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Scientific, Technical and Economic Committee for Fisheries (STECF)

Report of the SGMED-08-01 Working Group on the Mediterranean Part I

10-14 MARCH 2008, BRUSSELS, BELGIUM

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TABLE OF CONTENTS

SCIENTIFIC, TECHNICAL AND ECONOMIC COMMITTEE FOR FISHERIES (STECF)

STECF COMMENTS ON THE REPORT OF THE SGMED-08-01

WORKING GROUP ON THE MEDITERRANEAN PART I

Brussels 10 – 14 March 2008

STECF OPINION EXPRESSED DURING THE PLENARY MEETING HELD IN HAMBURG 14-18 APRIL 2008

1. BACKGROUND

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[5].

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[6]. 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[7], as well as the report of the STECF working group on balance between fishing capacity and fishing opportunities[8].

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

[5] 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

[6] 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

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

[8] 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.

2. STECF OBSERVATIONS

The SGMED-08-01 realised that it was not the intention to address all ToRs in one meeting and it was understood, that the meeting was to be seen as the first of a number of meetings aiming at enhancing the scientific basis for providing advice on Mediterranean fisheries.

Recognising that an important task for the subgroup was to establish a framework for conducting stock assessments, the subgroup decided to give priority to the following:

- compiling information on availability of fisheries and stock data collected under the data collection regulation,
- evaluating the consistency between available data and data required to conduct the assessments,
- and reviewing available stock assessments and the methods used.

The SGMED-08-01 concluded that the DCR both in terms of biological end economic data has the potential to deliver the data required in support of the assessment and advisory work for most of the priority species.

The Subgroup furthermore identified available stock assessments of priority species conducted since 2002 and presented to the GFCM. The assessments methods and modeling approaches used in these assessments were discussed and commented upon.

The sub-group concluded that a large number of assessments have been conducted applying a wide range of assessments methods. Most of these assessments have, however, not been reviewed and SGMED-08-01 could not within the time available, evaluate the quality of the assessments.

On the basis of the compiled information the subgroup made recommendations on fishing effort and landings data to be provided in advance of the next meeting of SGMED, to allow the sub-group to continue the work on stock assessments and to initiate trial assessments for a number of priority species.

The subgroup recommended the following topics to be included in the ToR for the next meeting.

- Definition of the standardized official data call through DCR.
- Provision and evaluation of effort and landings data for 2006 as described in the report of SGMED-08-01 to be provided by the experts of SGMED-08-02.
- Any indicator assessments for estimation of fishery impacts (probably requires a special subgroup) should be made available by the experts of SGMED-08-02 in the standard format of TA, TB and TC files as defined for the Medits – survey.
- Exploration and provision of data availability to enable and, if possible to initiate trial assessment of European hake, red mullet, anchovy and sardine during SGMED-08-03 and SGMED-08-04.
- Continue of review of existing fish stock assessments of red shrimps, Norway lobster, red mullet, European hake, sardine, anchovy and deep-sea pink shrimp in order to identify appropriate stocks and methods.
- Initiate assessments of demersal assemblages.
- Compilation and review of social-economic indicators previously obtained for the Mediterranean Sea.

3. STECF COMMENTS AND CONCLUSIONS

STECF considers that the SGMED-08-01 made good progress in developing a framework for conducting regular assessments of Mediterranean fish and shellfish stocks. The sub-group has compiled a large amount of information on Mediterranean fisheries and the state of the art of stock assessment and thereby established a good platform for forthcoming meetings.

STECF agrees with the recommendation of SGMED-08-01 on how to proceed with the work initiated by the sub-group. As highlighted by the sub-group, it is important that the four meetings planned for 2008 are seen as a continuous process and STECF requests, the SGMED-08-02 to take the report of the SGMED-08-01 as a starting point for its work.

The SGMED-08-01 concluded that the DCR both in terms of biological end economic data has the potential to deliver the data required in support of the assessment and advisory work for most of the priority species. Noting the large number of derogations for species sampling for the Mediterranean in 2008, STECF advises that it is important to ensure that the provisions of the DCR deliver the required information for 2008 for the species to be assessed.

SGMED-08-01 WORKING GROUP REPORT

THE MEDITERRANEAN PART 1

Brussels, 10 – 14 March 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. INTRODUCTION

The European Commission is planning to propose long-term management plan 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 if available data allow for stock assessment to be conducted and scientific management advice 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 precision and accuracy of estimated parameters
- provide information on data requirement.

To address the request the STECF Subgroup on The Mediterranean (SGMED-08-01) met in Brussels from 10 to 14 March 2008. The meeting was opened at 16:00. The meeting closed at 16:00h on 14 March.

1.1. Terms of reference

The terms of reference for the meeting were:

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 reference map in anex VII), 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

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[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

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 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

[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.

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.

1.2. Subgroup approach

The subgroup recognised that it would not be possible to address all TORs in one meeting and it was understood, that the meeting was to be seen as the first of a number of meetings required to develop the scientific basis for providing advice on all TOR.

Recognising that an important task for the subgroup was to initiate the process of developing a framework for providing stock assessment and management advice to the Commission the subgroup decided to give priority to establishing the basis for coming meetings. To this end the Subgroup compiled information on existing fisheries and stock data resulting from the collection of data under the data collection regulation (chapter 2), evaluated the consistency of fisheries data to be made available through the new DCR and the data segmentation defined by GFCM (chapter 3). The Subgroup furthermore reviewed available stock assessments on priority species presented to the GFCM and evaluated the assessments methods and modelling approaches used in these assessments (chapter 4).

On the basis of the compiled information the subgroup made recommendations on fishing effort and landings data to be provided in advance of the next meeting of SGMED. The subgroup furthermore made recommendations on the ToRs for the next meeting. Recommendations are given in chapter 5.

2. DESCRIPTIONS OF THE MEDITERRANEAN FISHERIES

SGMED-08-01 reviewed existing descriptions of the Mediterranean fisheries and updated the information adopted from report of the 26th plenary meeting of the STECF (PLEN -07-03), 5-9 November 2007. In order to improve the available description of European fleets operating in the Mediterranean Sea the subgroup decided to present 3 tables of fishing effort, landings and landings per day by gear (DCR level 3) and country for 2006. The information is adopted from the recent report of PGMed 2007 and updated according to the expertise of SGMED-08-01.

There are several reports about the status of stocks and the characteristics of Mediterranean fisheries, but the most updated and agreed at the international level are the GFCM reports, the STECF report SEC(2002)1374, the STECF-SGMED report SEC(2004)772 and the STECF-SGMED-06-01 report of the Working Group on Sensitive and Essential Fish Habitats in the

Mediterranean Sea. Mediterranean fisheries are relatively unique compared to other EU fishing regions, primarily due to the high number of artisanal fishing activities, the very low presence of industrial fishing, the high variety of fishing gears used, the multi-species targets, and the high number of species accepted by the markets. In addition, the majority of fish are sold fresh because of market preferences and there is relatively little processing (filleting, freezing and canning) of the catch.

International cooperation for research and management in Mediterranean started quite late in comparison with the North Sea or the Atlantic. The first international bottom trawl survey with a common protocol was carried out in 1994 (MEDITS) with the participation of four member states. At present, eleven countries, seven member states (Spain, France, Italy, Malta, Slovenia, Greece and Cyprus) and four non member states (Montenegro, Croatia, Albania and Morocco) carry out the survey, on an annual basis. In the next revision of DCR, another survey for pelagic stock assessment (Pan-Mediterranean pelagic Survey, MEDIAS) will be included and six member states and probably some non member states will participate. Additionally, international surveys are carried out in some areas with the participation of Mediterranean countries (e.g. GRUND, an Italian trawl survey programme, extended to other countries in the Adriatic Sea).

Mediterranean fisheries are characterized by the very high number of small vessels and the diversity of fishing techniques used by artisanal (skipper owner) fishermen throughout the coasts of bordering countries and islands. This feature is important from both a socio-economic and a management standpoint, and rules and regulations need to take into account this large diversity. This large fleet of small vessels lands its catches to many small and sometimes isolated ports and beaches, which not only creates problems with regard to enforcement and control, but also makes recording of catches and effort rather difficult. Several catches are sold directly to final consumers or to local retailers, while a part, which is variable from place to place, is sold by auction and then become more controlled.

Fisheries statistics in the Mediterranean have been relatively poor for many years. The situation has improved in recent years with the implementation of the DCR. However, fisheries data and analyses are still largely incomplete.

In addition to the small scale fisheries, important fishing activities are also carried out by larger vessels (bottom and pelagic trawlers, long-liners, purse-seiners, etc.). The industrial (corporate) fishery is mainly limited to the tuna purse-seines and to the very recent activity of tuna farming.

Local fishing patterns and exploitation rates may be an important issue for management of Mediterranean stocks. This implies that fishery data should be collected on a fine scale in order to take into account the variability of catches and exploitation rates. Especially for the small scale fishery, data have to be collected on metier basis.

Management of fisheries in the EU Mediterranean countries was originally under national jurisdiction. National management regimes were then supplemented by EC regulations. The management of tuna and tuna-like species is under the responsibility of the ICCAT (the EC is

an active member), while management advice for some shared stocks is provided at Mediterranean level by GFCM. The GFCM is currently in the process of changing the form of most of its management advice from stock-oriented advice to fisheries-oriented advice.

Management in the Mediterranean is primarily by effort control, minimum catching or landing size, closed areas (to protect sensitive habitats) or closed seasons (to protect juveniles or spawning stocks) and restrictions on gear construction (mesh size, gear dimensions, etc.). TACs and quotas are restricted to internationally agreed TACs for bluefin tuna, and national quotas for clams off the Italian Adriatic coast and for some small-pelagic stocks under Spanish jurisdiction.

Stock assessments for most of the species are under the responsibility of the GFCM-SAC, while the tuna and tuna-like species (also including some pelagic sharks concerned by these fisheries) are under the responsibility of ICCAT. The assessments presented in the WGs of GFCM cover only a small minority of the stocks under the DCR. Most of the Mediterranean species are not well defined either in terms of stock units or management units. The assessment is usually based on the GSAs of GFCM, which are not always in accordance with the distribution of the stocks. The methodology for collecting and analysing the data is not yet standardised across the Mediterranean countries. Available assessments of Mediterranean stocks are described in chapter 4.

According to the EU Fleet Register updated to 12/2006, the EU Mediterranean fleet comprises 40,035 (41,479 vessels in the 2006 STECF Report). The Greek and Italian fleets comprise 45% and 35%, respectively. About 30% of the vessels are below 6 meters overall length. This is likely to be an underestimate, since in some countries, fishing vessels of less than 5 meters overall length are not included in the fishing vessel register. It is also to be taken into account the very large number of small vessels carrying out recreational and subsistence fisheries in the Mediterranean Sea and targeting many species. Information on these vessels and their catches is very poor, when existing.

The fishing effort in terms days at sea, the landings per fleet segment and the estimated landings per day of the fleets of the Mediterranean MS are given in Tables 2.1 – 2.3 which are updated versions of the relevant tables included in the Planning Group for commercial catches discards and by catch species for Mediterranean 2008 PGMed report.

Table 2.1. Nominal fishing effort (days at sea) by gear groups and country in the Mediterranean Sea in 2006.

Level 1	Level 2	Level 3	Cyprus	France	Greece	Italy	Malta	Spain	Slovenia	Total
Activity	Gear classes	Gear groups	days at sea	days at sea	days at sea	days at sea	days at sea	days at sea	days at sea	days at sea
Fishing activity	Dredges	Dredges		7,331		71,828		6,996		86,155
	Trawls	Bottom trawls	1,636	40,666	60,051	481,586	415	145,763	914	731,031
		Pelagic trawls		10,997		22,355			318	33,670
	Hooks and Lines	Rods and Lines	4,935	763		23,922	363			29,983
		Longlines	2,538	28,715	63,311	50,806	4,689	23,546		173,605
	Traps	Traps		49,028		198,789	406	5,055	148	253,426
	Nets	Nets	98,020	174,921	2,602,925	980,175	473	38,771	2,206	3,897,491
	Seines	Surrounding nets		4,163	46,434	34,039	1,117	41,955	466	128,174
		Seines		878	41,424	84,342	73			126,717
		TOTAL	107,129	317,462	2,814,145	1,947,841	7,535	262,086	4,052	5,460,250

Table 2.2. Landings (tons) by gear groups and country in the Mediterranean Sea in 2006.

Level 1	Level 2	Level 3	Cyprus	France	Greece	Italy	Malta	Spain	Slovenia	Total
Activity	Gear classes	Gear groups	tons	tons	tons	tons	tons	tons	tons	tons
Fishing activity	Dredges	Dredges				21,679		145		21,824
	Trawls	Bottom trawls	499		20,829	100,968	77	36,835	107	159,315
		Pelagic trawls				53,582			560	54,142
	Hooks and Lines	Rods and Lines	50			768	7			825
		Longlines	754		7,898	14,244	551	2,627		26,073
	Traps	Traps				6,380	10	242	1	6,633
	Nets	Nets	855		42,190	31,457	15	2,293	25	76,835
	Seines	Surrounding nets			50,517	52,915	545	58,741	225	162,942
		Seines			4,997	2,707	1			7,705
		TOTAL	2,157		126,431	284,699	1,207	100,883	919	516,296

Table 2.3. Landings per unit of effort (kg/day at sea) by gear groups and country in the Mediterranean Sea in 2006.

