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Report of the Workshop 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.

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International Council for
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Executive summary

Good Environmental Status for Descriptor 3 – Populations of all commercially exploited fish and shellfish are within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock.

The current interpretation based on this definition is that the descriptor covers 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). The assessment of the status involves a pragmatic selection which needs to be agreed upon at a (sub-) regional level and should include at least all DCF monitored species of which each may consist of several stocks. This selection represents “all commercially exploited fish and shellfish” of which the status of each species/stock will be assessed against GES based on three criteria: (3.1) exploited sustainably consistent with high long-term yields, (3.2) have full reproductive capacity and (3.3) exhibit a population age and size distribution that is indicative of a healthy stock, of which the latter consists of three complementary properties.

For each of these criteria and properties indicators and, if possible, potential reference points were proposed depending on the information available per species or stock and distinguishing between primary indicators and secondary indicators. Primary indicators are based on what is considered the best source of information while secondary indicators require less sophisticated information and can be used if the primary indicators cannot be calculated for a species or stock. The calculation, and use, of primary indicators take precedence over secondary indicators when available.

The assessment of D3 against GES is based on each indicator separately. The primary indicators for criteria 3.1 (i.e. Fishing mortality F) and 3.2 (i.e. Spawning-stock biomass SSB) always come with a reference point, respectively F_{MSY} (the value of F expected to produce the high long-term sustainable yield) and a biomass safeguard ($MSY B_{trigger}$) capable of producing maximum sustainable yield which can be used to assess if GES is achieved (respectively $F < F_{MSY}$ and $SSB > MSY B_{trigger}$ for all stocks). All other indicators for which at present no reference values are available should be used as surveillance indicators and for which the current value is compared to a long-term historic average. The selection of reference values and choice of period for the long-term historic average should be done on a (sub) regional basis by the authoritative scientific institutions.

The status of D3 per (sub) region is described based on each indicator separately by the proportion of stocks (%) that meet GES based on that indicator while the progress over time towards the achievement of GES is described by a time-series of the annual mean value of the indicator relative to the reference value or long-term historic mean of that indicator across all stocks.

The quality of the assessment and hence the confidence in the outcome is determined by the quality of the information (primary > secondary indicators) available and the proportion of all species that could be assessed based on that information. This needs to be reported together with the outcome of the assessment against GES.

1 Introduction

The Commission Decision on criteria and methodological standards on good environmental status (GES) of marine waters (2010/477/EU) has raised many challenges for the implementation. Many of these are concerned with the scientific interpretation of the ideas and concepts of the Decision.

The European Commission (DG ENV) has decided to consider a revision of the Decision and to that end requested ICES to provide a technical input for a revision of e.g. Descriptor 3 (Commercial fish and Shellfish).

The revision process has so far consisted of preparation of a standardized template for all Descriptors by the DG ENV and its consultant Milieu. ICES has commented on the template which has been pre-filled by Milieu. The template also contains a section on the § 12 assessments based on the Initial assessment reports from the Member States. ICES has not commented on this §12 assessment section but has taken the conclusions into account.

Based on the prefilled template a small ICES Core team of scientists: Gerjan Piet (NL, chair), Carl O'Brien (UK), Manuela Azevedo (PT), Cristina Ribeiro (JRC) and Claus Hagebro (ICES Secretariat), has prepared a background document for discussion at the workshop. The Core team has been selected based on criteria such as geographical coverage, previous experience with the Marine Strategy Framework Directive and the implementation process in the Member States.

The workshop on the Descriptor 3 focused on the scientific challenges with a view to clarify the text and make the Decision more understandable and to foster a more coherent approach across Regions. Recent relevant ICES Advice has been taken into account in the review as well as the work on indicators conducted by the Regional Seas Conventions.

In the annexes 1-4 to this report the Terms of Reference, the agenda, a list of participants and the workshop discussion document can be found.

2 Aim of the workshop

The overall aim of a revision is to make the Decision:

- Simpler
- Clearer
- Introduce minimum requirements
- Self-explanatory
- Coherent with other EU legislation
- Coherent with regional assessments methods (where EU methods do not exist)

with the ultimate intention to support a better inter-regional coherence as well as between regions.

3 Definition of Descriptor

Good Environmental Status for Descriptor 3 – Populations of all commercially exploited fish and shellfish are within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock.

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

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

“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 be made up of several “subpopulations”.

We will use “stock” when the methodology to assess status of Descriptor 3 against GES is based on data from stock assessments and “species” when this is based on data from monitoring programs although in practice 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 North-east Atlantic and Baltic region ICES has defined a stock as being a part of a fish population usually with a particular migration pattern, specific spawning grounds, and subject to a distinct fishery. However, fishery management units rarely match the scale of populations and research has frequently found that more than one population occurs within a stock boundary. In recent ICES benchmarks there has been considerable progress in considering population structuring and some boundaries for assessed stocks now reflect our understanding of population structure.

In the Mediterranean region due to lack of biological knowledge, stocks are 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 Regulation 199/2008 (DCF regulation) within the scope of Directive 2008/56/EC, including internationally-managed stocks as well as regionally- and nationally-managed stocks.

Regulation (EC) 199/2008 – the Data Collection Framework (DCF) – establishes the Community framework for the collection, management and use of data in the fisher-

¹ Reference to CFP

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

ies 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, i.e. 2011-2013. The species listed by region in Annex VII of 2010/93/EU are therefore the commercial species of fish and shellfish that should be considered under Descriptor 3 at a minimum.

In addition to this, Member States can include other commercially-exploited species such as inshore stocks not covered by the CFP or DCF, as well as other stocks. 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 of which their exploitation is considered to have significant social or economic importance for the (sub-)region.

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

The two attributes that are currently used to assess stocks against safe biological limits both in the ICES area as well as in the Mediterranean by GFCM are that they should be:

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

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

“*exhibiting a population age and size distribution that is indicative of a healthy stock*” introduces a requirement to manage the demographics of fish stocks. At present there is uncertainty about how to interpret and implement this aspect and a scientific debate 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”.

3.1 Conclusion

The current interpretation is that the descriptor covers 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). The assessment of the status involves a pragmatic selection which needs to be agreed upon at a (sub-)regional level and should include at least all DCF species of which each may consist of several stocks. This selection represents “all commercially exploited fish and shellfish” of which the status of each species/stock will be assessed against GES based on three criteria: (1) exploited sustainably consistent with high long-term yields, (2) have full reproductive capacity and (3) exhibit a population age and size distribution that is indicative of a healthy stock. The proportion of all commercially exploited fish and shellfish that are assessed against GES per criterion are indicative of how comprehensive the D3 assessment was.

