

ECOREGION **General advice**

SUBJECT **EU request on draft recommendations for the assessment of MSFD Descriptor 3**

Advice summary

ICES advises a common approach comprising four steps for the assessment of MSFD Descriptor 3 (EU, 2010) which represents a logical framework for the evaluation of good environmental status (GES) for commercially exploited fish and shellfish stocks. The four steps include 1) prepare a list of commercially exploited fish and shellfish stocks, 2) catalogue and document available information for each of the selected stocks, 3) evaluate the stock performance against MSFD Descriptor 3 criteria, and 4) determine the overall status by MSFD region/subregion.

In addition, ICES offers a number of generic recommendations to facilitate the consistent evaluation of MSFD Descriptor 3 across the MSFD regions (the Baltic Sea, the Northeast Atlantic Ocean, the Mediterranean Sea, and the Black Sea) and to address identified gaps.

Request

'Draft recommendations for the assessment of descriptor 3, as e.g. the monitoring recommendations (strategic document and technical annexes) <https://circabc.europa.eu/d/a/workspace/SpacesStore/6902dba0-53e4-4cf4-8483-689fc1daffdb/Recommendation%20for%20monitoring%20-%20202%20May%202013.doc> 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 Paris, 9-10 April 2013, Brussels), the outcome of the CFP reform, the application of the precautionary principle and the results of the MSFD Article 12 report. ICES should also provide and implement a consultation process plan of the draft recommendations'

ICES advice

1. Context and background

The European Commission (DG ENV) has requested ICES to draft recommendations for the assessment of Descriptor 3 (also referred to as D3 – all commercial fish and shellfish). The advice is based on the outcome of the WKD3R workshop, held at ICES Headquarters, 13–17 January 2014. The workshop was attended by experts from EU member states covering the MSFD regions Baltic Sea; Northeast Atlantic Ocean, including the subregions North Sea, Celtic Sea, Bay of Biscay and Iberian Coast; Macaronesia; the Mediterranean Sea; and the Black Sea and provided a platform to progress the assessment methodology on Descriptor 3 and draft recommendations. The workshop developed a common approach or “roadmap” for the assessment of Descriptor 3, which involves four distinct steps:

Step 1 – Prepare a list of commercially exploited fish and shellfish stocks in the relevant marine region, to be used for the assessment of Descriptor 3, and provide the rationale for the selection of stocks.

Step 2 – Catalogue and document the available information for each of the stocks selected for the Descriptor 3 assessment.

Step 3 – Evaluate the stock status against the three GES criteria mentioned in EC Decision 2010/477/EU (EU, 2010), i.e. criterion 3.1 (level of pressure of the fishing activity), criterion 3.2 (reproductive capacity of the stock), and criterion 3.3 (population age and size distribution) by stock and species-functional group (i.e. pelagic, demersal/benthic, shellfish, elasmobranch, deep-water).

Step 4 – Determine the overall status and identify issues, problems, gaps, and links to other MSFD descriptors (e.g. D1 – Biodiversity and D4 – Foodwebs), together with any additional monitoring needs.

The individual steps are described in detail below.

The common approach was applied to the four MSFD regions in order to harmonize the Descriptor 3 assessment process between different geographical regions and EU Member States, thereby ensuring comparability and coherence. The detailed outcome of the Descriptor 3 assessments by MSFD region is presented in the WKD3R report (ICES, 2014).

To implement the requested consultation process plan, ICES sent the draft workshop report on 3 February 2014 to all members of the DG ENV MSCG group with an invitation to provide comments before 26 February 2014. Two Member

States responded; one expressed satisfaction with the report and the other provided some substantive comments. Issues relevant to the advice request have been addressed in this document and, in addition, ICES has provided the comments received from the Member States and ICES remarks in a separate consultation document to DG ENV.

It should be noted that the assessments of stock status were based on reference points derived from single-species stock considerations and not on multispecies or mixed-fisheries considerations. Assessment of the stock status against the latter would require policy guidelines on objectives and priorities on trade-offs between stocks and fisheries.

2. Step 1. Selection of stocks for Descriptor 3

Descriptor 3 applies for all the stocks covered by the Data Collection Framework (DCF) as described in Council Regulation (EC) No. 199/2008 (within the geographical scope of Directive 2008/56/EC) and similar obligations under the Common Fisheries Policy.

The identification of commercial stocks is the first step to undertake in order to conform to the MSFD Descriptor 3. This was conducted for each of the MSFD regions and subregions. A common approach was followed for the Baltic Sea region and for the Northeast Atlantic region, by selecting the stocks that are internationally assessed by either ICES or ICCAT and cross-referencing them with the stocks that represent 99% of the total landings by weight. A comparison to DCF stocks was carried out previously by ICES (ICES, 2012b).

