ICES WKD3R REPORT 2014

ICES ADVISORY COMMITTEE

ICES CM 2014/ACOM:50

REF. ACOM, SCICOM

Report of the Workshop to draft recommendations for the assessment of Descriptor D3 (WKD3R)

13–17 January 2014

Copenhagen, Denmark

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CIEM
Conseil International pour l'Exploration de la Mer

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Recommended format for purposes of citation:

ICES. 2014. Report of the Workshop to draft recommendations for the assessment of Descriptor D3 (WKD3R), 13-17 January 2014, Copenhagen, Denmark. ICES CM 2014/ACOM:50. 153 pp.

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Executive summary

This workshop (WKD3R) meeting provided a platform for experts from the EU member states to meet and progress the assessment methodology on Descriptor 3 (commercially exploited fish and shellfish populations) and draft recommendations.

Attendance at the meeting included thirty-three participants from Bulgaria, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Poland, Romania, Slovenia, Spain, Sweden, United Kingdom, and; together with representatives from Danish Fishermens Association, Seas at Risk and JRC.

The first two days of the workshop were to discuss the process and horizontal remaining gaps and settle issues, followed immediately by a 3-day workshop with four parallel sessions drafting recommendations and regional assessments for the four marine regions of MSFD (Baltic Sea, North-east Atlantic Ocean, Mediterranean Sea and Black Sea). The workshop was guided by the Chair and by facilitators assigned to each of the regional seas.

One activity of the workshop was to take all commercially exploited fish and shellfish stocks into account under D3 and evaluate whether sufficient data are available to assess each against the three criteria – level of pressure of the fishing activity (criterion 3.1), and reproductive capacity of the stock (criterion 3.2). Obtaining an indicator and a reference point for an age structure that fulfills Criteria 3.3 of Descriptor 3 (COM Dec 2010/477/EU) was found to be challenging. Additionally, some species may have to be considered under D1 and D4 and this remains an ongoing discussion. Such considerations are especially pertinent to the Black Sea Region and are discussed further in the report of the workshop.

In each of the four marine regions of MSFD, a common approach was adopted for D3 at the workshop involving four distinct steps:

> Step 1 – List of commercially exploited fish and shellfish stocks in the relevant marine region. Selection of commercial fish and shellfish stocks; together with reasons for any omission.
>
> Step 2 – Catalogue and documentation of available information for the D3 assessment, incorporating ICES' data-limited stock approach.
>
> Step 3 – Evaluation of GES by appropriate functional group (e.g. demersal, pelagic etcetera).
>
> Step 4 – Overall status, issues, problems, gaps and links to other MSFD Descriptors (e.g. D1 and D4); together with any additional monitoring needs.

The full details and findings are presented in this workshop report but may be succinctly summarised as follows.

> <u>Baltic Sea Region</u>: For the ICES' catch statistics from 1983-2009 in the Baltic Sea Region as they occur in the FAO FishStat database (Anon 2009; ICES/JRC Task Group D3+ report) there were about 70 different species or species-groups landed and reported. For the 17 stocks assessed by ICES in the Baltic Sea, 14 stocks are assessed using F and SSB metrics comparable to indicators under descriptor 3.1 and 3.2. Out of the seven stocks having full assessment, four achieve green status for fishing mortality (3.1.1) and six stocks achieve green status for spawning stock biomass (3.2.1). For the seven stocks with

survey-based trend assessments, only two report on the fishing mortality (3.1.2) out of which one is achieving green status. Concerning standing stock biomass five out of the seven category 3 stocks are presently achieving green status. For the stocks in the Baltic Sea, ICES is not assessing the status of stocks based on size or age structure of the populations according to Criteria 3.3.

<u>North-east Atlantic Region</u>: Several observations on status are consistent across the four sub-regions in the NEA; namely,

- Migratory pelagic stocks contribute significantly to the landings in each sub-region. Their data status is good, overall, with quantitative assessments against Criteria 3.1 and 3.2 carried out for most stocks. The status of the majority of pelagic stocks in relation to 3.1 and 3.2 is green.
- Around 30% of the demersal stocks have quantitative stock assessments in relation to reference points. For trend-based assessments using survey or commercial CPUEs, methods have not yet been fully established to derive F and SSB proxies in relation to reference points. Overall, just over half of the demersal stocks with quantitative assessments in the NEA have green status in relation to Criteria 3.1 and 3.2.
- Within the shellfish category, *Nephrops* is well assessed in the North Sea and the Celtic Sea but not in the Bay of Biscay/Iberian sub-region. There is an overall deterioration in status for *Nephrops* stocks in the last three years with less than half of the stocks reaching green status in Criterion 3.1 in the last assessment year.
- Elasmobranchs are data poor in each sub-region of the NEA with no stocks having full assessments. Assessments rely primarily on abundance data from surveys and commercial CPUEs. Status in relation to Criteria 3.1 and 3.2 is unknown for most elasmobranch stocks in the NEA but expert judgements based on qualitative evaluation indicate that a large number of stocks are depleted and below any possible biomass reference points. The majority of stocks with abundance trends show increasing trends.
- Most deep-water stocks are in the data poor category.

<u>Mediterranean Sea Region</u>: Lamentably, there is a weak international survey coordination in this region which has a direct impact on the proportion of stocks assessed achieving GES which is still generally low, when adopting indicators 3.1.1 and 3.2.1. Even though the goal of achieving GES for all commercial species is increasingly recognized as an ambitious objective mostly independent of the management regime applied, there is no agreed strategy and approach to a coherent assessment of GES in the Mediterranean Sea sub-regions. Furthermore, it appears that the available knowledge on the status of the stocks is still poor in some GSAs. There is an urgent need to establish an overarching strategic framework to ensure the coordination of approaches toward GES assessment and monitoring programmes at the Mediterranean Sea regional scale, by collaboration between GFCM, EC and the Barcelona Convention.

Black Sea Region: The main sources of information used to compile the list of stocks were stock assessment reports, landing statistics and published literature. Of the 25 stocks identified, only nine stocks have been subject to evaluation by STECF. A mere 5 of the 25 important Black Sea stocks are assessed against Criteria 3.1, and one is assessed for the Criteria 3.3. In 2013 the STECF EWG on Black Sea stock assessments assessed nine stocks, but in some the data and results were not reliable to produce advice relevant to F_{MSY}. SSB related reference levels were not estimated in any of the assessed stocks. Fish stocks in the Black Sea Region lack reliable estimates of indicators from research surveys which is due to the history of the development of the DCF in this region.

The outcome of the workshop will contribute to the next annual DG ENV organised workshop on Descriptor 3+ scheduled 3-4 April 2014 in Brussels.

1 Introduction

1.1 Terms of reference

The **Workshop to draft recommendations for the assessment of Descriptor D3** (WKD3R), chaired by Carl O'Brien (UK) met at ICES Headquarters, 13-17 January 2014, to provide:

i. Draft recommendations for the assessment of Descriptor D3, as e.g. the monitoring recommendations (strategic document and technical annexes) building on the work of ICES (D3+ report), the discussions at the two workshops on "Descriptor 3+ regarding all commercial exploited fish and shellfish stocks in relation to GES", organised by DG ENV (8-9 April 2012 held in Paris, 9-10 April2013 held in Brussels), the outcome of the CFP reform, the application of the precautionary principle and the results of the MSFD Article 12 report.

ii. ICES should also provide and implement a consultation process plan of the draft recommendations.

iii. ICES shall make efforts to coordinate closely with activities in the framework of Regional Sea Conventions and to include in the preparatory work experts covering the four marine regions of MSFD (Baltic Sea, North-east Atlantic Ocean, Mediterranean and Black Sea). In the development of the draft recommendations for the assessment of Descriptor D3 it will also consult Member States and relevant stakeholders.

WKD3R will report by 30 January 2014 for the attention of ACOM and SCICOM.

1.2 Background

The European Commission (DG ENV) has requested ICES to provide advice on Descriptor 3 (all commercial fish and shellfish).

According to the MoU between ICES and the European Commission, ICES shall provide further scientific advice in support of MSFD on the correct implementation of the Descriptor D3 on populations of all commercially exploited fish and shellfish, including fisheries-related information for the other related descriptors (mainly D1, D4 and D6) as described in the draft MSFD Commission Staff Working Paper.

This workshop (WKD3R) meeting provides a platform for experts from the EU member states to meet and progress the assessment methodology on Descriptor 3 and draft recommendations.

1.3 Conduct of the meeting

Attendance at the meeting included thirty-three participants from Bulgaria, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Poland, Romania, Slovenia, Spain, Sweden, United Kingdom, and; together with representatives from Danish Fishermens Association, Seas at Risk and JRC.

The first two days of the workshop were to discuss the process and horizontal remaining gaps and resolve issues, followed immediately by a 3-day workshop with four parallel sessions drafting recommendations and regional assessments for the four marine regions of MSFD (Baltic Sea, North-east Atlantic Ocean, Mediterranean Sea and Black Sea).

The workshop was guided by the Chair and by facilitators assigned to each of the regional seas:

Name	Function	Region/sub-region
Carl O'Brien	Chair of workshop	
Eero Aro	Chair/Facilitator of subgroup	**Baltic Sea**
Leonie Dransfeld Carl O'Brien	Chair/Facilitators of subgroup	**North-east Atlantic Ocean** (Greater North Sea including the Kattegat and the English Channel, Celtic Seas, Bay of Biscay and the Iberian Coast, and Macaronesian biogeographic region – waters surrounding the Azores, Madeira and the Canary Islands)
Francesco Colloca	Chair/Facilitator of subgroup	**Mediterranean Sea** (several sub-regions)
Georgi Daskalov	Chair/Facilitator of subgroup	**Black Sea**

In each of the four marine regions of MSFD, a common approach was adopted for D3 at the workshop involving four distinct steps:

Step 1 – List of commercially exploited fish and shellfish stocks in the relevant marine region. Selection of commercial fish and shellfish stocks; together with reasons for any omission.

Step 2 – Catalogue and documentation of available information for the D3 assessment, incorporating ICES' data-limited stock approach.

Step 3 – Evaluation of GES by appropriate functional group (e.g. demersal, pelagic etcetera).

Step 4 – Overall status, issues, problems, gaps and links to other MSFD Descriptors (e.g. D1 and D4); together with any additional monitoring needs.

The outcome of the workshop will contribute to the next annual DG ENV organised workshop on Descriptor 3+ scheduled 3-4 April 2014 in Brussels.

1.4 Structure of the report

The structure of the report is as follows:

- Section 2 deals with scene setting for the activities of the workshop during the week-long meeting covering presentations to the workshop, background and working documents, the ICES' data-limited stocks approach, generic roadmap towards Descriptor D3 GES (Good Environmental Status), and aspects of criterion 3.3;
- Section 3 deals with the Baltic Sea region;
- Section 4 deals with the North-east Atlantic Ocean region (covering the Greater North Sea including the Kattegat and the English Channel, Celtic Seas, Bay of Biscay and the Iberian Coast, and Macaro-

nesian biogeographic region – waters surrounding the Azores, Madeira and the Canary Islands);

- Section 5 deals with the Mediterranean Sea region (several sub-regions);
- Section 6 deals with the Black Sea region; and
- Section 7 deals with discussions and conclusions.

The first ToR is dealt with for each regional sea in Sections 3-6 for the Baltic Sea, North-east Atlantic Ocean, Mediterranean Sea and Black Sea, respectively. The second ToR is addressed in the next Section 1.5 and the conclusion of the consultation process will lead to the fulfilment of the third ToR.

1.5 Follow-up process within ICES

ICES has been requested by the European Commission (DG ENV) to provide, and implement, a consultation process plan of the draft recommendations from the workshop (second ToR).

The consultation will be implemented according to the following schedule:

- The draft report emerging from the WKD3R workshop will be sent for peer review by independent experts selected by the ICES' Secretariat as is the normal procedure for ICES scientific advice.
    - The draft report will be ready no later than 30th January 2014 and after formatting be sent out for review on 3rd February 2014. The review will be finished by 21st February 2014 upon completion of a technical report.
- The draft WKD3R report will be sent for consultation to the European Union's (EU's) Member States via the mailing list of the DG ENV WG GES group. The member states will be invited to consider the report and to provide any comments.
    - The report will be sent for consultation on 3rd February 2014 and comments should be sent to ICES before 26th February 2014.
- The ICES Advice Drafting Group (ADG), ADGWKD3R, will meet 5-6 March 2014 with the task to:
    - Draft advice based on the WKD3R report, the technical report from the ICES' review group and the comments from Member States.
    - Factual comments will be considered and accommodated as decided by the ADG. All other comments (either general or with a political flavour) will be collated into a separate document for the DG ENV and possibly, with a summary at the beginning.
- The draft advice will be sent to the ICES' Advisory Committee (ACOM) on 11th March 2014, and ACOM will meet in a WebEx for discussion and adoption of the advice on 19th March 2014.
- The advice and an annex with the Member States comments not considered will be delivered to the DG ENV on Friday 21st March 2014.

- The advice and the WKD3R report, with the technical report of the review annexed, will be published on the ICES' homepage.

The conclusion of the consultation process will lead to the fulfilment of the third ToR.

2 Setting the scene

2.1 Introduction

A number of presentations were given on the first day of the workshop and these guided the discussions on the first two days; together with defining the programme of work for the remainder of the week and subsequently, for the completion of the workshop report after the 5-day meeting in order to accommodate the follow-up process within ICES (see Section 1.5). The presentations are not presented separately in this Section 2 as the subsequent Sections of this report present the details of the adopted generic methods used as applied in each of the four marine regions of MSFD.

In the Commission Decision 2010/477/EU three criteria including methodological standards were described for MSFD Descriptor 3 (D3). The three criteria and associated indicators are:

Criterion 3.1 Level of pressure of the fishing activity

- Primary indicator: Indicator 3.1.1 - Fishing mortality (F)
- Secondary indicator (if analytical assessments yielding values for F are not available): Indicator 3.1.2 - Ratio between catch and biomass index (hereinafter 'catch/biomass ratio')

Criterion 3.2 Reproductive capacity of the stock

- Primary indicator: Indicator 3.2.1 - Spawning Stock Biomass (SSB)
- Secondary indicator (if analytical assessments yielding values for SSB are not available): Indicator 3.2.2 Biomass indices

Criterion 3.3 Population age and size distribution

- Primary indicator: Indicator 3.3.1 - Proportion of fish larger than the mean size of first sexual maturation
- Primary indicator: Indicator 3.3.2 - Mean maximum length across all species found in research vessel surveys
- Primary indicator: Indicator 3.3.3 - 95% percentile of the fish length distribution observed in research vessel surveys
- Secondary indicator: Indicator 3.3.4 - Size at first sexual maturation, which may reflect the extent of undesirable genetic effects of exploitation

With the benefit of hindsight, the time scheduled for the meeting was too short and if future evaluations are undertaken then more time should be allowed for completion of work and the compilation of a final report.

2.2 Presentations

Five presentations are worthy of note:

1. Overview of North-east Atlantic stocks situation in 2013 by Henrik Sparholt (ICES).
2. Potential MSFD indicators and reference points for data-limited stocks by Rainer Froese which discussed how DATRAS can be used to derive indicators and reference points for data-limited stocks.

3. Indicator-based status assessment of commercial fish species in the North Sea according to the EU Marine Strategy Framework Directive (MSFD) by Wolfgang Nikolaus Probst.
4. Assessing the state of pelagic fish communities within an ecosystem approach and the European Marine Strategy Framework Directive by Mark Dickey-Collas.
5. Roadmap towards Descriptor D3 GES by Gerjan Piet.

2.3 Steps identified

Based on the presentations and subsequent discussions, a common approach was adopted for D3 at the workshop involving four distinct steps for each of the four marine regions of MSFD:

Step 1 – List of commercially exploited fish and shellfish stocks in the relevant marine region. Selection of commercial fish and shellfish stocks; together with reasons for any omission.

Step 2 – Catalogue and documentation of available information for the D3 assessment, incorporating ICES' data-limited stock approach.

Step 3 – Evaluation of GES by appropriate functional group (e.g. demersal, pelagic etcetera).

Step 4 – Overall status, issues, problems, gaps and links to other MSFD Descriptors (e.g. D1 and D4); together with any additional monitoring needs.

The JRC Draft MSFD Monitoring Guidance (Version 0.1) was the starting point for this workshop WKD3R and aided the work undertaken.

2.4 Generic report structure for each of the four marine regions of MSFD

For each region:

Introduction (approach, data availability, solutions to problems)

- Choice of stocks and reasons for omission, any links to D1, anything else
- DLS categorisation (# category 1 etc)
- Illustrative examples of Rainer's estimation of proxies, if available

Results (tables)

- Evaluation of GES (region/sub-region)
- By functional group (demersal, pelagic, deep-sea, elasmobranchs, shellfish) as separate tables
- Sort by DLS classification
- Map for category 1 (F, SSB)

Summary

Status by region/sub-region

	3.1.1	3.1.2	3.2.1	3.2.1	3.3	Unknown	Total
Number of stocks							
Number of stocks achieving green status							

Percentage of stocks achieving green status							

Problems and gaps identified

- Links to other descriptors, D3+, multi-species, foodwebs
- Monitoring needs wrt criteria; e.g. criterion 3.3

Recommendations for further development to overcome these (bulleted list, if possible)

Section references

2.5 Indicators and reference levels – follow-up to presentation by Rainer Froese

The workshop identified the availability of meaningful reference points is a challenge for indicator-based assessments. For stock status, the spawning stock biomass (SSB) is the internationally recognized indicator and the SSB that can produce the maximum sustainable yield (SSBmsy) is the corresponding reference point (UNCLOS 1982, MSFD COM 2010, CFP 2013).

During the workshop there were discussions if the agreed reference points and criteria under MSFD Descriptor 3 and CFP are applicable for all stocks. A controversial discussion was focused on the use of $B_{MSY\ trigger}$. An appropriate choice of B_{MSY} requires contemporary data with fishing at F_{MSY} to experience the normal range of fluctuations in SSB. Until this experience is gained, B_{pa} has for the time being, been adopted for many stock assessed by ICES as $B_{MSY\ trigger}$ even though B_{pa} and $B_{MSY\ trigger}$ correspond to different concepts. Therefore B_{MSY} marks the lowest possible value that can be associated with SSB_{MSY} which in practice is set as equal with the border of safe biological limits (SSB pa). Some participants of the workshop proposed that maintaining stock at this level as compatible with the Good Environmental Status (GES). Others argued that stocks with SSB < SSB_{MSY} are clearly not in accordance with the legal requirements of the MSFD and the reformed CFP (2013).

Some scientists stated that SSB_{MSY} cannot be reached for all stocks due to predator-prey interactions. Other scientists argued that some stocks already reached B_{MSY} and MSFD criteria and reference points are achievable for all stocks, if fishing mortality is reduced accordingly. Common sense was to use best data available.

<u>Data limited stocks</u>

During the workshop a method was presented how to derive indicators and reference points proxies to assess data limited stocks (DLS) under Descriptor 3. DLS lack assessment of fishing mortality, biomass and recruitment and therefore the indicators described above cannot be applied directly. Landing for most of these stocks are considered unreliable, mainly because they do not include discards and therefore underestimate the true catch. Data which are mostly available are life history data such as growth in length, length relationship, and length or age at first maturity as derived with standard models from DATRAS SMALK data (ICES 2013b). Also ICES provides catch per-unit effort by length class and ICES area in the DATRAS CPUE-per-length-per-area database (Froese & Sampang 2013).

From combination of these data it is possible to receive proxies for fishing morality (F) and spawning stock biomass (SSB). The participants agreed to test the method to assess DLS in the respective subgroups for each of the regional seas.

Therefore the method to assess DSL should be tested on a selection of stocks and the results will be forwarded to the responsible assessment groups to evaluate the reliance of the proposed method.

2.6 Population age and size distribution indicator

Obtaining an indicator and a reference point for an age structure that fulfills Criteria 3.3 of Descriptor 3 (COM Dec 2010/477/EU) was found to be challenging. During the workshop a method was presented to use the biomass of large fish relative to the spawning stock biomass as indicator, with a reference point derived from simulations:

Lmean / Lm90: This is a pressure indicator giving the ratio of the observed mean length in the catch to the length where 90% of the females have reached maturity.

Four proposals on how to deal with Descriptor 3.3 are presented at the end of this workshop report in Section 7.6.

Overall the workshop agreed that a review process is needed on how to fulfill the gaps of the actual CFP and MSFD criteria and reference points but some useful exploratory methods were presented and investigated at this workshop.

2.7 References cited in Sections 2

CFP, 2013. Basic Regulation on the CFP – Final Compromise Text. Downloaded from http://cfp-reformwatch.eu/wp-content/uploads/2013/06/2013-06-14_Basic_regulation_on_the_CFP_final_compromise_text.pdf on 15 October 2013.

COM, 2010. Commission Decision of 1 September 2010 on criteria and methodology standards on good environmental status of marine waters. Official Journal of the European Union L232/14-24

Froese, R. & A. Sampang. 2013. Potential indicators and reference points for good environmental status of commercially exploited marine fish and invertebrates in the German EEZ. World Wide Web electronic publication, available from http://oceanrep.geomar.de/22079/

3 Baltic Sea Region

3.1 Introduction

3.1.1 Identification of commercially exploited fish- and shellfish populations for the Baltic Sea

In order to assess the representativeness of the commercially exploited fish stocks for the Baltic Sea we used the estimate of what proportion of all landed fish and shellfish consisted of assessed stocks. For this we used the ICES catch statistics in the Baltic from 1983-2009 as they occur in the FAO FishStat database (Anon 2009; ICES/JRC Task Group D3+ report). The subareas used were ICES Subdivisions 22-32 except for herring, where catches from Division IIIa (i.e. Kattegat) were included to get the full coverage. Over the whole period (1983-2009) there were about 70 different species- or species-groups landed and reported. The exact number of species is difficult to determine as there was overlap between groups and some overlapping of areas as well as different species aggregated in one group (e.g. freshwater species). The last 5 years period of 2005-2009 was considered to represent well present situation in the Baltic and it has been used as a reference period. During this 5 years period there were 47 species out of 70 without relevant amount of landing data (less than 0.1 % of the total landings) to carry out any proper assessment for them. 23 species out of 70 species (22 fish, 1 invertebrate) that each contributed more than 0.1% of the total landings or were considered as important species. Together these 23 species made up 82% of the total landings consisting of approximately 95% fish and about 5% invertebrates. About 92 % of the landed species consists of assessed species (Table 3.1), comprising almost entirely (>95%) of sprat, herring and cod.

Table 3.1: Internationally assessed species

Species	Internationally Assessed	Internationally managed	Type	Relative to time period 2005-2009 (%)
Baltic sprat	A	Yes	F	51.9
Baltic herring	A	Yes	F	31.8
Baltic cod	A	Yes	F	8.1
Flounder	A	Yes	F	2.2
Blue mussel	NA	No	I	2.0
Perch	NA	No	F	0.8
Bream	NA	No	F	0.4
Roach	NA	No	F	0.4
Plaice	A	Yes	F	0.3
Northern pike	NA	No	F	0.3
European whitefish	NA	No	F	0.2
Pike-perch	NA	No	F	0.2
Common dab	A	Yes	F	0.2
Vendace	NA	No	F	0.2
Smelt	NA	No	F	0.1
European eel	A	Yes	F	0.1
Whiting	NA	Yes	F	0.1
Atlantic horse mackerel	NA	Yes	F	0.1
Baltic salmon	A	Yes	F	0.1
Garfish	NA	No	F	0.1
Sea trout	A	Yes	F	0.1
Turbot	A	Yes	F	0.1
Brill	A	Yes	F	0.1

For most of the internationally assessed species the assessments produce information for the D3 criteria related to fishing mortality (3.1), spawning stock biomass (3.2) and size distributions and maturation (3.3). The approaches for Baltic Salmon and sea trout are, however, little different. The assessments of the state of the stocks for these species are based on river specific estimates of the actual smolt production or parr densities compared to the potential production/densities, as a proxy for the amount of spawning fish entering the wild salmon/sea-trout rivers. Thus the information provided for these species could also well support the biodiversity indicators in D1. Furthermore, the sea-trout stocks, especially in the northern parts of the Baltic Sea are close to extinction and there hardly any targeted commercial fishery for sea trout.

There are small-scale fisheries on European eel in the Baltic and the stock is presented among widely distributed stocks in the North-east Atlantic Ocean region.

In addition to those internationally assessed species (see Table 3.1), there are several fish species/stocks which are important for small-scale coastal fishery on regional or national level. The majority of them are typically freshwater species. National catch statistics of commercial fishery have been a common data sources for these species/stocks. Coastal fish communities have also been monitored by gillnets in many areas of the Baltic Sea, producing data on e.g. perch and cyprinids which are typically caught by gillnets during the monitoring in late summer. Many of the nationally/regionally assessed species could support the indicators for D1 (biodiversity) or D4 (foodwebs). However, the need to manage the fishery of some of them is well acknowledged and for them the approaches in D3 could thus be more useful and should be applied in the respective country. Here good examples are pikeperch and perch which are even included in national DCF programs and sampled from commercial catches in four countries around the Baltic Sea. Local stock assessments have also been carried out.

We propose that it is important in the international cooperation to develop and test common approaches and methods to D3 indicators for nationally/regionally managed species, too. The analysis of the usefulness and sufficiency of the data collected under present DCF-program for D3 indicators should have a preference. International cooperation for coastal species has been done in HELCOM Fish-Pro but the work has so far been focused on gillnet monitoring data for D1 indicators.

Some participants stressed that CFP Article 2.3 states the following: "**The CFP shall implement the ecosystem-based approach to fisheries management so as to ensure that negative impacts of fishing activities on the marine ecosystem are minimised,** ..." The quantitative analysis (SMS), as presented by Stefan Neuenfeldt from DTUA Aqua (*Indicators in a multispecies environment: Some considerations for the central Baltic stocks*, see Section 3.3.2), did not try to minimize impact but rather aimed at maximizing catch. Also, there is no evidence in the stomach analysis data that phases of higher cannibalism coincide with phases of large stock size, as assumed in the SMS model. Therefore, it was proposed that a more realistic model is applied that includes more groups and that tries to minimize impact by, e.g., maximizing biomass for an optimum combination of catches below single-species Fmsy.

3.1.2 Compilation of stock information relating to D3 criteria

3.1.2.1 Category 1 stocks

At present, there is full analytical assessment with defined levels of Fmsy and SSBmsy-trigger for three species in the Baltic Sea region. Still these species comprise more than 90% of the commercial landings in the area (Table 3.2). The seven category 1 stocks include two stocks of cod, one sprat stock and four out of five herring stocks (see Table x *Large*). The herring stock in the Bothnian bay (SD31) lack survey data and is classified as a DLS category 3.2. The herring stocks in the Bothnian Sea (SD30) and the Gulf of Riga are assessed separately from the central Baltic herring (SD25-29 and 32). Assessments of the cod stocks rely on data from the Baltic International Trawl Survey (BITS) and the assessed sprat and herring stocks use information from the Baltic International Acoustics Survey (BIAS). The herring in Division IIIa and SD 22-24 (western Baltic spring spawners) is a shared stock with the North Sea subregion and is assessed using a combination of surveys from the two regions (see latest assessment).

Table 3.2 Stocks in trhe Baltic region for which there is an international advice through ICES. For category 1 species estimates of F in relation to Fmsy and estimates of SSB in relation to SSBmsytrigger stocks the direction of trends in harvest rate and survey are given

Table X.X Stocks in the Baltic Sea region for which there is an international coordinated advice through ICES. For category 1 species estimates of F in relation to Fmsy and estimates of SSB in relation to SSBmsytrigger are given. For category 3 stocks the direction of trends in harvest rate and survey index are given

Stock code	Species name	2012 DLS Category	WKD3R data	FMSY	F_2010	F_2011	F_2012	F-Fmsy/Fmsy	SSBMSYtrigger	SSB_2011	SSB_2012	SSB_2013	SSB-SSBmsytrigger/SSBmsytrigger	Harvest rate (trend)	Survey index (trend)	Comments
cod-2224	Cod	1,0	ICES advice	0,26	0,709	0,761	0,698	1,6846	36400	33962	41028	38793	0,0657			
cod-2532	Cod	1,0	ICES advice	0,46	0,422	0,392	0,373	-0,1891	88200	132191	153584	179872	1,0394			
her-2532-gor	Herring	1,0	ICES advice	0,26	0,219	0,1736	0,1331	-0,4881	600000	730206	751456	716586	0,1943			2013 data predicted
her-30	Herring	1,0	ICES advice	0,15	0,091	0,087	0,01	-0,9333	316000	815046	970921	940567	1,9765			
her-riga	Herring	1,0	ICES advice	0,35	0,3475	0,3959	0,3694	0,0554	60000	94662	79100	77088	0,2848			
spr-2232	Sprat	1,0	ICES advice	0,29	0,31	0,26	0,29	0	570000	927000	905000	883000	0,5491			2013 data predicted
her-3a22	Herring	1,0	ICES advice	0,28	0,3703	0,3171	0,3311	0,1825	110000	85681	87936	106053	-0,0359			2013 data predicted; shared stock with the North Sea
sal-2231	Salmon	NA						NA					NA	NA	NA	Other indicators are used for salmon and sea trout
sal-32	Salmon	NA						NA					NA	NA	NA	
trt-bal	Sea trout	NA						NA					NA	NA	NA	
dab-2232	Dab	3,2	ICES advice											?	Increasing	
ple-2123	Plaice	3,1	ICES advice	0,25	0,31	0,22	0,16	(-0.36)	undefined					Decreasing	Increasing	Provisional Fmsy from neighboring NS stock
bll-2232	Brill	3,2	ICES advice											?	Increasing	
fle-2232	Flounder	3,2	ICES advice											?	Decreasing	
her-31	Herring	3,2	ICES advice											Increasing	Increasing	
ple-2432	Plaice	3,2	ICES advice											?	Increasing	
tur-2232	Turbot	3,2	ICES advice											?	Decreasing	

3.1.2.2 Category 3 stocks

The method proposed by Froese and Sampang (2013) was investigated as a potential way to establish proxies for indicators and reference points for data-limited stocks (ICES Category 2, 3) in the Baltic. This general appraoch and possible indicators and how to derive those are presented in further detail in Froese & Sampang (2013). The analyses of these authors showed that applying this method to fully assessed stocks and comparing the resulting scores for good environmental status shows a reasonably good agreement (Froese & Sampang 2013).

In the Baltic, there are currently 7 fish stocks which are assessed in ICES under Categories 2 or 3; six of them being flatfish and one herring stock (between Category 2 and 3). These are:

1. Plaice in SDs 21-23
2. Plaice in SDs 24-32
3. Flounder in SDs 22-23
4. Dab in SDs 22-32
5. Brill in SDs 22-32
6. Turbot in SD 22-32

7. Baltic herring in SD 31

For each of these stocks above, except for Baltic herring in SD 31, the Baltic subgroup at WKD3R analysed the proxy indicators for biomass and exploitation, to evaluate the usefulness of this approach for these stocks. For flounder, SIMWG has recommended to use four different stock in the Baltic Sea, i.e. Flounder in SD 22-23; Flounder in SDs 24-25; Flounder in SDs 26 &28; and Flounder in SDs 27&29-32. This option is currently under consideration as part of benchmark process (WKBALFLAT). Therefore, the analyses to derive proxy indicators was extended to these units as well.

The biomass indicators explored were based on data from the BITS (demersal trawl) surveys downloaded from DATRAS database. To derive indicators for fishing pressure, additionally data for commercial landings were used. The analyses distinguish between proxies for "recruits", i.e. the number of "youngest fish in the survey", and spawning stock biomass, i.e. the number of individuals larger than the length at 50% female maturity, converted to weight and added up to obtain biomass of mature.

There are different options in the approach suggested by Froese and Sampang (2013) for deriving biomass reference points, based on relative biomasses and abundances from surveys. These can be derived for example based on the breakpoint in a stock-recruitment relationship, or set to the lowest or highest value observed in the time series. Some observations emerging from applying these options on the Baltic stocks are outlined in the conclusion chapter below.

Concerning proxies for fishing pressure, the Baltic group focused on exploring the trends in exploitation rate, i.e. the ratio between commercial landings and relative biomass from surveys.

Results

Below the standard output figures with trends in relative biomass and exploitation rate are presented for each of the Baltic data limited fish stocks for which the method was applied.

Plaice in SD 21-23

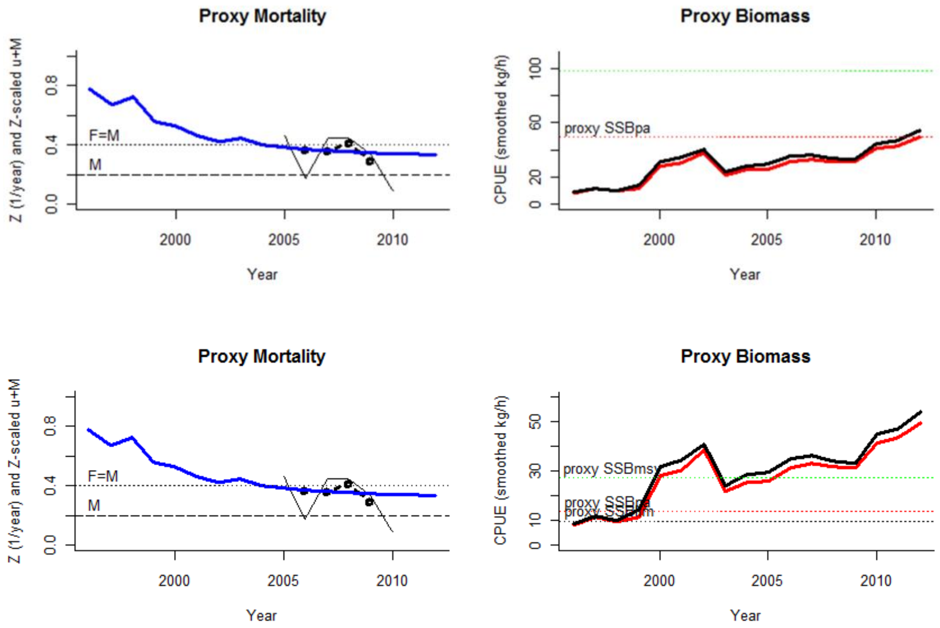


Figure 3.1. Plaice 21-23. In the right graph, length of individuals was converted to weight and added up to show biomass of mature (individuals larger than the length at 50% female maturity) (red) and all fish (black). The dotted horizontal lines are proxy reference points for spawning stock biomass. The left graph shows total mortality *Z* experienced over the respective previous two years (black circles) and scaled exploitation rate *u+M* (blue), both as a proxies for fishing mortality, with indication of natural mortality (*M*, dashed line) and total mortality if *F* = *M* (dotted line) as reference points. The blue line shows scaled exploitations rate (commercial landings divided by survey biomass index). The upper panel shows biomass reference poin that is set to the highest observed value in the time sereis, the lower panel shows biomass reference points derived from S-R relationship.

Plaice in SD 24-32

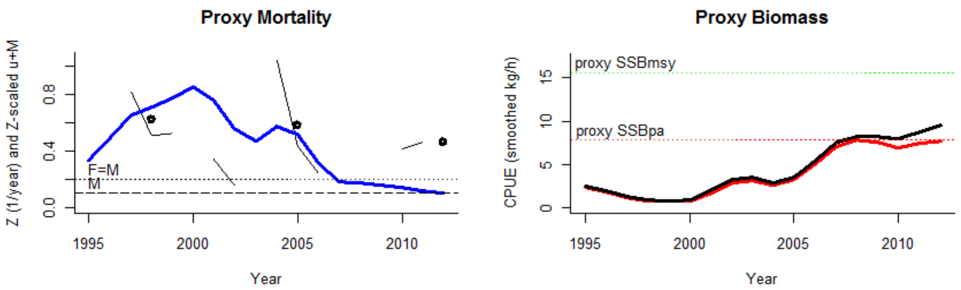


Figure 3.2. Plaice 24-32. In the right graph, length of individuals was converted to weight and added up to show biomass of mature (individuals larger than the length at 50% female maturity) (red) and all fish (black). The dotted horizontal lines are proxy reference points for spawning stock biomass. The left graph shows total mortality *Z* experienced over the respective previous two years (black circles) and scaled exploitation rate *u+M* (blue), both as a proxies for fishing mortality, with indication of natural mortality (*M*, dashed line) and total mortality if *F* = *M* (dotted line) as reference points. The blue line shows scaled exploitations rate (commercial landings divided by survey biomass index).

Flounder

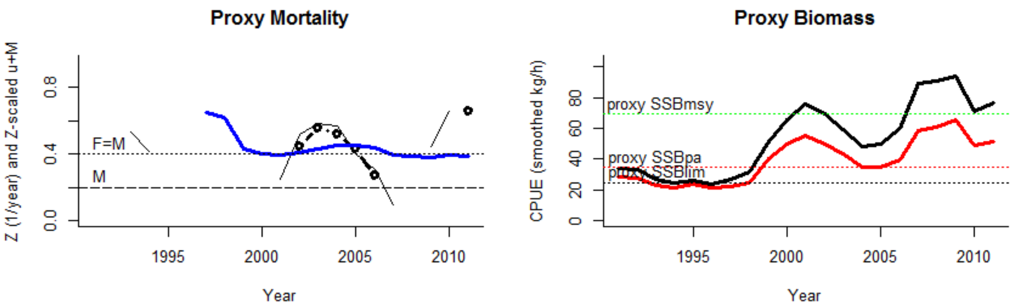


Figure 3.3. Flounder SD 22-32. In the right graph, length of individuals was converted to weight and added up to show biomass of mature (individuals larger than the length at 50% female maturity) (red) and all fish (black). The dotted horizontal lines are proxy reference points for spawning stock biomass. The left graph shows total mortality *Z* experienced over the respective previous two years (black circles) and scaled exploitation rate *u+M* (blue), both as a proxies for fishing mortality, with indication of natural mortality (*M*, dashed line) and total mortality if *F* = *M* (dotted line) as reference points. The blue line shows scaled exploitations rate (commercial landings divided by survey biomass index).

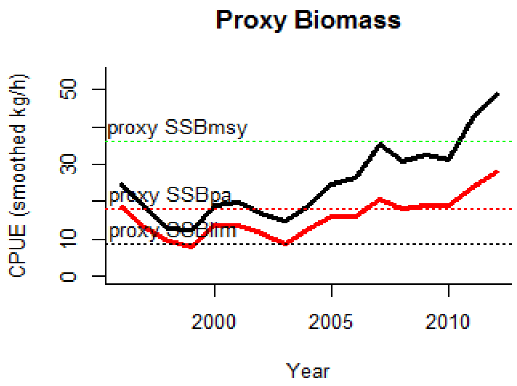


Figure 3.4. Flounder 22-23. The length of individuals was converted to weight and added up to show biomass of mature (individuals larger than the length at 50% female maturity) (red) and all fish (black). The dotted horizontal lines are proxy reference points for spawning stock biomass.

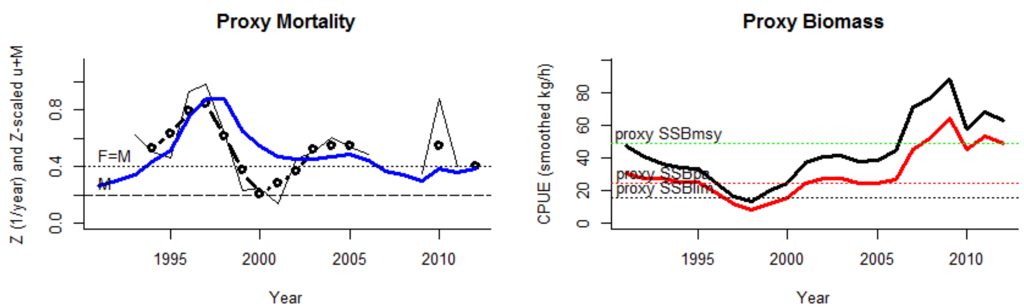


Figure 3.5. Flounder 24-25. In the right graph, length of individuals was converted to weight and added up to show biomass of mature (individuals larger than the length at 50% female maturity) (red) and all fish (black). The dotted horizontal lines are proxy reference points for spawning stock biomass. The left graph shows total mortality *Z* experienced over the respective previous two years (black circles) and scaled exploitation rate *u+M* (blue), both as a proxies for fishing mortality, with indication of natural mortality (*M*, dashed line) and total mortality if *F* = *M* (dotted line) as reference points. The blue line shows scaled exploitations rate (commercial landings divided by survey biomass index).

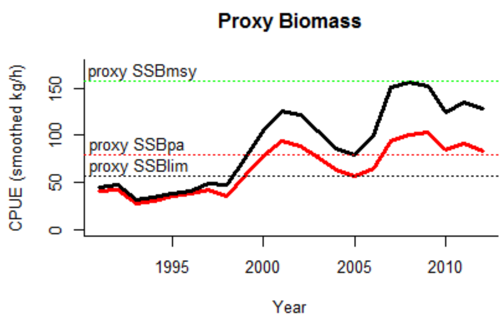


Figure 3.6. Flounder 26&28. The length of individuals was converted to weight and added up to show biomass of mature (individuals larger than the length at 50% female maturity) (red) and all fish (black). The dotted horizontal lines are proxy reference points for spawning stock biomass.

Dab 22-32

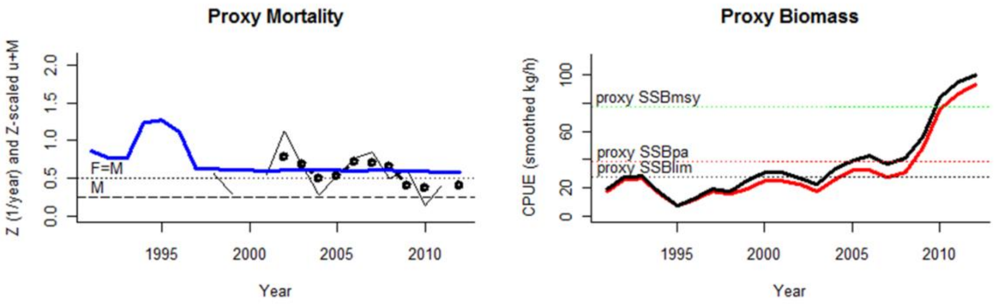


Figure 3.7. Dab 22-32. In the right graph, length of individuals was converted to weight and added up to show biomass of mature (individuals larger than the length at 50% female maturity) (red) and all fish (black). The dotted horizontal lines are proxy reference points for spawning stock biomass. The left graph shows total mortality *Z* experienced over the respective previous two years (black circles) and scaled exploitation rate *u+M* (blue), both as a proxies for fishing mortality, with indication of natural mortality (*M*, dashed line) and total mortality if *F* = *M* (dotted line) as reference points. The blue line shows scaled exploitations rate (commercial landings divided by survey biomass index).

Brill 22-32

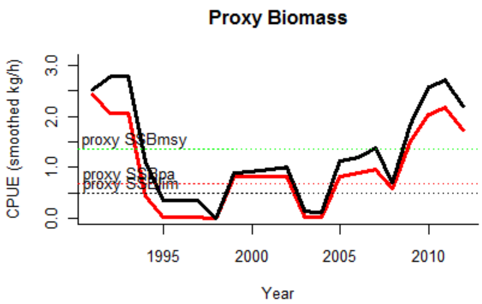


Figure 3.8. Brill 22-32. The length of individuals was converted to weight and added up to show biomass of mature (individuals larger than the length at 50% female maturity) (red) and all fish (black). The dotted horizontal lines are proxy reference points for spawning stock biomass.

Turbot 22-32

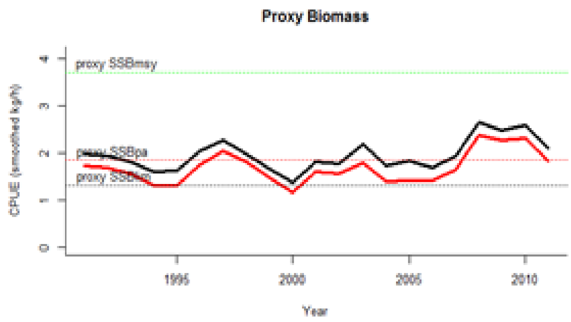


Figure 3.9. Turbot 22-32. The length of individuals was converted to weight and added up to show biomass of mature (individuals larger than the length at 50% female maturity) (red) and all fish (black). The dotted horizontal lines are proxy reference points for spawning stock biomass.

Summary of the results from the analyses for data-limited stocks

The table below (Table 2) summarizes the trends in relative spawner biomass and exploitation rate as proxies for indicators for spawning stock biomass (SSB) and fishing mortality (F) derived at WKD3R and compares those with the status of these stocks as defined in the latest ACOM advice.

In general the biomass trends derived during WKD3R were in line with the stock status concluded by ACOM, which is expected and both are essentially based on the same survey data. Information for fishing pressure is often not provided in ACOM advice for data limited stocks. In this respect, the indicator representing relative exploitation rate could be useful for providing information on the direction of the development in fishing pressure on the stock. The trends in exploitation rate indicate a decreasing or stable fishing pressure for all the analysed stocks (Table 2).

The comparisons with ACOM advice were made using the same criteria for defining a trend as used by ACOM for providing catch advice, i.e. for biomass the average value for last 2 years was compared with the average of the previous 3 years. The appropriate time period chosen for a trend and the definition of a trend could potentially be defined differently in the context of GES.

Table 3.3 Comparison of trends in indicators for fishing mortality (F) and Standing stock biomass (SSB) for Category 3 stocks in the Baltic Sea as given in ACOM advice and preliminary evaluations during the WKD3R.