4 Methodological standards for the assessment of Descriptor 3 in relation to GES

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

- 1) Prepare a list of commercially exploited fish and shellfish stocks in the relevant marine region, to be used for the assessment of Descriptor 3, and provide the rationale for the selection of species/stocks.
- 2) Catalogue and document the available information for each of the species/stocks selected for the Descriptor 3 assessment.
- 3) Evaluate the stock status against the three GES criteria mentioned in EC Decision 2010/477/EU (EU, 2010), i.e. criterion 3.1 (level of pressure of the fishing activity), criterion 3.2 (reproductive capacity of the stock), and criterion 3.3 (population age and size distribution) by stock and/or species-functional group (i.e. pelagic, demersal/benthic, shellfish, elasmobranch, deep water).
- 4) Determine the overall status and identify issues, problems, gaps, and links to other MSFD descriptors (e.g. D1 – Biodiversity and D4 – Foodwebs), together with any additional monitoring needs.

4.1 Selection of commercially exploited fish and shellfish

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

- Local species relevant at a national level;
- (Sub-) regional species of which their distribution area 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 of which their exploitation is considered to have significant importance for the (sub-) region. For this it is important to adopt a practical and common sense approach based on the species monitored under the DCF (Group 1, Group 2 and Group 3 Species see Chapter III section B/B1/3).

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

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

4.2 Available information

For each species in the suite of species established in section 4.1 needs to be recorded what source(s) of information are available (see Table 1).

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

CRITERIA	AVAILABLE STANDARDS FOR	SOURCE	REFERENCE	REGIONAL COVERAGE/ REMARKS
Fishing mortality (F) (3.1.1). F values are equal to or lower than F_{MSY} , the level capable of producing Maximum Sustainable Yield (MSY).	I, II, III	CFP	Quantitative stock assessment done by ICES, GFCM, STECF, ICCAT on data collected under DCF, 199/2008	All EU / Quantitative stock assessment 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 indicative reference.	II	CFP	Data collected under DCF, 199/2008	All EU/ Stock production-based assessments 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} , then an appropriate reference point (identical for all regions) needs to be identified by the authoritative scientific institutions. ICES has selected MSY Btrigger for this purpose.	I, II, III	CFP	Quantitative stock assessment done by ICES, GFCM, STECF, ICCAT on data collected under DCF, 199/2008	All EU/ Quantitative stock assessment are not available for all stocks and considerable differences in data availability exist between (sub)regions
Biomass indices (3.2.2). The proposed indicators for criterion 3.3 should be revised. These indicators should now capture three relevant properties that describe or are directly linked to this criterion: Size distribution of the species Selectivity pattern of the fishery exploiting the species Genetic effects of exploitation on the species	II	CFP	National and International data collection and monitoring programs under DCF 199/2008	All EU/ There are no reference values with enough scientific agreement for assessment. Time-series of indicators not available for all stocks.

The quality of the assessment and hence the confidence in the outcome is determined by the information available. This can be reported as the proportion of species and proportion of landings (based on the suite of species established in section 4.1) with adequate information per criterion (see Table 1). ICES FishStat and/or FAO annual statistics are the appropriate data sources to determine the proportion of landings.

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

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

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

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

Note that this classification has been developed by ICES for stocks mainly exploited in the North-east Atlantic and may need further revision in order to accommodate the classification of Mediterranean stocks - particularly, classifying stocks according to data availability and the availability of methods for the assessment of their status (see ICES 2014a, WKD3R). Also note that unless there is a direct relationship between these categories and the assessment against GES these categories cannot be used to report on the availability of information.

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

4.2.1 Indicators

ICES has proposed the following high level selection criteria for indicators with more detailed subcriteria:

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

These were considered at the workshop and could guide the (further) process of selecting the best indicators for the 3.3 criterion.

Here we provide more detail on the indicators identified in Table 1 and described in Decision 2010/477/EU.

Criteria 3.1 and 3.2

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

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

Criterion 3.3

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

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

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

Size distribution of the species.

In the initial methodological standards there were two indicators that capture this property:

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

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

Selectivity pattern of the fishery exploiting the species.

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

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

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

Genetic effects of exploitation.

Size at first sexual maturation (previously 3.3.4)

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

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

The initial 3.3.2 indicator (Mean maximum length across all species found in research vessel surveys) is considered not appropriate because according to (ICES, 2012) the MML indicator is calculated as the average maximum potential length of individuals making up a community and takes no account of length of individuals at the time of sampling. Or, in simple terms, the MML indicates what proportion of the community is made up of individuals from large species and what proportion of the community is made up of individuals from small species, and it does not matter if the individuals from the “large species” are themselves large or small. Therefore the MML indicator is not appropriate as an indicator of size (or age) of individuals making up a population and hence should not be applied for this purpose as criterion 3.3.2. This indicator would be appropriate to the Descriptor 1. It is worth noting in this context that alt-

though it is a community indicator it does reflect a shift in species composition from species with life-history characteristics that make them more vulnerable to species that are less vulnerable. As such any shift in community composition implies a risk of losing vulnerable species which is relevant to biodiversity, and possibly, but not primarily, foodweb and its functioning.

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

4.2.2 Reference points

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

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

4.3 Assessment of Good Environmental Status

There are several issues to consider when assessing D3 against GES and reporting on the status for as many as possible of the species identified in 4.1 and based on the best available information described in 4.2. 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, the third in the chapter 4.3.1.

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

CRITERION 3.1 PRIMARY INDICATOR	
Selection of stocks	All stocks for which a recent ¹ value of F and an agreed ² value for F_{MSY} is available.
GES	In order to be in GES a species/stock should be exploited sustainably consistent with high long-term yields For the primary indicator this implies $F < F_{MSY}$. As this is a limit reference point this implies 100% of the stocks for which both the indicator and the reference point is available should fulfil this criterion.
Status Reporting:	Proportion of stocks (%) that meet GES Annual mean value of F/F_{MSY} across all stocks
Quality Reporting:	Proportion of species ³ assessed against GES in relation to suite of "All" commercial species Proportion of landings assessed against GES in relation to total landings

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

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

³ if only one stock of a species consisting of several stocks is assessed against GES this species counts as assessed.

