessel (000 €) *	average net profit of each vessel.
Landings per vessel (ton)	average production of each vessel in terms of weight of landings.
Landings per GRT (ton)	average production in terms of weight of landings for each capacity unit (GRT) of the vessels.
Landings per day (ton)	average production in terms of weight of landings for each day at sea.
CPUE (kg)	average production of each effort (GRT*days/N.vessels) unit in terms of weight of landings.
Revenue per vessel (000 €) *	average production of each vessel in terms of market value.
Revenue per GRT (000 €) *	average production in terms of market value for each capacity unit (GRT) of the vessels.
Revenue per day (000 €) *	average production in terms of market value for each day at sea.
RPUE (€) *	average production of each effort (GRT*days/N.vessels) unit in terms of market value.
Average price (€/kg)	average market price of landings.
Fuel cost per vessel (000 €) *	average fuel cost of each vessel.
Fuel cost per day (000 €) *	average fuel cost for each day at sea of a vessel.
Maintenance cost per vessel (000 €) *	average maintenance cost of each vessel.

* Deflated by Italian consumer price index for the entire community.

Table II – Social indicators on the status of fisheries and description.

INDICATOR	DESCRIPTION
Landings per crew (ton)	average production in terms of weight of landings for each man employed.
Revenue per crew (€) *	average production in terms of market value for each man employed.
Crew/GRT	ratio between man employed and GRT employed.
Salary per crew (000 €) **	average salary obtained by each man employed.

* Deflated by Italian consumer price index for the entire community.
** Deflated by Italian consumer price index for workers and employees.

Table III – Economic indicators for demersal fisheries in GSA 17

INDICATORS	1996	1997	1998	1999	2000	2001	2002	2003	2004
Economic sustainability (ROI - Risk_free_rate) (%)	4.68	7.35	5.57	1.23	6.25	8.27	5.68	6.00	8.54
•Added Value/Revenue	0.68	0.68	0.66	0.60	0.59	0.59	0.60	0.60	0.57
•Gross Operative Margin/Revenue	0.30	0.31	0.26	0.19	0.24	0.26	0.25	0.27	0.29
•ROS (Return on Sale)	0.25	0.25	0.21	0.13	0.20	0.21	0.19	0.19	0.22
•ROI (Return on Investment) (%)	13.74	14.11	10.49	5.94	11.84	13.44	10.63	10.28	12.82
•Revenue/Invested Capital (%)	55.30	55.58	50.89	46.21	60.65	64.43	55.19	54.02	58.00
•Net Profit per vessel (000 €)	43.88	50.34	38.14	17.88	34.38	40.49	31.85	28.95	33.72
•Landings per vessel (ton)	49.16	53.95	49.52	40.10	43.39	44.06	33.87	30.58	35.37
•Landings per GRT (ton)	1.23	1.28	1.23	1.01	1.32	1.27	0.98	0.91	1.18
•Landings per day (ton)	0.31	0.34	0.31	0.30	0.28	0.25	0.21	0.20	0.24
•LPUE (kg)	7.75	8.02	7.61	7.69	8.47	7.25	6.09	5.90	7.99
•Revenue per vessel (000 €)	204.94	214.05	196.75	162.27	185.54	202.57	174.85	161.63	157.97
•Revenue per GRT (000 €)	5.13	5.08	4.88	4.07	5.64	5.84	5.05	4.80	5.27
•Revenue per day (000 €)	1.29	1.33	1.22	1.23	1.18	1.15	1.11	1.07	1.07
•RPUE (€)	32.29	31.83	30.25	31.11	36.23	33.31	31.42	31.16	35.67
•Average price (€/kg)	4.34	4.21	4.30	4.45	4.82	5.33	6.13	6.45	5.57
•Fuel cost per vessel (000 €)	27.45	29.00	28.31	28.83	39.60	41.40	34.38	30.96	36.33
•Fuel cost per day (000 €)	0.17	0.18	0.17	0.22	0.25	0.23	0.22	0.20	0.25
•Maintenance cost per vessel (000 €)	7.71	9.56	9.47	7.25	8.55	9.31	8.88	8.01	8.23

Table IV – Social indicators for demersal fisheries in GSA 17

INDICATORS	1996	1997	1998	1999	2000	2001	2002	2003	2004
Social sustainability (Salary - Minimum_salary) (000 €)	12.14	10.62	9.90	6.88	9.28	10.07	8.41	8.58	6.43
•Employed persons GSA 17 (num.)	11305	10693	11862	12290	10839	10061	9477	9226	8596
•Landings per crew (ton)	14.27	14.10	12.50	10.01	12.34	12.06	9.25	9.10	11.67
•Revenue per crew (000 €)	59.48	55.95	49.68	40.52	52.76	55.45	47.78	48.11	52.15
•Salary per crew (000 €)	22.45	20.62	19.58	16.50	18.24	18.44	16.73	16.46	14.86

Table V – Economic indicators for pelagic fisheries in GSA 17

INDICATORS	1997	1998	1999	2000	2001	2002	2003	2004
Economic sustainability (ROI - Risk_free_rate) (%)	3.57	1.74	0.89	8.80	10.10	8.87	12.09	14.24
•Added Value/Revenue	0.67	0.66	0.63	0.68	0.66	0.65	0.65	0.63
•Gross Operative Margin/Revenue	0.30	0.23	0.20	0.30	0.28	0.29	0.30	0.31
•ROS (Return on Sale)	0.23	0.16	0.14	0.25	0.23	0.24	0.24	0.26
•ROI (Return on Investment) (%)	10.33	6.66	5.60	14.39	15.27	13.82	16.37	18.52
•Revenue/Invested Capital (%)	44.75	41.71	41.27	56.51	65.11	58.12	66.95	71.21
•Net Profit per vessel (000 €)	60.79	38.82	27.19	82.79	68.94	62.69	63.94	71.61
•Landings per vessel (ton)	340.26	306.99	296.37	358.09	310.86	287.09	276.34	283.38
•Landings per GRT (ton)	4.49	4.31	4.16	4.95	5.59	5.15	5.73	5.88
•Landings per day (ton)	2.02	1.83	1.97	2.05	1.67	1.60	1.75	1.84
•LPUE (kg)	27.55	26.22	28.62	29.09	31.21	29.91	35.16	38.48
•Revenue per vessel (000 €)	291.38	268.84	239.86	337.87	302.82	274.30	267.73	280.90
•Revenue per GRT (000 €)	3.85	3.77	3.37	4.67	5.44	4.92	5.55	5.83
•Revenue per day (000 €)	1.73	1.60	1.59	1.94	1.63	1.53	1.69	1.83
•RPUE (€)	23.59	22.96	23.17	27.45	30.40	28.58	34.06	38.15
•Average price (€/kg)	0.91	0.95	0.89	1.06	1.13	1.14	1.18	1.24
•Fuel cost per vessel (000 €)	37.63	35.87	38.08	47.71	44.76	40.40	39.69	43.92
•Fuel cost per day (000 €)	0.22	0.21	0.25	0.27	0.24	0.23	0.25	0.29
•Maintenance cost per vessel (000 €)	11.92	11.26	9.18	11.78	11.48	10.72	10.76	14.14

Table VI – Social indicators for pelagic fisheries in GSA 17

INDICATORS	1997	1998	1999	2000	2001	2002	2003	2004
Social sustainability (Salary - Minimum_salary) (000 €)	4.56	6.00	5.20	10.56	11.03	7.54	8.21	6.35
•Employed persons GSA 17 (num.)	1178	1109	997	837	762	744	876	915
•Landings per crew (ton)	46.81	42.37	43.40	54.34	51.82	45.90	47.00	47.07
•Revenue per crew (000 €)	40.08	37.11	35.13	51.27	50.48	43.86	45.54	46.66
•Salary per crew (000 €)	14.89	15.96	14.97	19.39	19.27	16.00	16.15	14.80

10. SUMMARY AND RECOMMENDATIONS

All Terms of Reference for SGMED-08-02 were performed or initiated to underpin the assessment work to be undertaken at SGMED-08-03 and 08-04. Key issues and recommendations noted during the meeting were:

- Commercial data suffered from a number of issues, some of which should be improved through the DCR call. The need to ensure that data by GSA was consistent, considered the true location of effort and resulting catch (rather than the port of sampling), and where possible and necessary included the catches of non EU countries, was noted.
- The need to gather all information available on the species of key interest at the subsequent meetings, through the DCR call, from national studies, and EU Framework project reports (to be supplied by the EC). Even if the time series of data are limited, they are useful as prior information for parameters or assessments.
- The need to be consistent in the values of biological parameters used within assessments, in particular for natural mortality. The use of age-based vectors of natural mortality was strongly recommended. Sensitivity analyses may be required to examine further the influence of uncertainty on assessment results.
- The need to remain flexible in determining which stock assessment approach to be used. The selection should be based upon the data available for a species, and the quality of that data, for example. Where uncertainty exists, the use of more than one assessment approach was recommended to investigate model uncertainty.
- Assessments were proposed at the scale of the GFCM GSA. For hake and red mullet, GSAs 22 and 23 will be merged, and for hake only, GSAs 15 and 16.
- A range of potential biological reference points was selected for examination at subsequent SGMED meetings.
- The approach to undertake indicator assessments based upon MEDITS survey data was agreed and will be implemented at SGMED-08-03.
- Indicators for socio-economic parameters in the Mediterranean were expanded upon.

With the overall aim of progressing work against the overall terms of reference given to STECF, and in light of the work undertaken during the meeting, the SGMED-08-02 group recommended that the following tasks be considered in the Terms of Reference for SGMED-08-03:

a) assess the status of the stocks of hake by all relevant GSAs (15 and 16, 22 and 23 combined) in the Mediterranean Sea and provide short term, medium term and long term forecasts of stock biomass and yield under different management options, by fisheries if possible.

b) assess the status of the stocks of red mullet by all relevant GSAs (22 and 23 combined) in the Mediterranean Sea and provide short term, medium term and long term forecasts of stock biomass and yield under different management options by fisheries if possible.
c) assess the status of the stocks of *Parapenaeus longirostris* by all relevant GSAs (15 and 16, 22 and 23 combined) in the Mediterranean Sea and provide short term, medium term and long term forecasts of stock biomass and yield under different management options by fisheries if possible.
d) assess historic and recent trends (capacity, technological creep, nominal fishing effort) in the major fisheries by GSAs (22 and 23 combined) exploiting the stocks assessed. The trends should be interpreted in light of management regulations applicable to them.
e) review and propose biological reference points related to high yields and low risk in long term of each of the stocks assessed.
f) identify any needs for management measures required to safeguard the stocks assessed.
g) review the applicability and fully document all applied methodologies for the assessments, projections and determination of the proposed biological reference points.
h) fully document the data used and their origin for the assessments, projections and determination of the proposed biological reference points.
i) review social economic reference points.
j) provide and review population and community indicators.

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12. APPENDIX 1. SGMED OVERALL TERMS OF REFERENCE

The European Community is expected to establish long-term management plans (LTMP) for relevant Mediterranean demersal and small pelagic fisheries based on 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 eco-systems.

The plans shall include conservation reference points such as targets against which measuring the recovery to or the maintenance of stocks within safe biological limits for fisheries exploiting stocks at/or within safe biological limits (e.g. population size and/or long-term yields and/or fishing mortality rate and/or stability of catches). The management plans shall be drawn up on the basis of the precautionary approach to fisheries management and take account of limit reference points as identified by scientists. The quantitative scientific assessment should provide sufficiently precise and accurate biological and economic indicators and reference points to allow also for an adaptive management of fisheries.

Stating clearly how stocks and fisheries will be assessed and how decision will be taken is fundamental for proper and effective implementation of management plans as well as for transparency and consultations with stakeholders.

Demersal and small pelagic stocks and fisheries in the Mediterranean are evaluated both at national and GFCM level; however these evaluations are often not recurring, are spatially restricted to only some GFCM geographical sub-areas (see attached reference map), covering only partially the overall spatial range where Community fishing fleets and stocks are distributed, and address only few stocks out of several that may be exploited in the same fisheries. Limited attention is also given to technical interactions between different fishing gears exploiting the same stocks.

A limited, although fundamental, scientific contribution of EU fishery scientists to the GFCM assessment process is increasingly affecting the capacity of this regional fisheries management organization to identify harvesting strategies and control rules and to adopt precautionary and adaptive fisheries management measures based on scientific advice.

Anyhow, GFCM and most of the riparian countries consider that management measures to control the exploitation rate and fishing effort, complemented by technical measures, are the most adequate approach for multi-species and multiple-gears Mediterranean fisheries.

Nevertheless, provided that scientific advice underlines to do so, also output measures may be conceivable to manage fisheries particularly for both small pelagic and benthic fish stocks.

Coherence and certain level of harmonization between Community and multilateral framework measures are advisable for effective conservation measures and to enhance responsible management supported by all concerned Parties and stakeholders in the Mediterranean.

STECF can play an important role in focusing greater contributions of European scientists towards stocks and fisheries assessment, in identifying a common scientific framework regarding specific analyses to advise on Community plans and to be then channeled into or completed by the GFCM working groups[1].

STECF was requested at its November plenary session to set up an operational work-programme for 2008, beginning in the 1st quarter of 2008, with a view to update the status of the main demersal 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 Collection regulation N° 1543/2000 as well as other scientific information collected at national level.

Within this work-programme STECF is also requested to provide its advice on the status of the main small pelagic stocks and to evaluate the exploitation levels with respect to their biological and economic production potentials and the sustainability of the stock by using both echo and/or DEPM surveys and commercial catch/landing data as collected through the Community Data Collection regulation N° 1543/2000 as well as other scientific information collected at national level.

STECF should take into consideration the data that Member States have been collecting on a regular basis both via monitoring fishing activities and carrying out direct surveys[2]. STECF, in replying at the following terms of reference, should also take into consideration chapter 7 of the 26th STECF Plenary session of 5-9 November 2007[3], as well as the report of the STECF working group on balance between fishing capacity and fishing opportunities[4].

