

ECOREGION **Introduction and general advice**
SUBJECT **EU request to ICES for review of the Marine Strategy Framework
 Directive Descriptor 3 – Commercially exploited fish and shellfish**

Introduction

Preparatory to a revision of the Decision on criteria and methodological standards on good environmental status of marine waters (Commission Decision 2010/477/EU) the European Commission has set up a process to produce a science-based evaluation and amendment proposal for the descriptors described in the Decision.

ICES was asked to facilitate this process regarding descriptors 3 (Populations of commercially exploited fish and shellfish), 4 (Foodwebs), 6 (Seafloor integrity), and 11 (Energy, including underwater noise). ICES has in this respect received a request from the European Commission to:

The MSFD Committee discussed in 2013 and concluded an approach and an outline for the process of a review and possible revision of Commission Decision on criteria and methodological standards on good environmental status of marine waters (2010/477/EU) and of MSFD (2008/56/EC) Annex III.

The Commission (DG ENV and JRC) in association with ICES will organise and steer the process. At technical level a systematic analysis of the current GES Decision needs to be carried out reviewing all parts of the Decision, taking into account latest scientific and other developments. The review will aim to define GES criteria more precisely, including setting quantifiable boundaries for the GES criteria where possible and specifications and standardised methods for GES assessments in particular as regards temporal and spatial aggregation. The first phase of the exercise is scheduled from May to October 2014. Subsequent work will be decided then.

ICES will be responsible for the relevant work related to the review of the descriptors D3 (fisheries), D4 (food webs), D6 (seafloor integrity) and D11 (noise). For D11 the work will build on the continued work of the Technical Group on Noise (TG Noise).

ICES is therefore requested to provide an offer covering the following tasks for the first phase of the GES review:

- a) prepare draft documents for each of the above-mentioned descriptors (see outline enclosed);*
- b) organise open workshops with experts from all interested EU member states to consult of the draft documents;*
- c) provide recommendations for revision with a proposed draft text with changes and the rationale for these changes to the Commission;*
- d) provide feedback to WG GES (and the preparatory drafting group) which is the forum to oversee the organisation and planning of the technical review process.*

ICES will also have to participate and contribute actively in the internal coordination process with the JRC, the EEA and DG ENV.

The process to produce the amendment text for Descriptor 3 was:

- A template for evaluation and amendment proposal was provided by the European Commission.
- ICES established a core group of experts, based on personal expertise, geographical coverage, and insights into the MSFD framework.
- The core group of experts produced a background document discussing the descriptor from a scientific perspective.
- An open workshop was conducted where the background document was discussed. The report of this workshop is available as a background document (ICES, 2014).
- The core group of experts finalized the draft text for the amendment, based on the outcomes of the workshop.

- The draft text for amendment was posted to the ICES Advisory Committee (ACOM) for information and comments.
- The amendment text was then finalized by the core group of experts and delivered to the European Commission.

The outcome of this process is enclosed and will be published by the European Commission.

Sources

EU. 2010. Commission Decision on criteria and methodological standards on good environmental status of marine waters. Commission Decision 2010/477/EU of 1 September 2010. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:232:0014:0024:EN:PDF>.

ICES. 2014. Report of the Workshop on guidance for the review of MSFD Decision Descriptor 3 – Commercial fish and shellfish (WKGMSFDD3), 4–5 September 2014, ICES HQ, Copenhagen, Denmark. ICES CM 2014\ACOM:59. 47 pp.

Possible approach to amend Decision 2010/477/EU

Descriptor 3: Commercially exploited fish and shellfish

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Review of Decision 2010/477/EU

Descriptor 3: Commercially exploited fish and shellfish

Title of Descriptor

Good environmental status for Descriptor 3

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.

1. Approach

Definition of the Descriptor

Descriptor 3 deals specifically with the state of all commercially exploited fish and shellfish. The descriptor definition contains a number of specific attributes that require further specification.

Commercially exploited fish and shellfish are all marine biological resources¹ which are targeted for economic reasons, including the bony fish (teleosts), sharks and rays (elasmobranchs), crustaceans such as lobsters and shrimps, and molluscs (including bivalves and cephalopods). Other marine biological resources (e.g. jellyfish and starfish) might be included² in the circumstances of being commercially exploited and managed under the Common Fisheries Policy (CFP).

Population usually refers to a reproductively isolated biological unit. We propose to use “species” for the wider population, which may consist of several stocks, i.e. the functional unit for management/assessment purposes, while recognizing that a stock may consist of several “subpopulations”.

ICES uses “stock” when the methodology to assess the status of Descriptor 3 against good environmental status (GES) is based specifically on stock assessments; in other cases “species” is used, acknowledging that sometimes higher taxonomic groupings (e.g. genus) may be used.

The CFP provides a definition for “stock” – “a marine biological resource that occurs in a given management area”.

For the Northeast Atlantic and Baltic region ICES has defined a stock as being part of a fish population, usually with a particular migration pattern, specific spawning grounds, and subject to a distinct fishery. However, fishery management units rarely match the scale of populations and research has frequently found that more than one population occurs within a stock boundary. In recent ICES benchmarks there has been considerable progress in considering population structuring and some boundaries for assessed stocks now reflect our understanding of population structure.

Lack of biological knowledge in the Mediterranean region leads stocks to be defined largely by area and not on the basis of well-established biological knowledge of population units.

“**All**”. The Descriptor applies to all the species covered by Council Regulation 199/2008 (the Data Collection Framework (DCF)) within the scope of Directive 2008/56/EC (MSFD), including internationally managed stocks as well as stocks managed regionally and nationally.