CRITERION 3.1 SECONDARY INDICATOR	
Selection of stocks	All species for which a reliable ¹ value of the indicator (i.e. catch/biomass ratio) can be calculated.
GES	The mean of the most recent 3 years should be below the long-term historic average ²
Status Reporting:	Proportion of species (%) that meet GES Annual mean of the indicator value/long-term mean indicator value across species
Quality Reporting:	Proportion of species assessed against GES in relation to suite of "All" commercial species Proportion of landings assessed against GES in relation to total landings

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

² Appropriate period depending on the monitoring program

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	In order to be in GES a species/stock should have full reproductive capacity, i.e. SSB>MSY Btrigger. As this is a limit reference point this implies 100% of the stocks for which both the indicator and the reference point is available should fulfil this criterion.
Status	Proportion of stocks (%) that meet GES
Reporting:	Annual mean value of SSB/MSY Btrigger across all stocks
Quality	Proportion of species ⁴ assessed against GES in relation to suite of "All" commercial species
Reporting:	Proportion of landings assessed against GES in relation to total landings

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

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

³ Other reference points (>MSY Btrigger) 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 counts as assessed.

CRITERION 3.2 SECONDARY INDICATOR	
Selection of stocks	All species for which a reliable ¹ value of the indicator (i.e. biomass index) can be calculated.
GES	The mean of the most recent 3 years should be above the long-term historic average ²
Status	Proportion of species (%) that meet GES
Reporting:	Annual mean of the indicator value/long-term mean indicator value across species
Quality	Proportion of species assessed against GES in relation to suite of "All" commercial species
Reporting:	Proportion of landings assessed against GES in relation to total landings

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

² Appropriate period depending on the monitoring program

CRITERION 3.3 INDICATORS	
Selection of stocks	All species for which a reliable ¹ value of each of the indicators can be calculated.
GES	If a reference point can be identified for one or more of the indicators it can be used to identify a boundary for GES. Depending on the nature of this boundary and the level of uncertainty the proportion of species that should achieve GES can be determined. If no reference point is available the mean of the most recent 3 years should be above (or below depending on the reference direction) the long-term historic average ²
Status	Proportion of species (%) that meet GES
Reporting:	Annual mean of the indicator value/long-term mean indicator value across species
Quality	Proportion of species assessed against GES in relation to suite of "All" commercial species
Reporting:	Proportion of landings assessed against GES in relation to total landings

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

² Appropriate period depending on the monitoring program

4.3.1 Aggregation method(s) to consider

At present there are no aggregation criteria mentioned in the Decision. A recent study by (Borja, 2014) discusses the various aggregation issues. For the MSFD in general and D3 these issues may apply to the following:

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

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

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

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

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

cumulative effects (pressure indicators). Thus far there is no scientific basis to apply any weighting to the different criteria.

4.4 Climate sensitivity

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

The distribution of many fish stocks have been shifting northwards, possibly linked to changes in sea temperature, although this trend is not uniform across stocks³. Furthermore in areas where species cannot shift their range further, it is possible that some species will be lost. In the case of the Mediterranean it might become a more homogenous tropical-like ecosystem with likely loss of cold-water species⁴. The achievement of GES in particular in regards to criterion 3.2 on reproductive capacity of the stock and criterion 3.3 on population age and size distribution needs to take into account and be able to differentiate between shifts that are due to fishing pressure and those that are due to shifts in climatic/hydrological conditions.

4.5 Conclusion and discussion

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

- 1) The selection of a pragmatic suite of species that represent “all commercially exploited fish and shellfish” for each MSFD (sub)region;
- 2) The recording of all relevant source(s) 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 aggregated across species.

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

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

³<http://www.ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/SGSUE/2013/WGHIST2013.pdf>

⁴http://www.vliz.be/wiki/Predicted_biodiversity_changes_in_the_Mediterranean_Sea

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

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

5 Analysis of the current text of the Decision (2010/477/EU)

Based on the background discussion document the workshop considered the present text in the Decision 2010/477/EU) and agreed proposals for changes. Taking into account that the Decision text should be simplified and contain legal text only it is recommended that some sections providing background information or technical explanations should be deleted and moved to a guidance document (e.g. Staff Working Paper) where they can be further developed. Such text is marked with yellow below. Both in the yellow sections and in the remaining text some amendments have been made.

Furthermore, a major revision of the criterion 3.3 was 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 Mean maximum length across all species found in research vessel surveys (3.3.2) was considered not appropriate to this Descriptor 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 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 Regulation (EC) No 199/2008 into account), which will determine the most appropriate indicators to be used. For this descriptor, the three criteria for assessing progress towards good environmental status, as well as the indicators related respectively to them, are the following.

3.1. Level of pressure of the fishing activity

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

- Fishing mortality (F) (3.1.1).

Achieving or maintaining good environmental status requires that F values are equal to or lower than F_{MSY} , the level capable of producing Maximum Sustainable Yield (MSY). In mixed fisheries and where ecosystem interactions are important, long-term management plans may result in exploiting some stocks more lightly than at F_{MSY} levels in order not to prejudice the exploitation at F_{MSY} of other species⁵

⁵ Communication ‘Implementing sustainability in EU fisheries through maximum sustainable yield’ (COM(2006) 360 final).

F and F_{MSY} need to be estimated from appropriate quantitative assessments based on the analysis of catch-at-age or at length (to be taken as all removals from the stock, including discards and unaccounted catch) and ancillary information. Where the knowledge of the population dynamics of the stock do not allow to carry out such assessments, 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, can be used. Only stocks for which a recent value of F and an agreed value for F_{MSY} is available from the authoritative scientific institutions can be included in the assessment against GES using this indicator.

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

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

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

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

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

3.2. Reproductive capacity of the stock

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

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

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

SSB and SSB_{MSY} need to be estimated from appropriate quantitative assessments based on the analysis of catch-at-age or at length (to be taken as all removals from the stock, including discards and unaccounted catch) and ancillary information. Where the knowledge of the population dynamics of the stock do not allow to carry out such assessments, 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, can be used.

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

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

Where current knowledge does not allow the estimation of a reliable value for SSB_{MSY} , then an alternative reference point at which there is a high probability that the stock is able to replenish itself under the prevailing exploitation conditions can be set

by the authoritative scientific institutions to be used for the purpose of this criterion in the assessment against GES using this indicator.