STECF shall contribute to identify and setup an advisory framework regarding low risk adaptive management by identifying and using appropriate risk assessment methods in

[1] STECF is requested to take into account the GFCM stock assessment forms as available at the web site http://www.gfcm.org/fishery/nems/36406/en

[2] Council Regulation (EC) No **1343/2007** of 13 November 2007 amending Regulation (EC) No 1543/2000 establishing a Community framework for the collection and management of the data needed to conduct the common fisheries policy

Commission Regulation (EC) No **1581/2004** of 27 August 2004 amending Regulation (EC) No 1639/2001 establishing the minimum and extended Community programmes for the collection of data in the fisheries sector and laying down detailed rules for the application of Council Regulation (EC) No 1543/2000

[3] http://stecf.jrc.ec.europa.eu/38

[4] Report of the STECF Working Group on The Balance between Capacity and Exploitation SGRST-SGECA-07-05 Working group convened in the margin of SGECA-SGRST-SGECA-07-02 (Review of Scientific advice II), 22-26th Oct 2007. Evaluated and endorsed at the November plenary session.

order to understand where we stand with respect to sustainable exploitation of ecologically and economically important stocks and what additional management actions need to be taken.
On the basis of the STECF advice the Commission will launch official data calls to EU Member States requesting submission of data collected under the Community Data Collection regulation N° 1543/2000.
STECF is requested in particular:
- to advice whether the data availability may allow the development of a precautionary conceptual framework within which develop specific harvesting strategies and decision control rules for an adaptive management of demersal and small pelagic fisheries in the Mediterranean;

- to set up a conceptual, methodological and operational assessment framework which will allow STECF to carry out in a standardized way both stocks assessment analyses and detailed reviews of assessments done by other scientific bodies in the Mediterranean. The selected assessment methods shall allow estimating indicators for measuring the current status of demersal and small pelagic fisheries and stocks, the sustainability of the exploitation and to measure progress towards higher fishing productivity (MSY or other proxy) with respect to precautionary technical/biological reference points relating to MSY or other yield-based reference points, to low risk of stock collapse and to maintaining the reproductive capacity of the stocks;

- to set up a conceptual, methodological and operational assessment framework which will allow STECF to identify economic indicators and reference points compatible with economic profitability of the main fisheries while ensuring sustainable exploitation of the stocks in the Mediterranean;

- to indicate whether age/length-based VPA or statistical catch-at –age/length methods are adequate modelling tools to estimate precautionary indicators and reference points measuring the current status and future development of multispecies/multigears Mediterranean fisheries. STECF shall also provide a conceptual and operational framework to use, if advisable, these methods for demersal and small pelagic Mediterranean fisheries;

- to identify adequate empirical modelling approaches that are adequate to estimate precautionary indicators and reference points measuring the current status and future development of multispecies/multigears Mediterranean fisheries. STECF shall also provide a conceptual and operational framework to use, if advisable, these methods for demersal and small pelagic Mediterranean fisheries;

- to identify the decision-making support modelling tools that are adequate for the Mediterranean fisheries and that will produce outputs that support sustainable use of fishery resources recognizing the need for a precautionary framework in the face of uncertainty and that may allow to provide projections of alternative scenarios for short-medium and long term management guidance;

- to provide either a qualitative or quantitative understanding of the level of precision and accuracy attached to the estimation of indicators and reference points through the different modelling tools;

- to identify which decision-making support modelling tools may help in setting up stock-size dependent harvesting strategies and respective decision control rules;

- to provide information on the data and standardised format needed for each of the decision-making support modelling tool which will be used to launch official data calls under the DCR n° 1543/2000. STECF should also indicate criteria to ensure quality cross-checks of the data received upon the calls.

13. Appendix 2. SGMED-08-02 List of participants

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14. APPENDIX 3. PARAMETERS AND AGGREGATIONS RECOMMENDED FOR THE PROPOSED DCR CALL FOR DATA.

DATA AGGREGATION AND CODIFICATION

Area

The code AREA can have the following values

AREA	description
GFCM GSAs	e.g. 1

Species

SPECIES should use the 3-letter FAO code

SPECIES REQUESTED	*Merluccius merluccius, Mullus barbatus, Parapenaeus longirostris, Engraulis encrasicolus and Sardina pilchardus* HKE, MUT, DPS, ANE, PIL

Time Period

The time period is defined in terms of years

YEAR PERIOD (for some biological data)	2003-2005 etc.
YEARS REQUESTED FOR FISHERIES DATA	2002-2007
YEARS REQUESTED FOR SURVEYS DATA (MEDITS)	1994-2007

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. As a second option, submit according to the current EC DCR Regulation
VESSEL LENGTH	vessel length class (EC 1581/2004, appendix IV)

Sex

M= male; F= female; C= combined (F+M); U= unidentified

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)		

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

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	Value
Number (LN)	Number of fish landed	Optional, Unit (thousands)
Weight (LW)	Weight declared on landing	Mandatory, Unit (t)
Comments	Any relevant comments	Text max. 250 characters

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

Type	Description	Value
Days	Number of days each vessel spends at sea over the time period in question - sum for whole fleet segment	Mandatory, Unit (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	Mandatory, Unit (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	Mandatory, Unit (GT*Days)
Comments	Any relevant comments	Text max. 250 characters

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

Type	Description	Value
Length distribution	Annual length structure of the total landings (number of individuals 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 or 0.1 cm, aggregation	LN, Mandatory, Unit number in thousands LW, Mandatory. Unit weight in t

	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)	
Mean individual weight		Mandatory, Unit (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	2.0 to 90
Mullus barbatus	Total length	1.0	1.0 to 30
Engraulis encrasicolus	Total length	0.5	0.5 to 20
Sardina pilchardus	Total length	0.5	0.5 to 25
Parapenaeus longirostris	Carapace length	0.1	0.1 to 3.5

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

Type	**Description**	**Value**
Age distribution	Annual age structure of the total landings (number of individuals per age class raised to landings by age class).	Mandatory, Unit: number in thousands
	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)	LW, Mandatory. Unit weight in t
Mean individual		Mandatory, Unit (g)

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 6
Parapenaeus longirostris	1	0 to 5

weight		
Comments	Any relevant comments	Text max. 250 characters

MATURITY OGIVE AT LENGTH	Aggregated by species, length class, age,, sex, , year period, and area where fish were caught	
Type	**Description**	**Value**
Maturity ogive (PrM)	The proportion of mature individuals per length class according to the classification of the length distribution file (landings)	Mandatory, Unit (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**	**Value**
Linf	Von Bertalanffy growth parameters	Mandatory, Unit (cm)
k	Von Bertalanffy growth parameter	Mandatory
t_0	Von Bertalanffy growth parameter	Mandatory, Unit (year)
a	Length- weight relationship parameter	Mandatory, Units to be used (cm, g)
b	Length- weight relationship parameter	Mandatory, Units to be used (cm, g)
Method used	Method used to calculate the growth parameters	Mandatory, Text max. 250 characters
Spawning period	The spawning season in range of months e.g. April - June	Optional
Spawning peak	The peak of the spawning period with the highest proportion of spawners e.g. May	Optional
Comments	Any relevant comments	Text max. 250 characters

SEX RATIO AT LENGTH	Aggregated by segment, species, length class, year period and area where fish were caught	
Type	**Description**	**Value**

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)	Mandatory, Unit (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**	**Value**
Number (DN)	Number of fish estimated	Optional, Unit in thousands
Weight (DW)	Weight estimated	Optional, Unit (t)
Comments	Any relevant comments	Text max. 250 characters

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

Type	**Description**	**Value**
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, Optional, Unit number in thousands DW, Optional, Unit weight in t

Species	Length type	Length class interval (cm)	Length range (cm)
Merluccius merluccius	Total length	2.0	2.0 to 90
Mullus barbatus	Total length	1.0	1.0 to 30
Engraulis encrasicolus	Total length	0.5	0.5 to 20
Sardina	Total	0.5	0.5 to

	pilchardus	length		25	
	Parapenaeus longirostris	Carapace length	0.1	0.1 to 3.5	
Mean individual weight					Optional, Unit (g)
Comments	Any relevant comments				Text max. 250 characters

MEDITS DATA Refer to the International Bottom Trawl Survey in the Mediterranean (MEDITS)

Type	**Description**	**Value**
TA, TB, TC	Instruction manual, Version 5 April 2007	Mandatory

SMALL PELAGIC SURVEY

Type	**Description**	**Value**
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)	Mandatory, Unit numbers in thousands, Unit biomass in t

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

SMALL PELAGIC SURVEY

Type	Description	Value
Age distribution	Age structure of the survey data (numbers and biomass per length 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)	Mandatory, Unit numbers in thousands, Unit biomass in t

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

SMALL PELAGIC SURVEY

Type	Description	Value
Maturity at age (PrM)	The proportion of mature individuals per age class according to the classification of the age distribution file.	Mandatory, Unit (0 to 1)

15. APPENDIX 4. LIST OF MEDITS AND GRUND TARGET SPECIES

TARGET SPECIES	MEDITS date[1]	GRUND date[1]
Aspitrigla cuculus	1998	
Boops boops	2006	
Citharus linguatula	1994	
Eutrigla gurnardus	1994	
Galeus melastomus	1998	
Helicolenus dactylopterus	1994	
Lepidorhombus boscii	1994	
Lophius budegassa	1994	
Lophius piscatorius	1994	
Merluccius merluccius	1994	1994
Micromesistius poutassou	1994	1994
Mullus barbatus	1994	1994
Mullus surmuletus	1994	
Pagellus acarne	1994	
Pagellus bogaraveo	1994	
Pagellus erythrinus	1994	
Sparus pagrus	>1996	
Phycis blennoides	1994	1994
Raja clavata	1994	
Scyliorhinus canicula	1998	
Solea vulgaris	1994	
Spicara flexuosa	1994	
Spicara smaris	1998	
Trachurus mediterraneus	1994	
Trachurus trachurus	1994	
Trigla lucerna	2006	
Trigloporus lastoviza	1998	
Trisopterus minutus capelanus	1994	
Zeus faber	1994	
Selacians[2]	2006	
Aristaeomorpha foliacea	1994	1994
Aristeus antennatus	1994	1994
Nephrops norvegicus	1994	1994
Parapenaeus longirostris	1994	1994
Eledone cirrhosa	1994	
Eledone moschata	1997	
Illex coindetti	1994	
Loligo vulgaris	1994	
Octopus vulgaris	1994	1994
Sepia officinalis	1994	
1 year in which the species was introduced in the list (or removed if the year is preceded by >)		

16. Appendix 5. Assessments presented at SGMED-08-02

The assessments developed or presented at SGMED-08-02 are summarised here.

Assessment of hake (*Merluccius merluccius*) exploited by the French and Spanish fisheries in the Gulf of Lions (GFCM-GSA 07)

SCSA working group on demersals of the GFCM (Sète, France 4-5 July 2006)

Angélique Jadaud, Capucine Mellon and Henri Farrugio IFREMER, Sète, France

Enric Massutí, Beatriz Guijarro, María Valls, Francesc Ordinas and Antoni Quetglas IEO, Palma Spain

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

The objectives of this study, which was first presented during the 2006 working group on demersals of the GFCM (Sète 4-5 July 2006) were: (i) to assess the multi-gear shared fishery of the Gulf of Lions hake stock by performing a tuned VPA (Extended Survivor Analysis; XSA) and a Y/R on the 1998-2004 data series; (ii) to compare the results obtained considering two sets of growth parameters (slow growth from traditional studies, used in previous assessments, and fast growth hypothesis from recent studies on otolith daily increments and tagging experiments); and (iii) to compare the results with previous assessments of this stock for the period 1988-1991 (Aldebert & Recasens, 1996; French-Spanish Working Group, 2002, 2005).

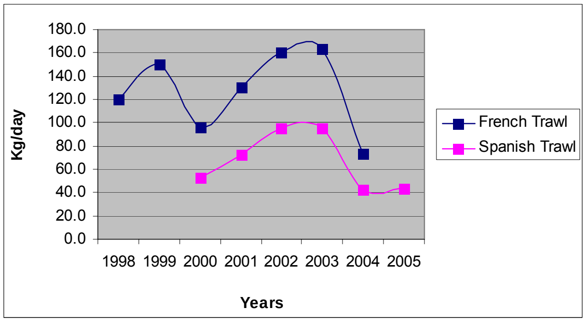
Data used were: (i) commercial hake catches by fishery, registered in seven French harbours and three Spanish harbours; (ii) size composition of landings, obtained from monthly length sampling in the main landing ports; and (iii) available CPUE data series, both of commercial fisheries (French trawl, Spanish trawl and Spanish long-line) and scientific survey (MEDITS). Distribution length was weighted to annual catches and sex-ratio, previously calculated for the species in the area, was applied to obtained annual length frequency distributions of hake catches by gear and sex. The assessment of the stock has been carried out using the methods of cohort analysis and length cohort analysis.

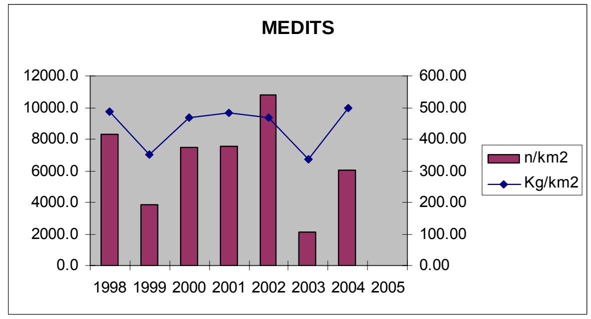
Main results:

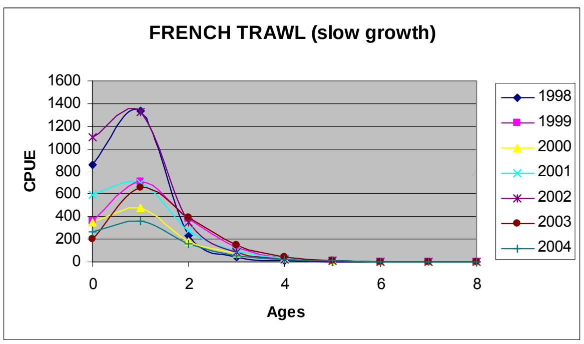
Catch-at-age analysis (CPUEs):

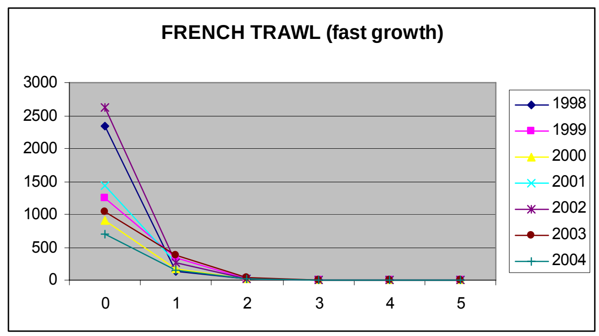
Four tuning fleets were available for the stock, including three commercial series and one survey. Good agreement was found between French and Spanish trawls (maximum on 2002 and 2003) but not with MEDITS, probably because the short period of sampling (only half month in spring) during that survey, hence reflecting only the first yearly recruitment.

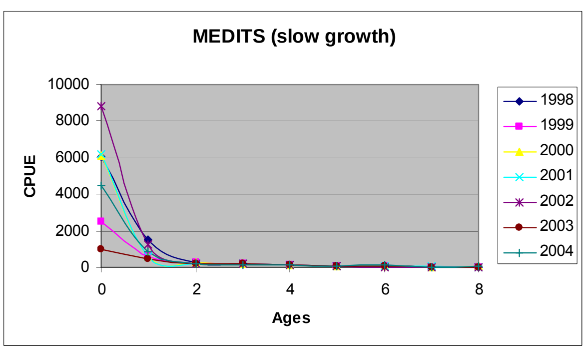
By age class: in general, it seems that there is a better correlation between the abundance of age classes along data series from different gears by considering fast growth than slow growth.

