1.6.2.1 EU request on revisions to Marine Strategy Framework Directive manuals for Descriptors 3, 4, and 6

Advice summary

Revisions to three MSFD manuals were carried out based on the results of three workshops. These revisions are annexed in the requested format to this advice. Broadly these revisions have followed the templates and texts supplied to ICES following discussion by the EU's Working Group on Good Environmental Status. For Descriptors 3 and 4, no major changes were made to the manuals, but revision was deeper for Descriptor 6 following comments from many EU Member States. EU Member States (supported by the European Commission) asked also for advice on the next steps for implementation of the Descriptors for the period 2015–2018.

Request

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 organised and steered the process. ICES has been responsible for the relevant work related to the review of the descriptors D1 (biodiversity), D3 (fisheries), D4 (food webs), D6 (sea-floor integrity) and D11 (noise). For D1, ICES had to coordinate the process with JRC and for D11 the work has built on the continued work of the Technical Group on Noise (TG Noise). During the first phase of the review process ICES had to prepare draft documents for each of the above-mentioned descriptors, provide recommendations for revision of the technical issues of the Decision with a proposed draft text with changes and the rational for these changes to the Commission and provide feedback to WG GES which is the forum to oversee the organisation and planning of the technical review process.

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

a) *consolidate all comments (technical and on policy issues) received from WG GES and DG ENV on the draft documents for each of the above-mentioned descriptors;*
b) *if necessary, organise targeted meetings of expert groups from all interested EU member states and Regional Sea Conventions to address outstanding technical issues identified in the review process (particularly following DG ENV guidance on the ToR and agenda of the meetings);*
c) *provide reports of the targeted expert meetings;*
d) *revise documents after input received during the cross-cutting workshop (see (ii) below) and during the targeted expert meetings;*
e) *finalise draft documents per descriptor (or via combined descriptors, where agreed), providing recommendations for revision of the Decision with a proposed draft text with changes and the rationale for these changes to the Commission by 25 March 2015;*
f) *provide feedback on the work undertaken to WG GES in April 2015 which is the forum to oversee the technical review process.*

Elaboration on ICES advice

The manuals for the Descriptors 3, 4, and 6 were revised (from versions provided in October 2014) to differing extents, dependent largely on feedback received from EU Member States and the Regional Seas Conventions, and on comments from the European Commission.

For Descriptor 3, the greatest changes were in the approaches to Criterion 3.3 on fish population, age and size distribution. This criterion requires further development; monitoring should continue, but the results cannot presently be used to evaluate GES. An approach is suggested for the development of this criterion.

For Descriptor 4, the concept of "trophic guild" was clarified; further guidance was provided on GES criteria and methodological standards.

Descriptor 6 required considerable further revision. The suggestion for a fairly radical overhaul of the criteria met much resistance in feedback and was difficult to support with current science. The concept of switching to an approach based on functionality and recoverability should not be lost for future work. These concepts though are difficult to make

operational with the current evidence base. The manual has therefore been rewritten to update and improve the current approach of damage to the seafloor and condition of benthic community. In particular, forms of pressure on the seafloor other than physical damage and functional aspects of the benthic community have been further emphasized.

The work on Descriptor 1 was taken over by JRC and that on Descriptor 11 has been carried out by TG Noise.

Suggestions

Next steps for implementation of the GES Descriptors for the period 2015–2018
In response to requests from EU Member States, and informally from the European Commission, ICES recommends the following as next steps to aid implementation of Descriptors 1, 3, 4, and 6 of the MSFD.

Cross-cutting work

1. Gaps and overlaps across descriptors. The challenges when considering state (including biodiversity) and function need to be considered across Descriptors 1, 3, 4, and 6. The concepts of trophic guild, taxonomic grouping, habitat type, and fish stock need to be combined in a way that accounts for the functional requirements of the state descriptors to ensure efficient implementation of the MSFD. This scientific work is needed before the revision of the Commission decision is finalized; it is therefore relatively urgent. ICES recommends a preparatory project, followed by a final 4- to 5-day workshop to agree ways to reconcile functionality with conservation objectives in state descriptors. The outcomes of the workshop should be internationally peer-reviewed.
2. Aggregation within Descriptors 3, 4, and 6 (including spatial integration). Further guidance is required by EU Member States (and European bodies) on approaches to aggregate indicators proposed to assess Descriptors 3, 4, and 6. Aggregation of assessments of different indicators should take the varying qualities of each indicator into account, both in terms of their pressure–state relationships and to the levels of uncertainty in their estimation. The issue of spatial extent in relation to overall assessment should also be considered. This guidance is needed for the 2018 reporting round and should be carried out by the Regional Seas Commissions as a combination of science and management decisions. ICES would be able to help in providing science support and comparing regional responses.

Descriptor 3

ICES recommends developmental work to underpin the implementation of Criterion 3.3 and proposes a preliminary suite of candidate indicators (see Annex 1). These indicators capture three relevant properties representing the state of fish populations and pressure exerted on those populations: i) size distribution of the species (state), ii) selectivity pattern of the fishery exploiting the species (pressure), and iii) genetic effects of exploitation on the species (state).

The following steps, involving a series of workshops, are required to make these proposals operational before 2017:

1. Indicator selection and evaluation against ICES criteria (ICES, 2014a, 2014b) using selected representative fish stocks. The selected stocks should exhibit different characteristics (e.g. long-lived, short-lived, pelagic, demersal, elasmobranchs) and be selected from a range of regions with the aim to select one validated indicator per property. The selection of example stocks should consider data availability, the stock dynamics should exhibit contrast (both in terms of productivity and exploitation). Data will be collated using a formal data call and should include both catch/landings and age-at-length data, and survey information. Guidelines will be provided on the type of stocks for which each indicator is relevant. Workshops with scientists with experience in fisheries science from across Europe will be needed. The properties of underlying data, knowledge base, construction of operational indicators, and sensitivities to underlying assumptions will be explored.
2. Evaluation of GES for Criterion 3.3 for selected stocks. Primary indicators will be processed similar to those in criteria 3.1 and 3.2; where the knowledge on the characteristics of the indicator and its reference level should enable the identification of the requirements for GES. Secondary indicators will also be considered. Workshops will be needed and would follow step 1.
3. Applying methods for Criterion 3.3 to regional evaluations. Taking the methods developed to make an evaluation of GES using example regions to further test the applicability of the approaches. This may be possible at a workshop under Step 2 above or could be included as part of the work of ICES integrated ecosystem assessment groups.

Descriptor 4

ICES recommends further developmental work to underpin the implementation of Descriptor 4 and proposes that the challenges need to be addressed in the following ways:

1. Uncertainty and GES. Three major sources of uncertainty affect the ability to determine Descriptor 4 indicator bounds (and similarly for other descriptors) and the interpretation of change in indicators in relation to GES: i) statistical uncertainty with respect to measuring indicators, ii) uncertainty reflecting whether the values for indicators relate to desirable or undesirable states, and iii) how direct and indirect linkages between indicators and pressures affect Descriptor 4 indicator behaviour. Building upon existing projects, ICES recommends an international peer-reviewed advisory process to provide methods to address these issues for all recommended indicators (see Annex 2) in 2016.
2. Consistent regional and pan-regional interpretations of indicators, limits, and estimation methods. ICES notes the suggestion to bring together experts to progress consistency in interpretation is important both within and between regional seas (HELCOM–OSPAR, 2014). If requested, existing ICES working groups could be tasked with developing agreed international guidelines to ensure consistent interpretations of indicators, limits, and estimation methods in 2016–2017 in order to feed through to EU-wide assessments.
3. Further development of Descriptor 4 indicators. This work is required to consider the differing influences of environmental variability and anthropogenic activity on considerations of GES for Descriptor 4. Indicator development should specifically investigate the role of lower trophic guilds on the likely assessment of GES for Descriptor 4, the role of size in foodweb stability, and management strategy evaluations of the sensitivity of Descriptor 4 indicators to anthropogenic pressures. Much of this work should be carried out through projects, but a workshop to bring together the outputs of the projects and updating the foodweb advice should be planned for 2017.