Stock code	Species name	2012 DLS Category	ACOM advice		WKD3R		Comments
			F trend	SSB trend	F trend	SSB trend	
dab-2232	Dab	3.20	?	Increasing	Stable	Increasing	
ple-2123	Plaice	3.10	Decreasing	Increasing	Decreasing	Increasing	

bll-2232	Brill	3.20	?	Increasing	Stable	Increasing	Very low CPUE values through out the time series 0-2 ind/h trawling. Coastal species, problems with survey coverage.
her-31	Herring	3.20	Increasing	Increasing	NA	NA	
ple-2432	Plaice	3.20	?	Increasing	Decreasing	Stable (slight Increase)	
tur-2232	Turbot	3.20	?	Decreasing	Stable	Stable (Slight decrease)	Time series stops 2011. Very low CPUE values through out the time series. Coastal species, problems with survey coverag

						e.
fle-2232	Flounder	3.20	?	Decreasing	Stable	Stable (Slight decrease)
fle-2223*	Flounder	3.20	NA	NA	?	Increasing
fle-2425*	Flounder	3.20	NA	NA	Stable	Stable
fle-2628*	Flounder	3.20	NA	NA	?	Stable (Slight decrease)

*Proposed to be assessed as separate stocks from 2014 by SIMWG

Conclusions and comments on the approach tested

Coverage of survey time series

One of the general issues related to using survey data for deriving indicators of GES is related to the relatively short time series available for the Baltic. The calibration and standardization of survey gears was made between 1999-2001 and after 2002 standardized TVG trawls have been used. Therefore, consistent time series are only available from there onwards. In the analyses conducted by WKD3R the entire available time series was used (starting from the beginning or mid 1990s), recognizing that the stock-recruitment relationships fitted include both the data from old and new survey gears. Thus, the analyses presented here are preliminary and only indicative for recent trends, while the values for reference points derived in these analyses are not considered applicable for GES or other management purposes.

Further, only a very low numbers of some data limited species are caught in BITS, such as brill and turbot. For example, only an average of 0-2 individuals of brill are caught per hour. Some of these flatfish species inhabit more coastal areas and are out of the coverage of BITS, thus the standard survey may not be suitable for deriving GES indicators for these species.

Estimation of proxies for biomass reference points

An issue that complicates deriving biomass reference points based on fitting stock-recruitment relationships is related to poor fit in a number of cases (Fig. 9). Thus, this appraoch may potentially be applicable only for a limited number of stocks. It should also be mentioned that in the standard software the S-R analysis operates with 3 year smoothed averages, which reduces variability in observed interannual variations. For some stocks, with naturally high recruitment variability, smoothing may imply deterioration of SR fit. Thus, in future analyses, different options with both original and smoothed values should be explored and compared.

A possible other option for defining biomass reference points in the proposed approach includes setting it to the highest value observed in the time series. This is however problematic, for example in case of stocks that are increasing in biomass and are currently at the highest level in record (see for example plaice in SD 21-23). In this case, when the reference point is set to the highest value, a further increase in stock size would also move the reference point, making reaching GES in fact impossible. Another possibility would be to set the limit reference point to the lowest value observed, after which the stock has increased again (similar to ICES B_{loss} approach) which could also be explored for data-limited stocks based on survey indices only.

Estimation of proxies for fishing mortality indicators and reference points

In the analyses conducted by WKD3R, the Baltic sub-group focused on investigating trends in an indicator measuring fishing pressure, i.e. the exploitation rate, and not on the absolute values or reference points. The approach proposed by Froese and Sampang (2013) offers possibilities to derive proxies for fishing mortality at an absolute scale. However, a number of assumptions and intermediate calculations are involved in this process, that was not possible to explore closer at WKD3R due to time constraints.

As a general conclusion arsing from the Baltic sub-group at WKD3R was that more work should be allocated in future to explore and evaluate the usefulness of proposed indicators for the Baltic data limited stocks, using BITS survey indices from DATRAS data base.

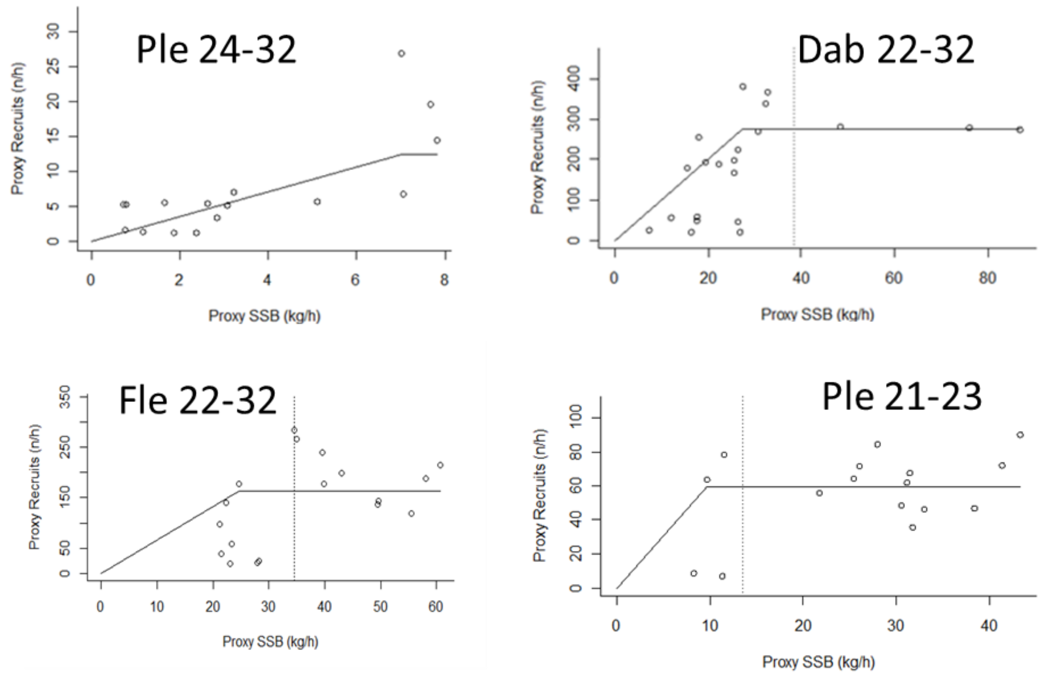


Figure 3.10. Fitted stock recruitment relations (hockey-stick) and respective break points for selected stocks.

3.2 Overall summary

Table 3.4: Proportion of stocks achieving green status in the Baltic Sea divided by Criteria under D3 (excluding Salmon and Sea trout, for which other indicators are used). Numer of unknown stocks are referring to the five criteria groups 3.1.1-3.3.

	3.1.1	3.1.2	3.2.1	3.2.2	3.3	Unknown	Total
Number of stocks	7	2	7	7	0	0/5/0/0/14	14
Number of stocks achieving green status	4	1	6	5	NA		
Percentage of stocks achieving green status	57	50	86	71	NA		

* During the workshop different methods were presented, but there was no overall agreement how to assess Criteria 3.3. For further details note Section 7.6.

For the ICES' catch statistics from 1983-2009 in the Baltic Sea Region as they occur in the FAO FishStat database (Anon 2009; ICES/JRC Task Group D3+ report) there were about 70 different species or species-groups landed and reported. Out of the 17 stocks assessed by ICES in the Baltic Sea, 14 stocks are assessed using F and SSB metrics comparable to indicators under descriptor 3.1 and 3.2 (large Table). Out of the seven stocks having full assessment (Category 1 stocks) four achieve green status for fishing mortality (3.1.1) and six stocks achieve green status for spawning stock biomass (3.2.1; Table O'Brien). For the seven stocks with category 3 assessments only two report on the fishing mortality (3.1.2) out of which one is achieving green status. Concerning standing stock biomass five out of the seven category 3 stocks are presently achieving green status. For the stocks in the Baltic Sea, ICES is not assessing the status of stocks based on size or age structure of the populations according to Criteria 3.3.

3.3 Problems and gaps identified

3.3.1 Data gaps in the context of single and multispecies

One big issue concerning the calculation of DLS indicators with the BITS data from the DATRAS database concerns the comparability of data from different years and different countries, since most of the older data was generated by the use of various gears with different catchability:

The Baltic International Trawl Survey (BITS) has a long history in the Baltic Sea, but it began in the form of several national trawl surveys. The first national surveys started in 1962, and several others followed, thus the time-series available are quite long. But the various national survey designs differentiated according to the special scientific interests wherefore they had a very heterogeneous distribution in space, time and gears used. In order to obtain comparable results in 1985 first attempts were made to an international coordination of the national trawl surveys and these attempts were continued with varying intensities in subsequent years. In 1995 the development of a bottom-trawl manual was started and finally in 2001 the BITS survey was standardised and internationally coordinated. A new survey design was established determining the TV-3 demersal trawl (types TV3#520 and TV3#930) as standard fishing gear during the BITS surveys (ICES 2013).

A number of inter-calibration experiments between the former used national gears and the new standard gear were carried out in relation to EU project IDSBITS in 2001 and additional experiments were coordinated by WGBIFS in the following years (Oeberst 2007). Based on these experiments WGBIFS estimated conversion factors for cod to guarantee comparability of the obtained data. In 2007 WKAFAB started investigations to also develop conversion factors for flounder. Nevertheless in the DATRAS database conversion factors are only applied to cod data so far. For all other species the gear differences may cause a bias.

Furthermore there may be a bias in the spatial distribution patterns of species before 2001 because the conducted national surveys used different gears (see EU project IDSBITS) and different survey periods. And also in the data from 2001 onwards some species may not be representatively covered in their spatial distribution because the area covered by the BITS survey orientates on the distribution of cod (ICES Subdivision 22-28). Other areas, where cod does not occur, are not necessarily covered.

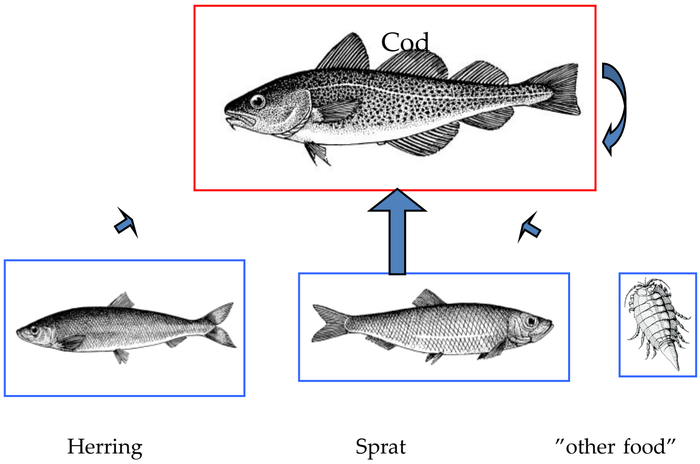
3.3.2 Indicators in a multispecies environment – some considerations for the central Baltic Sea stocks

Presentation by Stefan Neuenfeldt DTU Aqua
Indicators in a multispecies environment: Some considerations for the central Baltic stocks.
(ICES. 2012a. Report of the Workshop on Integrated/Multispecies Advice for Baltic Fisheries (WKMULTBAL), 6–8 March 2012, Charlottenlund, Denmark. ICES CM 2012/ACOM:43. 112 pp.)

EU member states have finalised the national suggestions for indicators of Good Environmental Status. In addition to this process, in ICES WGSAM, WGFE and WGECO have continued to work towards defining suitable indicators of GES, in particular the aspects of foodwebs. As ICES Member Countries and working groups provide more of these objectives, they should ideally be built into the delimitation of space for policy choices, and further define the ICES opinion of precautionary, MSY and ecosystem approaches.

Extensive multispecies and ecosystem research has been performed in the Baltic past 30 years. ICES, together with several institutes around the Baltic, has invested substantially in the research on multispecies interactions, ecosystem functioning, and integrated assessment. Currently, several multispecies and ecosystem models exist for the Baltic Sea (for an overview cf. ICES, 2009a). One of them, the stochastic multispecies model (SMS), was chosen for a more detailed scrutiny in 2012 by ICES in cooperation with the EU STECF (ICES, 2012a, 2012b).

The three stocks considered in the multispecies model are eastern Baltic cod in Subdivisions 25–32, Baltic herring in Subdivisions 25–29 and 32 (excl. Gulf of Riga), and Baltic sprat in Subdivisions 22–32. Cod is a predator on herring, sprat, and juvenile cod (Figure xxx below). This predation by cod forms the main interactions among these stocks and is the only type of interaction considered in the quantitative analysis (SMS). In the model cod is the only predator, and forages on small cod, herring, sprat, and zoobenthos, which is pooled as ‘other food’.



The SMS model is a stochastic “forward running” model based on the theory for predation mortality. It is a stock assessment model including biological interaction, and it produces quantification of historical stock dynamic: recruitment, Fs, and SSB. It contain forecast scenarios, including performance of harvest control rules. SMS estimates parameters from observations of catch at age data, abundance indices, survey CPUE at age data, stomach contents data by length group, food rations, age-length keys and is able to use additional data such as maturity ogives, weight at age, residual mortality

The multispecies results are derived assuming that there is full spatial overlap for all three stocks. The geographical overlap of cod and clupeid stocks is currently small, with cod found mainly in the south (Subdivision 25) and clupeids mainly in the north (Subdivisions 28–29 and 32) as shown in Figure 9 below for the 4th quarter. However, for sprat this distribution is valid only for quarter 4 and during spring and spawning time spart is distributed more southern area in the spawning grounds.

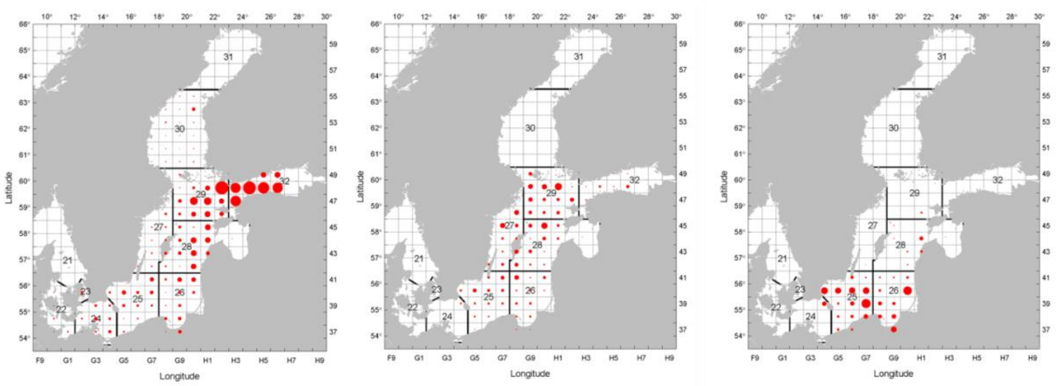


Figure 3.11. Spatial distribution of Baltic sprat from the acoustic survey (BIAS) in the 4th quarter in 2012 (in Subdivisions 22–30; left panel); herring in Subdivisions 25 to 29 and 32, excluding the Gulf of Riga from the BIAS survey (BIAS) in the 4th quarter in 2012 (in Subdivisions 25–29 and 32; middle panel); eastern Baltic Sea cod (Subdivisions 25–32) from the bottom trawl survey (BITS) in the 4th quarter in 2012 (in Subdivisions 25–29 South; right panel).

The current distribution pattern of cod and clupeids implies that:

- an increase in F on cod in the southern Baltic will not necessarily result in increasing clupeid stock sizes (and hence will not increase clupeid cpue's)
- a reduction of clupeid F in Subdivision 25 is likely to improve growth and condition of cod as well as reduce cannibalism;
- an increase in clupeid F in northern areas (Subdivisions 27–32) is unlikely to negatively affect the major cod stock component distributed in southern areas (Subdivisions 25–26);
- an increase in sprat F in northern areas (Subdivisions 27–32) is likely to improve the growth rates of the clupeid stocks; and
- an increase in cod F may imply higher probability of low cod SSB.

Management of fisheries for cod has an impact on fishing opportunities for sprat and herring, and vice versa; management of the clupeid fisheries influences the food availability for cod, and thereby indirectly cod yield. If the cod stock is large, the yield of herring and sprat will be reduced. Spatial management of the herring and sprat fisheries may influence the growth of individual fish of cod and possibly also on clupeids, and thus the potential yield.

Single species and multispecies MSY reference points

The values of present reference points can change in the future since there are many process functions in the species dynamics, both in terms of population numbers, spatial distributions, and body growth, which have not been sufficiently evaluated. The MSY reference points are sensitive to changes in density-dependent effects, cannibalism, and environmental drivers that affect recruitment and body growth.

The single- and multispecies F_{MSY} are similar, though B_{MSY} of cod may vary by up to a factor 1.74 (Table xxx below). This difference is mainly due to cod cannibalism taken into account in the multispecies model.

It should be noted when examining F_{MSYS} that no value of F_{MSY} can be considered precautionary until a formal harvest control rule has been evaluated in a management strategy evaluation framework

Table 3.5: MSY reference points from the SMS mode and as used in the single species advice. The "~" in front of the MSY values means "around" as no fixed value for the reference points exist in a multispecies context.

	F_{MSY}			MSY (yield)			B_{MSY}		
	Cod	**Herring**	**Sprat**	**Cod**	**Herring**	**Sprat**	**Cod**	**Herring**	**Sprat**
Multispecies advice (SMS)	~0.55	~0.3	~0.3	~77	~178	~225	~200	~730	~1000
Single-stock advice	0.46	0.26	0.29	-	170	180	115	617	655

In a dynamic environment with species and technical interactions, no fisheries can exploit all populations at FMSY. When offering trade-offs, it is possible to produce scenarios below FMSY for the exploitation of some populations. This will allow a policy choice to be made within the limits defined. FMSY could thus be defined as a range, although the upper bound should not be seen as optimum solution for fisheries exploitation rates. FMSY should be seen as the upper bound for the target F.

The main result of the present SMS multispecies analysis for the central Baltic is that, compared to the present single-species approach, it could be possible to increase the sum of the sustainable yields in tonnes of the three species combined; the growth of individual fish would be improved if multispecies interactions were taken into account when setting target Fs.

However, cod yields will remain about the same, whereas the probability of low cod spawning-stock biomass (SSB) will increase. Multispecies considerations indicate a multitude of solutions, all being biologically sustainable. The societal choice between these must be based on social and economic considerations and informed by social and economic impact assessments.

Spawning-stock biomass (SSB) as reference point for good environmental status (GES), based on single-species considerations, cannot be considered fixed when multispecies interactions are taken into account. When the predator SSB representing single-species GES results in prey SSB at a level below GES, predator reference SSB has to be re-defined. As soon as prey-dependent growth of the predator is accounted for, it is also possible that prey reference SSB has to be redefined to avoid too low predator SSB.

There are also other aspects of interactions related to these three stocks which are presently not included in the SMS model, the most important being: 1) the variation in spatial overlap between the three stocks, 2) inter- and intraspecific competition for food between and within the two clupeid stocks, 3) cod growth in relation to amount of food available, and 4) herring and sprat predation on cod eggs and clupeid food competition with cod larvae.

3.4 Recommendations for further development

- Froese & Sampang (2013) method provides an alternative, interesting approach to estimate reference points for survey data and may improve the evaluation of the state of category-3 stocks. However, for time being it might be wise to explore further how this approach would fulfil the quality requirements for ICES advice and – more technically – fit ICES software suites. We propose that the method should be evaluated by WGMG.
- There is a need for including new stomach data into the Baltic multispecies models and thus a new stomach sampling programme should be initiated for next 3 years or so to update interaction data, which presently dates back mainly to 1980s and 1990s.
- In addition to fish-fish interactions, a new interaction fish-benthos data would enhance multispecies models performance and quality of advice deliverables.
- Exploration and the consequences of multispecies interactions and environmental factors should be also in focus in practical multispecies reference points evaluations and advice as the effect of environmental changes are key points in multispecies context.

- Comparison of methods used to include spatial structure (predator-prey overlap) in multispecies prediction models would facilitate the future of development of multispecies advice.
- For the future integrated ecosystem advice, development and testing of common approaches and methods of D3 indicators for nationally/regionally managed species should be made internationally available.
- A number of coastal fish species are important for foodweb functioning and eventually for ecosystem structure. These species often have many local populations, and are by various degree targeted by recreational and commercial fishery. New and innovative data collection and assessment tools needs to be developed to support relevant indicators for the MSFD

3.5 References cited in Sections 3

Froese, R. and A. Sampang. 2013. Potential Indicators and Reference Points for Good Environmental Status of Commercially Exploited Marine Fish and Invertebrates in the German EEZ. World Wide Web electronic publication, available from http://oceanrep.geomar.de/22079/

ICES. 2009a. Report of the ICES/HELCOM Working Group on Integrated Assessments of the Baltic Sea (WGIAB), 16–20 March 2009, Rostock, Germany. ICES CM 2009/BCC:02. 81 pp.

ICES. 2012a. Report of the Workshop on Integrated/Multispecies Advice for Baltic Fisheries (WKMULTBAL), 6–8 March 2012, Charlottenlund, Denmark. ICES CM 2012/ACOM:43. 112 pp.

ICES. 2012b. Report of the Baltic Fisheries Assessment Working Group (WGBFAS), 12–19 April 2012, ICES Headquarters. ICES CM 2012/ACOM:10.

3.6 Overall status of the Baltic Sea in relation to Criteria 3.1 and 3.2

Figures 3.12 and 3.13 show the overall status of commercial fish stocks in the Baltic Sea.

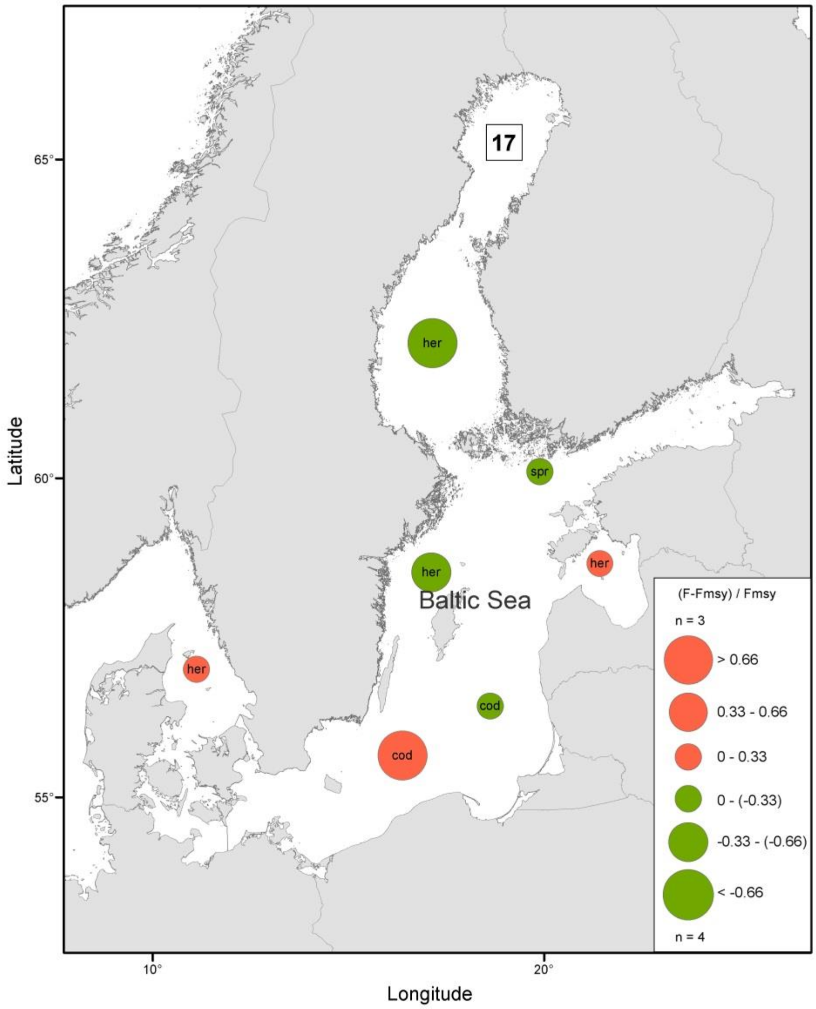


Figure 3.12. Status of the current fishing mortality (F) in relation to the target reference mortality (Fmsy) for 7 Baltic stocks with analytical assessment. Circle size is proportional to the absolute value of (F-Fmsy/Fmsy). Circle color indicates whether the current F is above (red) or below (green) the reference Fmsy. Black square indicates the number of stocks in the region and n indicates the number of stocks above and below the reference point respectively. Figure based on (Fernandez and Cook, 2013) and modified by the ICES data Centre.

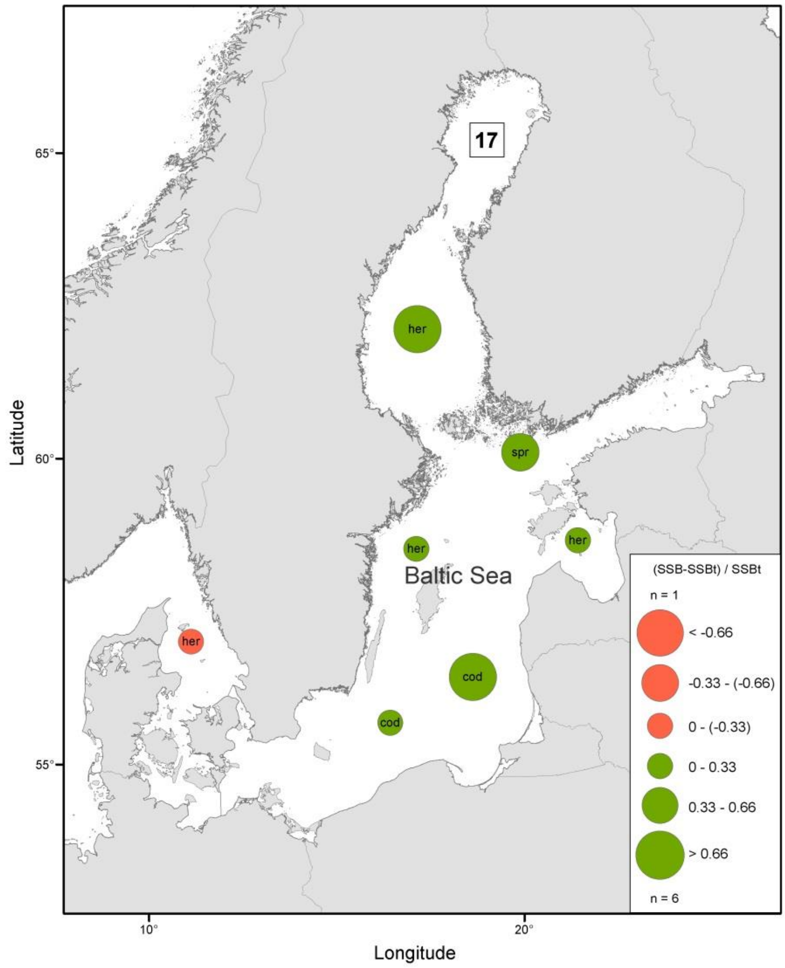


Figure 3.13. Status of the current adult Biomass (SSB) in relation to the target reference SSB-trigger (SSBt) for 7 Baltic stocks with analytical assessment. Circle size is proportional to the absolute value of (SSB-SSBt/SSBt). Circle color indicates whether the current SSB is above (green) or below (red) the reference SSBt. Black square indicates the number of stocks in the region and n indicates the number of stocks above and below the reference point respectively. Figure based on (Fernandez and Cook, 2013) and modified by the ICES data Centre.

3.7 References cited in Sections 3

Fernandes, P.G. and Cook, R.M. (2013). Reversal of Fish Stock Decline in the Northeast Atlantic. Current Biology 23, 1432–1437.

4 North-east Atlantic Region

4.1 Introduction

4.1.1 Regional scope

The MSFD region of the Northeast Atlantic encompasses the ICES eco-regions of the greater North Sea, the Celtic Seas, including west of Scotland, the Irish Sea and the Celtic Sea proper, the Bay of Biscay, Iberia and the wider Atlantic.

The D3 assessment for the Northeast Atlantic region was conducted at a sub-regional level following the subregions as detailed in the Directive 2008/56/EC and shown in Table 4.1.

Table 4.1- MSFD subregions for the Northeast Atlantic and corresponding ICES Subareas and divisions

Subregions of the NEA according to 2008/56/EC	Corresponding ICES Subareas and divisions
Greater North Sea, including the Kattegat and the English Channel	IIIa, VI, VIId&e
Celtic Seas	VI, VII except VIId&e
Bay of Biscay and the Iberian Coast	VIII and IX
Macaronesia: waters surrounding the Azores, Madeira and the Canary Islands;	X and outside ICES area

4.1.2 Selection of commercial fish and shellfish stocks

ICES is the scientific advisory body for most marine fish stocks in the NEA region, while ICCAT (The International Commission for the Conservation of Atlantic Tunas) covers the assessments of tuna, swordfish and some pelagic sharks. Commercial fish and shellfish stocks, selected for the D3 assessment, included all Northeast Atlantic stocks that ICES assesses as part of the MOU with the European Union and ICCAT tuna stocks that are fished in the area.

In order to identify any fish and shellfish species that are of commercial importance but not internationally assessed, the list of selected stocks was compared with the list of fish and shellfish species contributing to the upper 99% of landings in the past three years in each subregion[1]. Species that were exploited by international fisheries but not assessed by an international body were identified as gaps. A gap analysis based on the list of sampled DCF species vs assessed stocks by ICES has been performed in the previous ICES D3+ initiative (ICES, 2012).

4.1.3 Compilation of stock information relating to D3 criteria

The information of ICES and ICCAT assessed stocks was compiled using the six ICES categories based on information available for stock assessment and advice:

- Category 1 – Stocks with quantitative assessments
- Category 2 – stocks with analytical assessments and forecasts that are only treated qualitatively
- Category 3 – stocks for which survey-based assessments indicate trends

[1] Based on average landings from 2009 to 2011 from the official ICES-STATLANT catch database. Data from 2012 could not be included due to incomplete submissions.

- Category 4 – stocks for which only reliable catch data are available
- Category 5 – Landings only stocks
- Category 6 – negligible landings stocks and stocks caught in minor amounts as bycatch

For category 1 stocks, information on msy reference points, F- estimates for 2010 to 2012 and SSB estimates for 2011 to 2013 were compiled from the most recent ICES advice summaries. For most ICES stocks, B reference points consisted of B_{msy} trigger (see Section 2.5 for further details on reference points used in ICES' advice).

For category 2 to 6 stocks, data on F and SSB in relation to reference points is not available in most cases. For some of the stocks in these categories, ICES does however use trends in data and/or expert judgement to provide a qualitative estimation of exploitation and biomass against reference points. This information has been used in the D3 assessment where available. Also any information of trends on biomass and exploitation pattern, provided in the latest ICES advice, has been included and used in the D3 assessments.

4.1.4 Stocks assessed by ICCAT

Category 3 stocks were reviewed in terms of the survey(s), used as a basis of advice, their data availability and overall suitability to apply approximation methods of reference points, fishing mortality and biomass as described below in Section 4.1.5.

Highly migratory tuna species are assessed in ICCAT usually each three years. During the assessments, several models are compared and used to provide complementary information. For tropical and temperate tunas there are no survey data and biological information usually is obtained from tagging data. One of the most important differences regarding ICES species is that it is difficult to separate catches by ages, due to the difficulties in the reading of otholitses. This is a problem for the age structured assessment models, and usually non equilibrium stock production models are used together with the VPA analysis to compare results. Also, integrated models as MFCL, are often used to incorporate tagging data.

Reference points on fishing mortality and biomass from ICCAT assessments are provided as ratios but also vary between species depending on the assessment group. Reference values in the denominator can be associated with MSY or F0.1 and population capacity can be expressed in terms of biomass or spawning stock biomass. The ratios capture essentially the same idea about the level of fishing pressure and the population capacity than those provided by ICES although the different variables were used.

Regarding species assessed by ICCAT in North East Atlantic region, tropical tunas are distributed in the Canary Islands (Thunnus albacares, Thunnus obesus and Katsuwonus pelamis) and Thunnus alalunga for the temperate tunas. In ICES VIII there are catches of temperate tunas of Thunnus albacares and Thunnus thynnus and ICES IXa only Thunnus thynnus is landed. All of them are in the category 1 in the DLS classification, except skipjack (Katsuwonus pelamis), which is in category 2.

4.1.5 Secondary indicators for Criteria 3.1 and 3.2

Where primary indicators of fishing mortality and spawning biomass are not available secondary "proxy" indicators are required to determine relative estimates of exploitation rate and status of the stock or spawning stock biomass.

Commission Decision 2010/477/EU noted that indicators which reflect the status relative to F_{msy} need to be determined by scientific judgement following analysis of the observed historical trends of the indicator combined with other information on the historical performance of the fishery.

Similarly the Decision noted that where simulation models do not allow the estimation of a reliable value for $SSB_{msy,}$ then the reference to be used for the purpose of this criterion is SSB_{pa}, which is the minimum SSB value for which there is a high probability that the stock is able to replenish itself under the prevailing exploitation conditions.

To date although many studies have derived potential indicators for relative exploitation rate and biomass from survey data series (e.g. SURBA) the reference points associated with the derived proxies, that are required for determination of the relative exploitation status and management decisions, have not been successfully derived and evaluated.

This lack of survey based reference points is reflected in the evaluation of the status of the stocks presented in Sections 4.2 to 4.5, in which the only determinations of status are based on the trends in surveys information and catch data, usually where time series catches have shown strong declines for which supporting evidence of stock decline is provided by research surveys or standardised commercial cpue trends.

In addition to the lack of reference points for the proxy indicators, the main inhibitor to the determination of stock status is the short time for which information is available for the majority of the category 3 data limited stocks. In many cases survey data have been collected after the fishery has been in progress for many years and significant changes in stock status have occurred and the lack of contrast in the data available does not currently allow the determination of reference levels.

4.1.5.1 Developmetn of proxy indicators

Research conducted at ICES WKLIFE (ICES, 2012b and ICES, 2012c) into the provision of management advice for data limited stocks based on survey information has established that survey based indices can be used to guide management in controlling the development of stocks in terms of their biomass trajectories. However, a similar lack of related reference targets derived from the surveys which provide the goals for management was identified as a gap in the development of management advice for data limited stocks. At present the required stock trajectories are determined by reference to external information such as long term trends in catch data, but where this is absent advice cannot be provided.

During the workshop three methodological approaches were applied to Northeast Atlantic Stocks to assess the status of fish stocks based on survey data. Where possible, results on proxies were compared to established reference points of fully assessed stocks. The results of the methods are presented on several case studies but are not incorporated into the regional D3 assessment for the Northeast Atlantic. Further validation and endorsement by ICES within their review process is recommended to ensure consistency between the proxies proposed during the Descriptor 3 assessment and the single-species assessment and advice.

4.1.5.2 The Froese & Sampang approach

The first approach was developed by Froese & Sampang (2013) estimating time series of F and SSB with associated reference points (F_{MSY} and SSB_{MSY}, SSB_{pa}). This approach is based on DATRAS survey data and commercial landings (or catches) combined with a preceding analysis on life-history traits from SMALK-data (Figure 4.1).

Based on the life-history traits the proportions of mature and immature individuals in the stock are estimated to obtain proxy time series of total stock biomass (TSB), SSB and recruits (Figure 4.2). Reference values of SSB are estimated by fitting a hockey-stick curve to the SSB-R plot. SSBpa is set with a safety-buffer of 40% towards the right of the hockey-stick inflection (=SSB_{lim}), SSB_{MSY} is set equal to double SSB_{pa}. F_{MSY} is set equal to M (justifications and supporting references for proxy SSBmsy and proxy Fmsy are given in Sampang & Froese 2013) and exploitation rates are estimated based on annual landings divided by the SSB proxy (Figure 4.2).

The Froese & Sampang-method was applied to eight stocks from the North Sea using R-Scripts provided by Froese. The output of the Froese & Sampang assessments were compared to the assessment results of the ICES ACOM advice sheets (Table 4.2).

The outcomes of the stocks assessed by the Froese & Sampang method showed mixed agreement with the ICES assessed stocks, with closer agreement in the trend of the indicators than in the magnitude of the change needed to be consistent with the reference points; for example the biomass of North Sea cod was estimated to be increasing and currently at half the Btrigger reference level by ICES and increasing but just below Btrigger by the Froese & Sampang approach. The Froese & Sampang method provides an interesting approach to use survey data to estimate the current status of the stock against proposed reference points and may improve assessments of Category 3 stocks. It is suggested that the Froese & Sampang method should be evaluated further within WKLIFE/WGMG (see general comments in Section 7).

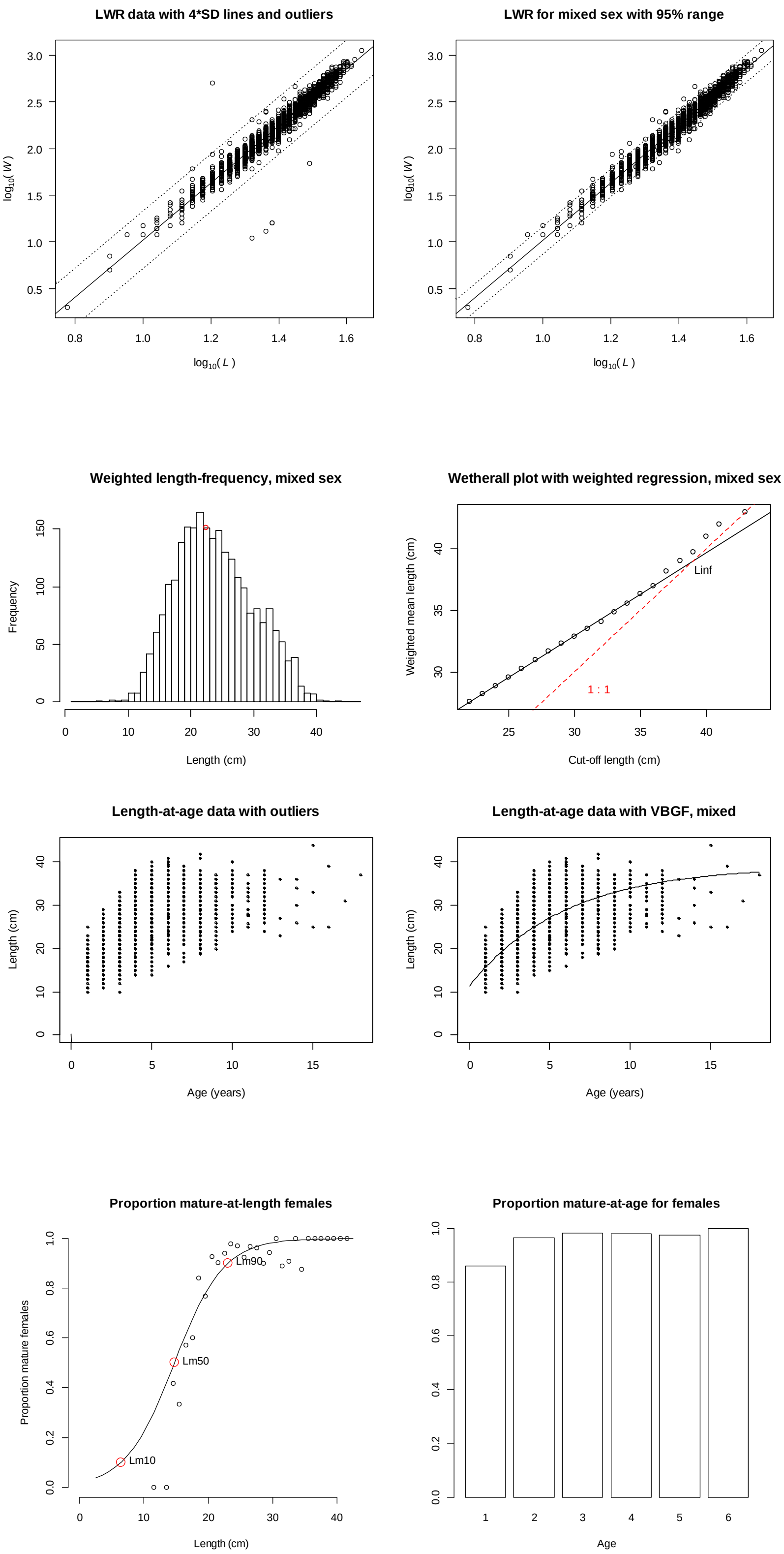
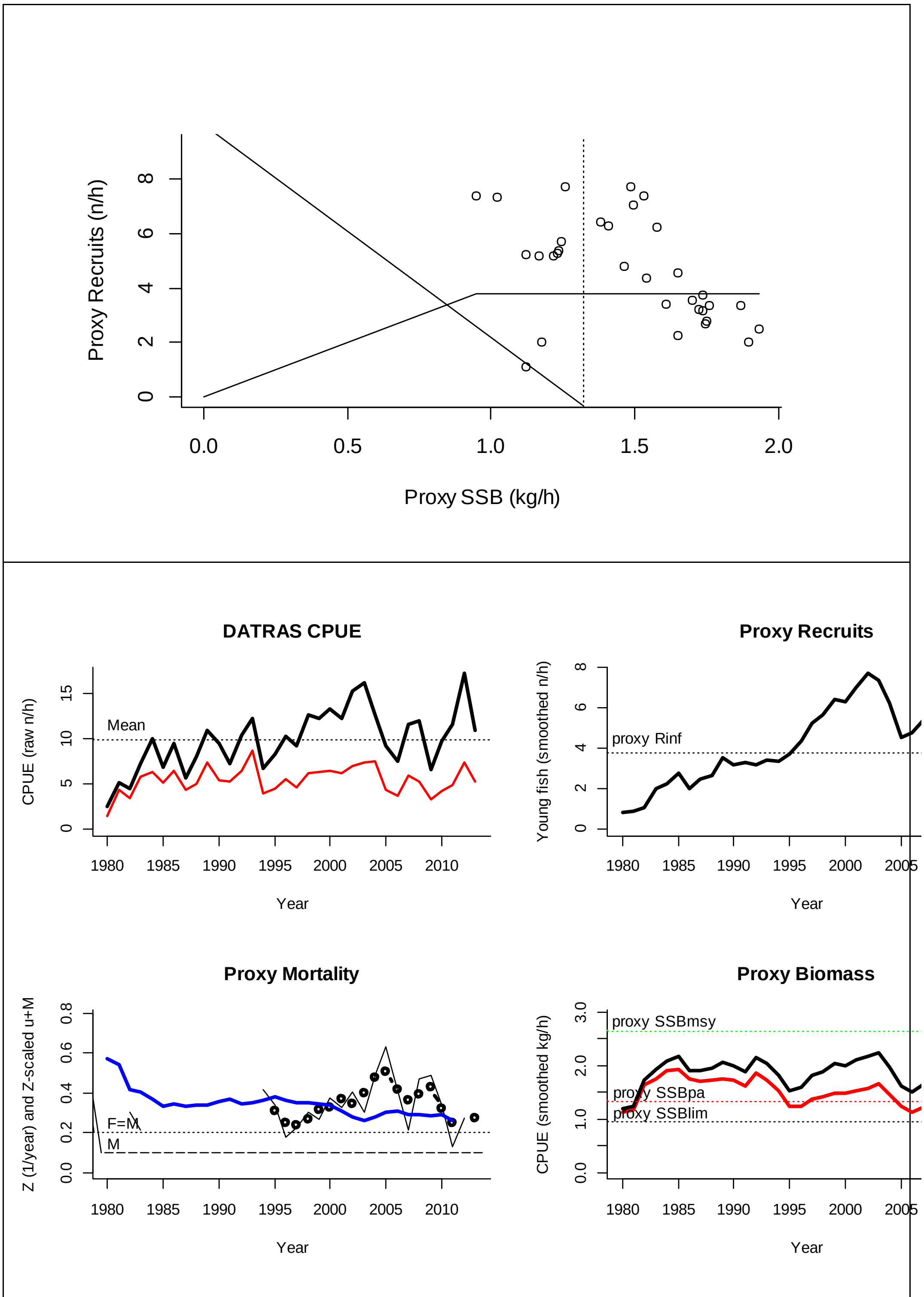


Figure 4.1. Output of the SMALK-Analysis by the Froese & Sampang method for North Sea lemon sole *Microstomus kitt*. Estimated size- and age-at-maturity (Lm50, Lm90), vanBertalanffy growth parameters L_{inf}, K and t_0 and parameters of the length-weight regression.



Figre 4.2. Output of the Froese and Sampang survey-based stock assessment method for North Sea lemon sole (*Microstomus kitt*). Estimated SSB_{pa} (dashed vertical line in upper plot), total stock abundance and mature stock abundance (black & red lines, middle left), recruits (middle right), exploitation rate (blue line, lower left) and TSB,SSB (black & red lines, lower right).

Table 4.2. Summary of comparison between ICES stock assessments and the Froese & Sampang method. NA: no information available, +: increasing trend, 0: stable trend, -: decreasing trend. Colour of boxes indicates assessmnet result: green :‚good' (if F/F_{ref}<1, SSB/SSB_{ref}>1) , red: ‚GES failed' (if F/F_{ref}>1, SSB/SSB_{ref} < 1).

	Stock Code	cod-347d	dab-nsea	gug-347d	her-47d3	lem-nsea	ple-nsea	tur-nsea
ICES Assess-ment	Species	Cod	Dab	Grey gurnard	Herring	Lemon sole	Plaice	Turbot
	F (last available year)	0.391 (2012)	NA	NA	0.168 (2012)	NA	0.232 (2012)	NA
	F_{ref}	0.19	NA	NA	0.27	NA	0.25	0.34
	F/F_{ref}	2.06	NA	NA	0.62	NA	0.93	NA
	F-Trend	-	NA	NA	+	NA	0	-
	SSB (last available year)	71,970 (2013)	NA	NA	1,996,101 (2013)	NA	663,200 (2013)	NA
	SSB_{ref} (t)	150000	NA	NA	1,000,000	NA	230000	NA
	SSB/SSB_{ref}	0.480	NA	NA	2.00	NA	2.88	NA
	SSB-Trend	+	0	0	-	+	+	+
Froese & Sampang	Z (last available year)	0.554 (2012)	0.639 (2011)	0.245 (2012)	0.598 (2012)	0.264 (2011)	0.077 (2012)	0.102 (2012)
	Z_{ref}	0.52	0.5	0.4	0.7	0.2	0.2	0.2
	Z/Z_{ref}	1.07	1.28	0.61	0.85	1.320	0.385	0.51
	Z-Trend	-	0	0	-	-	-	-
	SSB (last available year)	15 (2012)	20 (2013)	16.2 (2013)	148 (2012)	1.28 (2013)	20.6 (2012)	0.717 (2012)
	SSB_{ref} (Kg/h)	18.1	15.4	23	78	1.32	5.57	0.227
	SSB/SSB_{ref}	0.83	1.30	0.70	1.90	1.00	3.70	3.16
	SSB-Trend	+	-	0	+	+	+	+
Agree-ment	F/F_{ref} vs. Z/Zref	No	NA	NA	Yes	NA	No	NA
	F vs. Z trend	Yes	NA	NA	No	NA	No	Yes
	SSB/SSB_{ref}	No	NA	NA	Yes	NA	Yes	NA
	SSB Trend	Yes	No	Yes	No	Yes	Yes	Yes

4.1.5.3 Probst *et al.* approach

The second method proposed during the workshop is an indicator-based assessment of North Sea fish stocks (invertebrates were not considered) against the three criteria of the 477/2010/EU (Probst et al., 2013). The assessment combines information from full stock assessments and survey data for stocks without full assessments.