¹ http://ec.europa.eu/fisheries/cfp/index_en.htm.

² http://ec.europa.eu/environment/marine/good-environmental-status/descriptor-3/index_en.htm.

Council Regulation (EC) 199/2008 (DCF) establishes the Community framework for the collection, management, and use of data in the fisheries sector. Pursuant to the Regulation, the Commission Decision (2010/93/EU) set forth the multiannual Community programme for the collection, management, and use of data in the fisheries sector. It determines which stocks are considered under the DCF for the period covered by the Decision (2011–2013). The species listed by region in Annex VII of 2010/93/EU are therefore the commercial species of fish and shellfish that, as a minimum should be considered under Descriptor 3.

In addition to this, Member States can include other commercially exploited species such as inshore species not covered by the CFP or DCF, as well as other species. Because it is impossible to include every species that has occurred in the catches at some point in time (or are otherwise deemed to be of commercial interest), a pragmatic interpretation of “all” needs to result in a “selection” (i.e. in line with the phrase “selected commercially exploited fish and shellfish” in the Barcelona Convention (UNEP/MAP) objective related to fisheries) which needs to be agreed upon at a (sub-)regional level. This selection should include all species for which exploitation is considered to have significant social or economic importance for the (sub-)region.

“**Safe biological limits**”. European Parliament and Council Regulation 1380/2013 (CFP) defines a “stock within safe biological limits” as “a stock with a high probability that its estimated spawning biomass at the end of the previous year is higher than the limit biomass reference point (B_{lim}) and its estimated fishing mortality rate for the previous year is less than the limit fishing mortality rate reference point (F_{lim})” (Article 4(18)).

The two attributes currently used to assess stocks against safe biological limits, both in the ICES area and (by GFCM) in the Mediterranean, specify that stocks should:

- 1) be exploited sustainably consistent with high long-term yields; and
- 2) have full reproductive capacity.

Even if a stock is fished at a constant level of fishing mortality (F), the spawning-stock biomass (SSB) will fluctuate due to natural factors. Thus a stock fished constantly at F_{MSY} (the value of F expected to produce the long-term maximum sustainable yield) should result in the SSB fluctuating around SSB_{MSY} (the spawning-stock biomass expected to produce the long-term maximum sustainable yield). ICES has refrained from using any SSB_{MSY} value as a reference point and focused on F_{MSY} and a biomass safeguard ($MSY B_{trigger}$ or B_{pa}) for scientific quota advice. This reflects the point that biomass depends on a number of factors, including fishing mortality, but is not exclusively determined by fisheries management measures. Therefore it may not make sense to set SSB_{MSY} as a specific target or limit for policy. However, fish stocks do need to be maintained within safe biological limits according to a precautionary approach to make MSY possible. Both these reference points ($MSY B_{trigger}$ and B_{pa}) should be used as limits below which SSB must not fall.

“**Exhibiting a population age and size distribution that is indicative of a healthy stock**” introduces a requirement to manage the demographics of fish stocks. At present there is uncertainty about how to interpret and implement this aspect and a scientific debate is ongoing on relevant indicators and reference points. While several criteria have been put forward that characterize a “healthy stock”, i.e. high resistance and/or high resilience, the Commission Decision 2010/477/EU states that “Healthy stocks are characterized by a high proportion of old, large individuals”.

Linkages with existing relevant EU legal requirements

European Parliament and Council Regulation (EU) 1380/2013. The Common Fisheries Policy (CFP) is closely linked to the MSFD and the achievement of GES for Descriptor 3 relies on the measures taken under the CFP. When the MSFD was adopted the CFP was still in the reform process. The new CFP includes specific links to the MSFD; Article 11(1)³ in particular creates a direct link from the CFP to the MSFD.

Council Regulation (EC) 199/2008 establishes the Community framework for the collection, management, and use of data in the fisheries sector (Data Collection Framework (DCF)). Pursuant to the Regulation, the Commission Decision (2010/93/EU) set forth the multiannual Community programme for the collection, management, and use of data in

³ Member States are empowered to adopt conservation measures not affecting fishing vessels of other Member States that are applicable to waters under their sovereignty or jurisdiction and that are necessary for the purpose of complying with their obligations under Article 13(4) of Directive 2008/56/EC, Article 4 of Directive 2009/147/EC or Article 6 of Directive 92/43/EEC, provided that those measures are compatible with the objectives set out in Article 2 of this Regulation, meet the objectives of the relevant Union legislation that they intend to implement, and are at least as stringent as measures under Union law.

the fisheries sector. It determines which stocks are considered under the DCF for the period covered by the Decision (2011–2013). Descriptor 3 applies at least to all DCF stocks as laid out in the multiannual community programmes for the relevant time period, but also to regionally important stocks currently not listed under the DCF.

Linkages with international and RSC norms and standards

The RSCs vary in their approach to fisheries.

OSPAR has two ecological quality objectives (EcoQOs) that are relevant to Descriptor 3. The first one is to maintain the spawning-stock biomass above precautionary reference points for commercial fish stocks where those were agreed by the competent authority for fisheries management. This EcoQO is strongly linked to the requirement of Descriptor 3 for stocks to remain within safe biological limits and to indicator 3.2.1 of Commission Decision (2010/477/EU). The second EcoQO is that at least 30% of fish (by weight) should be greater than 40 cm in length. This EcoQO is relevant as a secondary indicator of fishing pressure.