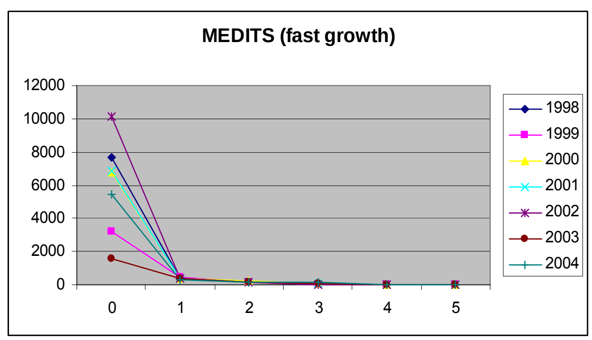












Exploratory Stock analysis:

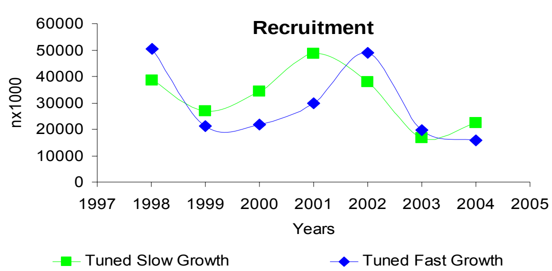
XSA, Separable VPA and VIT softwares where used. Several runs were performed using the “Slow growth”, which is the VBGF used in previous assessments, applied to length frequency of catches by sex and then combined. Another set of runs were performed using the “Fast growth” taking into account the recent results (e.g. daily increments and tagging experiments). This was also applied to length frequency of catches by sex and then combined.

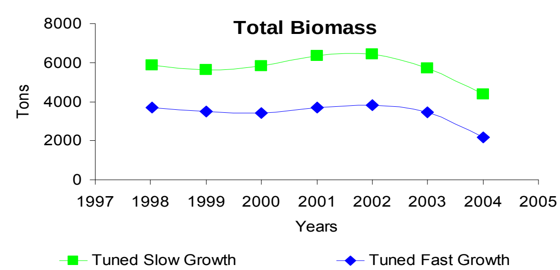
Tuning fleets

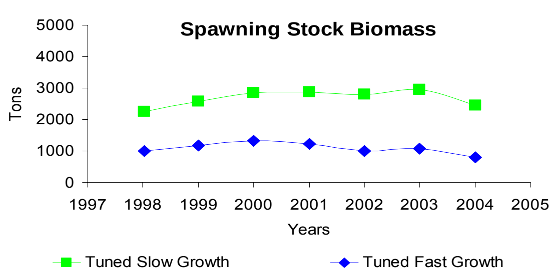
- French trawlers targeted to hake on the continental shelf (juveniles and younger adults) in the eastern and middle Gulf have been selected in Sète (represents 40% of total hake catches in GSA07) considering the importance of hake in catches (>10% for hake and <15% for sardine and anchovy).
- From MEDITS surveys (using a smaller mesh size than commercial trawlers) have been considered trawls on the continental shelf.
- Longliners (targeting the oldest adults hake on the slope) from Llançà (the most important harbour in fleet and catches) have been selected. Spanish trawlers mostly targeting hake in the western Gulf have been selected from Llançà from a multivariate analysis.

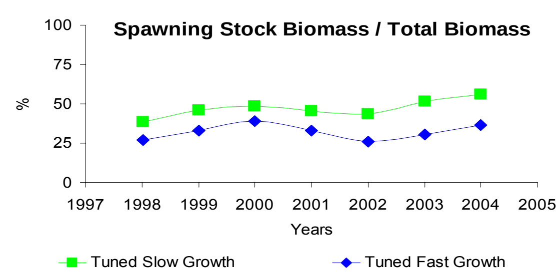
Main results and conclusions (see 1996 GFCM assessment forms on the GFCM website):

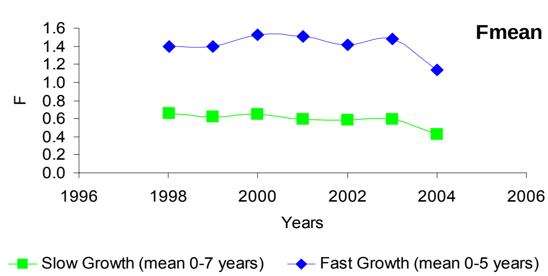
- Separable VPA: no problem was detected with CPUE data series, except for the youngest ages (0/1 and1/2) in the first years of the series (1998/1999).
- VIT: VPA and Y/R analysis have been developed, by sex, considering both growth hypotheses. Their comparison show lower values of population parameters and higher values of Y/R considering fast growth.
- Risk of recruitment overexploitation. In addition to the decreasing trend in SSB, a decrease in average recruitment can also been observed by comparing the VPA results for the period 1988-91 (46 milions; Aldebert and Recasens, 1996) and 1998-2004 (32 millions; present assessment)

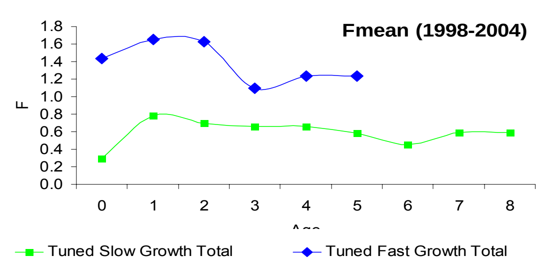




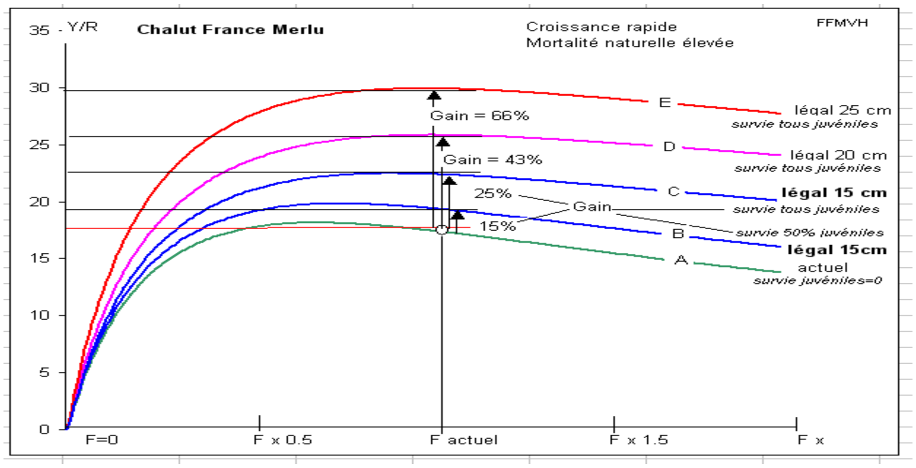








More recently, an Y/R simulation analysis has been performed to test the impact of the application of various minimum length size:



Assessment of hake (*M. merluccius*) and deep water pink shrimps (*P. longirostris*) in the Strait of Sicily (GSA 16)

Recent provisional assessments carried out in the GSA 16 were presented by F. Fiorentino. Analyses concerned deep water pink shrimps (*P. longirostris*) and hake (*M. merluccius*), which are the main target species of trawling in the Strait of Sicily.

Deep water pink contributed to about 30% of the yield from GSA 16. In the most recent years, production ranged between 6,600 (2004) and 8,400 (2006) tons (fonte IREPA). Potential yield of the stock (only females about 65% of landing in weight) in the Strait of Sicily (GSA 16) was assessed by Y and B per recruit analyses with Yield package by (Branch *et al*., 2000), which includes uncertainty in estimation (fig. FF1). Main Biological reference points (F_{max}, as limit, and $F_{0.1}$ and $F_{SPR0.3}$ – F corresponding to a current SSB/pristine SSB ratio equal to 30% - as target), with their probability distribution, were also estimated (table FF1). Current exploitation was evaluated by fishing mortality rates estimated with data from trawl surveys (2004-2007) and length structure of landings (2006) (DCR). In the first case F was assessed using the estimator for total mortality (Z) of Beverton and Holt - package LFDA (Kirkwood *et al.*, 2001), on the mean LFD of the last three years of trawl surveys (MEDITS and GRUND) and the first length at full recruitment (L') equal to 20 mm LC. In the second case the F vector and corresponding mean value, was obtained from "length cohort analysis" (LCA) package "VIT4WIN" (Lleonart & Salat, 2000) on annual commercial catch of trawlers in 2006, assuming a strictly steady state (fig. FF2). Comparison with another assessment approach (ALADYM) is still in progress.

The stock is exploited within the limit reference point F_{max}, although some differences in estimated current status versus an optimal one resulted using length cohort analysis (LCA) on commercial catches (no significant reduction) or mortality estimates from trawl surveys (reduction from 20 to 40 % of the current fishing mortality) (Table FF2).

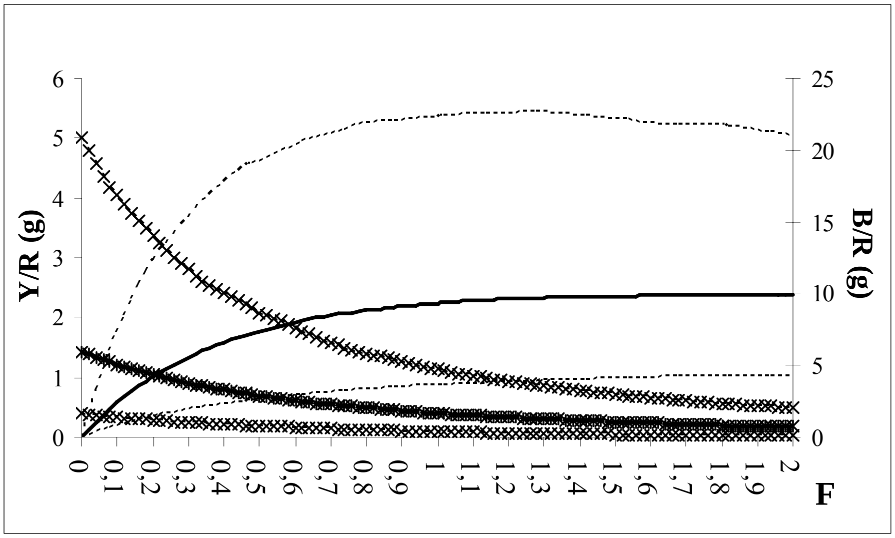


Fig. FF1 - Y/R and B/R vs fishing mortality (F) analysis of deep water pink shrimp (*P. longirostris*) with Yield Package. Curves at median, upper and lower 2.5 percentiles are shown.

Table FF1 - Main BRPs obtained by Yield package for deep water pink shrimp (*P. longirostris*) in GSA 16

Biological Reference Points			
Y/R_{max}	2.44	**F_{max}**	1.98
$Y/R_{F0.1}$	2.19	**$F_{0.1}$**	0.88
$Y/R_{SPR0.3}$	2.23	**$F_{SPR0.3}$**	0.91

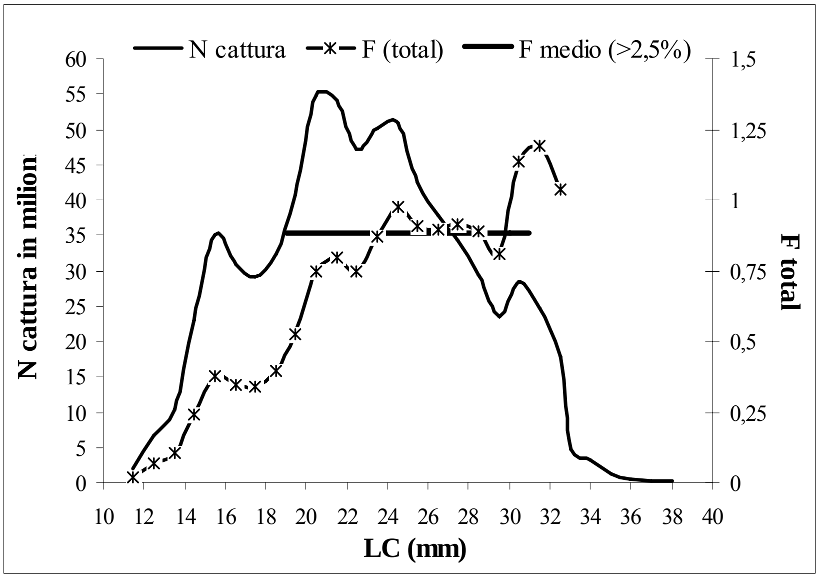


Fig. FF2 - Length frequency distribution of catches and fishing mortality by size of deep water pink shrimp (*P. longirostris*) in 2006 obtained by win VIT package.

Table 2 Current fishing mortality (Fc) and Optimal Fishing mortality ($F_{0.1}$~ $F_{SPR0.3}$ = 0.9) with the reduction (%) to reach the optimal value according to the different estimation of Fc.

Current F	Source	Reduction (%) for Optimal F
0.88±0.17	LCA on 2006 catches	No significant Reduction (?)
1.15	B&H estimator on mean LFD from Medits (2005-07)	0.22
1.56	B&H estimator on mean LFD from Grund (2004-2006)	0.42

It is worth noting that the more optimistic view of the current state of deep water pink shrimp given by the LCA might be influenced by the limited data (just one year) used in the analysis.

Mean hake landing in the GSA 16 during the last years (2003-2005) was about 1650 ton per year (IREPA source), being the contribution of other gears less to the 5% of the hake landing in the area. The assessment presented was based on a “VPA” approach under strict steady state assumption using the winVIT package. Y and B per recruit analyses was estimated using a multiplicative factor of current F on the virtual population (only females

– about 50-60% of landing in weight). Data derived from biological sampling of commercial data of the 2006 catches (fig. FF3).

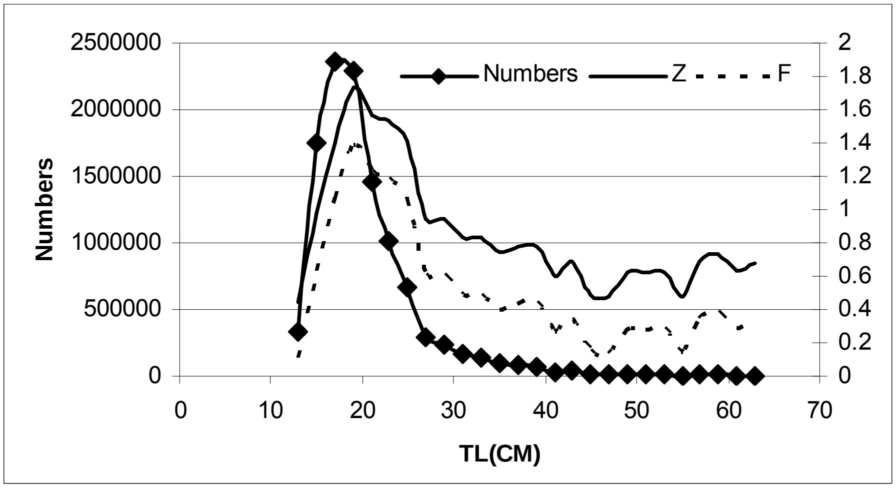


Fig.FF3 - Length frequency distribution of catches, total (Z) and fishing (F) mortality by size of hake (*M. merluccius*) in 2006 obtained by win VIT package.

Table FF3 – Main results of VPA on hake of GSA 16 with winVIT package.