Descriptor 6

ICES recommends further developmental work to underpin the implementation of D6 and proposes the following actions:

1. Develop and test standards for assessing human pressures on benthic habitats within and between MSFD regions. ICES in collaboration with the RSCs can provide peer-reviewed guiding principles that ensure alignment between GES boundaries for seafloor integrity to support regional indicator development and to avoid conflicting results between regions.
    •   Identify where the collection of additional information is needed (ICES working groups are evaluating this for the OSPAR area; similar processes are needed for other regional seas);
    •   Agree the list of key functions to be addressed across and within MSFD regions using the recommended Descriptor 6 indicators;
    •   For each indicator, evaluate the applicability of existing concepts for setting GES boundaries and where possible identify critical values that could be used for these boundaries. This will need a dedicated workshop in 2017.
2. Habitats and issues of scale. Long-term action is needed to select habitats and address the role of scale and of connectivity in setting GES boundaries for the sea-floor. This work could take place in one workshop in 2018 and would include:
    •   Agreeing the list of habitats to be assessed;
    •   Resolving issues of scale by defining, e.g. at what EUNIS hierarchical level habitats are going to be addressed.
3. Assessment of recoverability of seafloor integrity. No standards or methods exist for this key attribute of marine ecosystems. Development of such standards could be carried out in a project.

Basis of the advice

The European Commission is in the process of reviewing and potentially revising the Decision on criteria and methodological standards on good environmental status of marine waters (EU, 2010).

As part of this process, ICES was tasked in early 2014 with Descriptors 3 (Populations of commercially exploited fish and shellfish), 4 (Foodwebs), and 6 (Sea-floor integrity). A series of workshops held in autumn 2014 provided guidance reports with dedicated recommendations (ICES, 2014a, 2014c, 2014e). The results of the workshops were used to update "templates" provided by the European Commission to form first drafts of Descriptor "manuals" (ICES, 2014b, 2014d, 2014f). Following a meeting of the MSFD Common Implementation Strategy Working Group on Good Environmental Status (WGGES) in October 2014, further work and clarification was requested from ICES in December 2014 (see request

below). As a result further workshops were held in Copenhagen in February 2015 (ICES, 2015a, 2015b). The results of these second workshops have been used in updating the templates (attached as Annexes 1–3).

Sources and references

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Annex 1

Possible approach to amend Decision 2010/477/EC

Descriptor 3: Commercially exploited fish and shellfish

Author	Version	Date
Milieu	V1	2 May 2014
DG Environment	V2	30 May 2014
ICES Core group	V3	1 October 2014
ICES advice (Annex 1)	V4	20 March 2015

Possible approach to amend Decision 2010/477/EC

Descriptor 3: Commercially exploited fish and shellfish

Title of Descriptor

Good environmental status for Descriptor 3 – Commercially exploited fish and shellfish

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 resources 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 included 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. There has been considerable recent improvement in the understanding of population structuring and some boundaries for assessed stocks now reflect this understanding.

In the Mediterranean, the limited biological knowledge 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.

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, EU 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)).

Following the precautionary approach the two attributes that have been used by ICES and GCFM to assess stocks against safe biological limits specify that stocks should:

> 1) be exploited sustainably (e.g. $F \leq F_{pa}$ or $F \leq F_{0.1}$)
>
> and
>
> 2) have full reproductive capacity ($B \geq B_{pa}$).

In order to align with CFP aiming "to restore and maintain populations of harvested species above levels which can produce maximum sustainable yield", the first attribute of GES, i.e. exploited sustainably, was extended into "be exploited sustainably with high long-term yield" and including the requirement $F \leq F_{MSY}$.

With respect to reproductive capacity of the stock, ICES (2014a) advised that:

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 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}).

While ICES initially adopted B_{pa} as a proxy for MSY $B_{trigger}$, a process is now underway to update the value of MSY $B_{trigger}$ so that it corresponds with the lower boundary in the range of SSB_{MSY}. For example, MSY $B_{trigger}$ has for some stocks been defined as "the lower 95% confidence limits (of SSB) with exploitation at F_{MSY} from long-term simulations".

Hence, concerning stocks for which ICES advice is used as the basis for the assessment of GES, and to fulfil the GES Criterion 3.2, ICES recommends that SSB ≥ MSY $B_{trigger}$, where MSY $B_{trigger}$ marks the lowest boundary associated with SSB_{MSY}.

Updated estimates of reference levels for criteria 3.1 and 3.2 will be reviewed periodically and adopted by ICES, GFCM, ICCAT, and STECF, as relevant.

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) 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 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 Regional Seas Conventions (RSCs) vary in their approach to fisheries.

OSPAR had an ecological quality objective (EcoQO) that aims 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.

HELCOM adopted the Baltic Sea Action Plan (BSAP) in 2007, 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 BSAP text was clarified during the Ministerial Declaration in 2013: "populations of all commercially exploited fish and shellfish should be within safe biological limits, exhibiting a population age and size distribution indicative of a healthy stock and that Maximum Sustainable Yield shall be achieved by 2015 where possible and on a progressive, incremental basis at the latest by 2020 for all stocks". The updated text shows consistency between the BSAP and the MSFD D3 in that it requires all species to be within safe biological limits, fish populations should reach MSY and exhibit a population that is indicative of a healthy stock.

In the Mediterranean, 11 ecological objectives are set by the Barcelona Convention (UNEP/MAP, 2012) 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 that 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 relevant EcoQO is split into two generic components:

- 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 and subsequent environmentally driven sensitivity. Short- and long-term trends in weight and maturity are frequently observed across a range of species, especially in recent years. The difficulty in predicting the trends in future climate-driven effects means that reference points should be based on recent productivity. 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.

Distribution has been shifting northwards for many fish stocks. This may be linked to changes in sea temperature, although the trend is not uniform across stocks (ICES, 2013). Furthermore, in areas where species cannot shift their range further, it is possible that some species will be lost. The Mediterranean, for example, might become a more homogenous tropical-like ecosystem with likely loss of cold-water species (MARBEF, 2013). Regular updates of assessments and management reference points ensures that such variation is taken into account.

Definition of GES

Aggregation method(s) considered

In relation to GES, aggregation criteria have not been considered previously. A recent study by Borja *et al.* (2014) discusses the various aggregation issues. For the MSFD in general and Descriptor 3 in particular, these issues may apply to the following:

- Across stocks per indicator;

- Across indicators within criteria;

- Across criteria within descriptors;

- Across descriptors.

Several relevant examples of aggregation in the context of Descriptor 3 exist (e.g. Probst *et al.*, 2013; ICES, 2014a, 2014b).

Prioritization of criteria (e.g. 3.1 vs. 3.2 or 3.3) can be considered for simplicity, communicability and cost-efficiency in analysis and monitoring. However, this should not compromise comprehensiveness (state indicators) or integration of cumulative effects (pressure indicators).

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 <u>each MSFD (sub)region</u>. It is important to note that for stocks that straddle national boundaries there should not be a national selection of species alone;

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 <u>ensure consistency</u> and <u>to allow for comparison between marine regions or subregions</u> of the <u>extent to which good environmental status is being achieved</u>."*

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) reports the extent to which good environmental status is being achieved over time.

Reporting of each criterion separately also has the advantage of avoiding the need to take arbitrary decisions on the preferred aggregation method. Each aggregation method will deliver a different outcome and there is no scientific basis to favour 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, 2014a).

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

Descriptor

All EU Member States defined GES for Descriptor 3; however, only four did so at the descriptor level. Although GES definitions were not directly comparable between EU Member States, none were defined in a way that significantly deviated from those provided in the Commission Decision 2010/477/EU. Most EU 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 EU Member States applied Indicator 3.1.1 "Fishing mortality (F)" and each of these used the fishing mortality at maximum sustainable yields (F_{MSY}) in their GES definition, except one Member State that used a proxy for F_{MSY} ($F_{0.1}$). Most countries have GES definitions which do not require either explicitly or implicitly that all stocks are exploited at or below F_{MSY}. Two EU Member States used F_{MSY} 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 EU 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 EU Member States included the "exploitation rate" indicator and set a threshold level of E = 0.4, which is appropriate for small pelagic species.This approach is followed for the GFCM assessed stocks.

Criterion 3.2 – Reproductive capacity of the stock

For Criterion 3.2, most EU Member States have covered the primary Indicator 3.2.1 "Stock-spawning biomass SSB", but using different reference points: SSB_{MSY}, SSB_{pa}, or MSY $B_{trigger}$. Other EU Member States implicitly applied precautionary approach levels by stating that stocks need to be within safe biological limits. Six EU 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 for Descriptor 3

There are few specific regional differences to highlight. Only Mediterranean EU 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.

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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 strike-through text below. Amendments have been made both in the strike-through text 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 whether it is appropriate to use primary or secondary indicators. For Descriptor 3, the three criteria for assessing progress towards good environmental status, as well as the indicators related respectively to them, are mentioned below.