HELCOM adopted the Baltic Sea Action Plan, which urges the 'competent fisheries authorities to take all the necessary measures to ensure that, by 2021, populations of all commercially exploited fish species are within safe biological limits, reach maximum sustainable yield (MSY), are distributed through their natural range, and contain full size/age range.' The text is close to Descriptor 3 definition in that it requires all species to be within safe biological limits, but it also states that fish populations should reach the maximum sustainable yield although it is not completely clear whether this refers to the exploitation rate or SSB. The text also introduces a concept which is not in the MSFD Descriptor 3. It states that all stocks should be distributed throughout their natural range and that they should contain full size/age range. This does not refer to healthy stocks but to concepts similar to those covered by Criterion 3.3 of the Commission Decision (2010/477/EU).

In the Mediterranean 11 ecological objectives⁴ are set by the Barcelona Convention (UNEP/MAP) and one objective applies to fisheries: Populations of selected commercially exploited fish and shellfish that are within biologically safe limits, exhibiting a population age and size distribution that is indicative of a healthy stock. The text is almost the same as the one for Descriptor 3. The only difference is that instead of applying it to all commercially exploited stocks it applies only to selected stocks.

For the Black Sea the Strategic Action Plan (SAP) aims to preserve commercial marine living resources. The EcoQO is split into two components, both of which remain very general and noncommittal:

EcoQO 1a: Sustainable use of commercial fish stocks and other marine living resources;

EcoQO 1b: Restore/rehabilitate stocks of commercial marine living resources.

The "climate sensitivity"

Fish stocks have a high level of climate sensitivity. However, population dynamic models used for fisheries management assume that stocks are isolated entities, ignoring the influence of environmental factors on stock productivity. The reference points based on these models do not take these environmental factors into account. (Brunel *et al.*, 2010) have shown how environmental Harvest Control Rules (eHCRs) can be developed with F_{MSY} varying according to environmental conditions. They tested such eHCRs and found that the benefits were the greatest for stocks with the strongest environment–recruitment relationship.

The distribution of many fish stocks have been shifting northwards, possibly linked to changes in sea temperature, although this trend is not uniform across stocks⁵. Furthermore, in areas where species cannot shift their range further, it is possible that some species will be lost. In the case of the Mediterranean it might become a more homogenous tropical-like ecosystem with likely loss of cold-water species⁶. The achievement of GES, in particular with respect to Criterion 3.2 on reproductive capacity of the stock and Criterion 3.3 on population age and size distribution requires that shifts are taken into account, differentiating between shifts that are due to fishing pressure and those that are due to changes in climatic/hydrological conditions.

⁴ <http://planbleu.org/sites/default/files/upload/files/Information%20Note%20EcAp%20Process.pdf>.

⁵ <http://www.ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/SSGSUE/2013/WGHIST2013.pdf>.

⁶ http://www.vliz.be/wiki/Predicted_biodiversity_changes_in_the_Mediterranean_Sea.

Aggregation method(s) considered

No aggregation criteria are at present mentioned in the Decision. A recent study by Borja *et al.* (2014) discusses the various aggregation issues. For the MSFD in general and D3 these issues may apply to the following:

- 1) Across stocks per indicator;
- 2) Across indicators within criteria;
- 3) Across criteria within descriptors;
- 4) Across descriptors.

For D3 specifically aggregations 1–3 may be reversed in that the aggregations across indicators and/or criteria (aggregations 2 and 3) may be applied prior to across stocks (aggregation 1).

Several relevant examples of aggregation in the context of D3 exist. Probst *et al.* (2013) assessed the status in relation to GES for three criteria: first per species, applying the One Out All Out principle (OOAO), after which an overall assessment across all species was conducted. For this final overall assessment these authors then applied probabilities to determine the proportion of stocks (< 100%) that needed to be in GES for the overall assessment, concluding with a specific level of confidence (limit 50%, target 90%) that all commercial fish species were in GES.

In contrast, the status of the commercial fish species per MSFD region is reported by the European Environment Agency (EEA) per criterion (only 3.1 and 3.2) based on assessed stocks only and the status in relation to GES is expressed per criterion as the proportion of stocks that fulfil $F \leq F_{MSY}$ and/or $SSB \geq MSY B_{trigger}$.

Prioritization of criteria (e.g. 3.1 vs. 3.2 or 3.3) can be considered for simplicity, communicability, and possibly also cost-efficiency in analysis and monitoring. However, this should not compromise comprehensiveness (state indicators) or integration of cumulative effects (pressure indicators). Thus far there is no scientific basis to apply any weighting to the different criteria.

Reporting

The methodological standards to report on the status of Descriptor 3 against GES contain guidance on:

- 1) The selection of a pragmatic suite of species that represent “all commercially exploited fish and shellfish” for each MSFD (sub)region;
- 2) The recording of all relevant sources of information that provide information for the assessment of status against three criteria of GES;
- 3) The reporting of the status against GES for each of these criteria separately.

Article 9(3) of the MSFD states: *“Criteria and methodological standards to be used by the Member States, which are designed to amend non-essential elements of this Directive by supplementing it, shall be laid down, on the basis of Annexes I and III, in accordance with the regulatory procedure with scrutiny referred to in Article 25(3) by 15 July 2010 in such a way as to ensure consistency and to allow for comparison between marine regions or subregions of the extent to which good environmental status is being achieved.”*

The proposed reporting fulfils the requirements of the methodological standards in that it (1) ensures consistency, (2) allows comparison between marine regions or subregions, and (3) the extent to which good environmental status is being achieved over time.