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

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

– Biomass indices (3.2.2).

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

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

3.3. Population age and size distribution

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

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

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

At least one validated indicator per property needs to be selected.

6 Conclusions and further work

Below is a range of observations and recommendations for solving existing problems and gaps in relation to the implementation of the MSFD Descriptor 3.

Selection of stocks

i. Observations

- 1) Aggregation of current and/or historical information on landings across several species can hamper the selection process of stocks; e.g. landings not registered by species but by group of species, such as skates and rays.
- 2) The consequence of the landing obligation on the application of landing information as part of this assessment needs to be considered.

ii. Recommendations

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

Available information

i. Observations

Preliminary results show that there are huge regional differences in terms of the proportion of species for which information is available and the quality of that information; i.e. primary indicators are preferred to secondary indicators which in turn are preferred to a complete lack of information. The required quality reporting should reveal those differences and initiate a process to improve the availability and quality of information.

ii. Recommendations

The proportion of species for which indicators and reference values (often based on quantitative stock assessments) are available should increase.

Assessment

i. Observations

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

ii. Recommendations

- 1) For MSFD stocks for which there is no assessment of stock status but for which data are available, a priority ranking should be developed where landings/value and vulnerability are used jointly. Such analysis would provide a road map indicating how to fill the main gaps in stock status knowledge in order to assess the criteria of MSFD Descriptor 3.
- 2) The Regional overarching framework for the Mediterranean should seek the coordination of approaches for the assessment of GES for Descriptor 3 at the Mediterranean Sea regional scale.
- 3) Research surveys, as well as other relevant data collection programmes for the Mediterranean and Black Sea should be internationally coordinated and information from these processed and stored in standardized formats to facilitate the estimation of the Descriptor 3 indicators.
- 4) For data-limited stocks in the Mediterranean and Black seas currently lacking assessment methods, the data-limited stocks approaches developed by ICES should be considered for application and are under consideration by GFCM.

- 5) For Criterion 3.2, ICES recommends that the methods in the FAO report (Rosenberg *et al.*, 2014) should be considered to fulfil the needs for ICES Categories 4 and 5 stocks and work is ongoing.
- 6) ICES recommend the indicators for criterion 3.3 should be revised. These indicators should capture three relevant properties that describe or are directly linked to this criterion, these are: size distribution of the species, selectivity pattern of the fishery exploiting the species (pressure) and genetic effects of exploitation on the species. The best indicators for these properties must be selected based on appropriate criteria and subject to a prior validation process.
- 7) Under Criterion 3.3, ICES concurs with Zampoukas *et al.*, (2014) and recommends not using indicator 3.3.2 (mean maximum length across all species) as this is a community indicator and does not address Criterion 3.3 and is better considered under Descriptor 1.
- 8) Under Criterion 3.3, ICES has previously recommended to not use indicator 3.3.4 (size at first sexual maturation) as targets cannot be set, trends are not linked to a clear consequence or benefit, and management response to achieve targets are not defined (ICES, 2012b).
- 9) Under Criterion 3.3, it is recommended that the remaining available indicators (indicators 3.3.1 and 3.3.3) should be monitored for trends while their utility is further investigated (Piet *et al.*, 2010).

Other observations

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

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

As a starting point, and to provide a firm basis for listing stocks, the ICES workshop in January 2014 (ICES 2014a) prepared lists of stocks for assessment for each MSFD region/subregion.

7 References

- Barot, S., Heino, M., O'Brien, L., and Dieckmann, U. 2004. Estimating reaction norms for age and size at maturation when age at first reproduction is unknown. *Evolutionary Ecology Research*, 6: 659-678.
- Borja, A., Prins, T, Simboura, N, Andersen, JH, Berg, T, Marques, JC, Neto, JM, Papadopoulou, N, Reker, J, Teixeira, H and Uusitalo, L 2014. Tales from a thousand and one ways to integrate marine ecosystem components when assessing the environmental status. *Frontiers in Marine Science*, 1:22. doi:10.3389/fmars.2014.00022.
- Heino, M., Dieckmann, U., and Godø, O.R. 2002. Measuring Probabilistic Reaction Norms For Age And Size At Maturation. *Evolution*, 56: 669-677.
- ICES 2012. Marine Strategy Framework Directive – Descriptor 3+. ICES MSFD D3 report 2012. ICES CM 2012/ACOM: 62
- ICES 2014a. Report of the workshop to draft recommendations for the assessment of Descriptor D3 (WKD3R). 13-17 January 2014. ICES CM 2014/ACOM: 50
- ICES 2014. EU request on draft recommendations for the assessment of MSFD Descriptor 3. ICES Advice, *In* Report of ICES Advisory Committee, 2014. ICES Advice 2014, Book 1, Section 1.6.2.1
- Probst, W. N., Kloppmann, M., and Kraus, G. 2013. Indicator-based status assessment of commercial fish species in the North Sea according to the EU Marine Strategy Framework Directive (MSFD). *ICES Journal of Marine Science*, 70: 694-706.
- Wright, P.J., Millar, C.P., and Gibb, F.M. 2011. Intra-stock differences in maturation schedules of Atlantic cod, *Gadus morhua*. *ICES Journal of Marine Science: Journal dsu Conseil*, 68. 1918-1927.

Annex 1 Term of Reference

2013/2/ACOM59 The **Workshop on guidance for the review of MSFD Decision Descriptor 3 - commercial fish and shellfish (WKGMSFD-D3)**, chaired by Gerjan Piet, The Netherlands, will meet in Copenhagen, Denmark, 4–5 September 2014 to:

- a) Consider the issues raised by the ICES science team on the scientific challenges associated with the implementation of the MSFD decision.
- b) Provide guidance for the finalization of the review
- c) Report on additional scientific challenges to the implementation of the MSFD decision (D3) criteria. WKGMSFD-D3 will report by 15 September for the attention of ACOM.