Level 1	Level 2	Level 3	Cyprus	France	Greece	Italy	Malta	Spain	Slovenia	Total
Activity	Gear classes	Gear groups	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day
Fishing activity	Dredges	Dredges				301,82		20,73		253
	Trawls	Bottom trawls	305,01		346,86	209,66	185,35	252,70	117,59	218
		Pelagic trawls				2.396,88			1.762,23	1.608
	Hooks and Lines	Rods and Lines	10,10			32,09	20,27			28
		Longlines	296,92		124,75	280,35	117,56	111,57		150
	Traps	Traps				32,09	25,62	47,87	4,38	26
	Nets	Nets	8,72		16,21	32,09	31,39	59,14	11,53	20
	Seines	Surrounding nets			1.087,93	1.554,54	488,06	1.400,10	481,95	1.271
		Seines			120,63	32,09	17,67			61
		TOTAL	20		45	146	160	385	227	95

2.1. Main fishing activities in the Mediterranean

2.1.1. Bottom trawling

Minimum mesh size is 40 mm stretched for all EU member state fleets in Mediterranean according to the regulation EU 1626/1994. However, according to the regulation EU 1967/2006 concerning management measures for the sustainable exploitation of fishery resources in the Mediterranean Sea, from 1 July 2008, the net shall be replaced by a square-meshed net of 40 mm at the cod-end or, at the duly justified request of the ship owner, by a diamond meshed net of 50 mm. Fishing is forbidden in depth less than 50 m or at a distance less than three miles from the coast. Fishing effort restrictions exist in all the member states.

All the bottom trawl fisheries in Mediterranean are multi-species fisheries. Three main categories can be identified.

a) Shelf fishery (down to 200 m) targeting: red mullets, hake, poor cod, sparids, sole, horse mackerels, anglerfish, octopuses, cuttlefish, squids, mantis shrimp, caramote prawn.

b) Shelf break fishery (200 – 450 m) targeting: hake, blue whiting, anglerfish, Norway lobster, rose shrimp.

c) Upper slope fishery in waters 450 - 800 m targeting mainly deep sea red shrimps.

Besides these main species the catch usually includes many other species (more than 60) and nearly all of them are landed and contribute to the income of the fishing fleets.

Spain:
The Spanish bottom trawl fleet consists of 895 vessels (SERVIPES, 2006). The fleet mainly operates in the Spanish fishing grounds, although a limited number of units traditionally go fishing to the Gulf of Lions. In a general way, the fleet can be segmented into two groups: trawlers developing their activity mainly on the continental shelf ("Arrastreros de plataforma") and those operating on the continental slope ("Arrastreros de talud"). The trawlers are stern trawlers. The activity of bottom trawlers is limited to a maximum of 5 days per week and some of them fish 12 hours per day. Pelagic trawling is forbidden. Additionally, bottom trawling usually stops for 60 days per year mainly in spring.

France:
There are 144 French Mediterranean otter trawlers and they variously practise bottom trawling and pelagic trawling according to specific fishing strategies targeting either pelagic fish or bottom and demersal fish or both. Some of them are specialized on one métier, the other practice indifferently the 2 techniques. Consequently, there are three main groups of trawl metiers: bottom trawling, pelagic trawling and mixed trawling. Regional regulation limits the trawl fishing activity to a period of maximum 17 hours during the day and to working days. The bottom trawlers work around 200 or 220 days/year, from 1,200 to 2,000 h of fishing time/year/boat.

Italy:
According to the EU fleet register in Italy there are 3,513 trawlers (EC Fleet Register updated 16/03/2007), including bottom otter trawlers, beam trawlers and midwater pair trawlers. Trawling is allowed 5 days per week with local regulations regarding the number of hours per day. Additionally, fishing activity is usually stopped for 45 days in summer in some areas. Specific local closed areas to trawls are enforced.

Greece:
According to the EU fleet register, the trawler fleet of Greece consists of 376 vessels (EC Fleet Register updated 16/03/2007) using bottom trawl net as the main gear. According to the data of the Ministry of Agriculture the number of the bottom trawlers decreased from 1990 to 2001 by 14.3%, the gross tonnage increased by 12.7% and the engine power decreased by 14%. The bottom trawl fishery is closed in the entire area from 1st June until 30 September every year. There are some other local restrictions concerning closed gulfs where bottom trawling is forbidden during all the year or during a shorter period. For example, in Amvrakikos and Pagassitikos Gulfs, bottom trawl fishery is closed all over the year whereas in Patraikos and Korinthiakos Gulfs the fishery is open for six months.

Malta:
The Maltese trawling fleets accounts for 15 bottom otter trawlers and 4 beam-trawlers. Trawling within the 25 Nautical Mile Fisheries Management Zone (FMZ) is allowed only in specific areas (EC 813/2004, EC 1967/2006) and vessels only smaller than 24 m in length can fish in the zone. Furthermore the fishing capacity of any trawler fishing at a depth less than 200 m inside the FMZ must not exceed 185 kW.

Cyprus:
According to the EU fleet register, the trawler fleet consists of 18 vessels (EC Fleet Register updated 16/03/2007), using bottom trawl net.

Slovenia:
According to the EU fleet register, the trawler fleet of Slovenia consists of 22 vessels (EC Fleet Register updated 16/03/2007), including bottom trawlers and midwater pair trawlers.

2.1.2. Purse seining for small pelagics

Main target species are anchovy, sardine, mackerels, horse mackerels, bogue. Generally fishing takes place close to the coast, in depths down to 150 m using lights. Daily purse seine fishing in Greece is targeting migratory species.

Spain:
The purse seine fleet from the South Mediterranean Region (SMR) continuously decreased in the last two decades, reaching a total of 321 vessels in 2003 and 278 in 2006 (SERVIPES, 2006). The purse seine is not authorised in waters shallower than 35 m. The minimum distance between boats is 500 m. Fishing is permitted only 5 days a week.

France:
This fleet, which involved more than 150 units in the seventies, today is reduced to only 44 vessels, and most of them are from wood and of more of 25 years old. The crew is composed of 4 to 8 persons.

Italy:
According to the EU fleet register the purse seine fleet consists of 2340 vessels (EC Fleet Register updated 16/03/2007). Purse seine fishing is allowed 5 days a week and stops in full moon days.

Greece:
The Greek fleet using the purse seine as main gear consists of 307 vessels (EC Fleet Register updated 16/03/2007). In addition, there are several bottom trawlers using purse seine as second gear. Since 1991 the number of vessels has reduced by about 15%. Purse seines are distinguished into two major types: day fishing and night fishing with lights. There are no significant differences between the two types as far as the equipment and vessel construction are concerned. The most important difference is related to the mesh size of the net (14 mm for the night and 40 mm for the day, full mesh both). Seining is forbidden inside 300 m from the coast and/or in depths less than 30 m. There is a closed season from 15th of December to the end of February for the night purse seines, and from 1st of July to 31st of August for the day purse seiners. In some areas there are local restrictions (e.g. Amvrakikos Gulf is closed throughout the year). Purse seining is prohibited during full moon, two days before and two days after. The intensity of the light must be up to 2,000 candles per light.

Malta:
At present nine purse seiners undertake this fishery with the main targeted species being the chub mackerel. The term '*lampara*' is used because fishermen use strong lights to attract fish, which are then caught by purse seining. The boats used for this fishery are in the 10-15 meters length category. The purse seine is between 400 to 450 meters long and about 105

meters high. 'Lampara' fishing is undertaken throughout the year except for the period from September to December when these boats target the lampuki. Furthermore about 100 boats are involved in the dolphinfish fishery which uses a surrounding net without a purse-line (*lampara* nets) to catch fish that aggregate under fish aggregating devices (FADs).

Cyprus:
According to the EU fleet register, the purse seine fleet consists of only 1 vessel (EC Fleet Register updated 16/03/2007).

Slovenia:
According to the EU fleet register, the purse seine fleet of Slovenia consists of 7 vessels (EC Fleet Register updated 16/03/2007).

2.1.3. Large pelagic fisheries

The large pelagic fisheries are carried out by a composite fleet of Mediterranean vessels: large tuna purse-seines, normal purse-seines, surface drifting long-lines, small vessels using trolling and hand-lines, a few vessels with pole and line and a very small fleet of traditional harpoon vessels in the Strait of Messina (14 vessels). All the vessels over 24 m fishing for tunas are registered by ICCAT. Originally, there was a huge fleet of pelagic driftnet vessels, able to get important catches of swordfish and albacore, but all the drift-nets were banned by the EU Countries since 1st January 2002, even if it is known that some driftnet fishery is still illegally carried out. The fishing activity is carried out all the year round, but it changes according to the target species and the local habits. In Greece, from October to January it is forbidden to catch and sell swordfish (PD 87/1987).

Target species are Thunnus thynnus, Thunnus alalunga, Xiphias gladius, Euthynnus *alletteratus*, *Auxis thazard*, *Auxis rochei*, *Sarda sarda* and other tuna and tuna-like species. Regulation made by the ICCAT includes bluefin tuna catch quota, closed areas and seasons for specific gear and vessels, the prohibition to use aircrafts in June and size limits for the bluefin tuna. ICCAT and GFCM also adopted the driftnet ban. The EC also issued several regulations, including the maximum length for pelagic long-lines. Other regulations exist at a national level. Recently, tuna farming has been developed as a new activity in many Mediterranean countries and ICCAT had already issued some regulations. This is mostly an economic activity for fattening wild bluefin tuna and selling them to the Japanese market at the highest price, but it is causing many management and data problems.

2.1.4. Small scale fisheries

Small-scale fisheries are very important all over the Mediterranean. Their significance varies among countries. The inshore fisheries are targeting a high number of species. Many vessels shift metier during the same year. The allocation of the effort to fishing gear used or to a single target species is extremely difficult. The recreational and subsistence fishing activities are another relevant part of such a difficulty. The available data on catch and size composition, discards etc. are very poor, sporadic and geographically restricted. For important species (e.g. lobster) there are almost no data.

The inshore fisheries are much more species selective than bottom trawl and some of them can be characterized as single species metiers (e.g. *Pagellus bogaraveo*). Although these gears are selective for small sized species, for large sized species (e.g. *Dentex dentex*) the selectivity is significantly reduced. In addition, compared to towed gears, the inshore fishing gears can

usually operate on any kind of substrate and consequently there are no natural shelters for the target and for the by-catch species. Some stocks have collapsed locally (e.g. *Pagellus bogaraveo*, *Polyprion americanum*) under the exploitation of small-scale fishing gears.

Trammel net is one of the most important gears of the inshore fishery. This gear is used all over the year in nearly all the places. There are different kinds of trammel net defined by technical characteristics and according to target species. Some metiers are dispersed almost throughout the Mediterranean, whereas others have only a local interest. Target species of the trammel nets are: *Mullus surmuletus, Merluccius merluccius, Penaeus kerathurus, Solea solea, Diplodus sargus, Mullus barbatus, Pagellus erythrinus, Dentex dentex, Sepia officinalis* and other Sparidae species.

Gill nets are very common fishing gears of the inshore fishery fleet. The extent of the gear's use changes from port to port. In some places it is used all over the year while in other places it is used during short time periods. Some of the target species in the gill net fisheries are: *Mullus barbatus, Mullus surmuletus, Boops boops, Caranx sp., Pagellus erythrinus, Sarda sarda, Solea solea, Sparidae, Scomber scombrus, Scomber j. colias, Sphyraena sphyraena, Merluccius merluccius* and *Atherina hepsetus.*

Bottom long-lines are used throughout the Mediterranean Sea. The technological features, the length, the fishing period and the depth vary according to the target species. For species of the Sparidae family fishing takes place along the coast with long-lines equipped with small hooks, for hake in depths between 300 and 600 m and for sharks in depths down to 1000 m. The most common target species are: *Dentex dentex, Diplodus sargus, Pagellus erythrinus, Sparus aurata, Pagrus pagrus, Merluccius merluccius, Epinephelus spp., Anguilla anguilla, Conger conger, Mustelus spp*.

Various other gears as traps, pots, fyke nets, surrounding nets, boat purse seines (on derogation), hand dredges, small towed dredges (e.g. gangue, on derogation), harpoons, jiggling hooks, troll and hand lines etc., targeting mullets, octopus, Norway lobster, cuttlefish, squids etc., have local interest in many Mediterranean areas.

2.1.5. Hydraulic and towed dredges

Hydraulic dredges are used for clam fishing in Italy, a practice mostly based in the Adriatic Sea. This type of fishing is strictly regulated and aims to collect mostly *Chamelea gallina.* The regulations in force allow a fixed number of licenses for each port of registry. In Spain towed dredges are used for clam fishing. In Greece some vessels are using dredges targeting to bivalves (e.g. *Chamelea gallina*, *Venus verrucosa*, *Callista chione*).

3. CONSISTENCY OF FISHERIES DATA TO BE MADE AVAILABLE THROUGH THE NEW DCR AFTER 2008 AND THE DATA SEGMENTATION DEFINED IN GFCM

The SGMED-08-01 concluded that the DCR and its fleet segmentation defined for 2009 and onwards largely fits the fleet segmentation of the GFCM and thus support management of Mediterranean living resources. Gear including mesh size, vessel size and area definitions are found consistent with such requirements. Minor inconsistencies should be resolved in the GFCM segmentation during the SCSI/SCESS/SCSA workshop on fleet segmentation in order to improve the GFCM definitions in terms of gear specification.