The assessment by Probst et al. (2013) suggests that 27 out of 43 stocks achieve good environmental status in the North Sea. The advantage of this approach is that it is consistent with ICES Advice because it considers information from stock assessments with higher priority than information from secondary indicators. The disadvantage is that the assessment of non-stock-assessment indicators is based on statistics of the indicator metric time series, which may reflect periods of unsustainable exploitation.

The chosen GES reference points of 33% for state and 66% for pressure are not related to the MSY-concept and are less ambitious than the mean of the respective time series.

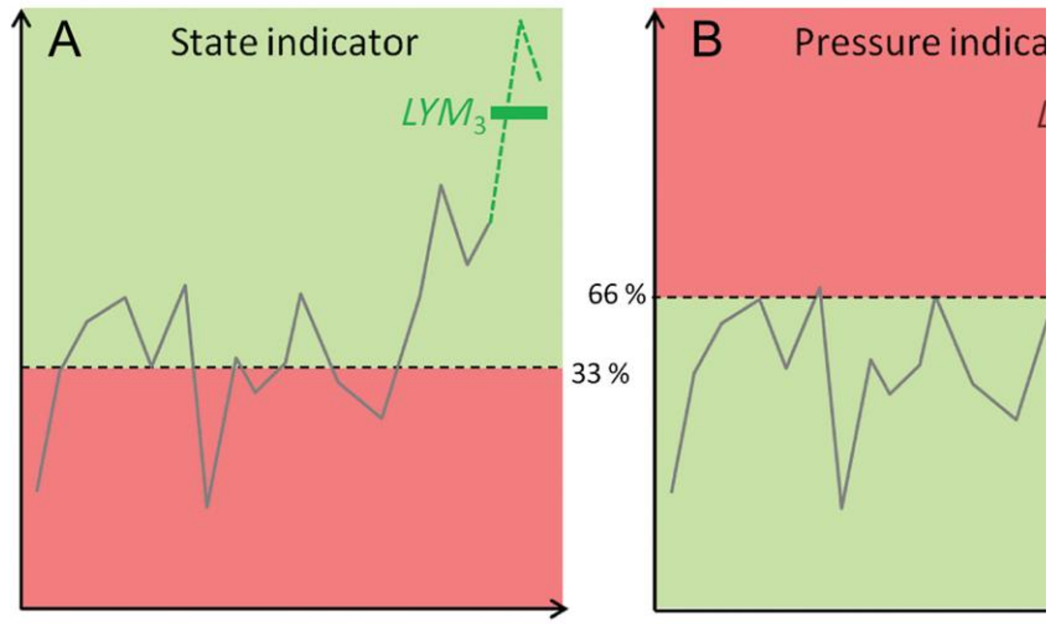
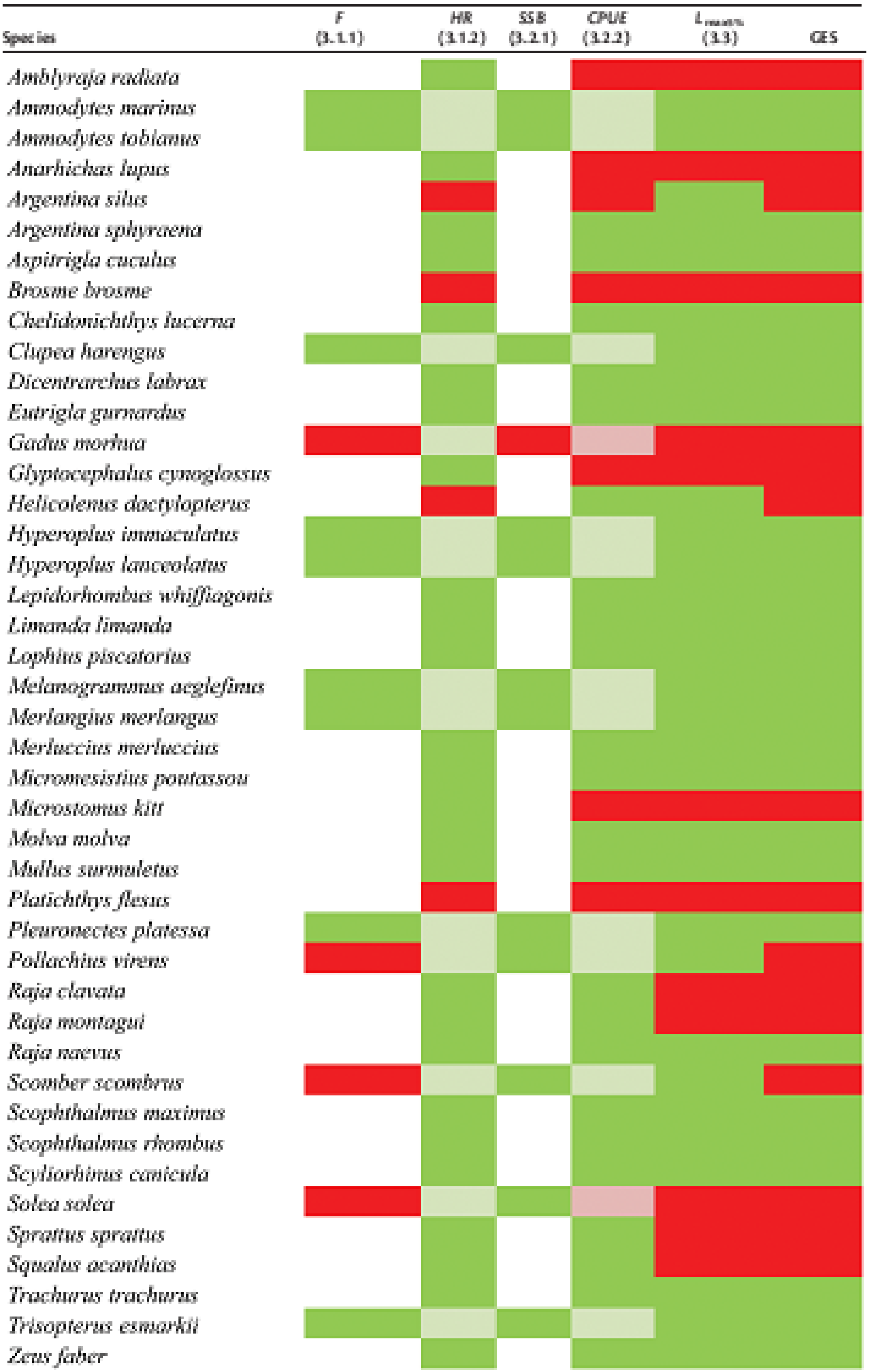


Figure 4.3: Scheme for setting assessment thresholds for pressure and state indicators for criteria 3.1, 3.2 and 3.3 according to Table 4.3. The rational was to avoid further detoriation of current states (33%-percentile for abundance CPUE and $L_{max5\%}$) or aggravate further pressures (66%-percentile for harvest rate HR)

Table 4.3. Results of indicator -based assessment of North Sea fish stocks (Probst et al., 2013).



The colors of the indicators *F*, *HR*, *SSB*, *CPUE* and $L_{mat\%}$ indicate the status. Red: below GES-limit, green: above GES-limit. Numbers below indicators refer to *MSFD* criteria/indicators of EU-Com Decision 477/2010. The *HR* and *CPUE* indicator assessment result are shown as half-tones for stocks when *F* and *SSB* were used to assess GES of C3.1 and C3.2. Note that for these cases *HR* and *CPUE* were not considered for the assessment of stock status.

4.1.5.4 The AIM approach

A comparison between results from the analytical assessment and the AIM method has been done on the White Anglerfish southern stock from the VIIIc and IXa Divisions. The stock is assessed with surplus production model (ICES 2011). Bmsy, Fmsy and MSY values are straight outputs of the model.

1. Input Data

- Time series of landings (1980-2010) (kt).

- Two time series of relative abundance (index):

Coruña LPUE: kg/day*100hp

Cedeira LPUE: kg/soaking day

There are two abundance indices, but with different measure units.

2. Basic Results:

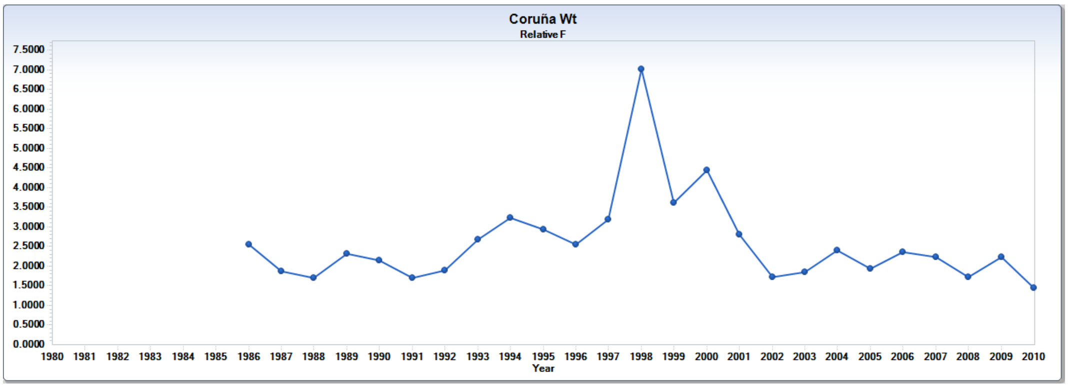


Figure 4.4. Relative F (kt/kg/day*100HP) by year:

If Replacement Ratio > 1, biomass is growing: years 1996, 1997, 2002-2005

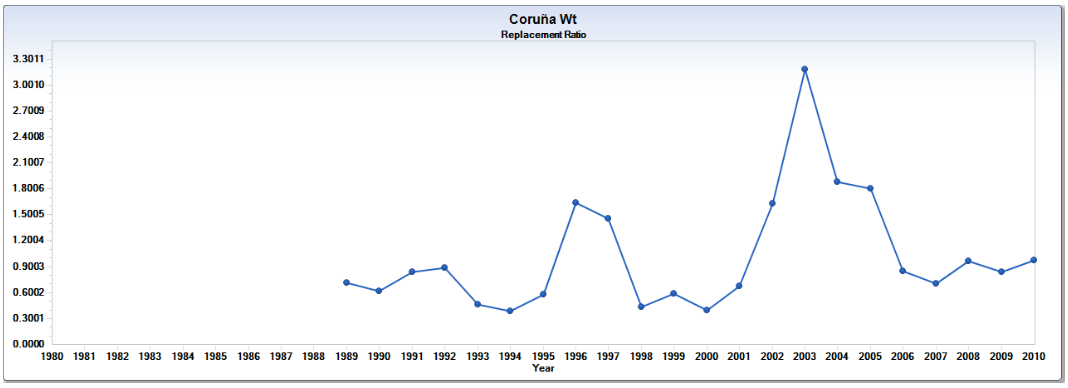


Figure 4.5. Replacement Ratio by year:

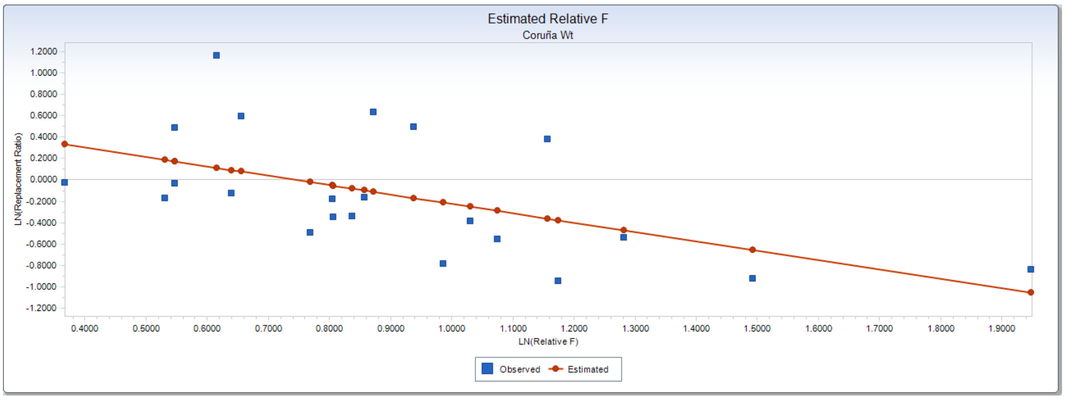


Figure 4.6. Relative F at LN(replacement ratio)=0: 2.10 kt/kg/day*100HP:

Biological Reference Points:

- Using first estimate of relative F =2.10 as proxy of Fmsy

If relative F is above than 2.10, the stock is overfishing

External information:

ASPIC estimate: MSY=7.288 kt

Bmsy = 3.47 (kg/10day*100HP). If the index value is below Bmsy then the stoc is overfished.

Model	MSY (t)	Fmsy	Bmsy (t;kg/day*100HP)
ASPIC	7 288	0.28	25720
AIM	7 288	2.10	34.7

Model	Fcurrent/Fmsy	Bcurrent/Bmsy
ASPIC	0.85	0.29
AIM	0.69	0.32

Both assessments results indicate that the white anglerfish stock is not currently overfishing but it is overfished.

4.2 North Sea

The MSFD subregion of the North Sea includes the greater North Sea (ICES Subarea IV), Kattegat and the Channel (VII d&e)

Selection of commercial fish and shellfish stocks

In order to assess the number of exploited species in the North Sea and its subregions we used FAO FishStat database 2009-2012. The subareas used were ICES Subdivisions IIIa, IV, VIId. In total there are 356 species or species-groups listed in the ICES landing statistic. The exact number of species is difficult to determine as the categories contain species and species groups which are partly overlapping or are occurring under different taxonomic categories in the table (e.g. “common shrimp”, “crangon shrimps”). It should be taken note that some of these categories are rather broad or unspecific e.g. *Osteichthyes*, which could not be assessed.

The workshop focused on species/ species-groups, which have a proportion < 0.1 % of the total catch in the North Sea. Species with lower landings are often characterized by very infrequent landings. Nevertheless, the MSFD is asking to reach GES for all commercial species. Even though some species have very low landings, they are important due to ecological role or their sensitivity related to fishing pressure (e.g. sharks, rays etc.) and should be taken into account in the other Descriptors such as D1 and D4.

In the North Sea 65 fish and shellfish species have a higher proportion < 0.1 of the total catch and cover cumulatively more than 99% of the landing weights. 27 species are subject of an assessment by ICES, which account for 84.2 % of the landing weights. Eight of the ten species with the highest landings in the North Sea are assessed by ICES. All these species are fish species. Species with substantial landings that are not assessed are shellfish species: Great Atlantic Scallop (2.4% of the landings, Common shrimp (2.1 % of the landings), Blue mussel (1.6% of the landings). Therefor one major gap is the lacking assessment of shellfish.

Another species with high economic importance and vulnerability according to fishing mortality is eel, which is lacking in the landing statistics of the North Sea stock, but is presented among widely distributed stocks in the North-east Atlantic Ocean region.

Table 4.4 Species in the North Sea subregion ranked by official STATLANT landings (mean 2009-2011) with details of whether they are subject to an international assessment and advisory framework.

No.	Row Labels	Scientific name	Common name	Mean 2009-2011	%-contribution	Assessed
1	SAN	*Ammodytes spp*	Sandeels(=Sandlances) nei	408746	21,6%	y
2	MAC	*Scomber scombrus*	Atlantic mackerel	267488	14,2%	y
3	HER	*Clupea harengus*	Atlantic herring	238264	12,6%	y
4	SPR	*Sprattus sprattus*	European sprat	164049	8,7%	y
5	POK	*Pollachius virens*	Saithe(=Pollock)	92244	4,9%	y
6	PLE	*Pleuronectes platessa*	European plaice	72349	3,8%	y
7	NOP	*Trisopterus esmarkii*	Norway pout	67152	3,6%	y
8	HOM	*Trachurus trachurus*	Atlantic horse mackerel	62093	3,3%	y
9	SCE	*Pecten maximus*	Great Atlantic scallop	46258	2,4%	n
10	CSH	*Crangon crangon*	Common shrimp	40539	2,1%	n
11	COD	*Gadus morhua*	Atlantic cod	35800	1,9%	y
12	HAD	*Melanogrammus aeglefinus*	Haddock	32739	1,7%	y
13	MUS	*Mytilus edulis*	Blue mussel	30226	1,6%	n
14	NEP	*Nephrops norvegicus*	Norway lobster	25556	1,4%	y
15	LQD	*Laminaria digitata*	Tangle	23749	1,3%	n
16	WHG	*Merlangius merlangus*	Whiting	20893	1,1%	y
17	WHE	*Buccinum undatum*	Whelk	20230	1,1%	n
18	CRE	*Cancer pagurus*	Edible crab	19040	1,0%	n
19	SOL	*Solea solea*	Common sole	18389	1,0%	y
20	WHB	*Micromesistius poutassou*	Blue whiting(=Poutassou)	15764	0,8%	y
21	PIL	*Sardina pilchardus*	European pilchard(=Sardine)	14463	0,8%	n
22	ANF	*Lophiidae*	Anglerfishes nei	9334	0,5%	n
23	JAX	*Trachurus spp*	Jack and horse mackerels nei	9061	0,5%	y
24	DAB	*Limanda limanda*	Common dab	8754	0,5%	y
25	PRA	*Pandalus borealis*	Northern prawn	8416	0,4%	y
26	HKE	*Merluccius merluccius*	European hake	8011	0,4%	y
27	LIN	*Molva molva*	Ling	7782	0,4%	y
28	CTC	*Sepia officinalis*	Common cuttlefish	6124	0,3%	n
29	BIB	*Trisopterus luscus*	Pouting(=Bib)	6039	0,3%	n
30	LEM	*Microstomus kitt*	Lemon sole	4676	0,2%	y
31	BSS	*Dicentrarchus labrax*	European seabass	4042	0,2%	y
32	POL	*Pollachius pollachius*	Pollack	3993	0,2%	y
33	SYC	*Scyliorhinus canicula*	Small-spotted catshark	3646	0,2%	y
34	TUR	*Psetta maxima*	Turbot	3645	0,2%	n
35	BRB	*Spondyliosoma cantharus*	Black seabream	3569	0,2%	y
36	FLE	*Platichthys flesus*	European flounder	3489	0,2%	y
37	SCR	*Maja squinado*	Spinous spider crab	3484	0,2%	n
38	GKL	*Glycymeris glycymeris*	Common European bittersweet	3429	0,2%	n
39	GUR	*Aspitrigla cuculus*	Red gurnard	3203	0,2%	n
40	SQZ	*Loliginidae*	Inshore squids nei	3146	0,2%	n
41	CTL	*Sepiidae, Sepiolidae*	Cuttlefish, bobtail squids nei	2932	0,2%	n
42	QSC	*Aequipecten opercularis*	Queen scallop	2885	0,2%	n
43	LBE	*Homarus gammarus*	European lobster	2875	0,2%	n
44	RAZ	*Solen spp*	Solen razor clams nei	2853	0,2%	n
45	MNZ	*Lophius spp*	Monkfishes nei	2805	0,1%	n
46	COC	*Cerastoderma edule*	Common edible cockle	2644	0,1%	n
47	MON	*Lophius piscatorius*	Angler(=Monk)	2508	0,1%	n
48	GUU	*Chelidonichthys lucerna*	Tub gurnard	2269	0,1%	n
49	MUR	*Mullus surmuletus*	Surmullet	2263	0,1%	n
50	SQC	*Loligo spp*	Common squids nei	2223	0,1%	n
51	BLL	*Scophthalmus rhombus*	Brill	2161	0,1%	n
52	USK	*Brosme brosme*	Tusk(=Cusk)	2009	0,1%	y
53	SDV	*Mustelus spp*	Smooth-hounds nei	1942	0,1%	y
54	MZZ	*Osteichthyes*	Marine fishes nei	1831	0,1%	NA
55	LIO	*Necora puber*	Velvet swimcrab	1812	0,1%	n
56	LAH	*Laminaria hyperborea*	North European kelp	1682	0,1%	n
57	LEZ	*Lepidorhombus spp*	Megrims nei	1662	0,1%	n
58	WIT	*Glyptocephalus cynoglossus*	Witch flounder	1619	0,1%	n
59	COE	*Conger conger*	European conger	1523	0,1%	n
60	RJC	*Raja clavata*	Thornback ray	1354	0,1%	n
61	OYF	*Ostrea edulis*	European flat oyster	1307	0,1%	n
62	GUX	*Triglidae*	Gurnards, searobins nei	1208	0,1%	n
63	SWX	*Algae*	Seaweeds nei	1080	0,1%	n
64	SKA	*Raja spp*	Raja rays nei	972	0,1%	n
65	GDG	*Gadiculus argenteus*	Silvery pout	953	0,1%	n

Information available for D3 assessment overall

Overall 84 stocks have been assessed by ICES in the North Sea. Of those about the half (44 stocks) are in category 1, which means they undergo a full stock assessment with fishing mortality and biomass evaluated against reference points. Twenty stocks, about one quarter, are in category 3, which uses survey data or commercial CPUEs to describe trends. The remaining stocks have been classified into categories 4 to 6 using primarily catch data for the basis of the advice.

The North Sea stocks are grouped in four functional groups: deep (6 stocks), demersal (48 stocks) elasmobranchs (19 stocks) and pelagic stocks (11 stocks).

GES by functional group:

During the workshop there were discussions if the agreed reference points and criteria under MSFD Descriptor 3 and CFP are applicable for all stocks. A controversial discussion was focused on the use of reference points regarding indicator 3.2. As the discussion on the appropriate reference levels has not been finalized, GES according to the indicator 3.2 cannot be defined.

Obtaining an indicator and a reference point for an age-structure that fulfills Criteria 3.3 of Descriptor 3 (COM Dec 2010/477/EU) was found to be challenging. During the workshop a method was presented to use the biomass of large fish relative to the spawning stock biomass as an indicator (see Section 7.6).

Status of pelagic stocks in the North Sea

Pelagic species represent a major proportion of the landings in the North Sea. Three species herring, mackerel and sprat account for more than the half (56 %) of the overall landings in the North Sea. The data availability to assess the status of pelagic stocks regarding descriptor 3 of the MSFD is relatively good. Seven of the eleven stocks have been assigned to category 1 (with quantitative assessment). Two sprat stocks are in category 3 (surveys-based assessments indicate trends). One stock horse mackerel is in category 5 (Landings only stocks).

The status of the pelagic stocks in the North Sea can be summarized as follows:

Regarding the fishing mortality five of the eleven stocks are fished below the F reference point. One herring and one sprat stock are fished below F MSY. One herring stock and the stock of horse mackerel are fished above F MSY. The reference level regarding biomass is clearly exceeded only by the horse mackerel stock. North Sea herring and sprat are at the biomass reference level but herring in Division IIIa and Subdivisions 22–24 (western Baltic spring spawners) are not. For the mackerel and horse mackerel stocks in the North Sea, not enough information is available. Several widely distributed stocks that also occur in the North Sea are at the biomass reference level for 3.1 (boarfish, blue whiting and Norwegian spring-spawning herring) and 3.2 (boarfish, blue whiting and Norwegian spring-spawning herring).

Status of demersal stocks in the North Sea

The majority of stocks in the North Sea are demersal, including some of the most valuable commercial species.

Although relatively much information is available, still only for a few species the status of stocks is clear. In general, flatfish species are at reference levels (plaice) or show an upward trend for 3.2 in the North Sea. Some roundfish species are at (haddock) or almost at reference levels (saithe), but cod is not, neither for criterion 3.1 nor 3.2. For the different Norway lobster functional units, insufficient information is available on 3.2. Where information is available for 3.1, results are variable. Norway pout is at the reference level for 3.2. For sandeel, not enough information is available on criterion 3.1. Sandeel at the Doggerbank and in the South Eastern North Sea (SA 2) and the Central Eastern North Sea (SA 3) is not at the reference level for 3.2. For the other stocks not enough information is available.

Status of shellfish stocks

Assessments against reference points are available for most Norway lobster functional units in the North Sea. There has been a deteriation is status against both criteria with more than 50% fished above MSY and 50% stocks below $SSB_{MSY\ trigger}$ (based on 2012 figures). Where information is available for 3.1, results are variable.

<u>Elasmobranchs</u>

As in other sea regions the availability data about the status of elasmobranchs is very poor. None of the elasmobranch species/stocks occurring in the North Sea belong to the categories 1 and 2. Seven of the elasmobranch species fall in the category 3 and are assessed by trends based on surveys. The rest of the species are assigned to category 5 and 6.

It is not possible to give an indication of the status for skates and rays because information on neither of the 3 criterions is available. For sharks, qualitative information on criterion 3.2 indicates low (below historic values) or depleted status. Only for smooth hounds criterion 3.2 appears to be increasing.

<u>Deep-sea</u>

In the North Sea region six stocks of deep-water fish have been listed. As in other region the data availability and the scientific knowledge to assess the stocks according to the relevant MSFD criteria is poor. Four of these species fall in the category 3 and are assessed by trends based on surveys. The rest of the species are assigned to category 5 and 6.

It is not possible to give an indication of the status of GES for deep-sea species because information on neither of the 3 criterions is available. Qualitative information on criterion 3.2 indicates stable or low (below historic values) status.

Table 4.5. Stock status in relation to criteria 3.1 and 3.2 of demersal stocks in the North Sea. For further details including full stock names please see accompanying datasheet

Stoc	2013	F ref	F_201	F_201	F_201	F/Fref	SSB	SSB_201	SSB_201	SSB_201	SSB /SSB ref
cod-	1.00	0.19	0.562	0.47	0.391	1.06	15000	45899	54776	71970	-0.52
sol-	1.00	0.3	0.353	0.316	0.309	0.03	2000	1688	1639	1338	-0.33
had-	1.00	0.3	0.23	0.331	0.176	-0.41	14000	194942	258458	257701	0.84
nop-	1.00	NA	0.405	0.031	0.309	NA	15000	370802	175871	183213	0.22
ple-	1.00	0.25	0.207	0.2	0.232	-0.07	23000	493600	540300	663200	1.88
sai-	1.00	0.3	0.3	0.3	0.3	0.00	20000	212900	196500	196237	-0.02
sol-	1.00	0.29	0.4909	0.4277	0.4618	0.59	8000	10660	12662	11428	0.43
sol-	1.00	0.22	0.375	0.322	0.238	0.08	35000	32567	43748	50546	0.44
whg-	1.00	NA	0.223	0.174	0.153	NA	NA	311516	319340	281593	stable
san-	1.00	NA	0.44	0.55	0.1	NA	21500	428674	244155	186297	-0.13
san-	1.00	NA	0.15	0.22	0.08	NA	10000	166020	104613	79269	-0.21
san-	1.00	NA	0.56	0.51	0.22	NA	19500	231559	136655	87742	-0.55
hke-	1.00	0.24	0.25	0.24	0.24	0.00	NA	277794	260690	NA	>1
ple-	1.00	0.24	0.4983	0.4155	0.3978	0.66	1650	2906	3388	4615	1.80
sol-	1.00	0.27	0.208	0.213	0.246	-0.09	2800	3450	3488	3517	0.26
tur-	2.11	0.34	NA	NA	NA	decreasin	NA	NA	NA	NA	increasing
ple-	2.11	0.23	NA	NA	NA	decreasin	NA	NA	NA	NA	increasing
cod-	2.13	0.4	NA	NA	NA	NA	10500	NA	NA	NA	NA
ele-	3.14	NA	NA	NA	NA	NA	NA	NA	NA	NA	decreasing
bll-	3.20	NA	NA	NA	NA	NA	NA	NA	NA	NA	stable/increasin
dab-	3.20	NA	NA	NA	NA	NA	NA	NA	NA	NA	stable
fle-	3.20	NA	NA	NA	NA	NA	NA	NA	NA	NA	increasing
lem-	3.20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
lin-	3.20	NA	NA	NA	NA	NA	NA	NA	NA	NA	stable
tur-	3.20	NA	NA	NA	NA	NA	NA	NA	NA	NA	stable
wit-	3.20	NA	NA	NA	NA	>1	NA	NA	NA	NA	increasing
mur-	3.20	NA	NA	NA	NA	NA	NA	NA	NA	NA	decreasing
ple-	3.20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
san-	3.20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Usk-	3.20	NA	NA	NA	NA	NA	NA	NA	NA	NA	>1
pol-	5.20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
whg-	5.20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
san-	5.20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
san-	6.30	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
san-	6.30	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
czs-	5.20q	NA	NA	NA	NA	NA	NA	NA	NA	NA	Stable
gug-	6.20q	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 4.6. Stock status in relation to criteria 3.1 and 3.2 of shellfish functional units in the North Sea. For further details including full stock names please see accompanying datasheet.

Stock cod	2013 DLS Catego	F ref point	F_2010	F_2011	F_2012	F/Fref	SSB ref	SSB_2011	SSB_2012	SSB_2013	SSB /SSB ref
pan	1.00	1	79%	102%	93%	-	0.5	0.7	0.75	0.76	0.52
nep	1.00	7.90	NA	6%	8%	0.04	N	3577	2526	NA	NA
nep	1.00	8.10	10%	11%	16%	1.00	858	878	758	706	<1
nep	1.00	10%	10%	6%	5%	-	276	3382	2748	NA	-0.01
nep	1.00	16%	18%	22%	25%	0.51	292	533	522	NA	0.79
nep	1.00	11.90	11%	19%	14%	0.15	262	372	299	NA	0.14
nep	4.14	NA	NA	NA	NA	NA	N	NA	NA	NA	NA
nep	4.14	NA	NA	NA	NA	<1	N	NA	NA	NA	stable
nep	4.14	NA	NA	NA	NA	NA	N	NA	NA	NA	increasi
nep	4.14	NA	NA	NA	NA	NA	N	NA	NA	NA	decreasi
nep	4.14	NA	NA	NA	NA	NA	N	NA	NA	NA	NA
pan	6.30	NA	NA	NA	NA	NA	N	NA	NA	NA	NA

Table 4.7. Stock status in relation to criteria 3.1 and 3.2 of pelagic stocks in the North Sea. For further details including full stock names please see accompanying datasheet.

Stock	2013 DLS	F ref	F_2010	F_2011	F_2012	F/Fref	SSB ref	SSB_2011	SSB_2012	SSB_2013	SSB /SSB ref
her-	1.00	0.27	0.084	0.109	0.168	-	10000	222663	234782	199610	1.00
spr-	1.00	1.3	0.496	0.536	0.365	-	14200	355114	204419	217169	0.53
her-	1.00	0.28	0.370	0.317	0.331	0.18	11000	85681	87936	106053	-0.04
her-	1.00	0.15	0.185	0.142	0.144	-	5	6.729	5.832	5.006	0.00
ho	1.00	0.13	0.136	0.144	0.193	0.48	NA	125640	105880	835853	decreas
wh	1.00	0.3	0.182	0.04	0.103	-	22500	302070	416405	553166	1.46
boc	1.00	0.23	0.141	0.043	0.09	-	NA	974025	108465	653668	>1
spr-	3.20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
spr-	3.20	NA	NA	NA	NA	NA	NA	NA	NA	NA	increasi
ho	5.20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
mac	NA			NA	NA	NA	NA	NA	NA	NA	increasi

Table 4.8. Stock status in relation to criteria 3.1 and 3.2 of elasmobranches in the North Sea. For further details including full stock names please see accompanying datasheet.

Stock code	2013 DLS Category	F ref point	F_2010	F_2011	F_2012	F/Fref	SSB ref	SSB_2011	SSB_2012	SSB_2013	SSB /SSB ref
dgs-nea	3.14	0.029	0.014	NA	NA	-0.52	NA	NA	NA	NA	<1
rjc-347de	3.20	NA	NA	NA	NA	NA	NA	NA	NA	NA	increasing
rjm-347d	3.20	NA	NA	NA	NA	NA	NA	NA	NA	NA	increasing
rjn-	3.20	NA	NA	NA	NA	NA	N	NA	NA	NA	increasi

347d							A				ng
rjr-347d	3.20	NA	NA	NA	NA	NA	NA	NA	NA	NA	decreasing
syc-347d	3.20	NA	NA	NA	NA	NA	NA	NA	NA	NA	unknown
trk-nea	3.20	NA	NA	NA	NA	NA	NA	NA	NA	NA	Increasing
gag-nea	5.20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
por-nea	5.30	NA	NA	NA	NA	NA	NA	NA	NA	NA	<1
sck-nea	5.30	NA	NA	NA	NA	NA	NA	NA	NA	NA	<1
rjb-347d	6.30	NA	NA	NA	NA	NA	NA	NA	NA	NA	<1
rju-ech	6.30	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
agn-nea	6.30	NA	NA	NA	NA	NA	NA	NA	NA	NA	<1
bsk-nea	6.30	NA	NA	NA	NA	NA	NA	NA	NA	NA	<1
raj-347d	5.20q	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
rjh-4c7de	5.20q	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
raj-ech	6.20q	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
rjc-echw	ignore	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
rje-ech	ignore	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 4.9. Stock status in relation to criteria 3.1 and 3.2 of deep-water stocks in the North Sea. For further details including full stock names please see accompanying datasheet.

Stock code	2013 DLS Category	F ref point	F_2010	F_2011	F_2012	F/Fref	SSB ref	SSB_2011	SSB_2012	SSB_2013	SSB /SSB ref
arg-oth	3.20	NA	NA	NA	NA	NA	NA	NA	NA	NA	Stable
gfb-comb	3.20	NA	NA	NA	NA	NA	NA	NA	NA	NA	Stable
bli-oth	5.30	NA	NA	NA	NA	NA	NA	NA	NA	NA	<1
rng-	6.30	NA	NA	NA	NA	NA	N	NA	NA	NA	NA

kas k							A				

Table 4.10. Summary of stock status in relation to criteria 3.1 for all species/stocks in the North Sea. For further details including full stock names please see accompanying datasheet.

Criteria 3.1 Fishing mortality	Quantitative (3.1.1)	Qualitative	Trends only	Unknown	Total
Number of stocks	24	2	2	56	84
Number of stocks achieving green status	13	1	2		16
Percentage of stocks achieving green status	54%	50%	100%		19%

Table 4.11. Summary of stock status in relation to criteria 3.1 for all species/stocks in the North Sea. For further details including full stock names please see accompanying datasheet.

Criteria 3.2 Biomass	Quantitative (3.1.1)	Qualitative	Trends only	Unknown	Total
Number of stocks	24	10	25	25	84
Number of stocks achieving green status	15	3	11 increasing/ 9 stable		29
Percentage of stocks achieving green status	63%	30%	44%		

4.3 Celtic Sea

The MSFD subregion of the Celtic Sea includes the west of Scotland (ICES Subarea VI), the Irish Sea (VIIa) and the Celtic Sea and west of Ireland (VIIb-c; e-k).

Selection of commercial fish and shellfish stocks

Commercial fish and shellfish stocks selected for the D3 assessment of the Celtic Sea included all stocks assessed by ICES for the Celtic Sea ecoregion and ICES widely distributed stocks that are fished in this subregion. Two tuna stocks that are fished in the Celtic Sea, Albacore tuna and Bluefin tuna are also included in the assessment.

Fish and shellfish species that are exploited by international fisheries (ie fisheries outside the national jurisdiction), but not internationally assessed were identified based on the list of fish and shellfish species contributing to the upper 99.9% of landings between 2009 and 2011 in the Celtic Sea.

The table of accumulated landings indicate that most of the fish species contributing 99% of the landings are undergoing scientific by ICES. Some gaps identified for this subregion include witch flounder, sardines, lemon sole and conger eel. The former three species are assessed by ICES in other ecoregions. Nineteen of the assessed species have stocks undergoing analytical stock assessments with primary indicators against reference points for criteria 3.1 and 3.2 These species cover ca. 85% of the total volume of landings in the Celtic Sea. With regards to the shellfish the situation is different. Nephrops is the only shellfish species that is part of an international assessment and advisory framework. Statlant figures indicate significant landings of scallops, crab, cephalopods, blue mussel etc. While the majority of shellfish species are fished in national waters and are not part of the assessment presented in this report some shellfish stocks such as scallops, brown crab and some cephalopod species are part of international fisheries. The lack of an international advisory framework for these species is a clear gap and should be addressed.

Table 4.12. Species in the Celtic Sea subregion ranked by official STATLANT landings (mean 2009-2011) with details of whether they are subject to an international assessment and advisory framework.

	Celtic Sea	VIa, VII except VIIe	Mean is 2009-2011 as	2012 has no UK data		
	FAO Species	Scientific name	Common	Mean 2009-2011 tons	%	Assessed
1	WHB	*Micromesistius poutassou*	Blue whiting(=Poutassou)	259157	22.9%	y
2	MAC	*Scomber scombrus*	Atlantic mackerel	204225	18.0%	y
3	HOM	*Trachurus trachurus*	Atlantic horse mackerel	108505	9.6%	y
4	BOR	*Caproidae*	Boarfish nei	69605	6.1%	y
5	HER	*Clupea harengus*	Atlantic herring	63057	5.6%	y
6	SCE	*Pecten maximus*	Great Atlantic scallop	36731	3.2%	n
7	JAX	*Trachurus spp*	Jack and horse mackerels nei	33995	3.0%	y*
8	NEP	*Nephrops norvegicus*	Norway lobster	29687	2.6%	y
9	HKE	*Merluccius merluccius*	European hake	27296	2.4%	y
10	CRE	*Cancer pagurus*	Edible crab	19241	1.7%	n
11	OSC	*Aequipecten opercularis*	Queen scallop	16678	1.5%	n
12	HAD	*Melanogrammus aeglefinus*	Haddock	14895	1.3%	y
13	BOC	*Capros aper*	Boarfish	14230	1.3%	y
14	WHE	*Buccinum undatum*	Whelk	13958	1.2%	n
15	WHG	*Merlangius merlangus*	Whiting	12440	1.1%	y
16	MNZ	*Lophius spp*	Monkfish nei	11443	1.0%	y
17	LEZ	*Lepidorhombus spp*	Megrims nei	10801	1.0%	y
18	LIN	*Molva molva*	Ling	7902	0.7%	y
19	POK	*Pollachius virens*	Saithe(=Pollock)	7406	0.7%	y
20	WIT	*Glyptocephalus*	Witch flounder	7037	0.6%	n
21	ANF	*Lophiidae*	Anglerfishes nei	6768	0.6%	y
22	PIL	*Sardina pilchardus*	European	6532	0.6%	n
23	SOL	*Solea solea*	Common sole	6131	0.5%	y
24	COD	*Gadus morhua*	Atlantic cod	5594	0.5%	y
25	MUS	*Mytilus edulis*	Blue mussel	5051	0.4%	n
26	ALB	*Thunnus alalunga*	Albacore	4864	0.4%	y
27	PLE	*Pleuronectes platessa*	European plaice	4843	0.4%	y
28	ARG	*Argentina spp*	Argentines	4661	0.4%	y*
29	LEM	*Microstomus kitt*	Lemon sole	4598	0.4%	n
30	GRO	*Osteichthyes*	Groundfishes nei	4588	0.4%	NA
31	POA	*Brama brama*	Atlantic pomfret	4530	0.4%	n
32	COE	*Conger conger*	European conger	4254	0.4%	n
33	SPR	*Sprattus sprattus*	European sprat	4134	0.4%	y
34	CTC	*Sepia officinalis*	Common cuttlefish	3774	0.3%	n
35	MON	*Lophius piscatorius*	Angler(=Monk)	3751	0.3%	y
36	BIB	*Trisopterus luscus*	Pouting(=Bib)	3275	0.3%	n
37	OYX	*Ostrea spp*	Flat oysters nei	3072	0.3%	n
38	FOR	*Phycis phycis*	Forkbeard	3009	0.3%	n
39	SYC	*Scyliorhinus canicula*	Small-spotted catshark	2978	0.3%	n
40	RJN	*Raja naevus*	Cuckoo ray	2940	0.3%	y
41	POL	*Pollachius pollachius*	Pollack	2598	0.2%	y
42	SQI	*Illex illecebrosus*	Northern shortfin squid	2589	0.2%	n
43	JOD	*Zeus faber*	John dory	2569	0.2%	n
44	SQZ	*Loliginidae*	Inshore squids nei	2372	0.2%	n
45	BSF	*Aphanopus carbo*	Black scabbardfish	2271	0.2%	y
46	GUR	*Aspitrigla cuculus*	Red gurnard	2110	0.2%	n
47	BSS	*Dicentrarchus labrax*	European seabass	2005	0.2%	y
48	BRF	*Helicolenus dactylopterus*	Blackbelly rosefish	1945	0.2%	n
49	BLI	*Molva dypterygia*	Blue ling	1898	0.2%	y
50	USK	*Brosme brosme*	Tusk(=Cusk)	1790	0.2%	y
51	RJC	*Raja clavata*	Thornback ray	1778	0.2%	y
52	RNG	*Coryphaenoides rupestris*	Roundnose grenadier	1705	0.2%	y
53	SQC	*Loligo spp*	Common squids nei	1616	0.1%	n
54	GFB	*Phycis blennoides*	Greater forkbeard	1595	0.1%	y
55	LBE	*Homarus gammarus*	European lobster	1593	0.1%	n
56	MEG	*Lepidorhombus*	Megrim	1562	0.1%	y
57	GAD	*Gadiformes*	Gadiformes nei	1544	0.1%	NA
58	ARU	*Argentina silus*	Greater argentine	1529	0.1%	y
59	SKA	*Raja spp*	Raja rays nei	1495	0.1%	y
60	LIO	*Necora puber*	Velvet swimcrab	1478	0.1%	n
61	SDV	*Mustelus spp*	Smooth-hounds nei	1465	0.1%	n
62	BRB	*Spondyliosoma cantharus*	Black seabream	1401	0.1%	y
63	MUR	*Mullus surmuletus*	Surmullet	1377	0.1%	n
64	DAB	*Limanda limanda*	Common dab	1339	0.1%	n
65	SCR	*Maja squinado*	Spinous spider crab	1294	0.1%	n
66	OCT	*Octopodidae*	Octopuses, etc. nei	1181	0.1%	n
67	CTL	*Sepiidae, Sepiolidae*	Cuttlefish, bobtail squids nei	1114	0.1%	n
68	GUU	*Chelidonichthys lucerna*	Tub gurnard	1093	0.1%	n
69	SAN	*Ammodytes spp*	Sandeels(=Sandlances) nei	994	0.1%	y
70	OYC	*Crassostrea spp*	Cupped oysters nei	970	0.1%	n
71	TUR	*Psetta maxima*	Turbot	969	0.1%	n
72	LOD	*Laminaria digitata*	Tangle	937	0.1%	n
73	RJH	*Raja brachyura*	Blonde ray	919	0.1%	y
74	COC	*Cerastoderma edule*	Common edible cockle	917	0.1%	n
75	MZZ	*Osteichthyes*	Marine fishes nei	888	0.1%	NA
76	RJM	*Raja montagui*	Spotted ray	837	0.1%	y

77	MYV	*Mytilus spp*	Mytilus mussels nei	733	0.1%	n
78	ALC	*Alepocephalus bairdii*	Baird's slickhead	732	0.1%	n
79	PEE	*Littorina littorea*	Common periwinkle	725	0.1%	n
80	OMZ	*Ommastrephidae*	Ommastrephidae squids nei	652	0.1%	n
81	RAZ	*Solen spp*	Solen razor clams nei	633	0.1%	n
82	ARY	*Argentina sphyraena*	Argentine	617	0.1%	n
83	BLL	*Scophthalmus rhombus*	Brill	586	0.1%	n

Information available for D3 assessment overall

Overall, there are 89 stocks selected for assessment in the Celtic Sea. Of those, 31stocks, i.e. ca one third, are in category 1, which means they have undergone full stock assessment with fishing mortality and biomass evaluated against reference points. Four stocks are in category 2 and have trends assessment, with sufficient data to estimate whether stock status is below or above msy, but not always an indication how far from msy. A further one third of the stocks (29 stocks) are in category 3, which uses survey data or commercial CPUEs to describe trends. The remaining stocks are classified into categories 4 to 6, using primarily catch data for the basis of advice. The Celtic Sea stocks have been grouped into pelagic, demersal, shellfish, elasmobranchs and deep-water stocks and their status is described by group below.

Status of pelagic stocks in the Celtic Sea in relation to D3

As can be seen from the international landings table, pelagic species contribute the highest volume of catches in this subregion. In the Celtic Sea, there are "resident pelagic stocks", which include four herring stocks and one sprat stock and six migratory pelagic stocks which have a stages of their life cycle in this sub-region and are subject to important commercial fisheries. These include NEA mackerel, blue whiting, boarfish, horse mackerel and two tuna stocks. The availability of scientific information to assess pelagic stocks in the Celtic Sea under D3 is good. Eight out of the eleven stocks are category 1 stocks, the NEA mackerel stock is temporarily not included in category 1 due to an uncertainty in the catch data, but normally undergoes full stock assessment providing suitable information to assess under D3 criteria 1 and 2. The only pelagic stock with truly limited data availability and lack of assessment in relation to exploitation and status is Celtic Sea sprat. There are currently also no suitable surveys, due to the high variability in catches, however it has to be noted that overall sprat landings in the Celtic Sea are low relative to other pelagic species (see table 4.12). The status of pelagic stocks in relation to D3 criteria 3.1 and 3.2 is as follows: three out of the four resident herring stocks are fished at or below F_{msy} with biomass above $B_{msy\ trigger}$, while the Northwest herring stock is fished above F_{msy} with depleted biomass. Four migratory pelagic stocks are fished at or below F_{msy} including the two tuna stocks, while western horse mackerel is fished above F_{msy}. The status of NEA mackerel in relation to reference point cannot be evaluated, but biomass has shown a strong increase in the last 10 years.

Status of demersal stocks in the Celtic Sea in relation to D3

The demersal group includes the largest number of stocks in the Celtic Sea. There are ca. demersal 40 stocks in the Celtic Sea, but only 11 stocks of these are included in category 1 and can be fully used for the assessment against criteria 3.1 and 3.2. Just over half of these stocks are fished at or below msy, and have biomasses at or above B msy trigger. The status has improved from three years ago, but not from two years ago. A number of stocks in the other categories are qualitatively assessed for exploitation and status against reference points, these include plaice and whiting in the Irish Sea, sole and plaice to the west of Ireland, Rockall megrim and seabass. Half of the stocks are fished below msy and half above. The remaining stocks are assessed using trends from surveys or commercial CPUEs or based on the history of their catches. For the category three stocks, trends in biomass are reported but in most cases it is not possible to establish how current or recent biomass levels are in relation to msy. This is due to relatively short times series in relation to their exploitation history. For some of the species that have stocks in this category such as monkfish and megrim there are significant landings in the Celtic Sea.