This also has the advantage that it avoids having to take any arbitrary decisions on what should be the preferred method to aggregate as it is known that each method will deliver a different outcome while there is no scientific basis that favours one method over another.

Moreover, from a transparency point of view and also as a guide to management, aggregation across criteria may obscure or hide the reasons for failing to reach GES. Applying the proposed reporting approach for each criterion separately therefore seems the best solution. Examples of this kind of reporting can be found in ICES advice on Descriptor 3 (ICES, 2014b).

2. Results of the Article 12 assessment (including in-depth assessment)

This section reflects the assessment as prepared by Milieu.

Descriptor

All Member States defined GES for Descriptor 3; however, only four did so at the descriptor level. Although GES definitions were not directly comparable between Member States, none were defined in a way that significantly deviated from those provided in the Commission Decision 2010/477/EU. Most Member States applied criteria 3.1 and 3.2 and a more limited, but still noticeable, number applied Criterion 3.3.

Criterion 3.1 Level of pressure of the fishing activity

All Member States applied Indicator 3.1.1 Fishing mortality (F) and each of these used the fishing mortality at maximum sustainable yields (FMSY) in their GES definition, except one Member Country that used a proxy for FMSY (F0.1). Most countries have GES definitions which do not require either explicitly or implicitly that all stocks are exploited at or below FMSY. Two Member States used FMSY as an environmental target value rather than as a limit or boundary for GES. For those stocks for which F could not be determined seven Member States applied the secondary indicator 3.1.2 catch/biomass ratio. One Member State also provided a third indicator, catch per unit effort (cpue). Moreover, three Member States included the “exploitation rate” indicator and set a threshold level $E = 0.4$ which is appropriate for small pelagic species.

Criterion 3.2 Reproductive capacity of the stock

For Criterion 3.2, most Member States have covered the primary indicator (Indicator 3.2.1), i.e. Stock-spawning biomass SSB, but they used different reference points: SSBMSY, SSBpa, or MSY Btrigger. Other Member States implicitly applied precautionary approach levels by stating that stocks needed to be within safe biological limits. Six Member States also applied the secondary Indicator 3.2.2 Biomass indices. One Member State proposed an alternative secondary indicator based on trends of survey abundance.

Criterion 3.3 Population age and size distribution

Criterion 3.3 is the least developed criterion for Descriptor 3 and still needs further methodological development.

Regional coherence descriptor 3

There are few specific regional differences to highlight. Only Mediterranean Member States applied the indicator exploitation rate (E) for small pelagic species. Criterion 3.3 was proportionally used least in the Northeast Atlantic; the Mediterranean and Baltic Member Countries applied this criterion more often.

3. Analysis of the current text of the Decision

Taking into account that the Decision text should be simplified and contain legal text only it is recommended that some sections providing background information or technical explanations should be deleted and moved to a guidance document (e.g. Staff Working Paper) where they can be further developed. Such text is marked with yellow below. Amendments have been made both in the yellow sections and in the remaining text.

Furthermore, a major revision of Criterion 3.3 is proposed based on three properties of the “population age and size distribution that is indicative of a healthy stock” and at least three (primary) indicators for these properties. Each of the initial indicators for 3.3 except 3.3.2 are potential candidates, while at least one new indicator describing the “Selectivity pattern of the fishery exploiting the species” (pressure indicator) should be selected. The Indicator 3.3.2 Mean maximum length across all species found in research vessel surveys was considered not appropriate to Descriptor 3 and possibly more relevant to describe biodiversity of the wider fish community (i.e. beyond the commercial fish species) addressed in Descriptor 1 (ref. Section 4.2.1).

With these comments the present Decision text could be amended as follows:

Descriptor 3: 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.

This section applies for all the stocks covered by Council Regulation (EC) No. 199/2008 (within the geographical scope of Directive 2008/56/EC) and similar obligations under the common fisheries policy. For these and for other stocks, its application depends on the data available (taking the data collection provisions of Council Regulation (EC) No. 199/2008 into account), which will determine the most appropriate indicators to be used. For Descriptor 3, the three criteria for assessing progress towards good environmental status, as well as the indicators related respectively to them, are the following.

3.1. Level of pressure of the fishing activity

Primary indicator. The primary indicator for the level of pressure of the fishing activity is the following:

— Fishing mortality (F) (3.1.1).

Achieving or maintaining good environmental status requires that F values are equal to or lower than F_{MSY} , the level capable of producing maximum sustainable yield (MSY). In mixed fisheries and where ecosystem interactions are important, long-term management plans may result in exploiting some stocks more lightly than at F_{MSY} levels in order not to prejudice the exploitation at F_{MSY} of other species⁷.

F and F_{MSY} need to be estimated from appropriate quantitative assessments based on the analysis of catch-at-age or at length (to be taken as all removals from the stock, including discards and unaccounted catch) and ancillary information. Where the knowledge of the population dynamics of the stock do not allow such assessments to be carried out, scientific judgement of F and (proxy of) F_{MSY} values associated to the yield-per-recruit curve (Y/R), combined with other information on the historical performance of the fishery or on the population dynamics of similar stocks, may be used. Only stocks for which a recent value of F and an agreed value for F_{MSY} is available from the authoritative scientific institutions can be included in the assessment against GES, using this indicator.

Secondary indicators (if analytical quantitative assessments yielding values for F are not available):

— Ratio between catch and biomass index (hereinafter “catch/biomass ratio”) (3.1.2).