Sampling lists of species in the DCR and the GFCM requests are considered consistent. Biological parameters will be recorded for both landed and discarded catch portions for the defined fleets and their métiers. SGMED-08-01 recommends that all future data collection should be designed to be fishery based rather than stock based. Market samplings have been indicted problematic by an ICES workshop. Consequently, sampling effort on board the fishing vessels should be given highest priority for most of the species. Furthermore, SGMED-08-01 indicated problems with the historic landings data officially reported due to inconsistent area classifications (FAO Sub-areas), which can not be subdivided into the GSAs (geographical sub-areas defined by GFCM). Logbook data bases do not include boats ≤10 m and landings by species below 50 kg or, more recently, below 15 kg. However, landings data from such fleets are estimated through the DCR or national scientific programs applying certain assumptions. The experts noted that landings and effort data are often not GSA specific (PGMed 2008). SGMED-08-01 recommends that all landings of target species of the various métiers being recorded and reported (implication=amend logbook data regulation for the Mediterranean). SGMED-08-01 expressed that more accurate catch data are highly needed for the purpose to estimate the fishing effects on the Mediterranean fishery resources.

As concerns the economic data, first of all, it should be clarified some terminology, since sometimes both terms (variable and indicator) have been used indistinctly and may create some confusion.

- Variable: by (economic) variables they are understood the parameters to be requested by the data collection schemes (both at DCR and GFCM levels). Even at the GFCM the parameters to be collected are named indicators.
- Indicator: by (economic) indicators they are understood the parameters to be calculated using the requested variables.

Next, there are compared the economic variables to be collected under the GFCM (Task 1.3) and the new DCR. The economic variables recommended being collected under the GFCM and the new DCR are detailed in ANNEX II. Comparing both sources, GFCM and the new DCR, the variables are similar and have no major incompatibilities. However, as a general rule, the new DCR is demanding economic variables at higher level of detail and they are more precisely defined (due to a more similar economic frame).

Some economic variables to be collected under the GFCM do not appear on the economic variables to be collected under the new DCR, as they are considered as transversal variables (variables of interest for both biologic and economic issues). While other economic variables to be collected under the new DCR do not appear on the economic variables to be collected under the GFCM, as they belong to other Tasks than Task 1.3.

Main divergences are:

- Employment: the GFCM requests the total number of people employed on fishing vessels belonging to the given Fleet Segment, allowing the possibility to estimate them on a full time equivalent (FTE) basis. While it in the new DCR is required to obtain economic variables for the Engaged crew and its value on FTE for both the EU level (with a 2000 hours a year threshold) and national level (to be set by each country if wanted).

- Wages and salaries of crew: while the GFCM requests for the salary share, which is the percentage of the revenues for the crew (after discounting commercial costs, daily costs and fuel costs), distributed as salary. The new DCR asks for the labour costs compounded by the actual payments to vessel crew, together with the imputed cost of the labour of the vessel owner and relatives if applicable (where this is not included in actual crew payments) and should also consider social security payments.
- Variable costs: at the new DCR the variable costs are required on a year basis, while at the GFCM the variable costs are required by fishing day per vessel. Fuel, repair and maintenance costs are not included in the new DCR variable costs parameter, as they are considered independently. It is not specified if repair and maintenance costs are included in the variable costs at the GFCM level. Both GFCM and STECF are working to establish which costs should be included on the list, so certain degree of cooperation in their elaborations would be desirable.
- Fuel costs: at the new DCR the fuel costs are required as a total amount, while at the GFCM the energy costs are required as a percentage of total variable costs.
- Fixed/Non-variable costs: at the new DCR the fixed (non-variable) costs are required on a year basis, while at the GFCM the fixed costs are required by fishing day per vessel. The GFCM parameter refers that this amount is inevitable to pay, while the new DCR does not consider it inevitable as it can also consider leased equipment. Both GFCM and STECF are working to establish which costs should be included on the list, so certain degree of cooperation in their elaborations would be desirable.
- Vessel value: at the GFCM the vessel value (for the total Fleet) is defined as present value of the total invested capital (value of hull, engine, gear and equipment) allowing using the replacement-value method to estimate this parameter (in current year local currency), while the new DCR estimate should be based on the methodology from the Evaluation of the Capital Value, Investments and Capital cost in the fisheries sector (Study N° FISH/2005/03) and detailed in the National Plan.

Effective fishing effort measures are proposed in GFMC 2007 recommendations. However, the issue of appropriate effective fishing effort units is still under consideration. The experts noted that the DCR defined the kW*days as a measure of nominal effort across all fleets. While this measure is quite useful for the economic analysis, the experts noted that other parameters are necessary to better assess some fisheries or métier (e.g.: length of the net for gillnets, number of hooks for longlines, number of pots, etc.). As no major incompatibilities have been found between both sets of variables, next there are identified and compared the socio-economic indicators at the fleet level used by STECF and GFCM.

The STECF has not established the socio-economic indicators to be used. Notwithstanding, some recent meetings have focus on the identification of useful indicators for management purposes. SGRST-07-05 and SGECA/SGRST-08-01 (follow-up to SGECA-SGRST-07-02) were required to identify quantitative indicators to improve the qualitative assessment of the balance between fishing capacity and fishing opportunities either at Member State or at the Commission level. Results from these two meetings recommended to use two economic (Return on Investment and Ratio between Current Revenue and Break-Even Point) and two social indicators (Average Wage per Full-Time Equivalent and Gross Added Value). The specifications of all the indicators are detailed on ANNEX III.

On the other hand, even that at the 25th Session of the GFCM (September 2000) it was recommended to the SCESS to develop and use homogenous socio-economic indicators in each of the GFCM management units; at the GFCM level there is not an official list of socio-economic indicators to be estimated and then, different case studies (most of them funded by COPEMED and ADRIAMED) are using different sets of indicators.

Comparing both sources of socio-economic indicators, it can be seen that "Return on Investment" as it is used by the STECF working groups is the same indicator of the GFCM called "Profit Rate". The only concern on this indicator strikes on the fact that opportunity cost may be undesirable included in the calculation. The "Ratio between Current Revenue and Break-Even Point" used by the STECF working groups does not appear among the GFCM's socio-economic indicators, but could be easily calculated by the requested variables. The "Average Wage per Full-Time Equivalent" used by the STECF working groups and the "Average Wage" by GFCM are similar, but the former is considering the employment on a Full-Time Equivalent basis, while the latter does not specify this issue. Finally, "Gross Added Value" is identically defined by both GFCM and STECF working groups.

Again, no major incompatibilities have been found between the definitions and the calculations of economic indicators at the GFCM and STECF working group levels.

Thus, no major incompatibilities have been found between both sets of economic variables and indicators, and then a major concern is related to the possible comparability between fleet segments obtained using different segmentations (GFCM and DCR).

Hence, SGMED-08-01 acknowledges the importance of socio-economic indicators to monitor the evolution of various fisheries and support their sustainable management. SGMED-08-01 recommends the compilation of socio-economic indicators previously obtained in the area and encourages its further gathering and analysis. The experts note that GFCM has defined but not yet requested economic parameters being reported or evaluated.

4. REVIEW OF STOCK ASSESSMENTS

The subgroup reviewed stock assessments of priority species presented to the FAO General Commission of Fisheries of the Mediterranean and evaluated the different assessment methods and empirical approaches used in these assessments. The priority species were chosen in accordance with the priority list of GFCM and DCR species mainly reflecting their commercial interest.

4.1. Available assessments

Considering the combinations of countries, divisions in Geographic Sub-areas and species, the number of available assessments is very low and based on many different approaches (see Tables 4.3, 4.4.1-3 and Annex VI). Most of the assessments that have been conducted are from the western Mediterranean and the Adriatic. It is worth mentioning that there are large areas where no assessments are available so far. In the last years, some improvements in the assessment methodology applied have been observed.

A number of reasons may explain this modest number of assessments. Thus, contributions presented to the GFCM-SCSA (Sub-Committee Stock Assessment) working groups were for

different reasons considered by GFCM-SAC not proper assessments but assessment-related studies. Moreover, several countries seldom or never attended the SAC meetings. In other cases, it seems there was no interest to present assessments in an international forum. SGMED-08-01 remarks that information available in certain areas does not permit the performance of analytical assessments. Finally, some assessments were not presented during SAC meetings, but in other fora or independently published on scientific journals. For instance, assessments of small pelagics presented in 2000 in the SCSA meeting in Fuengirola, Spain, were later not discussed at the level of SAC.

The subgroup stressed that assessments presented in SAC-GFCM meetings are not systematically evaluated in terms of methodology and reliability of data. SAC-GFCM has developed a comprehensive set of forms for each assessment, to be filled with basic and elaborated information on the species/specific fisheries. The forms include information on catch, the related demographic structure, sets of biological parameters, time series of abundance indices proceeding from commercial catch assessments or from surveys, etc. This information is potentially very important in order to understand the quality of basic data used for the assessments and results. However, these forms are seldom filled completely, and it is therefore difficult to evaluate the reliability of the assessments.

4.2. General comments on data collection and methods suitable for the stock assessment in the area.

After the analysis of the current state of the art, SGMED-08-01 decided to analyse the assessment approaches performed in recent years in the area and to define their suitability according to the available data (in particular regarding the information potentially derived from the DCR), the main assumptions of the models, parameters and reliability of results. A short list of species, considered commercially important and representative of different life strategies (i.e. short living-long living) as well as taxa (fin fish, crustaceans) was defined. Red shrimps, Norway lobster, red mullet, European hake, sardine, anchovy and deep-water pink shrimp were selected as the species to give a major attention in this first phase.

A summary of the methodological approaches used in the last 5 years by species and area can be found in Tables 4.3 and 4.4.1-2. Table 4.4.3 includes also comments and recommendations made during the SAC-GFCM working groups. Inconsistencies between diagnosis of stock status and recommendations may be observed in some cases.

Table 4.3 describes the feasibility of the more frequently used methods for stock assessment in the Mediterranean as regards the quality of data collected in the frame of the DCR.

During the discussion, it was possible to identify many problems related to the data collection, which are able to create difficulties for the performance of stock assessments in the area. Specific problems are often related to some group of species and their behaviour. Finally, some considerations on the need to face the ecosystem based approach and the use of biological indicators that may be related to the level of exerted fishing pressure are included.

A brief description of the main characteristics of the stock assessment methods used in the Mediterranean is presented below. A more detailed description is given in Annex V.

The choice of the methods is highly dependent on the available information in each area. In some areas, national or local institutions started their own data collection of commercial fishing activities or conducted scientific surveys well before the enforcement of the national programs in the frame of the DCR. This allowed to have information of demographic structure of the catch, total catches, fishing effort, etc., and to utilize in such areas some approaches as VPA, XSA or Surplus Production Models. In the other areas or countries, only recently time series are becoming long enough in order to allow the performance of such approaches. Considering the fact that in many areas fisheries dependent information was absent or incomplete or time series were too short, many attempts to use surveys information for a preliminary assessment of stock status were done. In some cases, LCA was used with commercial data of only 2 or 3 years assuming equilibrium, in other cases Y/R approaches with parameters derived from scientific surveys were adopted.

4.3. Stock assessments of demersal species

The issue related to the identification of stocks in the Mediterranean was discussed. A few data on the population structure of the main commercial species are available so far. This reduces the possibility of defining the geographic boundaries of the main stocks and to carry out assessments on an appropriate spatial scale. Assessments are currently carried out on the FAO geographic-sub area level (GSA).

Frequency and periods of trawl surveys many times preclude the detection of certain phenomena (as time schedules for spawning or recruitment) or the proper quantification of the abundance of the individuals in certain phases of life. Often only one scientific cruise is performed each year. However, trawl survey data (Medits project) represents the longer time series of standardized data on fishery resources available in the Mediterranean. Standardized data have been collected since 1994 in most of the GSAs. An attempt of implementing a standardized methodology for the assessment of fishery resources using these data was carried out within the SAMED program (SAMED, 2002).

Routine data collection, in particular of fisheries dependent data, started in most of the countries in recent years (2002-03) and the lack of long time series precludes the utilization in most of the areas of many widely utilized assessment approaches as VPA. Moreover, information is representative only of situations in which most of the stocks were already full or overexploited. The absence of information of previous situations of lower fishing pressure and such data characteristics 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.

The lack of precise information of real effort directed to each stock by fishing strategy and vessels's structural category in the current DCR does not allow the use of certain assessment models based on such kind of information.

Most of the information on demographic structure of the numbers at sea or commercial catch is structured by size. While this is unavoidable for species that do not have hard structures suitable for age reading, in the Mediterranean seldom this is done also in the case of bonefish.

Notwithstanding that some doubts on the suitability of size structured assessment approaches have been posed, participants noted that age reading is also difficult for some species (e.g.: hake, red mullet) and some times age readings are completely unreliable. The slicing procedures for assign ages in size distributions should also be used carefully since it can add bias in estimations of numbers at age.

It has also been noticed that growth parameters for some species from various areas differ too much and it has been stressed the necessity of performing a deep discussion at regional level in order to define (when possible) common sets of growth parameters. This action should be potentially useful for making results of assessments performed in different areas (GSAs) more easily comparable.