Status of shellfish stocks in the Celtic Sea in relation to D3

Only *Nephrops* in the Celtic Sea is included in the assessment of shellfish due to a lack of internationally agreed assessments and advice for other shellfish species in this subregion. The scientific knowledge and status of assessment for Celtic Sea nephrops functional units is good. Nine out of ten functional units are fully assessed and belong to category 1. It has to be noted, though, that only three of these functional units have an estimation of $B_{msy\ trigger}$, allowing the assessment against criteria 3.2. The status of nephrops has deteriorated in the last three years in relation to fishing mortality. While most functional units were fished at or below msy in 2010, now there are less than half. The stocks that have biomass against reference points all show biomass levels above $B_{msy\ trigger}$ for the last year. While the scientific information for Nephrops stocks in the Celtic Sea is good, there are significant landings for a number of shellfish stocks in this region that are not part of an international assessment and advisory framework.

Status of elasmobranch stocks in the Celtic Sea in relation to D3

The status of elasmobranchs in the Celtic Sea is very uncertain. There are 22 stocks/species of elasmobranchs in this subregion, without any stocks falling into category 1 or 2. Half of the stocks/species are assessed using survey and/or trends in CPUE, while the other half is assessed using commercial catches only. Although the stocks are not undergoing stock assessments of F and SSB against reference points, a number of stocks have a qualitative evaluation and indicate that 8 stocks are believed to be in a depleted status in relation to biomass.

Status of deep-water stocks in the Celtic Sea in relation to D3

There are six deep-water stocks in the Celtic Sea subregion and overall data availability and scientific knowledge to assess the stocks in relation to criteria 3.1 and 3.2 is limited. There are two stocks with availability of F against F_{msy} and one stock with SSB estimates against $B_{msy\ trigger}$. Both, Blue ling and Roundnose grenadier is fished at msy with biomass above $B_{msy\ trigger}$ for Roundnose grenadier. Black scabbard has qualitative evaluation of SSB against reference points and has a green status. All other stocks do not have sufficient information to asses against criteria 3.1 and 3.2. A lack of suitable monitoring programmes and insufficient knowledge of stock structure have hampered further progress in many of the deep-water assessments.

Table 4.13 Stock status in relation to criteria 3.1 and 3.2 of pelagic stocks in the Celtic Sea. For further details including full stock names please see accompanying datasheet.

Stock code	2013 DLS Category	F_2010	F_2011	F_2012	F to Fref	SSB ref	SSB_2011	SSB_2012	SSB_2013	SSB to Bref
her-irls	1.00	0.1	0.11	0.15	-0.40	61000	157338	159776	156355	1.56
her-nirs	1.00	0.243	0.242	0.253	-0.03	9500	21530	21541	22114	1.33
her-vian	1.00	0.25	0.187	0.1606	-0.36	50000	76985	102008	101920	1.04
her-irlw	2.13	0.897	1.1766	0.6583	1.63	110000	10964	9461	11588	-0.89
spr-celt	5.20	NA	NA	NA	NA	NA	NA	NA	NA	NA
hom-west	1.00	0.136	0.144	0.193	0.48	NA	1256400	1058800	835853	decreasing
whb-comb	1.00	0.182	0.04	0.103	-0.66	2250000	3020703	4164055	5531668	1.46
boc-nea	1.00	0.141	0.043	0.09	-0.61	NA	974025	1084655	653668	>1
mac-nea	NA	NA	NA	NA	NA	NA	NA	NA	NA	
ALB ATL N-ICCAT	1.00	Fcurrent/FRMS=0.72	NA	NA	81110t	SSBcurrent/SSBRMS	NA	NA	NA	SSBcurrent/SSBRMS=0.94
BFT East Atl&Med - ICCAT	1.00		0.36<=F2011/F0.1<=0.36	NA		SSB2011/SSBRMS 3 scenarios	NA	NA	NA	

Table 4.14. Stock status in relation to criteria 3.1 and 3.2 of demersal stocks in the Celtic Sea. For further details including full stock names please see accompanying datasheet.

Stoc k	2013 DLS	Fr ef	F_20 10	F_20 11	F_20 12	F to Fref	SSB ref	SSB_20 11	SSB_20 12	SSB_20 13	SSB to Bref
cod-	1.00	0.4	0.484	0.374	0.424	0.06	103	11726	20858	21632	1.10
cod-	2.13	0.4	1.209	1.187	NA	1.97	100	2033	2394	NA	-0.76
cod-	1.00	0.1	0.877	1.022	0.92	3.84	220	2217	1835	1689	-0.92
had-	1.00	0.3	0.652	0.564	0.93	1.82	750	72429	50873	24006	2.20
had-	1.00	0.3	0.282	0.229	0.132	-	900	8333	9218	6224	-0.31
had-	1.00	0.3	0.288	0.182	0.258	-	300	24350	33663	30365	0.01
meg	1.00	0.3	0.15	0.13	0.09	-	974	25004	36862	NA	2.78
sol-	1.00	0.3	0.32	0.261	0.447	0.44	220	3778	3686	3319	0.51
sol-	1.00	0.1	0.286	0.343	0.301	0.89	310	1095	1126	961	-0.69
whg	1.00	0.3	0.505	0.328	0.161	-	210	53833	62920	58883	1.80
whg	1.00	0.6	0.121	0.076	0.069	-	220	9007	8028	8526	-0.61
whg	2.13	0.6	NA	NA	NA	>1	700	NA	NA	NA	<1
ang-	3.20	N	NA	NA	NA	NA	NA	NA	NA	NA	Increasi
had-	3.20	N	NA	NA	NA	NA	NA	NA	NA	NA	Increasi
meg	3.20	N	NA	NA	NA	<1	NA	NA	NA	NA	Increasi
mg	3.20	N	NA	NA	NA	stab	NA	NA	NA	NA	Increasi
ple-	3.20	N	NA	NA	NA	NA	NA	NA	NA	NA	Increasi
ple-	3.20		NA	NA	NA	<1	NA	NA	NA	NA	>1
ple-	3.20	N	NA	NA	NA	>1	NA	NA	NA	NA	Increasi
sol-	3.20		NA	NA	NA	<1	NA	NA	NA	NA	Increasi
pol-	4.12	N	NA	NA	NA	NA	NA	NA	NA	NA	NA
bss-	3.20	N	NA	NA	NA	>1	NA	NA	NA	NA	decreasi
cod-	6.20	N	NA	NA	NA	NA	NA	NA	NA	NA	NA
sol-	6.20	N	NA	NA	NA	NA	NA	NA	NA	NA	NA
whg	6.20	N	NA	NA	NA	NA	NA	NA	NA	NA	NA
ple-	6.20	N	NA	NA	NA	NA	NA	NA	NA	NA	NA
gug-	6.20q	N	NA	NA	NA	NA	NA	NA	NA	NA	NA
san-	6.30	N	NA	NA	NA	NA	NA	NA	NA	NA	NA
nop	6.30	N	NA	NA	NA	NA	NA	NA	NA	NA	NA
ang-	3.20	N	NA	NA	NA	NA	NA	NA	NA	NA	decreasi
bss-	6.20	N	NA	NA	NA	NA	NA	NA	NA	NA	NA
hke-	1.00	0.2	0.25	0.24	0.24	0.00	NA	261990	277794	260690	>1
ele-	3.14	N	NA	NA	NA	NA	NA	NA	NA		<1
lin-	3.20	N	NA	NA	NA	NA	NA	NA	NA	NA	
usk-	3.20	N	NA	NA	NA	NA	NA	NA	NA	NA	>1
usk-	3.20	N	NA	NA	NA	NA	NA	NA	NA	NA	
sbr-	4.20	N	NA	NA	NA	NA	NA	NA	NA	NA	<1
mur	5.20	N	NA	NA	NA	NA	NA	NA	NA	NA	
alf-	6.20	N	NA	NA	NA	NA	NA	NA	NA	NA	
czs-	5.20q	N	NA	NA	NA	NA	NA	NA	NA	NA	

Table 4.15 Stock status in relation to criteria 3.1 and 3.2 of shellfish functional units in the Celtic Sea. For further details including full stock names please see accompanying datasheet.

Stock code	2013 DLS Category	Fref	F_2010	F_2011	F_2012	F to Fref	SSB ref	SSB_2011	SSB_2012	SSB_2013	SSB to Bref
nep-11	1.00	10.9	6.6	6.3	17.9	0.64	541	1726	891	1403	0.65
nep-12	1.00	12.3	7.4	6.5	15.8	0.28	1016	1945	919	1718	-0.10
nep-13	1.00	16.4	17.5	17.6	26	0.59	579	2165	1421	1990	1.45
nep-14	1.00	9.8	6.6	6.2	3.9	-0.60	NA	431	652.7	465.7	NA
nep-15	1.00	0.171	0.15	0.19	0.2	0.17	NA	4.9	5.1	4.3	NA
nep-16	1.00	5	NA	NA	3.2	-0.36	NA	NA	787	768	NA
nep-17	1.00	10.5	8.3	7.7	19.2	0.83	NA	491	325	317	decreasing
nep-19	1.00	7.5	NA	7	9.3	0.24	NA	557	498	397	decreasing
nep-22	1.00	10.9	13.2	5.3	9.5	-0.13	NA	1256	1498	1254	stable
nep-2021	4.14	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 4.16 Stock status in relation to criteria 3.1 and 3.2 of elasmobranch species/stocks in the Celtic Sea. For further details including full stock names please see accompanying datasheet.

Stock code	2013 DLS Category	Fref	F_2010	F_2011	F_2012	F to Fref	SSB ref	SSB_2011	SSB_2012	SSB_2013	SSB to Bref
rjb-celt	3.14	NA	NA	NA	NA	NA	NA	NA	NA	NA	<1
rjc-7afg	3.20	NA	NA	NA	NA	NA	NA	NA	NA	NA	Increasing
rjc-VI	3.20	NA	NA	NA	NA	NA	NA	NA	NA	NA	Increasing
rjm-7afg	3.20	NA	NA	NA	NA	NA	NA	NA	NA	NA	Increasing
rjm-VI	3.20	NA	NA	NA	NA	NA	NA	NA	NA	NA	decreasing
syc-celt	3.20	NA	NA	NA	NA	decreasing	NA	NA	NA	NA	Increasing
rjn-celt	3.20	NA	NA	NA	NA	NA	NA	NA	NA	NA	decreasing
rjf-celt	5.20q	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
rjh-7afg	5.20q	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
rjh-VI	5.20q	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
rji-celt	5.20q	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
raj-celt	6.30	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
rju-7j	6.30	NA	NA	NA	NA	NA	NA	NA	NA	NA	<1
dgs-nea	3.14	0.029	0.014	NA	NA	-0.52	NA	NA	NA		
guq-nea	3.14	NA	NA	NA	NA	NA	NA	NA	NA		<1
cyo-nea	3.14	NA	NA	NA	NA	NA	NA	NA	NA	NA	<1
trk-nea	3.20	NA	NA	NA	NA	NA	NA	NA	NA	NA	
gag-nea	5.20	NA	NA	NA	NA	NA	NA	NA	NA	NA	
por	5.30	NA	NA	NA	NA	NA	N	NA	NA	NA	<1

- nea							A				
sck-nea	5.30	NA	NA	NA	NA	NA	N A	NA	NA	NA	<1
agn - nea	6.30	NA	NA	NA	NA	NA	N A	NA	NA	NA	<1
bsk - nea	6.30	NA	NA	NA	NA	NA	N A	NA	NA	NA	<1

Table 4.17 Stock status in relation to criteria 3.1 and 3.2 of deep-water species/stocks in the Celtic Sea. For further details including full stock names please see accompanying datasheet.

Stock code	2013 DLS Category	Functionl Group	Fref	F_2010	F_2011	F_2012	F to Fref	SSB ref	SSB_2011	SSB_2012	SSB_2013	SSB to Bref
rng-5b67	1.00	DW	0.08	NA	0.07	NA	-0.13	44900	NA	NA	0.13024499	
bli-5b67	2.00	DW	0.12	0.099	0.056	NA	-0.53	NA	NA	NA	NA	
arg-oth	3.20	DW	NA	NA	NA	NA	NA	NA	NA	NA	NA	
bsf-nrtn	3.20	DW	NA	NA	NA	NA	NA	NA	NA	NA	NA	>1
gfb-comb	3.20	DW	NA	NA	NA	NA	NA	NA	NA	NA	NA	
ory-comb	6.30	DW	NA	NA	NA	NA	NA	NA	NA	NA	NA	

Overall status, issues and gaps

Tables 4.18 and 4.19 gives the breakdown of stock status for all groups together in the Celtic Sea subregion in relation to criteria 3.1 and 3.2. From the stocks that have a quantitative assessment of F against reference points (F_{msy} for most cases) for criteria 3.1, almost three quarters have achieved green status in the last two years (final values used depend on last assessment and advice year). For the stocks that are qualitatively assessed against criteria 3.1, half of the stocks have green status. Only few are assessed by trends for fishing mortality. This is mainly due to an uncertainty in total catches including discard estimates for many of the data poor stocks. Historic species specific catch data is also a mayor gap for some groups, the elasmobranch species in particular.

In relation to criteria 3.2, 68% of stocks that have quantitative estimation against biomass reference points ($B_{msy\ trigger}$ in most cases), have green status. For stocks with qualitative estimations, 69% have biomass below any possible reference points. In many data poor situations, expert knowledge was applied to assess whether stocks are depleted. The qualitative approach is more difficult in situations when biomass is close to possible reference points. This is apparent in particular for category three stocks which allow the assessment of trends. The majority of stocks show increasing trends (58%), but it is not possible to ascertain whether current biomass levels are above or below reference points.

When carrying out the Celtic Sea assessment for D3 the following gaps have been identified:

1) Species assessments/advice in relation to landings:

a) A number of shellfish stocks have important international fisheries but there is no international assessment/advisory framework.

b) Some fish species are also high in landings without stocks identified in the Celtic Sea subregion for international assessments/advice.

c) Most pelagic species that have significant contribution to overall landings are fully assessed under category 1. There are some demersal species that rank high in overall landings but only have trends based assessments without evaluation against reference points.

2) Assessment status in relation to functional groups

a) Elasmobranchs and deep-water stocks are mostly not assessed against reference points. Trends based evaluation of biomass is the basis of advice for the majority of stocks.

b) Uncertainty in total catches including discards often hamper the evaluation of F. In the case of elasmobranchs there is a lack of species specific catch reporting for historic catches.

Table 4.18. Summary of stock status in relation to criteria 3.1 for all species/stocks in the Celtic Sea.

Criteria 3.1 Fishing mortality	Quantitative (3.1.1)	Qualitative	Trends only	Unknown	Total
Number of stocks	31	6	2	50	89
Number of stocks achieving green status	23	3	1		26
Percentage of stocks achieving green status	74%	50%	50%		29%

Table 4.19 Summary of stock status in relation to criteria 3.2 for all species/stocks in the Celtic Sea

Criteria 3.2 Biomass	Quantitative (3.1.1)	Qualitative	Trends only	Unknown	Total
Number of stocks	19	16	19	35	89
Number of stocks achieving green status	13	5	11		29
Percentage of stocks achieving green status	68%	31%	58%		33%

4.4 Bay of Biscay and Iberian Coast

The stocks considered are those which are assessed by ICES and ICCAT:

Table 4.20 presents the stocks [65 within ICES and 2 ICCAT] internationally assessed relative to this sub-region.

Stock	Scientific name	Group	Category
anb-8c9a	*Lophius budegassa*	Benthic-Demersal	1.00
anp-8c9a	*Lophius piscatorius*	Benthic-Demersal	1.00
hke-soth	*Merluccius merluccius*	Benthic-Demersal	1.00

mgb-8c9a	*Lepidorhombus boscii*	Benthic-Demersal	1.00
mgw-8c9a	*Lepidorhombus whiffiagonis*	Benthic-Demersal	1.00
ane-bisc	*Engraulis encrasicolus*	Pelagic	1.00
sol-bisc	*Solea solea*	Benthic-Demersal	1.00
nep-25	*Nephrops norvegicus*	Shellfish	3.14
nep-2627	*Nephrops norvegicus*	Shellfish	3.14
nep-31	*Nephrops norvegicus*	Shellfish	3.14
nep-2324	*Nephrops spp.*	Shellfish	3.20
nep-2829	*Nephrops norvegicus*	Shellfish	3.20
nep-30	*Nephrops norvegicus*	Shellfish	3.20
rjc-bisc	*Raja clavata*	Elasmobranch	3.20
rjn-bisc	*Leucoraja naevu*	Elasmobranch	3.20
syc-8c9a	*Scyliorhinus canicula*	Elasmobranch	3.20
syc-bisc	*Scyliorhinus canicula*	Elasmobranch	3.20
ane-pore	*Engraulis encrasicolus*	Pelagic	0.00
hom-soth	*Trachurus trachurus*	Pelagic	1.00
jaa-10	*Trachurus picturatus*	Pelagic	5.20
raj-89a	*Raja sp*	Elasmobranch	5.20
sar-78	*Sardina pilchardus*	Pelagic	3.20
ple-89a	*Pleuronectes platessa*	Benthic-Demersal	5.20q
pol-89a	*Pollachius pollachius*	Benthic-Demersal	5.20q
rjc-pore	*Raja clavata*	Elasmobranch	5.20q
rjh-pore	*Raja brachyura*	Elasmobranch	5.20q
rjm-bisc	*Raja montagui*	Elasmobranch	5.20q
rjm-pore	*Raja montagui*	Elasmobranch	5.20q
rjn-pore	*Leucoraja naevu*	Elasmobranch	5.20q
whg-89a	*Merlangius merlangus*	Benthic-Demersal	5.20q
sar-soth	*Sardina pilchardus*	Pelagic	1.00
rjb-89a	*Dipturus spp.*	Elasmobranch	5.30
gug-89a	*Eutrigla gurnardus*	Benthic-Demersal	6.20q
bss-8ab	*Dicentrarchus labrax*	Benthic-Demersal	5.20
bss-8c9a	*Dicentrarchus labrax*	Benthic-Demersal	5.20
sol-8c9a	*Solea solea*	Benthic-Demersal	6.20q
her-noss	*Clupea harengus*	Pelagic	1.00
hke-nrth	*Merluccius merluccius*	Benthic-Demersal	1.00
hom-west	*Trachurus trachurus*	Pelagic	1.00
whb-comb	*Micromesistius poutassou*	Pelagic	1.00
boc-nea	*Capros aper*	Benthic-Demersal	1.00
dgs-nea	*Squalus acanthias*	Elasmobranch	3.14
guq-nea	*Centrophorus squamosus*	Elasmobranch	3.14
ele-nea	*Anguilla anguilla*	Benthic-Demersal	3.14
cyo-nea	*Centroscymnus coelolepis*	Elasmobranch	3.14
arg-oth	*Argentina silus*	Deep	3.20
bsf-89	*Aphanopus carbo*	Deep	3.20
lin-oth	*Molva molva*	Deep	3.20
trk-nea	*Mustelus spp.*	Elasmobranch	3.20

usk-oth	*Brosme brosme*	Deep	3.20
gfb-comb	*Phycis blennoides*	Deep	3.20
sbr-678	*Pagellus bogaraveo*	Deep	4.20
gag-nea	*Galeorhinus galeus*	Elasmobranch	5.20
mur-west	*Mullus surmuletus*	Benthic-Demersal	5.20
CS	*Pagellus bogaraveo*	Deep	5.20
bli-oth	*Molva dypterygia*	Deep	5.30
por-nea	*Lamna nasus*	Elasmobranch	5.30
sck-nea	*Dalatias licha*	Elasmobranch	5.30
alf-comb	*Beryx spp.*	Deep	6.20
rng-oth	*Coryphaenoides rupestris*	Deep	6.20
agn-nea	*Squatina squatina*	Elasmobranch	6.30
bsk-nea	*Cetorhinus maximus*	Elasmobranch	6.30
ory-comb	*Hoplostethus atlanticus*	Deep	6.30
czs-comb	*Aspitrigla cuculus*	Benthic-Demersal	5.20q
mac-nea	*Scomber scombrus*	Pelagic	NA
ALB ATLN-ICCAT	*Thunnus alalunga*	Pelagic	1.00
BFT East Atl&Med-ICCAT	*Thunnus thynnus*	Pelagic	1.00

These 67 stocks represent around 50% of the reported landings in this sub-area (under 49 species or group of species names). 9 species contribute to at least 1% each of the total landings (Table 4.21).]

Table 4.21: Landings by species (or group of species) in the Bay of Biscay sub-area.

Bay of Biscay									
VIII & IX									
Mean is 2009-2011 as 2012 has no UK data									
Row Labels	Scientific name	Common	Sum of 2012	Sum of 2011	Sum of 2010	Sum of 2009	lean 2009-2011		ICES/ICCAT
Grand Total			459136	517342	537785	477603	510910	o total landings	
PIL	Sardina pilchardus	European pilchard(=Sardine)	82085	102878	109512	109247	107212.3	21.00%	X
PEL	Osteichthyes	Pelagic fishes nei	45	36500	53255	30247	40000.67	7.80%	
JAX	Trachurus spp	Jack and horse mackerels nei	23423	43940	32663	37004	37869	7.40%	
MAC	Scomber scombrus	Atlantic mackerel	29003	20903	32295	24887	26028.33	5.10%	X
HKE	Merluccius merluccius	European hake	27351	26742	25077	21813	24544	4.80%	X
HOM	Trachurus trachurus	Atlantic horse mackerel	21628	12692	14442	18295	15143	3.00%	X
ANE	Engraulis encrasicolus	European anchovy	22282	23280	13825	2467	13190.67	2.60%	X
MAS	Scomber japonicus	Chub mackerel	36134	199	24318	14492	13003	2.50%	
WHB	Micromesistius poutassou	Blue whiting(=Poutassou)	8703	3135	12777	17260	11057.33	2.20%	X
MAZ	Scomber spp	Scomber mackerels nei	1520	32596	0	0	10865.33	2.10%	
ALB	Thunnus alalunga	Albacore	9345	6888	11708	7968	8854.667	1.70%	X
PRC	Percoidei	Percoids nei	253	5158	18673	1172	8334.333	1.60%	
OCC	Octopus vulgaris	Common octopus	9369	7259	10467	6747	8157.667	1.60%	
COE	Conger conger	European conger	7221	8997	8499	6728	8074.667	1.60%	
MNZ	Lophius spp	Monkfishes nei	8190	8380	7566	7856	7934	1.60%	X
CTC	Sepia officinalis	Common cuttlefish	8365	8611	7323	6248	7394	1.40%	
MAX	Scombridae	Mackerels nei	5333	7685	2286	11570	7180.333	1.40%	
COC	Cerastoderma edule	Common edible cockle	3772	5809	7123	7586	6839.333	1.30%	
BIB	Trisopterus luscus	Pouting(=Bib)	6440	5837	6145	6601	6194.333	1.20%	
SOL	Solea solea	Common sole	4632	5228	5204	5155	5195.667	1.00%	X
OCT	Octopodidae	Octopuses, etc. nei	6397	4562	6113	4765	5146.667	1.00%	
GAD	Gadiformes	Gadiformes nei	93	1181	3070	9701	4650.667	0.90%	
GRO	Osteichthyes	Groundfishes nei	2	1224	4479	8151	4618	0.90%	
POA	Brama brama	Atlantic pomfret	12565	8023	4140	1370	4511	0.90%	
BOG	Boops boops	Bogue	13996	7699	2660	1464	3941	0.80%	
NEP	Nephrops norvegicus	Norway lobster	2790	4170	3916	3568	3884.667	0.80%	X
BSH	Prionace glauca	Blue shark	2796	4071	3043	3101	3405	0.70%	
DPS	Parapenaeus longirostris	Deep-water rose shrimp	2074	3297	2151	4671	3373	0.70%	
BSS	Dicentrarchus labrax	European seabass	3229	3628	3278	3176	3360.667	0.70%	X
BSF	Aphanopus carbo	Black scabbardfish	2778	2815	3377	3519	3237	0.60%	X
JAA	Trachurus picturatus	Blue jack mackerel	0	3012	2366	3231	2869.667	0.60%	X
CLV	Veneridae	Venus clams nei	2298	2759	2762	2906	2809	0.50%	
MZZ	Osteichthyes	Marine fishes nei	805	2500	3260	2559	2773	0.50%	
OMZ	Ommastrephidae	Ommastrephidae squids nei	114	3147	2999	1934	2693.333	0.50%	
CRE	Cancer pagurus	Edible crab	2451	2745	2489	2581	2605	0.50%	
FIN	Osteichthyes	Finfishes nei	1516	2244	2323	2652	2406.333	0.50%	
SVE	Chamelea gallina	Striped venus	2777	1269	2380	3215	2288	0.40%	
WHG	Merlangius merlangus	Whiting	1998	2245	2451	1474	2056.667	0.40%	X
SQI	Illex illecebrosus	Northern shortfin squid	7263	3269	1831	952	2017.333	0.40%	
SQZ	Loliginidae	Inshore squids nei	3410	2202	2378	1459	2013	0.40%	
MUR	Mullus surmuletus	Surmullet	1593	2022	1996	1783	1933.667	0.40%	X
POL	Pollachius pollachius	Pollack	1394	1907	1671	1837	1805	0.40%	X
BRB	Spondyliosoma cantharus	Black seabream	1681	2051	1526	1773	1783.333	0.30%	
LQD	Laminaria digitata	Tangle	0	2695	1750	896	1780.333	0.30%	
LEZ	Lepidorhombus spp	Megrims nei	1243	1564	1749	1713	1675.333	0.30%	X
SCR	Maja squinado	Spinous spider crab	1113	1245	1570	2077	1630.667	0.30%	
JOD	Zeus faber	John dory	1398	1544	1794	1495	1611	0.30%	
RJN	Raja naevus	Cuckoo ray	1133	1490	1608	1409	1502.333	0.30%	X
BRF	Helicolenus dactylopterus	Blackbelly rosefish	1403	1822	1862	652	1445.333	0.30%	
CTS	Venerupis pullastra	Pullet carpet shell	1229	1316	1445	1428	1396.333	0.30%	
RJC	Raja clavata	Thornback ray	1551	1585	1587	906	1359.333	0.30%	X
SYC	Scyliorhinus canicula	Small-spotted catshark	1400	1331	1293	1290	1304.667	0.30%	X
BFT	Thunnus thynnus	Atlantic bluefin tuna	505	1459	867	1512	1279.333	0.30%	X
CLU	Clupeoidei	Clupeoids nei	11	1827	852	961	1213.333	0.20%	
FOR	Phycis phycis	Forkbeard	936	1477	1237	652	1122	0.20%	
CET	Dicologlossa cuneata	Wedge sole	1181	1327	1103	897	1109	0.20%	
SWA	Diplodus sargus	White seabream	1027	1088	1079	1101	1089.333	0.20%	
SQC	Loligo spp	Common squids nei	1794	1308	1111	801	1073.333	0.20%	
MGR	Argyrosomus regius	Meagre	1084	937	880	1191	1002.667	0.20%	
SBA	Pagellus acarne	Axillary seabream	794	904	1063	1011	992.6667	0.20%	
GUX	Triglidae	Gurnards, searobins nei	1846	1293	862	722	959	0.20%	
CTG	Ruditapes decussatus	Grooved carpet shell	793	861	899	948	902.6667	0.20%	
MGS	Mugil spp		451	395	866	1339	866.6667	0.20%	
PAX	Pagellus spp	Pandoras nei	1188	1187	705	642	844.6667	0.20%	
SWO	Xiphias gladius	Swordfish	732	868	893	770	843.6667	0.20%	
MEG	Lepidorhombus whiffiagonis	Megrim	747	794	881	805	826.6667	0.20%	X
SDV	Mustelus spp	Smooth-hounds nei	619	763	800	903	822	0.20%	
SLM	Sarpa salpa	Salema	586	617	1239	596	817.3333	0.20%	
CAR	Chondrichthyes	Cartilaginous fishes nei	0	997	1239	158	798	0.20%	
BON	Sarda sarda	Atlantic bonito	2456	1222	931	227	793.3333	0.20%	
SBG	Sparus aurata	Gilthead seabream	581	834	816	675	775	0.20%	
SKA	Raja spp	Raja rays nei	413	411	614	1299	774.6667	0.20%	
MUX	Mullus spp	Surmullets(=Red mullets) nei	632	622	760	750	710.6667	0.10%	
SMA	Isurus oxyrinchus	Shortfin mako	568	616	857	608	693.6667	0.10%	
SCE	Pecten maximus	Great Atlantic scallop	980	371	526	1133	676.6667	0.10%	
CRG	Carcinus maenas	Green crab	688	695	703	597	665	0.10%	
SFS	Lepidopus caudatus	Silver scabbardfish	60	486	794	710	663.3333	0.10%	
ULO	Spisula solida	Solid surf clam	624	557	666	678	633.6667	0.10%	
URX	Echinoidea	Sea urchins, etc. nei	747	742	684	439	621.6667	0.10%	
FRZ	Auxis thazard, A. rochei	Frigate and bullet tunas	1493	759	620	367	582	0.10%	
CDX	Sciaenidae	Croakers, drums nei	248	413	583	498	498	0.10%	
BLT	Auxis rochei	Bullet tuna	103	388	656	436	493.3333	0.10%	
WRF	Polyprion americanus	Wreckfish	255	496	497	429	474	0.10%	
CTB	Diplodus vulgaris	Common two-banded seabream	367	398	457	490	448.3333	0.10%	
SYT	Scyliorhinus stellaris	Nursehound	347	395	464	457	438.6667	0.10%	
YFT	Thunnus albacares	Yellowfin tuna	205	225	302	779	435.3333	0.10%	
SAU	Scomberesox saurus	Atlantic saury	280	794	159	344	432.3333	0.10%	
LIN	Molva molva	Ling	955	470	408	405	427.6667	0.10%	X
SYX	Scyliorhinidae	Catsharks, etc. nei	379	431	391	443	421.6667	0.10%	
RJH	Raja brachyura	Blonde ray	370	424	397	438	419.6667	0.10%	X
CRU	Crustacea	Marine crustaceans nei	373	438	425	359	407.3333	0.10%	
RAZ	Solen spp	Solen razor clams nei	514	474	400	342	405.3333	0.10%	
SRX	Rajiformes	Rays, stingrays, mantas nei	282	274	251	626	383.6667	0.10%	
CPL	Centrophorus lusitanicus	Lowfin gulper shark	600	432	271	423	375.3333	0.10%	
TPS	Ruditapes spp	Carpet shells nei	350	451	401	271	374.3333	0.10%	
SCO	Scorpaenidae	Scorpionfishes nei	302	374	397	319	363.3333	0.10%	
HMM	Trachurus mediterraneus	Mediterranean horse mackerel	503	403	221	462	362	0.10%	
DON	Donax spp	Donax clams	382	281	369	411	353.6667	0.10%	
MLR	Chelon labrosus	Thicklip grey mullet	505	479	360	214	351	0.10%	
KLK	Callista chione	Smooth callista	278	360	381	306	349	0.10%	
BET	Thunnus obesus	Bigeye tuna	79	498	503	34	345	0.10%	
GAG	Galeorhinus galeus	Tope shark	81	232	297	487	338.6667	0.10%	X
SBR	Pagellus bogaraveo	Blackspot(=red) seabream	339	262	409	339	336.6667	0.10%	X
FLX	Pleuronectiformes	Flatfishes nei	181	302	397	302	333.6667	0.10%	
ANF	Lophiidae	Anglerfishes nei	295	390	285	317	330.6667	0.10%	
HER	Clupea harengus	Atlantic herring	25	357	539	89	328.3333	0.10%	X
CBR	Serranus cabrilla	Comber	100	307	367	279	317.6667	0.10%	
WRA	Labridae	Wrasses, hogfishes, etc. nei	283	297	340	313	316.6667	0.10%	
SOS	Solea lascaris	Sand sole	261	348	298	299	315	0.10%	
SCX	Pectinidae	Scallops nei	207	165	406	371	314	0.10%	
SKJ	Katsuwonus pelamis	Skipjack tuna	697	528	231	180	313	0.10%	X
SBS	Oblada melanura	Saddled seabream	398	483	243	189	305	0.10%	
LBE	Homarus gammarus	European lobster	114	637	137	128	300.6667	0.10%	
THS	Microchirus spp	Thickback soles nei	138	307	292	297	298.6667	0.10%	
TUR	Psetta maxima	Turbot	281	305	331	239	291.6667	0.10%	
SCL	Scyliorhinus spp	Catsharks, nursehounds nei	421	300	263	298	287	0.10%	
PLE	Pleuronectes platessa	European plaice	252	282	326	245	284.3333	0.10%	X
GFB	Phycis blennoides	Greater forkbeard	304	297	273	280	283.3333	0.10%	X
GUR	Aspitrigla cuculus	Red gurnard	283	296	250	290	278.6667	0.10%	X
CPR	Palaemon serratus	Common prawn	318	275	294	236	268.3333	0.10%	
SIL	Atherinidae	Silversides(=Sand smelts) nei	252	247	276	276	266.3333	0.10%	
GAR	Belone belone	Garfish	197	484	161	151	265.3333	0.10%	
WEG	Trachinus draco	Greater weever	250	337	254	197	262.6667	0.10%	

Following the >1% criteria for selecting the species will lead to 21 species (or group of species) among which 9 comprise stocks internationally assessed. Using a 0.1% criteria will add 102 species (or group of species), 22 with stocks internationally assessed.

It should be noted that 18 species for which stocks are internationally assessed contribute less than 0.1% each to the total reported landings in this sub-area.

Among the 65 stocks in the Bay of Biscay-Iberia subregion, for which ICES gives an advice on, 14 are fully assessed (category 1), 21 are in category 3 (with 7 for which the advice is 0 catch), 28 are classified under categories 5 and 6, and 2 are not classified (anchovy in the Portuguese waters for which no advice could be given, and mackerel which could not be classified).

For stocks (14) under category 3.2, surveys indices are used for advice for 9 of them. However those surveys are either not in the Datras database or the data do not include some information such as maturity to be used for the evaluation of proxies as described in Section 4.1.

The 2 tunas stocks are fully assessed by ICCAT and could be considered as corresponding to the ICES category 1.

Table 4.22: Evaluation of GES – Benthic-Demersal stocks in Bay of Biscay and Iberian waters. Note that the values for anb-8c9a are ratio of current F against Fmsy and B respectively.

Stock	Scientific name	Group	Cat	FMSY	F_2010	F_2011	F_2012	F-Fmsy/Fmsy	FGES	SSBMSY	SSB_2011	SSB_2012	SSB_2013	SSB-SSBmsy/SSBmsy	BGES
anb-8c9a	*Lophius budegassa*	Benthic-Demersal	1.00		0.67	0.66	0.81	0.81	YY		0.63	0.66	0.68	0.68	NN
anp-8c9a	*Lophius piscatorius*	Benthic-Demersal	1.00	0.19	0.21	0.14	0.17	-0.11	NN	NA	6663	7107	7482	NA	
hke-soth	*Merluccius merluccius*	Benthic-Demersal	1.00	0.24	0.7	0.73	0.57	1.38	YY	NA	18600	20900	25400	NA	
mgb-8c9a	*Lepidorhombus boscii*	Benthic-Demersal	1.00	0.18	0.2187	0.1981	0.0899	-0.50	NN	NA	7018	7575	8287	NA	
mgw-8c9a	*Lepidorhombus whiffiagonis*	Benthic-Demersal	1.00	0.17	0.0847	0.1508	0.1853	0.09	YY	NA	1254	1513	1345	NA	
sol-bisc	*Solea solea*	Benthic-Demersal	1.00	0.26	0.369	0.373	0.463	0.78	YY	13000	15889	14663	16360	0.26	YY
ple-89a	*Pleuronectes platessa*	Benthic-Demersal	5.20q	NA	NA	NA	NA	NA		NA	NA	NA	NA	NA	
pol-89a	*Pollachius pollachius*	Benthic-Demersal	5.20q	NA	NA	NA	NA	NA		NA	NA	NA	NA	NA	
whg-89a	*Merlangius merlangus*	Benthic-Demersal	5.20q	NA	NA	NA	NA	NA		NA	NA	NA	NA	NA	
gug-89a	*Eutrigla gurnardus*	Benthic-Demersal	6.20q	NA	NA	NA	NA	NA		NA	NA	NA	NA	NA	
bss-8ab	*Dicentrarchus labrax*	Benthic-Demersal	5.20	NA	NA	NA	NA	NA		NA	NA	NA	NA	NA	
bss-8c9a	*Dicentrarchus labrax*	Benthic-Demersal	5.20	NA	NA	NA	NA	NA		NA	NA	NA	NA	NA	
sol-8c9a	*Solea solea*	Benthic-Demersal	6.20q	NA	NA	NA	NA	NA		NA	NA	NA	NA	NA	
hke-nrth	*Merluccius merluccius*	Benthic-Demersal	1.00	0.24	0.25	0.24	0.24	0	YY	NA	261990	277794	260690	NA	
boc-nea	*Capros aper*	Benthic-Demersal	1.00	0.23	0.141	0.043	0.09	-0.609	YY	NA	974025	1084655	653668	NA	
ele-nea	*Anguilla anguilla*	Benthic-Demersal	3.14											<1	N
mur-west	*Mullus surmuletus*	Benthic-Demersal	5.20												
czs-comb	*Aspitrigla cuculus*	Benthic-Demersal	5.20q												
YY or NN according to quantitative assessment															
Y or N according to expert judgment															

Table 4.23: Evaluation of GES – Pelagic stocks in Bay of Biscay and Iberian waters.

Stock	Scientific name	Group	Cat	FMSY	F_2010	F_2011	F_2012	F-Fmsy/Fmsy	FGES	SSBMSY	SSB_2011	SSB_2012	SSB_2013	SSB-SSBmsy/SSBmsy	BGES
ane-bisc	*Engraulis encrasicolus*	Pelagic	1.00	NA	0.175	0.124	0.173	NA		33000	117100	81245	56055	0.70	YY
ane-pore	*Engraulis encrasicolus*	Pelagic	0.00	NA	NA	NA	NA	NA		NA	NA	NA	NA	NA	
hom-soth	*Trachurus trachurus*	Pelagic	1.00	0.11	0.11	0.08	0.07	-0.36	NN	NA	230468	222194	224000	<1?	N
jaa-10	*Trachurus picturatus*	Pelagic	5.20	NA	NA	NA	NA	NA		NA	NA	NA	NA	NA	
sar-78	*Sardina pilchardus*	Pelagic	3.20	NA	NA	NA	NA	NA		NA	NA	NA	NA	NA	
sar-soth	*Sardina pilchardus*	Pelagic	1.00	NA	0.5	0.51	0.34	NA		NA	224	185	192	NA	
her-noss	*Clupea harengus*	Pelagic	1.00	0.15	0.185	0.142	0.144	-0.04	YY	5	6.729	5.832	5.006	0.001	YY
hom-west	*Trachurus trachurus*	Pelagic	1.00	0.13	0.136	0.144	0.193	0.485	NN	NA	1256400	1058800	835853	NA	
whb-comb	*Micromesistius poutassou*	Pelagic	1.00	0.3	0.182	0.04	0.103	-0.657	YY	2250000	3020703	4164055	5531668	1.459	YY
mac-nea	*Scomber scombrus*	Pelagic	NA												
ALB ATLN-ICCAT	*Thunnus alalunga*	Pelagic	1.00	0.1486		Fcurrent/FRMS=0.72			YY	81110t	SSBcurrent/SSBRMS=0.94				NN
BFT East Atl&Med-ICCAT	*Thunnus thynnus*	Pelagic	1.00	0.083<=F0.1<=0.10			0.70<=F2011/F0.1<=0.36		YY		SSB2011/SSBRMS between: scenario 1:[0.89-1.16], scenario 2:[0.63-0.76], scenario 3: 0.37				
YY or NN according to quantitative assessment															
Y or N according to expert judgment															

Table 4.24: Evaluation of GES – Elasmobranch stocks in Bay of Biscay and Iberian waters.

Stock	Scientific name	Group	Cat	FMSY	F_2010	F_2011	F_2012	F-Fmsy/Fmsy	FGES	SSBMSY	SSB_2011	SSB_2012	SSB_2013	SSB-SSBmsy/SSBmsy	BGES
rjc-bisc	*Raja clavata*	Elasmobranch	3.20	NA	NA	NA	NA	**NA**		NA	NA	NA	NA	**NA**	
rjn-bisc	*Leucoraja naevu*	Elasmobranch	3.20	NA	NA	NA	NA	**NA**		NA	NA	NA	NA	**NA**	
syc-8c9a	*Scyliorhinus canicula*	Elasmobranch	3.20	NA	NA	NA	NA	**NA**		NA	NA	NA	NA	**NA**	
syc-bisc	*Scyliorhinus canicula*	Elasmobranch	3.20	NA	NA	NA	NA	**NA**		NA	NA	NA	NA	**NA**	
raj-89a	*Raja sp*	Elasmobranch	5.20	NA	NA	NA	NA	**NA**		NA	NA	NA	NA	**NA**	
rjc-pore	*Raja clavata*	Elasmobranch	5.20q	NA	NA	NA	NA	**NA**		NA	NA	NA	NA	**NA**	
rjh-pore	*Raja brachyura*	Elasmobranch	5.20q	NA	NA	NA	NA	**NA**		NA	NA	NA	NA	**NA**	
rjm-bisc	*Raja montagui*	Elasmobranch	5.20q	NA	NA	NA	NA	**NA**		NA	NA	NA	NA	**NA**	
rjm-pore	*Raja montagui*	Elasmobranch	5.20q	NA	NA	NA	NA	**NA**		NA	NA	NA	NA	**NA**	
rjn-pore	*Leucoraja naevu*	Elasmobranch	5.20q	NA	NA	NA	NA	**NA**		NA	NA	NA	NA	**NA**	
rjb-89a	*Dipturus spp.*	Elasmobranch	5.30	NA	NA	NA	NA	**NA**		NA	NA	NA	NA	**NA**	
dgs-nea	*Squalus acanthias*	Elasmobranch	3.14	0.029	0.014			-0.517	YY	NA				<1	N
guq-nea	*Centrophorus squamosus*	Elasmobranch	3.14											<1	N
cyo-nea	*Centroscymnus coelolepis*	Elasmobranch	3.14											<1	N
trk-nea	*Mustelus spp.*	Elasmobranch	3.20												
gag-nea	*Galeorhinus galeus*	Elasmobranch	5.20												
por-nea	*Lamna nasus*	Elasmobranch	5.30											<1	N
sck-nea	*Dalatias licha*	Elasmobranch	5.30											<1	N
agn-nea	*Squatina squatina*	Elasmobranch	6.30											<1	N
bsk-nea	*Cetorhinus maximus*	Elasmobranch	6.30											<1	N
YY or NN according to quantitative assessment															
Y or N according to expert judgment															

Table 4.25: Evaluation of GES – Deep-sea stocks in Bay of Biscay and Iberian waters.

Stock	Scientific name	Group	Cat	FMSY	F_2010	F_2011	F_2012	F-Fmsy/Fmsy	FGES	SSBMSY	SSB_2011	SSB_2012	SSB_2013	SSB-SSBmsy/SSBmsy	BGES
arg-oth	*Argentina silus*	Deep	3.20												
bsf-89	*Aphanopus carbo*	Deep	3.20											>1	Y
lin-oth	*Molva molva*	Deep	3.20												
usk-oth	*Brosme brosme*	Deep	3.20											>1	Y
gfb-comb	*Phycis blennoides*	Deep	3.20												
sbr-678	*Pagellus bogaraveo*	Deep	4.20											<1	N
CS	*Pagellus bogaraveo*	Deep	5.20												
bli-oth	*Molva dypterygia*	Deep	5.30											<1	N
alf-comb	*Beryx spp.*	Deep	6.20												
rng-oth	*Coryphaenoides rupestris*	Deep	6.20												
ory-comb	*Hoplostethus atlanticus*	Deep	6.30												
YY or NN according to quantitative assessment															
Y or N according to expert judgment															

Table 4.26: Evaluation of GES – Shellfish stocks in Bay of Biscay and Iberian waters. Note that the three Iberian Nephrops stocks for which the workshop indicates that they are not at GES follows from the ICES' advice for zero catch.

Stock	Scientific name	Group	Cat	FMSY	F_2010	F_2011	F_2012	F-Fmsy/Fmsy	FGES	SSBMSY	SSB_2011	SSB_2012	SSB_2013	SSB-SSBmsy/SSBmsy	BGES
nep-25	*Nephrops norvegicus*	Shellfish	3.14	NA	NA	NA	NA	**NA**		NA	NA	NA	NA	**NA**	N
nep-2627	*Nephrops norvegicus*	Shellfish	3.14	NA	NA	NA	NA	**NA**		NA	NA	NA	NA	**NA**	N
nep-31	*Nephrops norvegicus*	Shellfish	3.14	NA	NA	NA	NA	**NA**		NA	NA	NA	NA	**NA**	N
nep-2324	*Nephrops spp.*	Shellfish	3.20	NA	NA	NA	NA	>1	N	NA	NA	NA	NA	**NA**	
nep-2829	*Nephrops norvegicus*	Shellfish	3.20	NA	NA	NA	NA	**NA**		NA	NA	NA	NA	**NA**	
nep-30	*Nephrops norvegicus*	Shellfish	3.20	NA	NA	NA	NA	**NA**		NA	NA	NA	NA	**NA**	
YY or NN according to quantitative assessment															
Y or N according to expert judgment															

Status by region/sub-region

Table 4.27. Summary of stock status in relation to criteria 3.1 for all species/stocks in the Bay of Biscay and Iberian waters.

F	3.1.1	3.1.2	Expert judgment	Unknown	Total
Number of stocks	15		1	51	67
Number of stocks achieving green status	11		0		11
Percentage of stocks achieving green status	73%				16%

Table 4.28. Summary of stock status in relation to criteria 3.2 for all species/stocks in the Bay of Biscay and Iberian waters.