Criterion 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) (Indicator 3.1.1).

Achieving or maintaining good environmental status requires that F values for stocks 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 species (EU, 2006).

~~F and F_{MSY} need to be estimated using standardized procedures (e.g. analysis of catch-at-age or at length) 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. All stocks for which a value of F and an agreed value for F_{MSY} is available 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") (Indicator 3.1.2).

This is a typical secondary indicator for which there is a limited scientific basis to set any reference points. For assessment purposes an appropriate method for trend analysis can be adopted (e.g. the current value can be compared against the long-term historical average).

Criterion 3.2 – Reproductive capacity of the stock

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

— Spawning-stock biomass (SSB) (Indicator 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 using standardized procedures (e.g. analysis of catch-at-age or at length) 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.~~

~~Further research is needed to address the fact that the values of SSB corresponding to MSY, estimated for each stock in isolation, 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 international scientific bodies, 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 primary indicator.~~

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

— Biomass indices (Indicator 3.2.2).

This is a typical secondary indicator for which there is as yet limited scientific basis to set any reference points. For assessment purposes an appropriate method for trend analysis needs to be adopted (e.g. 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.~~

Criterion 3.3 – Population age and size distribution

This criterion should reflect that healthy stocks of many species are characterized by a high proportion of old, large individuals. The current four indicators are difficult to use at present to assess GES; however, they do provide a way of assessing change. Data collection for these indicators should be maintained for the time being, but the indicators should not be used in evaluating GES.

Specifically, new indicators for Criterion 3.3 are needed to take account of varying selectivity patterns in commercial catches. This new suite of indicators should aim to capture three relevant properties that describe or are directly linked to this criterion.

Size distribution of the species (state)

- Proportion of fish larger than the mean size of first sexual maturation (former Indicator 3.3.1).
- 95th percentile of the fish length distribution observed in research vessel surveys (former Indicator 3.3.3).

Selectivity pattern of the fishery exploiting the species (pressure)

- Length (or age depending on data availability) at first capture (length/age at which 50% of fish are vulnerable to/retained by the gear).
- Proportion of fish in the catch larger than size at which 50% is mature.
- Mean length in the catch.

Genetic effects of exploitation on the species (state)

- Size at first sexual maturation (former Indicator 3.3.4).
- Length at which half of the (female) population are mature (50% of total length – TL50).

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. The assessment should be based on a common four-step approach:

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 – Food webs), 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 commercial 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.

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 five (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, consideration could be made as to whether a species that presently occurs at a low level (e.g. due to overexploitation) but with historically high landings, should be included in the suite of species.

Available information

For each of the species in the selected suite of species, the available sources of information need to be recorded (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, and ICCAT on data collected under DCF (EU, 2008a)	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 (EU, 2008a)	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, and ICCAT on data collected under DCF (EU, 2008a)	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). For assessment purposes an appropriate method for trend analysis needs to be adopted (e.g. the current value can be compared against the long-term historical average).	II	CFP	National and international data collection and monitoring programmes under DCF (EU, 2008a)	There is limited scientific basis to set reference points for GES assessment. Time-series of indicators are not available for all stocks.

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 EU Member State should report for each MSFD (sub)region these metrics of quality together with the indicators for each of the criteria.

Further development of indicators

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) (Indicator: 3.1.1);

- Catch/biomass ratio (Indicator 3.1.2);

- Spawning-stock biomass (SSB) (Indicator 3.2.1);

- Biomass indices (Indicator 3.2.2).

<u>Criterion 3.3</u>

The current four indicators are difficult to use at present to assess GES, but do provide a way of assessing change. Data collection for these indicators should be maintained for the time being but not used in evaluating GES.

Any new 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)**.**

The indicators proposed in the initial Commission decision are related to the newly proposed properties of Criterion 3.3 as described above. One "best indicator" needs to be selected for each property based on appropriate criteria. This may be a new and better indicator or one of the previous indicators.

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, 2014c) should be the basis for a process involving one or more further 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 international scientific bodies (i.e. ICES, GFCM, STECF, and ICCAT) for internationally managed stocks.

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

There are several issues to consider when assessing Descriptor 3 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.

Table 2. Selection of indicators.

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

Table 3a. Recommendations for proposed status and quality of reporting (Criterion 3.1).

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 boundary	A species/stock should be exploited sustainably, consistent with high long-term yields. For the primary indicator this implies $F \le F_{MSY}$.
Status reporting	Aggregated to: Proportion of stocks (%) that meet GES.
	Aggregated to: Annual mean value of F/F_{MSY} across all stocks.
Quality reporting	Aggregated to: Proportion of species[3] assessed against GES in relation to a suite of "All" commercial species.
	Aggregated to: 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 agreed[2] species-specific threshold lag of what can still be considered "recent".

[2]   Agreed by the relevant international 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 EU 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 boundary	The mean of the most recent three years should be below the long-term historical average[2].
Status reporting	Aggregated to: Proportion of species (%) that meet GES.
	Aggregated to: Annual mean of the indicator value/long-term mean indicator value across species.
Quality reporting	Aggregated to: Proportion of species[3] assessed against GES in relation to a suite of "All" commercial species.
	Aggregated to: 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 relevant international scientific body. In the case of regional or widely distributed stocks this is ICES/GFCM/ICCAT.

[2]   Appropriate period depending on the monitoring programme.

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

Table 3b. Recommendations for proposed status and quality of reporting (Criterion 3.2).

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 boundary	A species/stock should have an SSB >MSY $B_{trigger}$[3].
Status reporting	Aggregated to: Proportion of stocks (%) that meet GES.
	Aggregated to Annual mean value of SSB/MSY $B_{trigger}$ across all stocks.
Quality reporting	Aggregated to: Proportion of species[4] assessed against GES in relation to a suite of "All" commercial species.
	Aggregated to 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 agreed[2] species-specific threshold lag of what can still be considered "recent".

[2]   Agreed by the relevant international scientific body (ICES/GFCM/ICCAT).

[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 boundary	The mean of the most recent three years should be above the long-term historical average[2].
Status reporting	Aggregated to: Proportion of species (%) that meet GES.
	Aggregated to: Annual mean of the indicator value/long-term mean indicator value across species.
Quality reporting	Aggregated to: Proportion of species[3] assessed against GES in relation to a suite of "All" commercial species.
	Aggregated to: 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 relevant international scientific body (ICES/GFCM/ICCAT).

[2]   Appropriate period depending on the monitoring programme.

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

Table 3c. Recommendations for proposed status and quality of reporting (Criterion 3.3).

CRITERION 3.3 INDICATORS

Selection of stocks	All species for which a reliable[1] value of each of the indicators can be calculated.
GES boundary	GES boundaries cannot be set for these indicators at present.
Status reporting	Monitoring should be maintained.
Quality reporting	Not applicable at present.

[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 relevant international scientific body (ICES/GFCM/ICCAT).

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. Rationale 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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ICES. 2014c. Report of the Workshop on guidance to review the 2010 Commission Decision on Criteria and Methodological Standards on good environmental status (GES) of marine waters – Descriptor 3 – commercial fish and shellfish, 4–5 September 2014, ICES HQ, Denmark. ICES CM 2014/ACOM:59.

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Annex 2

Possible approach to amend Decision 2010/477/EC

Descriptor 4: Food webs

Author	Version	Date
Milieu-Nature Bureau	V 1	09 May 2014
DG Environment	V1.2	30 May 2014
ICES D4 science team	V2	15 August 2014
ICES D4 science team (post WK)	V3	30 September 2014
ICES D4 review	V4	20 March 2015

Possible approach to amend Decision 2010/477/EC

Descriptor 4: Food webs

Title of Descriptor

Good environmental status for Descriptor 4 – Food webs

All elements of the marine food webs, to the extent that they are known, occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity (EU, 2008).

1. Approach

Definition of the Descriptor

The Descriptors 1 (Biodiversity *per se*), 4 (Food webs), and 6 (Sea-floor integrity) are frequently addressed together as the "biodiversity theme." They are all influenced by multiple pressures and impacts (as listed in Annex 3 of EU, 2010), in addition to the natural variations in the ecosystems. There is significant overlap of the data requirements for each of these descriptors when addressing the state and/or alteration of biodiversity. Furthermore, Descriptor 3 (Commercial fish and shellfish) is strongly linked to the biodiversity theme, especially in relation to the status of fish stocks and how these influence food webs. The Directive separates these issues into separate GES descriptors.