More explorations on the relationships between environmental parameters and recruitment success, mortality and abundance in the Mediterranean seem necessary in order to better understanding the causes of changes in abundance, that are hardly explained by fishing activity. It has been highlighted that many Mediterranean species (especially the short living ones) are very exposed to these environmental variables. Shrimps are good examples of such variations in abundance.

Several species are exploited in the area as part of multispecific mixes and often the same species is exploited with different gears other than by the semi-industrial fleets (e.g.: by the small scale fisheries) that may remove different fractions of the age structure of the stocks. Considering that these removals may be significant, fairly complex sampling schemes are necessary for a proper reconstruction of size/age structure of the catch. Moreover, fishers used to put in the same box several species that have similar market price, making it even more difficult and expensive to collect suitable samples for a good reconstruction of demographic structure of the whole catch. Discards are also difficult to quantify.

Table 4.3. Assessments presented for demersal species in SAC-GFCM by GSA, year and method.

N. norvegicus	GSA	DIRECT METHODS (Trawl-surveys)				INDIRECT METHODS (Landing surveys)					
		empirical	model-based								
			CPM	B&H	T&B	LCA	VPA	XSA	Y/R	PM	SSR
N Alboran	1										
S Alboran	3										
Balearic Islands	5										
N Spain	6	2002									
Gulf of Lion	7	2002									
Corsica	8	2002									
Ligurian and northern-central Tyrrhenian	9	2002			2002	2002					
Central-southern Tyrrhenian	10										
Sardinia	11	2002									
Malta	15	2002									
Sicily	16	2002									
North Adriatic	17	2002									
SouthAdriatic	18	2002									
Western Ionian	19										
Eastern Ionian	20	2002									
Aegean	22	2002									
Crete	23										

CPM=Composite Production Model

A. antennatus	GSA	DIRECT METHODS (Trawl-surveys)				INDIRECT METHODS (Landing surveys)					
		empirical	model-based								
			CPM	B&H	T&B	LCA	VPA	XSA	Y/R	PM	SSR
N Alboran	1					2002, 2003	2004		2002, 2003, 2004		
S Alboran	3					2004			2004		
Balearic Islands	5					2002, 2003	2004	2004, 2005, 2006	2002, 2003, 2004, 2005, 2006	2003	2007
N Spain	6					2002, 2003	2004	2004, 2005, 2006, 2007	2002, 2003, 2004, 2005, 2006, 2007		
Gulf of Lion	7										
Corsica	8										
Ligurian and northern-central Tyrrhenian	9										
Central-southern Tyrrhenian	10										
Sardinia	11										
Malta	15										
Sicily	16										
North Adriatic	17										
SouthAdriatic	18										
Western Ionian	19										
Eastern Ionian	20										
Aegean	22										
Crete	23										

Table 4.3 (cont.). Assessments presented for demersal species in SAC-GFCM by GSA, year and method.

A. foliacea	GSA	DIRECT METHODS (Trawl-surveys)				INDIRECT METHODS (Landing surveys)					
		empirical	model-based								
			CPM	B&H	T&B	LCA	VPA	XSA	Y/R	PM	SSR
N Alboran	1										
S Alboran	3										
Balearic Islands	5										
N Spain	6										
Gulf of Lion	7										
Corsica	8										
Ligurian and northern-central Tyrrhenian	9										
Central-southern Tyrrhenian	10										
Sardinia	11			2002, 2004							
Malta	15										
Sicily	16										
North Adriatic	17										
SouthAdriatic	18										
Western Ionian	19										
Eastern Ionian	20										
Aegean	22										
Crete	23										

P. longirostris	GSA	DIRECT METHODS (Trawl-surveys)				INDIRECT METHODS (Landing surveys)					
		empirical	model-based								
			CPM	B&H	T&B	LCA	VPA	XSA	Y/R	PM	SSR
N Alboran	1										
S Alboran	3					2003, 2004			2003, 2004		
Balearic Islands	5										
N Spain	6					2006, 2007		2006, 2007	2006, 2007		
Gulf of Lion	7										
Corsica	8										
Ligurian and northern-central Tyrrhenian	9										
Central-southern Tyrrhenian	10										
Sardinia	11										
Malta	15										
Sicily	16										
North Adriatic	17										
SouthAdriatic	18										
Western Ionian	19										
Eastern Ionian	20										
Aegean	22										
Crete	23										

4.4. Stock assessment for Small Pelagics (Anchovy and Sardine)

The population dynamics and assessment of small pelagic species are conditioned by their particular biology: they are in general short-living species (usually up to 3-4 yr for anchovy and up to 6-7 yr for sardine), their exploited populations are dominated by the strength of the generation born each year (recruitment) which may represent more than 50% of the biomass of the stock and the fishery is mostly dependent on the first age classes. There are large inter-annual fluctuations in recruitment and eventually in population abundance and recruitment can be strongly affected by environmental conditions. Fishing pressure on all the stock components (fry and adults) is also very important and data on fry fishery are usually very poor, when existing. Thus, precautionary approach should be adopted, since few years of poor recruitment can reduce the stock suddenly and even dramatically.

Recognizing the significant influence of environmental factors on small pelagic fish recruitment, and giving the fact that they are "prey species" for large number of predators, it might be suggested to take into consideration also the Ecosystem Approach to fisheries management.

Tuned Indirect Methods have shown to be suitable to assess sardine and anchovy stocks. VPA, XSA and ICA should be preferred to LCA, as this last method assumes a steady state. However, at the present time, data from DCR do not provide long time series so that LCA could be still needed; anyway, long time series started before DCR and useful data for VPA (both catch and age and acoustic) do exist in some GSAs in the Mediterranean Sea.

A useful biological reference point based on the exploitation rate F/Z can be derived from indirect methods. On the basis of the analysis performed by Patterson (1992), when the exploitation rate F/Z is higher than 0.4, stocks have a relatively high probability of decline. Such a probability is particularly high when F/Z is over 0.5. On the contrary, a value of F/Z under 0.3 is compatible with increasing stock abundance and is associated to a relatively low risk of decline.

Direct Methods (both Acoustic and/or Daily Egg Production Method) are particularly useful for assessing these stocks since they provide direct estimates of biomass/SSB that are used to tune analytical methods. These direct methods must be also standardized. Often only one scientific cruise is performed each year in some areas.

Confidence in the assessment in relation to the current status of the stocks exists. In fact, direct and indirect methods, carried out in same study area, can provide similar trends of the relative stock abundance and/or the same perception of the state of the stocks. This is the case of the small pelagic stocks assessed in the Mediterranean with the analytical methods applied like VPA and XSA.

However, there is no faith in predictions about the future status of the stocks unless an indicator of the recruitment strength is available. Indicators of the strength of the incoming year class are of large importance for these species. They may come from two different sources: surveys targeting recruits or improved stock-recruitment relationships using environmental indexes. 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.

It has also been noticed for small pelagics that growth parameters are often too different and it is necessary of perform a deep discussion at regional level in order to define (when possible) common sets of growth parameters. This action is useful for making the results of assessments performed in different areas (GSAs) comparable among them.

Table 4.4.1. Assessment carried out for small pelagic species in the Mediterranean Sea by GSA, year and method.

SARDINE	GSA	DIRECT METHODS		INDIRECT METHODS				
		Acoustic	DEPM	LCA	VPA	XSA	ICA	AMCI
N Alboran	1	Since 90s		2004		2007		
N Spain	6	Since 90s		2004		2007		
Gulf of Lion	7	Since 90s						
Malta	15	Since 2004						
Sicily	16	Since 1998						
Adriatic	17	Since 1976 (W) / 2002 (E)			Since 90s	2008		
Adriatic	18	Since 1987 (W)						
Ionian	20		2001					
Aegean	22	2002	2000					

ANCHOVY	GSA	DIRECT METHODS		INDIRECT METHODS				
		Acoustic	DEPM	LCA	VPA	XSA	ICA	AMCI
N Alboran	1	Since 90s		2004				
N Spain	6	Since 90s	90-93-94-07	2004				
Gulf of Lion	7	Since 90s	1993					
Lig & Tyrr	9	1993	1993					
Malta	15	Since 2004						
Sicily	16	Since 1998	98-99-00					
Adriatic	17	Since 1976 (W) / 2002 (E)			Since 90s			
Adriatic	18	Since 1987 (W)	1994					
Ionian	20		1999					
Aegean	22	2003-2006	93-95-99-03-04-05-06				2007	

Table 4.4.2. Number of assessments by species and year and main comments and recommendations made during the SAC-GFCM working groups. There can be noticed some inconsistencies between diagnosis of stock status and recommendations.

Species	Assessments/Years							Comments and recommendations
	2001	2002	2003	2004	2005	2006	2007	
Boops boops	1							F, Keep fishing effort at current level.
Engraulis encrasicolus	3	6	3	3	5	7	7	Risk of recruitment-overfishing. Set minimum legal size to that of 1st maturity. Low biomass. Moderately exploited.
Dentex dentex							2	not to increase the effort
Diplodus annularis	3							F
Lophius budegassa							1	Preliminary, no management advice
Merluccius merluccius	4	16	3	3	4	3	3	O, growth-overfishing, risk of recruitment overfishing. Reduce effort. Improve trawl selectivity. Temporary nursery areas closures.
Mullus barbatus	3	13	2	4	1	1		O-F, Coastal zone closure for protection of juveniles. Use of artificial reefs. Seasonal closure. Reduce effort. Enforce current management measures. Risk of recruitment overfishing.
Mullus surmuletus				1	1	1	4	F
Pagellus erythrinus	3							F
Pomatomus saltatrix				1				
Sardina pilchardus	3	5	4	5	5	5	7	O-F, not to increase the effort. Decreasing biomass. Decreasing catches. Stable stock. Fully exploited-Overexploited.
Spicara smaris					1			Moderately exploited
Scomber japonicus						1		Not defined
Sprattus sprattus						1		Not defined
Solea solea							1	Fully exploiteed, Intermediate abundance, Exploitation rate: uncertain/not assessed
Trachurus trachurus	1		1			1		F, Keep fishing effort at current level.
Mixed pelagic stock (anchovy, sardine and sprat, etc)					1	3		Fully exploited-Overexploited.
Aristeus antennatus	2	3	3	3	2	2	1	O-F
Aristaeomorpha foliacea		1		1				F
Nephrops norvegicus	1	11						F, Technical improvement of gear to avoid capture of small individuals. Reduce trawl doors effect on bottom.
Parapenaeus longirostris			1	1		1	1	U-F. Decreasing biomass trend
Total	24	55	17	22	20	26	27	

Table 4.4.3. Feasibility of each of the more frequently used methods for stock assessment in the Mediterranean as regards the quality of data collected in the frame of the DCR.

Method	Required data collected under DCR
Surplus Production models with commercial data	Not enough detailed info on effort directed to a given species or species assemblage is present
VPA or XSA	Yes
Y/R, B/R, SSB/R	Yes
Biomass assessment with echo surveys for small pelagic fish	Partially. Some of the surveys are included in the extended program of DCR Note: Research surveys are required under EC Regulation No. 1543/2000 (see Article 4) and 199/2008
Daily Egg Production for small pelagic species	No Note: Research surveys are required under EC Regulation No. 1543/2000 (see Article 4) and 199/2008
SURBA	Yes
Simulations for B, SSB and yield forecast	Yes
Composite Surplus Production models with Z as a direct index of effort	Yes
LCA and Y/R	Yes
Indicators of fishing pressure on ecosystem	Yes

4.5. Data needs for future stock assessments

The group described the main approaches that have been utilised and their main strengths and limits, the existence of data gaps by checking if data needed are already included in the requests of the DCR, the biological reference points that may be generated by the model, level of precaution, and the software available for the application of the approach. A series of tables, including a brief description of the models, data need in input and output produced have been included in Annex V.

For the future meetings, alternative and/or integrated approaches are planned to be tested in order to evaluate their performances, 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, 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 the future exercises, formats for the presentation of basic data necessary for the assessments with the different methods were prepared. The formats for each approach are positioned just after the description of the main features of each method.

For the evaluation of the suitability of different methods based on the fisheries characteristics and availability of data in the area it is necessary that information be furnished as complete as possible in order to allow the planned analyses. Considering that methods potentially useful for rough or sound assessments of the stock status need of a variety of information, it is not advisable to make a priori reduction of the data that should be asked to furnish, especially

when these data are already available in each country in the frame of the DCR and, therefore, no supplementary effort is necessary for providing information in such format. According with the ToRs of the meeting, the logic process is first the identification of the tools that we intend to evaluate their performance and only after to define the set of data that will be asked countries to provide. It is considered necessary that information on size and age structure of the commercial catch be separated by gear. Moreover, it should be advisable that size frequencies be separated by sex in order to allow proper slicing procedures and to avoid errors in the successive analyses. It is unlikely that the same approach will be immediately followed by all the countries and GSAs and hence it is considered necessary to define a fairly wide set of potential methods with different degrees of complexity in order to allow all countries to proceed at least with some kind of assessment.

4.6. Empirical Indicators

The Sub-Group emphasized for the future meetings alternative approaches to be tested in order to evaluate their performances, 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, 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 the future exercises, formats for the presentation of basic data necessary for the assessments with the different alternative methods were prepared. The formats for each approach are positioned just after the description of the main features of each method (Rochet et al. 2005; Shin et al. 2005; Massutí and Moranta 2003).