This indicator is proposed to be used as a “surveillance indicator”. For assessment purposes the current value can be compared against the long-term historical average.

Where stock production-based assessments are available, the catch/biomass ratio yielding MSY can be taken as indicative reference.

Alternatively to the catch/biomass ratio, secondary indicators may be developed on the basis of any other appropriate proxy for fishing mortality, adequately justified.

3.2. Reproductive capacity of the stock

Primary indicator. The primary indicator for the reproductive capacity of the stock is the following:

— Spawning-stock biomass (SSB) (3.2.1).

Achieving or maintaining good environmental status requires that SSB values are equal to or above SSB_{MSY} , the level capable of producing maximum sustainable yield (MSY).

SSB and SSB_{MSY} need to be estimated from appropriate quantitative assessments based on the analysis of catch-at-age or at length (to be taken as all removals from the stock, including discards and unaccounted catch) and ancillary information. Where the knowledge of the population dynamics of the stock do not allow such assessments to be carried out, scientific judgement of SSB and (proxy of) SSB_{MSY} values associated to the yield-per-recruit curve (Y/R), combined with other information on the historical performance of the fishery or on the population dynamics of similar stocks, may be used.

⁷ Communication ‘Implementing sustainability in EU fisheries through maximum sustainable yield’ (COM(2006) 360 final).

This is estimated from appropriate quantitative assessments based on the analysis of catch-at-age or at length and ancillary information.

Further research is needed to address the fact that an SSB corresponding to MSY may not be achieved for all stocks simultaneously due to possible interactions between them.

Where current knowledge does not allow for estimation of a reliable value for SSB_{MSY} , an alternative reference point at which there is a high probability that the stock is able to replenish itself under the prevailing exploitation conditions may be set by the authoritative scientific institutions, to be used for the purpose of this criterion in the assessment against GES with this indicator.

Only stocks for which a recent value of SSB and an agreed value for SSB_{MSY} is available can be included in the assessment against GES, using this indicator.

Secondary indicators (if analytical quantitative assessments yielding values for SSB are not available):

— Biomass indices (3.2.2).

This indicator is proposed to be used as a “surveillance indicator”. For assessment purposes the current value can be compared against the long-term historical average.

Alternative indices may be obtained for the fraction of the population that is sexually mature.

3.3. Population age and size distribution

Primary indicators. Healthy stocks are characterized by a high proportion of old, large individuals.

Proposal: The initial indicators for Criterion 3.3 should be revised. These indicators should capture three relevant properties that describe or are directly linked to this criterion:

- Size distribution of the species (state);
- Selectivity pattern of the fishery exploiting the species (pressure);
- Genetic effects of exploitation on the species (state).

At least one validated indicator per property needs to be selected. Existing text should be revised accordingly.

4. Methodological standards for monitoring and assessment in relation to GES

Different aspects of the methodological standards required for the assessment of Descriptor 3 in relation to GES are considered in each of the sections below. This is based on a common approach or “roadmap” which involves four distinct steps:

- 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 species/stocks.
- 2) Catalogue and document the available information for each of the species/stocks selected for the Descriptor 3 assessment.
- 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/or species-functional group (i.e. pelagic, demersal/benthic, shellfish, elasmobranch, deep water).
- 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.

Selection of commercially exploited fish and shellfish

It is important to adopt a practical and common sense approach based on the species monitored under the DCF, potentially involving three spatial scales:

- Local species relevant at a national level;
- (Sub-)regional species with a distribution area that maps entirely or sufficiently to that region;
- Straddling or highly migratory species occur in several subregions and may be exploited by fisheries based in remote MSs (outside the subregion). Because of their often high landings compared to the (sub-)regional species inclusion of these species may severely affect the outcome of the assessment.

This should result in the selection of a suite of species for which exploitation is considered to have significant importance for the (sub-)region. To obtain this it is important to adopt a practical and common sense approach based on the species monitored under the DCF (Group 1, Group 2, and Group 3 Species; see Chapter III, Section B/B1/3).

The ICES FishStat and/or FAO annual statistics can be used as an aid to determine the importance of each species based on their relative contribution to the landings. To that end a minimum threshold (e.g. >1% or >0.1%) over the landings in the last 5 (or more?) years can be applied. Species that do not meet this threshold but are considered important (e.g. salmon in the Baltic Sea) can still be included. With the full introduction of the landings obligations, the process used to support the determination of the importance of each species should be reviewed to ensure that proper quantities in terms of catches are being used.

Finally, it should be considered whether a species that presently occurs at a low level (e.g. due to overexploitation), but with historical high landings, should be included in the list.

Available information

For each of the species in the suite of species established as described above, the available sources of information need to be recorded (see Table 1).

Table 1. Methodological standards for commercially exploited fish and shellfish. I: Assessment of the status of the marine environment, II: monitoring, and III: environmental targets.