Yield in tons	870	Y/R max in g	63.42
Recruits at 12 cm TL	16.20	Y/R 0.1 in g	61.11
Mean Z (> 2.5%)	1.11	Factor per Y/R max	0.51
mean F (>2.5%)	0.77	Factor per Y/R 0.1	0.36
Mean Z (vit)	0.77	Current SSB/R in g	38.71
Mean F(vit)	0.43	Virgin SSB/R in g	813.83
Global F	0.74	Fmax SSB/R in g	287.53
Exploited critical age	1.50	F0.1 SSB/R in g	410.04
Virgin critical age	5.20	Current SPR	0.05
Exploited critical length	18.00	Fmax SPR	0.35
Virgin critical length	44.00	F0.1 SPR	0.50
Current Y/R	53.33		

The current fishing mortality was also assessed by using trawl surveys data. Z was obtained with Length Converted Catch Curve (LCCC) on LFD of females (Ragonese S. pers. com.). Other estimation were obtained by slicing of the same LFD using the LFDA package. Indices of number by age group were finally used to estimate Z by Surba (Colloca F., pers. com., estimated during the meeting) and within a spreadsheet as $Z=-\ln((N_{a+1,t+1})/(N_{a,t}))$. F values from surveys estimation were than calculated subtracting M=0.34 to Z. Values of the last three years were averaged to gives a mean value. Mean values of F from different methods are reported in table FF4. It is worth noting that different approaches, both in data and method, gave very similar figures.

Table FF4 – Estimations of mean fishing mortality rates from commercial catches and surveys. F values from Surba and Survival analysis were estimated during the meeting.

Method	F	Remarks
"VPA" mean	0.77	Mean of class contributing more than 2.5 catch in weight (2006)
"VPA" global	0.74	Sum of catches/Sum of mean numbers at sea (2006)
Surba	0.78	Mean of age class 1-4 (2004-2006)
LCCC	0.80	Points belonging to age group 1-3 considered in the regression (2004-2006)
Survivals from LFD slicing	0.91	Mean of Zs from survivors between 2/1, 2/3 and ¾ (2002-2004)

The current status of overexploitation of deep water pink shrimps and hake was in agreement with the analyses produced in the previous years for these stock in GSA 16 (Fiorentino *et al*., in prep.)

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Hake (*M. merluccius*) in the central-southern Tyrrhenian sea (GSA 10) examined using ALADYM

ALADYM: an age and length-based simulation model for stock assessment.
by M.T. Spedicato

General characteristics, conceptual framework and basic methods of Aladym model, developed in the Fisboat EU project (Lembo et al., 2007) have been overviewed in this presentation (see Appendix 9 (section 0) of this report). Analyses of the different applications of Aladym on several fish populations inside and outside Mediterranean were also shown, as well as the use of Aladym model for a range of objectives, such as: simulating population dynamics, exploring alternative management strategies in the medium and long-term, understanding the responsiveness of model-based population indicators to pressure, and searching for reference points.

A summary of strengths, weakness, data requirements, inputs, outputs and/or produced reference points, software and references of Aladym model are included in the SGMED-08-01 report.

This presentation also reports recent applications of the model to the hake population in the central-southern Tyrrhenian sea (GSA 10) addressed to understand the consequences of different management scenarios on the population and yield.

As regards the vital traits parameters, the model was mainly fed using the information gathered in the Samed project (Samed, 2002) integrated with the estimates from Medits and Grund trawl surveys and biological samplings from DCR. Spawning pattern and peak were derived from literature, comparing this information with that obtained during the trawl surveys and DCR biological sampling. Initial number of individuals was estimated from the trawl survey indices, extrapolating these relative densities to the area and back-calculating the numbers to the starting time using the mortality coefficient. The harvesting pattern was modelled using the selectivity parameters of the fleet, while the fishing coefficient was adjusted by month using the information from the real landings (ratio of the month landing/average landing of the year) under the hypothesis of a linear relationship between pressure and catches. A table summarising the inputs parameters is reported in the presentation in the Appendix 9 (section 0) of this report.

Simulations were based on five scenarios. In the *status quo* scenarios all parameters were kept constant in the future at current levels. In the 'fishing ban' scenario a closure of the fishery was introduced in August-October period, starting from the current year. In the 'reduction of fishing vessel' scenario, a decreasing of the pressure of about 20% was assumed starting from the current year, while in the 'mesh size increase' scenario an augmentation of the mesh size from 40 to 50 mm opening was considered from 2010. In this case selection parameters were from literature. In the 'mix of the measures' scenario a combination of all the mentioned strategies was applied.

The results of the Aladym model in terms of change/impact of main model-based indicators (biomass and catches) and reference point (ESSB/USSB) in the long-term are synthesised at annual time scale and reported in the following figure and in the presentation in Appendix 9 (section 0) of this report.

Results highlighted that the current situation of hake stock overexploitation would substantially be mitigated if the 'mix' scenario were applied. The sustainability reference point %SSBo (indicated as ESSB/USSB in the following figure) would rise in the long-term reaching a value of about 18%. Also catches, after a decrease in the short term, would increase after about three years of measure enforcement.

In addition, a preliminary test on the predictive capability of Aladym was also conducted comparing the catches simulated by the model with that obtained from IREPA in the GSA 10 during the period 2004-2007.

A first evaluation on the *P. longirostris* stock in the GSA 16, carried out during the meeting was also presented (see presentation in Appendix 9 (section 0) of this report). Also in this case a reduction of fishing pressure was needed, to bring the %SSBo towards safer levels (about 25%).

References

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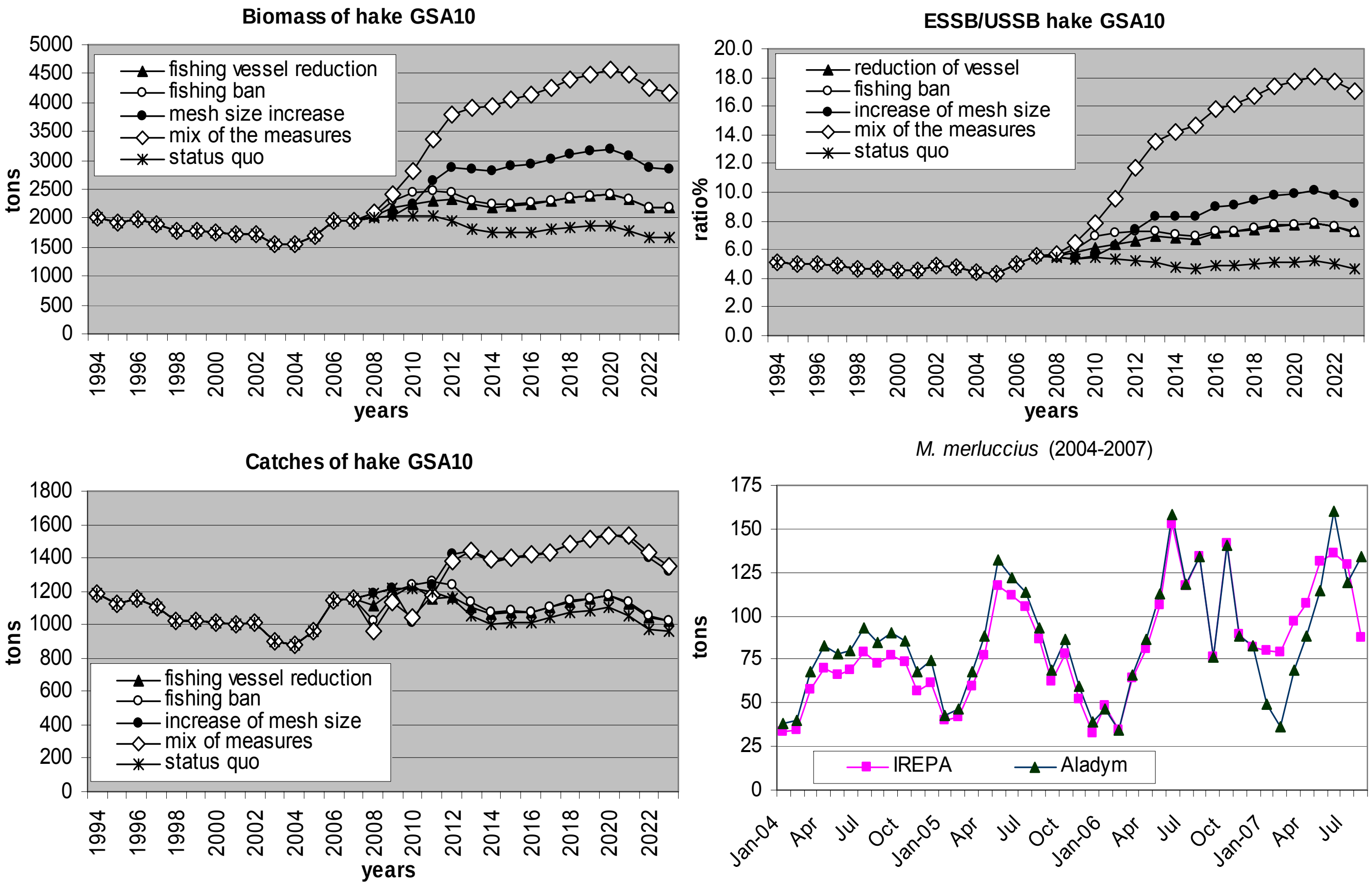

Aladym-model results for hake in the GSA 10. Prediction of the level of abundance (biomass at sea), sustainability (ratio between the exploited and unexploited biomass), and production (catches) of model-based indicators simulating 5 different management scenarios and where *status quo* is the current situation. Comparison of the catches simulated by the model with true ones estimated by IREPA from 2004 to 2007 is also shown.

Trial assessment of hake (*M. merluccius*) in the Ligurian and northern-central Tyrrhenian Seas (GSA 9) using landings and trawl surveys data

(Paolo Sartor and Francesco Colloca)

European Hake (*Merluccius merluccius*) is the most important demersal target species of the trawl fisheries performed along the GFCM geographical sub-area 9 (Ligurian, northern and central Tyrrhenian Seas). The species is mostly exploited by trawling, even though a minor fraction of landings comes from small scale fishery using gillnets. According to official estimates of 2006, 361 bottom trawlers were operating in this area and about 1,300 vessels using artisanal gears, mainly set nets along the coastal area. In the period 2004-2006 landings of *M. merluccius* in the whole GSA ranged from about 1,000 to 1,600 tons, showing an increasing trend.

As concerns the historical series of LPUE, a decreasing trend was detected from 1991 to 2004 for two important trawl fleets of the GSA9, Viareggio and Porto Santo Stefano, in spite of the consistent reduction of fishing capacity and fishing activity showed in the same period. The landing decrease observed from 1991 to 2004 is mainly due to a change in fishing pattern observed in this period in several trawl fleets operating in the area. The commercial fraction comprised of small hake (0+ age group), historically dominant in the trawl landings, was progressively less exploited, disappearing from the landings since 2004, as reported in fig. 1 for Porto Santo Stefano trawl fleet.

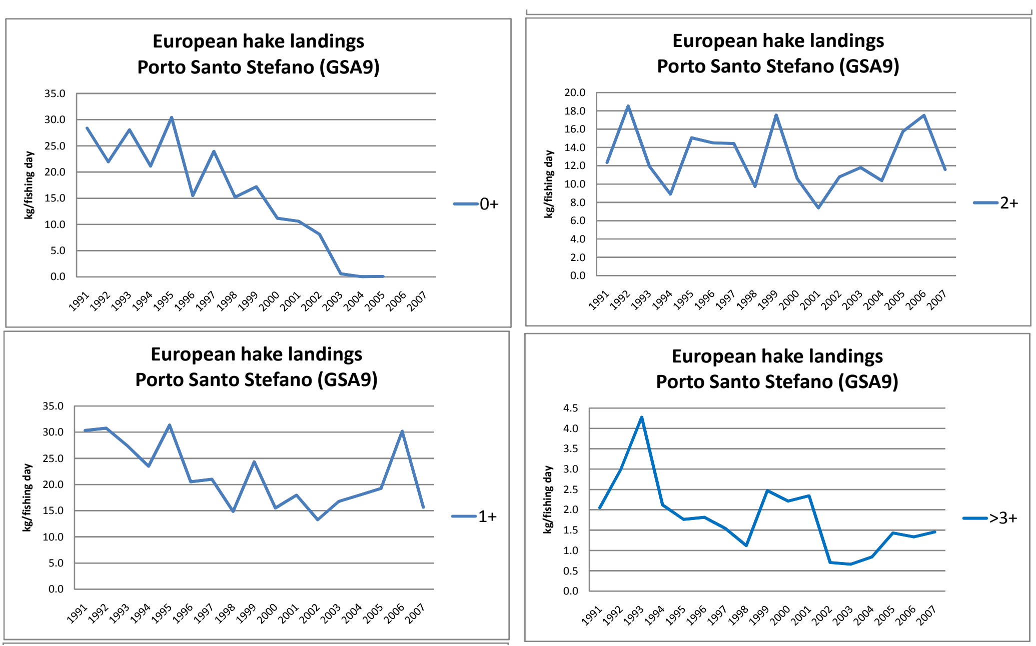

Fig. 1 – LPUE of *M. merluccius* of the Porto Santo Stefano trawl fleet according to age classes.

The European hake fishery of GSA9 is characterised by a high fishing mortality on juveniles due to the large presence of these specimens. Estimations from MEDITS trawl surveys data showed that in the GSA9 there is the highest concentration of hake juveniles of the western Mediterranean (Fig, 2). Juveniles are concentrated in well defined and spatio-temporally stable areas: about 40% of recruitment occurred in two areas which corresponds to 7% of the whole GSA9 area (Fig 2).

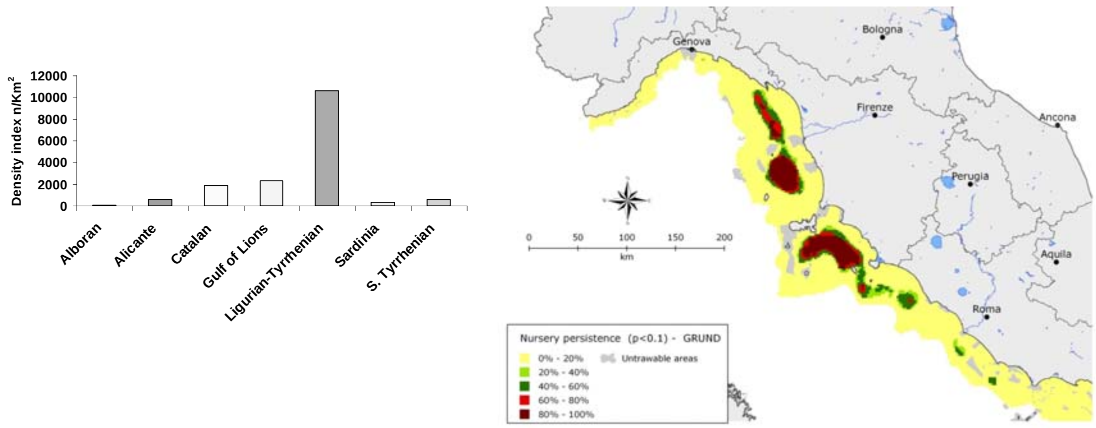

Fig. 2 – Left: Density indices of juveniles of *M. merluccius* in different geographic subareas of the western Mediterranean (Orsi Relini *et al*., 2002). Right: Temporal persistence (1994-2006) of hake nurseries in GSA9.