In the Mediterranean, different selection rules were adopted by the four EU Member States represented at the workshop, either depending on the criteria assessed or in terms of the proportion of landings covered. The discrepancies in the criterion for selecting the number of stocks in the Mediterranean need to be addressed to ensure that similar approaches for MSFD Descriptor 3 are applied to all selected commercial stocks.

In the Black Sea, 25 commercial species cover 100% of the reported landings (2000–2010).

While the selections of species in the MSFD regions were made on the basis of landed weight, it is noted that ranking stocks by the commercial value of the landings would be a valid alternative to retain small stocks which are subject to intense targeting because of high resale value.

i. Gaps

1. The rules for selecting stocks for Descriptor 3 applied by Member States are not identical across all Member States.
2. Aggregation of current and/or historical information on landings across several species can hamper the selection process of stocks (landings not registered by species but by group of species, such as skates and rays).

ii. Recommendations

1. The Member States' lists of commercial stocks should first be derived at the MSFD regional (subregional in the case of the Northeast Atlantic) level by including stocks that are assessed at the international level.
2. In addition to the internationally assessed stocks, there may be several fish and shellfish stocks that are important for small-scale/local coastal fisheries on a regional or national scale. Member States should identify these stocks and add them to their national list.
3. It should be ensured that the list set up in accordance with point 1 and 2 covers a very high proportion of the landings (e.g. >90%) in weight.
4. The selection of stocks based on the ranking of the landings by weight (or commercial value) should be applied using the longest available time-series in order to also include depleted stocks that in the past had much larger landings. Extirpated species should not be included but would be covered under Descriptor 1.

3. Step 2. Cataloguing and documenting available information for each selected stock

Once the selection of commercial fish and shellfish stocks has been made in the relevant MSFD (sub)region, there is a need to catalogue and document the available stock information in order to perform the Descriptor 3 assessment.

The available information on stock assessment and advice compiled by ICES, STECF, GFCM, ICCAT, and the Black Sea Commission should be catalogued in one of ICES six stock categories listed below:

- **Category 1** – Stocks with quantitative assessments
This type of stock can be considered in two sub-categories: a) stocks having several year classes contributing to the fishery, including stocks with full analytical assessments and forecasts as well as stocks with quantitative assessments based on production models; and b) short-lived species stocks with quantitative assessments. These are the stocks that have short life cycles with catches dominated by single year classes. They are not considered data-limited and this category includes stocks with full analytical assessments and forecasts as well as stocks with quantitative assessments based on production models.
- **Category 2** – Stocks with analytical assessments and forecasts that are only treated qualitatively
This category includes stocks with quantitative assessments and forecasts that, for a variety of reasons, are considered indicative of trends in fishing mortality, recruitment, and biomass.
- **Category 3** – Stocks for which survey-based assessments indicate trends
This category includes stocks for which survey indices (or other indicators of stock size such as reliable fishery-dependent indices, e.g. *l*_{pue}, *cpue*, and mean length in the catch) are available, providing reliable indications of trends in stock metrics such as total mortality, recruitment, and biomass.
- **Category 4** – Stocks for which only reliable catch data are available
This category includes stocks for which a time-series of catch data can be used to approximate maximum sustainable yield (MSY).
- **Category 5** – Landings-only stocks
This category includes stocks for which only landings data are available.
- **Category 6** – Negligible landings stocks and stocks caught in minor amounts as bycatch.

Category 1 stocks are the so-called data-rich stocks, whilst those in the Categories 2–6 are referred to as data-limited stocks (ICES, 2013).

Information on MSY reference points, exploitation (F) rates, and biomass (SSB) for recent years is available for stocks under Category 1 and can be compiled from the most recent international assessments and advice summaries.

i. Gaps

For stocks in Categories 2 to 6, information on F and SSB in relation to MSY reference points is not generally available. For some of the stocks in these categories, trends in indicators (survey, catch rates, etc.) and/or expert judgement can be used to provide a qualitative estimation of the exploitation status and biomass against reference point proxies. This information can be used in the Descriptor 3 assessment, when available.

ii. Recommendations

For the selection of commercial fish and shellfish stocks in the relevant marine (sub)region, assign each stock to one of the six ICES stock categories and collate either the MSY reference points or the MSY proxies for undertaking the Descriptor 3 assessment. For stocks in Category 6, evaluate whether each stock should be assessed under Descriptor 3 or more appropriately, under the biodiversity Descriptor D1 when the level of catch has historically been low. If low catches are likely to be due to low stock abundance, the stock should be considered under Descriptor 3.

4. Step 3. Assessing status

The Commission Decision 2010/477/EU (EU, 2010), describes three criteria and their methodological standards for MSFD Descriptor 3 (D3):

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

i. Criterion 3.1 – Level of pressure of the fishing activity

Criterion 3.1 relates to fishing pressure and states that “achieving or maintaining good environmental status requires that F values are equal to or lower than F_{MSY} ”.