CRITERIA	AVAILABLE STANDARDS FOR	SOURCE	REFERENCE	REGIONAL COVERAGE/ COMMENTS
Fishing mortality (F) (3.1.1). F values are equal to or lower than F_{MSY} , the level capable of producing maximum sustainable yield (MSY).	I, II, III	CFP	Quantitative stock assessment done by ICES, GFCM, STECF, ICCAT on data collected under DCF, 199/2008	EU/Quantitative stock assessments are not available for all stocks and considerable differences in data availability exist between (sub)regions. Data deficiencies often result in the use of agreed approximations of F_{MSY} rather than F_{MSY} .
Ratio between catch and biomass index (hereinafter catch/biomass ratio) (3.1.2). The catch/biomass ratio yielding MSY can be taken as an indicative reference.	II	CFP	Data collected under DCF, 199/2008	EU/Stock production-based assessments are not available for all stocks.
Spawning-stock biomass (3.2.1.). Any observed SSB value equal to or greater than SSB_{MSY} is considered to meet this criterion. Where it is not possible to determine a reliable value for SSB_{MSY} , an appropriate reference point (identical for all regions) needs to be identified by the authoritative institutions. ICES has selected $MSY B_{trigger}$ for this purpose.	I, II, III	CFP	Quantitative stock assessment done by ICES, GFCM, STECF, ICCAT on data collected under DCF, 199/2008	EU/Quantitative stock assessments are not available for all stocks and considerable differences in data availability exist between (sub)regions.
Biomass indices (3.2.2). The proposed indicators for Criterion 3.3 should be revised. These indicators should now capture three relevant properties that describe or are directly linked to this criterion: Size distribution of the species; Selectivity pattern of the fishery exploiting the species; Genetic effects of exploitation on the species.	II	CFP	National and International data collection and monitoring programmes under DCF 199/2008	There are no reference values with enough scientific agreement for assessment. Time-series of indicators are not available for all stocks.

The quality of the assessment and hence the confidence in the outcome is determined by the information available. This can be reported as the proportion of species and proportion of landings (based on the suite of species established in Section 1) with adequate information per criterion (see Table 1). ICES FishStat and/or FAO annual statistics are the appropriate data sources to determine the proportion of landings.

ICES has developed a classification of stocks and their assessment data that identifies six categories (see Table 2).

Table 2. Categories of assessment for stocks according to ICES (2012).

CATEGORY	DEFINITION
1 Data-rich stocks (quantitative assessments)	These are the stocks that are not considered data-limited and this category includes stocks with full quantitative assessments and forecasts as well as stocks with quantitative assessments based on production models.
2 Stocks with quantitative assessments and forecasts that are only treated qualitatively	This category includes stocks with quantitative assessments and forecasts which for a variety of reasons are merely indicative of trends in fishing mortality, recruitment, and biomass.
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-dependant indices; e.g. <i>Ipue</i> , <i>cpue</i> , and mean length in the catch) are available that provide reliable indications of trends in stock metrics such as mortality, recruitment, and biomass.
4 Stocks for which reliable catch data are available	This category includes stocks for which a time-series of catch can be used to approximate MSY.
5 Data-poor stocks	This category includes stocks for which only landings data are available.
6 Negligible landings stocks and stocks caught in minor amounts as bycatch	This category includes stocks where landings are negligible compared with discards. It also includes stocks that are part of stock complexes and are primarily caught as bycatch species in other targeted fisheries. The development of indicators may be most appropriate to such stocks.

This classification should guide the process towards expanding the selection of species/stocks for which information suitable for the assessment of this descriptor is available.

Note that this classification has been developed by ICES for stocks mainly exploited in the Northeast Atlantic and may need further revision in order to accommodate the classification of Mediterranean stocks – in particular, classifying stocks according to data availability and the availability of methods for the assessment of their status (see ICES, 2014c). Also note that unless there is a direct relationship between these categories and the assessment against GES, these categories cannot be used to report on the availability of information.

At present there is no boundary in terms of the proportion of species and/or landings that needs to be met for any of the criteria to meet a quality standard. However, each Member State should report for each MSFD (sub)region these metrics of quality together with the indicators for each of the criteria.

Indicators

ICES proposes the following high-level criteria (each with more detailed subcriteria) for the selection of indicators:

- 1) **Availability of data.** For *Measurability*, robust quantifiable data that covers a range of spatial and temporal natural variability of suitable (historical) duration and resolution, availability of historical data, or other reference points for benchmarking,
- 2) **Quality of underlying data.** Data that are *Sensitive* to the magnitude and direction of response to underlying attribute/pressure with high signal-to-noise ratio, and *Responsive* at an appropriate time-scale. A *tangible* indicator that is intuitive to understand.
- 3) **Conceptual.** *Theoretical basis*, with indicator behaviour (in response to pressure) that is understood to support management advice.
- 4) **Communication,** an indicator that is simple, credible, *unambiguous*, *comprehensible*, and can be easily communicated.

- 5) **Manageable**, an indicator that is relevant to management, with estimable targets and boundaries and which are *responsive, sensitive, and cost-effective* to develop.

These can guide the (further) process of selecting the best indicators for the 3.3. criterion.

More detail is provided below on the indicators identified in Table 1 and described in Decision 2010/477/EU.

Criteria 3.1 and 3.2

The indicators listed under criteria 3.1 and 3.2 are operational and can be implemented.

- Fishing mortality (F) (3.1.1);
- Catch/biomass ratio (3.1.2);
- Spawning-stock biomass (SSB) (3.2.1);
- Biomass indices (3.2.2).

Criterion 3.3

The proposed indicators for Criterion 3.3 should be revised. These indicators should capture three relevant properties that describe or are directly linked to this criterion:

- **Size distribution of the species** (state)
- **Selectivity pattern of the fishery exploiting the species** (pressure)
- **Genetic effects of exploitation on the species** (state)

Below is discussed how the indicators proposed in the initial methodological standards relate to these newly proposed properties of Criterion 3.3. This should be the basis for a process that results in at least one indicator per property.