Descriptor 4 aims to cover the structure and function of marine food webs, including the abundance and productivity of species/groups at different trophic levels. Usually environmental influence has a high impact on food web structure and function. Current scientific understanding is such that the effects of anthropogenic pressures are often difficult to distinguish from environmentally influenced variability. This difficulty creates many challenges to monitor and assess GES for this descriptor as the identification of simple pressure–state relationships is usually beyond current understanding and available tools (ICES, 2014a).

The following aspects of the Annex I definition (EU, 2010) are defined in further detail:

'All elements' considers all components of the food webs, 'i.e. all trophic and functional groups, comprising either one or several species. This potentially includes all living organisms and non-living organic components' (Rogers *et al.*, 2010).

'Food webs' are defined as 'networks of feeding interactions between consumers and their food' (Rogers *et al.*, 2010).

'Reproductive capacity' is defined as the 'maintenance of fertility and avoidance of reduction in population genetic diversity.'

'Normal abundance' – judgements of what normal abundances are will need to be determined as food webs have already been adversely affected by humans. The thresholds set for indicators should ensure that the populations of selected food web components occur at levels that are within acceptable ranges to ensure their long-term viability. This means that thresholds should be sufficient to maintain the full reproductive capacity of selected components.

'To the extent that they are known' – This has been interpreted by the Task Group 4 (Rogers *et al.*, 2010) as follows: 'While examination of food webs should in principle include "all elements", for practical purposes it would include only those food web components that can effectively be sampled by established robust methods of monitoring' (Rogers *et al.*, 2010).

Linkages with existing relevant EU legal requirements, standards, and limit values

There are few tools or frameworks in current use that focus specifically on food webs or trophic interactions between species. The **Habitats Directive (HD), Birds Directive (BD),** and the **Water Framework Directive (WFD)** do not explicitly refer to food webs, but state that the structure and function of habitats and ecosystems need to be restored and/or conserved, thus implicitly requiring the maintenance of healthy food webs. Indicators of the structural components (taxonomic groups) of the ecosystem such as the abundance/biomass of selected species at different trophic levels are

used for assessments within all three directives (e.g. phytoplankton, macrobenthos for WFD, annexed species for BD and HD; Palialexis *et al.*, 2014).

The reformed **Common Fisheries Policy** makes specific reference to the trophic linkages between fish stocks in its requirement for multiannual plans. These are to cover fisheries exploiting several stocks and, in the case of mixed fisheries or where the dynamics of stocks impact on one another, to take into account knowledge about the interactions between fish stocks, fisheries, and marine ecosystems (EU, 2013).

Linkages with international and RSC norms and standards

Standards related to biodiversity in general are less well-developed at EU and regional levels, compared to, for instance, Descriptors 3 (Commercial fish and shellfish), 5 (Eutrophication), and 8 (Contamination).

HELCOM is advanced in developing and agreeing on methods related to Descriptor 4. The HELCOM CORESET project developed a set of core indicators for biodiversity along with quantitative targets to allow an assessment of the status of the Baltic Sea in relation to the biodiversity ecological objectives (HELCOM, 2013): 20 core indicators have been developed for biodiversity, covering a range of aspects of Descriptors 1, 4, and 6. A number of HELCOM indicators relate directly to the Commission Decision indicators for Descriptor 4, such as the indicator on the "Abundance of key functional fish groups" (related to Indicator 4.3.1) or the "Proportion of large fish in the community" (related to Indicator 4.2.1).

OSPAR is developing 'common indicators' for MSFD assessments. To date three food web indicators have been adopted by the OSPAR Commission for one or more subregions. These are: Large Fish Indicator (FW3), Marine Trophic Index (FW4), and Plankton Lifeform Index (FW5). Work on more food web indicators and extension to more subregions is in progress. Indicators developed or under development for Descriptors 1 and 6 may also contribute to the assessment of Descriptor 4.

Both the **Black Sea** and the **Barcelona Conventions** have either not agreed on, or only just started a process to develop common indicators related to MSFD biodiversity descriptors (Descriptor 4 included); these are not yet operational.

Definition of GES

The current interpretation of the descriptor assesses whether the certain elements that make up the food web are present in a way that allow the ecosystem to be considered in good environmental status. Descriptor 4 is a descriptor of state. The assessment in the current Decision is based on productivity, the abundance of top predators, and the abundance and distribution of other functionally important groups/species in the food web. To achieve GES, the pressures from human activities should be managed in order to ensure the long-term abundance of the species in the food web and the retention of their full reproductive capacity. This poses a major challenge as scientific understanding is such that anthropogenic pressure is often difficult to distinguish from the environmentally influenced variability. In the absence of strong indicators reflecting pressure–state relationships, Descriptor 4 indicators can be treated as surveillance indicators (for monitoring change in the food web, see below for definition).

The "climate sensitivity" for Descriptor 4 (or criteria/indicators)

Marine food webs are extremely closely linked to natural variability. This makes Descriptor 4 particularly sensitive to climate change as the changing climate superimposes further trends onto prevailing natural conditions. Both structure and function can be influenced by these shifts, thus perturbing the ability to distinguish whether changes are climate induced or resulting from anthropogenic activity. Therefore it is likely that Descriptor 4, together with associated considerations of GES, are very sensitive to climatic trends in a region.

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2. Analysis of the implementation process

GES definition

According to the Commission Staff Working Document 2014 (EU, 2014), all EU Member States who have reported have defined GES for Descriptor 4. Only two EU Member States were judged to have an adequate definition of GES, six were found to have a partially adequate definition, whilst eight were found to be inadequate. Four EU Member States have not defined GES for this descriptor. The definitions provided applied to their entire marine waters, with one exception where a Member State makes a minor differentiation between its subregions.

The definitions vary enormously in their content and level of detail; most were qualitative and many were rather vague, lacking definitions of key terms used or specificity as to which elements of food/food webs were addressed.

Most EU Member States have referred to specific food web components in their GES definition, sometimes in addition to defining it for all food web components. In the Baltic region, most EU Member States have put an emphasis on fish

communities. Most EU Member States referred to components such as 'key' species or 'functional groups', and/or to 'top predators' or 'species at the top of the food web'. Very few EU Member States included in their GES definitions specific species or habitats as indicators of change. Indicator species include the harbour porpoise and the harbour seal, and indicator habitats include *Posidonia* meadows. Only three EU Member States included a reference to the pressures of food web components, in particular fisheries.

Criterion 4.1 – Productivity (production per unit biomass) of key species or trophic groups

Three EU Member States have referred to energy transfers between trophic levels in their GES definition. Several EU Member States have covered Criterion 4.1 using metrics for the reproductive performance (success, ability, rate) of birds, marine mammals, etc., by using the biomass and abundance of higher trophic-level species and/or the structure of populations of main trophic groups.

Criterion 4.2 – Proportion of selected species at the top of food webs

Most EU Member States have covered Criterion 4.2, although there was a large variation regarding the methodological approaches that were applied. The Indicator 4.2.1 "Large fish (by weight)" was reported by a few EU Member States. In the Mediterranean, three EU Member States have indicated that for Indicator 4.2.1 they will use the same threshold, requiring the weight of large fish caught by research vessels that are above a threshold length "L_{cut}" to be above a percentage of the total weight "W_{lim}". In other marine regions, there is no similar coherence in the thresholds used.

Criterion 4.3 – Abundance/distribution of key trophic groups/species

The approaches for addressing Criterion 4.3 and the associated indicators varied greatly across the EU Member States. A few EU Member States considered only higher trophic levels; others covered all trophic levels, including plankton. Reference to pressures in the GES definition (e.g. bycatch, eutrophication) was made by only a very small number of EU Member States. Indicator 4.3.1 "Abundance trends of functionally important selected species and functional groups" was reported almost twice as frequently as Indicators 4.2.1 and 4.1.1.

Regional coherence descriptor

The level of coherence for Descriptor 4 is low in the Northeast Atlantic, Mediterranean, and Baltic regions. In the Black Sea region, neither of the two EU Member States has defined GES for Descriptor 4. To improve coherence, the Commission Report (EU, 2014) suggests that further scientific and methodological developments should occur at the regional level to improve the possibilities for setting GES and environmental targets, and also to consider a more holistic setting of GES through integrating Descriptor 4 with other descriptors, particularly Descriptors 1 and 6.