Supporting information

Priority	High. This workshop is part of a process to respond to a request to ICES from DGENV for a technical service to review the descriptors for the MSFD 2010/477 Decision.
Scientific justification	The 2010 Decision of the MSFD raised many challenges. Many of these are concerned with the scientific interpretation of the ideas and concepts of the Decision. This workshop will focus on the scientific challenges for D3- commercial fish and shellfish with a view to clarify the text and make the Decision more understandable. Recent relevant ICES Advice should be taken into account in the review.
Resource requirements	None
Participants	Experts with expertise in MSFD implementations or scientific issues regarding the descriptor are encouraged to participate. Each country can send 1–2 participants. If nominations exceed the meeting space available ICES reserves the right to reject participants. This will be done based on the experts' relevant qualifications for the Workshop and geographical coverage. National participants join the workshop at national expense. The Workshop will be open to stakeholders.
Secretariat facilities	Secretariat support and meeting room
Financial	No financial implications.
Linkages to advisory committees	Direct link to ACOM.
Linkages to other committees or groups	Direct link to the CSGMSFD
Linkages to other organizations	Links to DGENV and the EU GES/MSCG

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Annex 3 Agenda

Workshop 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**

ICES H.Q. Copenhagen, Denmark

09:00 4 September to 17:00 5 September 2014

Chair: Gerjan Piet, Netherlands

September 4

- 1) Introductions and welcome

Participants will be welcomed to the workshop.

- 2) Aim of the workshop

The agenda, aims of the workshop, and expected outcomes will be reviewed. Participants will be invited to provide initial feedback on the proposed agenda and process.

- 3) Definition of the descriptor 3
- 4) Approach: Methodological issues relevant to the assessment of descriptor 3 in relation to GES

Issues related to indicators and reference levels

September 5

- 5) Approach (continued): Methodological issues relevant to the assessment of descriptor 3 in relation to GES

Issues related to aggregation and assessment of GES

- 6) Analysis of the current text of the decision

Special consideration of the specifics as indicated in the Annex 1 of the D3 Discussion Document

- 7) Conclusion

The main conclusions of the workshop will be reviewed and summarized.

Annex 4 Workshop Background document

Good Environmental Status for Descriptor 3 – Populations of all commercially exploited fish and shellfish are within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock.

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1 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. Relevant background material is provided after each phrase in italics.

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

“population” may consist of several stocks of a species. In the Northeast Atlantic area stocks are generally defined based on biological criteria and knowledge of migration, mixing and spawning areas, while in the Mediterranean due to lack of biological knowledge, stocks are defined largely by area and not in general on the basis of well-established biological knowledge on population units. For non-assessed species “population” usually refers to the species as they are identified in the relevant monitoring programs but sometimes higher taxonomic groupings (e.g. genus) are used.

‘all’ The Descriptor applies to all the species/stocks covered by Regulation 199/2008 (DCF regulation) within the scope of Directive 2008/56/EC. It is specific in that it applies to “all” commercially-exploited fish and shellfish. However the status is not at present assessed for all commercially exploited species. Important target species with a high commercial importance or making up a high proportion of landings are more comprehensively monitored and assessed than stocks of lesser importance. The use of the word “all” means that Descriptor 3 covers both internationally-managed stocks as well as regionally- and nationally-managed stocks. As it is impossible to include every population that is commercially exploited at some point in time a pragmatic interpretation of “all” needs to be agreed upon. Background

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, i.e. 2011-2013.

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

¹ Reference to CFP

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

difference is that instead of applying to all commercially exploited stocks it applies to selected stocks.

‘Safe biological limits’ Regulation 1380/2013 (CFP) defines “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 (Blim) and its estimated fishing mortality rate for the previous year is less than the limit fishing mortality rate reference point (Flim), (CFP article 4 point 18).

The two attributes that are currently used to assess the stocks both in the ICES area as well as in the Mediterranean by GFCM are: a stock should be (1) exploited sustainably consistent with high long-term yields and (2) have full reproductive capacity. When a stock is fished at a constant F value, the SSB will fluctuate due to natural factors. Thus a stock fished constantly at F_{MSY} should result in the SSB fluctuating around SSB_{MSY} . However, because this SSB_{MSY} is achieved in a multi-species context it is probably not equal to the estimated single-species SSB_{MSY} . Therefore ICES has refrained from using any SSB_{MSY} value as a reference level and focused on F_{MSY} and a biomass safeguard ($MSY B_{trigger}/B_{pa}$) for scientific quota advice. This reflects the point that biomasses are dependent on a number of factors, including fishing mortality, but not directly managed by fisheries measures, so it may not make sense to set SSB_{MSY} as a specific target or limit for policy. However, fish stocks need to be maintained within safe biological limits according to a precautionary approach to make MSY possible. Both these new reference levels should be used as a limit, not a target.

Background

In general terms stocks are characterized as being outside safe biological limits (or overfished stocks) when the fishing pressure (measured as mortality rate F) exerted on them, exceeds sustainable levels i.e. when mortality exceeds recruitment and growth. There are however also some more specific fisheries concepts and fish stock reference points that can be associated with the wording “safe biological limits”. For example, up until 2008 ICES classified stocks that were below the reference point B_{pa} as being outside “safe biological limits” even if fishing mortality was below the F_{pa} reference point³. The Descriptor text does not provide guidance on which of these, or another, approach is correct. Furthermore the concept of what constitutes “within safe biological limits” could be defined using other fish stock reference points and other management concepts.

Regulation (EU) 1380/2013 of the Common Fisheries Policy (CFP) is closely linked to the MSFD as the achievement of GES for Descriptor 3 relies, in large

³<http://www.eea.europa.eu/data-and-maps/indicators/fish-stocks-outside-safe-biological-limits/fish-stocks-outside-safe-biological-limits>

part, on the measures taken under the CFP. The CFP includes specific links to the MSFD; in particular Article 11(1)4 creates a direct link between CFP and MSFD stating that “The CFP should contribute to the protection of the marine environment, to the sustainable management of all commercially exploited species, and in particular to the achievement of good environmental status by 2020 as set out in Article 1(1) of Directive...”.

The objective of the CFP is to exploit all stocks at or below a maximum sustainable yield (MSY) exploitation rate by 2020. Where possible stocks should be exploited at or below MSY by 2015. The limit value of F_{MSY} applied to all stocks for the CFP is the same as that applied for indicator 3.1.1 of Commission Decision (2010/477/EU). The Commission Decision states that achieving GES requires that all F values are equal to or lower than F_{MSY} .

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

In relation to criterion 3.2, the reference to SSB_{MSY} and SSB_{pa} is likely going to be outdated in light of the reform of the CFP and consequent shift to the use MSY Btrigger by ICES⁵. Therefore the explanatory text for criterion 3.2 should be reviewed and possibly adapted in response to the changes to fisheries management being developed in ICES and GFCM.