A trial assessment was performed using commercial and trawl survey (MEDITS) data, with the following parameters: $L\infty$ = 104 cm TL; k = 0.212; terminal fishing mortality = 0.15; a vector of natural mortality (Caddy & Abella, 1999). Length cohort and yield per recruit analyses, performed by VIT routine (Lleonart & Salat 1992), were applied on landing data (trawling+gillnet). Two different scenarios were considered: a size structure of landings and a size structure of catches, obtained including the discard vector. MEDITS survey data (1994-2007) were used to estimate F and relative SSB and abundance at age using SURBA 2.0 software. The FAO YIELD tool was also used to calculate a target reference point ($F_{0.1}$). The calculation of reference points (F) based on data collected during a period of low exploitation rate was also attempted.

The general results of LCA highlight an exploitation focused on young age classes, mainly 0+ and 1+ individuals, reflecting a growth overfishing state. A global F of 0.84 was estimated, while F_{max} corresponds to 0.34; the current Y/R is about 60% of Y/R_{max} (Fig. 3). These results substantially agree with those obtained in previous assessments made in the GSA; only a small decrease in global F was detected, still insufficient to produce a significant recovery of the stock.

Results obtained with SURBA showed a stable fishing mortality ($F_{0\text{-}4+}$) ranging over time between 1.0-2.0. A decreasing trend in relative SSB was also observed. The SSB pattern was consistent with that obtained from commercial catches. The estimated Y/R reference point $F_{0.1}$ was 0.16+/-0.08 far below the estimated current F value.

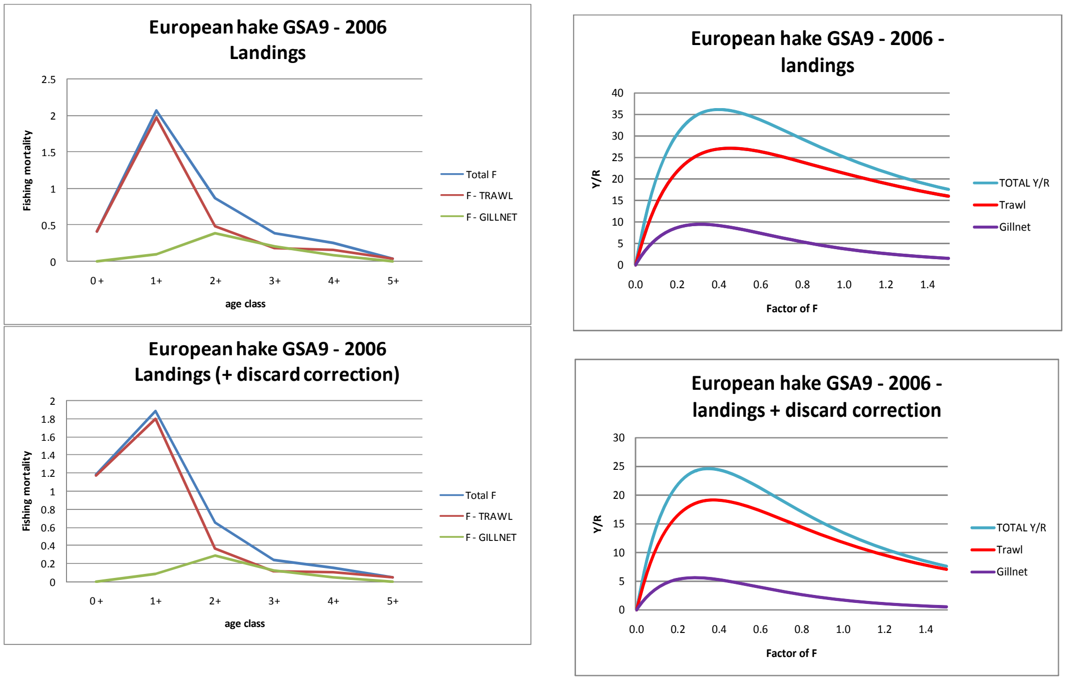

Fig. 3- VPA and Yield per recruit results on hake of GSA9.
Fishing mortality (left) and yield per recruit (right) plots.

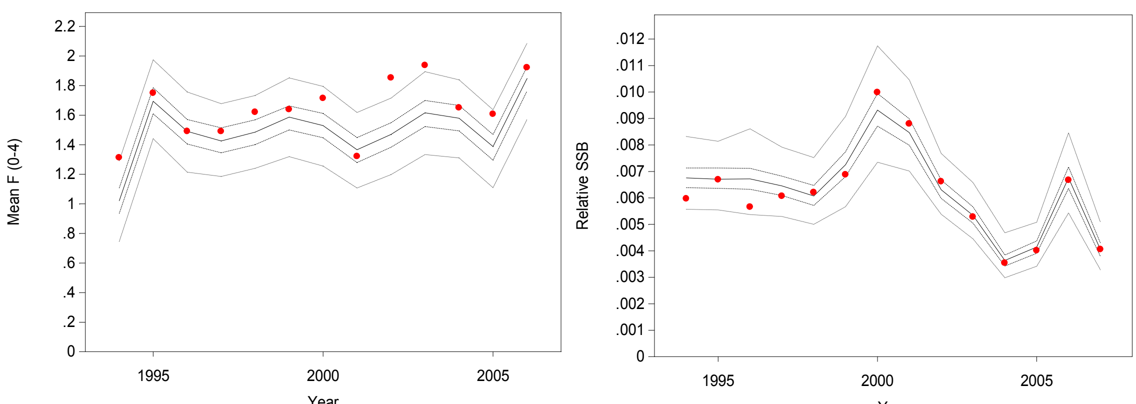

Fig. 4 – Temporal evolution of the fishing mortality (left) and spawning stock biomass (right) according to SURBA estimations.

References

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Orsi Relini L., Papaconstantinou C., Jukic-Peladic S., Souplet A., Gil de Sola L., Piccinetti C., Kavadas S, Rossi M. (2002) - Distribution of the Mediterranean hake populations (*Merluccius merluccius smiridus* Rafinesque, 1810) (Ostheichthyes: Gadiformes) based on six years monitoring by trawl-surveys: some implications for management. *Scientia Marina*, Vol 66, No S2.

Trial assessment of hake (*M. merluccius*) in the North Aegean (GSA 22)

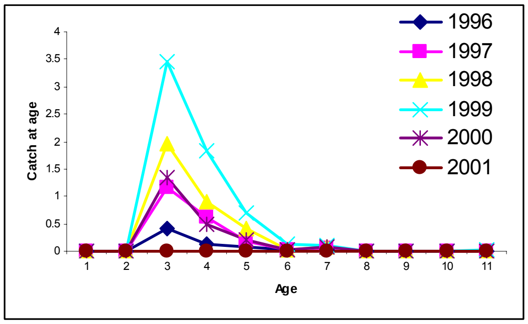
Using the MEDITS survey dataset and the population parameters we have attempted a trial run for **hake** using the SURBA 2.0 software. Further development of this assessment will occur in future meetings, and hence the results presented below are very preliminary and should be viewed as such. The package calculates relative indices regarding the stock status and not the actual number of individuals in the population or actual biomass.

Input concerned:

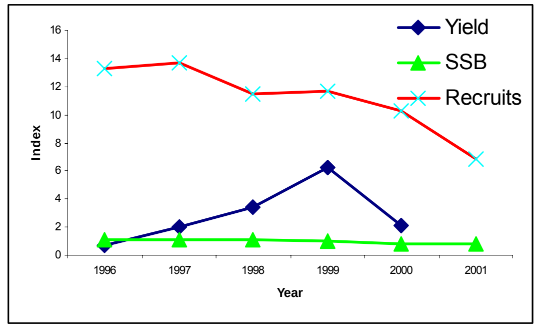
- catch at age per year
- catchability vector by age class per year
- natural mortality vector by age class per year
- proportion of mature at age per year
- mean weight at age per year

The package estimations indicated a stable population in numbers and biomass (Figure 1). On the other hand, spawning stock biomass and recruitment at age 0 was suggested to be decreasing (Figure 1). Additionally to that, mean weight at age for large adults exhibited a constantly decreasing trend (Figure 1).

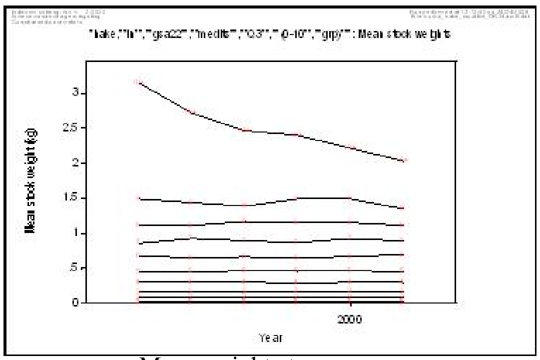
These findings were contrary to the most recent MEDITS assessment of indicator trends in the North Aegean (MEDITS, 2007), which suggested that for the period 1994-2004 the total abundance and total biomass exhibited significant increasing trends while the mean weight showed significant decreasing trend. However, this trial run was conducted only for a small subset of the available data concerning the GSA22 (northernmost area) and covering only 6 out of 12 available annual series.



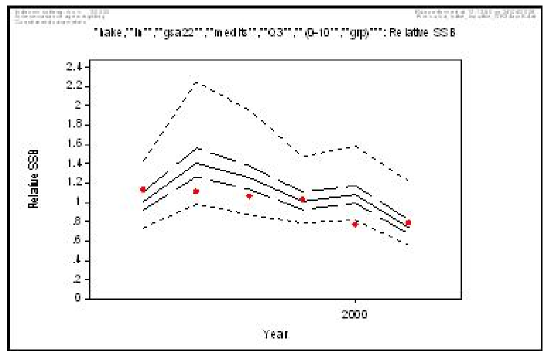
Annual catch at age



Yield, Spawn.Stock Biomass & Recruits



Mean weight at age



Relative Spawning Stock biomass (+ CI's)

Figure 1. North Aegean hake population status, as derived from SURBA estimations using 1996-2001 North Aegean (GSA22) MEDITS survey data.

References

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Assesment of hake (*M. merluccius*) in Northern Spain (GSA 6)

Presented at the GFCM WG Demersals, 2007Athens

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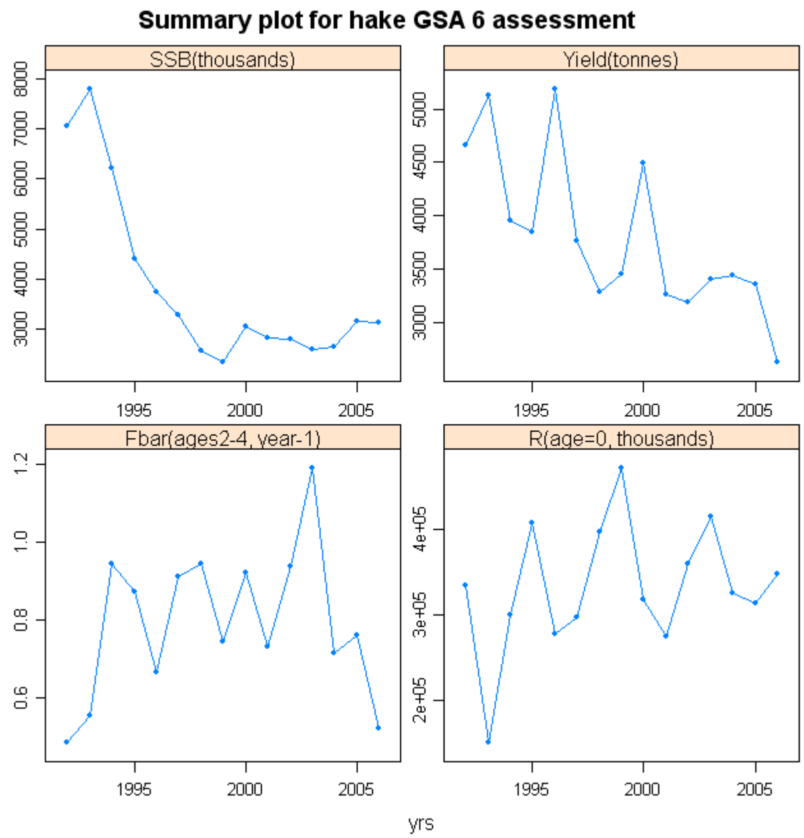
Hake (*Merluccius merluccius*) is one of the most important target species for the trawl fisheries developed by around 647 vessels along the GFCM geographical sub-area Northern SPAIN (GSA-06). In last years, the annual landings of this species, which are mainly composed by juveniles living on the continental shelf, were situated around 3800 tons in the whole area. The state of exploitation was assessed for the period 1992-2006 by means of a Separable VPA, tuned with standardised CPUE from commercial fleet and abundance indices from two trawl surveys. Analysis was carried out applying the Extended Survivor Analysis (XSA) method (Lowestoft suite; Darby and Flatman, 1994; Fisheries Library in R) over the period 1992-2006. In addition, a yield-per-recruit (Y/R) analysis (VIT program; Lleonart and Salat, 1992) was applied on the mean pseudo-cohort 1992-2006 for the GFCM geographical sub-area Northern Spain (GSA-06). Both methods were performed from size composition of trawl catches (obtained from on board and on port monthly sampling) and official landings, transforming length data to age data by slicing (L2AGE program). Transition analysis was also made to simulate different management strategies for the improvement of the state of this resource. In this assessment, a new set of parameters (fast growth hypothesis) were considered and a natural mortality vector (PROBIOM, Caddy and Abella, 1999) was applied.

The general results are similar to those obtained in previous assessments. Exploitation is based on very young age classes, mainly 0 and 1 year old individuals, with immature fraction dominating the landings. A decreasing trend in both landings and yields across the studied period was found. Total mortality (Z) showed an increasing trend, as well as fishing mortality (F_{bar}), with the latter decreasing from 2003 onwards. The current Y/R value represents a 83% of Y/R_{max}, meanwhile B/R represents a 30 % of the B/R_{max}, with a reduction of 53% in the current effort needed to reach the Y/R_{max} values. Total biomass of the stock decreased slowly, stabilising at around 8,000 t. The SSB-R relationship also shows a decreasing trend, with some stability around R_{max}, with recruitments showing a slight tendency to increase. Abundance indices show a slight recovery in 2006. Forecast at status quo predicts an increment of SSB and yields. If we consider a 10% yearly reduction in F, the recovery of SSB will be increased.

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

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

It can be concluded that the resource is over-exploited (growth over-fishing), with a risk of recruitment over-exploitation, which seems to be present in the forecast. The use of 40 mm square mesh in the cod-end could improve yields and the state of the stock. The resource should be considered the object of a special surveillance. The first step must be not to increase fishing mortality at all, both for trawl as well as for artisanal, being accompanied by a change in the cod end mesh type, as well as a yearly 10% reduction of effort to ensure the forecasted increase in SSB.



Estimates of SSB, yield, Fbar and recruitment over time from the hake GSA6 XSA assessment.