Member State good practices

A few EU Member States included specific species as indicators of change in their GES definition, including the harbour porpoise and the harbour seal. Some EU Member States have included a reference to the pressures on food web components, in particular fisheries (e.g. bycatch and discards). Some EU Member States have also included quantitative threshold values for certain criteria/indicators/species. Three EU Member States refer to energy transfers between trophic levels in their GES definition. Three EU Member States from the same region (Mediterranean) have defined the same threshold for Indicator 4.2.1, requiring the weight of large fish caught by research vessels that are above a threshold length ("L_{cut}") to be above a percentage of the total weight ("W_{lim}"). One Member State included a condition related to recycling processes of organic matter for the achievement of GES.

Identification of issues arising from the application of the current Decision, including those identified by the Article 12 assessment

1) Need to set minimum requirements.
2) Need to increase integration levels between Descriptor 4 and EU legislation.
3) Need for further scientific and methodological developments to improve the possibilities for setting GES and environmental targets, both at the EU and the regional level.
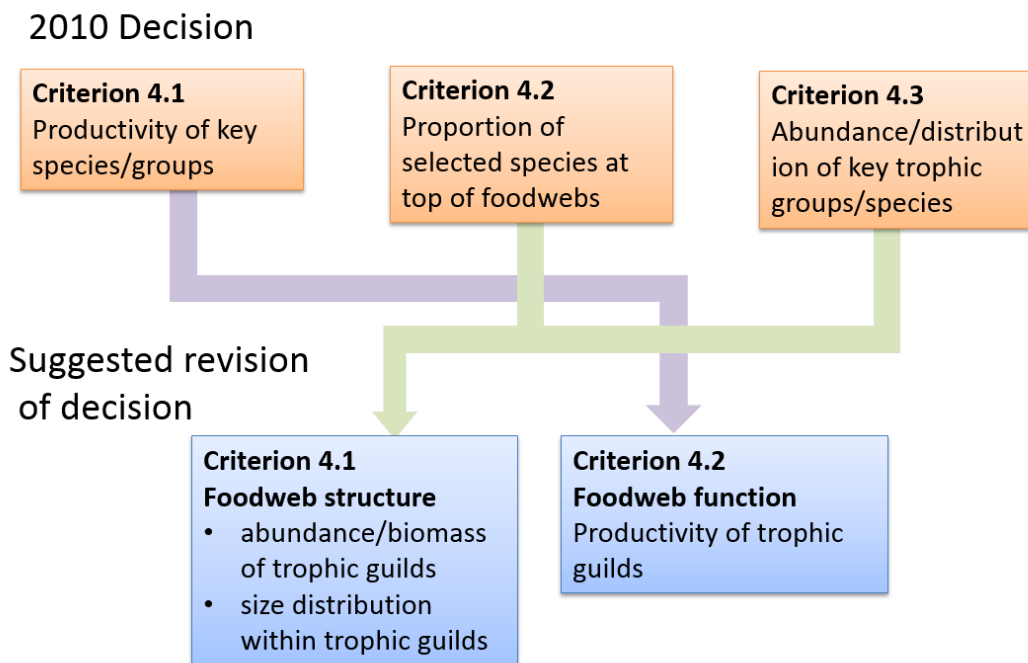
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3. Analysis of the current text of the Decision

➢ **To be kept in the Decision, in accordance with the mandate provided by the Directive**

A revision of the criteria is necessary to provide a closer relation to the important aspects of food webs as described in the Directive and to create a simpler decision. The proposal is to merge the existing current three Descriptor 4 criteria to just two criteria (4.1 Food web Structure and 4.2 Food web Function). This is based on the current state of scientific

understanding and a pragmatic approach to ongoing monitoring programmes. The categorization of food webs using taxonomy should be removed from the Decision and replaced with the concept of trophic guilds, meaning that the criteria should be applied across groups related to trophic interactions, e.g. trophic groups which are important recipients or providers of services to other trophic groups. The new Criterion 4.1 Structure should be subdivided into biomass of guilds over time and size structure within those guilds.

2010 Decision

Criterion 4.1
Productivity of key species/groups

Criterion 4.2
Proportion of selected species at top of foodwebs

Criterion 4.3
Abundance/distribut ion of key trophic groups/species

Suggested revision of decision

Criterion 4.1
Foodweb structure
- abundance/biomass of trophic guilds
- size distribution within trophic guilds

Criterion 4.2
Foodweb function
Productivity of trophic guilds

It is therefore suggested that the Decision text for Descriptor 4 be changed to:

Criterion 4.1 "Food web structure" – Abundance/biomass of, and size distribution within trophic guilds.

Criterion 4.2 "Food web function" – Productivity of trophic guilds.

> ➢ **To be taken out of the Decision and included in guidance document**

The guidance document should clarify:

- The combining of the 2010 Decision Criteria 4.2 and 4.3 into the new Decision Criterion 4.1, with associated explanation of the two new criteria.
- The concept of "trophic guild" and the indicative list of trophic guilds (ICES, 2014b). This is important as the guild approach is different from the taxonomic approach although it relies on almost identical monitoring information. Trophic guilds can refer to important prey groups (defined by who eats them) as well as predators (a group that eats the same thing).
- The recommendation that not all trophic guilds in each ecosystem need to be assessed but that, by region, a minimum of at least three trophic guilds should be monitored, preferably covering both lower and higher trophic levels. EU Member States can monitor as many guilds as deemed appropriate (with a minimum of three), but at least two non-fish guilds should be required to ensure that not only fish are monitored. Existing monitoring programmes and many proposed indicators can already provide the majority of the information requirements for these criteria (biomass and size of three trophic guilds and productivity of the food web).
- The choice of trophic guilds is expected to reflect regional differences in priorities and ecosystem dynamics.
- Methodological standards for defining GES for Descriptor 4.

4. The issues

Food webs characterized by structure and by function

The Task Group 4 report (Rogers et al., 2010), as well as the recent ICES Descriptor 4 advice (ICES, 2014a), have proposed that Descriptor 4 criteria should cover food web structure and function. The rationale for this is:

- • A food web depicts feeding connections in an ecological community.
- • Structure – the manner in which the elements or parts of something are organized.
- • Function – the way something works or operates.

Food web structure and function are closely linked. There are several ways to characterize structure in a food web. For instance, by the relative abundances of its components or by the degree to which the components are connected to each other. The former can often be estimated and therefore could provide indicators. The connections in the structure of food webs may also provide information about transfer functions.

There are aspects of function that cannot be captured by structure indicators. For example, a given structure might exist and be consistent with differing rates of flow between components. Also, owing to delays in propagating perturbations through food webs, changes in structure caused by alteration to functions may take time. Therefore, criteria are needed for both attributes. The criteria must be complementary to increase the likelihood that they will inform of change and, where necessary, stimulate action.

The 2008 Directive wording for Descriptor 4 "capable of ensuring long-term abundance and the retention of their full reproductive capacity" is in essence about maintaining resilience (the ability to recover from perturbations). Resilience of a food web might depend on many of its attributes, so that any structure or function indicator can be considered an indicator of resilience, but it may not be sufficient to maintain this indicator at a GES level to ensure that the food web remains resilient. Further studies are needed to investigate this aspect, but current knowledge is insufficient to suggest appropriate indicators of resilience besides those related to structure and function.

Trophic guilds and food webs

It would be exceedingly complex and very difficult to monitor and assess food web structure and function without considering trophic guilds. Food webs are complex, not only in structure but also in function. To monitor the degree to which they are affected by management therefore requires condensed information on food web status. This is most appropriately done by dividing the structure and function into compartments which share common features. For the food web, such compartments can be trophic guilds such as fish benthivores, fish planktivores, filter-feeding benthos, or omnivorous zooplankton (see Table 1 of indicative trophic guilds). The compartments can be classified as more or less important, depending on the services they supply, and are likely to vary regionally. There is some overlap between Descriptor 4 and Criterion 1.7 (Descriptor 1). Descriptor 4 is addressing functional aspects of ecosystems whereas Descriptor 1 is addressing the group's "position" within ecosystem structure. The proposed approach does not exclude other approaches to determining trophic guilds, such as using information on taxonomy or habitat.

Table 1. Indicative trophic guilds. X denotes where the taxonomic groups contribute significantly to each guild. Nekton includes bony fish, elasmobranchs, and squids.

Guild\Taxonomic group	Phytoplankton[1]	Zooplankton	Benthos	Nekton excl. warm-blooded	Seabirds	Marine mammals
Primary producers	X					
Secondary producers		X				
Filter-feeders			X			
Deposit-feeders			X			
Planktivores			X	X	X	X
Sub-apex pelagic predators				X	X	X
Sub-apex demersal predators			X	X	X	X
Apex predators				X	X	X

[1]In shallower waters, macrophytes may also be important.