Size distribution of the species

In the initial methodological standards two indicators capture this property:

- The proportion of fish larger than the mean size at first sexual maturation (previously 3.3.1);
- 95th percentile of the fish length distribution observed in research vessel surveys (previously 3.3.3).

One “best indicator” needs to be selected for this property based on appropriate criteria. This may be a new and better indicator or one of the previous indicators.

Selectivity pattern of the fishery exploiting the species

This requires a new indicator as this property was initially not considered. Three potential new candidates based on recorded commercial catches were considered in the workshop:

- Proportion of fish larger than Lm50;
- Mean length;
- First fully fished age class.

One “best indicator” needs to be selected for this property based on appropriate criteria. This may be one of the indicators considered at the workshop or a more promising alternative.

Genetic effects of exploitation

Size at first sexual maturation (previously 3.3.4)

For this property the preferred (primary) indicator is the probabilistic maturation reaction norm (PMRN). Early versions of this approach based only on maturity, size, age, and growth rate (Heino *et al.*, 2002; Barot *et al.*, 2004) were found to ignore some environmental sources of variation acting directly on maturation. Wright *et al.* (2011) presents an improved calculation of the indicator that accounts for such sources of environmental variation and requires smaller sample sizes. Several other methods of calculating the PMRN that include additional covariates have also been developed. ICES WGEVO is currently testing an approach to link changes in maturation probability with the magnitude of selection arising from the mortality schedule. This work should increase the confidence of inferring that changes in size at maturation are linked to an undesirable genetic effect.

A less data demanding alternative (secondary) indicator is the TL50 (length at which half of the (females) are mature) which gives valuable information of the effects of fishery on a population, although the indicator may better reflect fishery-induced changes rather than genetic effects *per se*.

The initial 3.3.2 indicator (Mean maximum length across all species found in research vessel surveys) is considered not appropriate because the MML indicator is calculated as the average maximum potential length of individuals making up a community and takes no account of length of individuals at the time of sampling (ICES, 2012). Or, in simple terms, the MML indicates what proportion of the community is made up of individuals from large species and what proportion of the community is made up of individuals from small species, and it does not matter if the individuals from the “large species” are themselves large or small. Therefore the MML indicator is not appropriate as an indicator of size (or age) of individuals making up a population and hence should not be applied for this purpose as Criterion 3.3.2. This indicator would be appropriate to the Descriptor 1. It is worth noting in this context that although it is a community indicator it does reflect a shift in species composition, from species with life-history characteristics that make them more vulnerable to species that are less vulnerable. As such any shift in community composition implies a risk of losing vulnerable species which is relevant to biodiversity, and possibly, but not primarily, foodweb and its functioning.

These three properties of the “population age and size distribution that is indicative of a healthy stock” and the provisional suggestions for indicators from the workshop (ICES, 2014d) should be the basis for a process involving one or more workshops aimed to select at least one “best” indicator for each property. If problems are expected in terms of data availability to calculate these preferred (primary) indicators for enough species/stocks to be representative for the (sub)region, an additional (secondary) indicator should be proposed similar to the approach for criteria 3.1 and 3.2.

Reference points

For the primary indicators (i.e. F and SSB) the appropriate reference points are adopted from the authoritative scientific institutions (i.e. ICES, GFCM, STECF, and ICCAT for internationally managed stocks, Member Countries for national stocks).

There are at present no known reference points for Criterion 3.3. Once the preferred indicators are identified a process can be initiated to establish reference points for one or more of the indicators. Until that time the Criterion 3.3 indicators can be used as “surveillance indicators” which help to track the impact of human activity and natural change at a high level in relation to the age and size structure of commercial species.

Assessment of good environmental status

There are several issues to consider when assessing D3 against GES and reporting on the status for as many as possible of the species identified, based on the best available information. The main issues involve (1) the selection of species/stocks to be included in the analysis, (2) the assessment against GES based on the proposed indicators and their reference points, and (3) the aggregation method(s) used. The first two issues are addressed in the tables below.

CRITERIA	CRITERION 3.1	CRITERION 3.2	CRITERION 3.3
	LEVEL OF PRESSURE OF THE FISHING ACTIVITY	REPRODUCTIVE CAPACITY OF THE STOCK	POPULATION AGE AND SIZE DISTRIBUTION
INDICATORS	<p>Primary indicators</p> <p>The GES boundary should be defined for each primary indicator, based on the selected reference points. The nature of this reference point (e.g. target or limit) and thus the setting of this GES boundary is directly related to the proportion of the stocks that should meet this boundary.</p>		<p>The current lack of reference points at EU or MSFD (sub)region makes it difficult for MS to define quantitative GES boundaries.</p>
	$F < F_{MSY}$	$SSB > MSY B_{trigger}$	<p>The process of selecting (new) indicators is ongoing. For some of these potential indicators it is possible to determine reference points. This needs to be considered in the selection process.</p>
	<p>Secondary indicators</p> <p>If the status of a species is already reported based on the primary indicator, no secondary indicator is required for that criterion.</p> <p>For the secondary indicators there are currently no known reference points and therefore these should be used as surveillance indicators.</p>		

CRITERION 3.1 PRIMARY INDICATOR

Selection of stocks	All stocks for which a recent ¹ value of F and an agreed ² value for F_{MSY} is available.
GES	To be in GES a species/stock should be exploited sustainably, consistent with high long-term yields. For the primary indicator this implies $F < F_{MSY}$. As this is a limit reference point this implies that 100% of the stocks for which both the indicator and the reference point are available should fulfil this criterion.
Status	Proportion of stocks (%) that meet GES.
Reporting:	Annual mean value of F/F_{MSY} across all stocks.
Quality	Proportion of species ³ assessed against GES in relation to suite of "All" commercial species.
Reporting:	Proportion of landings assessed against GES in relation to total landings.