Among others, the following biological indicators are suggested:

Single species indicators:
- total standardized abundance and biomass;
- recruitment index; mean body length (excluding the recruits);
- distribution and extension of spawning areas.

Community indicators:
- total abundance;
- abundance of commercial species;
- ratio between biomass of pelagic and demersal species;
- abundance of elasmobranches;
- mean weight of fish,

BOI index;

diversity indexes;

(more details on indicators used in the Mediterranean: MEDITS 2007; FAO-ADRIAMED 2005).

5. RECOMMENDATIONS

5.1. Specific data requirements and data calls for future SGMED meetings

SGMED-08-01 noted that logbook data in the Mediterranean Sea was generally criticized because of its unreliability and it was suggested to use the landings information given by the alternative expert systems developed in various regions. SGMED-08-01 discussed the need of reviewing of all official and scientific sources of landings and catch estimates. The subgroup emphasized that it should be in the responsibility of the scientific subgroup to review the landings and catch information and to propose landings and catches figures in accordance with the best scientific estimate available for the purpose to best estimate the fishery impact on the Mediterranean fishery resources.

The experts of the subgroup recommended the provision of the fishery effort and landings data in the segmentation defined below in advance of the follow-up meeting SGMED-08-02. The subgroup emphasized that the motivation to compile this data is to express the active scientific cooperation within SGMED and its ability to summarize and evaluate detailed fishery information (Table 5.1).

For SGMED-08-02 any indicator assessments for estimation of fishery impacts (probably requires a special subgroup) should be made available in the format of TA (station specifics) and TB file (abundance and biomass by station and species) defined for the Medits – survey covering the years 1994-2006 by GSA.

Table 5.1. Data base definitions regarding effort and landings by certain fleet identifications according to level 4 of the future DCR (Annex IV) for hake, red mullet, anchovy and sardine.

Gear specific fishing effort data:
Level 1, Fishing activity: active
Level 2, Gear classes: dredge, trawl, hooks_line, trap, net, seine, other, misc
Level 3, Gear groups: dredge, bottom_trawl, pelagic_trawl, rod_line, longline, trap, net, surrounding_net, seine, other, misc
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: 1-28
Year: 2006
Nominal effort: kW*days at sea

Gear specific landings data:
Level 1, Fishing activity: active
Level 2, Gear classes: dredge, trawl, hooks_line, trap, net, seine, other, misc
Level 3, Gear groups: dredge, bottom_trawl, pelagic_trawl, rod_line, longline, trap, net, surrounding_net, seine, other, misc
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: 1-28
Year: 2006
Species: Hake, Red Mullet, Anchovy and Sardine
Landings: t
Length (unit according to DCR), No. raised to landings

In addition, the SGMED-08-01 proposed to undertake trial assessments for selected Mediterranean stocks during the SGMED meetings 08-03 and 08-04, e.g. hake, red mullet, anchovy and sardine. Given the poor stock definitions of these shared stocks, supporting data from the DCR should be officially called for all GSAs. In addition, all national data bases which can contribute to the trial assessments should be made available.

The experts identified a list of data required to apply relevant assessment methods (Table 5.2):

Table 5.2. Data required for stock assessment.

1. Annual national landings (t) by species, GSA for the longest time period possible including 2007
2. Annual national discards (t) by species, GSA for the longest time period possible including 2007
3. LPUE and CPUE (preferably standardized) series by species from well defined commercial fleets by GSA
4. LPUE and CPUE (preferably standardized) series by species at age from well defined commercial fleets by GSA
5. LPUE and CPUE (preferably standardized) series by species at length from well defined commercial fleets by GSA
6. Annual international or national standardized survey catch rates (kg) and numbers at age (abundance indices) or acoustic abundance estimates if available for the longest time period possible including 2007 by GSA
7. Annual international or national standardized survey catch rates (kg) and numbers at length (abundance indices) if available for the longest time period possible including 2007 by GSA
8. Mean weight at age (kg) by species from the scientific surveys
9. Landings by year at age (000) by species, nation, GSA for the longest time period possible including 2007
10. Discards by year at age (000) by species, nation, GSA for the longest time period possible including 2007
11. Landings at length (000) by species, nation, GSA for the longest time period possible including 2007
12. Discards at length (000) by species, nation, GSA for the longest time period possible including 2007
13. Annual mean weight at age (kg) by species from the commercial landings for the longest time period possible including 2007
14. Annual mean weight at age (kg) by species from the discards for the longest time period possible including 2007
15. Maturity ogive (at age) by species from the surveys or commercial landings for the longest time period possible including 2007
16. Maturity ogive (at length) by species from the surveys or commercial landings for the longest time period possible including 2007
17. Growth parameters by species, sex and GSA
18. Length-weight relationships per species, sex and GSA

SGMED-08-01 strongly recommends a data call under the DCR be issued for standardized data covering all fishery and related biological and economic data from the Mediterranean. The data should be delivered on an annual basis and be available to STECF by June each year. The data call should be issued to all member states having fishing activities in the Mediterranean. SGMED-08-01 recommends that the definition and segmentation of the standardized data call shall be elaborated during its follow-up meeting SGMED-08-02.

5.2. ToRs for SGMED-08-02

SGMED-08-01 recommends the following tasks to be considered in the ToRs of SGMED-08-02:

- Definition of the standardized official data call through DCR.
- Provision and evaluation of effort and landings data for 2006 as described above to be provided by the experts of SGMED-08-02.
- Any indicator assessments for estimation of fishery impacts (probably requires a special subgroup) should be made available by the experts of SGMED-08-02 in the format of TA, TB and TC files defined for the Medits – survey covering the years 1994-2006 by GSA.

- Exploration and provision of data availability to enable and, if possible to initiate trial assessment of hake, red mullet, anchovy and sardine during SGMED-08-03 and SGMED-08-04 as defined in Table 5.2.
- Continue of review of existing fish stock assessments of red shrimps, Norway lobster, red mullet, European hake, sardine, anchovy and deep-water pink shrimp in order to identify appropriate stocks and methods.
- Initiate assessments of demersal assemblages.
- Compilation and review of social-economic indicators previously obtained for the Mediterranean Sea.

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ANNEX II - ECONOMIC VARIABLES TO BE COLLECTED UNDER GFCM AND THE NEW DCR.

The SCESS (Sub-Committee on Economic and Social Sciences of the GFCM) recommended minimum indicators (variables) to be used within Task 1 (Report of the 8th Meeting of the SCESS in Kavala, Greece, September 2007). Resolution GFCM/2007/1 on the implementation of GFCM Task 1 Statistical Matrix, agrees on the economic variables to be collected (task 1.3). Between the recommended variables by the SCESS and the ones adopted by the GFCM only fuel costs (% of V.C. from fuel costs) are missing.

These economic variables are defined on the following table.

Table 1: Economic components variables used at the GFCM

Data	Description	Sources
Gross Tonnage	Total gross tonnage of fishing vessels belonging to the given Fleet Segment.	Census
Horse Power	Total engine power of fishing vessels belonging to the given Fleet Segment.	Census
Employment	Total number of people employed on fishing vessels belonging to the given Fleet Segment. The number of crew members can be estimated on a full time equivalent (FTE) basis.	Surveys
Salary Share %	Percentage of the revenues (after discounting commercial costs, daily costs and fuel costs) that pertain to the crew. It will be distributed among the crew as salary.	Surveys
Landing weight	Total landings in weight. (tonnes live weight)	Auctions – Surveys
Landing value	The volume of landed fish valued against actual market prices. It equals to quantities landed multiplied by the landing average price (current year local currency)	Auctions – Surveys
Vessel value of total Fleet	This is defined as present value of the total invested capital - value of hull, engine, gear and equipment. The replacement-value method can be used to estimate this parameter (current year local currency).	Surveys
Fishing days/year per vessel	Number of fishing days per year for each vessel (average).	Surveys
Fishing hours/day per vessel	Number of fishing hours per day (average) including the time of work in harbour preparing the trip, the trip and commercialization.	Surveys
Costs of fishing/day per vessel	These include daily expenses incurred in fishing activity, such as fuel, lubricants, etc. They are variable costs that depend on the time spent in fishing. (Completed list to be added).	Surveys
% of V.C. from fuel costs	The percentage of total variable costs from fuel costs	Surveys
Yearly fixed costs per vessel.	These comprise costs not directly connected with operational activity, such as non-routine maintenance, vessel insurance, taxes and dues, etc. The fixed costs are all the costs that are inevitable to pay yearly, independently from the time spent to fish. (Completed list to be added).	Surveys

While the SGECA 08-01 Report on the Proposal for Economic Parameters for the Fishing, Aquaculture and Processing Sectors to be Collected through the New Data Collection Framework

(Lisbon, January 2008) identifies and characterised the economic variables to be collected under the new DCR. These variables are shown on table 2.

Table 2: Economic variables for the new DCR

Variable group	Variable
Turnover	Gross value of landings
	Income from leasing out, quota or other fishing rights
	Subsidies
	Other income
Labour costs	Wages and salaries of crew
	Imputed value of unpaid labour
	Social security costs
Energy costs	Energy costs
Repair and maintenance costs	Repair and maintenance costs
Other operational costs	Variable costs
	Non-variable costs
	Lease/rental payments for quota or other fishing rights
Capital costs	Depreciation of physical capital
	Opportunity costs
Capital value	Value of physical capital: depreciated replacement value
	Value of physical capital: depreciated historical value
	Value of fishing rights
Investments	Investments in physical capital
	Net investments in permanent quota or other permanent fishing rights
Production value per species	Value of landings per species
	Average price per species
Financial position	Total equity
	Total liabilities (debt)
Employment	Engaged crew
	FTE National
	FTE European
Fleet	Number
	Mean LOA
	Mean GT
	Mean kW
	Mean age
Effort	Days at sea
	Energy consumption
Number of fishing companies	Number of fishing companies

ANNEX III - INDICATORS

STECF working groups socio-economic indicators

The **Return on Investment** (**ROI**) was the preferred economic indicator. It is measured as the ratio between profits (positive or negative) and the total capital invested for a given period. Normaly, this ratio is multiplied by 100, and then expressed as a percentage. This indicator is extremely important as it provides an indication on the profitability of the fishery and a good understanding of the economic performance of fishing vessels/segments.
The reference point for this indicator could be 0 or the interest rate (and/or previous years results).

- A result higher than 0 show that the fishery is profitable for the companies.
- A result lower than 0 show that the fishery is not profitable for the companies.

Alternatively, the **Ratio between Current Revenue and Break-Even Point** was chosen as a second best indicator. The Ratio between current revenue and break even revenue gives an indication of the economic sustainability of the fishing fleet. This break even revenue point is defined as the revenue point at which the gross cash flow equals the fixed costs. However, the problem with this indicator is that it is not useful in telling us whether the fishery is overcapitalised (it only identifies whether the fishery is overexploited). This ratio can be multiplied by 100, and then expressed as a percentage.
The reference point for this indicator could be 1 (and/or previous years results).

- When the indicator equals 1, then the break-even revenue point equals the current revenue.
- For values lower than 1, then the current revenue value is lower than the break-even revenue, so the current revenues cannot meet the fishing costs. Then, the activity is *not* sustainable at current conditions, so it presents signs of over-capitalisation.
- If the indicator is higher 1, the current revenue is higher than the break-even revenue point, implying that the activity is sustainable, as the current revenues are higher than the fixed and operating costs. However, as capital costs are not taken into account, when this indicator is below 1 it cannot be known whether overcapitalisation in the fishery is present or not.

While from a more social point of view the **Average Wage per Full-Time Equivalent** was found to be the preferred indicator. The reference point for this indicator could be the minimum wage on the country (and/or previous years results).

Alternatively, the **Gross Added Value** expresses how much the activity contributes to the Economy. The added value is expressed as income minus operative costs.
The reference point for this indicator could be 0 (and/or previous years results).

- A result higher than 0 show that the fishery is profitable for the society.
- A result lower than 0 show that the fishery is not profitable for the society.

Table 1: STECF working groups' socio-economic indicators and their formulas

Indicator	Abbreviation	Formula	Units
Return on Investment	ROI	(LV-((LV-VC)*SS) - VC-YFC-D))/IC	%
Ratio between Break-Even Point and Current Revenue	RBEPCR	LV-YFC	%
Gross Added Value	GAV	LV-VC-YFC	Money
Average Wage per Full-Time Equivalent	AWFTE	(LV-VC)*SS /FTE	Money

GFCM's main socio-economic (and technical) indicators

Technical indicators

- **Vessel Physical Productivity** (VFP), shows the average production of each vessel in terms of weight of landings.

- **Capacity Physical Productivity** (CFP), indicates average production in terms of weight of landings for each capacity unit (GT) of the vessels.
- **Power Physical Productivity** (PFP), shows the average production in terms of weight of landings for each power unit (HP) of the vessels.
- **Per vessel Hour Physical Productivity** (HFP), indicates the average production in terms of weight of landings for each full fishing hour. The total fishing time (T) results from multiplying the number of fishing hours by working days and then by the number of working days in one year (TD).
- **Man Physical Productivity** (MFP), shows the average production in terms of weight of landings for each man employed.