For most of the so-called data-rich stocks (ICES Category 1) quantitative estimates of exploitation rates relative to F_{MSY} (or a proxy it) are available. For these stocks the assessment of Descriptor 3 should be carried out using the primary indicator for the level of pressure of the fishing activity (3.1.1). A stock can be classified as fulfilling Criterion 3.1 (i.e. “green status”) if fished at or below the MSY reference.

Data-limited stocks (referred to as DLS; ICES Categories 2–6) generally lack assessment of fishing mortality and estimates of F_{MSY} reference points. However, where qualitative assessments have been conducted, these results should be used. Most of the DLS stocks are in ICES Category 3 and use survey data or commercial cpue to describe trends; only very few stocks have sufficient data available to estimate whether the stock status is below or above MSY reference points.

For data-limited stocks in Categories 2 to 5, the catch/biomass ratio (secondary indicator 3.1.2), should be used for the assessment of stock status (in terms of exploitation rate) under Criterion 3.1. For those stocks for which time-series of survey data or standardized commercial cpue are considered a reliable index of stock biomass, the secondary indicator can be used. While this is only indicative of trends, further exploration would be required to determine how appropriate reference levels should be set. For the time being, it is possible to provide an indication of partial fulfilment of Criterion 3.1 by assessing stocks using short-term trends with respect to long-term historical development.

ii. Criterion 3.2 – Reproductive capacity of the stock

Criterion 3.2 relates to the reproductive capacity of the stock and the EC Decision (EU, 2010) states that “any observed SSB value equal to or greater than SSB_{MSY} is considered to meet this criterion”.

Even when a stock is fished at a constant F value, the SSB will fluctuate due to natural factors. For most data-rich stocks, assessed with analytical methods, information on the lower bound of SSB fluctuations around B_{MSY} (e.g. $MSY B_{trigger}$ for ICES stocks) is available to be used as a reference level for Criterion 3.2. ICES considers a stock fulfils the criterion (“green status”) if the spawning-stock biomass is above $MSY B_{trigger}$.

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 of the stocks assessed by ICES as $MSY B_{trigger}$ even though B_{pa} and $MSY B_{trigger}$ correspond to different concepts. Therefore, $MSY B_{trigger}$ marks the lowest boundary associated with SSB_{MSY} , and in practice this is set as the border of safe biological limits (B_{pa}).

For data-limited stocks (Categories 2–6), quantitative data on SSB in relation to reference points are not available. 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 biomass against reference points. This should be used where available. It is possible to provide an indication of partial fulfilment of the Criterion 3.2 by assessing stocks using short-term trends with respect to long-term historical development.

An FAO technical report on data-poor methods testing (Rosenberg *et al.*, 2014) provides important results in the context of this request. The report is based on the result of an FAO organized working group to test four candidate data-limited methods, divided in empirical and catch-based methods. A simulation testing framework was developed to assess the four potential data-limited models. The results suggested that Catch- MSY , a catch-based method, was the best performer, although the different models performed similarly in many cases. Catch- MSY was more effective in estimating status over short time scales and could be particularly applicable for use in countries where data time-series are shorter. Harvest dynamics was the most important explanatory variable in determining performance, which emphasizes the importance of having accurate information on total removals and fishing effort.

iii. Criterion 3.3 – Population age and size distribution

Obtaining an indicator and a reference point for an age structure that fulfils Criterion 3.3 was found to be challenging.

Criterion 3.3 relies on the concept of a healthy size/age structure of the stocks, and it is not essential to assess the exploitation status of resources in terms of pressure (F) and status (SSB). However, it provides the ability to track biological improvements in stock development, although possibly with a time delay, as MSY-based management is achieved, and has also utility where stock status and exploitation rate information are unavailable.

Although exploratory analyses were considered during the WKD3R workshop, none of the indicators have been evaluated and reviewed across stocks and functional groups and no reference levels agreed. Therefore, no assessment with respect to Criterion 3.3 has been considered.

Within the current reform of the CFP, management is with respect to Criteria 3.1 and 3.2 and as such, Criterion 3.3 may not be essential in the short term. There is a need for further work to select and define indicators and associated reference levels for Criterion 3.3 that respond to changes in the populations subject to fishing.

iv. Species groupings

Evaluation of good environmental status (GES) by species groupings that share similar life-history traits and/or fishery characteristics can be instructive in terms of identifying generic data and/or commercial fishery issues that could be addressed in order to improve the assessment of GES status. For the purpose of assessment of Descriptor 3, which relates to commercial fisheries, five species groupings were found to be widely relevant. They include the demersal/-benthic, pelagic (including tunas), shellfish, elasmobranchs, and deep-water stocks. Other relevant groupings could encompass the diadromous and freshwater species.