‘exhibiting a population age and size distribution that is indicative of a healthy stock’ the final part of the Descriptor 3 text introduces a requirement to manage the demographics of fish stocks; this is a concept that is not part of existing fisheries management concepts and may be at odds with the recent CFP landing obligation (EU 1380/2013). It is currently still unclear what constitutes a healthy stock (Brunel and Piet, 2013; Borja, 2014) and which age and size distributions are reflective of such a healthy stock. Commission Decision 2010/477/EU states that “Healthy stocks are characterised by high proportion of old, large individuals.”

There are several references on the importance of monitoring the length structure of the stocks population given its linkage with the selectivity pattern

4 Member States are empowered to adopt conservation measures not affecting fishing vessels of other Member States that are applicable to waters under their sovereignty or jurisdiction and that are necessary for the purpose of complying with their obligations under Article 13(4) of Directive 2008/56/EC, Article 4 of Directive 2009/147/EC or Article 6 of Directive 92/43/EEC, provided that those measures are compatible with the objectives set out in Article 2 of this Regulation, meet the objectives of the relevant Union legislation that they intend to implement, and are at least as stringent as measures under Union law [Regulation 1380/2013].

5 ICES considers a stock fulfils the 3.2 criterion if SSB is above MSY Btrigger ... An appropriate choice of BMSY requires contemporary data with fishing at F_{MSY} to experience the normal range of fluctuations in SSB.
http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2014/Special%20Requests/EU_Draft_recommendations_for_the_assessment_of_MSFD_Descriptor3.pdf

of the fishery/gear and the impact this might have on the MSY reference levels (Kell and Fromentin, 2007; Colloca et al., 2013).

The process requires further work to select and define indicators and associated reference levels for Criterion 3.3 that respond to changes in the populations subject to fishing. Simulation studies suggest that not all proposed indicators of the COM Decision 2010/477 provide suitable sensitivity in the timescales required for management and that indicators for Criterion 3.3 need to be robust to variation in natural processes such as recruitment variability, regional and seasonal variation in the spatial distribution of juveniles, adults, small and large species (Probst et al., 2013b).

A question which needs to be addressed is whether meeting Criteria 3.1 and 3.2 would lead to fulfilment of Criterion 3.3 after a time lag, thereby making Criterion 3.3 redundant. First simulations suggest that the achievement of good environmental status within Criterion 3.3 depends on fishing mortality and the selection pattern of fisheries (Brunel & Piet, 2013). While the further development of criterion 3.3 is hampered by the lack of a specific definition of what is considered as a “healthy” population age or size structure (JRC, 2014), there are several studies that have proposed healthy selection patterns of fisheries, either from a single-species perspective (Froese et al., 2008; Colloca et al., 2013) or from an ecosystem perspective (Garcia et al., 2012). However, as currently phrased the Descriptor 3 is about stock structure in terms of size or age, not the exploitation pattern.

1.1 Recommendation

The current interpretation is that the descriptor covers all marine biological resources which are targeted for economic profit including the bony fish (teleosts), sharks and rays (elasmobranchs), crustaceans such as lobsters and shrimps, and molluscs (including bivalves and cephalopods). The assessment of the status involves at least all DCF species of which each may consist of several stocks. In order to be in GES a species/stock should be (1) exploited sustainably consistent with high long-term yields, i.e. $F < F_{MSY}$ and (2) have full reproductive capacity, i.e. $SSB > MSY$ Btrigger.

2 Approach

In this section we will consider the methodological issues relevant for the assessment of descriptor 3 in relation to GES. This is based on a common approach or “roadmap” which involves four distinct steps:

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

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

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

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

As similar issues apply to steps 3 and 4 these are considered together in chapter 2.3.

2.1 Selection of commercially exploited fish and shellfish

Selection of species: *What species should be considered for the (sub)region?* For this it is important to adopt a practical and common sense approach based on the species monitored under the DCF and potentially involving three spatial scales:

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

2.2 Available information

The quality of the assessment and hence the confidence in the outcome is determined by the information available. This can be reported as the proportion of species/stocks with adequate information, i.e. data availability and quality. ICES FishStat and/or FAO annual statistics are important data sources. ICES has developed a classification of stocks and their assessment data that identifies six categories (see Table 1).

Table 1. Categories of assessment stocks according to ICES (2012).

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

This classification should guide the process towards expanding the selection of species/stocks for which information suitable for the assessment of this descriptor is available. Note that this classification has been developed by ICES for stocks mainly exploited in the North-east Atlantic and may need further revision in order to accommodate the classification of Mediterranean stocks - particularly, classifying stocks according to data availability and the availability of methods for the assessment of their status (see ICES 2013 WKD3R).

This information will be collated for all (sub)regional and widely distributed species/stocks (i.e. not local) into a database (see ICES 2013 WKD3R).

2.2.1 Indicators

The indicators identified in (Piha, 2011) still apply for this descriptor. However the following can be discussed (mainly based on proposals either from the authoritative institutions that formulate advice or from the national authorities responsible for the management of local stocks):

Criterion 3.1: Consider possible alternative secondary indicators?

Criterion 3.2: Consider possible alternative secondary indicators?

Criterion 3.3: It seems reasonable to only keep indicators 3.3.1 and 3.3.3 and to not use indicators 3.3.2 and 3.3.4. 6.

6 This position was also supported by ICES. See <https://circabc.europa.eu/sd/a/d875d4e9-64e6-4ee9-9400-7656d275bc1d/Draft%20recommendations%20for%20the%20assessment%20of%20MSFD%20Descriptor%203.pdf>

Indicator 3.3.2 is considered not appropriate because according to (ICES, 2012) the MML indicator is calculated as the average maximum potential length of individuals making up a community and takes no account of length of individuals at the time of sampling. Or, in simple terms, the MML indicates what proportion of the community is made up of individuals from large species and what proportion of the community is made up of individuals from small species, and it does not matter if the individuals from the 'large species' are themselves large or small. Therefore the MML indicator is not appropriate as an indicator of size (or age) of individuals making up a population and should not be applied for this purpose as criterion 3.3.2.

For indicator 3.3.4 the method of calculation is still not resolved. Wright et al. (2011) presents an improved calculation of the indicator.

Background

The Regional Seas Conventions (RSCs) have been developing indicators but vary in their approach to fisheries.