Descriptor 4 and criteria in relation to state/pressure

Descriptor 4 is classified as a state descriptor (see Common Understanding Document, draft 22 September 2014). There are direct links between some elements of marine food webs and human pressures, such as primary production relating to the input of nutrients or fishing in relation to the abundance and distribution of forage fish. Overall the relationship between marine food webs and human pressures is complex and mainly indirect. Environmental influence has a high impact on food web structure and function. Current scientific understanding is such that anthropogenic pressure is difficult to unequivocally distinguish from the environmentally influenced variability. In the absence of strong indicators reflecting pressure–state relationships, the indicators of Descriptor 4 should be treated as surveillance indicators (for monitoring change in the food web); see definitions in Section 5 below.

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5. GES criteria (in accordance with Art. 9.3)

Food web indicators differ from indicators of other descriptors in a number of ways. Many food web indicators have weak or indirect links to human pressure and may show substantial variation due to factors not related to anthropogenic activities. With such indicators, it is difficult or impossible to identify values of the indicator that are desirable or undesirable in relation to human impacts. Furthermore, indicators often reflect the desire to achieve a balanced ecosystem; having very high or very low indicator values can therefore be equally undesirable. This is in contrast to, for example, indicators for environmental contaminants, where an upper limit alone constrains the desired range of values. Finally, the desired level of a specific indicator may be related to avoiding undesirable effects on other ecosystem components and hence requires information and knowledge on the relationship between different food web components.

The aim of food web indicators is to monitor key aspects of the food web structure and function and, by doing so, gain evidence to better understand the relationship between the monitored aspect and other ecosystem components as well as pressure–state relationships for these indicators. Passing beyond limits of indicators should trigger action including, e.g. dedicated research to understand the cause of changes.

Definitions

'**Food web surveillance indicators**' are defined as indicators of aspects of the structure or function of the food web, for which it is either not possible (through lack of evidence) to define limits based on knowledge of the system or where the link to anthropogenic pressures is weak or unclear, so direct management actions cannot be prescribed.

'**Limit**' defines the indicator value(s) at which a food web indicator changes between desirable and undesirable states. Food web indicators are defined as '**within limits**' when they are in the 'desirable state'. The target equates to the values or range of values that are 'within limits' and represent a 'desirable state'. Where limits are based on statistical analysis of time-series alone, or limited datasets, **'passing limits'** means moving into terra incognita, and not necessarily leaving the desirable state, thus requiring further research. See Section 6 for further guidance.

'**GES boundaries**' define the difference between GES and sub-GES in assessments of criteria and descriptors. The food web descriptor and the proposed criteria are considered essential and therefore GES boundaries apply to the descriptor as well as the criteria. GES boundaries are defined according to the assessments of an agreed set of indicators and according to agreed methods of aggregating these assessments. GES is measured for each food web criterion based on indicators under the criterion. The exact link between the number, level, and other aspects of the indicator that need to be 'within limits' in order to achieve GES depends on the specific aggregation methods that are used to combine indicator assessments and the methods used to set GES boundaries.

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

Limits for indicators can be determined by several methods.

A food web indicator may be associated with different combinations of available data with which to construct the indicator and knowledge about the relationship of the indicator with the food web components in the specific ecosystem. Each combination of knowledge and data availability requires associated guidance for setting indicator limits.

For many food web indicators, there is little knowledge about what values should be considered desirable or undesirable. In such cases, limits can be derived from the range of variation in the indicator, which is known from past time-series or from historical knowledge, where limits could be set at, for example, the maximum or minimum observed. Other options are available when more knowledge exists, including expert elicitation, empirical analysis, and modelling (see ICES, 2014a). Further statistical and modelling/simulation approaches are described in ICES (2015).

When the data and knowledge available is very limited, for example, when sampling has only just begun, appropriate limits can be suggested based on knowledge from similar ecosystems, theoretical considerations, or a desired direction of change. In all cases, the estimated limits are highly uncertain and this should be reported together with the indicator. Limits should be updated regularly as more information becomes available.

Where data exists and no undesirable effects have been observed, but knowledge of the direct relationship between the indicator and other ecosystem characteristics is limited, the indicator limits could be described by the observed range of known indicator values. Protocols should be in place such that when the indicator is not within limits, this triggers further investigation to determine the cause of the change as well as the effects on other ecosystem components. The likely impacting pressures should also be reviewed. As there is limited knowledge of the relationship between the indicator and other components, there is a possibility that undesirable effects occurred but were not recorded. This should be reflected in the reported uncertainty of assessments.

Where data exists and undesirable effects on other ecosystem components has been observed or is predicted based on solid knowledge of the direct relationship between the indicator and other ecosystem aspects, the range of indicator values associated with no (substantial) undesirable effects on other components should be used to set limits that denote the desirable range of indicator values. If the indicator is not within limits, action should be triggered. Action would involve further investigation to determine the cause of the deviation from the desired range, as well as the effect on other ecosystem components. The presence of (substantial) undesirable effects on ecosystem components can be determined based on a variety of measures. Ideally, the evaluation should include both analyses of historical data and investigation of model results.

Food web indicators are influenced by both natural and anthropogenic factors. To ensure that the limits continue to be relevant to the evaluation of GES, they should relate to current conditions of the ecosystem. For example, if the food web has exhibited pronounced regime shifts, the limit level should reflect the current regime rather than historical regimes. This conclusion also applies to the case where the regime shift is caused by excessive human pressure at an earlier time, for example when excessive removal of top predators has led to an increase in forage fish and a subsequent decrease of zooplankton (trophic cascade), but the system appears stable in the present regime. In this case, the current limit level for zooplankton biomass should reflect the current regime rather than a regime where predators have returned. If top predators are returning to the system, limit levels should be updated accordingly. When ecosystem trends are more gradual, which is often the case with the effect of climate change on food webs, a gradual change in the limit level should be implemented. Another example is the irreversible introduction of non-indigenous species with apparent disruption of food web structure and/or function. ICES suggests that "current conditions" might be re-evaluated once in the six-yearly MSFD cycle.

There are three types of uncertainty in determining the location of current state of the indicators relative to their limit or limits: uncertainty about the correct limit level, uncertainty about the bias and precision of the indicator estimated from data, and uncertainty about the effect of pressures on the indicator and hence about the potential effect of management measures. Ideally, the state of the indicator relative to the limit is determined from properly determined limit levels, an accurate estimate of the indicator, and a well-documented relationship between management, pressure, and indicator. In this case, pressures should be managed in accordance with the defined acceptable risk of falling outside limits.

In the case of food webs, one or more of these uncertainties are often considerable. In spite of this, the observed level of the indicator and the probability that the indicator is not within limits should be provided. If the estimated indicator is being measured with poor precision, there is a strong likelihood that the indicator will be recorded as outside the limits. It is important that this does not lead to revised (wider) limits. Instead, the frequent occurrence of indicators outside limits, or at high probability of being outside limits, should provide the incentive to improve the precision of the indicator. Where the link between management, pressure, and state of the indicator is poorly understood, assessments of such indicators should include explicit advice on (a) the probability of the indicator being outside the agreed limits, (b) the quality and reliability of the limits, and (c) the strength of the link with pressures and management.

Interpretation of the term 'to the extent that they are known'

A strict interpretation of the requirement for all elements of the marine food webs to 'occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity' would indicate a requirement to monitor all elements of the food web, an impractical and unfeasible task. However, the term 'to the extent they are known' may be interpreted as leaving the option that not knowing about the food web automatically leads to GES. This is an equally unacceptable interpretation. A balance between the two extremes seems to be the most appropriate way forward. When possible, the best available knowledge of food webs should be used, but the lack of detailed knowledge should not inhibit the monitoring of indicators of Descriptor 4. It is recommended that a minimum of at least three trophic guilds should be monitored by region, preferably covering both lower and higher trophic levels. Qualitative methods should be investigated where data is insufficient to estimate even the key aspects or aggregated indicators.

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

Three standardized methods for selected example indicators are proposed in the ICES report on the review of MSFD decision 2010 (ICES, 2014b). These are:

- Biomass of regionally important trophic guilds (Section 4.3.1);
- Primary production (Section 4.3.2);
- Seabird breeding success (Section 4.3.3).

Further examples are explored in ICES (2015).