¹ Preferably these should be annual values, but if this is not possible there needs to be an agreed² species-specific threshold lag of what can still be considered "recent".

² Agreed by the authoritative scientific institution. In the case of regional or widely distributed stocks this authority is ICES/GFCM/ICCAT, in the case of national stocks this is the member state.

³ If only one stock of a species consisting of several stocks is assessed against GES, this species is considered assessed.

CRITERION 3.1 SECONDARY INDICATOR

Selection of stocks	All species for which a reliable ¹ value of the indicator (i.e. catch/biomass ratio) can be calculated.
GES	The mean of the most recent three years should be below the long-term historical average ² .
Status	Proportion of species (%) that meet GES.
Reporting:	Annual mean of the indicator value/long-term mean indicator value across species.
Quality	Proportion of species assessed against GES in relation to suite of "All" commercial species.
Reporting:	Proportion of landings assessed against GES in relation to total landings.

¹ This requires an appropriate monitoring programme covering a large enough extent of the (sub)region in order to be representative, and with a catchability that allows an accurate estimation of species abundance. What can be considered "appropriate" needs to be determined by the authoritative scientific institution. In the case of regional or widely distributed stocks this is ICES/GFCM/ICCAT possibly together with the RSCs, in the case of national stocks this is the member state. How this is affected by the landings obligation needs to be determined.

² Appropriate period depending on the monitoring programme.

CRITERION 3.2 PRIMARY INDICATOR

Selection of stocks	All stocks for which a recent ¹ value of SSB and an agreed ² value for SSB _{MSY} is available.
GES	To be in GES a species/stock should have full reproductive capacity, i.e. $SSB > MSY B_{trigger}$. As this is a limit reference point this implies that 100% of the stocks for which both the indicator and the reference point are available should fulfil this criterion.
Status	Proportion of stocks (%) that meet GES.
Reporting:	Annual mean value of SSB/MSY $B_{trigger}$ across all stocks.
Quality	Proportion of species ⁴ assessed against GES in relation to suite of "All" commercial species.
Reporting:	Proportion of landings assessed against GES in relation to total landings.

¹ Preferably these should be annual values, but if this is not possible there needs to be an agreed² species-specific threshold lag of what can still be considered "recent".

² Agreed by the authoritative scientific institution. In the case of regional or widely distributed stocks this is ICES/GFCM/ICCAT, in the case of national stocks this is the member state.

³ Other reference points ($>MSY B_{trigger}$) can also be applied. In that case, however, it is not realistic to require ALL stocks to meet this reference point. The proposed "Reporting" indicators can still be calculated, albeit resulting in different values.

⁴ If only one stock of a species consisting of several stocks is assessed against GES, this species is considered assessed.

CRITERION 3.2 SECONDARY INDICATOR

Selection of stocks	All species for which a reliable ¹ value of the indicator (i.e. biomass index) can be calculated.
GES	The mean of the most recent three years should be above the long-term historical average ² .
Status	Proportion of species (%) that meet GES.
Reporting:	Annual mean of the indicator value/long-term mean indicator value across species.
Quality	Proportion of species assessed against GES in relation to suite of "All" commercial species.
Reporting:	Proportion of landings assessed against GES in relation to total landings.

¹ This requires an appropriate monitoring programme covering a large enough extent of the (sub)region to be representative, and with a catchability that allows an accurate estimation of species abundance. What can be considered "appropriate" needs to be determined by the authoritative scientific institution. In the case of regional or widely distributed stocks this is ICES/GFCM/ICCAT possibly together with the RSCs, in the case of national stocks this is the member state. How this is affected by the landings obligation needs to be determined.

² Appropriate period depending on the monitoring programme.

CRITERION 3.3 INDICATORS

Selection of stocks	All species for which a reliable ¹ value of each of the indicators can be calculated.
GES	<p>If a reference point can be identified for one or more of the indicators it can be used to identify a boundary for GES. Depending on the nature of this boundary and the level of uncertainty, the proportion of species that should achieve GES can be determined.</p> <p>If no reference point is available the mean of the most recent three years should be above (or below, depending on the reference direction) the long-term historical average².</p>
Status	Proportion of species (%) that meet GES.
Reporting:	Annual mean of the indicator value/long-term mean indicator value across species.
Quality	Proportion of species assessed against GES in relation to suite of "All" commercial species.
Reporting:	Proportion of landings assessed against GES in relation to total landings.

¹ This requires an appropriate monitoring programme that delivers data of sufficient quality. What can be considered "appropriate" needs to be determined by the authoritative scientific institution. In the case of regional or widely distributed stocks this is ICES/GFCM/ICCAT possibly together with the RSCs, in the case of national stocks this is the member state.

² Appropriate period depending on the monitoring programme.

5. GES methodological standards (in accordance with Art. 9.3)

Addressed above.

6. Standardized methods for monitoring for comparability (in accordance with Art. 11.4)

Addressed above.

7. Standardized methods for assessment for comparability (in accordance with Art. 11.4 GES)

Addressed above.

8. Rational and technical background for proposed revision

Core group and Workshop discussions.

9. Other related products (e.g. technical guidance, reference in common understanding document)

Common Understanding Document, draft 22 September 2014.

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