While these are not strictly functional groupings, there are a number of commonalities that make this classification useful. For example, demersal stocks are targeted by similar gears and often the object of mixed fisheries, pelagic stocks are targeted by specific fisheries and are often forage species, while elasmobranchs are generally bycatch species with low fecundity.

v. Gaps

1. Many stocks are in the ICES Categories 2–6 and information on F and SSB reference points or proxies are not available; thus it is not possible to establish current fishing mortality and/or reproductive potential levels relative to MSY. Proxies are being developed and investigated (ICES, 2014).
2. Generic gaps, such as the comparability of data from different years and different countries due to varying survey protocols, gears, and coverage that have been identified as affecting the assessment of GES on an individual species level will also affect the assessment of GES on a species grouping basis.
3. For a number of stocks, a lack of suitable monitoring programmes and insufficient knowledge of stock structure have hampered further progress in the assessments.
4. Some shellfish stocks such as scallops, brown crab, and some cephalopod species in the Northeast Atlantic are part of international fisheries. The lack of an international assessment framework for these species is a clear gap.
5. There has so far been weak international coordination to develop a coherent and harmonious framework for the assessment of MSFD Descriptor 3 in the Mediterranean ecoregions. This hampers the regional assessment of GES by species as well as by species groupings.
6. In the Black Sea, large parts of the stocks' distribution areas lay along the coasts of Georgia, Russian Federation, Turkey, and Ukraine, i.e. outside EU territorial waters and, as such, the existing monitoring data does not allow for a proper evaluation of the indicators for some of the stocks that are distributed in the entire Black Sea.

vi. Recommendations

1. For MSFD stocks for which there is no assessment of stock status but for which data is available, a priority ranking should be developed where landings/value and vulnerability (derived from a Productivity and Susceptibility Analysis (PSA)) are used jointly. Such analysis would provide a road map indicating how to fill the main gaps in stock status knowledge in order to assess the criteria of MSFD Descriptor 3.
2. An overarching framework should be established to ensure the coordination of approaches for the assessment of GES for Descriptor 3 at the Mediterranean Sea regional scale.
3. Demersal and pelagic research surveys, as well as other relevant data collection programmes for the entire Black Sea basin should be internationally coordinated and information from these processed and stored in standardized formats to facilitate the estimation of the Descriptor 3 indicators.
4. For data-limited stocks in the Mediterranean and Black seas currently lacking assessment methods, the data-limited stocks approaches developed by ICES should be considered for application.
5. For Criterion 3.2, ICES recommends that the methods in the FAO report (Rosenberg *et al.*, 2014) should be considered to fulfil the needs for ICES Categories 4 and 5 stocks.

6. ICES recommends that a review of methods to assess Criterion 3.3 and the utility of the indicators and the associated reference points is conducted in order to compare their effectiveness in indicating pressure on status of size/age structure.
7. Under Criterion 3.3, ICES concurs with Zampoukas *et al.* (2014) and recommends not using indicator 3.3.2 (mean maximum length across all species) as this is a community indicator and does not address Criterion 3.3.
8. Under Criterion 3.3, ICES has previously recommended to not use indicator 3.3.4 (size at first sexual maturation) as targets cannot be set, trends are not linked to a clear consequence or benefit, and management response to achieve targets are not defined (ICES, 2012b).
9. Under Criterion 3.3, it is recommended that the remaining available indicators (indicators 3.3.1 and 3.3.3) should be monitored for trends while their utility is being investigated (Piet *et al.*, 2010).

5. Step 4. Overall status

ICES is at this stage not in a position to advise on an overall status of Descriptor 3 by MSFD regions/subregions in relation to GES. Determination of the overall status of Descriptor 3 requires policy choices of the aggregation methods across stocks and criteria for how this relates to the progress towards GES (ICES, 2012b). Further work is required before an assessment of Criterion 3.3 can be made.

ICES (2014) conducted an illustrative assessment on individual stocks and by functional groups using Criteria 3.1 and 3.2. The results are given below by region.

Baltic Sea Region: ICES catch statistics from 1983–2009 in the Baltic Sea region as they appear in the FAO FishStat database show about 70 different species or species-groups landed and reported. Of the 17 stocks assessed by ICES in the Baltic Sea, 14 stocks are assessed using F and SSB metrics comparable to indicators under Criteria 3.1 and 3.2. Out of the seven stocks having full assessment (i.e. in ICES stock Category 1), four achieve GES (green status) for fishing mortality (indicator 3.1.1) and six stocks achieve green status for spawning-stock biomass (indicator 3.2.1). For the seven stocks in Category 3 (ICES stock categories), only two report on fishing mortality, one of which is achieving green status. Concerning stock biomass, five of the seven Category 3 stocks are presently increasing. 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 Criterion 3.3.