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

Food web indicators are grouped in two different types: surveillance indicators, where the limit levels are poorly defined or the link between state and manageable pressures is unclear or limited, and indicators with well-defined limit levels and well-described pressure–state relationships (management indicator). As a consequence of this, there are three options for defining GES for Descriptor 4:

i. evaluating GES based only on indicators with clearly defined limit levels and well-described pressure–state relationships

ii. providing separate evaluations for surveillance indicators and indicators with clearly defined limit levels and well-described pressure–state relationships

iii. providing a joint evaluation of GES based on all indicators.

Each option has advantages and disadvantages (Table 2).

Table 2. Advantages and disadvantages of the three potential options for evaluating GES.

Option	Advantages	Disadvantages
GES evaluation based only on management indicators	GES is clearly linked to manageable pressures; management action therefore has the potential to affect the assessed status of Descriptor 4.	There are few management indicators for food webs and hence, GES for Descriptor 4 would be based on assessment of a small part of the food web, leading to potential misleading conclusions.
GES evaluation based on separate evaluations of management and of surveillance indicators	GES assessments based on management indicators is clearly linked to pressures and management action therefore has the potential to affect the assessed status of one aspect of Descriptor 4. GES assessments using surveillance indicators can provide information to help explain deviations from GES.	Having two types of indicator separately contributing to the evaluation of GES means that a single estimate of GES would be difficult. This could potentially complicate the presentation of GES across descriptors.
GES evaluation based on all indicators	One joint GES for Descriptor 4 can be estimated, integrating all indicators.	The GES assessment can be highly affected by non-manageable pressures. Descriptor 4 may be perceived as a descriptor that cannot be affected by management.

Regardless of which option is chosen, there are many indirect impacts and linkages between different food web components. For instance, rebuilt predator populations may cause cascading effects through the ecosystem or cyclic behaviour, in which case not even an undisturbed and perfectly monitored ecosystem will necessarily show all indicators within limits at a specific point in time. This aspect means that the application of simple aggregation or averaging rules across indicators (e.g. one out all out, % agreed targets) are not suitable for food web criteria. Indicators do not necessarily behave independently; many food web indicators are highly correlated. The degree of independence of indicators can be tested by quantifying the covariance and modelling indicator behaviour. Even where state indicators have clear links to pressures, there will be cases where pressure indicators are within limits, while state indicators are not. These mismatches may be due to lag periods (e.g. slow recovery times), other pressures, or different requirements for determining status.

Aggregation of assessments of different indicators should take the varying qualities of each indicator into account, in terms of their pressure–state relationships, levels of uncertainty in their estimation, and relationships with other food web indicators. Borja *et al.* (2014) reviewed methods for weighting, as well as considering the pros and cons of different methods, providing a useful to guide for choosing the most appropriate aggregation method.

Although methods to aggregate indicators within the Descriptor 4 criteria might differ, both structure and function need to be at GES for overall GES to be achieved.

9. Rationale and technical background for proposed revision

The proposed revision comes from the development on food web GES descriptors from two ICES-led workshops in response to the requests from DGENV (ICES, 2014a)

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

See documents below.

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11. Reference documents

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Annex 3

Possible approach to amend Decision 2010/477/EC

Descriptor 6: Sea-floor integrity

Author	Version	Date
Milieu	V1	16 May 2014
DG Environment	V1.2	28 May 2014
ICES D6 scientists	V2	29 September 2014
ICES advice	V3	20 March 2015

Possible approach to amend Decision 2010/477/EC

Descriptor 6: Sea-floor integrity

Title of Descriptor

Good environmental status for Descriptor 6 – Sea-floor integrity

Sea-floor integrity is at a level that ensures that the structure and functions of the ecosystems are safeguarded and that benthic ecosystems, in particular, are not adversely affected.

1. Approach

Definitions

Sea-floor includes both the physical and chemical parameters of seabed and the benthic community. Different kinds of habitats for fixed or mobile marine species are formed inside, on, and above the sea-floor.

Integrity is interpreted as both covering spatial connectivity and ecosystem processes functioning within their natural variability.

Assessing environmental status of the sea-floor is particularly challenging for four reasons:

- The large range of human pressures that may degrade the status of the sea-floor;
- Pressures and impacts from human activities are patchy;
- Habitat distribution on the sea-floor is patchy; and,
- The monitoring of the different range of sea-floor types is also irregular and not homogenous (e.g. lack of information about the sea-floor in the deep sea).

Linkages with existing relevant EU legal requirements, standards, and limit values

Sea-floor integrity as set out in the Directive is a relatively new concept, but one which encompasses aspects of the physical attributes and the functioning of seabed habitats and communities that have a long history of scientific study and environmental assessment, e.g. in the Water Framework Directive and the Habitats Directive. The Habitats, Birds, and Water Framework Directives do not explicitly define biodiversity and sea-floor integrity includes much more than just biodiversity. Special habitats are covered by a range of protected area measures, e.g. Natura 2000 sites. Sea-floor integrity must be achieved for widespread/predominant habitats, not just special (usually sensitive) ones.

Linkages with international and RSC norms and standards

HELCOM's CORESET II project has developed a suite of indicators which will form the core of the commonly agreed indicators among the HELCOM Contracting Parties. CORESET II also allows for the development of pre-core and candidate indicators relevant for Descriptor 6. Both state- and pressure-indicators are under development, and the work will build on relevant previous HELCOM products such as the reports from the HELCOM Red List project where a EUNIS compatible habitat classification system (HUB) was developed and threatened biotopes were identified.

Development of a set of common biodiversity indicators by **OSPAR** includes a number related to assessing seabed habitat quality and one assessing the spatial extent of damage from human activities. Five benthic habitat (BH) indicators pertaining to Descriptor 6 are included in the OSPAR list of common indicators: BH1 "Typical species composition", BH2 "Multi-metric indices", BH3 "Physical damage of predominant and special habitats", BH4 "Area of habitat loss", and BH5 "Size-frequency distribution of bivalve or other sensitive/indicator species". None of these indicators are yet fully operational, but offer a logical way of bringing information together, covering several attributes which are now being tested and validated to make them operational, at least in some areas.

The **Bucharest and Barcelona Conventions** have respectively not agreed or have just started a process to agree on indicators; these are not yet operational.

To the extent that these international and RSC norms and standards focus on specific, often highly sensitive habitats, or solely on biodiversity rather than ecological functions provided by all aspects of the sea-floor substrate and biota, they would be an incomplete basis for evaluating sea-floor integrity.

Definition of GES

ICES interprets GES for this descriptor to mean that the cumulative effect of pressures associated with human activity is at a level that ensures that sea-floor ecosystems maintain their structure and functioning. Any disturbance (intensity, frequency, and spatial extent) should not exceed a level that significantly and permenantly jeopardises recovery.

The Decision 2010/477/EU Descriptor 6 Criterion 6.1 "Physical damage" does not cover all aspects of sea-floor integrity with regard to substrate characteristics. Other pressures (e.g. eutrophication) are not explicitly included. Some indicators under this criterion (e.g. OSPAR's BH3) address some of these further pressures, but it is recommended that the criterion be adjusted to be more explicit on these aspects. The criterion is not clear in that both pressures and impacts are to be assessed. Only a few EU Member States incorporated functional aspects of sea-floor integrity in their implementation of Criterion 6.2 "Condition of benthic community".

It is recommended to adapt the Decision 2010/477/EU Descriptor 6 criteria and indicators to accommodate the inclusion of further pressures and their impacts, and to provide an effective and clearer transposition of functional aspects of the sea-floor integrity.

The "climate sensitivity" for Descriptor 6 (or criteria/indicators)

Climate changes can lead to changes in sea temperature and sea level as well as to ocean acidification, all of which can have an effect on sea-floor integrity, mainly on benthic species and communities, but potentially also on the physical habitat. One potential impact is due to a reduced exchange of nutrients between surface waters and deeper waters. It is expected that surface waters will receive fewer nutrients which will reduce the growth of phytoplankton and eventually the amount of organic matter that sinks down to sea-floor communities. This is expected to affect the composition, functioning, and biomass of deep-sea communities.

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2. Results of the Article 12 assessment (incl. In-depth assessment)

Descriptor

All EU Member States but one who submitted a report have defined GES for Descriptor 6, with definitions applying to their entire marine waters. The definitions were formulated at descriptor level by most EU Member States.

Criteria

Most EU Member States provided additional detail at the criterion level, often with a close relationship to the Commission Decision 2010/477/EU criteria. In general, depending also on data availability, it seems that the contribution of each indicator into the implementation of MSFD differs; however, some EU Member States have not used both criteria mentioned in the Decision. Other EU Member States provided additional details at the indicator level, with a close relationship to the Commission Decision indicators although every indicator was not always used. The definitions varied considerably in their content and level of detail; most were qualitative and were lacking definitions of key terms used or specificity of the sea-floor types to be addressed.