Economic Indicators

- **Capacity Productivity** (PGT), shows average production in terms of market value in the first sale for each capacity unit installed (GT) in the vessels.
- **Vessel Productivity** (PV), shows average production in terms of market value in the first sale for each vessel.
- **Power Productivity** (PP), shows the average production in terms of market value in the first sale for each power unit (HP) of the vessels.
- **Per Vessel Hour Productivity** (PVH), shows the average production in terms of market value in the first sale for each fishing hour.
- **Man Productivity** (MP) shows average production in terms of value in the first sale for each man used.
- **Invested Capital** (IC) shows the current value of the whole of the vessels. Invested capital is very difficult to measure in the Mediterranean Sea.
- **Opportunity Cost** (OP) shows the yields that the owner could obtain should he invest his money in National Debt instead of investing in his business. This means that the owner is relinquishing that potential income. There is a profit in its economic sense when the yields of the invested capital surpass the opportunity cost.
- **Gross Estimated Profit** (GEP), which indicates the total profits obtained by the whole of the vessel owners, once the operating costs have been deducted. Such costs include: Salary Cost (SC), Opportunity Cost (OP), Costs related to Fishing (CDxTD) and Yearly Fixed Costs (YFC). How to calculate CD and YFC is explained below.
- **Net Estimated Profit** (NEP), which shows the total earnings obtained by the whole of the owners, once the depreciation cost has been deducted from the GEP. This cost is calculated following the criterion that the shelf life of a vessel is 10 years. In fact, the shelf life of vessels is normally longer, but in that subsequent period repair costs equal the value of a new vessel.
- **Profit Rate** (PR), which indicates the percent ratio of yearly net profits plus the opportunity cost in relation with the investment. It should be borne in mind that this figure does not include the additional earnings obtained by the owner as an employee in artisanal fisheries.
- **Gross Added Value** (GAV), which expresses the Added Value that the segment in question contributes to the National Economy. This includes: salaries, profits, opportunity cost and depreciations.
- **Landing Prices** (LP) represents the average market price of landings per kilo.

Social indicators

- **Average Wage** (AW) indicates the average salary obtained by each man employed.
- **Salary Cost** (SC) indicates the fishermen's income. To measure the salary cost, we must bear in mind the parts in which landings of each kind of fleet are divided. This indicator tends to underestimate the actual figures, since fishermen usually keep a small part of landings as salary in kind. Often, in artisanal fisheries, each fisherman's earnings depend on his condition, i.e., whether he is a sailor (salary) or the owner (salary plus profits). For the purposes of making an economic analysis, we should make a distinction between the natures of each distinctive part of the income.

Next table summarizes main GFCM socio-economic indicators and their formulas.

Table 2: GFCM' socio-economic indicators and their formulas

Indicator	Abbreviation	Formula	Units
Vessel Physical Productivity	VFP	LW/N	Kg
Capacity Physical Productivity	CFP	LW/GT	Kg/GT
Power Physical Productivity	PFP	LW/HP	Kg/HP
Per Vessel Hour Physical Productivity	HFP	LW/T	Kg/hour
Man Physical Productivity	MFP	LW/E	Kg/man
Vessel Productivity	PV	LV/GT	Money
Capacity Productivity	PGT	LV/N	Money/GT
Power Productivity	PP	LV/HP	Money/HP
Per Vessel Hour Productivity	PVH	LV/T	Money/hour
Man Productivity	MP	LV/E	Money/man
Invested Capital	IC	VV*N	Money
Opportunity Cost	OP	IC*R	Money
Gross Estimated Profit	GEP	LV-SC-(CD*TD)-YFC-OP	Money
Net Estimated Profit	NEP	GEP-(IC/10)	Money
Profit Rate	PR	(NEP+OP)/IC	%
Gross Added Value	GAV	GEP+OP+SC	Money
Average Wage	AW	SC/E	Money
Salary Cost	SC	(LV-CD*TD)*SS	Money
Landing Prices	LP	LV/LW	Money

Where the data to calculate the GFCM and STECF working groups socio-economic indicators is detailed on next table.

Table 3: Basic data to build up the socio-economic indicators

Code	Data	Units
LW	Landings Weight	Tonnes
LV	Landings Value (current revenue)	Money
VC	Variable Costs (CD*TD)	Money
DC	Daily Costs (Variable costs by day)	Money
IC	Invested Capital (Total value of all vessels in the fleet)	Money
D	Depreciation: IC/life years	Money
YFC	Yearly Fixed Costs	Money
TD	Total Days	Money
SS	Salary Share	%
E	Fishing Sector Employment	People
FTE	Fishing Sector Employment on a Full Time Equivalent basis	People
R	Yearly interest rate	%
N	Number of vessels	Vessels
GT	Gross Tonnage (total)	GT
HP	Horse Power (total)	HP
T	Time in hours	hours
IR	Inflation rate	%

ANNEX IV - FLEET SEGMENTATION IN THE MEDITERRANEAN SEA (SGRN-SGECA 08-01 ANNEX IV TABLE).

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.

ANNEX V - STOCK ASSESSMENT METHODS

Biomass Dynamic Models

The state of some stocks has been evaluated using Non-equilibrium Surplus Production Model utilizing information from commercial catch.

assessment method	Surplus production model using fishing effort and total catch (software ASPIC). This program implements a non-equilibrium, continuous-time, observation-error estimator for the production model (Schnute, 1977; Prager, 1994).
strength	It allows an assessment of stock status through the use of commercial data on directed effort and catch. It allows defining the fishing effort or F corresponding to the Maximum Sustainable Yield. Different models (Schaefer, Fox, etc) can be hypothesized and checking quality of fitting. The software allows making yield forecasting and to derive precautionary target reference points facing to the intrinsic uncertainty that characterises the analysed processes and the observation errors. Time series of abundance proceeding from alternative sources can be included in order to improve the reliability of the results.
limits	More suitable for species that are exploited almost exclusively with a unique gear. It is necessary to have good data on effective effort directed to the considered species. Contrasting enough levels of effort are necessary for obtaining reliable results.
data need	Time series of catch and effort
RP and other outputs produced	K, r, q, f_{MSY} F_{MSY} F_{prec} f_{prec}, yield forecasting with confidence intervals
level of precaution	F_{prec} and f_{prec} are considered precautionary because they consider the probability of overestimation of the correspondent values at the MSY level.
Prediction capability	It allows to predict equilibrium yields at different levels of fishing pressure.

INFORMATION FROM COMMERCIAL CATCH
(for non-equilibrium surplus production models using commercial catch and effort) Minimal information needed for each species and area.

example 3:

YEAR	CATCH	EFFORT*
1995	234500	35600
1996	228900	34000
1997	I	I
1998	I	I
1999	I	I
2000	I	I
2001	I	I
2002	I	I
2003	I	I
2004	I	I
2005	I	I
2006	I	I
2007	I	I
2008	v	v

*Only the effort directed to the species in question has to be considered (some available fishery independent index of abundance can be potentially useful in order to improve the quality of results):

complementary information from surveys (if available)

YEAR	ABUNDANCE INDEX
1995	44.5
1996	40
1997	45.2
1998	49
1999	I
2000	I
2001	I
2002	I
2003	I
2004	I
2005	I
2006	I
2007	I
	v

Any other available information on fleets, gears used, target species, biological aspects of the single species, spatial distribution, selectivity of gears, species behaviour, changes in catches along the year, changes in target or on fishing strategy along time, etc. may be useful for an improvement of the study and for a critical analysis of results. For this reason, participants are invited to bring as major information as possible.

Composite Surplus Production Models

The state of some stocks has also been evaluated using Composite Surplus Production Model utilizing information from trawl surveys.

assessment method	Composite Surplus production model using Z as a direct index of effort
strength	It allows a preliminary assessment of stock status even when commercial information lacks or is partial. The model fit is done with the exclusive use of trawl surveys couples of data of Z and index of biomass. It allow to define the Z corresponding to the Maximum Biological Production and to compare the rates in the different areas with this reference point. Different models (Schaefer, Fox, etc) can be hipothesized and testing best fits The use of information proceeding from areas exploited at different rates fill the necessity of having enough contrast as regard exploitation status. Z considers removals produced by both fishing and due to natural causes. Surplus Prod. Models include intrinsically complex processes and relationships that are very difficult to modelize, but in this case that does not need to be defined nor to estimate their parameters.
limits	M is assumed constant for different levels of fishing pressure. Close to equilibrium conditions have to be hypothesised in each area. Similar evolution under changing fishing pressure is assumed for each of the included areas.
data need	Index of abundance and a Z estimate by each area
RP produced	Z_{MBP}
level of precaution	Z_{MBP} is considered more precautionary than the Z corresponding to MSY
Prediction capability	It allows to predict equilibrium yields at different levels of Z.

Information from different areas derived from trawl surveys		
Area	Z	U (index of biomass)
1	0.45	22.1
2	0.37	27.5
3	0.8	13.0
4	1.2	10.2
5	0.5	20
6	0.52	19.5
7	0.9	12.6

(Available information regarding operation areas of fleets targeting the studied species is useful for de definition of the limits of the areas exploited at different rates).

Simulation

assessment method	ALADYM (Age-Length Based Dynamic Model) is a simulation model, belonging to the group of dynamic pool models. It was developed within the EU FISBOAT project (Fisheries Independent Survey Based Operational Assessment Tools) and applied to different species outside and inside the Mediterranean. The model simulates population dynamics of a single species following the simultaneous evolution of several cohorts at monthly intervals and accounting for sex differences in growth, maturity and mortality. Stochasticity is implemented using a Monte Carlo approach.
strength	non-equilibrium approach; capability of working also in absence of fishery-dependent information; exploring alternative management strategies; ability of predicting consequences of different management strategies in the medium and long-term; possibility of using natural mortality varying by age/length; very detailed time scale (1 month) allowing to envisage management actions considering biological process in time.
limits	total mortality *Z* reliably reflects the decline of ages/sizes in the population, including the effects of different fishing gears; the growth, the natural mortality, and the maturity parameters are assumed constant over time; harvesting scenarios based on the control of the total catches are not foreseen.
data need	growth parameters; length-weight relationship; total mortality; natural mortality; maturity; recruitment and spawning season and peak, stock recruitment relationship (facultative) or a recruitment vector; selectivity parameters of the gears used by the fleet; a fishing activity coefficient by month. Type and parameters of pdfs. In absence of this information the deterministic version of the model can be run. Data and information derived from DCR are suitable because parameters are available or derivable from the existing information.
outputs and/or RP produced	Time scale of outputs is month and year. Outputs are: population traits (average length and age of the exploited and unexploited population and spawning population); abundance indicators (biomass and spawning biomass of the exploited –EB, ESSB- and unexploited population-UB, USSB); production metrics (yield, average length of the catches, biological production); sustainability indicators in the long-term (e.g. the ratio ESSB/USSB, the ratio of ESSB vs EB and vs yield); fishing mortality;

	metrics characterising attributes of fish population can be used to build up a model-based time series. Reference points based on mortality, biomass, yield, and ratio between exploited and unexploited spawner biomass can be derived.
level of precaution	High, based on the reproductive potential of the population (ESSB/USSB).
prediction capability	High. Model predictions are accompanied by uncertainty measures and confidence intervals using a Monte Carlo approach. A harvest control rule is implemented to simulate consequences of different management options. Effects of management measures (i.e. fishing pressure reduction, change in mesh size and closed season) on the population and yield can be predicted in the short and long-term.
Software and references	*Aladym* is written in the R language and licensed as open source under GPL2. The software can be downloaded from the Fisboat project web-site, where also a detailed description of the input sheet for user help is available. (http://www.ifremer.fr/drvecohal/fisboat/).

Format of the input parameters to the *Aladym-r* model are:

1. von Bertalanffy growth parameters by sex with associated variability if available;
2. length-weight relationship parameters (weight in grams and length in mm) by sex;
3. maturity ogive parameters ($L_{m50\%}$ and $L_{m25\%}$-$L_{m75\%}$ range) with associated variability (if available);
4. natural mortality by sex (a constant value or a vector, alternatively a vector will be created by the model using Chen and Watanabe sub-model);
5. recruitment estimates (minimum, maximum, *ln*-mean and *ln*-standard deviation) (initial numbers in the population);
6. guess proportion of offsprings entering in the stock by month;
7. stock-recruitment relationship parameters or a vector of recruit numbers by month (for example randomly generated between the minimum and maximum set at point 5);
8. sex-ratio (female/total);
9. *Z* by sex and year (a time series is preferable);
10. selection ogive parameters of the gear used by the fleet. Parameters are: $L_{50\%}$ and $L_{25\%}$-$L_{75\%}$ range. Also the de-selection parameters ($D_{50\%}$) is needed in case selectivity would be modelled according to the product of two ogives (user's option);
11. fishing activity coefficient by month (from 0, in case of absence of fishing activity, to 1).

Remarks
In case variability is not introduced, the model runs in a deterministic mode.
If parameters are not available by sex the model runs for sex combined.
Information regarding catch levels by year are useful.