Northeast Atlantic Region: Several observations on status are consistent across the four subregions in the Northeast Atlantic; namely:

Migratory pelagic stocks contribute significantly to the landings in each subregion. There is good data availability 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 Criteria 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 Northeast Atlantic have green status in relation to Criteria 3.1 and 3.2.

Within the shellfish category, *Nephrops* stocks are mostly in Category 1 (ICES stock categories) in the North Sea and the Celtic Sea, but not in the Bay of Biscay/Iberian subregion (where they are in Category 3). The status for *Nephrops* stocks has deteriorated overall 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 subregion of the Northeast Atlantic with no stocks (except spurdog) 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 Northeast Atlantic, but expert judgements based on qualitative evaluation indicate that a large number of stocks are depleted and below any possible biomass reference points. However, the majority of stocks with abundance trends derived from surveys show an increasing trend.

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

Mediterranean Sea Region: The high fragmentation of assessments by geographical subarea (GSA) and the low number of assessment working groups has a direct impact on the proportion of stocks assessed. Consequently, assessment of GES is only available for a low number of stocks using indicators 3.1.1 and 3.2.1. Even though the goal of achieving GES for all commercial species is increasingly recognized as an objective, there is a need for an agreed strategy and approach to a coherent assessment of GES in the Mediterranean Sea subregions. 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 the associated

monitoring programmes at the Mediterranean Sea regional scale, by collaboration between Member States and GFCM, and with support from EC-STEFCF 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. Five of the 25 important Black Sea stocks are assessed against Criterion 3.1, and one is assessed for Criterion 3.3. In 2013 the STECF assessed nine stocks, but for some of the stocks data and results were not reliable to produce assessment. SSB-related reference levels were not estimated for most of the assessed stocks.

6. Presentation of results

ICES considered the best way to present, in an easily understandable way, the results of the Descriptor 3 assessments of stock status relative to the three criteria at regional level. In this initial examination, three approaches, which could be complementary, were identified. It is noted that other result presentation options could be explored and developed. Optimal presentation options would best be determined through dialogue with policy-makers and the relevant audience. The options examined are illustrated below.

Regional maps with circles

An example from the Northeast Atlantic is presented in Figure 1.5.2.1.1 for indicators 3.1.1 (F) and 3.2.1 (SSB). Circle size is proportional to the absolute value of $(F-F_{MSY})/F_{MSY}$ and $(SSB-MSY B_{trigger})/(MSY B_{trigger})$ respectively, the circle colour indicates whether the current F is above (red) or below (green) the reference F_{MSY} and, for SSB whether the current SSB is above (green) or below (red) the reference trigger SSB. The advantage is that the overall status can easily be compared between regions. The disadvantage is that the location of the circles can easily be misunderstood as an indication of the geographical location of stocks – particularly in areas with many stocks such as in the Mediterranean.