Small pelagic assessments for Northern Alboran Sea (GSA 1) and Northern Spain (GSA 6)

Two small pelagic assessments were shown to SGMED-08-02 experts. Both assessment are from sardine in Spanish waters (GSA01 and GSA06). They were presented at last GFCM WGSCSA Small pelagics, held in Athens September 2007. A summary of both assessments is presented below.

Fishery assessment of the Northern Alboran Sea (GSA 1) stock of sardine (*Sardina pilchardus*).

Bellido, J.M.[1], Giráldez, A.[2], Torres, P[2]., Ceruso, C.[1], Quintanilla, L.[2], Alemany, F.[3], Iglesias, M.[3]

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[3] Instituto Español de Oceanografía. Centro Oceanográfico de Baleares. Muelle del Poniente s/n. Apdo 291. Palma de Mallorca 07015. Spain.

Introduction

Fishery assessment by indirect methods of the Northern Alboran sardine stock is reported. This is the first time that this fishery is assessed by VPA methods. GSA01 time series for assessment goes from 2000 onwards. VPA Lowestoft software suite was used and XSA was the assessment method. A separable VPA was also run as exploratory analysis for both stocks. Deterministic short term projections were also produced.

XSA Results

Separable VPA results show no unusual pattern of Log catchability residuals and no particular conflicts between ages. XSA main settings were F_{bar} 1-3; Age 2 for q stock-size independent and age 3 for q independent of age; $F_{shrinkage}$ = 0.500 and S.E. for fleet terminal estimates ≥ 0.300. Tuning data came from acoustic survey ECOMED and Commercial Fleet off Estepona, Málaga and Adra from 2003 onwards. Landings increase in 2006, risen up 10,000 t. The time series shows a increasing trend from 2004, which was the lowest value of the assessed time series (see Fig. 1). Fishing mortality is at a moderate level (F_{06}=0.35), showing a rather stable trend. Recruitment in 2006 decreases from that of previous years. The time series recruitment shows a sinusoidal pattern that should be checked in following years as well as its influence on the strength of the stock. Both Total biomass in 2006 (TB=42,000 t) and Spawning Stock Biomass in 2006 (SSB=34,000 t) show an increasing trend, suggesting a recovery from the lowest SSB in 2001 (B_{loss}=20,000 t).

Short term projections

Table 1 shows the management options from the short term catch prediction. Assuming statu quo F (Fbar04-06=0.30) and a geometric mean recruitment (RGM02-06=540 millions), landings in 2007 and 2008 are predicted to be slightly over 8,000 t. Total biomass will remain stable around 40,000 t and SSB will be around 35,000 from 2007 to 2009. Then this exploitation pattern of maintaining F *status quo* 2007-09 will not produce either major gains or loss. Recruitment levels should be monitored as they could prompt sudden increases or drops from this stable pattern.

Management considerations

No reference points for sardine can be suggested at this point. Further years will come an extension of the assessment time series suitable to suggest Reference Points and Harvest Control Rules for the sardine GSA01 fishery.

Regarding suggestion for management options, this fishery is considered as fully exploited. However this has to be confirmed in following years, as this assessment should be considered still as preliminary. Under these premises we consider fishing effort should not increase beyond the current levels. This should allow to maintain the current levels of Fishing mortality.

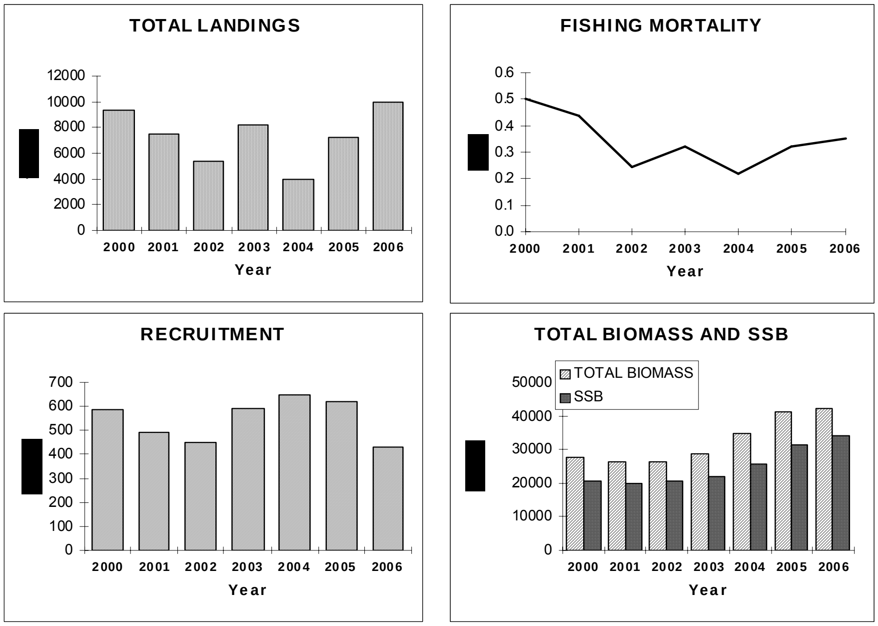

Figure 1. Stock assessment summary of Sardine GSA-01.

Table 1. Short term projections for years 2007-2009 of sardine in GSA-01

2007				
Biomass	SSB	FMult	FBar	Landings
41199	32985	1	0.2957	8071

2008					2009	
Biomass	SSB	FMult	FBar	Landings	Biomass	SSB
42880	34175	0	0	0	53390	44402
.	34175	0.1	0.0296	939	52356	43398
.	34175	0.2	0.0591	1854	51349	42421
.	34175	0.3	0.0887	2745	50369	41470
.	34175	0.4	0.1183	3613	49415	40545
.	34175	0.5	0.1479	4458	48486	39645
.	34175	0.6	0.1774	5282	47582	38769
.	34175	0.7	0.207	6084	46702	37916
.	34175	0.8	0.2366	6865	45845	37086
.	34175	0.9	0.2661	7626	45010	36278
.	34175	1	0.2957	8368	44198	35492
.	34175	1.1	0.3253	9090	43406	34727
.	34175	1.2	0.3549	9795	42636	33982
.	34175	1.3	0.3844	10481	41885	33256
.	34175	1.4	0.414	11150	41154	32550
.	34175	1.5	0.4436	11802	40442	31862
.	34175	1.6	0.4731	12437	39749	31193
.	34175	1.7	0.5027	13056	39073	30541
.	34175	1.8	0.5323	13660	38415	29906
.	34175	1.9	0.5619	14249	37774	29288
.	34175	2	0.5914	14823	37150	28686

Fishery assessment of the Northern Spain (GSA 6) stock of sardine (*Sardina pilchardus*).

Bellido, J.M.[1], Giráldez, A.[2], Torres, P[2]., Ceruso, C.[1], Quintanilla, L.[2], Alemany, F.[3], Iglesias, M.[3]

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[2] Instituto Español de Oceanografía. Centro Oceanográfico de Málaga. Puerto Pesquero s/n. Apdo 285. Fuengirola. 29640. Málaga. Spain.
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Introduction

Fishery assessment by indirect methods of the Spanish sardine stocks GSA06 is shown. This is the first time that this fishery has been assessed using VPA methods. GSA06 time series for assessment goes from 1994 onwards. VPA Lowestoft software suite was used and XSA was the assessment method. A separable VPA was also run as exploratory analysis for both stocks. Deterministic short term projections were also produced.

XSA Results

Separable VPA results show no unusual pattern of Log catchability residuals and no particular conflicts between ages. XSA main settings were F_{bar} 1-3; Age 2 for q stock-size independent and age 3 for q independent of age; $F_{shrinkage}$ = 0.500 and S.E. for fleet terminal estimates ≥ 0.300. Tuning data came from acoustic survey ECOMED and Commercial Fleet off Barcelona, Tarragona, Castellón and Torrevieja from 1994 onwards. Landings in 2006 were 29,350 t, showing a slightly increase from previous years. The time series shows an stable pattern, although it is at low level. The lowest landings of the assessed time series is 2002 (see Fig. 1). Fishing mortality is at a moderate-high level ($F_{0.6}$=0.99), showing an increase in 2006 that should be checked in following years. Anyway the F series shows a clear decrease from 1994 onwards, with only a peak in 2001. Recruitment in 2006 decreases from that of previous years, following a decreasing trend from 2001. These lower and lower recruitments should be monitored next years as they can affect seriously to the stock health. Both Total Biomass in 2006 (TB=76,200 t) and Spawning Stock Biomass in 2006 (SSB=43,400 t) show a stable pattern with a slight recovery from the lowest observed SSB (Bloss=25,100 t, in 2002), although both TB and SSB are still at a rather low level.

Short Term projections

Table 1 shows the management options from the short term catch prediction. Assuming statu quo F (F_{bar}=0.83) and a geometric mean recruitment (RGM94-05=1840 millions), landings are predicted to be close to 23,000 t in 2007 and 27,000 t in 2008. Total biomass will be 74,000 t in 2007, 84,000 t in 2008 and 88,000 t in 2009, what account for an increase on stock numbers. SSB will also increase from 36,000 t to 44,000 t from 2007 to 2009, although this increase seems to be proportionally smaller than that of the total biomass. Hence this exploitation pattern to maintain F statu quo 2007-09 will produce a slightly gain and continuing the increasing trend, helping the recovery of the stock from its lowest value in 2002. Recruitment levels should be still monitored as standard.

Management considerations

No reference points for sardine can be suggested at this point. Further research is aimed to produce Reference Points and Harvest Control Rules for the sardine GSA06 fishery. Regarding suggestion for management options, this fishery is considered as fully exploited. However this has to be confirmed in following years, as this assessment should be considered still as preliminary. Under these premises we consider fishing effort should not increase beyond the current levels. This should allow to maintain the current levels of Fishing mortality.

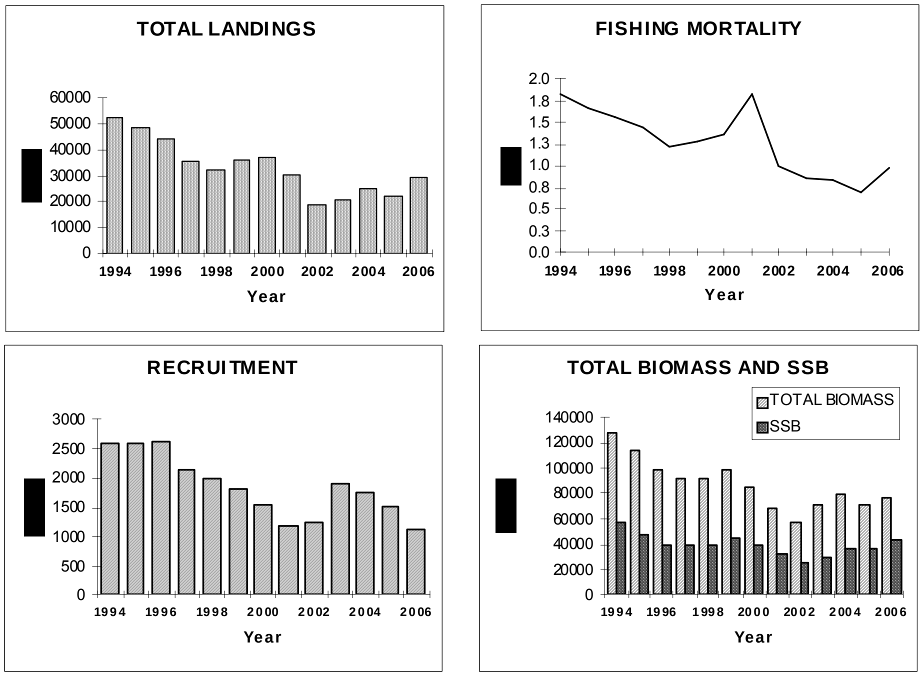

Figure 2. Stock assessment summary of Sardine GSA06.

Table 2. Short term projections for years 2007-09 of Sardine GSA06.

2007				
Biomass	SSB	FMult	FBar	Landings
74215	36388	1	0.8316	22562

2008					2009	
Biomass	SSB	FMult	FBar	Landings	Biomass	SSB
84001	39791	0	0	0	117603	70361
.	39791	0.1	0.0832	3531	113730	66810
.	39791	0.2	0.1663	6836	110114	63511
.	39791	0.3	0.2495	9933	106737	60445
.	39791	0.4	0.3326	12835	103581	57595
.	39791	0.5	0.4158	15557	100630	54944
.	39791	0.6	0.499	18111	97869	52478
.	39791	0.7	0.5821	20510	95284	50183
.	39791	0.8	0.6653	22764	92862	48046
.	39791	0.9	0.7485	24883	90592	46055
.	39791	1	0.8316	26878	88463	44201
.	39791	1.1	0.9148	28757	86463	42472
.	39791	1.2	0.9979	30527	84585	40859
.	39791	1.3	1.0811	32197	82819	39355
.	39791	1.4	1.1643	33773	81157	37950
.	39791	1.5	1.2474	35262	79592	36638
.	39791	1.6	1.3306	36670	78117	35412
.	39791	1.7	1.4137	38002	76726	34265
.	39791	1.8	1.4969	39264	75412	33192
.	39791	1.9	1.5801	40460	74171	32188
.	39791	2	1.6632	41594	72997	31247

Use of composite models for the assessment of European hake, Red mullet and Norway lobster stocks in the North-Western Mediterranean (GSAs 7, 8, 9, 10 and 11).