Decision 2010/477/EU Criterion 6.1 "Physical damage, having regard to substrate characteristics"

A majority of EU Member States refer to the reduction of physical pressures from human activities on the sea-floor, either directly or indirectly (through reference to impacts). Only four EU Member States included an indicator on the percentage of area occupied by biogenic substrate affected by human pressures, but three of these indicators did not specified a threshold value. Three out of these four EU Member States also have quantified indicators for non-biogenic habitat impacted by human pressures, but none of them have set a threshold yet.

Decision 2010/477/EU Criterion 6.2 "Condition of benthic community"

Across the EU Member States, the coverage of Criterion 6.2 on the condition of the benthic community is rather limited. In the Northeast Atlantic marine region, two EU Member States have included a quantitative indicator in their GES definition in relation to Indicator 6.2.2. In the Baltic region, several EU Member States have used quantitative indicators in their GES definition. In the Mediterranean, two EU Member States have indicated that the assessment of GES will be based on multi-metric indices, one of whom specifically refers to the WFD and good environmental status. The definitions for Criterion 6.2 from the other fourteen EU Member States are generally vague and only two of them make reference to the WFD good ecological status. Very few EU Member States consider how their indicators are linked to functionality in their consideration of the condition of the benthic community.

Regional coherence

The regional coherence for Decision 2010/477/EU Descriptor 6 is low in all regions except the Black Sea, where only one Member State has defined Decision 2010/477/EU Descriptor 6.

MS good practices

Four EU Member States have included an indicator on the percentage of area occupied by biogenic substrate affected by human pressures. One has associated the indicator with a quantitative threshold value. Four EU Member States have included a quantitative indicator as indicator for 6.2.2. Three additional EU Member States refer to the WFD good ecological status. Two EU Member States have specified the substrate types covered by the GES definition.

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3. Analysis of the current text of the Decision

> ➢ **To be kept in the Decision, but amended**

The following amended text is recommended to meet the issues identified above (strike-through = deleted, underline = inserted):

6.1. ~~Physical~~ Damage <u>to the sea-floor, having regard <u>to both pressure(s) on, and sensitivity of, habitats</u> ~~substrate characteristics~~

— <u>Extent of pressure(s) on the sea-floor (single, multiple, or cumulative)</u>

~~Type, abundance, biomass and areal extent of relevant biogenic substrate~~ (6.1.1)

— Extent of the sea~~bed~~ <u>floor</u> significantly affected by human activities for the different substrate types (<u>including biogenic</u>) (6.1.2).

6.2. <u>Structural and functional</u> condition of benthic community

— <u>Presence of a particular species providing a key function</u> ~~provided by sensitive and/or tolerant species~~ (6.2.1)

— Multi-metric indexes assessing benthic community structure and function~~, such as species diversity and richness, proportion of opportunistic to sensitive species~~ (6.2.2)

— Proportion of biomass or number of individuals in the macrobenthos above some specified length/size (6.2.3)

— Parameters describing the characteristics (shape, slope and intercept) of the size spectrum of the benthic community (6.2.4).

> ➢ **To be taken out of the Decision and included in guidance**

The following parts of the Decision describe qualitatively what the criteria and indicators refer to and provide limited guidance as to which elements should be assessed and the assessment methods that should be used. These sections should be moved to guidance:

The objective is that human pressures on the seabed do not hinder the ecosystem components to retain their natural diversity, productivity, and dynamic ecological processes, having regard to ecosystem resilience. The scale of assessment for this descriptor may be particularly challenging because of the patchy nature of the features of some benthic ecosystems and of several human pressures. Assessment and monitoring needs to be carried out further to an initial screening of impacts and threats to biodiversity features and human pressures, as well as an integration of assessment results from smaller to broader scales, covering where appropriate a subdivision, sub-region or region. (The following two paragraphs would need to be modified if the recommendations provided above are followed)

(6.1) The main concern for management purposes is the magnitude of impacts of human activities on sea-floor substrates structuring the benthic habitats. Among the substrate types, biogenic substrates, which are the most sensitive to physical disturbance, provide a range of functions that support benthic habitats and communities.

(6.2) The characteristics of the benthic community such as species composition, size composition, and functional traits provide an important indication of the potential of the ecosystem to function well. Information on the structure and dynamics of communities is obtained, as appropriate, by measuring species diversity, productivity (abundance or biomass), tolerant or sensitive taxa, and taxocene dominance and size composition of a community, reflected by the proportion of small and large individuals.

➢ **Outdated**

N/A

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4. GES criteria (in accordance with Art. 9.3)

Minor amendments to the existing GES criteria are recommended:

Criterion 6.1 "Damage to the sea-floor, having regard to both pressure(s) on, and sensitivity of, habitats"

— Extent of pressure(s) on the sea-floor (single, multiple, or cumulative);

— Extent of the sea-floor significantly affected by human activities for the different substrate types (including biogenic) (Indicator 6.1.2).

Criterion 6.2 "Structural and functional condition of benthic community"

— Presence of a particular species providing a key function (Indicator 6.2.1);

— Multi-metric indexes assessing benthic community structure and function (Indicator 6.2.2);

— Proportion of biomass or number of individuals in the macrobenthos above some specified length/size (Indicator 6.2.3);

— Parameters describing the characteristics (shape, slope, and intercept) of the size spectrum of the benthic community (Indicator 6.2.4).

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

No additional guidance.

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

A joint HELCOM CORESET II and OSPAR ICG–COBAM workshop (HELCOM–OSPAR, 2014) on biodiversity indicators identified particular opportunities for synergies for three indicators related to benthic habitats:

1) BH3 "Physical damage/cumulative effects" – the first steps could be sharing of progress and information via the workshop to see the potential for a common concept for Baltic/NEA; coordination of data calls (e.g. VMS data calls, sensitivity assessment); common standards for QA/QC.

2) BH2 "State of sea-floors composed of soft sediments (multi-metric index)" – exchanging of information would be appropriate for this indicator as an initial step. Cooperation could be helpful for development and testing, but it should be noted that the systems in the Northeast Atlantic and Baltic are sufficiently different that the calculation of the indicator would be different;

3) BH5 "Population structure" - there is potential here for common concepts across RSC areas, although species may differ. This would likely be a longer term action.

Further cooperation on concept development and testing could occur in the medium and long term.

This initiative should provide useful standardized methods for monitoring in northern and western European seas that could be adopted in other European seas.

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

None.

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8. Rationale and technical background for proposed revision

In early 2014, ICES was tasked with assessing Descriptor 6 "Sea-floor integrity" issues, focusing on methods and bounds for setting GES. A workshop held in September 2014 provided a guidance report with dedicated recommendations (ICES, 2014a). The results of this workshop were used to update a "template" provided by the European Commission to form a first draft of a Descriptor 6 "manual" (ICES, 2014b). Following a meeting of the MSFD Common Implementation Strategy Working Group on Good Environmental Status (WG-GES) in October 2014, further work and clarification was requested

from ICES in December 2014. As a result a further workshop was held in Copenhagen on 16–19 February 2015 (ICES, 2015). The results of this second workshop have been used in updating the current document.

Indicators on sea-floor functioning do not need more data to be collected. It would require the interpretion of structural data from a function perspective (i.e. assessing the functioning potential from structural data rather than directly measuring the actual process itself). These data are already being collected in ongoing monitoring programmes.

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

None.

10. Reference documents

HELCOM–OSPAR. 2014. Communication paper from the joint biodiversity indicator expert meeting of HELCOM CORESET II and OSPAR ICG–COBAM, 1 October 2014, Gothenburg, Sweden.

ICES. 2014a. Report of the Workshop to review the 2010 Commission Decision on criteria and methodological standards on good environmental status (GES) of marine waters; Descriptor 6: seafloor integrity, 2–3 September 2014, ICES Headquarters, Denmark. ICES CM 2014\ACOM:61. 37 pp.

ICES. 2014b. EU request to ICES for review of the Marine Strategy Framework Directive: Descriptor 6 – Seafloor integrity. *In* Report of the ICES Advisory Committee, 2014. ICES Advice 2014, Book 11 (Technical services), Section 11.2.1.5.

ICES. 2015. Report of the Workshop on guidance for the review of MSFD decision descriptor 6 – seafloor integrity II (WKGMSFDD6-II), 16-19 February 2015, ICES Headquarters, Denmark. ICES CM 2015\ACOM:50. 56 pp.