OSPAR has one EcoQO related to Descriptor 3. This is to maintain the spawning stock biomass above precautionary reference points for commercial fish stocks where these are 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 specifically in relation to reproductive capacity.

The Baltic Sea Action Plan of HELCOM 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, and are distributed through their natural range, and contain full size/age range.' The text is close to the Descriptor 3 definition in that it requires all species to be within safe biological limits but it also states that fish populations should reach the Maximum Sustainable Yield although it is not completely clear whether this refers to the exploitation rate F or biomass SSB . The text also states that all stocks should be distributed throughout their natural range and that they should contain full size/age range. The natural distribution range is relevant to Descriptor 1 while the size/age range relate to criterion 3.3 of the Commission Decision (2010/477/EU).

As already mentioned the Barcelona Convention has adopted one general ecological objective related to Descriptor 3 but instead of applying to all commercially exploited stocks it applies to selected stocks.

For the Black Sea the Strategic Action Plan (SAP) under the Bucharest Convention has defined the following EcoQO: preserve commercial marine living resources. The EcoQO is split into two components of which both remain very general and non-committal:

- EcoQO 1a: Sustainable use of commercial fish stocks and other marine living resources
- EcoQO 1b: Restore/rehabilitate stocks of commercial marine living resources.

The European Environment Agency (EEA) now reports on the status of marine fish stocks in line with the MSFD based on two criteria:

- Sustainable exploitation where sustainably exploited stocks are stocks for which fishing mortality (F) is at or below levels that deliver Maximum Sustainable Yield (MSY), i.e. $F \leq F_{MSY}$. Only if a value of F and F_{MSY} were available we considered the stock assessed against this criterion and only if $F \leq F_{MSY}$ this stock was considered to be in GES.
- Reproductive capacity where $SSB \geq MSY$ Btrigger.

2.2.2 Reference levels

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

There is agreement on the reference level for criterion 3.1, i.e. F_{MSY} , for category 1 stocks (Table 1) and proxies are under development by both ICES and GFCM for category 2-6 stocks.

For the criterion 3.2, the reference to SSB_{MSY} and SSB_{pa} is likely going to be outdated in light of the reform of the CFP and consequent shift to the use of MSY Btrigger by ICES⁷. Therefore the explanatory text for criterion 3.2 should be reviewed and possibly adapted in response to the changes to fisheries management being developed in ICES and GFCM.

There are no known reference levels for the criterion 3.3.

2.3 Assessment of Good Environmental Status

The Directive 2008/56/EC (MSFD Directive) defines “good environmental status” as: the environmental status of marine waters where these provide ecological diverse and dynamic oceans and seas which are clean, healthy and productive within their intrinsic conditions, and the use of the marine environment is at a level that is sustainable thus safeguarding the potential for uses and activities by current and future generations ...followed by some specifications. The Decision (2010/477) Part B outlines the criteria for good environmental status relevant to the descriptors of Annex I to the Directive.

⁷http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2014/Special%20Requests/EU_Draft_recommendations_for_the_assessment_of_MSFD_Descriptor3.pdf

One of the 11 criteria is Descriptor 3 (D3): 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. Under D3 there are 3 main 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
<p>The CFP defines “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 (Blim) and its estimated fishing mortality rate for the previous year is less than the limit fishing mortality rate reference point (Flim), (Regulation1380/2013 (CFP) article 4 point 18)</p> <p>GES thresholds (reference levels) should be defined in line with this requirement and the discussion in section 2.2.2.</p>		<p>The lack of reference points at EU and regional sea level makes it difficult for MS to define quantitative GES thresholds</p>

There are several issues to consider when assessing if GES is achieved for D3. The main issues involve the selection of stocks to be included in the analysis, the aggregation method(s) used and the reference levels applied. The criterion 3.1 is best developed, followed by criterion 3.2. Further work is required before an assessment involving criterion 3.3 can be made.

2.3.1 Aggregation

At present there are no aggregation criteria mentioned in the Decision. A recent study by (Borja, 2014) discusses the various aggregation issues. For D3 these issues may apply to the following:

- 1) Across stocks per indicator
- 2) Across indicators within criteria
- 3) Across criteria within descriptors
- 4) Across descriptors (outside the remit of this group)

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

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

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

2.3.2 Prioritisation

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

2.4 Climate sensitivity

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

The distribution of many fish stocks have been shifting northwards, possibly linked to changes in sea temperature, although this trend is not uniform across stocks⁸. Furthermore in areas where species cannot shift their range further, it is possible that some species will be lost. In the case of the Mediterranean it might become a more homogenous tropical-like ecosystem with likely loss of cold-water species⁹. The achievement of GES in particular in regards to criterion 3.2 on reproductive capacity of the stock and criterion 3.3 on population age and size distribution needs to take into account and be able to differentiate between shifts that are due to fishing pressure and those that are due to shifts in climatic/hydrological conditions.

2.5 Recommendation

Below are the preliminary recommendations for each of the steps in the common approach or “roadmap” presented at the start of this chapter. These recommendations will be further developed during the workshop thereby considering the specifics in Annex 1.

⁸<http://www.ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/SSGSUE/2013/WGHI/ST2013.pdf>

⁹ http://www.vliz.be/wiki/Predicted_biodiversity_changes_in_the_Mediterranean_Sea

- 1) Starting point is the list of DCF species per MSFD (sub)region. These lists need to be prepared based on the match ICES area – MSFD (sub)region. Each Member State (MS) should report on the stocks in its MSFD (sub)region. In addition a MS should report on
 - specific local species deemed important but not considered in the DCF
 - straddling or highly migratory species caught in a national fishery
- 2) By matching the identified species with the best information available on the (sub)regional catches and the catches of straddling or highly migratory species (i.e. ICES FishStat and/or FAO annual statistics) each MS can report on how representative their selection is in terms of the proportion of the catches covered.
- 3) For each species/stock needs to be indicated which indicators and reference levels are available. A database with this information will be developed for all (sub-)regional or widely distributed species/stocks by ICES in collaboration with GFCM and ICCAT. The reference levels will be adopted as put forward by the appropriate authoritative institution.

As the catch information per species is included in this database it is possible to report on the proportion of the catches covered by the different types of information. The main distinction is based on whether or not information on the indicator and the reference level is available for criterion 3.1 and/or 3.2.
- 4) The stock status should at least be reported as proportion of stocks that fulfil criterion 3.1 only, criterion 3.2 only and both 3.1 and 3.2. How to address criterion 3.3 will be discussed at the workshop.