Presented at *WG SAC Athens, September 2007*

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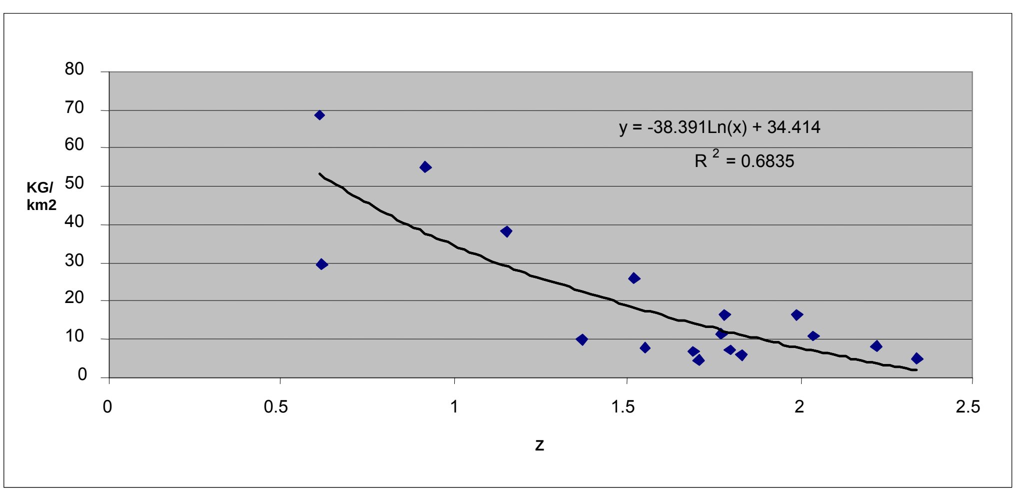
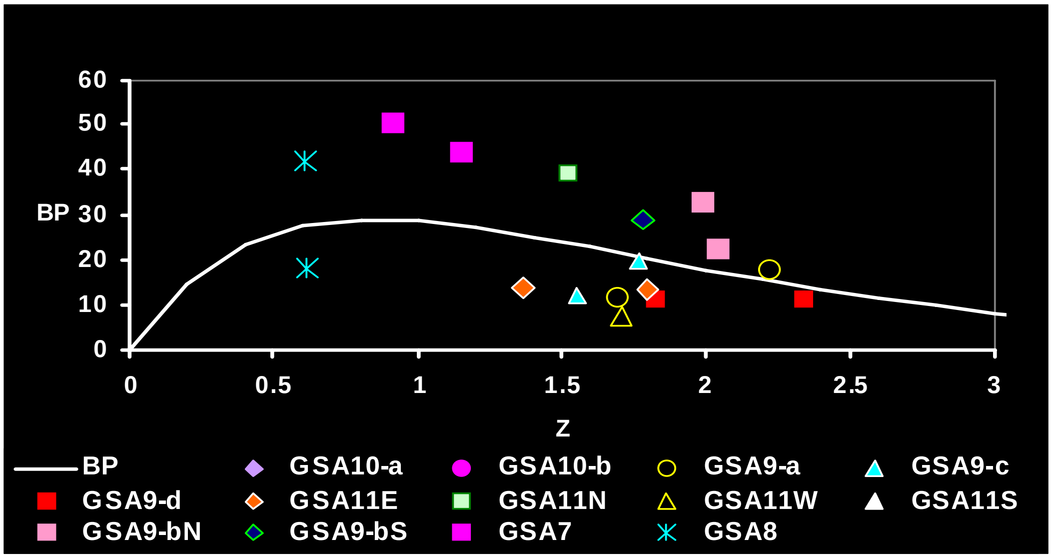
Introduction

The utilisation of surplus production models for stock assessment in the Mediterranean became very popular in the seventies and eighties but often they did not furnish reliable results. This has been mainly due to the lacking of long time series of catch and effort, to biased estimates of total catches, to the use of unsuitable effort units, to the unfeasibility of total effort partitioning, to the lack of contrasting enough data regarding to effort and correspondent abundance levels, to the assumption of equilibrium. In this document, results derived from the utilization of a variant of the traditional surplus production models namely composite production model (Munro, 1980) are presented. Composite models use spatial information proceeding from sub-areas exploited at different rates, for whom a similar productivity and evolution under different levels of fishing pressure are assumed. The change from a time to space-based data set allows the utilization of production models even in the case long data series on catch and effort are not available and may furnish useful information on the stocks status and evolution at different rates of exploitation. The results potentially obtained with such approach are not affected by most of the problems that characterize the traditional versions of surplus production models.

The mentioned approach was used for the definition of a sustainable level of fishing pressure for three stocks in the Western Mediterranean and for a preliminary assessment of the current status of exploitation in fishing grounds of different GSAs exploited with different rates. Total mortality rate was used as a direct index of fishing mortality. Considering that Z includes both, removals of fishing activity and deads due to natural causes, the model allows the estimation of the so-called Maximum Biological Production (MBP)(Csirke and Caddy, 1981)



Example of results for *Nephrops norvegicus* of relationship between total mortality Z and the Index of abundance (Kg/km^2) with the Fox model



Example of results for *Nephrops norvegicus* of Equilibrium Production Model and values of BP' (U*Z) obtained for different sub-areas according the Fox model

The analysis used data that are routinelly estimated in the International Trawl Surveys project MEDITS. It is very simple and furnish results easy to understand and to translate in measurable actions. The use of such approaches constitutes a unique opportunity to have a rough idea of the current status of the single species and for the evaluation of the likely consequences of changes in fishing pressure when fisheries dependent information is completely lacking or not reliable. As noted by Die and Caddy (1997) the Z_{MBP} reference point can be considered precautionary. It corresponds to a lower exploitation rate than the Z at Maximum Sustainable Yield, and is relatively stable and easy to calculate.

Assessment of the status of the coastal groundfish assemblage exploited by the Viareggio fleet (Southern Ligurian Sea, GSA 9)

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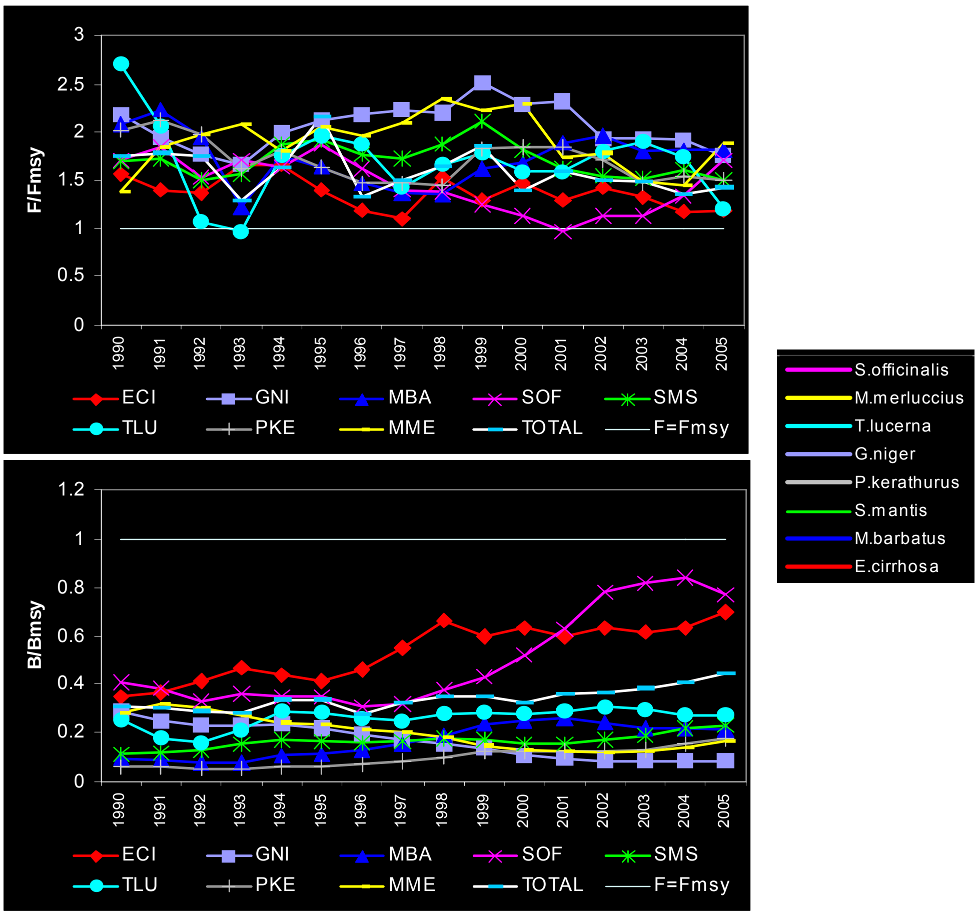
Introduction

In the Viareggio port (GSA9) operates one of the major Italian industrial fishing fleets of different size and tonnage, with a dominance of relatively small-sized vessels. Most of them target demersal resources and in general utilize bottom trawl nets locally called volantina.

In this port official statistics do not furnish enough information neither on details on operation areas, gear characteristics, nor on the identification of the target and effective effort exerted by vessel during each single fishing trip. The main goal of the study is the assessment of the status of the stocks assemblage exploited by the fishing fleet fishing on coastal grounds. A non equilibrium surplus production model was used for the assessment of the status of the coastal groundfish assemblage. The analyses were performed using the ASPIC.5 software (A Stock-Production model Incorporating Covariates) (Prager, 1994, 2005). This program implements a non-equilibrium, continuous-time, observation-error estimator for the production model (Schnute, 1977; Prager, 1994). The model was used to estimate r (the intrinsic rate of population growth), MSY, the ratios of current biomass or F to the biomass or F values at which MSY can be attained, and q (the catchability coefficient, the proportion of total stock taken by one unit of fishing effort). The available software allows making yield forecasting and to derive precautionary target reference points facing the intrinsic uncertainty that characterises the analysed processes and the observation errors. The routine REPAST (Ratio Extended Probability Approach to Setting Targets) (Prager et al., 2003) was used for this purpose.

These TRP's are based on the model defined Limit Reference Points fmsy, Fmsy and Bmsy. In this way it was possible to set a target level of effort that while maximizes yields it should guarantee that effort will remain below the estimated value for the limit reference point.



Trends of Fcurr/Fmsy (up) and Bcurr/Bmsy (down) rates for each selected species and for the assemblage.

The results obtained with the forecasting routine of ASPIC.5, assuming the level of effort fixed to the average value of the last 4 years, suggest an increase in abundance for almost all the species of the coastal groundfish assemblage. The levels expected of biomass obtained by keeping unchanged these mortality rates have to be considered still insufficient in order to maximise yields and to guarantee sustainability.

The special routine REPAST incorporated in the last version of ASPIC 5.0 is an important tool facing uncertainty. It allowed the definition of a target reference point linked to the Limit

Reference Point MSY, which consists of a more precautionary level of effort regarding MSY. This TRP takes into account a defined probability of not exceeding the LRP and the variability of the estimates. Finally, in this study was briefly addressed the problem of setting of an optimal level of effort for all the species involved in the fishery. The final choice and consequent advice has to consider the particular situation of the maximum number of single species as possible. It is necessary to pay special attention on those of major commercial importance as well as on those considered the weakest species in the multispecies mix, especially if biodiversity conservation is a management strategic priority goal. The construction of the production model and the definition of the level of fishing effort producing the Maximum Sustainable Yield for the whole species complex is considered useful. In this case the level of the f corresponding to the MSY for the whole assemblage is not far from the optimal F_{MSY} obtained in the single species based analysis for almost all the 8 species

SPECIES	K	r	q	MSY	Bmsy	Fmsy	fmsy	Fcurrent	from Fcurr to Ftarget	from Fcurr to Fmsy	f current	from fcurr to ftarget	from fcurr to fmsy
M.barbatus	1530000	0.95	0.00001094	362500	765000	0.4739	433000	0.86	-0.61	-0.45	62500	-0.51	-0.31
T.lucerna	402500	0.77	0.00000890	77480	201250	0.385	43290	0.46	-0.44	-0.17	62500	-0.53	-0.31
S.mantis	2729000	0.87	0.00001037	593900	1364500	0.4352	41980	0.65	-0.46	-0.33	62500	-0.46	-0.33
S.officinalis	225700	1.32	0.00001329	74410	112850	0.6595	49600	1.12	-0.57	-0.41	62500	-0.43	-0.21
M.merluccius	1268000	0.75	0.00000982	237200	634000	0.374	38070	0.63	-0.59	-0.38	62500	-0.59	-0.37
G.niger	1159000	0.69	0.00000992	200500	579500	0.346	34890	0.60	-0.54	-0.43	62500	-0.66	-0.58
E.cirrhosa	360300	1.19	0.00001137	107000	180150	0.594	52230	0.71	-0.32	-0.16	62500	-0.23	-0.04
P.kerathurus	599000	0.83	0.00000984	124400	299500	0.4152	42200	0.58	-0.47	-0.28	62500	-0.50	-0.32
Assemblage	8153000	0.81	0.00000899	1661000	4076500	0.4074	45280	0.66	-0.45	-0.38	62500	-0.36	-0.28

Main results for the 8 selected species and assemblage. K and r are parameters of the population growth model, q=coefficient of catchability; MSY=Maximum Sustainable Yield; B_{MSY} = level of Biomass corresponding to the MSY; F_{MSY} and F_{MSY} = levels of Fishing Mortality Rate or fishing effort corresponding to the MSY; F current and reduction of F (F_{curr}) necessary in order to reach the F_{MSY} and F_{target}; f current and reduction necessary to reach F_{MSY} and the precautionary reference point F_{target} with a reasonable probability (P=80%) that fishing at this exploitation rate will not exceed F_{MSY}.

17. APPENDIX 6. BIO-ECONOMIC MODELLING METHODS IN THE MEDITERRANEAN

STECF is requested in particular:

- to identify the decision-making support modelling tools that are adequate for the Mediterranean fisheries and that will produce outputs that support sustainable use of fishery resources recognizing the need for a precautionary framework in the face of uncertainty and that may allow to provide projections of alternative scenarios for short-medium and long term management guidance;
- to provide either a qualitative or quantitative understanding of the level of precision and accuracy attached to the estimation of indicators and reference points through the different modelling tools;
- to provide information on the data and standardised format needed for each of the decision-making support modelling tool which will be used to launch official data calls under the DCR n° 1543/2000. STECF should also indicate criteria to ensure quality cross-checks of the data received upon the calls.

Decision-making support modelling tools for Mediterranean fisheries

Three main bio-economic models have been developed and used for the analysis of a number of Mediterranean fisheries:

1. MOSES: Bio-economic models for Mediterranean;
2. BIRDMOD: Methodological Support for Analysis of Demersal Resources;
3. MEFISTO: Mediterranean Fisheries Tool.

MOSES (Placenti *et al.*, 1992) have represented for many years the unique model specifically designed for Italian fisheries. It is a static equilibrium model and was conceived as an optimization model aimed at estimating the long-term effects of changes in fishing effort levels. It consists of a biological and economic component. Given a level of fishing effort, the biological component estimates long-term landings based on the Schaefer logistic curve for each species and area, and the economic component estimates long-term profit (value added) for each area and fleet segment. An optimal level of fishing effort can be estimated by maximizing the value added of the whole fleet. Alternatively, sub-optimal levels of fishing effort can be estimated by introducing specific biological and inertia constraints in the optimization process. So, MOSES produces biological and economic results for different levels of fishing effort: the current level, the simulated levels (effort simulation), the optimal level (effort optimization) and the sub-optimal level (effort optimization with biological and inertia constraints).

MEFISTO (Lleonart *et al.*, 1999) is a bio-economic simulation model. The last version of this model (MEFISTO 3.0) has been developed as a result of the EU project BEMMFISH (Bio-economic modelling of Mediterranean fisheries, Q5RS 2001-01533). The model is multi-species and multi-gears. Alternative management measures can be simulated by changing the starting values of the main variables included in the model, like the maximum fishing time, the level of taxes, the fleet size, etc. For each simulation, the impact of these management measures on the indicators of each boat, stock, price, etc. can be analysed. The model consists of four main modules: Fisherman, Stock and Market. The “Fisherman” module simulates changes in the capital invested, and then in fishing effort and catchability. Effort and catchability is then fed into the “Stock” module that simulates resource dynamics. From the “Stock” module catches are fed into the “Market” module where catches are converted into economic performance, which then serves as input to the “Fisherman” module. A set of biological and economic indicators of the current scenario and alternative scenarios defined by specific management measures are projected into the future.