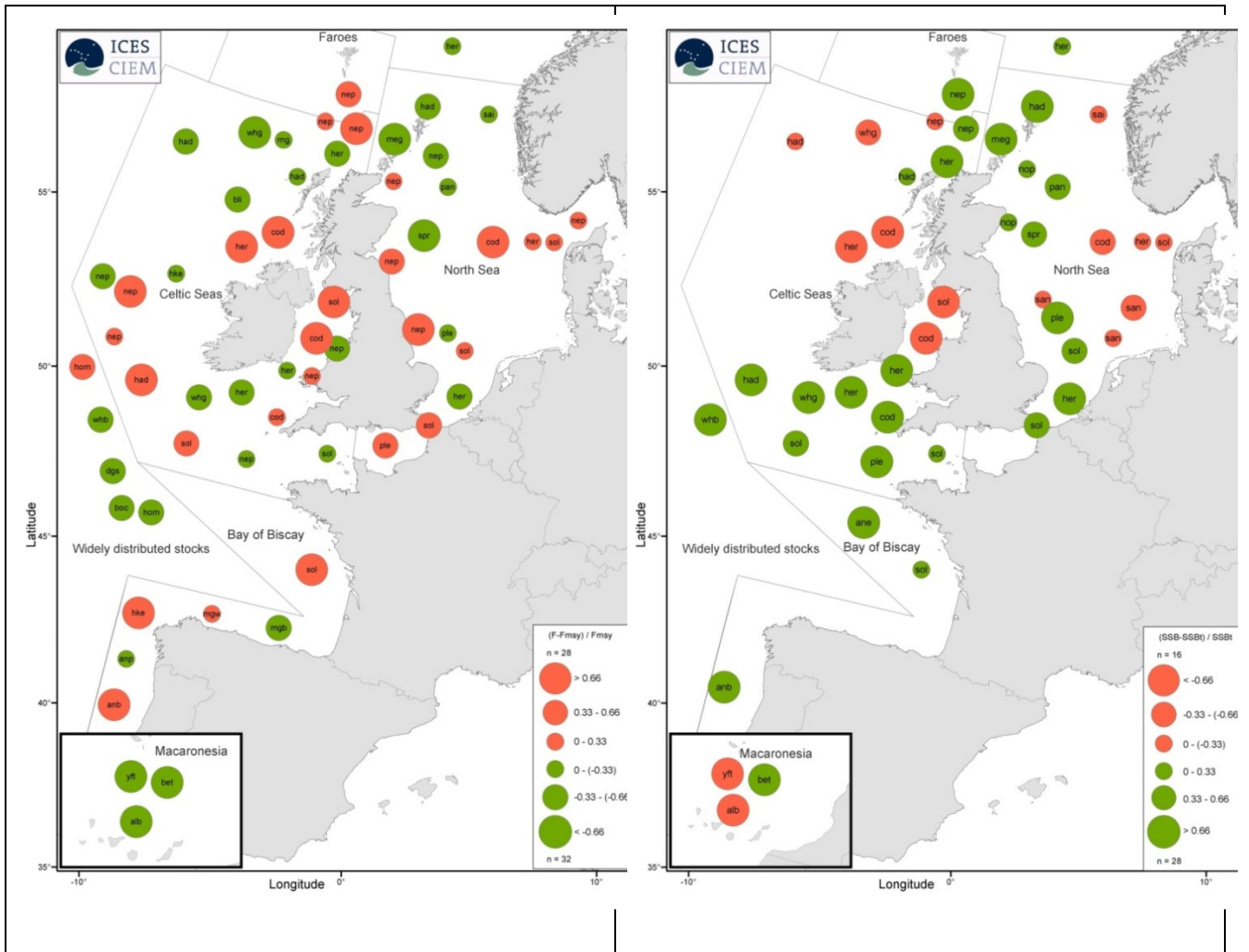


Figure 1.6.2.1.1

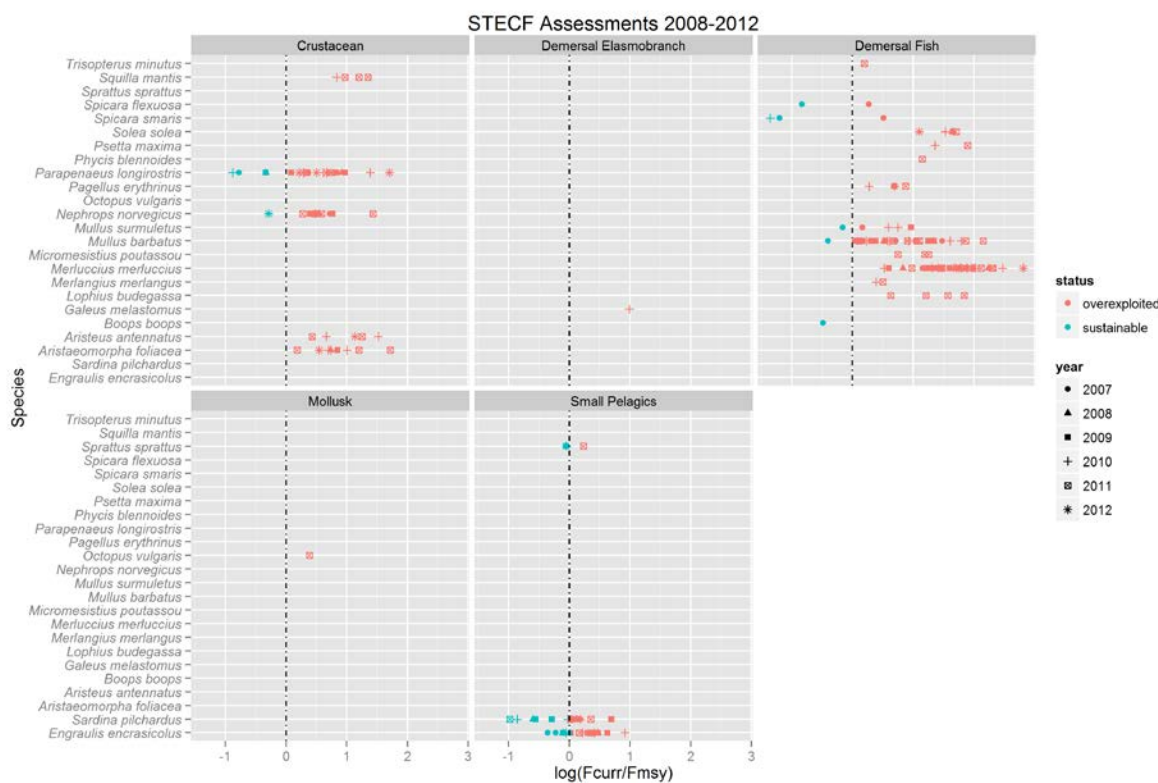
Status of Northeast Atlantic stocks relative to quantitative reference points based on the latest available assessments. Figures based on (Fernandes and Cook, 2013) and modified by the ICES Data Centre. (Note: the location of the circle is only representative of the general geographical location of the stock (e.g. North Sea, Celtic Sea, etc.)) **Left panel:** Status of the current fishing mortality (F) in relation to target reference mortality (F_{MSY}) for 60 Northeast Atlantic stocks with quantitative reference points. Circle size is proportional to the absolute value of $(F - F_{MSY}) / F_{MSY}$. Circle colour indicates whether the current F is above (red) or below (green) the reference F_{MSY} . 'n' indicates the number of stocks above and below the reference point respectively. Macaronesia subarea (in the Canary Islands) shows data for three tuna stocks with quantitative assessment in ICCAT. **Right panel:** Status of the current adult biomass (SSB) in relation to target reference $MSY B_{trigger}$ ($SSBt$) for 44 Northeast Atlantic stocks with quantitative reference points. Circle size is proportional to the absolute value of $(SSB - SSBt) / SSBt$. Circle colour 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 three tuna stocks with quantitative assessment in ICCAT.