B	3.2.1	3.2b	Expert judgment	Unknown	Total
Number of stocks	6		16	45	67
Number of stocks achieving green status	4		2		6
Percentage of stocks achieving green status	67%		13%		9%

The overall percentages presented above should be looked at with caution since a large amount of stocks internationally assessed and relevant for this sub-area are widely distributed. The contributions of the landings from this sub-area to the total landings of these stocks are negligible or very low in most cases. This has to be considered when assessing the overall GES of a sub-area or a region and especially regarding the measures the relevant countries would take to have a better score.

Furthermore, even though the number of stocks internationally assessed is high, their landings contribute to only a half of the total landings reported in this sub-area.

Problems and gaps identified:

- Half of the reported landings from non-assessed species
- Among assessed species, only 24% have got quantitative indicators (category 1).

Recommendations:

There are 4 stocks in subdivisions VIII and 9 stocks in IXa in the DLS category 3 with enough information to be analysed by alternative methods for estimating proxies for Fmsy and SSBmsy.

In subdivision VIII, 7 stocks are new stocks in ICES assessments that are in the category 5.

In IXa subdivision there are 17 stocks not defined by ICES, but with landings and different data from surveys that must also be used to approximate secondary indicators.

Experts should examine the different available methods to select the approach that better fit each individual stock. One example presented by Rainer Froese could be applied to survey data with CPUE indices for recruitments and adults. Experts should revise the possibility of obtaining CPUE indices by age from survey data.

Another approach that is nowadays being used in Spanish stocks in DLS category 3 is AIM, that only need as input data landings and CPUE from surveys. Most of the stocks of category 3 can be modelled with AIM.

Differences between ICES species assessment and local qualitative assessment:

In ICES IXa, some species have different population characteristics, and have developed a more stable and less recruitment dependent local population for the Spanish South-Atlantic subregion. This is the case of anchovy in the Gulf of Cádiz. As a result, indicators based on the assessment of the stock in the large ICES IXa division do not represent the status of the stock in the Spanish waters and it is suggested to conduct some analysis with AIM to estimate some local indicators and compare them with those from the analytical assessment. These differences should be considered to improve the evaluations and management of the local stocks and implementation of the MSFD.

4.5 Macronesia

In the Canary Islands in the Macaronesia subarea, apart from the 4 stocks of tunas with quantitative assessment in ICCAT (classified as DLS category 1), the rest of the 12 local Canary species are in category 5 and are the following: Scomber colias, Sparisoma cretense, Acanthocybium solandri, Sardina pilchardus, Sardinella aurita, Dentex gibbosus, Pagrus pagrus, Sarpa salpa, Engraulis encrasicolus, Muraena augusti, Trachusur picturatus, Spondylosoma cantharus. These local stocks are not identified in the DCF, so there are no records of landings, but some of them are periodically recorded in other ICES area.

Most of the commercial stocks monitored were fished outside EU waters, under economic agreements between Spain, Morocco and Mauritania, assessed in CECAF. The information used on local catches in Canary comes from the Information and Sampling Net from the Spanish Oceanographic Institute and it is being examined with the AIM method for some stocks when possible. The list of local stocks should be consider in the DCF for the properly implementation of the MSFD.

There are a number of stocks that are fished around the Azorean region, including the deep-water stocks Alfonsinos, black scabbard fish and blackspot seabream. These are category 3, 5 and 6 stocks with little information on status against reference points. A number of elasmobranch species are also in the Azorean region including rays, deep-water sharks (Portuguese dogfish and leafscale gulper sharks) and kitefin sharks. Qualtitative assessment against reference points indicate depleted biomass for the latter three species.

Table 4.29. Stock status in relation to criteria 3.1 and 3.2 of species/stocks in Macronesia. For further details including full stock names please see accompanying datasheet.

Stock code	2013 DLS Category	F MSY	F Basis	year used for F to MS ratio	F-Fmsy /Fmsy	SSBMSY	SSB ref basis	year used for B to MS ratio	SSB-SSBmsy/ SSBmsy
YFT-ICCAT	1.00		FRMS	2010	0.87	144600 t	MS	2010	0.85
BET-ICCAT	1.00		FRMS	2009	0.95	92000t	MS	2009	1.01
SKJ-ICCAT	1.00		FRMS	2008	<1	143000 - 170000 t	MS	2008	> 1

ALB ATLN-ICCAT	1.00	0.1486	FRMS	2009-2011	0.72	81110t	MS	2009-2011	0.94
jaa-10	5.20	NA	NA	NA	NA	NA	NA	NA	stable after increase
raj-mar	3.20	NA	NA	NA	NA	NA	NA	NA	decreasing
sbr-x	3.20	NA	NA	NA	NA	NA	NA	NA	decreasing
bsf-oth	5.00	NA	NA	NA	NA	NA	NA	NA	unknown
alf-comb	6.20	NA	NA	NA	NA	NA	NA	NA	stable
Gag-nea	5.2	NA	NA	NA	NA	NA	NA	NA	NA
cyo-nea	3.14	NA	NA	NA	NA	NA	NA	NA	<1
sck-nea	3.14	NA	NA	NA	NA	NA	NA	NA	<1
guq-nea	5.30	NA	NA	NA	NA	NA	NA	NA	<1

Table 4.30. Summary of stock status in relation to criteria 3.1 for species/stocks in Macronesia

Criteria 3.1 Fishing mortality	Quantitative (3.1.1)	Qualitative	Trends only	Unknown	Total
Number of stocks	4	0	0	8	13
Number of stocks achieving green status	4	0	0		4
Percentage of stocks achieving green status	100%				31%

Table 4.31. Summary of stock status in relation to criteria 3.2 for species/stocks in Macronesia.

Criteria 3.2 Biomass	Quantitative (3.1.1)	Qualitative	Trends only	Unknown	Total
Number of stocks	4	3	4	1	13
Number of stocks achieving green status	2	0	2 stable		2
Percentage of stocks achieving green status	50%	0%	0%		15%

4.6 Overall status of the North-east Atlantic in relation to Criteria 3.1 and 3.2

Figures 4.7 and 4.8 show the overall status of commercial fish and shellfish stocks in the North-east Atlantic. Several observations on status and data availability are consistent across the NEA subregions:

- Migratory pelagic stocks contribute significantly to the landings in each subregion. Their data status is good, overall, with quantitative assessments against Criteria 3.1 and 3.2 carried out for most stocks. The status of the majority of pelagic stocks in relation to 3.1 and 3.2 is green.
- Around 30% of the demersal stocks have quantitative stock assessments in relation to reference points. For trend-based assessments using survey or commercial CPUEs, methods have not yet been fully established to derive F and SSB proxies in relation to reference points. Time series of monitoring programmes in relation to exploitation history are short in most cases. For some stocks there are also issues with stock identity, uncertainty in catch data including discards and lack of suitable monitoring programmes. The status of demersal stocks has improved in recent years. Overall, just over half of the demersal stocks with quantitative assessments in the NEA have green status in relation to Criteria 3.1 and 3.2.
- Within the shellfish category, *Nephrops* is well assessed in the North Sea and the Celtic Sea but not in the Bay of Biscay/Iberian sub-region. There is an overall deterioration in status for *Nephrops* stocks in the last three years with less than half of the stocks reaching green status in Criterion 3.1 in the last assessment year. Other shellfish species are not part of an international assessment and advisory framework despite contributing significantly towards NEA landings. Some of the main species and species groups are scallops, brown crabs and cephalopods.
- Elasmobranchs are data poor in each subregion of the NEA with no stocks in category 1 assessments and very few in category 2. Assessments rely primarily on abundance data from surveys and commercial CPUEs (category 3). Da-

ta from scientific surveys are noisy due to patchy distribution and low abundances and can only be used for some stocks. There is a lack of monitoring programmes for pelagic sharks. The lack of species specific historic catch data hampers the estimation of fishing mortality, but this situation has improved in recent years and will allow better assessments in the future. This species group would benefit greatly from method development to derive proxies from surveys as discussed in section XX. Status in relation to criteria 3.1 and 3.2 is unknown for most elasmobranch stocks in the NEA but expert judgements based on qualitative evaluation indicate that a large number of stocks are depleted and below any possible biomass reference points. The majority of stocks with abundance trends show increasing trends.

- Most deep-water stocks are in the data poor category.

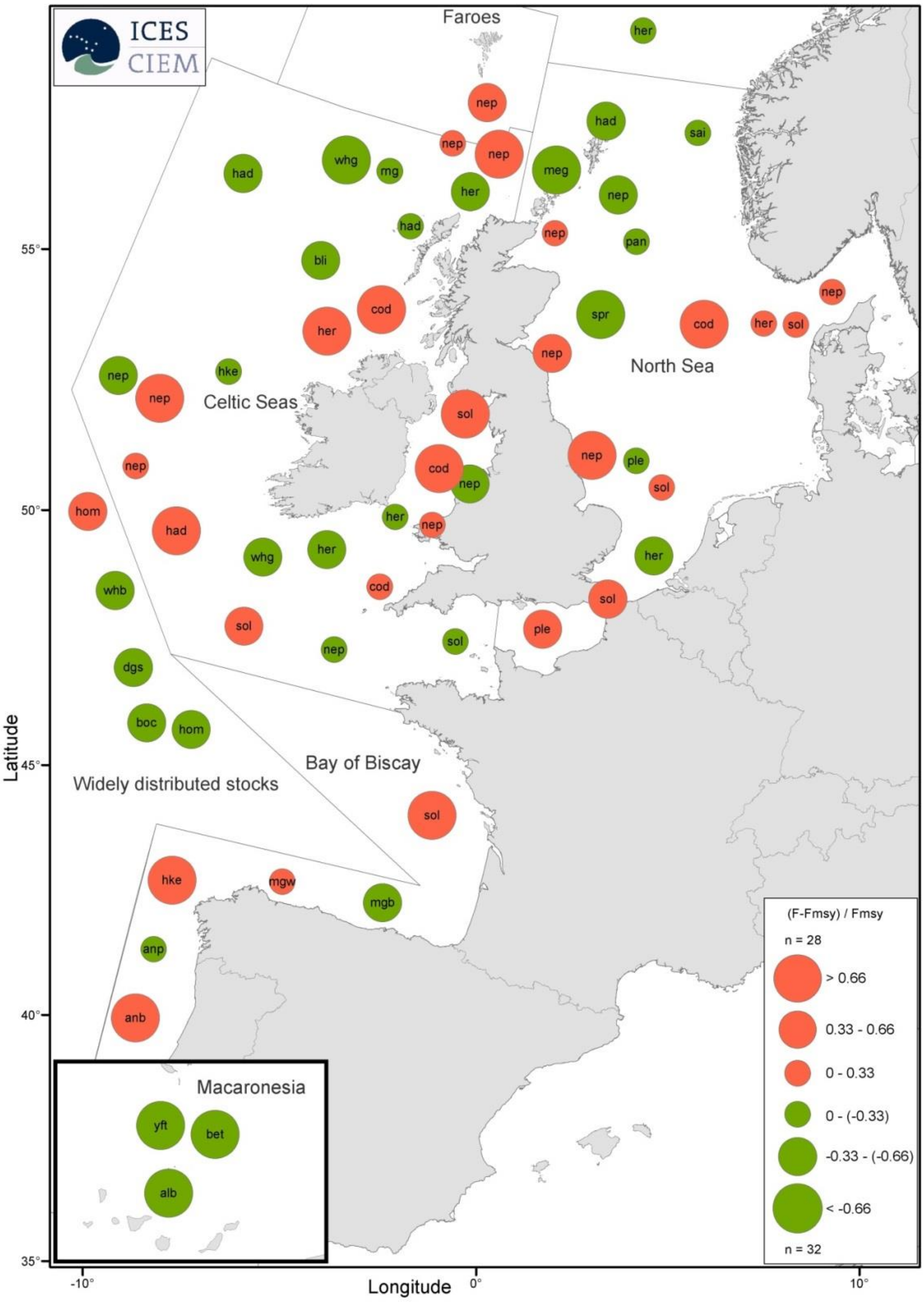


Figure 4.7. Status of the current fishing mortality (F) in relation to target reference mortality (Fmsy) for 60 NE Atlantic stocks with quantitative reference points. Circle size is proportional to the absolute value of (F-Fmsy/Fmsy). Circle color indicates whether the current F is above (red) or below (green) the reference Fmsy. 'n' indicates the number of stocks above and below the reference point respectively. Macaronesia subarea (in the Canary Islands) shows data for 3 stocks of tunas with quantitative assessment in ICCAT. Figure based on (Fernandez and Cook, 2013) and modified by the ICES data Centre.

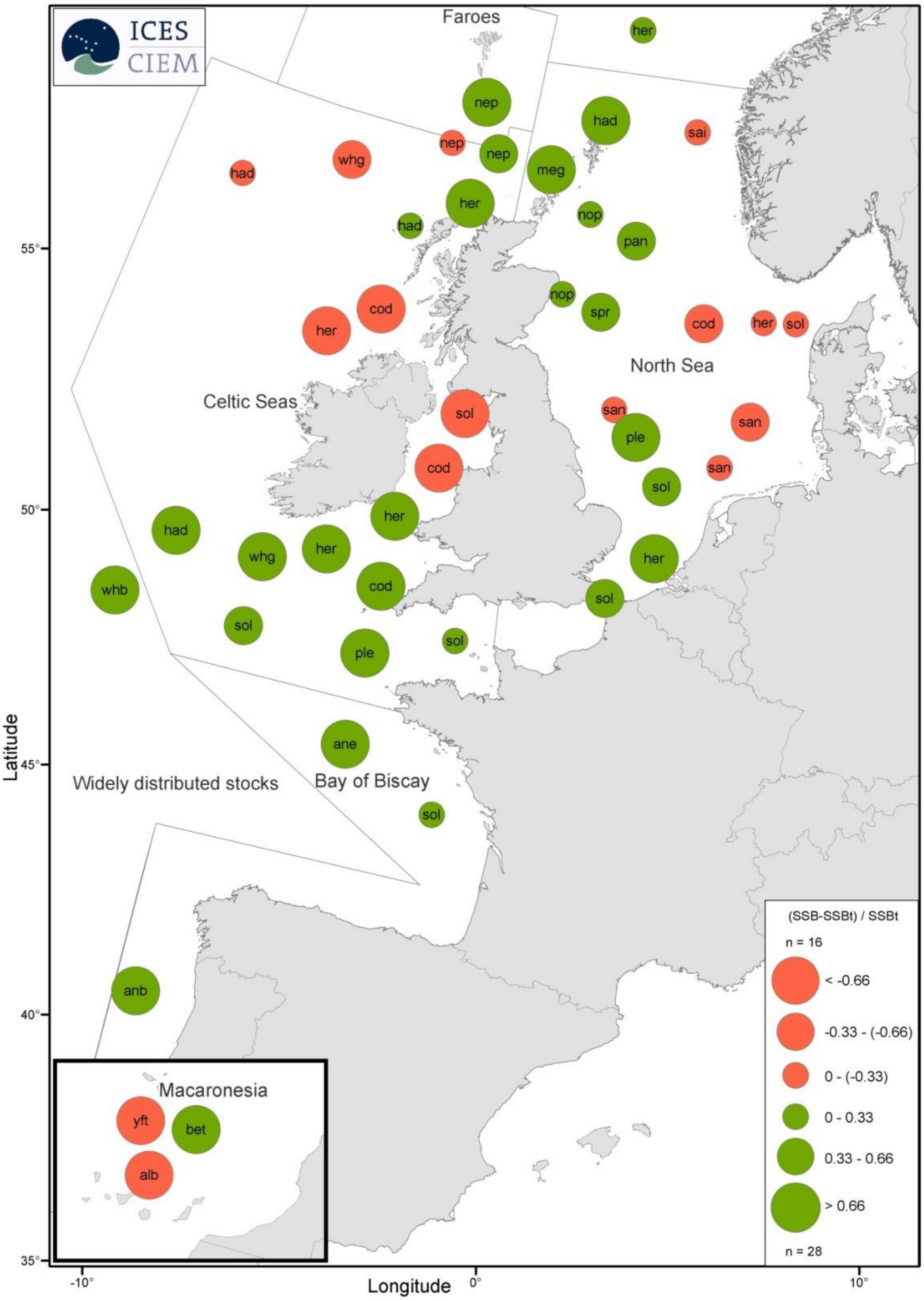


Figure 4.8. Status of the current adult Biomass (SSB) in relation to target reference SSB-trigger (SSBt) for 44 NE Atlantic stocks with quantitative reference points. Circle size is proportional to the absolute value of (SSB-SSBt/SSBt). Circle color indicates whether the current SSB is above (green) or below (red) the reference SSBt. 'n' indicates the number of stocks above and below the reference point respectively. Macaronesia subarea (in the Canary Islands) shows data for 3 stocks of tunas with quantitative assessment in ICCAT. Figure based on (Fernandez and Cook, 2013) and modified by the ICES data Centre.

4.7 References cited in Sections 4

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5 Mediterranean Sea Region

5.1 Introduction: overview on the knowledge on the status of commercial stocks in the Mediterranean

The main advisory body for management of Mediterranean (and Black Sea) marine resources is the General Fisheries Commission for the Mediterranean (GFCM). Consisting of 23 member countries along with the European Union, the GFCM's objectives are to promote the development, conservation, rational management and best utilization of living marine resources, as well as the sustainable development of aquaculture in the Mediterranean, Black Sea and connecting waters. In cooperation with other Regional Fisheries Management Organizations (e.g. ICCAT), the GFCM is instrumental in coordinating efforts by governments to effectively manage fisheries at regional level following the Code of Conduct for Responsible Fisheries. The GFCM has the authority to adopt binding recommendations for fisheries conservation and management in its Convention Area and plays a critical role in fisheries governance in the region (www.GFCM.org). For EU Member States the Common Fisheries Policy applies along with the EU regulation 1967/2006 concerning management measures for the sustainable exploitation of fishery resources in the Mediterranean Sea. The International Commission for the Conservation of Atlantic Tuna (ICCAT) defines management measure for large pelagics (i.e bluefin tuna and swordfish). Finally the Barcelona Convention is now going to play a relevant role on the application of the so-called "Ecosystem Approach" in the Mediterranean waters, as agreed by the Conference of the Parties in 2008 (Decision IG17/6), being aimed at achieving GES in the Mediterranean Sea by 2020.

Stock assessments are carried out both by the working groups of the GFCM and the Scientific, Technical and Economic Committee for Fisheries (STECF) of the EC. The second has recently established a priority list of stocks in EU Geographical Subareas (GSAs) to be assessed in the next years (STECF 2012). GFCM plays a key role in fostering the development of assessment on shared stocks between EU and non-EU countries also in cooperation with the FAO regional projects (ADRIAMED, MedSudMed, CopeMed, EastMed).

The lack of a more systematic data collection hindered the assessment and management of many fisheries resources in several Mediterranean areas until the early 2000s when the EU Data Collection Regulation (DCR, EU reg. 1543/2000) was enforced in all EU Member States. Also the standardized collection of fisheries independent data started relatively late with the MEDITS bottom trawl survey at the beginning of 1990's (Bertrand *et al.* 2002) and the more recent MEDIAS pelagic acoustic survey in 2008 (MEDIAS, 2010). The number of consistently assessed stocks by GFCM and STECF working groups increased significantly in the last 5 years as a result of the enhanced data collection system and commitment of Mediterranean scientists, elucidating the status of the main fisheries resources in the Mediterranean. A general condition of overfishing emerged for most of the stocks, confirming results of assessments carried out in the past (Lleonart and Maynou 2003; Lleonart 2005). According to the most recent estimates (Cardinale and Osio, 2013), 94% of the stocks has been overfished in 2010-2012 with an overall reduction between 45 % and 51% that is required for F to reach MSY.

The STECF-EWG 13-14 (STECF, 2013) has recently reviewed the assessments carried by GFCM and STECF EWG in Mediterranean waters. In summary, the STECF and

GFCM WG assessed 121 stocks of 37 different species of fish and shellfish (table 5.1). A total of 66 stocks can be considered as analytically assessed with exploitation rates evaluated with regard to proposed management reference points (F_{MSY} or its proxies, $F_{0.1}$ and E=0.4 for demersal fish and small pelagics, respectively). Advice on the most up to date available analytical stock assessments is provided for 37 different species of small pelagics, demersal fish and shellfish as summarized in Table 5.1

The results of the assessments carried out in 2010-2012 are listed in Tables 5.2, 5.3 and 5.4.

Table 5.1 Overview of stock assessments on Mediterranean stocks in the period 2008-2012 (from STECF, 2013)

		Coomon name	Scientific name	GSA																										
				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
Small pelagic	1	Anchovy	*Engraulis encrasicolus*																											
	2	Sardine	*Sardina pilchardus*																											
	3	Spanish mackerel	*Scomber japonicus*																											
	4	Sprat	*Sprattus sprattus*																											
	5	Horse mackerel	*Trachurus trachurus*																											
Demersal	6	Giant red shrimp	*Aristeomorpha foliacea*																											
	7	Blue and red Shrimp	*Aristeus antennatus*																											
	8	Bogue	*Boops boops*																											
	9	Common dentex	*Dentex dentex*																											
	10	Monkfish	*Lophius budegassa*																											
	11	European hake	*Merluccius merluccius*																											
	12	Blue whitihing	*Micromesistus potassou*																											
	13	Red mullet	*Mullus barbatus*																											
	14	Striped mullet	*Mullus surmuletus*																											
	15	Norway lobster	*Nephrops norvegicus*																											
	16	Octopus	*Octopus vulgaris*																											
	17	Black spot seabream	*Pagellus bogaraveo*																											
	18	Common pandora	*Pagellus erythrinus*																											
	19	Pink shrimp	*Parapenaeus longirostris*																											
	20	Spottail mantis shrimp	*Squilla mantis*																											
	21	Common sole	*Solea solea*																											
	22	Picarel	*Spicara smaris*																											
	23	Barracuda	*Sphyraena sphyraena*																											
	24	Poor cod	*Trisopterus minutus capelanus*																											
Elasmobranches	25	Thresher shark	*Alopias vulpinus*																											
	26	Carcharhinidae	*Carcharinus* spp.																											
	27	Basking shark	*Cethorinus maximus*																											
	28	Tope shark	*Galeorinus galeus*																											
	29	Blackmouth catshark	*Galeus melastomus*																											
	30	Blackchin guitarfish	*Glaucostegus cemiculus*																											
	31	Sixgill shark	*Hexanchus griseus*																											
	32	Pelagic stingray	*Pteroplatytrygon violacea*																											
	33	Starry skate	*Raja asterias*																											
	34	Thornback ray	*Raja clavata*																											
	35	Small-spotted catshark	*Scyliorinus canicula*																											
	36	Smoth hammerhead	*Sphyrna zygaena*																											
	37	Spurdog	*Squalus acanthias*																											

Status unknown: assessemtn done but still preliminary and/or not updated
Status: in overfishing according to Fmsy of the most up to date assessment available
Status: sustainable fished according to Fmsy of the most up to date assessment available
No information presented

In many cases the assessed stocks do not match the MS's marine waters

Table 5.2: Overview of the status of Mediterranean small pelagics stocks in 2010-2012. Estimates of exploitation rates (E), spawning stock biomass (SSB) and proxies for MSY reference points (exploitation rate (E) ≤0.4 and SSB_{MSY} are also provided. Scores above 0 indicate sustainable pressure or healthy stock status and are highlighted in green. Scores below 0 are highlighted in red.

Stock code	Species name	MSFD Sub Region	E_{MSY}	E_2010	E_2011	E_2012	E-Emsy / Emsy	SSB_{MSY} [1000 t]	SSB 2010 [1000 t]	SSB 2011 [1000 t]	SSB 2012 [1000 t]	SSB-SSBpa / SSBpa	SSBpa [1000 t]
ANE - 17	European anchovy	Adriatic Sea	0.4			0.47	0.18			333.4		-0.8669593	2.506
PIL - 17	European pilchard	Adriatic Sea	0.4		0.39	0.57	0.43						
ANE - 16	European anchovy	Ionian Sea	0.4	0.54	0.5	0.58	0.45	14.152		5.07		0.15700593	4.382
ANE - 20	European anchovy	Ionian Sea	0.4	0.41			0.02						
ANE - 22	European anchovy	Ionian Sea	0.4	0.36	0.38		-0.05						
PIL - 16	European pilchard	Ionian Sea	0.4	0.23	0.17	0.15	-0.63	32.527					
PIL - 20	European pilchard	Ionian Sea	0.4	0.46			0.15						
PIL - 22	European pilchard	Ionian Sea	0.4	0.41	0.48		0.20						
ANE - 1	European anchovy	Western Mediterranean	0.4	0.64			0.60						
ANE - 6	European anchovy	Western Mediterranean	0.4	0.6			0.50						
ANE - 9	European anchovy	Western Mediterranean	0.4	0.75	1		1.50						
PIL - 1	European pilchard	Western Mediterranean	0.4	0.3			-0.25						
PIL - 6	European pilchard	Western Mediterranean	0.4	0.8			1.00						
PIL - 9	European pilchard	Western Mediterranean	0.4			0.41	0.02						

Table 5.3: Overview of the status of Mediterranean demersal stocks in 2010-2012. Estimates of fishing mortality (F), and proxies for F_{MSY} are also provided. Scores above 0 indicate sustainable pressure and are highlighted in green. Scores below 0 are highlighted in red.

MSFD Sub Region	Scientific Name	Stock name	F_{MSY} (F_{01})	F_{2010}	F_{2011}	F_{2012}	F-Fmsy/ Fmsy
Adriatic Sea	Merluccius merluccius	European hake in GSA 17	0.2	0.6		2.02	9.1
Adriatic Sea	Merluccius merluccius	European hake in GSA 18	0.21	0.95	0.86	0.92	3.4
Adriatic Sea	Mullus barbatus	Red mullet in GSA 17	0.36			0.71	1.0
Adriatic Sea	Mullus barbatus	Red mullet in GSA 18	0.5			1.5	2.0
Adriatic Sea	Solea solea	Common sole in GSA 17	0.26	1.36	1.2	1.43	4.5
Aegean-Levantine Sea	Boops boops	Bogue in GSA 25	0.24	0.37			0.5
Aegean-Levantine Sea	Merluccius merluccius	European hake in GSA NA	0.15	0.62			3.1
Aegean-Levantine Sea	Mullus barbatus	Red mullet in GSA 25	0.22	0.84			2.8
Aegean-Levantine Sea	Mullus barbatus	Red mullet in GSA NA	0.31	0.53			0.7
Aegean-Levantine Sea	Spicara smaris	Picarel in GSA 25	0.31		0.08		-0.7
Aegean-Levantine Sea	Mullus barbatus	Red mullet in GSA 26	0.37 (2008)	0.73 (2008)			1.0
Ionian Sea	Merluccius merluccius	European hake in GSA 15-16	0				3.1
Ionian Sea	Merluccius merluccius	European hake in GSA 19	0.12			1	7.3
Ionian Sea	Merluccius merluccius	European hake in GSA 20	0				2.3
Ionian Sea	Merluccius merluccius	European hake in GSA 22	0				2.5
Ionian Sea	Mullus barbatus	Red mullet in GSA 15-16	0.45		0.8	1.3	1.9
Ionian Sea	Mullus barbatus	Red mullet in GSA 19	0.3			1.94	5.5
Ionian Sea	Mullus barbatus	Red mullet in GSA 20	0				-0.3
Ionian Sea	Mullus barbatus	Red mullet in GSA 22	0				0.0
Ionian Sea	Mullus surmuletus	Striped red mullet in GSA 20	0				-0.1
Ionian Sea	Mullus surmuletus	Striped red mullet in GSA 22	0				0.2
Ionian Sea	Pagellus erythrinus	Common pandora in GSA 15	0.3		0.6	0.72	1.4
Ionian Sea	Spicara smaris	Picarel in GSA 20	0				-0.7

Ionian Sea	Spicara smaris	Picarel in GSA 22	0				0.7
Ionian Sea	Lophius budegassa	Blackbellied angler in GSA 15	0.16			0.3	0.9
Ionian Sea	Boops boops	Bogue in GSA 22	0.65	0.4			-0.4
Ionian Sea	Merluccius merluccius	European hake in GSA 15	0.16	0.66			3.1
Ionian Sea	Merluccius merluccius	European hake in GSA 20	0.27	0.89			2.3
Ionian Sea	Merluccius merluccius	European hake in GSA 22	0.24	0.83			2.5
Ionian Sea	Mullus barbatus	Red mullet in GSA 20	0.27	0.18			-0.3
Ionian Sea	Mullus barbatus	Red mullet in GSA 22	0.308	0.32			0.0
Ionian Sea	Mullus surmuletus	Surmullet in GSA 20	0.27	0.23			-0.1
Ionian Sea	Mullus surmuletus	Surmullet in GSA 22	0.28	0.33			0.2
Ionian Sea	Spicara flexuosa (maena)	Blotched picarel in GSA 20	0.23	0.1			-0.6
Ionian Sea	Spicara flexuosa (maena)	Blotched picarel in GSA 22	0.23	0.3			0.3
Ionian Sea	Spicara smaris	Picarel in GSA 20	0.4	0.12			-0.7
Ionian Sea	Spicara smaris	Picarel in GSA 22	0.3	0.5			0.7
Ionian Sea	Sphyraena sphyraena	Barracuda GSA 12-13	?	?			>0
Western Mediterranean	Merluccius merluccius	European hake in GSA 1	0.21		1.37		5.5
Western Mediterranean	Merluccius merluccius	European hake in GSA 5	0.16	0.84	1.21		6.6
Western Mediterranean	Merluccius merluccius	European hake in GSA 6	0.11	0.99	1.3		10.8
Western Mediterranean	Merluccius merluccius	European hake in GSA 7	0.24	0.92	1.43	1.43	5.0
Western Mediterranean	Merluccius merluccius	European hake in GSA 9	0.2	1.3	1.32		5.6
Western Mediterranean	Merluccius merluccius	European hake in GSA 10	0.17	0.72	0.63		2.7
Western Mediterranean	Merluccius merluccius	European hake in GSA 11	0.51	0.98	0.37	3.19	5.3
Western Mediterranean	Micromesistius poutassou	Blue whiting in GSA 1	0.4			1.4	2.5
Western Mediterranean	Micromesistius poutassou	Blue whiting in GSA 6	0.32			1.05	2.3
Western Mediterranean	Micromesistius poutassou	Blue whiting in GSA 9	0.53			1.12	1.1
Western Mediterranean	Mullus barbatus	Red mullet in GSA 1	0.3		1.79		5.0
Western Mediterranean	Mullus barbatus	Red mullet in GSA 5	0.31	1.08			2.5
Western	Mullus barbatus	Red mullet in GSA	0.38	1.08	1.9		4.0

Mediterranean		6					
Western Mediterranean	Mullus barbatus	Red mullet in GSA 7	0.51	0.69	0.94	1.26	1.5
Western Mediterranean	Mullus barbatus	Red mullet in GSA 9	0.61	0.73	0.59	0.68	0.1
Western Mediterranean	Mullus barbatus	Red mullet in GSA 10	0.4	0.57	1.01		1.5
Western Mediterranean	Mullus barbatus	Red mullet in GSA 11	0.29	1.34		2.5	7.6
Western Mediterranean	Mullus surmuletus	Striped red mullet in GSA 5	0.26	0.76	0.55		1.1
Western Mediterranean	Mullus surmuletus	Striped red mullet in GSA 9	0.31		0.56		0.8
Western Mediterranean	Pagellus erythrinus	Common pandora in GSA 9	0.48	0.26	0.63		0.3
Western Mediterranean	Phycus blennoides	Greater forkbeard in GSA 9	0.32			1.01	2.2
Western Mediterranean	Trisopterus minutus	Poor cod in GSA 9	0.74			0.9	0.2
Western Mediterranean	Galeus melastomus	Blackmouth catshark in GSA 9	0.13	0.35			1.7
Western Mediterranean	Pagellus bogaraveo	Blackspot seabream GSAs 1, 3	0.11		0.19		0.4
Western Mediterranean	Scyliorhinus canicula	Small-spotted catshark in GSA 9	0.13	0.33			1.5
Western Mediterranean	Scyliorhinus canicula	Small-spotted catshark in GSA 4	0.38	1.5			2.9
Western Mediterranean	Raja clavata	Thornback ray in GSA 9	0.08	0.33			3.1
Western Mediterranean	Lophius budegassa	Blackbellied angler in GSA 5	0.18			1.13	5.3
Western Mediterranean	Lophius budegassa	Blackbellied angler in GSA 6	0.15			0.72	3.8
Western Mediterranean	Lophius budegassa	Blackbellied angler in GSA 7	0.29			0.97	2.3

Table 5.4: Overview of the status of Mediterranean shellfish stocks in 2010-2012. Estimates of fishing mortality (F), and proxies for F_{MSY} are also provided. Scores above 0 indicate sustainable pressure and are highlighted in green. Scores below 0 are highlighted in red.

MSFD Sub Region	Scientific Name	Stock name	F_{MSY} (F_{01})	F_{2010}	F_{2011}	F_{2012}	F-Fmsy / Fmsy
Adriatic Sea	Aristaeomorpha foliacea	Giant red shrimp in GSA 18	0.3			1	2.3
Adriatic Sea	Nephrops norvegicus	Norway lobster in GSA 18	0.3			0.54	0.8
Adriatic Sea	Parapenaeus longirostris	Deep-water rose shrimp in GSA 18	1.38			2.9	1.1
Adriatic Sea	Squilla mantis	Spottail mantis squillid in GSA 17	0.3			1	2.3
Adriatic Sea	Squilla mantis	Spottail mantis squillid in GSA 18	0.27			1.04	2.9
Ionian Sea	Aristaeomorpha foliacea	Giant red shrimp in GSA 15	0.3		1.09	1.67	4.6
Ionian Sea	Nephrops norvegicus	Norway lobster in GSA 20	0				1.1
Ionian Sea	Nephrops norvegicus	Norway lobster in GSA 22	0				0.6
Ionian Sea	Nephrops norvegicus	Norway lobster in GSA 15-16	0.2			0.15	-0.3
Ionian Sea	Aristeus antennatus	Aristeus antennatus GSA 15-16	0.26			0.81	2.1
Ionian Sea	Nephrops norvegicus	Norway lobster in GSA 20	0.38	0.78			1.1
Ionian Sea	Nephrops norvegicus	Norway lobster in GSA 22	0.39	0.63			0.6
Ionian Sea	Parapenaeus longirostris	Deep-water rose shrimp in GSA 12-16	1.22			1.6	0.3
Western Mediterranean	Parapenaeus longirostris	Deep-water rose shrimp in GSA 1	0.26			0.43	0.7
Western Mediterranean	Parapenaeus longirostris	Deep-water rose shrimp in GSA 1, 3, 4	0.48		1.1		1.3
Western Mediterranean	Aristaeomorpha foliacea	Giant red shrimp in GSA 9	0.5		1.05		1.1
Western Mediterranean	Aristaeomorpha foliacea	Giant red shrimp in GSA 10	0.4			0.48	0.2
Western Mediterranean	Aristaeomorpha foliacea	Giant red shrimp in GSA 11	0.49		0.98		1.0
Western Mediterranean	Aristeus antennatus	Blue and red shrimp in GSA 1	0.29		1.32		3.6
Western Mediterrane	Aristeus antennatus	Blue and red shrimp in GSA 6	0.3			1.05	2.5

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Western Mediterranean	Aristeus antennatus	Blue and red shrimp in GSA 5	0.26		1.01		2.9
Western Mediterranean	Aristeus antennatus	Blue and red shrimp in GSA 9	0.32		0.62		0.9
Western Mediterranean	Aristeus antennatus	Blue and red shrimp in GSA 10	0.28			0.43	0.3
Western Mediterranean	Nephrops norvegicus	Norway lobster in GSA 1	0.2			0.32	0.6
Western Mediterranean	Nephrops norvegicus	Norway lobster in GSA 5	0.42	0.62		0.55	0.3
Western Mediterranean	Nephrops norvegicus	Norway lobster in GSA 6	0.15			0.63	3.2
Western Mediterranean	Nephrops norvegicus	Norway lobster in GSA 9	0.21	0.45	0.34		0.6
Western Mediterranean	Parapenaeus longirostris	Deep-water rose shrimp in GSA 5	0.31	0.82			1.6
Western Mediterranean	Parapenaeus longirostris	Deep-water rose shrimp in GSA 6	0.25		1		3.0
Western Mediterranean	Parapenaeus longirostris	Deep-water rose shrimp in GSA 9	0.7	0.5	0.29		-0.6
Western Mediterranean	Parapenaeus longirostris	Deep-water rose shrimp in GSA 10	0.6	1.33	1.11		0.9
Western Mediterranean	Parapenaeus longirostris	Deep-water rose shrimp in GSA 11	0.49			0.69	0.4
Western Mediterranean	Squilla mantis	Spottail mantis squillid in GSA 9	0.54		1.24		1.3
Western Mediterranean	Squilla mantis	Spottail mantis squillid in GSA 10	0.41			1.08	1.6
Western Mediterranean	Octopus vulgaris	Common octopus in GSA 5	0.32			0.47	0.5

5.1.1 Current data collection under CFP/DCF

In the EU Mediterranean waters, fisheries dependent and independent data are collected by Member States under the Data Collection Framework (DCF) according to the FAO-GFCM Geographical Sub-Areas (GSAs), which represent management units (Annex I) established in 2001 and amended in 2009 (GFCM Resolution GFCM/33/2009/2). Appendix VII of the Commission Decision 93/2010, adopting a multiannual Community programme for the collection, management and use of data in the fisheries sector for the period 2011-2013 (DCF).

DCF requirements in Mediterranean EU waters are related to a total number of 90 species/groups of species, 28 bony fish, 49 elasmobranches, 6 cephalopods, 6 crustaceans, and 1 bivalve, respectively) (the complete list of species is given in Section 5.6 - *Annex 1*). Species are categorized according to two species groups, Group 1 (n= 63, species that drive the international management process including species under EU management plans or EU recovery plans or EU long-term multi-annual plans or EU action plans for conservation and management based on Council Regulation (EC) No 2371/2002) and Group 2 (n =27, other internationally regulated species and major non-internationally regulated by-catch species). In 73 species/groups, data should be collected in all Mediterranean EU waters, while for 17 species, data should be collected on a limited number of areas. Moreover, only for 10 species weight, fecundity and sex should be recorded on a yearly basis, while such data should be recorded over a three year frequency for 32 species.

DCF data collection includes, among others, catches and landings of the most important métiers in the EU Mediterranean Member States, the biological data of the most important species, the collection of socio-economic data, the estimate of ecosystem indicators as well as the collection of trawl-survey (MEDITs) and acoustic data (MEDIAS) for the assessment of demersal fish species and stock biomass of small pelagics, respectively. In addition, large pelagic stocks are assessed by ICCAT at large geographical scale: eastern Atlantic and Mediterranean for bluefin tuna (*Thunnus thynnus*) and Mediterranean for swordfish (*Xiphias gladius*). It is worth noting that the quality of available data, as highlighted by the STECF (2013a), in some cases is not sufficient to allow some analytical approaches to be applied.

5.2 Comparison of approaches for MSFD implementation – Descriptor 3

The current data availability on analytically assessed stocks in the Mediterranean as well as the criteria used to select commercial species and calculate indicators for Descriptor 3 were summarized during WKD3 meeting. A revision of the implementation of Descriptor 3 of the MSFD in the Mediterranean EU countries was possible only for Italy, Spain, Slovenia and Greece, lacking information for the other EU member states. This implies that a consolidated comparison of approaches between the 4 Mediterranean sub-regions could not be provided at this stage, since in all subregions information from some countries were lacking. Accordingly, and basing on the available range of information, the main aim of this exercise was to compare the national approaches to MSFD implementation in order to identify differences and communalities, as well as defining the main issues and gaps that are currently hampering the development of an harmonized approach to MSFD across the Mediterranean EU waters.

5.2.1 Selection of commercially exploited populations

A set of different rules has been used by EU Member States in Mediterranean to selected species and stocks to assess the Descriptor 3. A summary of the approaches used by Slovenia, Greece, Italy, Spain is provided below.

Slovenia

Slovenia is currently in the process of determining the species list for the Descriptor 3. Slovenia collects the catch and landings data according to the DCF regulation. Because of the low landings, Slovenia is not obliged to collect biological data on any of its fished species from 2014 on. Despite this fact, Slovenia go on to collect biological data on European pilchard (*Sardina pilchardus*) and European anchovy (*Engraulis encrasicolus*). The stock assessment for these two species in the GSA 17 is carried out by the GFCM WG on small pelagics.

Greece

In its MSFD initial assessment report on Descriptor 3, Greece included 9 species (hake *Merluccius merluccius*, red mullet *Mullus barbatus*, striped mullet *Mullus surmuletus*, anchovy *Engraulis encrasicolus*, sardine *Sardina pilchardus*, picarel *Spicara smaris*, thornback ray *Raja clavata*, catshark *Scyliorhinus canicula* and pink shrimp *Parapenaeus longirostris*) in GSA 22+23 (Aegean Sea) and 7 species (hake *Merluccius merluccius*, red mullet *Mullus barbatus*, striped mullet *Mullus surmuletus*, anchovy *Engraulis encrasicolus*, sardine *Sardina pilchardus*, picarel *Spicara smaris*, and pink shrimp *Parapenaeus longirostris*) in GSA 20 (eastern Ionian Sea). The 8 stocks of the GSA 22&23 (the landings of *Scyliorhinus canicula* are not recorded separately) represent about 48% of the landed biomass in that area, whereas the 7 stocks of the GSA 20 represent about 50% of the landed biomass. The total landed biomass and the landings of each species were estimated as average of the years 2008 to 2010, inclusive. A list of commercial species in Greek GSAs is provided in Table 5.5

Table 5.5 List of commercial species in Greek subregions included in the Appendix VII of the Commission Decision 93/2010.The species assessed and with available official landings data are also showed.

	Species	MSFD Aegean (GSA 22&23)	MSFD eastern Ionian (GSA 20)	Assessed (STECF-GSFCM)	Landings data
1	*Alopias vulpinus*	-	-	-	-
2	*Anguilla anguilla*	-	-	-	+
3	*Aristeomorpha foliacea*	-	-	-	
4	*Aristeus antennatus*	-	-	-	-
5	*Boops boops*	-	-	+	+
6	*Carcharinus plumbeus*	-	-	-	-
7	*Centrophorus granulosus*	-	-	-	-
8	*Cetorhinus maximus*	-	-	-	-
9	*Coryphaena equiselis*	-	-	-	-
10	*Coryphaena hippurus*	-	-	-	-
11	*Dalatias licha*	-	-	-	-

12	*Dicentrarchus labrax*	-	-	-	+
13	*Dipturus oxyrhincus*	-	-	-	-
14	*Eledone cirrosa*	-	-	-	-
15	*Eledone moschata*	-	-	-	+
16	*Engraulis encrasicolus*	+	+	+	+
17	*Etmopterus spinax*	-	-	-	-
18	*Eutrigla gurnardus*	-	-	-	+
19	*Galeorhinus galeus*	-	-	-	-
20	*Galeus melastomus*	-	-	-	+
21	*Heptranchias perlo*	-	-	-	-
22	*Hexanchus griseus*	-	-	-	-
23	*Illex spp*	-	-	-	+
24	*Istiophoridae*	-	-	-	-
25	*Lamna nasus*	-	-	-	-
26	*Leucoraja circularis*	-	-	-	-
27	*Leucoraja melitensis*	-	-	-	-
28	*Loligo vulgaris*	-	-	-	+
29	*Lophius budegassa*	-	-	-	+
30	*Lophius piscatorius*	-	-	-	+
31	*Merluccius merluccius*	+	+	+	+
32	*Micromesistius poutassou*	-	-	-	+
33	*Mugilidae*	-	-	-	+
34	*Mullus barbatus*	+	+	+	+
35	*Mullus surmuletus*	+	+	+	+
36	*Mustelus asterias*	-	-	-	+
37	*Mustelus mustelus*	-	-	-	+
38	*Myliobatis aquila*	-	-	-	-
39	*Nephrops norvegicus*	-	-	-	+
40	*Octopus vulgaris*	-	-	-	+
41	*Odontaspis ferox*	-	-	-	-
42	*Oxynotus centrina*	-	-	-	-
43	*Pagellus erythrinus*	-	-	-	+
44	*Parapenaeus longirostris*	+	+	+	+
45	*Penaeus kerathurus*	-	-	-	+
46	*Prionace glauca*	-	-	-	-
47	*Raja asterias*	-	-	-	-
48	*Raja clavata*	+	-	-	+
49	*Raja miraletus*	-	-	-	-
50	*Raja undulata*	-	-	-	-
51	*Rostroraja alba*	-	-	-	-
52	*Sarda sarda*	-	-	-	+
53	*Sardina pilchardus*	+	+	+	+
54	*Scomber spp.*	-	-	-	+

55	*Scyliorhinus canicula*	+	-	-	-
56	*Scyliorhinus stellaris*	-	-	-	-
57	*Sepia officinalis*	-	-	-	+
58	*Shark-like Selachii*	-	-	-	-
59	*Solea vulgaris*	-	-	-	+
60	*Sparus aurata*	-	-	-	+
61	*Sphyrna zygaena*	-	-	-	-
62	*Spicara spp.*	+	+	-	+
63	*Squalus acanthias*	-	-	-	-
64	*Squalus blainvillei*	-	-	-	-
65	*Squatina aculeata*	-	-	-	+
66	*Squatina oculata*	-	-	-	+
67	*Squatina squatina*	-	-	-	+
68	*Squilla mantis*	-	-	-	-
69	*Thunnus alalunga*	-	-	-	+
70	*Thunnus thynnus*	-	-	-	+
71	*Todarodes spp.*	-	-	-	-
72	*Torpedo marmorata*	-	-	-	-
73	*Trachurus mediterraneus*	-	-	-	+
74	*Trachurus trachurus*	-	-	-	+
75	*Trigla lucerna*	-	-	-	-
76	*Veneridae*	-	-	-	-
77	*Xiphias gladius*	-	-	-	+

Italy

To the purpose of the initial assessment, Italy reported on GES in relation to 3 different sub-regions (Western Mediterranean Sea, Central Mediterranean and Ionian Sea, Adriatic Sea) according to 7 GSAs (GSA9, 10 and 11, GSA 16 and 19, GSA 17 and 18, respectively).