BIRDMOD has been developed for a project financed by the Italian Ministry for Agriculture and Forestry Policy and carried out by IREPA (Institute for Economic Research on Fishery and Aquaculture) and SIBM (Society of Marine Biology). BIRDMOD is a bio-economic simulation model. The model is multi-species and multi-gears. The aim of the BIRDMOD model is to simulate the effects of the main management measures implemented in Mediterranean fisheries. These are mainly restrictions on the fishing effort in terms of activity and capacity, but also technical and economic measures, such as variations in gear selectivity and introduction of taxes and subsidies. The simulations are conducted step-by-step at regular time intervals along the period defined by the user for prediction. In this sense, BIRDMOD is a dynamic model. As reported in Accadia and Spagnolo (2006), BIRDMOD model consists of four main modules: biological, economic, state variation and managerial. The biological module simulates the evolution of the state of the biomass among the stocks exploited by the fishing activity. The economic module simulates the evolution of the state of the fleet within the geographic area of interest. The management module enables us to reproduce the Public Administration’s intervention on the sector and to measure the effects of the different management policies. The state variation module permits to draw the dynamic relations between the overall variables of the model by means of predetermined behaviour rules. The final output is composed of the historical series simulated for the biological and economic variables included in the logical-conceptual pattern of the model.

Recently the EU financed project EFIMAS has developed a framework within which to simulate and evaluate the biological and socio-economic consequences of a range of fishery management options and objectives. Three case studies were planned in the EFIMAS project for Mediterranean fisheries, and a bio-economic model has been developed for each of them:

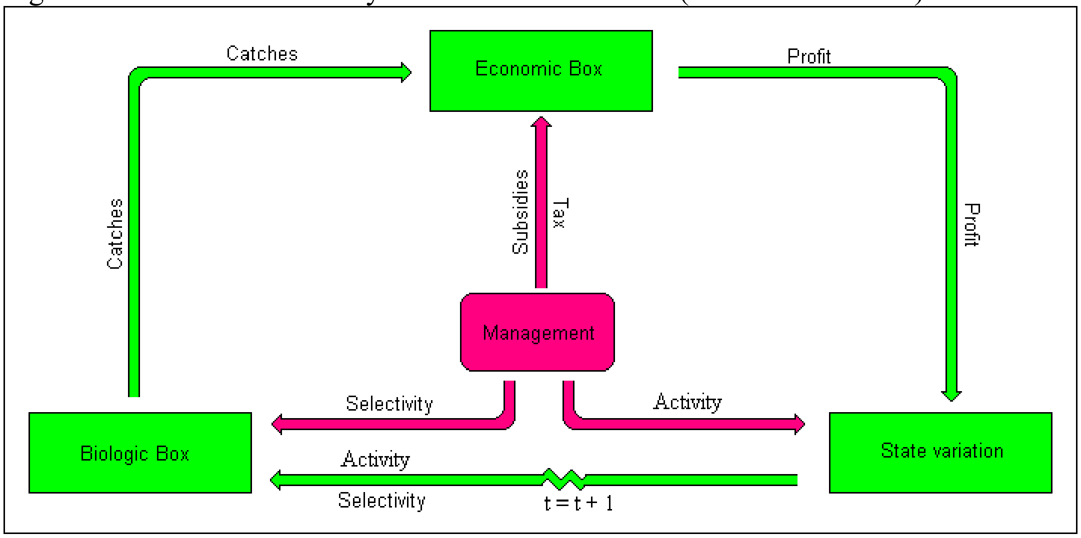
- Mediterranean Swordfish fisheries;
- Hake in Aegean Sea;
- Hake in Ligurian Sea.

EFIMAS bio-economic models for Mediterranean fisheries use a simulation approach similar to that proposed by the BIRDMOD model.

A very general structure of a dynamic simulation model for Mediterranean fisheries can be found in the final report of the Joint SGECA-SGRST sub-group meeting on bio-economic modelling (Ispra, 4-6 October 2005 and 7 – 9 March 2006), and in Accadia and Spagnolo (2006) as the structure of BIRDMOD model. It is reported in Figure 1. All the bio-economic simulation model developed for the Mediterranean fisheries can be described by this structure. For example, the three modules which compose the MEFISTO model, Stock, Market and Fisherman, can be respectively associated to the modules Biologic, Economic and State variation. Differences among models are internal to each module, and depend on the dimensions took into account and the functional relationships among the model variables.
One of the main differences between BIRDMOD and MEFISTO comes from the dimensions used to analyse the fleet. BIRDMOD and the EFIMAS models for Mediterranean fisheries perform simulations at level of fleet segment, while MEFISTO can produce projections for each vessel in the fleet. Fleet behaviour is then simulated following two different approaches. The Fisherman module in MEFISTO simulates the entry-exit and investment decisions for each vessel based on the profit generated in the past by the vessel. The State variation box in BIRDMOD and EFIMAS models simulates changes in the number of vessels and average days at sea by fleet segment based on the total profits realized by the fleet segment in the past.

Clearly, data required as model input reflect these features. So, MEFISTO needs data at vessel level, while the other simulation models described above request data al fleet segment level.

Figure 1 - The structure of a dynamic simulation model (BIRDMOD model)



Level of precision and accuracy of bio-economic models results
The sections that of which the modelling process is principally composed can be summarised as: 1) model selection; 2) model fitting; and 3) model validation. These three basic steps should be undertaken in an iterative procedure until an appropriate model for the data has been developed. The last step, model validation, is possibly the most important step in the model building sequence. However, it is generally the step that sees least effort. As reported in McCarl and Apland (1986), "validate means exercises designed to determine whether there is a sufficient relationship between modelled behavior and observed behavior such that the model user is content to use a model as a predictor".

A model cannot be used if it is not considered a valid depiction of the system modelled. Within the models used for management purposes, it is particularly important to check that the model output has an 'error' within reasonable bounds. Several different types of model uncertainty exist. Rosenberg and Restrepo (1994) identified five types: measurement error; process error; parameter estimation error; modelling error; and implementation error.

The validation of the model results are required to test how well a model is able to predict the real behaviour of the system modelled. Generally, this type of validation is performed comparing the model results to the observed outcomes of the system modelled. In this respect, a number of validation experiments are possible.

Within the bio-economic model-building process, the model validation step is the most overlooked. Even though some examples of model validation can be found in the literature, generally they are not consistent and do not provide reliable estimates of robustness. For example:

- the project FAIR CT95-0561, in order to estimate the prediction reliability of different catch-effort models used by the biological component of the MOSES model, a technique based on moving block estimation was developed and tested over a set of data on Italian fisheries (Placenti et al., 1995); and

- the project FAIR CT-96-1993 (Pascoe, 2000), in order to validate the results from the BECHAMEL model, a comparison of catches and some key economic variables estimated by the model with the estimates derived from the survey was performed on a period of three years, 1993-5.

Bio-economic models data requirement
Input data for the MOSES model are organized as historical time series at two dimensional levels: species and fleet segment. Commercial landings by species and effort data by fleet segment are the main data to run the MOSES model. Other data are the following:

- a matrix of prices by species and by fleet segment;
- a vector of costs per unit of effort by fleet segment.

The MEFISTO model can be run with the data organized at fleet segment level, but it works better with data individualized by vessel. Additionally to the economic data collected under DCR, MEFISTO uses the daily fuel consumption, which can be obtained indirectly from the total fuel consumption costs and price. Then it can be extrapolated to the vessel level by using vessel horse power and GT.

For the biological data on the target species, DCR data are used indirectly through stock assessments (e.g. from GFCM), including fishing mortality, and literature on growth, natural mortality parameters, or stock-recruitment relationships. For species whose data are not obtained in the regulation (secondary species), time series analysis of their catches are required.

BIRDMOD model needs data organized at the following dimensional levels: species (for the main target species), fleet segment and fishing gear. Technical and economic variables by fleet segment are the follow:

- number of vessels and GT;
- number of days at sea;
- number of people employed;
- landings in weight by species, by month, and by fishing gear;
- price by species;
- costs: commercial costs, fuel costs, other variable costs, maintenance costs, other fixed costs, depreciation and interest.

Biological data by species can be listed as follow:

- stock-recruitment parameters or constant recruitment with the number of recruits by month;
- Von Bertalanffy growth model parameters;
- length-weight relationship parameters;
- total mortality (Z);
- natural mortality (M);
- maturity function with parameters;
- selectivity function with parameters by fishing gear.

Practical applications of this model have been produced by collecting data on landings, costs, prices and activity from the IREPA database. Biological parameters have been estimated by trawl survey (MEDIT and/or GRUND) or derived under hypotheses formulated according to the conditions in the Mediterranean and reported in scientific literature.

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18. Appendix 7. Fleet segmentation in the Mediterranean Sea
(copied from SGMED-08-01 report).

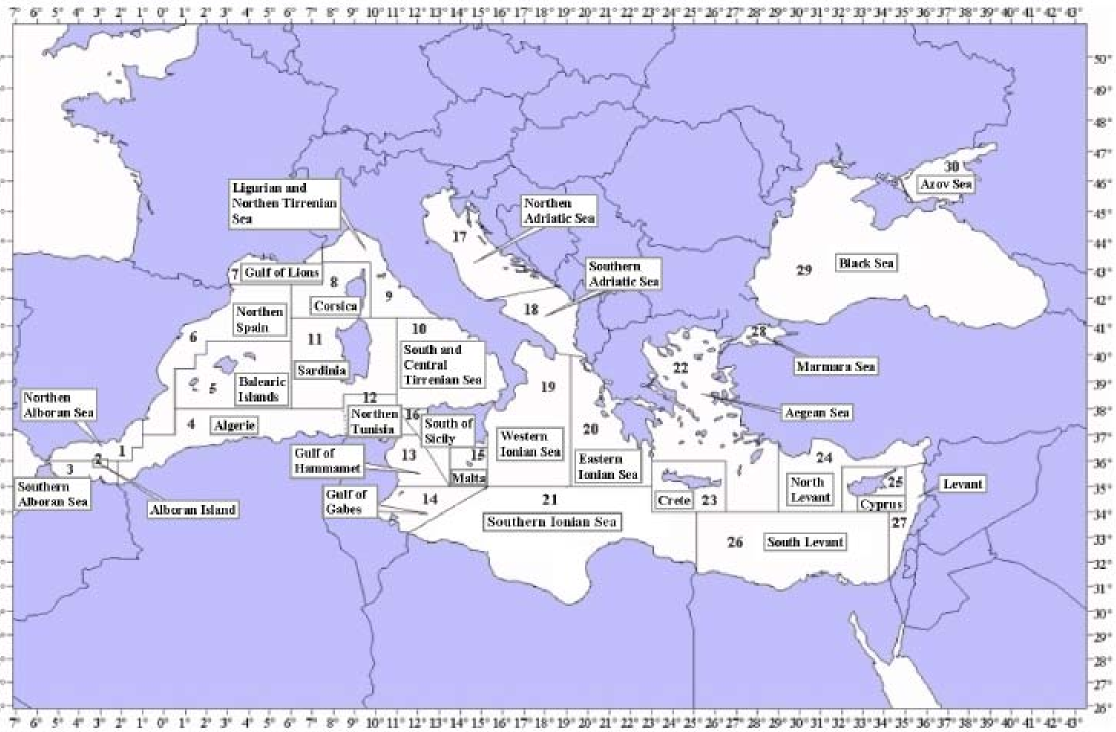
Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	LOA classes					
Activity	Gear classes	Gear groups	Gear type	Target assemblage	Mesh size and other selective devices	< 6	6-12	12-18	18-24	24-40	> 40
Fishing activity	Dredges	Dredges	Boat dredge [DRB]	Molluscs	(a)						
	Trawls	Bottom trawls	Bottom otter trawl [OTB]	Demersal species	(a)						
				Deep water species (b)	(a)						
				Mixed demersal species and deep water species (b)	(a)						
			Multi-rig otter trawl [OTT]	Demersal species	(a)						
			Bottom pair trawl [PTB]	Demersal species	(a)						
			Beam trawl [TBB]	Demersal species	(a)						
		Pelagic trawls	Midwater otter trawl [OTM]	Mixed demersal and pelagic species	(a)						
			Pelagic pair trawl [PTM]	Small pelagic fish	(a)						
	Hooks and Lines	Rods and Lines	Hand and Pole lines [LHP] [LHM]	Finfish	(a)						
				Cephalopods	(a)						
			Trolling lines [LTL]	Large pelagic fish	(a)						
		Longlines	Drifting longlines [LLD]	Large pelagic fish	(a)						
			Set longlines [LLS]	Demersal fish	(a)						
	Traps	Traps	Pots and Traps [FPO]	Demersal species	(a)						
			Fyke nets [FYK]	Catadromous species	(a)						
				Demersal species	(a)						
			Stationary uncovered pound nets [FPN]	Large pelagic fish	(a)						
	Nets	Nets	Trammel net [GTR]	Demersal species	(a)						
			Set gillnet [GNS]	Small and large pelagic fish	(a)						

				Demersal species	(a)						
			Driftnet [GND]	Small pelagic fish	(a)						
				Demersal fish	(a)						
	Seines	Surrounding nets	Purse seine [PS]	Small pelagic fish	(a)						
				Large pelagic fish	(a)						
			Lampara nets [LA]	Small and large pelagic fish	(a)						
		Seines	Fly shooting seine [SSC]	Demersal species	(a)						
			Anchored seine [SDN]	Demersal species	(a)						
			Pair seine [SPR]	Demersal species	(a)						
			Beach and boat seine [SB] [SV]	Demersal species	(a)						
	Other gear	Other gear	Glass eel fishing	Glass eel	(a)						
	Misc. (Specify)	Misc. (Specify)			(a)						
Other activity than fishing				Other activity than fishing							
Inactive				Inactive							
Recreational fisheries (non registered vessels or no vessels)				To be specified	Not applicable	All vessel classes (if any) combined					

(a) Not spelled out in DCR but defined with reference to relevant EU Regulation(s)

(b) Refering only to red shrimps *Aristaeomorpha foliacea* and *Aristeus antennatus*, species not included in the definition of deep sea species given by Council Regulation (EC) 2347/2002.

19. APPENDIX 8. GFCM GSAs



20. APPENDIX 9. PRESENTATIONS GIVEN AT SGMED-08-02

Presentations on stock assessments given at SGMED-08-02 can be viewed at:
http://stecf.jrc.ec.europa.eu/c/document_library/get_file?folderId=21123&name=DLFE-6901.pdf

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

EUR 23669 EN **– Joint Research Centre – Institute for the Protection and Security of the Citizen**
Title: Scientific, Technical and Economic Committee for Fisheries. Report of the SGMED-08-02 Working Group on the Mediterranean Part II.

Author(s): Pilling G., Abella A., Accadia P., Anastopoulou I., Bellido J.M., Charilaou C., Colloca F., Damalas D., Dimech M., Di Natale A., Farrugio H., Fiorentino F., Garcia-Rodriguez M., Karlou-Riga C., Katsanevakis S., Martin P., Petrakis G., Quintanilla L.F., Sartor P., Spedicato M.T., Tičina V., Ungaro N., Vidoris P., Rätz H.-J. & Cheilari A.

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Abstract

SGMED-08-02 Working Group on the Mediterranean Part II met during 21-25 April 2008 in Athens. The meeting was the second of a series of four meetings planned during 2008, aiming towards an intensified scientific cooperation and an improved scientific advice regarding the adaptive management of Mediterranean fisheries and resources, mainly demersal and small pelagic. STECF reviewed the report during its plenary meeting on 7-11 July 2008.

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