Table format

A second option is taken from the multi-panel stacked plots produced in Osio and Cardinale (2013) for presenting the overall status of Mediterranean stocks. Here the assessed stocks are listed on the y-axis while the x-axis shows the logarithm of the ratio between F_{curr} and F_{MSY} in each year for which an assessment is available. The status of the stocks can be easily picked up by the colour coding (red for overexploited, green for sustainably exploited) and the position in respect of the vertical line, set at $x = 0$, separating sustainable fishing from overexploitation. The stocks are grouped by five functional groups to convey the message over the more problematic groups in terms of exploitation as well as in number of assessments.

Such plots could be applied, by MSFD Region, to Criteria 3.1 and 3.2. For Criterion 3.3 a similar structure could be applied to display trends, with a positive trend shown as “+” and a negative trend as “-“. It would be advisable to incorporate only the last year of assessment or the last updated assessment to reduce the number of dots by year and have a snapshot of the most updated status.

Table 1.6.2.1.1 Overall status for Mediterranean stocks by functional groups based on 2008–2012 assessments. Red indicates overexploited and green indicates sustainably exploited. The position in respect of the vertical line, set at $x = 0$ separates sustainable fishing from overexploitation (from Osio and Cardinale, 2013).



Pie charts

An example of F relative to F reference points for all MSFD regions (including Northeast Atlantic subregions) is shown in Figure 1.5.2.1.2. Circle size is proportional to the total number of stocks, green represents the proportion of stocks with F in 2012 at or below F_{MSY} , and red represents the proportion of stocks with F above F_{MSY} . Grey is the proportion of stocks where F relative to F_{MSY} is unknown. The proportion of stocks in relation to F_{MSY} is put into context to the number of unknown stocks; however, there is no presentation of how far the stocks are from F_{MSY} . Qualitative assessments and/or trend assessments are also not presented in this plot.