SURBA

assessment method	**SURBA 2.1** (Survey Based Assessment) has been used for the first time in the Mediterranean area to assess hake in the GSA 9 using Medits data for the period 1994-2006. Surba uses data from trawl survey including catch, maturity, weight, and natural mortality at age. It is a VPA based model that assumes the F is separable into an age (s) and a year effect (f): F=s x f. The model estimates these parameters by minimizing the sum-of-squared differences between observed and fitted survey derived abundances at age using an assumed vector of catchability at age (q_a), which does not depend on year. Since abundances estimates from surveys are relative indexes, the model can only be used to estimate relative rather than absolute population numbers.
strength	It is a simple model (assumptions are clearly stated) with a Windows interface easy to be used. Graphical outputs of Surba allow evaluating the reliability of the parameters estimated and the fitting of the model using different sets on input parameters. The method has been proved to be a useful technique for investigating the dynamic of the fishery independently of the commercial catch and CPUE data (ICES Working Group on the Assessment of Northern Shelf Demersal Stocks, 2002).
limits	The model can be used to summarize population trends suggested by any particular survey. It does not estimate directly Reference Points but during the meeting it has been stressed the possibility to calculate RP using the Surba estimates (SSB, recruitment indexes), exploring stock-recruitment relationships. The 2.1 version of the model does not include an automatic scan over run-settings as well as of a sensitive analysis (SURBA 3.0 provides a routine).
data need	The model requires the following survey data by age-class and year: - Standardized abundance indexes (e.g.: n km^{-2}) - Mean weight - Natural mortality (fixed or vector) - Catchability (fixed or vector) - Proportion of mature individuals Estimation age weightings w may be entered manually. Alternatively, they can be calculated as the inverse of the variance of the survey index at age.
outputs and/or RP produced	The following outputs are provided by the model: - Mean-standardised survey abundance indices by age and year; - Mean stock weights-at-age; - Mean estimated trend in F; - Temporal trend in estimated F by age group; - Temporal trend in relative SSB; - Fitted temporal trend in model parameters (f, s, r);
level of precaution	Precautionary RP can be obtained from the stock-recruitment relationship.
Prediction capability	Surba 2.0 includes a deterministic forecasting capability. This is done by rolling the survey-estimated population forward through time, assuming fixed geometric mean recruitment. The effect of change in natural mortality and catchability on parameter estimation has to be evaluated. Surba 3.0 has analytical uncertainty estimation of total mortality and recruitment. Uncertainty in SSB is absent, due mainly to coding problems. Retrospective analyses are conducted back to time corresponding to half the earliest survey available.
Software and references	Surba 2.0, Surba 3.0. Beare et al., 2005. Using survey data independently from commercial data in stock assessment: an example using haddock in ICES Division Via. ICES J. Mar. Sci., 62: 996-1005. ICES, 2002. Report of the working Group on the Assessment of Northern Shelf demersal Stocks. ICES CM 2003/ACFM:04. Needle C. L., 2003. Survey based assessment with SURBA. Working document to the ICES WGMFSA, Copenhagen, 29 January to 5 February 2003.

Data format
Analyses with Surba 2.1 would require the following data:

Abundance indexes by age class and year (mean CPUE: n° / km^2)

	age 1	age 2	age 3	age 4	age 5*
1994	2062.564	132.3932	5.014344	1.051717	1.074878
1995	3446.191	159.4825	4.341949	0.91047	0.665319
1996	3366.341	80.87538	6.331439	1.291274	0.153139
1997					
1998					
1999					
2000					
2001					
2002					
2003					
2004					
2005					
2006					
2007					

*** indicate if this is a plus-group**

Proportion of mature fishes by age-class.
This proportion should be calculated according to year data on maturity-at-age or maturity-at-length (if the same maturity ogive is used for the whole period, please take into account annual variation in size/age distribution, and calculate proportions of mature fishes accordingly).

	age 1	age 2	age 3	age 4	age 5*
1994	0	0.012	0.96	1	1
1995	0	0.012	0.92	1	1
1996	0	0.029	0.9	1	1
1997					
1998					
1999					
2000					
2001					
2002					
2003					
2004					
2005					
2006					
2007					

Mean weight-at-age (kg)
This proportion should be calculated according to year data on length-weight relationships (if the same L-W is used for the whole period, please take into account annual variation in size/age distribution, and calculate mean weight of age classes accordingly).

	age 1	age 2	age 3	age 4	age 5*
1994	0.00821	0.085686	0.497895	1.243836	3.260848
1995	0.006417	0.090927	0.490828	1.20488	3.030937
1996	0.006478	0.102563	0.452161	1.45539	2.122156
1997					
1998					
1999					
2000					
2001					
2002					
2003					
2004					
2005					
2006					
2007					

A catchability vector should be also given (look at estimation from VPA).

	age 1	age 2	age 3	age 4	age 5*
q					

Assessment method	Virtual Population Analysis (VPA) - eXtended Survivors Analysis (XSA)
Strength	Analysis of both fish number and fishing mortality rates, F, as a function of age class and year (or other time interval). Possibility of using input data, for tuning, derived from fishery independent sources like trawl surveys, echo-surveys and DEPM surveys. The relationship between recruits and spawners can be obtained. The basic procedure used in the calculations is simple and "explicit". Consequently, sources of problems, like uncertainty in specific input data, can be individuated and sensitivity analysis can be performed.
Limits	The natural mortality rate, M, is commonly taken as fixed over years, but relevant fluctuations of this parameter may occur. Some degree of difficulties in estimating F at age in the most recent year. In some fisheries, discards may be not negligible so that, if they are not taken into account, catches are underestimated.
Data need	Catch at age times series, expressed as numbers of fish; weight at age data are thus required to transform estimated numbers into biomasses at sea. At least one value of the annual natural mortality rate M (in this case M is taken as fixed over age class and year). Different values of M as a function of age class have been used for some stock assessments in the Mediterranean Sea. Data for tuning like abundance at sea derived from echo-surveys, DEPM surveys or trawl surveys or commercial CPUE.
Outputs and/or RP produced	Number of fish at sea as well as fishing mortality rate, per age class and year. Reference points: - based on spawning stock biomass (SSB), i.e. a minimum level of SSB needed to maintain sufficient recruitment can be derived from the relationship between recruits and spawners; - based on F, e.g. exploitation rate F/Z.
Level of precaution	Different levels of precaution / risk can be evaluated by using different values for both natural mortalities and fishing mortalities (e.g. different exploitation patterns).
Prediction capability	Outputs of the model can be used for simulations of abundance and catches to carry out short and long time predictions.
Software	VPA and XSA: Darby C.D., Flatman S. 1994. Virtual Population Analysis: version 3.1 (Windows / Dos) user guide. Info. Tech. Ser., MAFF Direct. Fish. Res., Lowestoft, UK, 1: 85 pp. XSA (in FLR library): Kell L.T., Mosqueira I., Grosjean P., Fromentin J.-M., Garcia D., Hillary R., Jardim E., Mardle S., Pastoors M.A., Poos J.J., Scott F., Scott R.D. 2007. FLR: an open-source framework for the evaluation and development of management strategies. ICES J. Mar. Sci., 64: 640-646.

Data for VPA - XSA, software:

Darby C.D., Flatman S. 1994. Virtual Population Analysis: version 3.1 (Windows / Dos) user guide. Info. Tech. Ser., MAFF Direct. Fish. Res., Lowestoft, UK, 1: 85 pp.

This software imposes the following constraints on the data sets:

	VPA95	VPADOS	VPAWIN
The maximum number of years	100	30	40
Ages must be in the range	0 - 25	0 - 20	0 - 25
The maximum number of fleets	20	10	20

VPA 95 is the most recent version.

The start of the fishing year is January 1st.

1) optional.
Catches (= landings + discards) per each year, expressed as tonnes.

2) obligatory.
Number of fish caught per age class and year, expressed as thousands of individuals.

3) obligatory.
Weight at age data per age class and year, expressed as kilograms.

4) obligatory.
Annual value(s) of natural mortality rate M taken as fixed over age classes and years
or taken as changing over age classes, but fixed over years
or changing over age classes and years.

5) optional.
A vector of proportion of sexually mature individuals per age class, taken as fixed over years; alternatively, this vector can be taken as changing over years.

6) obligatory (for tuning).
Commercial or trawl survey CPUE at age:
number of fish caught per age class and year, expressed as thousands of individuals, along with (separately) the corresponding fishing effort per year. Alternatively, the number of fish caught per age class is already divided by effort, so that the values of effort per year in the input file have to be taken as equal to 1.

Commercial CPUE at age can be relative the total fleet or a fraction of the total fleet.
CPUE at age data sets for different fleets or trawl surveys can be used in the same file.

The number of fish at sea estimated by means of other methods (e.g. acoustics), distributed into age classes, can be treated as in the alternative case mentioned above, i.e. with the fishing effort per year being taken as equal to 1.

LCA and Y/R analyses

Assessment method	Length Cohort and Yield per Recruit Analysis (LCA & Y/R)
Strength	Short data series (even one year) Gears interactions in LCA and possibility to perform Y/R and transitional analysis between two steady states, changing F vector by a multiplicative factor (effort) and/or exploitation pattern (selectivity). It is possible to evaluate the effect of the parameters on the Y/R through e sensitivity analysis.
Limits	Since the steady state is assumed (pseudocohort), important biases can be obtained if this hypothesis is far from reality.
Data need	A length or age frequency distribution of the catch by gear, representing the pseudocohort. Growth parameters (VBGF); M vector or scalar; Terminal F; Length-weight relationship, maturity at length; Total catch in biomass by gear
Output	Numbers of individuals and biomass at sea by age (e.g. recruitment, SSB, total biomass). Fishing mortality by age or length and gear. Equilibrium surface of yield, biomass and SSB per recruit, as function of overall F (or effort) and exploitation pattern (selectivity) by gear. F_{max}, F_{mean}, F_{global}, $Y_{0.1}$, $F_{0.1}$, virgin biomass, critical biomass.
Level of precaution	Furnish limit (F_{max}) and target ($F_{0.1}$) reference point based on fishing mortalities
Prediction capability	Computation of the yield that produces one recruit given particular exploitation pattern (*F* vector) at different intensities of effort.
Software	Lleonart, J. & Salat, J., 1992.- VIT: Programa de análisis de pesquerías. *Informes Técnicos de Scientia Marina*, 168-169: 116 pp. http://www.fao.org/docrep/W7219E/W7219E00.htm http://www.faocopemed.org/es/activ/infodif/vit.htm

Data requirements to make an assessment exercise for hake and red mullet applying VIT

1. Annual length frequency weighed to catches by gear (including discards when possible). At least a complete one year of data should be necessary. The size intervals must be in cm and constant (0.5 cm for red mullets and 1 cm for hake).
2. Total annual catches (in grams) by gear (and percentage).
3. A proposal of VBGF parameters (L_{inf}, k, t_0), by sex and by the whole population, estimated in cm and years.
4. A proposal of length-weight relationship parameters (a, b), by sex and by the whole population, estimated from cm and grams.
5. A proposal of natural mortality (M), by sex and the whole population: constant or vector (by class)
6. A proposal of terminal fishing mortality (F_t)
7. Sexual maturity by class, for sex and the whole population
8. Sex-ratio by length classes

NOTES:

- The units must always be the same (cm and grams), both for data and estimation of parameters.

For each species, it should be adopted a set of parameters (points 3-8) before the analysis.

Y/R and B/R

assessment method	Yield and Biomass per recruit (Y/R & B/R)
strength	The output is very synthetic and gives a general overview of the state of the fishery. Easy to relate to reference points (maxima, marginal, ratio of current stock vs. virgin stock, etc.). With this method it is easy to detect growth overfishing and furnish harvesting alternatives. Including spawning stock recruitment in the analysis it is possible to detect also recruitment overfishing. Uncertainty may be considered
limits	Assumes steady state. Not consider vector M
data need	Growth parameters; length-weight relationships; Length at 50% maturity; Length at 50% capture; Natural mortality (scalar); Recruitment (also nominal); Spawning-stock relationships (not necessary); Spawning and fishery season
Ouput and RP produced	Main outputs: Sustainable yield, biomass, SSB with confidence intervals vs fishing mortality; Transition in main stocks indicators changing fishing mortalities and length at capture; Estimation of the probability distribution of RP (Fmax; F=0.1; F%USSB) and corresponding indices of Yield and Biomass; F required to furnish a given probability of reducing SSB to below a selected proportion of its unexploited level at least once in a given number of years.
level of precaution	For each parameter a probability distribution can be specified. Many limit and target reference points can be estimated
Prediction capability	Equilibrium dynamics of stock changing harvesting scenarios can be estimated. Transition between equilibria can also obtained
Software	BRANCH, T. A., KIRKWOOD, G. P., NICHOLSON, S.A., LAWLOR, B. AND ZARA, S. J. (2000): Yield version 1.0, MRAG Ltd, London, U.K.