In this context Italy selected as commercial stocks those stocks listed in the DCF species' list whose analytical stock assessment was available and internationally agreed, according to GFCM or STECF, and ICCAT (i.e. bluefin tuna and swordfish). Moreover, species listed into the DCF were also considered to establish GES according to the application of secondary indicators (3.1.2, 3.2.2) as well as criteria 3 indicators (i.e., 3.3.1, 3.3.3). To this purpose, within the DCF species' list, the commercial stocks that were characterised by established time series of catch/landings as well as biological data derived from trawl surveys data (MEDITS) and sampling of commercial fisheries, were considered. In addition, in the GSA 17, data collected from SoleMon beam-trawl survey on commercial stocks of national/local interest were also used, thus partially complementing the DCF species' list.

All this resulted in the assessment of GES based on a total number of 34 and 2 stocks according to indicators 3.1.1 and 3.2.1, respectively, and between 164 to 228 stocks for indicators 3.1.2, 3.2.2, 3.3.1, 3.3.3 in the overall Italian waters (the list of stocks by GSA is provided in table 5.5). Accordingly about 31-34% of overall Italian landings (estimated as mean of 2008-2010) were considered in the Initial Assessment for each indicator (a part for indicator 3.2.1, where this share was only 3%). As showed in Tab. 5.6 the landing percentage differed remarkably according to indicators and GSAs.

Table 5.6. Percentage of landings corresponding to the stocks considered in the Initial Assessment in Italian waters according to sub-region, GSA and D3 indicator.

Sub-region	GSA	3.1.1	3.1.2	3.2.1	3.2.2	3.3.1	3.3.3
Western Mediterranean	9	34	36	2	27	27	34
	10	16	23	9	18	23	25
	11	17	47	7	47	47	46
Central Mediterranean and Ionian Sea	16	63	55	5	58	56	57
	19	15	33	10	17	26	24
Adriatic Sea	17	39	19	0	28	28	26
	18	23	42	0	32	32	45
TOTAL percentage of Italian Landings		34	31	3	31	32	34

Spain

Two areas were established for implementation of MSFD, the Alborán and the Levantino-Balear areas corresponding to GFCM GSA's 1 - 2 and 5 - 6 respectively (GSA 2 is a small area around the Alborán island. For MSFD purposes GSA's 1 & 2 are considered together)
Species selected were those included in the DCF. Species of high economical value and species that represent more than 1% in landings not included in DCF list were also included. A total of 27 species representing 75% of total landings were selected for the Levantine-Balear area and 29 species representing 90% of landings for the Alboran area (Table 5.7).

Initial assessment report on GES were based on stock assessments carried out by the STECF and GFCM in different GSA's and years. For the whole Spanish Mediterranean waters 44 species/stocks were considered. Primary indicator for F (F/Fmsy) was available for 18 species/stocks, indicators based on SSBmsy were also available for 2 stocks of large pelagic fishes and biomass secondary indicators were available for 13 of these species/stocks. Indicators for population age and size were calculated for a total of 44 species/stocks.

Table 5.7 Percentage of landings by GSA for the selected species (mean 2008-2010).

Species	(G.S.A's 1-2)	(G.S.A's 5-6)
Aristeus antennatus	0.4	1.5
Auxis rochei	9.0	3.0
Boops boops	0.3	0.2
Engraulis encrasicolus	2.2	12.9
Euthynnus alletteratus	0.0	0.2
Gymnammodytes cicerelus	1.8	
Lepidopus caudatus	1.2	
Lophius budegassa + L. piscatorius	1.1	1.7
Merluccius merluccius	2.2	6.7
Micromesistius poutassou	3.51	3.4
Mullus barbatus + M surmuletus	1.2	2.2
Nephrops norvegicus		0.8
Octopus vulgaris	2.9	2.4
Pagellus bogaraveo	2.9	
Parapenaeus longirostris	0.7	0.2
Phycis blennoides	1.4	
Sarda sarda	0.4	0.5
Sardina pilchardus	26.4	18.5
Sardinella aurita	3.6	3.5
Scomber scombrus + S. colias	8.9	3.4
Scomberesox saurus	1.5	
Sparus aurata		0.9
Squilla mantis		1.0
Thunnus alalunga	0.1	0.4
Thunnus thynnus	1.0	1.5
Trachurus spp (3 spp)	16.4	6.7
Xiphias gladius	0.9	3.1

5.2.2 Assessment of current status in relation to GES

Greece, Italy, Spain largely diverged in the approach followed in their initial assessment of GES.

Greece

Not all criteria/indicators that determine GES were examined in the initial assessment report on descriptor 3 for Greece. The primary indicators 3.1.1 and 3.2.1 were the only reported while the remaining primary and all secondary indicators were not considered for any stock. The gap in the Data Collection program between 2008-2012 for Greece is definitely a restraining factor for assessing more stocks and applying more criteria/indicators.

Italy

Italy assessed GES using indicators 3.1.1, 3.1.2, 3.2.1, 3.2.2, 3.3.1 and 3.3.3 whereas indicators 3.3.2 and 3.3.4 were not applied. A trend-based approach (linear trend, with selection rule for species who showed significant trends – $p<0.05$ compatible to a worsening of their status) was used to evaluate the status of stocks against GES using both secondary indicators (3.1.2 and 3.2.2) and criteria 3 indicators 3.3.1 and 3.3.3, in particular for data limited stocks (DLS) and those stocks not covered by analytical stock assessments.

For the Italian implementation of MSFD, GES was assessed at indicator level, and rules were thus set according to each indicator (see below specifications) considering a preliminary threshold of 100% (i.e. all considered stocks should be in safe biological limits or show healthy status). This threshold was derived by the MSFD definition for Descriptor 3 that states that GES is achieved when "all commercial fishes and shell-fishes" are within safe biological limits and healthy status. The goal of achieving GES, in agreement with this definition, for all commercial species might be not possible. Indeed, the overall practical evaluation of the applied process in the Italian seas highlighted that this kind of preliminary thresholds might need to be revised, taking into account several issues, including, among the others, the outcome of the still ongoing process on CFP reform. In particular the goal of achieving GES for all commercial species could be not achievable owing to the multispecific nature of Mediterranean fisheries as well as the multi-trophic interactions among species and the effects of environmental drivers on key biological processes. Furthermore, it could be expected that assessed trends in indicators 3.1.2, 3.2.2, 3.3.1, 3.3.3 might not respond directly/immediately/exclusively to pressure release (reduction in F). Therefore, the threshold values still needs to be assessed before a confirmation of GES. Moreover it is worth noting that, in the context of the Ionian Sea and Central Mediterranean subregion (GSA16) and the Adriatic Sea sub-region (GSA17 and 18), there are stocks shared between EU and non-EU countries. In this context it is necessary to enforce an international coordination to achieve sustainable exploitation. The international programs of the FAO (Medsudmed and Adriamed) as well as the GFCM and the ECAP process are seen as relevant institutional tools for the achievement of GES and the setting of coherent programme of measures.

Spain

In Spain the definition of Good Environmental Status (GES) and Initial Evaluation (IE) for the MSFD implementation in Spain is as follow:

For Criteria 3.1.1 the basic idea for the definition of GES is the interpretation of F_{MSY} as a target instead of limit reference point, so it will be expected that values of F vary randomly around F_{MSY} and between precautionary limits that will assure that the stocks are at safe levels. For each stock F/ F_{MSY} is displayed in a traffic lights way (green if F/ F_{MSY} <1; yellow if F/ F_{MSY} ≥1 and < 1.6 and red if F/ F_{MSY} >1.6). The value 1.6 has been established based on the consideration that F_{pa}~1.57F_{MSY}(ICES Advice 2011; http://www.ices.dk/advice/icesadvice.asp). The GES is defined following the criteria that "at least the 50% of the stocks are in green and none of the stocks are in red". This definition allows to take into account the complexity in the interpretation of F_{MSY} when assessments are conducted in multispecific fisheries; in practice interactions between stocks make it impossible to reach F_{MSY} simultaneously for all species.

For Criteria 3.2.1 a similar traffic lights scheme for the interpretation of SSB/SSB_{MSY} was introduced (red if SSB/SSB_{MSY} < 0.6; yellow if 0.6 ≤ SSB/SSB_{MSY} < 1.0and green if SSB/SSB_{MSY} ≥ 1). The GES is defined as: "At least the 50% of the stocks are in green and none of the stocks are in red". SSB_{MSY} was available for *Thunnus thynnus* and *Xiphias gladius* so secondary indicators based on SSB were used for the rest of the stocks. Criteria 3.3 (population age and sizes) has not been used in the definition of GES due to the lack of reference points.

5.2.3 Approaches and methods applied for indicators

Criterion 3.1 Level of pressure of the fishing activity

Primary Indicator 3.1.1 - Fishing mortality

The main source of data to assess Descriptor 3 for marine commercial species in Greece, Italy, and Spain are the analytical assessments carried out in the last years within the GFCM and STECF stock assessment working groups. These assessments have been performed using standardized approaches and F_{MSY} reference points, whereas B_{MSY} estimates are generally lacking. According to STECF, 2013 there are 66 stocks throughout the Mediterranean with estimates of F_{cur}/F_{MSY} calculated in recent years.. A range of assessment methods have been applied including surplus production models (i.e. ASPIC), length cohort analysis (LCA-VIT), extended survivors analysis (XSA) and statistical catch at age models (e.g. a4a, SS3). Survey data (e.g. MEDITS bottom trawl survey and MEDIAS pelagic survey) have been extensively used as tuning data. It is worth mentioning that at the time the Initial Assessment was carried by MS, a lower amount of stock assessments was available.

The number of assessed stocks should increase in the next years following the recommendations provided by the STECF-EWG 13-05 which has established a priority list of stocks to be assessed in 2013-2015 (STECF, 2013).

$F_{0.1}$ as proxy of F_{MSY} has been adopted as limit RP and basis for management advice on demersal stocks in EU Mediterranean waters by STECF. The GFCM has extensively used $F_{0.1}$ as target reference point and F_{MAX} as limit reference point for demersal stocks and $E=F/Z \leq 0.4$ (value proposed by Patterson, 1992), as reference limit for E_{MSY} for small pelagic fishes) The framework adopted by GFCM for the management advice is however under revision and will be re-discussed during the next WG of the SCSA (Stock Assessment Sub-Committee). In Greece there is a lack of updated estimates of F_{cur}/F_{MSY} due to the interruption of data collection in 2008.

Italy in its Initial Assessment defined the GES as the following: "GES is achieved when all commercial species are subjected to sustainable exploitation (not in overfishing), i.e. $F_{cur} \leq F0.1$ (used as proxy for F_{MSY}) or, in the case of small pelagics, $E \leq 0.4$ applying a preliminary threshold value of 100% (i.e. considering F and E as reference limits). The application of 3.1.1 indicator is partially limited due to the relatively low number of assessed stocks (analytical stock assessment) in Italian waters.

Secondary Indicator 3.1.2 - Ratio between catch and biomass index

Only Italy used the catch/biomass ratio to assess the status of commercial stocks. Trend in secondary indicator 3.1.2 for the period 2004-2011 was analysed by considering official landings statistics and biomass index derived from trawl surveys data (Medits and SoleMon). The length of the time series was restricted to 2004-2011 since official statistics according to different Italian GSAs were available only on this timescale. Moreover, data were referred to landings and not catches (thus excluding discard estimates). Reference levels were not available, thus reference directions were adopted. To the purposes of implementing the Initial Assessment GES has been defined as the following: "GES is achieved when all commercial species are subjected to sustainable exploitation (not in overfishing), showing stability or a decrease in the ratio between catch and biomass indices from trawl surveys" applying a preliminary threshold value of 100%. Accordingly GES was not achieved in a GSA when at least one species showed a significant increasing linear trend ($p<0.05$) in indicator 3.1.2. However, the overall practical evaluation of the applied process in the Italian seas highlighted that this kind of preliminary threshold might need to be revised, taking into account the above mentioned limitations and the issues discussed in the paragraph 5.2.2. According to the above mentioned shortcomings in the data used for the estimation of the time-series, and the its shortness, the indicator was considered to provide a low resolution/capability to evaluate the status of the stocks.

Criterion 3.2 Reproductive capacity of the stocks

Primary Indicator 3.2.1 - Spawning Stock Biomass

Due to data deficiencies or shortage of data series, only for few Mediterranean stocks were provided precautionary management reference points of stock size. The stocks analysed include the two stocks of large pelagics routinely assessed by ICCAT (bluefin tuna and swordfish) and most of the stocks of small pelagics (sardine and anchovy). In the case of demersal stocks, there are few stocks with estimates of MSY and/or BMSY (e.g. Octopus in GSA 5).

In its Initial Assessment Italy has defined GES based on 3.2.1 indicator as the following: "GES is achieved when fish stocks are not overexploited, i.e. the Spawning Stock Biomass (SSB) of all commercial species is equal or above the reference limit of SSB_{MSY} or its proxy (SSBmsy-trigger SSBF0.1, SSBpa, etc.)" applying a preliminary threshold value of 100%. However, the practical implementation of the MSFD was carried out considering only bluefin tuna and swordfish, considering the latest ICCAT stock assessments.

Secondary indicator 3.2.2 - Biomass index

Only Italy and Spain adopted the secondary indicator 3.2.2 to assess the status of commercial stocks.

In Italian waters the secondary indicator 3.2.2 was estimated for the stocks where data from trawl survey were available (MEDITS, 1994-2011; SoleMON, 2005-2011). Due to some trawl survey limits (short sampling period across each year and gap in collection of males maturity data and individual biomass), the estimation of 3.2.2 was limited to the population fraction of sexually mature females of some species, requiring also the use of L_{50} and LW-relationships (in part obtained from information collected within the Biological Sampling program of DCF). A trend based approach was used (reference directions) since no reference levels were available for such indicator. In the Italian Initial Assessment GES has been defined as the following: "GES is achieved when all commercial species show stable or significant positive trends of the biomass indices from trawl surveys, referred to the sexually mature individuals of the population" applying a preliminary threshold value of 100%. Accordingly GES was not achieved in a GSA when at least one species showed a decreasing linear trend ($p<0.05$) in indicator 3.2.2. However, the overall practical evaluation of the applied process in the Italian seas highlighted that this kind of preliminary threshold (100%) might need to be revised, taking into account the above mentioned limitations and the issues discussed in the paragraph 5.2.2. Owing to the above mentioned limitation, GES determined according to indicator 3.2.2 was considered to have low to medium confidence.

In Spain, a Secondary Indicator 3.2.2 (SSB in the last year and SSB mean in the last three years in relation with the SSB mean in all period) was calculated for the stocks previously assessed analytically by STECF and GFCM. A trend based approach was used without providing reference levels to assess the GES.

Criterion 3.3 Population age and size distribution

Primary indicator 3.3.1 - Proportion of fish larger than the mean size of first sexual maturation

In Italy the primary indicator 3.3.1 was estimated for the stocks where data from trawl survey were available (MEDITS, 1994-2011; SoleMON, 2005-2011). Due to some trawl survey limits (short sampling period across each year and gaps in collection of males maturity data and individual biomass), the estimation of 3.3.1 indicator was limited to the population fraction of sexually mature females of some species, requiring also the use of L_{50} and LW-relationships (in part obtained from information collected within the Biological Sampling program of DCF). GES assessment was based on the analysis of temporal trend of the indicator considering the GES achieved when "all commercial species show stable or significant positive trends of the proportion of fish larger than the mean size at first sexual maturity, from trawl survey data" applying a preliminary threshold value of 100%. Accordingly GES was not achieved in a GSA when at least one species showed a decreasing linear trend ($p<0.05$) in indicator 3.3.1. However, the overall practical evaluation of the applied process in the Italian seas highlighted that this kind of preliminary threshold (100%) might need to be revised, taking into account the above mentioned limitations and the issues discussed in the paragraph 5.2.2. No specific reference levels have been defined, while reference directions were adopted. Owing to the above mentioned limitation, GES determined according to indicator 3.3.1 was considered to have low to medium confidence.

Spain adopted an approach calculating the proportion of fish larger than L50 from commercial catches.

Primary indicator 3.3.2 - Mean maximum length across all species found in research vessel surveys

Italy did not apply this community metric. Spain calculated the indicator from trawl survey data.

Primary indicator 3.3.3 - 95% percentile of the fish length distribution observed in research vessel surveys

In Italy the primary indicator 3.3.3 was estimated for the stocks where length frequency distribution data from trawl survey were available (MEDITS, 1994-2011; SoleMON, 2005-2011). To the purposes of implementing the Initial Assessment GES has been defined as the following: "GES is achieved when all commercial species show stable or significant positive trends of the 95% percentile of the fish length distribution observed in scientific trawl surveys" applying a preliminary threshold of 100%.

Therefore GES was assessed according to reference directions and was not achieved in a GSA when at least one species showed a decreasing linear trend ($p<0.05$) in indicator 3.3.3. However, the overall practical evaluation of the applied process in the Italian seas highlighted that this kind of preliminary threshold (100%) might need to be revised, taking into account the above mentioned limitations and the issues discussed in the Section 5.2.2.

Owing to the above mentioned limitations, GES determined according to indicator 3.3.3 was considered to have a medium confidence.

5.2.4 Evaluation of the performance of trend-based indicators to detect stock status

According to the MSFD implementation in Italy and Greece, it is possible to make a preliminary analysis on the performance of trend-based indicators (based on reference directions) in detecting the exploitation status of the stocks as compared to the outcomes of analytic stock assessments.

In particular, it is possible to compare stock status according to indicators 3.1.1 vs. indicators 3.1.2, 3.2.2, 3.3.1 and 3.3.3.

To this purpose we compiled a summary table (table 5.7) where the status of stocks where analytical assessment was available (in terms of 3.1.1 or 3.2.1 indicators) is compared to the stock status as derived from trend based indicators 3.1.2, 3.2.2, 3.3.1, 3.3.3. For the latter indicators status of stocks was assessed according to the evaluation of the linear trend in indicators according to the rules described in the above section.

Pertaining the comparison between indicators 3.1.1 and 3.2.1, 50 % of the stocks (9 out of 18) showed similar status, where both F and SSB indicated a positive or negative status of the stock.

The comparison between primary indicator 3.1.1 to secondary indicator 3.1.2 clearly shows that the application of secondary indicator was unable to detect overfishing in all assessed stocks where F was above the reference level. This result highlights that, given limitations of the time-series (see Section 5.2.3), the indicator 3.1.2 could point to a misleading assessment of the effect of fishing pressure on the stocks. Therefore caution should be used when interpreting the results for such indicator in the context of DLS. In particular this indicator could be better used to trace progresses toward GES. However, the detection of significant increases in the Catch/Biomass ration could be also used as an early warning to detect those stocks where worrying changes are happening.

Indicator 3.2.2 cannot be compared to the relative primary indicator, due to the lack of stock assessment providing SSB reference limits. However, only in 3 cases out of 25 stocks where the primary indicator 3.1.1 was available and showing an overexploited status, the indicator highlighted a significant reduction in SSB (as assessed by trawl-survey data) over time. This result suggests that this indicator could not be considered appropriate to detect the status of the overall stocks. This could be possibly due to the shortness of time-series that could have started when stocks were already at a low biomass level as effect of overfishing. The SSB trend should be however used to monitor the progress toward GES of overexploited stocks and identify stocks in critical situations. The same considerations hold true for indicators 3.3.1 and 3.3.3. While such indicators could show the progressive worsening of stocks health status, only in some cases significant (negative) changes were detected.

Overall, the application of secondary indicators 3.1.2 and 3.2.2 and indicators of criteria 3.3 confirm that trend based analysis, when based on short time series, have little capacity to assess the real status of the stocks. In particular trend-based indicators, when associated to reference directions, could overestimate GES status being not capable to detect critical status in most of the stocks. While such capability should improve with increasing the length of time-series, it is clear that the establishment of indicators with reference levels (or proxies) could provide a more robust approach to

GES assessment. However, stocks which highlights negative changes in their status over time according to trend-based indicators, should deserve much attention and could be preliminary described as not being within safe biological limits or in healthy state, although with high-medium uncertainty.

Table 5.8 Comparison of the outcomes of the application of the GES rules for indicators 3.1.1, 3.1.2, 3.2.1, 3.2.2, 3.3.1, 3.3.3 according those stocks which presented analytical stock assessments providing reference levels for F or SSB. Green = GES is achieved at stock level; Red = GES is not achieved at stock level. WM: Western Mediterranean Sea; ISCM: Ionian Sea and Central Mediterranean; EM: Eastern Mediterranean; Adr.: Adriatic Sea.

Group	Species	GSA	SUBREGION	3.1.1	3.1.2	3.2.1	3.2.2	3.3.1	3.3.3
Crustaceans	*Aristaeomorpha foliacea*	GSA11	WM	N	Y		Y	N	N
	Aristaeomorpha foliacea	GSA16	ISCM	N	Y		Y	Y	Y
	Aristeusantennatus	GSA9	WM	N	Y		Y	Y	Y
	Nephrops norvegicus	GSA18	Adr	N	Y		Y	Y	N
	Nephrops norvegicus	GSA9	WM	N	Y		Y	N	N
	Parapenaeus longirostris	GSA10	WM	N	Y		Y	Y	Y
	Parapenaeus longirostris	GSA11	WM	N	Y		Y	Y	Y
	Parapenaeus longirostris	GSA16	ISCM	N	Y		Y	N	Y
	Parapenaeus longirostris	GSA18	Adr	N	Y		Y	Y	Y
	Parapenaeus longirostris	GSA9	WM	Y	Y		Y	Y	Y
	Parapenaeus longirostris	GSA20	ISCM	Y		Y			
	Parapenaeus longirostris	GSA22 &23	EM	Y		N			
	Squilla mantis	GSA9	WM	N					
Demersalfish	*Lophius budegassa*	GSA16	ISCM	N	Y		Y	Y	Y
	Merluccius merluccius	GSA10	WM	N	Y		Y	Y	Y
	Merluccius merluccius	GSA11	WM	N	Y		Y	N	Y
	Merluccius merluccius	GSA18	Adr	N	Y		Y	Y	Y
	Merluccius merluccius	GSA19	ISCM	N	Y		Y	Y	Y
	Merluccius merluccius	GSA9	WM	N	Y		Y	Y	Y
	Merluccius merluccius	GSA20	ISCM	N		Y			
	Merluccius merluccius	GSA22 &23	EM	N		Y			
	Mullus barbatus	GSA10	WM	N	Y		N	Y	Y
	Mullus barbatus	GSA11	WM	N	Y		Y	Y	Y
	Mullus barbatus	GSA16	ISCM	N	Y		Y	Y	Y
	Mullus barbatus	GSA18	Adr	N	Y		Y	Y	Y
	Mullus barbatus	GSA9	WM	N	Y		Y	Y	Y
	Mullus barbatus	GSA20	ISCM	Y		Y			
	Mullus barbatus	GSA22	EM	Y		Y			

		&23							
	Mullus surmuletus	GSA9	WM	N	Y		Y	Y	Y
	Mullus surmuletus	GSA20	ISCM	Y		Y			
	Mullus surmuletus	GSA22 &23	EM	Y		Y			
	Pagellus erythrinus	GSA16	ISCM	N	Y		Y	Y	Y
	Solea solea	GSA17	Adr	N	Y		N	Y	Y
	Spicara smaris	GSA20	ISCM	Y		Y			
	Spicara smaris	GSA22 &23	EM	Y		Y			
	Trisopterus minutus capelanus	GSA9	WM	N	Y		N	Y	Y
Small Pelagics	*Sardina pilchardus*	GSA16	ISCM	N					
	Sardina pilchardus	GSA17	Adr	Y					
	Sardina pilchardus	GSA20	ISCM	N		Y			
	Sardina pilchardus	GSA22 &23	EM	N		Y			
	Engraulis encrasicolus	GSA16	ISCM	N					
	Engraulis encrasicolus	GSA17	Adr	N					
	Engraulis encrasicolus	GSA9	WM	N					
	Engraulis encrasicolus	GSA20	ISCM	N		Y			
	Engraulis encrasicolus	GSA22 &23	EM	Y		Y			
Large pelagics	*Thunnus thynnus*	All	Mediterranean Sea	Y		N			
	Xiphias gladius	All	Mediterranean Sea	N		N			

5.2.5 Status by region/sub-region

Results of the Initial Assessment carried out in Spain, Italy and Greece are summarized in the following tables, showing that the proportion of stocks achieving GES is still generally low, when adopting indicators 3.1.1 and 3.2.1. Furthermore, it appears also clear that the available knowledge on the status of the stocks is still poor in some GSAs. In the case of Italy the use of secondary indicators as well criteria 3 indicators to assess the status of DLS still needs to be reconsidered to achieve reliable evaluations, owing to the possible overestimation of GES status (see Section 5.2.4). Indeed temporal trend based analysis of indicators seems to do not led to reliable GES evaluation for DLS, since stocks that are overexploited according to 3.1.1 indicators do not show, most often, critical signs. Therefore, it would be envisaged the adoption of reference levels for secondary and size/age based indicators and/or eventually develop functionally equivalent indicators, against which comparing the current values of indicators.

SPAIN

West Mediterranean sub-region

GSA's 5& 6	3.1.1	3.1.2	3.2.1	3.2.2	3.3	Unknown	Total
Number of stocks	11(*)		2(**)	9	29		29
Number of stocks achieving green status	1		0	4	Not used in GES assessment		
Percentage of stocks achieving green status	9		0	44			

GSA 1	3.1.1	3.1.2	3.2.1	3.2.2	3.3	Unknown	Total
Number of stocks	7(*)		2(**)	4	15		15
Number of stocks achieving green status	2		0	1	Not used in GES assessment		
Percentage of stocks achieving green status	29		0	25			

GSA 1-5-6	3.1.1	3.1.2	3.2.1	3.2.2	3.3	Unknown	Total
Number of stocks	18		2(*)	13	44		44
Number of stocks achieving green status	3		0	5	Not used in GES assessment		
Percentage of stocks achieving green status							

(*) blue-fin tuna & swordfish

ITALY

Western Mediterranean Sea sub-region

GSA 9	3.1.1	3.1.2	3.2.2	3.2.2	3.3.1	3.3.1	Unknown	Total
Number of stocks	11	28	2	17	17	27		28
Number of stocks achieving green status	2	26	0	14	15	25		
Percentage of stocks achieving green status	18.2	92.9	0.0	82.4	88.2	92.6		
GSA 10	3.1.1	3.1.2	3.2.2	3.2.2	3.3.1	3.3.1	Unknown	Total
Number of stocks	5	27	2	12	13	37		37
Number of stocks achieving green status	1	25		11	13	37		
Percentage of stocks achieving green status	20.0	92.6	0.0	91.7	100.0	100.0		
GSA 11	3.1.1	3.1.2	3.2.2	3.2.2	3.3.1	3.3.1	Unknown	Total
Number of stocks	6	28	2	36	35	34		36
Number of stocks achieving green status	1	28		36	31	29		
Percentage of stocks achieving green status	16.7	100.0	0.0	100.0	88.6	85.3		

Ionian Sea and Central Mediterranean sub-region

GSA 16	3.1.1	3.1.2	3.2.2	3.2.2	3.3.1	3.3.1	Unknown	Total
Number of stocks	10	27	2	38	36	35		38
Number of stocks achieving green status	2	27		35	32	34		
Percentage of stocks achieving green status	20.0	100.0	0.0	92.1	88.9	97.1		
GSA 19	3.1.1	3.1.2	3.2.2	3.2.2	3.3.1	3.3.1	Unknown	Total
Number of stocks	3	24	2	8	9	26		26
Number of stocks achieving green status	1	23		8	9	24		
Percentage of stocks achieving green status	33.3	95.8	0.0	100.0	100.0	92.3		

Adriatic Sea sub-region

GSA 17	3.1.1	3.1.2	3.2.2	3.2.2	3.3.1	3.3.1	Unknown	Total
Number of stocks	5	24	2	41	41	33		41
Number of stocks achieving green status	2	23		36	41	31		
Percentage of stocks achieving green status	40.0	95.8	0.0	87.8	100.0	93.9		
GSA 18	3.1.1	3.1.2	3.2.2	3.2.2	3.3.1	3.3.1	Unknown	Total
Number of stocks	6	24	2	13	13	36		36
Number of stocks achieving green status	1	23		13	11	28		
Percentage of stocks achieving green status	16.7	95.8	0.0	100.0	84.6	77.8		

GREECE

Ionian Sea and Central Mediterranean sub-region (Eastern Ionian Sea)

GSA 20	3.1.1	3.1.2	3.2.1	3.2.2	3.3	Unknown	Total

Number of stocks	7	0	7	0	0		
Number of stocks achieving green status	4		7				
Percentage of stocks achieving green status	57		100				

Aegean Levantine Sea sub-region (Aegean Sea)

GSA 22&23	3.1.1	3.1.2	3.2.1	3.2.2	3.3	Unknown	Total
Number of stocks	7	0	7	0	0		
Number of stocks achieving green status	5		6				
Percentage of stocks achieving green status	71		86				

5.2.6 Classification of Mediterranean stocks

The classification of stocks according to the level of available data and knowledge on their exploitation status is an important task to quantify the base of data on which a monitoring programme for Descriptor 3 can be realistically developed in the different Mediterranean sub-areas and promote a coordinate regional approach to MSFD implementation. The involvement of local/national experts in this exercise is necessary and should be coordinated by the GFCM in cooperation with the Barcelona Convention to ensure standardization and a full geographical coverage of the information.

An attempt to classify Mediterranean stocks following the criteria adopted by the ICES was carried out during WKD3. Assessed stocks were classified as Category 1 based on the ICES classification, even though most of them are lacking of stock-recruitment relationships and estimates of spawning stock biomass at MSY. In the ICES' Category 2, can be included stocks with qualitative/preliminary assessments only, often without estimates of reference points for fishing mortality or stock biomass.

According to the information available during WKD3 all the other stocks for which a data collection is implemented as established by the Reg. 93 /2010 and/or are monitored during surveys (MEDITS, MEDIAS, SoleMon) can preliminary by classified in categories 3-6 (Table 5.2.5). However, a more detailed exercise would be required to analyse the real data availability for each single stock within each single GSA, and classify them accordingly. It is worth noting that for some 'data deficient' stocks the data required to enable a full assessment may be available, but that the data has not been collated and an assessment model developed, or reference points defined. In these cases it would be more appropriate to classify these stocks as 'model-deficient' rather than 'data-deficient' as suggested by Cefas (2013).

Moreover a general revision of the criteria used by ICES for stock classification is necessary to take into account the specificity of data collection and stock assessment in the Mediterranean region. This may result in slightly different classification categories, although a functional analogy could be possibly maintained, in particular classifying stocks according to different degree of data availability and applicable methods for the assessment of their status. An involvement of GFCM in this task would be also advisable due to the inherent role of this international commission in fisheries management in the Mediterranean Sea.

The species selected by Greece, Italy and Spain for the calculation of GES for Descriptor 3 and their categorization according to the information available during the

WKD3 meeting are listed in Table 5.8 There is a clear discrepancy in the species list of the three countries even in the same sub-region (i.e Spain and Italy in West Mediterranean) as a results of the different approaches adopted in the selection of the species and indicators to be used for GES assessment. In particular a larger number of stocks was considered in the Italian assessment by adopting secondary indicators 3.1.2 and 3.2.2 and criteria 3.3 indicators. This in turn make clearly evident the need for an enhanced international coordination at the Mediterranean level to achieve standardized and coherent approach to GES and, consequently, monitoring programs, as required by the MSFD. It is also worth noting that many stocks are shared between different countries, as identified by GFCM, and their status cannot be evaluated against GES without cross-national standardized approach, data collections and monitoring methodologies.

Table 5.8 List of commercial species in Italian, Spanish and Greek sub-regions. Numbers refer to the ICES categories for stocks. In green are indicated stocks used for the assessment of GES.

Species List in MSFD (GSAs)	Adriatic		Ion.Cent.Med.			West.Med.							East.Med.	
	17 ITA	18 ITA	16 ITA	19 ITA	20 GR	1 ES	2 ES	5 ES	6 ES	9 ITA	10 ITA	11 ITA	22 GR	23 GR
Aequipecten opercularis	3-6													
Aristeus antennatus		3-6	1	3-6	3-6	1		1	1	1	2-6	2-6	3-6	3-6
Aristaeomorpha foliacea		3-6	1	3-6	3-6					1	2-6	1	3-6	3-6
Arnoglossus laterna	3-6													
Auxis rochei								6						
Boops boops	3-6	3-6	3-6	3-6	5	3		6	3	3-6	3-6	3-6	5	5
Chelidonichthys cuculus	3-6	3-6	3-6	3-6							3-6	3-6		
Chelidonichthys lucerna	3-6	3-6	3-6	3-6						3-6	3-6	3-6		
Citharus linguatula	3-6	3-6	3-6							3-6	3-6	3-6		
Eledone cirrhosa	3-6	3-6	3-6	3-6	3-6					3-6	3-6	3-6	3-6	3-6
Eledone moschata	3-6	3-6	3-6	3-6	3-6					3-6	3-6	3-6	3-6	3-6
Engraulis encrasicolus	1		1		1	1		6	1	3-6			1	1
Euthynnus alletteratus								6						
Eutrigla gurnadrus	3-6	3-6	3-6	3-6	3-6					3-6		3-6	3-6	3-6
Galeus melastomus		3-6	3-6	3-6	3-6					3-6	3-6	3-6	3-6	3-6
Gymnammodytes cicerelus								6	6					
Helicolenus dactylopterus	3-6	3-6	3-6	3-6						3-6	3-6	3-6		

Illex coindetti	3-6	3-6	3-6	3-6	3-6					3-6	3-6	3-6	3-6	3-6
Lepidorhombus boscii	3-6	3-6	3-6	3-6						3-6	3-6	3-6		
Lepidopus caudatus														
Loligo vulgaris	3-6	3-6	3-6	3-6	3-6					3-6	3-6	3-6	3-6	3-6
Lophius budegassa	3-6	3-6	3-6	3-6	3-6	6		1	1	3-6	3-6	3-6	3-6	3-6
Lophius piscatorius	3-6	3-6	3-6	3-6	3-6			6	6	3-6	3-6	3-6	3-6	3-6
Melicertus kerathurus	3-6													
Merluccius merluccius	3-6	1	3-6	1	1	1		1	1	1	1	1	1	1
Merlangius merlangus														
Microchirus variegatus	3-6													
Micromesistius poutassou	3-6	3-6	3-6	3-6	3-6	1		6	1	3-6	3-6	3-6	3-6	3-6
Mullus barbatus	3-6	1	1	3-6	1	1		1	1	1	1	1	1	1
Mullus surmuletus	3-6	3-6	3-6	3-6	1			1		1	3-6	3-6	1	1
Nephrops norvegicus	3-6	1	3-6	3-6	3-6	1		1	1	1	3-6	3-6	3-6	3-6
Octopus vulgaris	3-6	3-6	3-6	3-6	3-6			1	6	3-6	3-6	3-6	3-6	3-6
Pagellus acarne	3-6	3-6	3-6	3-6	3-6					3-6	3-6	3-6	3-6	3-6
Pagellus bogaraveo	3-6	3-6	3-6	3-6	3-6			1	1	3-6	3-6	3-6	3-6	3-6
Pagellus erythrinus	3-6	3-6	3-6	3-6	3-6					1	3-6	3-6	3-6	3-6
Pagrus pagrus			3-6									3-6		
Parapenaeus longirostris	3-6	1	1	03_06	1	1		1	1	1	1	1	1	1
Pecten jacobaeus	3-6													
Phycis blennoides	3-6	3-6	3-6	3-6	3-6			1	1	3-6	3-6	3-6	3-6	3-6
Psetta maxima	3-6													
Raja clavata	3-6	3-6	3-6		3-6					3-6	3-6	3-6	3-6	3-6
Sarda sarda					4			6					4	4
Sardina pilchardus	1		1		1	1		6	1				1	1
Sardinella aurita								6						
Scomber colias					5			6	6				5	5
Scomber scombrus					5			6	6				5	5

Scomberesox saurus								6	6					
Scophthalmus rhombus	3-6													
Scyliorhinus canicula	3-6		3-6		3-6					3-6	3-6	3-6	3-6	3-6
Sepia officinalis	3-6	3-6	3-6	3-6						3-6	3-6	3-6		
Solea solea	1		3-6		3-6					3-6	3-6	3-6	3-6	3-6
Sparus aurata					5								5	5
Spicara flexuosa	3-6	3-6	3-6	3-6	3-6					3-6	3-6	3-6	3-6	3-6
Spicara smaris	3-6	3-6	3-6	3-6	1					3-6	3-6	3-6	1	1
Squilla mantis					3-6					3-6			3-6	3-6
Thunnus alalunga					3-6	6		6					3-6	3-6
Thunnus thynnus	1	1	1	1	1	1		1	1	1	1	1	1	1
Trachurus mediterraneus	3-6	3-6	3-6	3-6	3-6			6		3-6	3-6	3-6	3-6	3-6
Trachurus picturatus								6						
Trachurus trachurus	3-6	3-6	3-6	3-6	3-6			6		3-6	3-6	3-6	3-6	3-6
Trigloporus lastoviza	3-6	3-6	3-6	3-6							3-6	3-6		
Trisopterus capelanus	3-6	3-6	3-6	3-6	3-6					3-6	3-6	3-6	3-6	3-6
Xiphias gladius	1	1	1	1	1	1		1	1	1	1	1	1	1
Zeus faber	3-6	3-6	3-6	3-6						3-6	3-6	3-6		

Stocks categories (according to ICES)
1 stocks with quantitative assessments
2 stocks with analytical assessments and forecasts that are only treated qualitatively
3 stocks for which survey-based assessments indicate trends
4 stocks for which reliable catch data are available
5 landings only stocks
6 negligible landings stocks and stocks caught in minor amounts as by-catch

5.3 Problems and gaps identified

From the synthesis of the approaches implemented for Descriptor 3 by Greece, Italy, Spain, it can be pointed out the use of different methodologies to address GES, that reflects a lack of international coordination.

The set of species identified is different across countries, even within the same sub-region (e.g. Western Mediterranean). GES definition differed among countries, even for the use of 3.1.1 indicator since, according to different countries, Fmsy was considered as a limit or a target (i.e. approach 1 or 2 as detailed in WKMSFD3 + report, ICES, 2012). Despite the concerns related to the real possibility of reaching Fmsy for all stocks, due to the effect of multispecific interactions, it is clear that a coordinated approach on this issue is necessary, taking into account the recent reform of CFP.

In addition, there are discrepancies in the use of secondary and criteria 3 indicators to assess the GES for data limited stocks. The trend-based approach used by Italy, owing to the shortness of time-series and further limitations, could only be used to identify those stocks that recently showed a worsening of their status, while it is likely that many stocks that were historically overfished (before the onset of monitoring programs) could be classified in good conditions due to the lack of earlier data (i.e., the shifting the baseline syndrome).
Therefore, it is envisaged the identification of agreed reference limits for such indicators (or alternative indicators that provide reference limits), to assess the status of data limited stocks and allow a consistent comparison at the spatial scale of EU Mediterranean waters.

Indeed, as stated by the Directive 2008/56/EC there is a necessity of coherent criteria and methodological standards to ensure consistency and to allow for comparison between marine regions or subregions of the extent to which the good environmental status is being achieved. In addition in article 11 the MSFD states "*the monitoring programmes shall be compatible within marine regions or subregions and shall build upon, and be compatible with, relevant provisions for assessment and monitoring laid down by Community legislation*". In this context the GFCM, given its role in the region, can play a key role in fostering the implementation of coherent and harmonious monitoring programs to assess MSFD's Descriptor 3 in the Mediterranean ecoregion. The MSFD states that Regional Sea Conventions, and thus the Barcelona Convention, should play this role for coordination for the MSFD, a role that is being carried out under the so-called Ecosystem Approach (EcAp). However, so far, no cross cutting agreed approach have been developed for Descriptor 3, and therefore it is envisaged a strict collaboration between GFCM and the Barcelona Convention to be enforced.

Standardization of methodologies and criteria is particularly relevant in the region considering the important issues of the monitoring of shared stocks either among MS (e.g. Italy and Malta in GSAs 15-16; Italy, Croatia, Slovenia in GSA 17, etc.) and between MS and non-MS countries (e.g. Turkey in GSA 22). Ultimately, coherent monitoring programmes will facilitate the application of coherent management regime so that measures taken by one MS would facilitate and not prevent the achievement of GES in other MS.

In details, as direct effect of a lack of international coordination, the issues identified from the initial assessments of Greece, Italy and Spain can be summarized as follow:

- Countries, even when share commercial resources in the same subregion (e.g. Italy and Spain in western Mediterranean), did not follow the same criteria for species selection to be considered for the MSFD. The number of stocks to assess GES is, for example, higher in Italy than in Spain and Greece.
- Adoption of different approaches by Mediterranean MS to assess GES for Descriptor 3 according to different criteria and indicators, even for indicator 3.1.1.
- Italy, Spain and Greece used different approaches for the calculation of secondary and size-based indicators and reference levels for data limited stocks. In this regard is also worth noting the lack of a common "regional" approach to the classification and assessment of the status of data limited stocks.
- The use of secondary indicators for criteria 3.1. and 3.2 to address GES for data limited stocks can be still considered a working in progress since there are

aspects linked to their response to change in fishing exploitation and environmental change that have not fully explored. In this regard the temporal trend in exploitation (catch/biomass ratio) and biomass (i.e indicators 3.1.2 and 3.2.2) of commercial stocks cannot be considered as a reliable source of information on the status of the stocks since they are derived from relatively short time series of survey data.(i.e. MEDITS,1994-2012) covering presumably a period of high exploitation rate. The risk of interpreting as in good condition stocks that are still a low biomass levels is therefore very high. Reference levels for these or other functionally equivalent indicators, should be, thus, developed and adopted.

- The Criterion 3.3 relies on the concept of healthy size/age structure of the stocks, and while being possibly not essential to assess the exploitation status of resources in terms of pressure (F) and status (SSB) it provides the ability to track biological improvements in stock development, although possibly with a time delay, as MSY-based management is achieved. However criterion 3.3 requires a specific definition of what is considered as a "healthy" population age or size structure and, in turn, to reconsider and identify the most appropriate indicators and reference levels.
- Even though the goal of achieving GES for all commercial species is increasingly recognized as an ambitious objective for several different reasons (e.g. mixed fisheries, change in fishery selectivity and environmental fluctuations, interspecific interactions, environmental change), mostly independent of the management regime applied, there is any agreed strategy and approach to a coherent assessment of GES in the Mediterranean Sea sub-regions.
- Beyond the difference observed in MSFD implementation, it is clear that the current basis of knowledge (i.e. data, available stock assessments) allows one to track the status of a relatively small portion of commercially exploited species in the Mediterranean Sea. For instance, the share of landings considered for GES assessment according to 3.1.1 indicators ranged between about 35% to 50% of national landings while for indicator 3.2.1 was negligible. It is also true, however, that the number of commercial species in Mediterranean is high as results of high biodiversity and occurrence of diversified fisheries. In this regard it would be advisable to develop a coordinated strategy to set quantitative reliable targets in terms of coverage of total landing to be considered for the GES assessment. Moreover, when dealing with non EU countries (and in particular shared stocks), it is necessary to recall the imbalance in data availability, since in this countries standardized fishery-dependent and fishery-independent data collection are often not implemented.

5.4 Recommendations

5.4.1 Enhance standardized approaches for GES assessment

- Establish an overarching framework to ensure the coordination of approaches toward GES assessment and monitoring programmes at the Mediterranean Sea regional scale level, by collaboration between GFCM, EC and the Barcelona Convention.
- Define common criteria between EU-Mediterranean countries for the identification of commercial species to be included in the GES assessment. These should take into account the list of commercial species in-

cluded in the EU-DCF and a detailed analysis of current data availability and quality. For this purpose other specific aspects might be considered including, catch amount (or landings, as its proxy) and/or value, habitats coverage (e.g. pelagic, demersal, deep-sea), trophic levels (low, medium, high), and resilience (life-history parameters). In this context, the Productivity and Susceptibility Analysis (PSA) can be a useful tool to identify high risk species/stocks that require special attention. A number of scoring schemes are available for productivity and susceptibility which requires agreement on the attributes and scoring.

- The approach to select commercial species for GES assessment should also highlight those stocks with relevant catches that are currently not assessed due to lack of data in order to guide future monitoring programs. For instance the assessment of pelagic resources should cover more species (e.g.: like-tuna species, dolphin fish). In terms of total catches, the Mediterranean fishery production is mainly represented by pelagic resources (FAO, 2012), although the available stock assessments regards mainly demersal species. Moreover, the inclusion of some specific species exploited by the artisanal fisheries, even if representing low catch proportion, should be considered.
- An assessment of catches from Illegal, Unreported and Unregulated Fishing (IUUF) and from recreational fishing should be also carried out and considered when dealing with GES. Indeed the extent of these phenomena is today mostly unknown and it should be investigated to understand their impacts on exploited resources and marine habitats. Since the official landings do not reflect the real total catch, it could be hypothesized that the impact of these activities on some resources maybe relevant and to be taken into account.
- Countries should achieve an agrement on the lists of stocks to be included in monitoring of Descriptor 3 in each sub-region although species might potentially differ among them.
- Define common criteria for the classification of Mediterranean stocks, based on existing data and assessments results, is also a priority for the development of coherent cross-national monitoring programs for Descriptor 3.
- Given the large number of stocks defined for the Mediterranean, as result of the combination species/GSA, it is advisable to define for each subarea the list of stocks to be assessed in the next years, also to fill critical gaps in specific geographical areas and make more homogeneous the level of knowledge across the region. To this aim, the attention should be focused on the identification of “Model deficient stocks”, for which data collected in the last years are sufficient for their assessment.
- The enforcement of monitoring programs under MSFD should thus include common approaches to define not only the stocks where an increase collection of data is needed, but also to set quantitative targets in terms of coverage of total landings to be considered for the GES assessment, possibly delineating a time-frame to be applied. A tentative approach to be applied in such context is detailed in the JRC guidance to MSFD monitoring process for the Mediterranean data limited stocks (Zampoukas *et al.*, 2014).

5.4.2 Develop methods for the assessment of data-limited stocks

- Assessment approaches for data limited stocks needs to be further explored to understand their response to the fishing exploitation and identify reference values for size/age population metrics. During the WKD3 different reference levels, linked to specific management objectives, were proposed. These include length at which 95% of the females achieve maturity and the optimal length (e.g. length at which an unexploited cohort attain is maximum biomass). Simulations on Mediterranean rich data stocks should be undertaken to assess the effect of different exploitation scenarios on the population structure to identify the more appropriate reference levels for size/age based indicators.