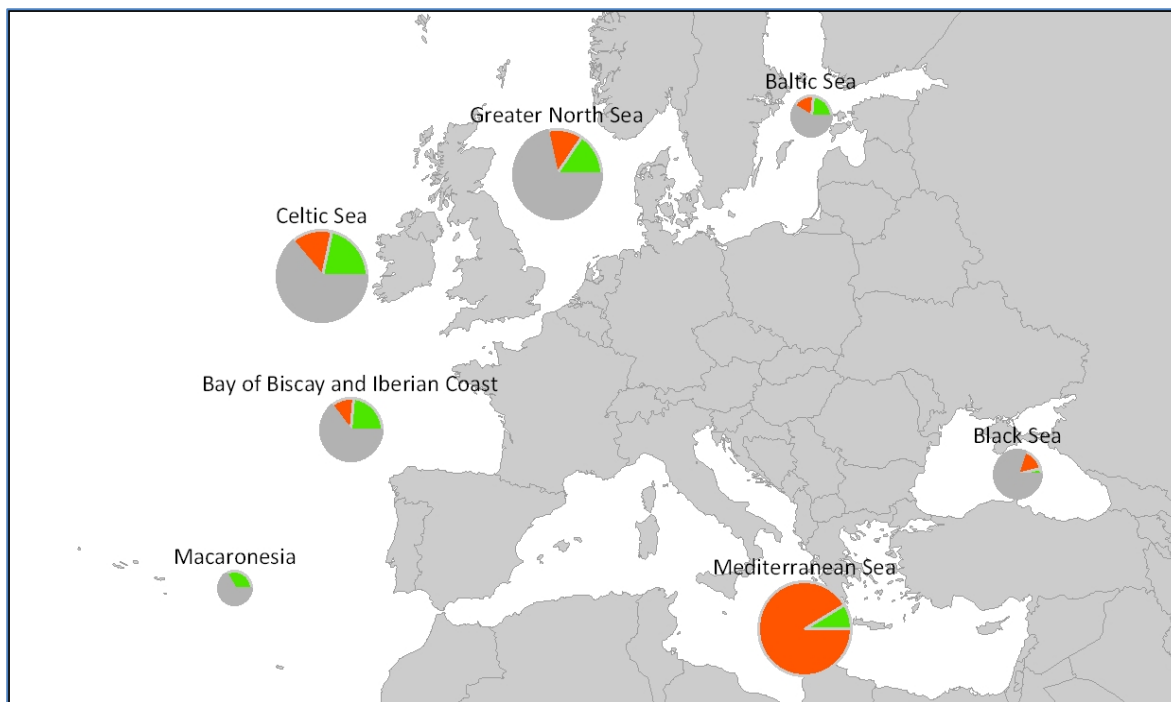


Figure 1.6.2.1.2 Assessment of F relative to F reference points for all MSFD regions (including Northeast Atlantic subregions) based on the latest available assessments. Circle size is proportional to the total number of stocks, green represents the proportion of stocks with F in 2012 at or below F_{MSY} , and red represents the proportion of stocks with F above F_{MSY} . Grey is the proportion of stocks where F relative to F_{MSY} is unknown. Mediterranean stocks only include stocks with F assessed against F_{MSY} reference points. No estimate of % of unknown stocks available.

7. Future collaboration

Based on the present advice an annual evaluation of the international commercial fish and shellfish stocks for which assessments and advice are provided by ICES, STECF, GFCM, ICCAT, and the Black Sea Commission could be undertaken. However, further work is needed to provide advice on GES based on the stock-based assessments. This will require dialogue with policy-makers on criteria for GES. ICES workshop (ICES, 2014) demonstrated that this is feasible for the four marine regions of MSFD (Baltic Sea, Northeast Atlantic Ocean, Mediterranean Sea, and Black Sea) and further collaboration would be welcomed.

8. Sources

- Brunel, T., and Piet, G. J. 2013. Is age structure a relevant criterion for the health of fish stocks? *ICES Journal of Marine Science* 70(2): 270–283.
- EU. 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.
- Fernandes, P G., and Cook, R. M. 2013. Reversal of Fish Stock Decline in the Northeast Atlantic. *Current Biology* 23, 1432–1437.
- Froese, R., and Sampang, A. 2013. Potential Indicators and Reference Points for Good Environmental Status of Commercial Exploited Marine Fish and Invertebrates in the German EEZ. World Wide Web electronic publication, available from <http://oceanrep.geomar.de/22079/>.
- ICES. 2012a. ICES Implementation of Advice for Data-limited Stocks in 2012 in its 2012 Advice. ICES CM 2012/ACOM:68. 42 pp.
- ICES. 2012b. ICES MSFD Descriptor 3 report. Marine Strategy Framework Directive – Descriptor 3+. ICES CM 2012/ACOM:62.
- ICES. 2013. General context of ICES advice. *In* Report of the ICES Advisory Committee, 2013. ICES Advice 2013. Book 1, Section 1.2.1.
- ICES. 2014. Report of the Workshop to draft recommendations for the assessment of Descriptor 3 (WKD3R), 13–17 January 2014, Copenhagen, Denmark. ICES CM 2014/ACOM:50. 148 pp.
- Osio, C., and Cardinale, M. 2013. Status of Mediterranean and Black Sea resources in European Waters in 2013. European Parliament, PECHÉ Committee, public hearing on Evaluation of the Mediterranean Fisheries Regulations.

- Piet, G. J., Albella, A. J., Aro, E., Farrugio, H., Leonart, J., Lordan, C., *et al.* 2010. MARINE STRATEGY FRAMEWORK DIRECTIVE, Task Group 3 Report. Commercially exploited fish and shellfish, March 2010. 87 pp.
- Probst, W. N., Stelzenmüller, V., and Kraus, G. 2013. A simulation-approach to assess the size structure of commercially exploited fish populations within the European Marine Strategy Framework Directive. *Ecological Indicators*, 24: 621–632.
- Rosenberg, A. A., Fogarty, M. J., Cooper, A. B., Dickey-Collas, M., Fulton, E. A., Gutiérrez, N. L., *et al.* 2014. Developing new approaches to global stock status assessment and fishery production potential of the seas. FAO Fisheries and Aquaculture Circular No. 1086. Rome, FAO. 175 pp.
- Zampoukas, N., Palialexis, A., Duffek, A., Graveland, J., Giorgi, G., Hagebro, C., *et al.* 2014. Technical guidance on monitoring for the Marine Strategy Framework Directive. Joint Research Center, Report EUR 26499 E. 175 pp.