Parameters for the *Yield software* have the following format:

- von Bertalanffy growth parameters with associated variability (units; cm & y);
- length-weight relationship parameters with associated variability (units; cm & g);
- length/age at 50% maturity with associated variability (units; cm or y);
- length/age at 50% capture with associated variability (units; cm or y);
- natural mortality with associated variability (units; y^{-1});
- spawning season (units; year, quarter, month or day);
- fishing season (units; year, quarter, month or day);
- recruitment estimates with associated variability (units; n);
- stock-recruitment relationship parameters with associated variability (Beverton & Holt; Ricker and constant);

Daily egg production

assessment method	DEPM -Daily Egg Production Method
strength	Provides precision levels for all their estimates: SSB, P_0, F, S, W and R (see outputs). Provides detailed information on essential habitats (spawning and nursery areas), reproductive potential of the adult population, and biotic and abiotic environmental conditions (throughout plankton hauls targeting different size fractions and CTD profiles). Very efficient for small pelagic species.
limits	Expensive. Research vessel needed. Must be applied during the peak spawning season and cover all the spawning area.
data need	All data needed are collected during the survey but they are not yet collected in the DCR framework.
outputs and/or RP produced	Spawning Stock Biomass (SSB) Daily Egg Production (P_0) Batch Fecundity (F) and Daily Specific Fecundity (DSF) Spawning Fraction (S) and Spawning Frequency (SF) Mature Females Weight (W) Sex Ratio (R) Spawning Area extension (A).
level of precaution	
Prediction capability	
Software	R bundle "Ichthyoanalysis" (http://ichthyoanalysis.wiki.sourceforge.net/)

Acoustic methods

assessment method	Acoustic survey
strength	Fast (results available in few months) – important for short living species; accurately calibrated; multispecies assessment posibilities; not based on steady-state assumption; all data needed are collected during survey; can be combined with environmental monitoring. Very efficient for small pelagic species.
limits	Expensive, not effective for fish close to sea bottom or surface (demersal and large pelagics), research vessel needed
data need	All data needed are collected during the survey
outputs and/or RP produced	Estimates of biomass and spatial distribution of the resources; stock structure indication; length-weight relationships; "snap-shot" of recent situation; RP – based on Catch/Biomass relationship
level of precaution	
Prediction capability	Low
Software	ER60 (echo sounder software)+ BI60 and/or EchoView (acoustic data post processing software)

Other methods used:

Depletion models have been used for the assessment and estimation of abundance of small pelagic species.

Underwater TV was used for mapping relative abundance indices for *Nephrops norvegicus*.

Bio-economic simulation models have been developed and applied to specific fisheries, among others, MEFISTO (Mediterranean Fisheries Simulation Tool) and BEMMFISH (Bio-economic of Mediterranean Fisheries). These models have been applied to the hake fishery (Gulf of Lions); red shrimp and small pelagics fisheries (Catalan Coast); Ligurian demersal fishery; Adriatic and small pelagics fishery; hake and red mullet fisheries (Gulf of Saronikos). Results of BEMMFISH were presented at the SAC-SCSA meeting in 2004
Life tables were used for a rough analysis of the status of some stocks of rays and sharks

ANNEX VI - STATE OF ASSESSMENTS AND DATA AVAILABILITY FOR KEY SPECIES BY GSA

SGMED decided to revise the availability of information from different data sources and for an extensive list of species, and it was decided to compile a table, visually showing all the available information with the purpose to define the existing gaps. The quality check of the various data sources is provided in other parts of this report or will be provided by future analysis.

The first list included all the Mediterranean species (35) listed in annex XII of Reg.(EC) 1563/2000 and following modification, considered as priority species, and those (34) listed under the same category by the GFCM. The two lists showed an overlapping for 22 species, due to the different motivations used to define their priority status and to the possible different interests for the two groups of MSs. This list was considered quite useful to better focus the attention on the most representative species in terms of quantities or conservation status.

The list was completed with the species considered as having shared stock in the Mediterranean Sea, as they were defined by STECF-SGMED (4-7 September 2002) and by the GFCM-SAC (Rome, 2006). The first group included 70 species, while the SAC considered only 25 species and the overlapping concerns 22 species. In this case, the major difference between the two lists is possibly due to a deeper examination of the stocks concerned in STECF-SGMED. The definition of shared stocks has direct implication on future assessment, because overlapping of different GSA should be taken into account to have a more complete overview of the real situation.

The information available about the assessments carried out for the various species at the GSA level by several scientists and presented at GFCM-SAC, or at the STECF-SGMED or in other fora was also included in the table.

After the examination of the various NPs presented by the EC countries having a fishery activity in the Mediterranean and related to the DCR, it was possible to define for which species and in which GSA there is a new series of data, collected according to well-defined standards.

The list was completed with the review of the existing data by species collected by various surveys (MEDITs, GRUND, etc.) or having other sources. In this case, due to the very long list of species (>300) for which some data were available, it was decided to define a minimum threshold of 1000 specimens. Information from France and Cyprus might be incomplete, due to the absence of local expertise at the meeting.

The full table below shows where the available information is able to provide a good background for future analysis and where previous assessments are available. According to this first overview (which does not include most of the non-EU countries, because the information was not available at the meeting), it seems than the main relevant species are well covered in terms of data and areas, while several other species show a good coverage. This might help in developing more advanced analysis for several fisheries. Not all the priority species show enough data or a large spatial coverage able to provide sufficient elements for future assessments.

	PRIORITY		SHARED		GSA																											
species	**STECF**	**GFCM**	**STECF**	**GFCM**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
Aristaeomorpha foliacea	P1	P	X	X																												
Aristeus antennatus	P1	P	X	X																												
Nephrops norvegicus	P1	P	X	X																												
Parapenaeus longirostris	P1	P	X	X																												
Anguilla anguilla	P1	P	X	X																												
Coryphaena hippurus	P1	P	X	X																												
Engraulis encrasicolus	P1	P	X	X																												
Merluccius merluccius	P1	P	X	X																												
Mullus barbatus	P1	P		X																												
Mullus surmuletus	P1	P	X	X																												
Pagellus bogaraveo	P1	P	X	X																												
Sardina pilchardus	P1	P	X	X																												
Eledone moschata	P	P	X	X																												
Eledone cirrhosa	P	P	X	X																												
Illex spp.	P																															
Loligo vulgaris	P	P	X	X																												
Loligo forbesi																																
Octopus vulgaris	P		X																													
Sepia elegans																																
Sepia officinalis	P	P	X	X																												
Sepia orbignyana																																
Todarodes sagittatus	P		X																													
Palinurus elephas		P	X	X																												
Palinurus mauritanicus		P	X	X																												
Penaeus kerathurus	P																															
Pleisionika heterocarpus																																
Pleisionika martia	P																															
Acipenser spp.		P																														
Argentina sphyraena			X																													
Arnoglossus laterna																																
Boops boops	P	P	X																													
Brama brama			X																													
Caranx crysos			X																													

Aspritrigla cuculus																															
Chelidonichthys gurnardus			X																												
Chelidonichthys lastoviza																															
Chelidonichthys lucernus			X																												
Chlorophthalmus agazzisi																															
Cytharus linguatula																															
Conger conger			X																												
Dalatias licha																															
Dentex dentex			X																												
Dentex maroccanus																															
Dicentrarchus labrax	P		X																												
Diplodus annularis			X																												
Diplodus puntazzo			X																												
Diplodus sargus			X																												
Diplodus vulgaris			X																												
Epinephelus marginatus			X																												
Gadiculus argenteus																															
Galeorhinus galeus																															
Galeus melastomus																															
Glossanodon leioglossus			X																												
Helicolenus dactylopterus																															
Hexanchus griseus			X																												
Huso huso		P																													
Lepidopus caudatus			X																												
Lepidorhombus boscii																															
Lepidotrigla cavillone																															
Lepidotrigla dieuzeidei																															
Lithognathus mormyrus			X																												
Liza spp.			X																												
Lophius piscatorius	P	P	X	X																											
Lophius budegassa	P	P	X	X																											
Merlangius merlangus		P																													
Micromesistius potassou		P	X	X																											
Mola mola			X																												
Mugil cephalus	P		X																												
Naucrates ductor			X																												

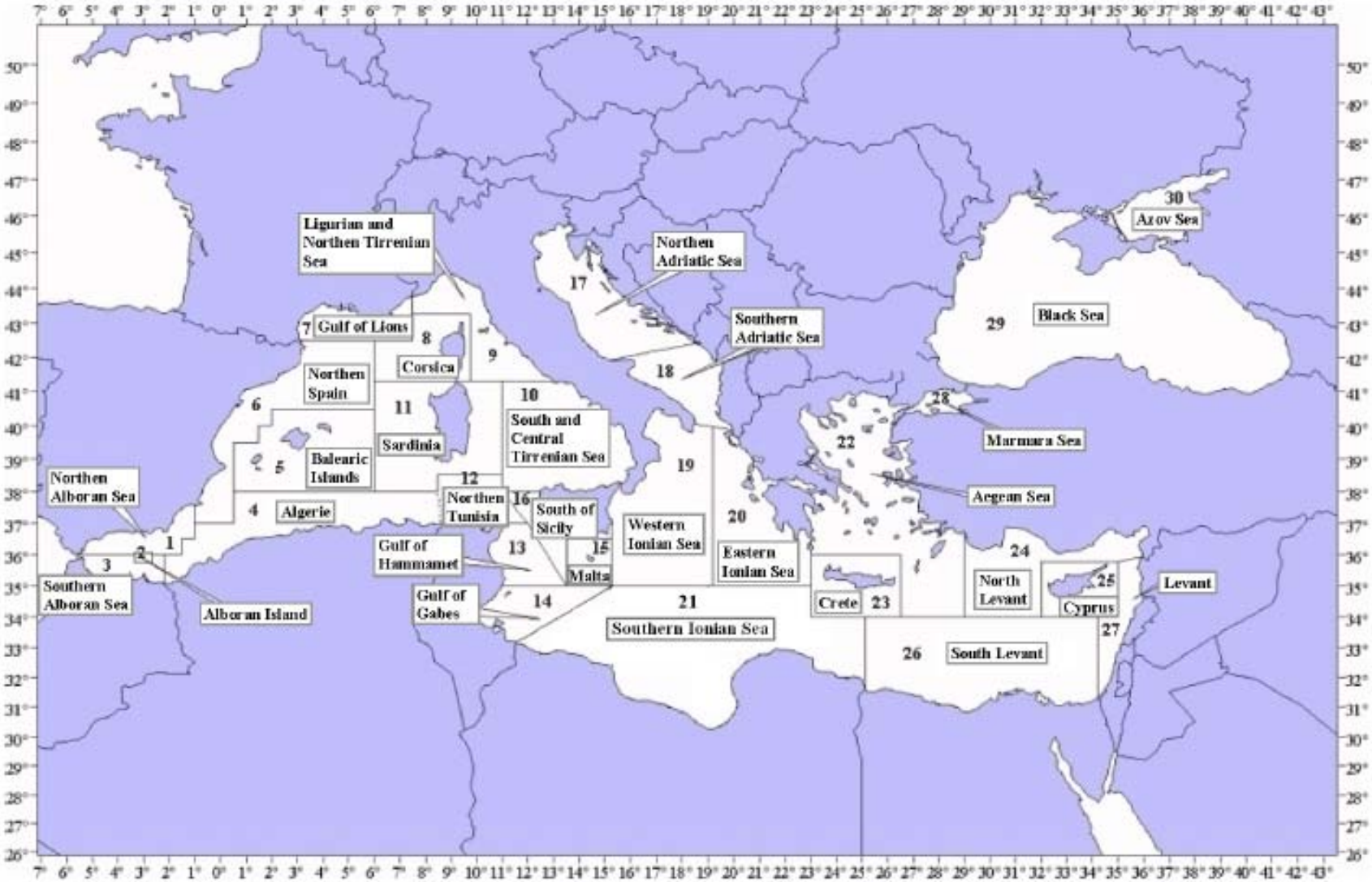
Oblada melanura			X																													
Pagellus acarne			X																													
Pagellus erythrinus	P	P	X	X																												
Pagrus pagrus			X																													
Phycis blennoides			X																													
Platichthtiys flesus			X																													
Polyprion americanus			X																													
Pomatomus saltatrix		P	X																													
Psetta maxima		P	X																													
Raja spp.			X																													
Ruvettus pretiosus			X																													
Sardinella aurita		P	X																													
Sarpa salpa			X																													
Scomber scombrus	P	P	X	X																												
Scomber japonicus	P		X																													
Scophthalmus rhombus			X																													
Scorpaena notata																																
Scorpaena porcus																																
Scorpaena scrofa																																
Scyliorhinus canicula																																
Seriola dumerilii			X																													
Serranus cabrilla																																
Serranus hepatus																																
Solea solea	P		X																													
Solea vulgaris	P	P		X																												
Sparus aurata			X																													
Sphyraena sphyraena			X																													
Spicara flexuosa																																
Spicara maena	P		X																													
Spicara smaris	P																															
Spondyliosoma cantharus			X																													
Sprattus sprattus		P	X	X																												
Trachinus draco																																
Trachurus mediterraneus	P		X																													
Trachurus trachurus	P		X																													
Trigla lyra																																

Trisopterus minutus																															
Zeus faber			X																												

Legend and ranking for overlapping		
Stock assessment provided by GFCM (2006>)	1	
Stock assessment provided at STECF WGs	2	
Previous stock assessments (various sources)	3	
data collected under DCR	4	
data collected by survey	5	
data available from other sources	6	

NOTE: The list of species for which data have been collected since many years by surveys is much longer than
this list. It was considered than a minimum threshold of about 1000 samples was necessary to include the
species on this table.

ANNEX VII - GFCM GSAs.



ANNEX VIII - EXPERT DECLARATIONS

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

European Commission

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Abstract

SGMED-08-01 Working Group on the Mediterranean Part I was held during 10-14 March 2008 in Brussels, Belgium. The report is a compilation of information on existing fisheries and stock data in order 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. STECF reviewed the report during its plenary meeting on 14-18 April 2008.

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