  According to the setting of such indicators/reference levels (both for secondary indicators of criteria 3.1 and 3.2, and for indicators for criteria 3), it would be necessary identify those stocks to be included for the assessment, the level of uncertainty associated to indicators, and ensure monitoring programs aimed at collecting data for their assessment in a coordinated approach. A key role in this regard should be played by the stock assessment working groups of GFCM and STECF.

  When long and contrasting time series of catch/effort data are available production models can be applied to derive estimates of biomass and fishing mortality at MSY. An attempt to use the catch-MSY (CMSY) method of Martell and Froese (2013) was done for 5 Mediterranean stocks (anchovy *Engraulis encrasicolus* in GSA 17, hake *Merluccius merluccius* in GSA 22, red mullet *Mullus barbatus* in GSA 6, striped red mullet *Mullus surmuletus* in GSA 15&16 and round sardinella *Sardinella aurita* in GSA 22) during WKD3 with promising results (see Section 5.7 - *Annex* 2). The method would require further investigation during GFCM and STECF WGs on stock assessment.

  Life-history based yield-per-recruit and spawner-per-recruit reference points could be applied as direct proxies for MSY reference points in the absence of knowledge of the stock-recruit relationships.

5.4.3 Evaluation of the GES

Figure 5.4 shows the overall status of commercial fish and shellfish stocks in the Mediterranean Sea according to the lastest available stock assessments considering (F-Fmsy)/Fmsy and (E-Emsy)/Emsy ratios. Data are available for 56 demersal fish stocks, 14 small pelagics and 34 shellfish, respectively, and shows that the vast majority of assessed stocks are overexploited. It is worth noting that there is a spatial imbalance in the availability of stock assessments, with 50 stocks assessed within the Western Mediterranean sub-region and 36 in the Ionian and Central Mediterranean compared to 12 and 6 stocks for the Adriatic Sea and Aegean-Levantine suberegion, respectively (elaboration from tables 5.1.2-5.1.4). Overall only 11 stocks out ot 104 shows to be sustainably exploited. In particular, about 21% of small pelagics stocks are in good status compared to 11% of demersal fish stocks and 6% of shellfish. In the Adriatic subregion no stock is in good status, while the Ionian and Central Mediterranean and the Western Mediterranean have the largest share of stocks in good status, 22% (1 out of 6) and 16% (8 out of 36), respectively.

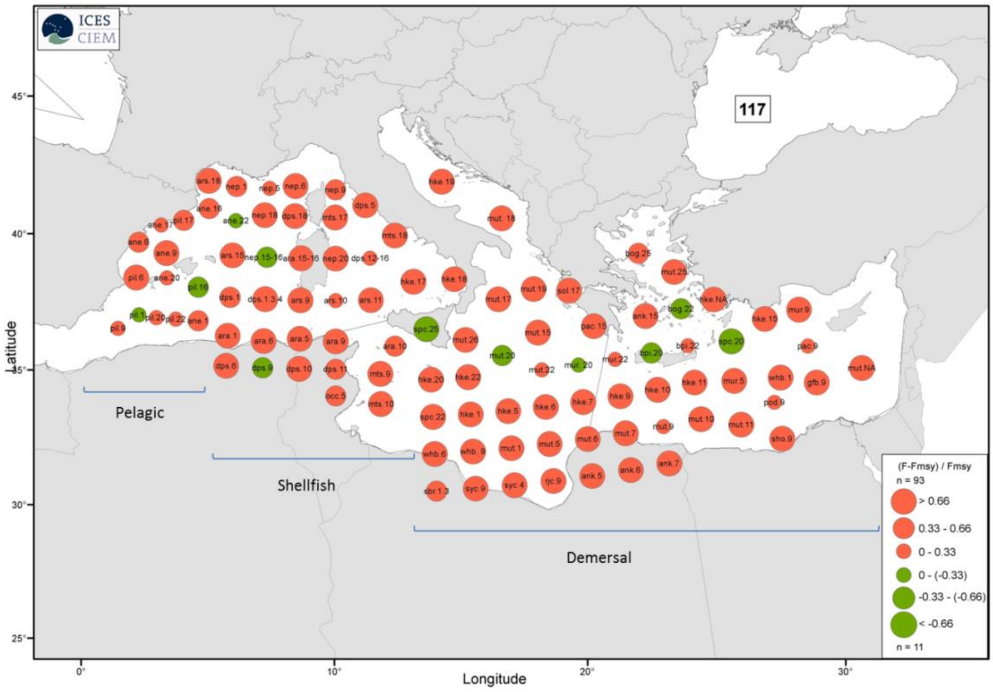

Figure 5.1 Status of the current fishing mortality (F) in relation to the target reference mortality (Fmsy) for 104 Mediterranean stocks. Circle size is proportional to the absolute value of (F-Fmsy/Fmsy). Circle color indicates whether the current F is above (red) or below (green) the reference Fmsy. Black square indicates the number of stocks in the region and n indicates the number of stocks above and below the reference point respectively. Stocks have been grouped by functional group rather that by geographical location and the stock code has been included for clarity. Figure based on (Fernandez and Cook, 2013) and modified by the ICES data Centre.

Pertaining the GES assessment at Mediterranean we also highlight:

- EU Mediterranean Member States should agree on the criteria to combine indicators of the three criteria for an overall GES interpretation.
- The high biodiversity of Mediterranean fish-shellfish communities is mirrored by the multispecies/multi-gear nature of fisheries in the region. These aspects can be critical for the achievement of GES and should be taken into account for the identification of the appropriate management measures to be enforced. In this regard, the ecosystem models already available in several Mediterranean areas should be explored for their capability to model trade-offs, such as the effect of different management strategies on prey-predators interactions. Moreover, there is a growing body of knowledge on the effect of ongoing climate change on productivity of fish stocks in the Mediterranean that would need to be considered in defining management objectives toward GES.

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5.6 List of species to be monitored in the Mediterranean Sea under the DCF (Annex 1)

List of species to be monitored in the Mediterranean Sea under the DCF. Source: Appendix VII of the Commission Decision 93/2010 adopting a multiannual Community programme for the collection, management and use of data in the fisheries sector for the period 2011-2013 (DCF). 1.1: Balearic; 1.2: Gulf of Lions; 1.3: Sardinia; 2.1: Adriatic; 2.2: Ionian; 3.1: Aegean; 3.2: Levant. G1: Species that drive the international management process including species under EU management plans or EU recovery plans or EU long-term multi-annual plans or EU action plans for conservation and management based on Council Regulation (EC) No 2371/2002. G2: Other internationally regulated species and major non-internationally regulated by-catch species. Age No/1000 t: number of individual to be assessed for age reading accordino to landings; T = Weight / Sex/ Maturity data to be recorded each three years; Y: Weight / Sex/ Maturity data to be recorded each year. [2] Age analysis for European eel (Anguilla anguilla) shall be set at a minimum of 5 individuals per cm length intervals. A minimum of 100 individuals shall be analysed per management unit as specified in Regulation (EC) No 1100/2007 for yellow and silver eels separately. [4] Periodicity for age is every three years (first year starting in 2009) and shall be carried out together with weight, maturity and sex estimates.

Species	Species (Latin)	Area/Stock	Species group	Age No/1000 t	Weight / Sex/ Maturity
Bony fish					
European Eel	*Anguilla anguilla*	All areas	G1	[2]	T
Billfish	*Istiophoridae*	All areas	G1		T
Bluefin tuna	*Thunnus thynnus*	All areas	G1	125 [4]	T
Sword fish	*Xiphias gladius*	All areas	G1	125 [4]	T
Anchovy	*Engraulis encrasicolus*	All areas	G1	50	Y
Hake	*Merluccius merluccius*	All areas	G1	125	Y
Red mullet	*Mullus barbatus*	All areas	G1	125	Y
Striped red mullet	*Mullus surmuletus*	All areas	G1	125	Y
Sardine	*Sardina pilchardus*	All areas	G1	50	Y
Dolphinfish	*Coryphaena equiselis*	All areas	G2		
Dolphinfish	*Coryphaena hippurus*	All areas	G2	500 [4]	T
Sea bass	*Dicentrarchus labrax*	All areas	G2	100	T
Pandora	*Pagellus erythrinus*	All areas	G2	125	T
Atlantic bonito	*Sarda sarda*	All areas	G2	50 [4]	T
Mackerel	*Scomber spp.*	All areas	G2	50	T
Albacore	*Thunnus alalunga*	All areas	G2	125 [4]	T
Mediterranean horse mackerel	*Trachurus mediterraneus*	All areas	G2	100	T
Horse mackerel	*Trachurus trachurus*	All areas	G2	100	T
Sole	*Solea vulgaris*	1.2, 2.1, 3.1	G1	250	Y
Grey gurnard	*Eutrigla gurnardus*	2.2, 3.1	G2	250	T
Picarels	*Spicara smaris*	2.1, 3.1, 3.2	G2	100	T
Tub gurnard	*Trigla lucerna*	1.3, 2.2, 3.1	G2		T

Bogue	*Boops boops*	1.3, 2.1, 2.2, 3.1, 3.2	G2		T
Grey mullets	*Mugilidae*	1.3, 2.1, 2.2, 3.1	G2		
Gilthead sea bream	*Sparus aurata*	1.2, 3.1	G2		T
Blue whiting	*Micromesistius poutassou*	1.1, 3.1	G2	250	T
Black-bellied angler	*Lophius budegassa*	1.1, 1.2, 1.3, 2.2, 3.1	G2	250	T
Anglerfish	*Lophius piscatorius*	1.1, 1.2, 1.3, 2.2, 3.1	G2	250	T
Elasmobranchs					
Bigeye thresher shark	*Alopias superciliosus*	All areas	G1		
Thresher shark	*Alopias vulpinus*	All areas	G1		
Sandbar shark	*Carcharhinus plumbeus*	All areas	G1		
Sand tiger shark	*Carcharias taurus*	All areas	G1		
Gulper shark	*Centrophorus granulosus*	All areas	G1		
Basking shark	*Cetorhinus maximus*	All areas	G1		
Kitefin shark	*Dalatias licha*	All areas	G1		
Blue skate	*Dipturus batis*	All areas	G1		
Longnosed skate	*Dipturus oxyrinchus*	All areas	G1		
Velvet belly	*Etmopterus spinax*	All areas	G1		
Tope shark	*Galeorhinus galeus*	All areas	G1		
Blackmouth dogfish	*Galeus melastomus*	All areas	G1		
Spiny butterfly ray	*Gymnura altavela*	All areas	G1		
Sharpnose sevengill shark	*Heptranchias perlo*	All areas	G1		
Bluntnose sixgill shark	*Hexanchus griseus*	All areas	G1		
Shortfin mako	*Isurus oxyrinchus*	All areas	G1		
Porbeagle	*Lamna nasus*	All areas	G1		
Sandy ray	*Leucoraja circularis*	All areas	G1		
Maltese skate	*Leucoraja melitensis*	All areas	G1		

Starry smooth-hound	*Mustelus asterias*	All areas	G1		
Smooth-hound	*Mustelus mustelus*	All areas	G1		
Blackspotted smooth-hound	*Mustelus punctulatus*	All areas	G1		
Common eagle ray	*Myliobatis aquila*	All areas	G1		
Smalltooth sand tiger	*Odontaspis ferox*	All areas	G1		
Angular roughshark	*Oxynotus centrina*	All areas	G1		
Blue shark	*Prionace glauca*	All areas	G1		
Smalltooth sawfish	*Pristis pectinata*	All areas	G1		
Common sawfish	*Pristis pristis*	All areas	G1		
Blue stingray	*Pteroplatytrygon violacea*	All areas	G1		
Starry ray	*Raja asterias*	All areas	G1		
Undulate ray	*Raja undulata*	All areas	G1		
Blackchin guitarfish	*Rhinobatos cemiculus*	All areas	G1		
Common guitarfish	*Rhinobatos rhinobatos*	All areas	G1		
White skate	*Rostroraja alba*	All areas	G1		
Small-spotted catshark	*Scyliorhinus canicula*	All areas	G1		
Nursehound	*Scyliorhinus stellaris*	All areas	G1		
Scalloped hammerhead	*Sphyrna lewini*	All areas	G1		
Great hammerhead	*Sphyrna mokarran*	All areas	G1		
Smalleye hammerhead	*Sphyrna tudes*	All areas	G1		
Smooth hammerhead	*Sphyrna zygaena*	All areas	G1		
Spiny dogfish	*Squalus acanthias*	All areas	G1		
Longnose spurdog	*Squalus blainvillei*	All areas	G1		
Sawback aculeata	*Squatina aculeata*	All areas	G1		
Smoothback angelshark	*Squatina oculata*	All areas	G1		
Angelshark	*Squatina squatina*	All areas	G1		

Spotted torpedo	*Torpedo marmorata*	All areas	G1		
Sharks	*Shark-like Selachii* [3]	All areas	G1		T
Thornback ray	*Raja clavata*	1.3, 2.1, 2.2, 3.1	G1		T
Brown ray	*Raja miraletus*	1.3, 2.1, 2.2, 3.1	G1		T
Bivalves					
Clam	*Veneridae*	2.1, 2.2	G2		T
Cephalopods					
Squid	*Illex spp., Todarodes spp.*	All areas	G2		T
Common squid	*Loligo vulgaris*	All areas	G2		T
Common octopus	*Octopus vulgaris*	All areas	G2		T
Cuttlefish	*Sepia officinalis*	All areas	G2		T
Musky octopus	*Eledone moschata*	1.3, 2.1, 2.2, 3.1	G2		T
Horned octopus	*Eledone cirrosa*	1.1, 1.3, 2.1, 2.2, 3.1	G2		T
Crustaceans					
Giant red shrimp	*Aristeomorpha foliacea*	All areas	G1		Y
Red shrimp	*Aristeus antennatus*	All areas	G1		Y
Norway lobster	*Nephrops norvegicus*	All areas	G1		Y
White shrimp	*Parapenaeus longirostris*	All areas	G1		Y
Mantis shrimp	*Squilla mantis*	1.3, 2.1, 2.2	G2		T

5.7 Case studies in the Mediterranean Sea using the Catch-MSY method for estimating MSY (Annex 2)

Description of the CMSY method (Martell & Froese, 2013).

The simplest model-based methods for estimating MSY are production models such as the Schaefer (1954). At a minimum, these models require time series data of abundance and removals to estimate two model parameters: k and r. While estimates of removals (defined here as catch plus dead discards) are available for most stocks, abundance estimates are difficult and costly to obtain and are mostly missing. However, given only a time series of removals, a surprisingly narrow range of r-k combinations is able to maintain the population such that it neither collapses nor exceeds the assumed carrying capacity. This set of viable r-k combinations can be used to approximate MSY. Here, we present a simple method that uses catch data plus readily available additional information to approximate MSY with error margins.

The Catch-MSY (CMSY) method (Martell & Froese, 2013) is based on the Schaefer production model (Schaefer 1954). It requires a time series of removals, prior ranges of the maximum rate of population increase r and the carrying capacity k, for a given stock in a given ecosystem, and possible ranges of relative stock sizes in the first and final years of the time series. It then uses the Schaefer production model to calculate annual biomasses for a given set of r and k parameters. As no prior distributions of r and k are available for most fish stocks, r-k pairs are randomly drawn from a uniform prior distribution and then use a Bernoulli distribution as the likelihood function for accepting each r-k pair that has never collapsed the stock or exceeded carrying capacity and that results in a final relative biomass estimate that falls within the assumed range of depletion (Martell & Froese, 2013). For full description of the model and examples see Martell & Froese (2013).

The method was applied to 5 Mediterranean stocks anchovy *Engraulis encrasicolus* in GSA 17, hake *Merluccius merluccius* in GSA 22, red mullet *Mullus barbatus* in GSA 6, surmullet *Mullus surmuletus* in GSA 15&16 and round sardinella *Sardinella aurita* in GSA 22.

The resilience for these species was set to medium for all except anchovy (very high resilience, 0.8-1.6) and round sardinella (high, 0.7-1.0). The official landings data were used and biomass estimates from surveys when available. The priors was set based on the knowledge of local experts.

Anchovy Engraulis encrasicolus at GSA 17

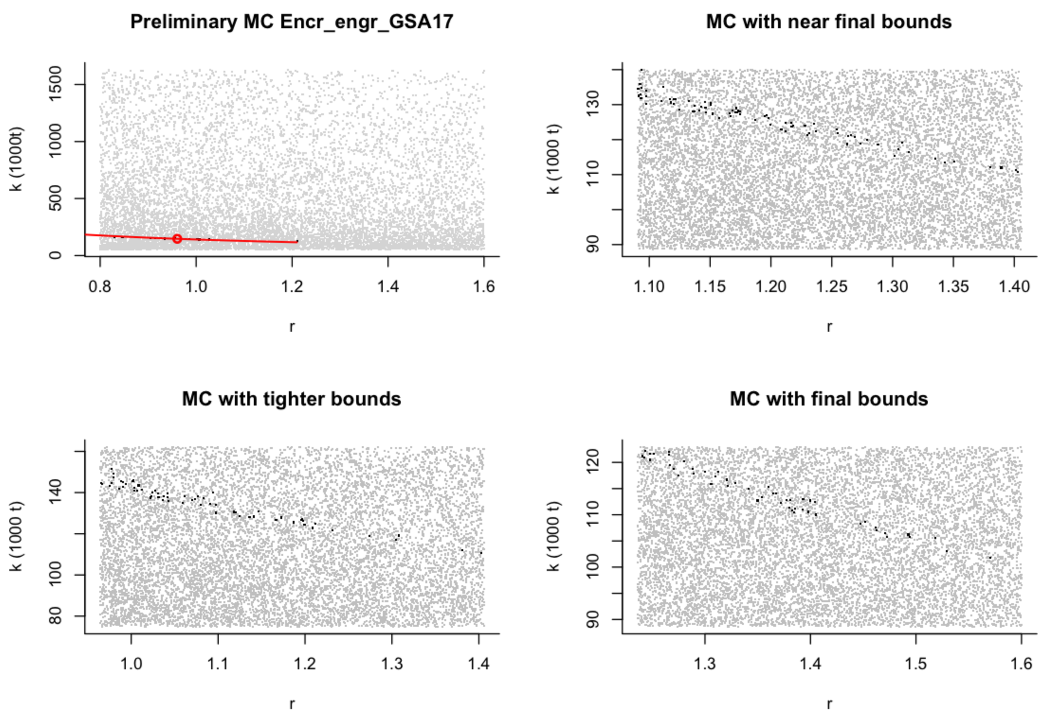
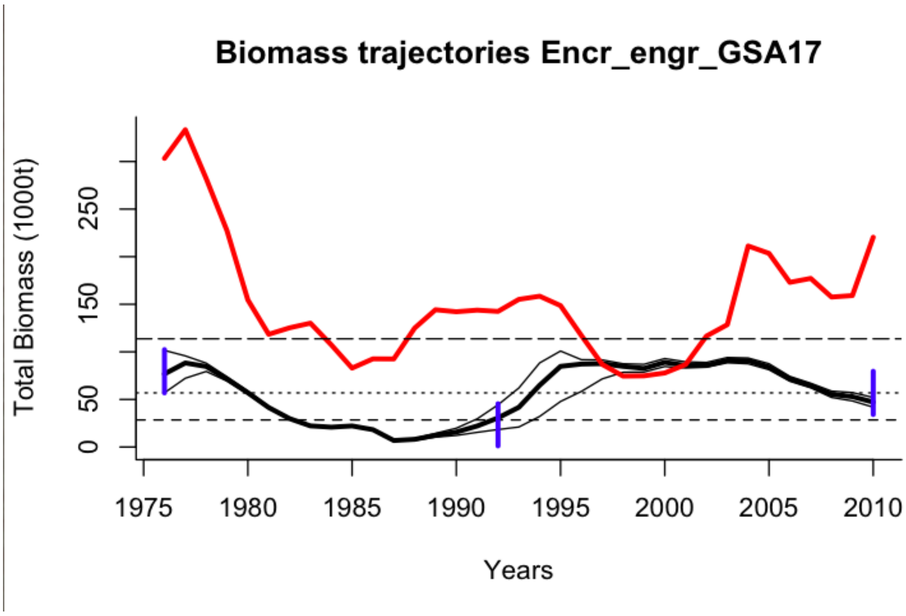
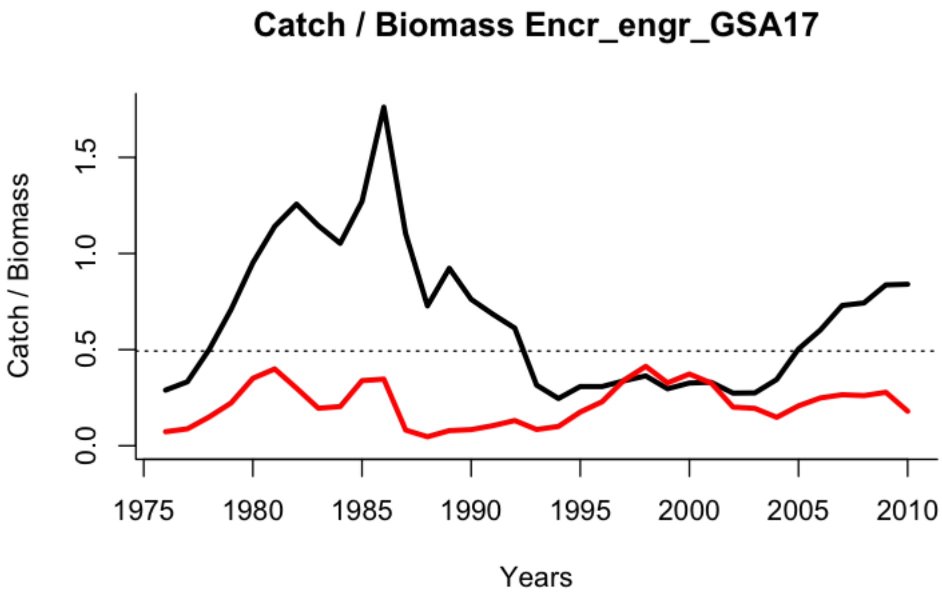


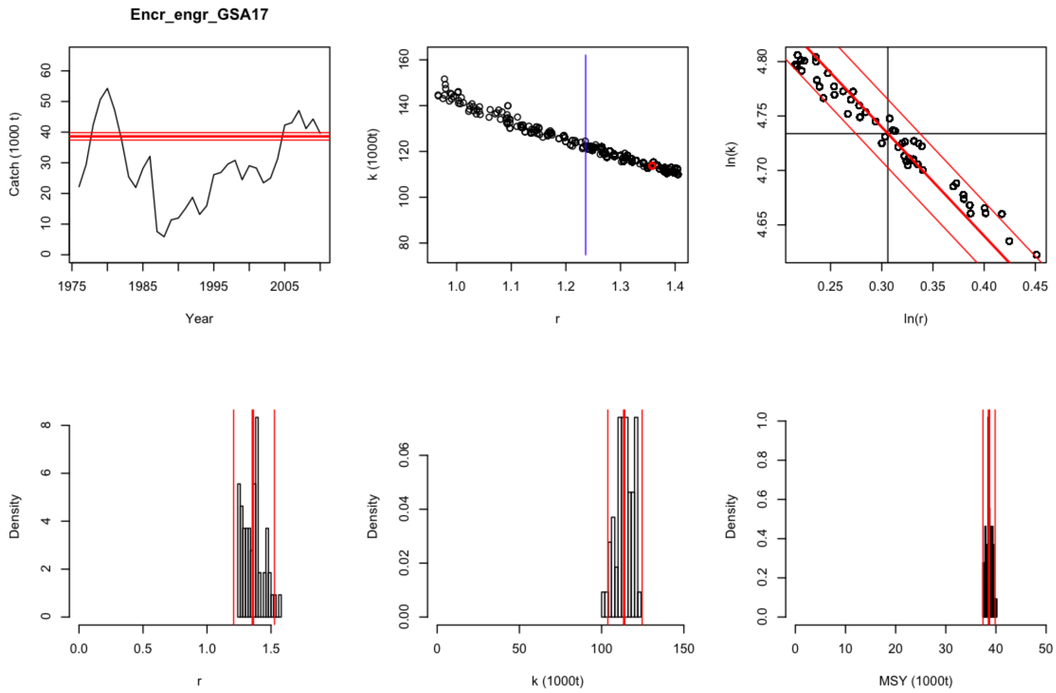
Figure 5.2 Output of the Catch-MSY method showing "viable" pairs (black dots) of surplus production rate *r* and unexploited biomass *k* for anchovy in GSA 17. The red line indicates all *r-k* pairs that would result in the same estimate of *MSY*; the red circle indicates the geometric mean (Martell & Froese 2013).



Fiure 5.3 The black line shows the biomass predicted by the CMSY-method and the red line shows observed total biomass for anchovy in GSA 17. The vertical blue lines show the prior biomass windows used as filters by the CMSY-method. The upper dashed line represents the unexploited biomass *k*, the middle dotted line represents *Bmsy* (~55000 t), and the lower dashed line represents *Bpa* (~30000 t).

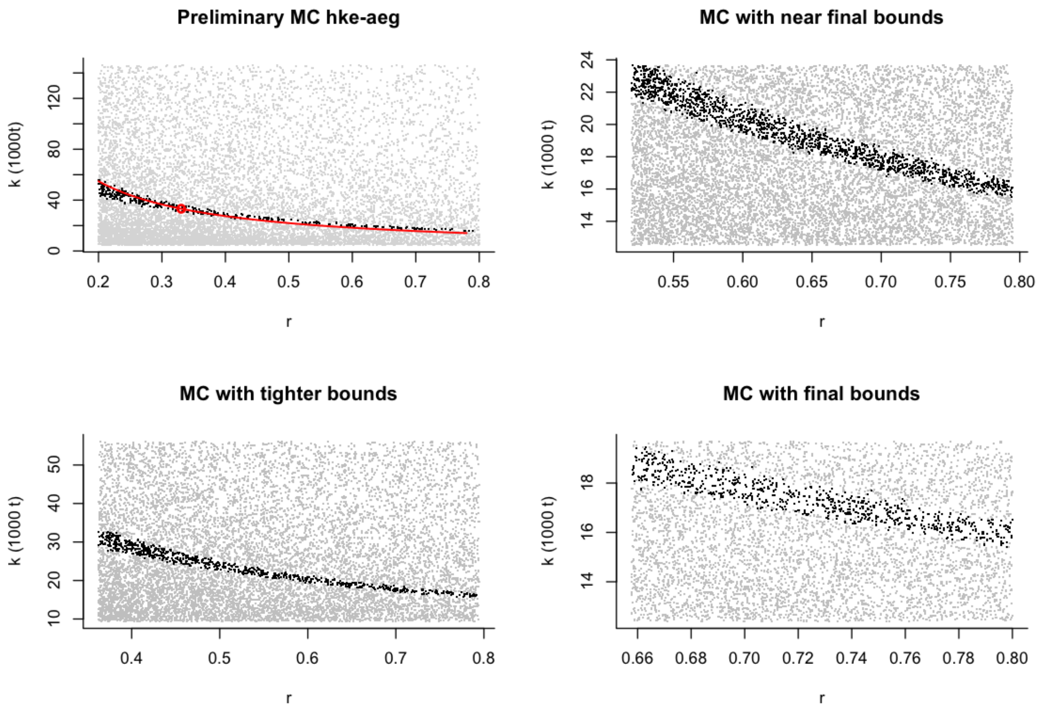


Fiure 5.4 Exploitation rate catch/biomass as predicted by the CMSY method (black line) and as observed (red line) for anchovy in GSA 17. The dotted line represents a proxy for *MSY*-compatible exploitation.

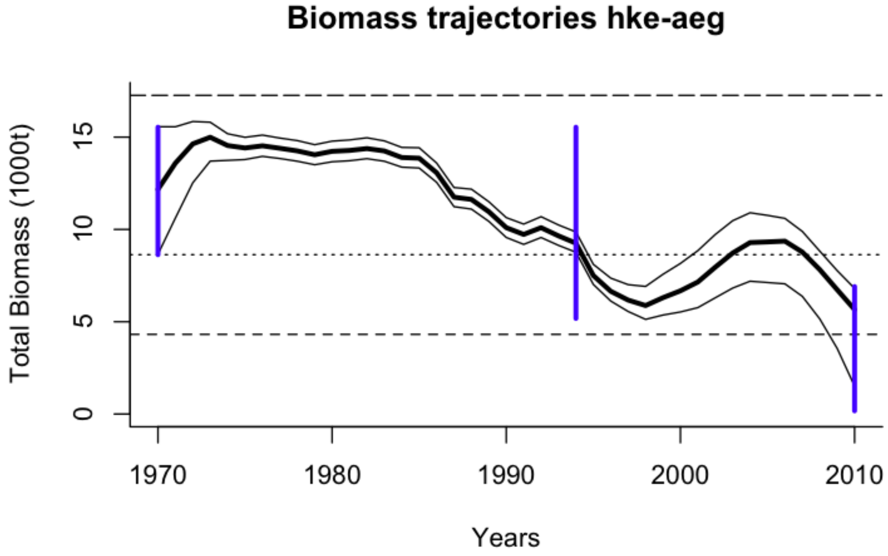


Fiure 5.5 Graphic output from the CMSY method for anchovy in GSA 17. Top left panel shows the time series of catches with overlaid estimate of MSY (bold) and the limits (broken) that contain about 95% of the estimates. Top middle panel frames the prior uniform distribution of r and k; the gray dots show the r-k combinations that are compatible with the time series of catches. Top right panel is a magnification of the viable r-k pairs in log space, with the geometric mean MSY estimate (bold) ± 2 standard deviations (broken lines) overlaid. Bottom panels show the posterior densities of r (left), k (middle), and MSY (right).

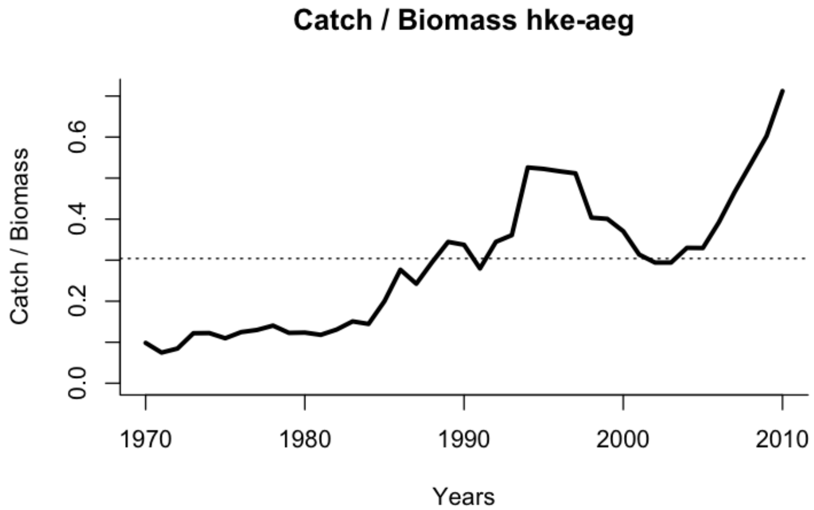
Hake Merluccius merluccius in GSA 22 (Aegean Sea)



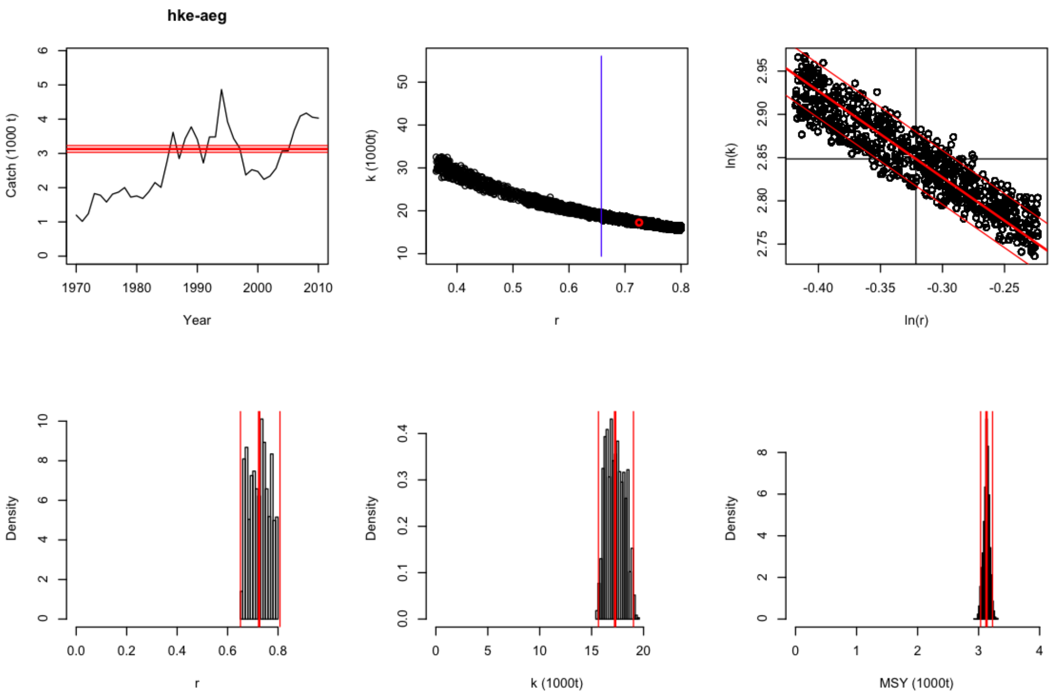
Fiure 5.6 Output of the Catch-MSY method showing "viable" pairs (black dots) of surplus production rate *r* and unexploited biomass *k* for hake in GSA 22. The red line indicates all *r*-*k* pairs that would result in the same estimate of *MSY*; the red circle indicates the geometric mean (Martell & Froese 2013).



Fiure 5.7 The black line shows the biomass predicted by the CMSY-method for hake in GSA 22 (Aegean Sea). The vertical blue lines show the prior biomass windows used as filters by the CMSY-method. The upper dashed line represents the unexploited biomass *k*, the middle dotted line represents *Bmsy* (~8000 t), and the lower dashed line represents *Bpa* (~4000 t).

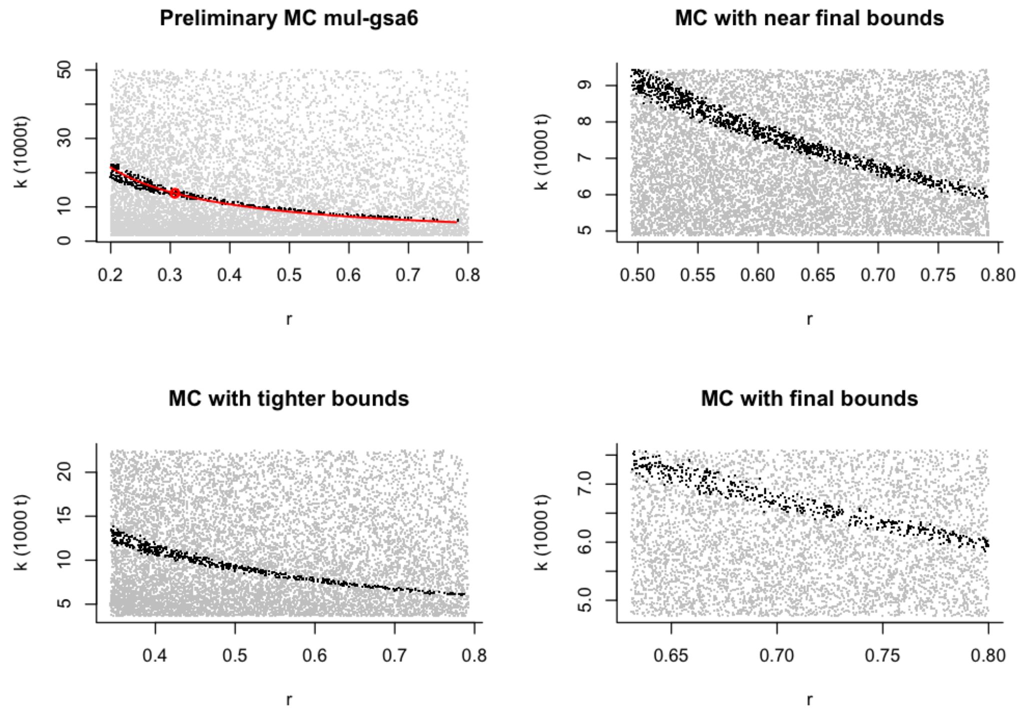


Fiure 5.8 Exploitation rate catch/biomass as predicted by the CMSY method (black line) and as observed (red line) for hake in GSA 22. The dotted line represents a proxy for *MSY*-compatible exploitation.

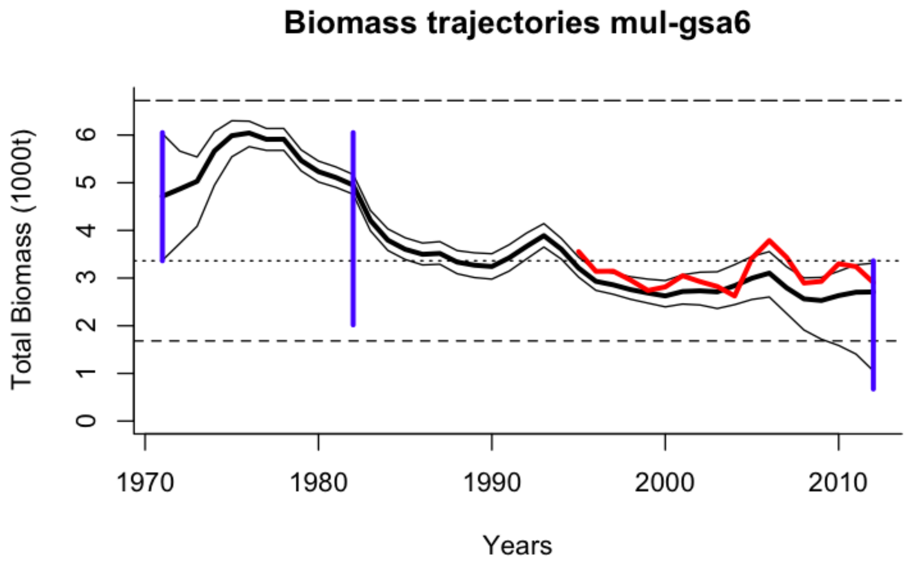


Fiure 5.9 Graphic output from the CMSY method for hake in GSA 22. Top left panel shows the time series of catches with overlaid estimate of MSY (bold) and the limits (broken) that contain about 95% of the estimates. Top middle panel frames the prior uniform distribution of r and k; the gray dots show the r-k combinations that are compatible with the time series of catches. Top right panel is a magnification of the viable r-k pairs in log space, with the geometric mean MSY estimate (bold) ± 2 standard deviations (broken lines) overlaid. Bottom panels show the posterior densities of r (left), k (middle), and MSY (right).

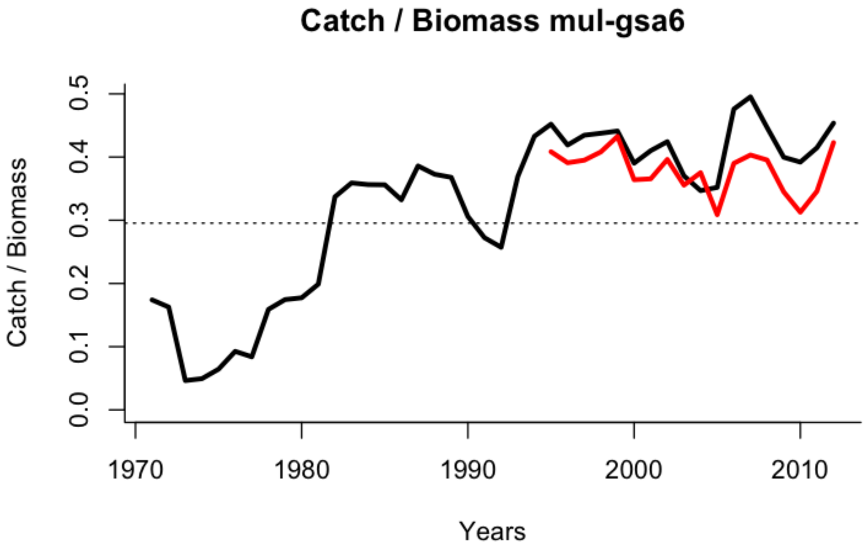
Red mullet Mullus barbatus in GSA 6



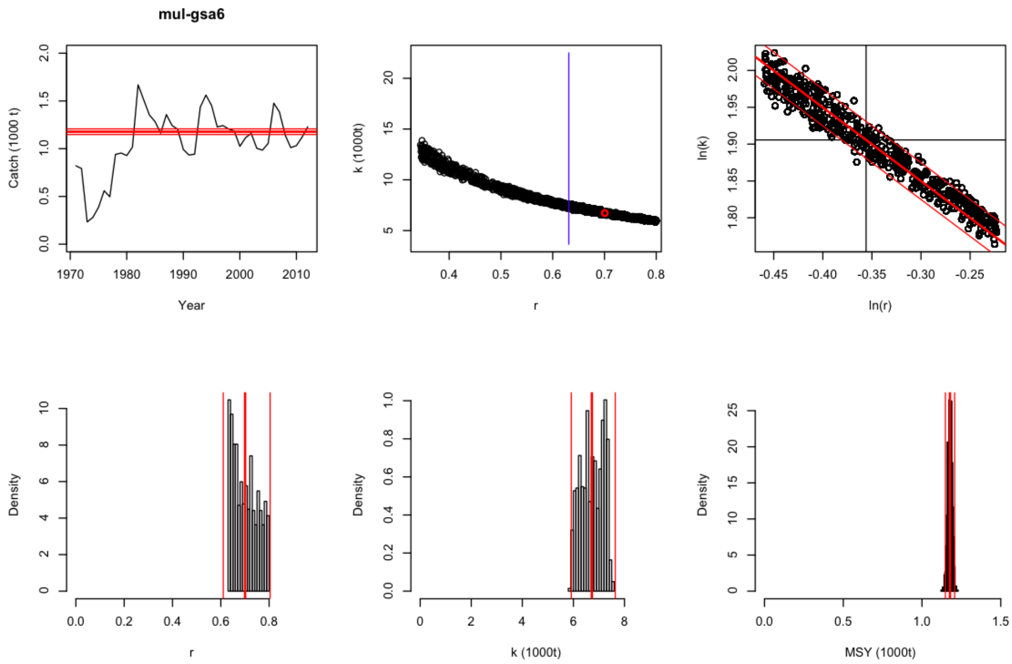
Fiure 5.10 Output of the Catch-MSY method showing "viable" pairs (black dots) of surplus production rate *r* and unexploited biomass *k* for red mullet in GSA 6. The red line indicates all *r-k* pairs that would result in the same estimate of *MSY*; the red circle indicates the geometric mean (Martell & Froese 2013).



Fiure 5.11 The black line shows the biomass predicted by the CMSY-method and the red line shows observed total biomass for red mullet in GSA 6. The vertical blue lines show the prior biomass windows used as filters by the CMSY-method. The upper dashed line represents the unexploited biomass *k*, the middle dotted line represents *Bmsy* (~3500 t), and the lower dashed line represents *Bpa* (~1800 t).

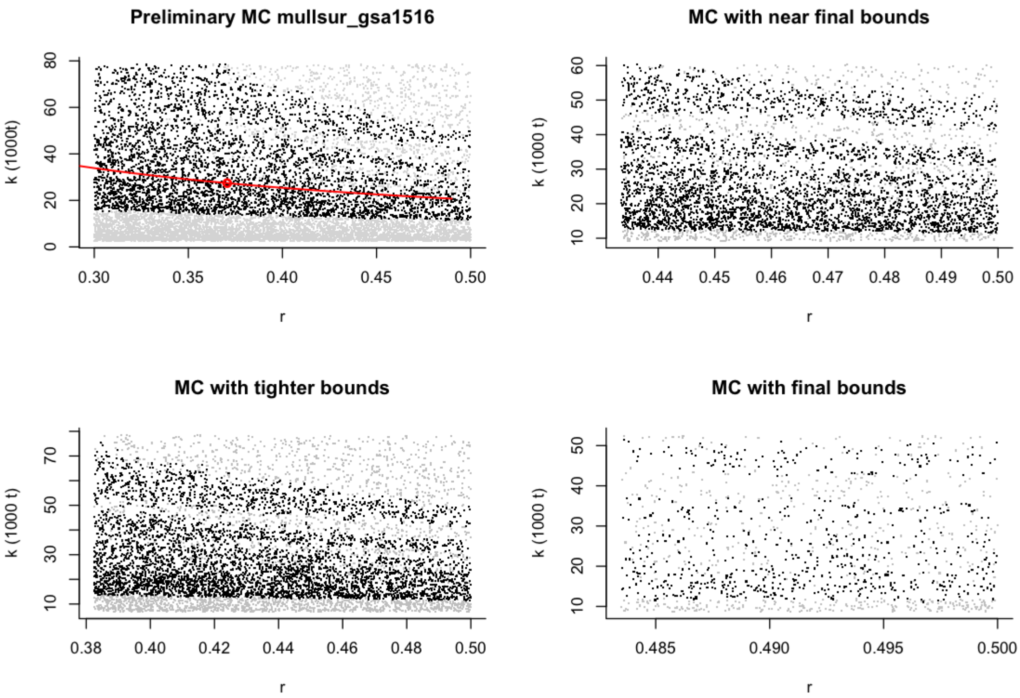


Fiure 5.13 Exploitation rate catch/biomass as predicted by the CMSY method (black line) and as observed (red line) for red mullet in GSA 6. The dotted line represents a proxy for *MSY*-compatible exploitation.