3 Analysis of the current text of the Decision

The introductory section states that the 'section applies for all the stocks covered by Regulation (EC) No 199/2008 (within the geographical scope of Directive 2008/56/EC) and similar obligations under the common fisheries policy.' The text should however take into account the fact that the MSFD also applies to regional and local stocks. Some might not be covered under the DCF, in particular freshwater species in the Baltic and e.g. some shellfish species.

3.1 To be kept in the Decision

The text of Indicator 3.1.1 (the primary indicator) should be limited to the first sentence: "Achieving or maintaining good environmental status requires that F values are equal to or lower than F_{MSY} , the level capable of producing Maximum Sustainable Yield (MSY)." The remaining text, which is primarily of explanatory nature, should be included in guidance.

For the secondary indicator (3.1.2) as well as any defined by the Member State under criterion 3.1, it should be clear that the indicator is to be used as a proxy of F and therefore any reference level should be aligned to the indicators equivalent of F_{MSY} . The following text could be kept but made more explicit in this regard.

"The value for the indicator that reflects F_{MSY} needs to be determined by scientific judgement following analysis of the observed historical trends of the indicator combined with other information on the historical performance of the fishery. Where stock production-based assessments are available, the catch/biomass ratio yielding MSY can be taken as indicative reference. Alternatively to the catch/biomass ratio, secondary indicators may be developed on the basis of any other appropriate proxy for fishing mortality, adequately justified."

3.2 To be taken out of the Decision and included in guidance

In line with the recommendations above, the following parts of the Decision could be taken out and included in a guidance document:

Criterion 3.1 Indicator 3.1.1:

"This means that 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."

" F is estimated from appropriate analytical assessments based on the analysis of catch (to be taken as all removals from the stock, including discards and unaccounted catch) at age or at length and ancillary information. Where the knowledge of the population dynamics of the stock do not allow to carry out simulations, scientific judgement of F 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, can be used."

Criterion 3.2 Indicator 3.2.1

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

"Further research is needed to address the fact that a SSB corresponding to MSY may not be achieved for all stocks simultaneously due to possible interactions between them." (This is also reflected in CFP preamble 8)

In relation to criterion 3.2, the reference to SSB_{MSY} and SSB_{pa} is likely going to be outdated in light of the reform of the CFP and consequent shift to the use MSY Btrigger by ICES¹⁰. Therefore the explanatory text for criterion 3.2 should be reviewed and possibly adapted in response to the changes to fisheries management being developed in ICES and GFCM.

Criterion 3.2 Indicator 3.2.2

"It can be used if such indices can be obtained for the fraction of the population that is sexually mature. In such cases, such indices need to be used when scientific judgement is able to determine, through detailed analysis of the historical trends of the indicator combined with other information on the historical performance of the fishery, that there is a high probability that the stock will be able to replenish itself under the prevailing exploitation conditions."

Criterion 3.3

"For the two sets of indicators (proportion of old fish and size at first sexual maturation), expert judgment is required for determining whether there is a high probability that the intrinsic genetic diversity of the stock will not be undermined. The expert judgment needs to be made following an analysis of the time series available for the indicator, together with any other information on the biology of the species."

This text needs amendments and in case it is concluded to propose to only keep indicators 3.3.1 and 3.3.3 and to not use indicators 3.3.2 and 3.3.4, due to lack of scientific understanding/related measures some further text is needed.

¹⁰http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2014/Special%20Requests/EU_Draft_recommendations_for_the_assessment_of_MSFD_Descriptor3.pdf

4 References

- Borja, A., Prins, T, Simboura, N, Andersen, JH, Berg, T, Marques, JC, Neto, JM, Papadopoulou, N, Reker, J, Teixeira, H and Uusitalo, L 2014. Tales from a thousand and one ways to integrate marine ecosystem components when assessing the environmental status. *Frontiers in Marine Science*, 1:22. doi:10.3389/fmars.2014.00022.
- Brunel, T., and Piet, G. J. 2013. Is age structure a relevant criterion for the health of fish stocks? *ICES Journal of Marine Science*, 70: 270-283.
- Brunel, T., Piet, G. J., van Hal, R., and Rockmann, C. 2010. Performance of harvest control rules in a variable environment. *ICES Journal of Marine Science*, 67: 1051-1062.
- Colloca, F., Cardinale, M., Maynou, F., Giannoulaki, M., Scarcella, G., Jenko, K., Bellido, J. M., et al. 2013. Rebuilding Mediterranean fisheries: a new paradigm for ecological sustainability. *Fish and Fisheries*, 14: 89-109.
- Froese, R., Stern-Pirlot, A., Winker, H., and Gascuel, D. 2008. Size matters: How single-species management can contribute to ecosystem-based fisheries management. *Fisheries Research*, 92: 231-241.
- Garcia, S. M., Kolding, J., Rice, J., Rochet, M. J., Zhou, S., Arimoto, T., Beyer, J. E., et al. 2012. Reconsidering the Consequences of Selective Fisheries. *Science*, 335: 1045-1047.
- ICES. 2012. Marine Strategy Framework Directive - Descriptor 3+
- Kell, L. T., and Fromentin, J. M. 2007. Evaluation of the robustness of maximum sustainable yield based management strategies to variations in carrying capacity or migration pattern of Atlantic bluefin tuna (*Thunnus thynnus*). *Canadian Journal of Fisheries and Aquatic Sciences*, 64: 837-847.
- Piha, H., Zampoukas, N. 2011. Review of methodological standards related to the Marine Strategy Framework Directive Criteria on Good Environmental Status. JRC 63584. 47 pp.
- Probst, W. N., Kloppmann, M., and Kraus, G. 2013. Indicator-based status assessment of commercial fish species in the North Sea according to the EU Marine Strategy Framework Directive (MSFD). *ICES Journal of Marine Science*, 70: 694-706.

Annex 1. Specifics to consider at the workshop

- GES criteria (in accordance with Art. 9.3)
- GES methodological standards (in accordance with Art. 9.3)
- Standardised methods for monitoring for comparability (in accordance with Art. 11.4)
- Standardised methods for assessment for comparability (in accordance with Art. 11.4 GES)
- Rational and technical background for proposed revision
- Other related products (e.g. technical guidance, reference in common understanding document)