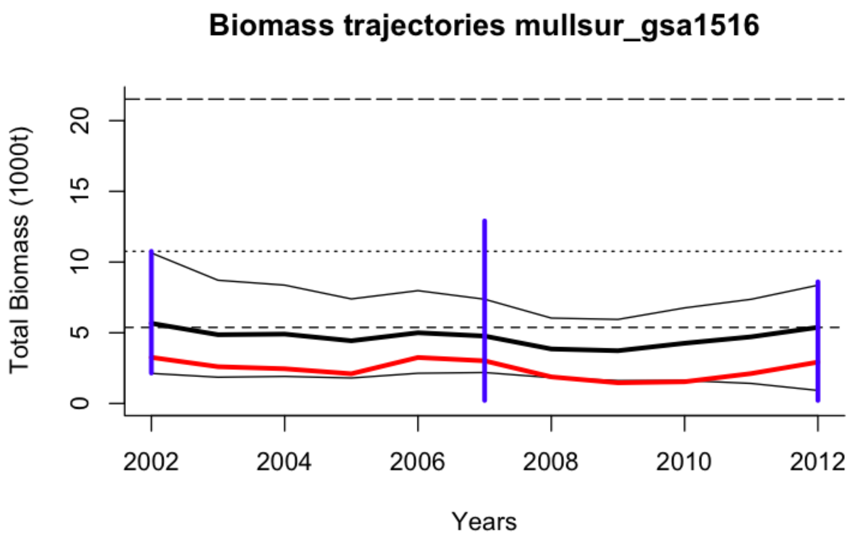


Fiure 5.14 Graphic output from the CMSY method for red mullet in GSA 6. Top left panel shows the time series of catches with overlaid estimate of MSY (bold) and the limits (broken) that contain about 95% of the estimates. Top middle panel frames the prior uniform distribution of r and k; the gray dots show the r-k combinations that are compatible with the time series of catches. Top right panel is a magnification of the viable r-k pairs in log space, with the geometric mean MSY estimate (bold) ± 2 standard deviations (broken lines) overlaid. Bottom panels show the posterior densities of r (left), k (middle), and MSY (right).

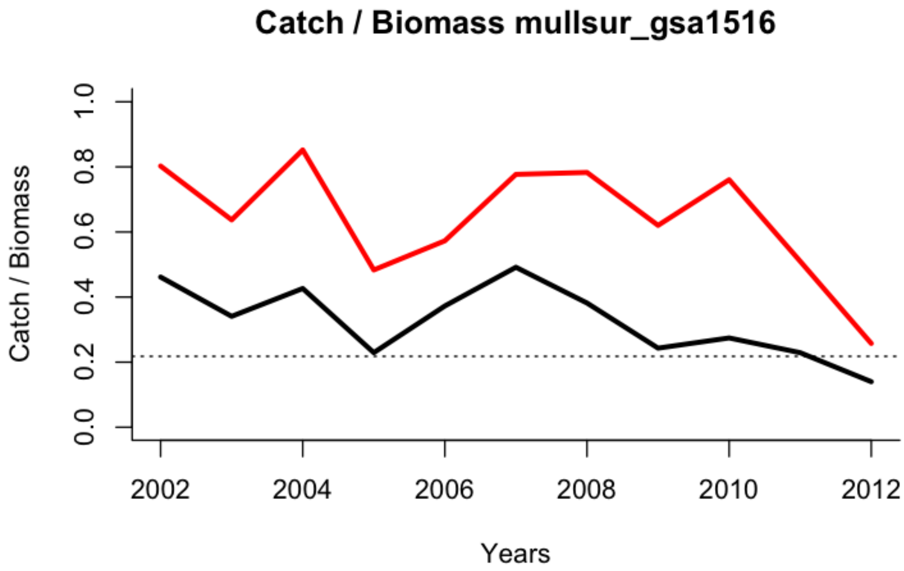
Surmullet Mullus surmuletus in GSA15&16



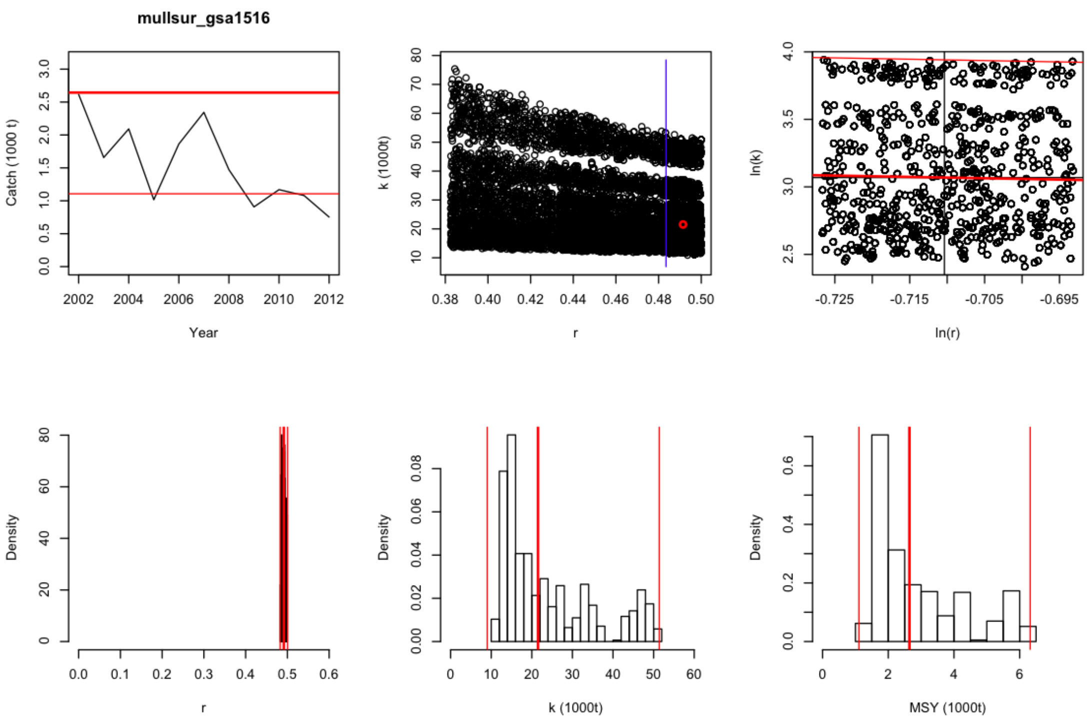
Fiure 5.15 Output of the Catch-MSY method showing "viable" pairs (black dots) of surplus production rate *r* and unexploited biomass *k* for surmullet in GSA 15&16. The red line indicates all *r*-*k* pairs that would result in the same estimate of *MSY*; the red circle indicates the geometric mean (Martell & Froese 2013).



Fiure 5.16 The black line shows the biomass predicted by the CMSY-method and the red line shows observed total biomass for surmullet in GSA15&16. The vertical blue lines show the prior biomass windows used as filters by the CMSY-method. The upper dashed line represents the unexploited biomass *k*, the middle dotted line represents *Bmsy* (~11000 t), and the lower dashed line represents *Bpa* (~5500 t).

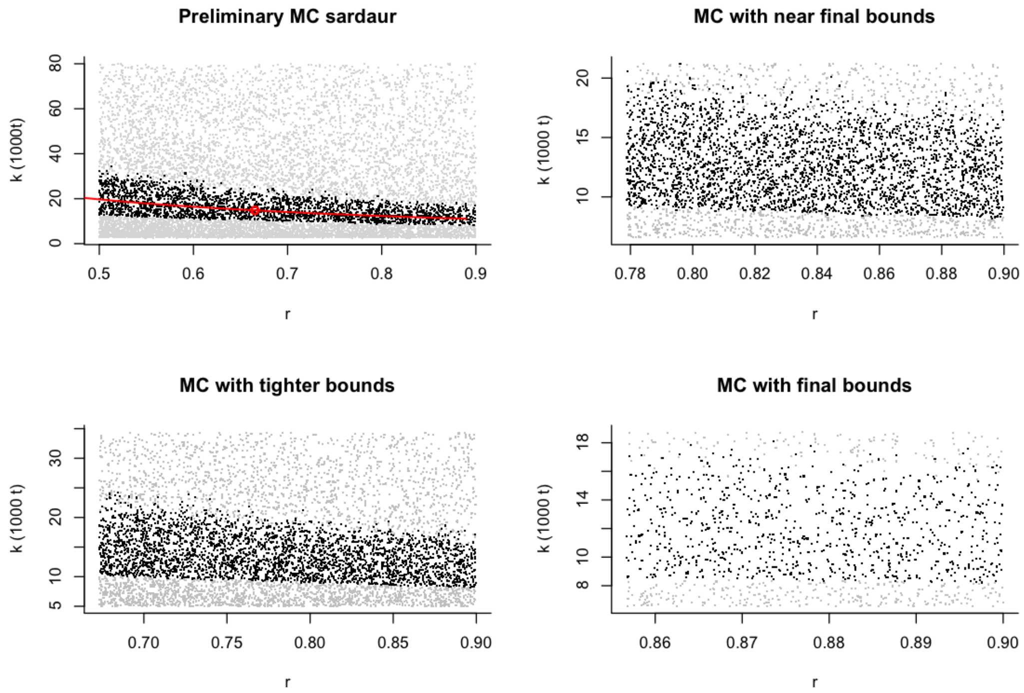


Fiure 5.17 Exploitation rate catch/biomass as predicted by the CMSY method (black line) and as observed (red line) for surmullet in GSA 15&16. The dotted line represents a proxy for *MSY*-compatible exploitation.

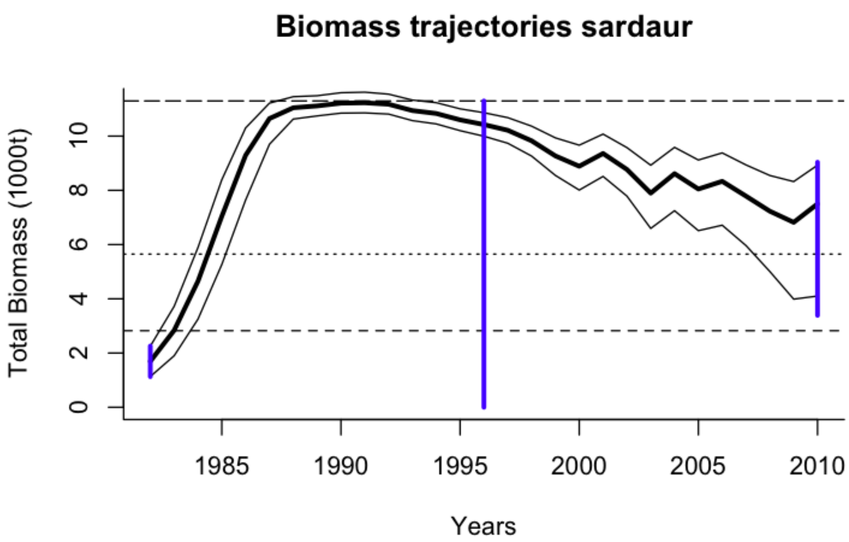


Fiure 5.18 Graphic output from the CMSY method for surmullet in GSA 15&16. Top left panel shows the time series of catches with overlaid estimate of MSY (bold) and the limits (broken) that contain about 95% of the estimates. Top middle panel frames the prior uniform distribution of r and k; the gray dots show the r-k combinations that are compatible with the time series of catch-es. Top right panel is a magnification of the viable r-k pairs in log space, with the geometric mean MSY estimate (bold) ± 2 standard deviations (broken lines) overlaid. Bottom panels show the posterior densities of r (left), k (middle), and MSY (right).

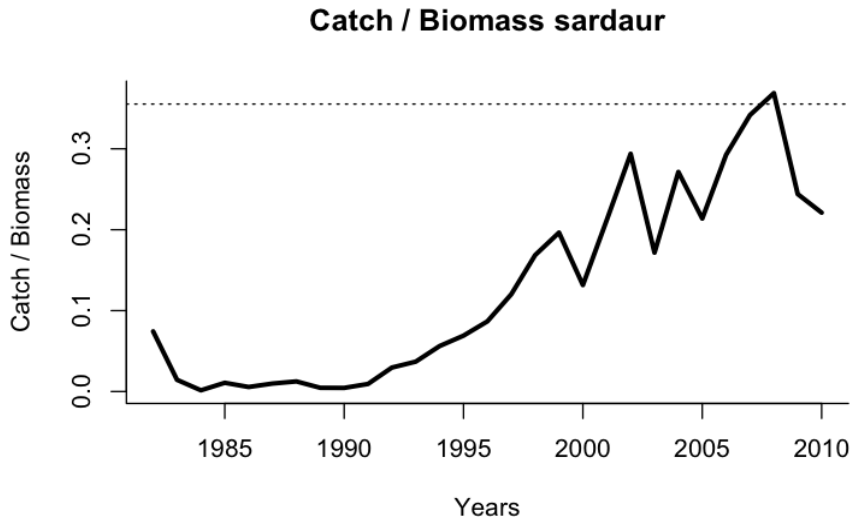
Round sardinella Sardinella aurita in GSA 22 (Aegean Sea)



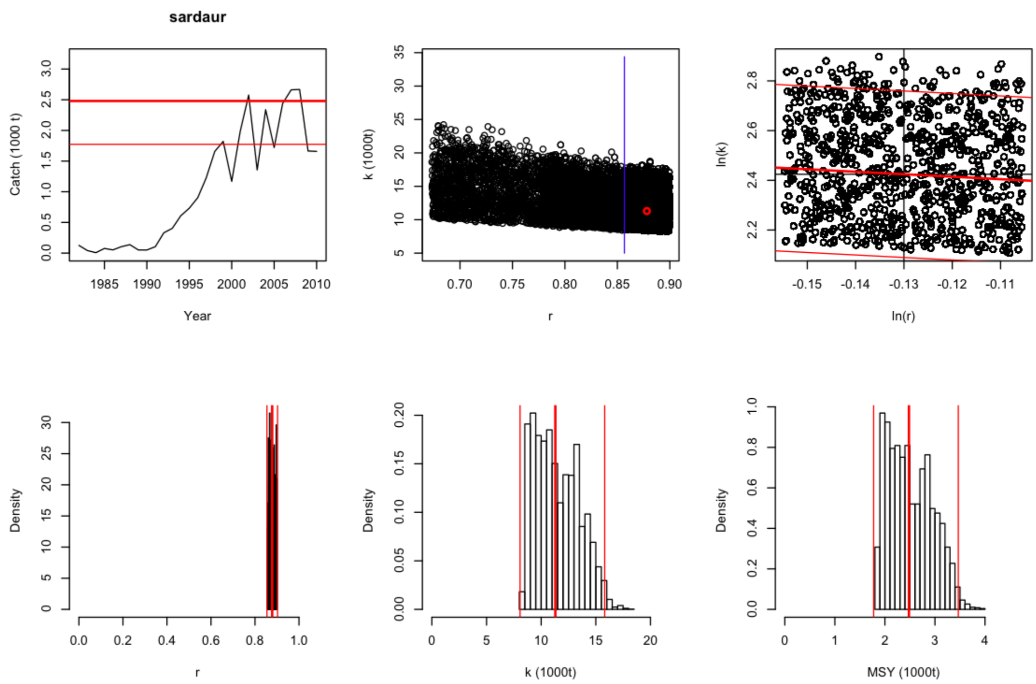
Fiure 5.19 Output of the Catch-MSY method showing "viable" pairs (black dots) of surplus production rate *r* and unexploited biomass *k* for round sardinella in GSA 22. The red line indicates all *r-k* pairs that would result in the same estimate of *MSY*; the red circle indicates the geometric mean (Martell & Froese 2013).



Fiure 5.20 The black line shows the biomass predicted by the CMSY-method for rould sardinella in GSA 22. The red line shows observed total biomass. The vertical blue lines show the prior biomass windows used as filters by the CMSY-method. The upper dashed line represents the unexploited biomass *k*, the middle dotted line represents *Bmsy* (~6000 t), and the lower dashed line represents *Bpa* (~3000 t).



Fiure 5.21 Exploitation rate catch/biomass as predicted by the CMSY method (black line) and as observed (red line) for round sardinella in GSA 22. The dotted line represents a proxy for *MSY*-compatible exploitation.



Fiure 5.22 Graphic output from the CMSY method for round sardinella in GSA 22. Top left panel shows the time series of catches with overlaid estimate of MSY (bold) and the limits (broken) that contain about 95% of the estimates. Top middle panel frames the prior uniform distribution of r and k; the gray dots show the r-k combinations that are compatible with the time series of catches. Top right panel is a magnification of the viable r-k pairs in log space, with the geometric mean MSY estimate (bold) ± 2 standard deviations (broken lines) overlaid. Bottom panels show the posterior densities of r (left), k (middle), and MSY (right).

6 Black Sea Region

6.1 Introduction

The Black Sea is an inland semi-enclosed sea that receives significant freshwater input from major rivers (the Danube, the Dnieper and the Don) and its catchment area extends over one third of continental Europe. The high biological productivity, together with restricted water circulation, creates the conditions for the pronounced stratification of the Black Sea waters, and for permanent anoxia below 150-200 m depth. Marine life is concentrated in the upper oxygenated layer, mostly along the continental shelf that hosts abundant fish stocks subject to productive fisheries.

Since the 1980s, the Black Sea ecosystem has been affected by changes related to overfishing, climate change, pollution/eutrophication and invasive species introductions, although the last 10-15 years some environmental recovery has been seen (BSC, 2008; Daskalov 2012).

The Black Sea is surrounded by Bulgaria, Georgia, Romania, Russian Federation, Turkey and Ukraine. Romania and Bulgaria became members of the EU in 2007, which extended the EU.

Common Fishery Policy (CFP) into the Black Sea. Turkey is a candidate country and, although it cannot take advantage of direct EFF support, EU twinning projects and technical assistance are currently in place. At present there is no internationally agreed legal framework to regulate the fisheries in the Black Sea, but several cooperative bodies such as EU STECF, GFCM, Black Sea Commission produce elements of fisheries assessments and advice (e.g. Sampson et al. 2013; GFCM).

6.2 Selection of commercially exploited fin- and shellfish populations relevant for Descriptor 3 in the Black Sea

The main sources of information used to compile the list of stocks were stock assessment reports (Sampson et al. 2013, Prodanov et al. 1997), landing statistics (FAO FIGIS 2013) and literature (e.g. Daskalov et al. 2008, Shlyakhov and Daskalov 2008).

The resulting list of stocks is shown in Tables 6.1 and 6.2. To each stock was assigned a category indicating the availability of data for stock assessment according to Le Quesne et al. (2013) and Section 2 of this report. From 25 stocks considered, only the first 9 stocks have been subject to evaluation by the STECF EWG (Table 6.2, Sampson et al. 2013). In 7 of these stocks: sprat, anchovy, horse mackerel, turbot, whiting, red mullet and dogfish analytical assessments were produced by the STECF EWG. The assessments of sprat, turbot and red mullet were considered satisfactory, but in the cases of anchovy, horse mackerel, whiting and dogfish data or analyses were considered as problematic and results were judged indicative of trends only (Sampson et al. 2013). Consequently, for these two groups we assigned categories 1 and 2, respectively. The rest of the stocks are not assessed at present, and consequently categories 5 and 6 were assigned to them related to reliability of the catch information.

As seen in Table 6.1 the stocks of small pelagic fishes (sprat, anchovy, contribute to 83 % of the total average (2000-2010) landings. The rest of the stocks have much lower reported landings with the exception of invertebrates such as clams and Rapa whelk. The landing statistics however must be regarded with caution and in the course of further evaluations should be verified and corrected against additional national data and expert assessments (e.g most of the grey mullets species from family Mugilidae appear in FAO statistics in a aggregate group Mullets nei).

Table 6.1. Average (2000-2010) catches in the Black Sea (in tonnes). Catches of stocks 1 to 9 are reviewed and corrected by the STECF EWG (Sampson et al. 2013). The rest are reported landings from FAO FIGIS.

#	Common name	Scientific name	Mean catch 2000-2010	% of total	% of total excluding small pelagics
1	Sprat	*Sprattus sprattus*	61275	14.77	
2	Anchovy	*Engraulis encrasicolus*	268324	64.68	
3	Mediterranean horse mackerel	*Trachurus mediterraneus*	14740	3.55	
4	Whiting	*Merlangius merlangus*	9705	2.34	13.76
5	Turbot	*Psetta maxima*	1067	0.26	1.51
6	Red mullet	*Mullus barbatus*	919	0.22	1.30
7	Picked dogfish	*Squalus acanthias*	573	0.14	0.81
8	Rapa whelk	*Rapana venosa*	11094	2.67	15.73
9	Bonito	*Sarda sarda*	12972	3.13	18.39
10	Russian sturgeon	*Acipenser guldenstaedti*	2	0.00	0.0026
11	Stellate sturgeon	*Acipenser stellatus*	1	0.00	0.0013
12	Beluga	*Huso huso*	2	0.00	0.0027
13	Thornback ray	*Raja clavata*	75	0.02	0.11
14	Sting ray	*Dasyatis pastinaca*	1	0.00	0.0019
15	Shad	*Alosa immaculata*	77	0.02	0.11
16	Silverside	*Atherina boyeri*	601	0.14	0.85
17	Grey Mullet	*Mugil cephallus*	22	0.01	0.03
18	Soiuy Mullet	*Mugil soiuy*	256	0.06	0.36
19	Golden Mullet	*Liza aurata*	2	0.00	0.0022
20	Leaping Mullet	*Liza saliens*	8	0.00	0.0116
21	Garfish	*Belone belone*	309	0.07	0.44
22	Blue-fish	*Pomatomus saltatrix*	7001	1.69	9.93
23	Chub mackerel	*Scomber japonicus*	373	0.09	0.53
24	Mediteranean mussel	*Mytilus galloprovincialis*	1971	0.48	2.80
25	Struped Venus (clam)	*Chamelea gallina*	23486	5.66	33.31
	Total		414856	100	
	Total - small pelagics		70517		100

Table 6.2. Black Sea stocks with data categories assigned and D3.1 assessment from the 2012 stock assessments (Sampson et al. 2013).

#	Common name	Scientific name	Data category	Stock assessment	F 2010	F 2011	F 2012	Fmsy	(F-Fmsy) /Fmsy
1	Sprat	*Sprattus sprattus*	1	STECF EWG	0.75	1.12	0.40	0.64	-0.37
2	Anchovy	*Engraulis encrasicolus*	2	STECF EWG					
3	Mediterranean Horse mackerel	*Trachurus mediterraneus*	2	STECF EWG					
4	Turbot	*Psetta maxima*	1	STECF EWG	0.79	0.73	0.85	0.27	2.17
5	Whiting	*Merlangius merlangus*	2	STECF EWG			0.96	0.40	1.40
6	Red mullet	*Mullus barbatus*	1	STECF EWG	0.79	0.81	0.91	0.46	0.97
7	Picked dogfish	*Squalus acanthias*	2	STECF EWG			0.24	0.18	0.33
8	Bonito	*Sarda sarda*	5	STECF EWG					
9	Rapa whelk	*Rapana venosa*	5	STECF EWG					
10	Russian sturgeon	*Acipenser guldenstaedti*	6	not assessed					
11	Stellate sturgeon	*Acipenser stellatus*	6	not assessed					
12	Beluga	*Huso huso*	6	not assessed					
13	Thornback ray	*Raja clavata*	6	not assessed					
14	Sting ray	*Dasyatis pastinaca*	6	not assessed					
15	Shad	*Alosa immaculata*	6	not assessed					
16	Silverside	*Atherina boyeri*	6	not assessed					
17	Grey Mullet	*Mugil cephallus*	6	not assessed					
18	Soiuy Mullet	*Mugil soiuy*	6	not assessed					
19	Golden Mullet	*Liza aurata*	6	not assessed					
20	Leaping Mullet	*Liza saliens*	6	not assessed					
21	Garfish	*Belone belone*	6	not assessed					
22	Blue-fish	*Pomatomus saltatrix*	5	not assessed					
23	Chub mackerel	*Scomber japonicus*	6	not assessed					
24	Mediteranean mussel	*Mytilus galloprovincialis*	5	not assessed					
25	Struped Venus	*Chamelea gallina*	5	not assessed					

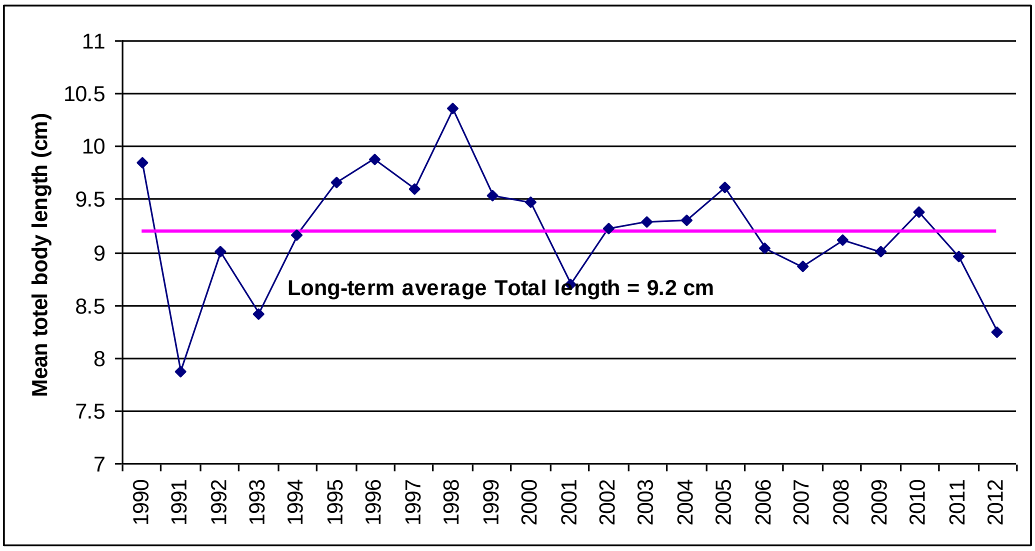


Fig. 6.1 Mean length of sprat in the catches. Long-term average (over 1990-2012) is shown as a purple line

Table 6.3 Status by region/sub-region

	3.1.1	3.1.2	3.2.1	3.2.2	3.3	Unknown	Total
Number of stocks	5				1	20	25
Number of stocks achieving green status	1						
Percentage of stocks achieving green status	20%						

From 25 important stocks in the Black Sea only in 5 stocks (sprat, turbot, whiting, red mullet and dogfish) it was possible to evaluate the status of D 3.1.1. In 4 of the stocks the D 3.1.1 indicator shows that fishing pressure is beyond the safe limits, a in one stock - sprat D 3.1.1 is within the safe limits set by the Fmsy proxy. Even in this stock however, the fishing mortality in 2010 and 2011 is above the proxy Fmsy= 0.64 (Tables 6.2 & 6.3).

Some indicators of D 3.3 have been evaluated in Bulgarian and Romanian national activities (Moncheva et.al., 2013; Radu, Stroie, 2013), but only for limited time periods that not allow assessments of trends. Data processed by the STECF EWG (Sampson et al. 2013) contain aggregated weight-at-age of the stocks subject of stock assessment. From these data, it possible to estimate a proxy of the mean length in the catch in each year. This was done, as an example for sprat as shown in Fig. 6.1. The mean length of sprat is decreasing in 2011-2012 compared to the long-term average.

6.3 Problems and gaps identified

Only 5 from 25 important Black Sea stocks are assessed against descriptor D 3.1.1 - level of pressure of the fishing activity from analytical stock assessments, and one is assessed for the D 3.3. In 2013 the STECF EWG on Black Sea stock assessments assessed 9 stocks, but in some the data and results were not reliable to produce advice relevant to F_{MSY} (Sampson et al. 2013). SSB related reference levels were not estimated in any of the assessed stocks.

Fish stocks in the Black Sea lack reliable estimates of indicators from research surveys and catch data. Some national research surveys have been conducted in the Black Sea (Sampson et al. 2013) in the last years, but they do not cover the entire area and their results are not available and standardised in a proper way to be used for estimating D3 indicators. Large parts of the stocks distribution areas lay beyond the EU territorial waters along the coasts of Georgia, Russian Federation, Turkey and Ukraine. To allow proper evaluation of the indicators, the surveys should cover the totality of the stock distribution areas in the Black Sea. In their last report STECF has recommended "the expansion of demersal and hydroacoustic surveys to cover a greater proportion of the Black Sea ... there is a need for better coordination of the existing national surveys at the international level" (Sampson et al. 2013).

STECF also recommended that "there should be a review of the fishery sampling programs of the Black Sea nations to document how the fishery and stock assessment data in the Black Sea are collected and to identify the causes of the data gaps, which were apparent in the information provided to EWG 13-12 (Sampson et al. 2013). The shortage of survey data in majority of the stocks is not surprising given that until 2013, only 6 species were covered by the DCF in Bulgaria and Romania: sprat, anchovy, horse mackerel, bonito, turbot, and dogfish.

The three most abundant sturgeon species: Russian & stellate sturgeons and beluga still appear in the landing statistics although in very low numbers. There is evidence of systematic misreporting of sturgeons, so that the actual catches would be at least 5 times more than the reported landings (Shlyahov and Daskalov 2008). The 3 sturgeon species are assigned as critically endangered in the IUCN Red List and listed in Annex V of the EC Habitat Directive as subject of special measures to control of the exploitation. In the last year their exploitation has been banned in all Black Sea countries (BSBLCP-SAP 2013). The above arguments led the group to consider that it will be appropriate to assess the status of sturgeons under both D3 and more appropriately, under the biodiversity descriptor D1.

6.4 Conclusions and recommendations

The main conclusion from the above analysis is that the information available for evaluation of D3 in the Black Sea is very meagre indeed, at present. Figure 6.2 shows the overall status of commercial fish stocks in the Baltic Sea.

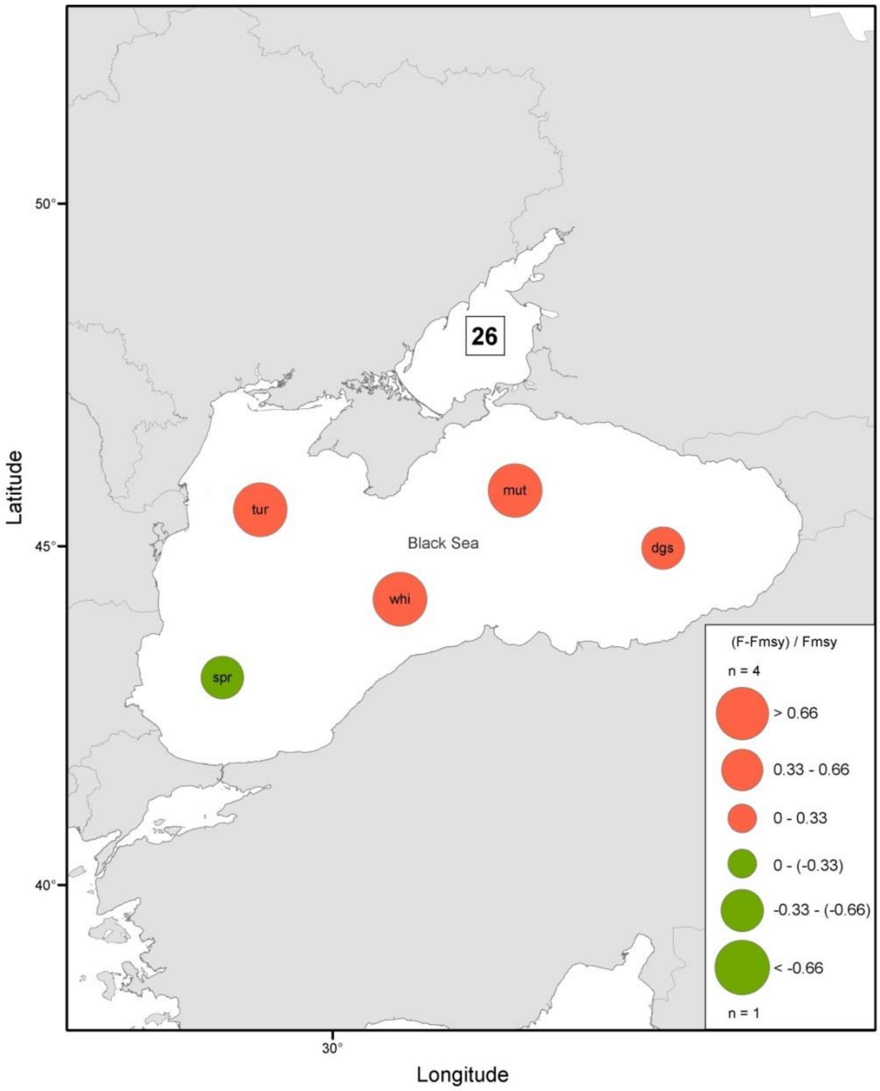


Figure 6.2. Status of the current fishing mortality (F) in relation to the target reference mortality (Fmsy) for of 5 Black Sea stocks. Circle size is proportional to the absolute value of (F-Fmsy/Fmsy). Circle color indicates whether the current F is above (red) or below (green) the reference Fmsy. Black square indicates the number of stocks in the region and n indicates the number of stocks above and below the reference point respectively. Figure based on (Fernandez and Cook, 2013) and modified by the ICES data Centre.

Several actions need to be considered in future in order to fill the gaps and perform appropriate evaluation of indicators under D3 including the following.

- The stock assessment WGs need to estimate SSB reference points in order to allow the evaluation of D3.2.1.
- The stock assessment WGs can also be asked to assess additional indicators under D 3.3, subject to data availability.
- Demersal and pelagic research surveys should be carried out and information from them should be processed and stored in standardised formats to allow the swift and reliable estimation of the indicators under D3.1.2, D3.2.2 and D3.3.
- The majority of the important stocks (as listed in Table 6.1) need to be covered by coordinated and standardised national and international data collection programmes monitoring both catches and fish stocks in the sea.

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7 Discussion and conclusions

The previous Sections 3-6 provide full details, including recommendations for improvements, and the findings, from this workshop but may be succinctly summarised as follows in Sections 7.1-7.4.

7.1 Baltic Sea Region

For the ICES' catch statistics from 1983-2009 in the Baltic Sea Region as they occur in the FAO FishStat database (Anon 2009; ICES/JRC Task Group D3+ report) there were about 70 different species or species-groups landed and reported. For the 17 stocks assessed by ICES in the Baltic Sea, 14 stocks are assessed using F and SSB metrics comparable to indicators under descriptor 3.1 and 3.2. Out of the seven stocks having full assessment, four achieve green status for fishing mortality (3.1.1) and six stocks achieve green status for spawning stock biomass (3.2.1). For the seven stocks with survey-based trend assessments, only two report on the fishing mortality (3.1.2) out of which one is achieving green status. Concerning standing stock biomass five out of the seven category 3 stocks are presently achieving green status. For the stocks in the Baltic Sea, ICES is not assessing the status of stocks based on size or age structure of the populations according to Criteria 3.3.

7.2 North-east Atlantic Region

Several observations on status are consistent across the four sub-regions in the NEA; namely,

- Migratory pelagic stocks contribute significantly to the landings in each sub-region. Their data status is good, overall, with quantitative assessments against Criteria 3.1 and 3.2 carried out for most stocks. The status of the majority of pelagic stocks in relation to 3.1 and 3.2 is green.
- Around 30% of the demersal stocks have quantitative stock assessments in relation to reference points. For trend-based assessments using survey or commercial CPUEs, methods have not yet been fully established to derive F and SSB proxies in relation to reference points. Overall, just over half of the demersal stocks with quantitative assessments in the NEA have green status in relation to Criteria 3.1 and 3.2.
- Within the shellfish category, *Nephrops* is well assessed in the North Sea and the Celtic Sea but not in the Bay of Biscay/Iberian sub-region. There is an overall deterioration in status for *Nephrops* stocks in the last three years with less than half of the stocks reaching green status in Criterion 3.1 in the last assessment year.
- Elasmobranchs are data poor in each sub-region of the NEA with no stocks having full assessments. Assessments rely primarily on abundance data from surveys and commercial CPUEs. Status in relation to Criteria 3.1 and 3.2 is unknown for most elasmobranch stocks in the NEA but expert judgements based on qualitative evaluation indicate that a large number of stocks are depleted and below any possible biomass reference points. The majority of stocks with abundance trends show increasing trends.
- Most deep-water stocks are in the data poor category.

7.3 Mediterranean Sea Region

Lamentably, there is a weak international survey coordination in this region which has a direct impact on the proportion of stocks assessed achieving GES which is still generally low, when adopting indicators 3.1.1 and 3.2.1. Even though the goal of achieving GES for all commercial species is increasingly recognized as an ambitious objective mostly independent of the management regime applied, there is no agreed strategy and approach to a coherent assessment of GES in the Mediterranean Sea sub-regions. Furthermore, it appears that the available knowledge on the status of the stocks is still poor in some GSAs. There is an urgent need to establish an overarching strategic framework to ensure the coordination of approaches toward GES assessment and monitoring programmes at the Mediterranean Sea regional scale, by collaboration between GFCM, EC and the Barcelona Convention.

7.4 Black Sea Region

The main sources of information used to compile the list of stocks were stock assessment reports, landing statistics and published literature. Of the 25 stocks identified, only nine stocks have been subject to evaluation by STECF. A mere 5 of the 25 important Black Sea stocks are assessed against Criteria 3.1, and one is assessed for the Criteria 3.3. In 2013 the STECF EWG on Black Sea stock assessments assessed nine stocks, but in some the data and results were not reliable to produce advice relevant to F_{MSY}. SSB related reference levels were not estimated in any of the assessed stocks. Fish stocks in the Black Sea Region lack reliable estimates of indicators from research surveys which is due to the history of the development of the DCF in this region.

7.5 Descriptor 3 versus Descriptor 3+

Descriptor 3 for determining Good Environmental Status (GES) under the MSFD is defined as 'Populations of all commercially exploited fish and shellfish are within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock' (Directive 2008/56/EC, Annex I). This definition includes the status of the commercially exploited stocks and the level of pressure of the fishing activity on each specific stock.

Based on this, the Commission Decision 2010/477/EU identified three criteria for this descriptor:

Criterion 3.1 Level of pressure of the fishing activity

Criterion 3.2 Reproductive capacity of the stock

Criterion 3.3 Population age and size distribution.

The first of these describes the mortality caused by fishing, whilst the second describes the state of the commercial stocks in terms of abundance (biomass or SSB). The third acts as a state criterion, and describes the age and size structure which indicates the resilience of a stock to stresses caused by, for example, unfavourable environmental conditions and human activities like fishing.

This shows how the three criteria fulfil the objective of assessing progress towards good environmental status of all commercially exploited fish and shellfish stocks. Taking into account the definition of the Descriptor 3 and its criteria it cannot be defined as a ***fisheries descriptor***. This descriptor is about the status of commercially exploited stocks due to fishing activities.

The impacts of fishing activity on other components of the marine ecosystem are covered under other Descriptors; e.g. by-catch of non-target species (D1) or physical damage to benthic habitats as part of the extent of the seabed significantly affected by human activities for different substrate types (D6).

One activity of the workshop was to take all commercially exploited fish and shellfish stocks into account under D3 and evaluate whether sufficient data are available to assess each against the three criteria – level of pressure of the fishing activity (criterion 3.1), reproductive capacity of the stock (criterion 3.2), and population age and size distribution (criterion 3.3). Additionally, some species may have to be considered under D1 and D4 and this remains an ongoing discussion.

7.5.1 Bottom disturbance data as important and critical part of Descriptor 6 (Sea floor integrity)

Showing the proportion of the surface area (possibly per habitat) affected by trawling. This could involve one or all of the three indicators based on VMS that the European Union adopted as part of their Data Collection Framework (DCF) and that describe the distribution and spatial extent of fishing as well as its impact on the seafloor (CEC, 2008):

Indicator (1) Distribution of fishing activity;

Indicator (2) Aggregation of fishing activity; and

Indicator (3) Areas not impacted by mobile bottom gears.

Indicator (3) contributes as essential basic information for D6 seafloor integrity as the proportion of area not impacted but could also be used as an indicator of state. For the development of measures, it is necessary to have this information separately within the overall D6 indicator. The first two indicators are clearly pressure indicators.

All of the three listed suggestions cannot be considered as indicators in their own right. From the view of the required measures it is necessary to have this information as such. From the view of the status it is necessary to have the information of all sea floor pressures; e.g. in the North Sea - sand and gravel extraction, and in the Baltic Sea - temporal or permanent oxygen depletion areas. This additional information is necessary for a comprehensive status description within the overall D6 indicators and well-informed decisions on measures.

7.6 Further development of criterion 3.3

Commission Decision 2010/477/EU noted that indicators which reflect the relative status of the population age and size distribution need to be determined by scientific judgement. Suggestions in the directive include the proportion of fish larger than the mean size of first sexual maturation, the mean maximum length across all species found in research vessel surveys, the 95% percentile of the fish length distribution observed in research vessel surveys and size at first sexual maturation (representing the extent of undesirable genetic effects of exploitation).

None of the indicators have been evaluated and reviewed across functional groups and stocks and no reference levels agreed, therefore no classification with respect to criterion 3.3 has been considered in this report.

ICES WKMSD3 previously discussed the practical application of the directive descriptors, suggested approaches to calculating them and highlighted potential problems. At this meeting additional metrics were suggested for evaluation:

Indicator: Mean length of 5% largest fishes.

Abbreviation: $L_{max5\%}$

Reference point: Comparison to long-term statistic (e.g. arithmetic mean or a predefined percentile) of the available time series.

This indicator is a derivation of L_{max} and was proposed by Probst et al. (2013a) in order to represent the right side of the length–frequency distribution (representing the abundance of the largest individuals). The indicator was designed to be independent to fluctuations in the abundance of smaller individuals due to variability in recruitment and therefore is considered to better represent the absolute abundance of large, old individuals than other size-based indicators (SBI) (Probst et al., 2013b). It is important to mention that the 5% refer to fixed number of individuals that remains constant between years and refers to the average observed annual catch throughout the reference time period.

It was mentioned by members of the workshop that this indicator may not be representative of size/age structure of the entire stock, as the largest individuals are often outliers in length or age histograms. Furthermore the proposed reference point is not linked to the biology of the stock.

Indicator: Weighted mean length in commercial catches.

Abbreviation: L_{mean}

Reference point: Length where 90% of the individuals or females have reached maturity (L_{m90}).

Lmean is a pressure and a state indicator. It indicates the size targeted by fishing as well as the length structure in the exploited part of the stock, as represented by weighted mean length. The reference point Lm90 refers to the length where 90% of females or individuals have reached maturity (Froese and Sampang, 2013) and a good environmental status is thus only achieved if the Lmean/Lm90 ratio is above 1.0. Technically the calculation and assessment of this indicator is feasible for fully assessed stocks. L_{m90} is available from the DATRAS data base, the mean length in commercial catches can be calculated from weight at age and numbers at age in the catch. For stocks which do not have good sampling coverage of commercial catches the estimation of the mean length in the commercial catch could be problematic.

Indicator: First age class which is fully fished (Aff).

Abbreviation: Aff

Reference point: Amat95 is the age class where at least 95% of the individuals have reached maturity. A good environmental status is achieved if the ratio Aff/Amat95 is at least 1.0, i.e., at least 95% of the individuals in the first age class that is fully fished have reached maturity. This indicator is a pressure indicator which is related to the proportion of mature individuals in the first fully fished age class. Data are readily available for most fully assessed stocks, e.g. in the ICES Stock Summary DB or in the full expert reports. For other stocks the proportion of mature individuals by age class can be obtained from DATRAS. However, an estimate of the first fully fished age class is needed for these stocks.

An initial approximation to the determine the indicator, the first age in the Fbar range was used. However, it was noted that this is a working group specific range, based on the ages which the group thinks provide the best indication of the dynamics of the fishery. It is not based on selection or stock characteristics and therefore will require further development where selection data is available.

A first attempt to calculate this indicator for 12 stocks has been assembled during the meeting. For only two of these stocks (Baltic sprat and whiting in the Celtic Sea) Aff was similar to Amat95. Though this analysis is preliminary, it is already evident that selection patterns are important to reach GES under criterion 3.3 (Brunel and Piet, 2013).

Table 7.1: Illustrative estimation of Aff/Amat95 for 12 stocks from three ecoregions of ICES.

FishStock	EcoRegion	Amat95	Aff	GES
cod-2532	Baltic	6	4	No
her-3a22	Baltic	5	3	No
spr-2232	Baltic	3	3	Yes
cod-scow	Celtic Sea and West of Scotland	4	2	No
had-rock	Celtic Sea and West of Scotland	3	2	No
had-scow	Celtic Sea and West of Scotland	3	2	No
whg-scow	Celtic Sea and West of Scotland	2	2	Yes
had-34	North Sea	5	2	No
her-47d3	North Sea	4	2	No
ple-nsea	North Sea	4	2	No
sai-3a46	North Sea	7	3	No
sol-nsea	North Sea	3	2	No
whg-47d	North Sea	3	2	No

Indicator: Mean length in surveys.
Abbreviation: L_{meanS}
Reference point: The length L_{optZ} where cohort biomass reaches its maximum under fishing with $F=F_{msy}$.

The reference length where a fished cohort reaches its maximum biomass can be obtained from a modification of Holt's L_{opt} formula as $L_{optZ} = L_{inf} * 3 / (3 + Z / K)$ where L_{inf} and K are parameters of the von Bertalanffy growth equation and $Z = M + F_{msy}$. For data-limited stocks, M can be used as a proxy for F_{msy}, as is done e.g. in NOAA stock assessments for Tier 5 stocks (NOAA 2013, page 17). The mean length in surveys is a status indicator depending on the length frequency distribution above a certain threshold length. Determining the most appropriate threshold length L_c needs more research. A possible candidate can be obtained as rearrangement of the B&H mean-length-in-catch equation, with $L_c = L_{meanS} + K * (L_{meanS} - L_{inf}) / Z$. Alternatively, L_c can be determined iteratively assuming equilibrium conditions. Neither L_{meanS} nor L_{optZ} or L_c should fall below the length where 90% of individuals have reached maturity.

7.6.1 Recommendation

WKD3R concluded that in order to review the newest developments, further develop, evaluate the indicators and reference points against real data and simulation test against potential D3.3 indicators, either a dedicated workshop on size- or age-based indicators should be convened or the next WKLIFE/WGMG meetings have an appropriate ToR to address these issues. The workshop/WKLIFE/WGMG ToR should perform assessments based on suggested indicators to compare their effectiveness in indicating pressure on or status of size/age structure.

7.7 References in cited in Section 7

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Annex B: Recommendations to ICES

Recommendation	For follow up by:
Section 2.1 (Introduction): With the benefit of hindsight, the time scheduled for the meeting was too short and if future evaluations are undertaken then more time should be allowed for completion of work and the compilation of a final report.	ACOM
Section 6.3 (Black Sea Region): It will be appropriate to assess the status of sturgeons under both D3 and more appropriately, under the biodiversity descriptor D1.	ACOM
Section 7.6.1 (Further development of Criterion 3.3): WKD3R concluded that in order to review the newest developments, further develop, evaluate the indicators and reference points against real data and simulation test against potential D3.3 indicators, either a dedicated workshop on size- or age-based indicators should be convened or the next WKLIFE meeting have an appropriate ToR to address these issues. The workshop/WKLIFE/WGMG ToR should perform assessments based on suggested indicators to compare their effectiveness in indicating pressure on or status of size/age structure.	ACOM WKLIFE WGMG