

**ECOREGION**      **General**  
**SUBJECT**        **EU request on proposal on indicators for MSFD Descriptor 4 (foodwebs)**

**Advice summary**

ICES advises on potentially useful future indicators for MSFD Descriptor 4 (foodwebs). These include some indicators that are currently being implemented (including the large fish indicator). A roadmap with a timetable towards implementing these indicators is suggested. In addition, this advice summarizes ICES work on the large fish indicator.

**Request**

*“According to the MoU between ICES and the European Commission ICES shall provide further scientific advice in support of MSFD on the correct implementation of the descriptor 3 on populations of all commercially exploited fish and shellfish, including fisheries-related information for the other related descriptors (mainly D1, D4 and D6) as described in the draft MSFD Commission Staff Working Paper.*

*A proposal on indicators for descriptor 4 of MSFD (food webs). As stated in the Commission Decision (2010/477/EU) additional scientific and technical support is required for the further development of criteria and potentially useful indicators to address the relationships within the food web. In this framework, ICES shall continue working on the large fish indicator (4.2.1) and initiate work towards recommendations for potentially useful indicators in the future (to be considered for the revision of the Commission Decision) with a roadmap how to get there.”*

**Advice**

**Recommended roadmap for the further implementation MSFD Descriptor 4 (foodwebs)**

ICES advises following a four-step roadmap to further implement MSFD Descriptor 4. This roadmap assumes that Member States will work together through relevant Regional Seas Conventions and other international bodies to select, develop, and implement indicators to assess the future status of foodwebs. In the advice below, reference to action required of Member States implies cooperation within relevant regional or subregional seas.

The first step includes a proposal that modifies the existing Commission Decision (EC, 2010). ICES recognizes that future EU processes may change the detail of this proposed modification; should such change occur, Member States should then select the relevant indicators from the changed version and the same subsequent steps would still apply.

*Step 1    Indicator selection (2015–2017)*

Member States should identify indicators that represent the range of foodweb components from plankton to top predators, including their structural and functional properties and their resilience (an emergent property of structure and function). Member States should select two indicators as a minimum; one indicator related to “structure” (corresponding to criteria 4.2 and 4.3 of the Commission Decision (EC, 2010)) and one related to “function” (corresponding to criterion 4.1 of the Commission Decision (EC, 2010)) from Table 1.6.2.2.1.

**Table 1.6.2.2.1**      ICES recommendations for revised criteria and indicators (italics) for MSFD Descriptor 4 on foodwebs (see Annex 1.6.2.2 for further details on indicator specification).

<b>Structure</b>	<b>Function</b>
4.3. Abundance/distribution of key trophic groups/species (includes 4.2. Proportion of selected species at the top of the foodweb)	4.1. Productivity (production per unit biomass) of key species or trophic groups
<i>i.    Biomass of trophic guilds</i> <i>ii.   Mean weight of zooplankton</i> Integrated size-based indicators <i>iii.   Proportion of large fish (large fish indicator, LFI)</i> <i>iv.    Mean length of surveyed community</i>	<i>v.    Primary production</i> <i>vi.   Seabird breeding success</i> <i>vii.   Mean weights at age of predatory fish</i>

Indicators should be selected so that they together include several taxonomic groups (e.g. plankton, fish, birds, mammals, etc.) to sufficiently represent the breadth of the taxonomic groups that make up the foodweb. Empirical data should be used rather than modelled information.

The indicators selected should have broad geographic coverage of the (sub-)regional sea, so that indicators are coherent and representative across (sub-)regional seas. This may involve calculating the same indicator(s) based on different datasets covering different parts of the sea.

Suitable indicators for foodwebs may also be appropriate for other descriptors of GES, particularly D1 (biodiversity) and D6 (seafloor integrity). Member States should highlight where this is the case and encourage the common use of suites of indicators, rather than creating separate, duplicate indicator sets that are specific to each descriptor. Foodweb indicators selected in Step 1 may be a mixture of a) indicators that are recommended for foodwebs but are of use for other descriptors, and b) indicators of foodwebs that are unique to D4. A broad process that applies a common interpretation of all indicators will be necessary.

An indicator set has also been developed under the data collection framework (DCF) to evaluate the effects of fishing on the ecosystem. Some of these indicators (e.g. LFI) are used in common with MSFD.

Few of the proposed foodweb indicators allow reference levels (and thus targets) to be set, or they are tightly linked to a management action and show a direct response to intervention. The majority are surveillance indicators that are unlikely to respond unequivocally to management or support target setting. These help to track the impact of human activity and natural change at a high level in foodwebs. Surveillance indicators provide valuable contextual information for an informed assessment of ecosystem change as well as a broad insight into changes that may affect our ability to achieve specific targets.

If none of the indicators suggested can be implemented in a regional sea, then work will be required to ensure that implementation can occur in the next MSFD cycle, using experience from other regional sea(s) where implementation has been successful.

#### *Step 2 Technical specification and toolkit elaboration (2015–2017)*

Member States should develop and agree on the technical specification of selected indicators for each (sub-)regional sea. This work programme should develop specifications in a clear and easily accessible format to enable all relevant Member States to contribute to regional sea implementation of MSFD. Further work should elaborate a toolkit to enable Member States (and Regional Seas Commissions) to prepare and report indicators using common data platforms and analysis methodologies.

#### *Step 3 Regional and subregional data collection and indicator calculation (2017 onwards)*

Member States need to commit the necessary infrastructure to, as appropriate, collect, process, manage (in a centralized database), and analyse requisite foodweb-related data at a regional and subregional seas scale. Coordination and collaboration through existing processes (such as relevant ICES expert groups) is required when further data collection is needed from existing surveys.

The data should then be analysed using the methods specified in the toolkit (from Step 2) to generate a set of regional foodweb indicator values/time-series.

#### *Step 4 Evaluation of the process (2020)*

MSFD has a six-year timetable that includes assessment and evaluation of progress towards achieving GES. A necessary part of that cycle is the evaluation of the appropriateness of the criteria, indicators, and methodology used, and comprehensiveness of the D4 indicators selected for the regional sea. This evaluation should be carried out at an international level (above regional sea level) so that regional seas may learn from each other.

This step should be informed by the evaluations of the criteria and indicators of other descriptors, and by their collective usefulness and consistency in evaluating overall GES.

### **Further work on the large fish indicator**

ICES has continued to work on the large fish indicator (LFI), specifically extending its application to seas other than the North Sea. ICES has progressed work on the following aspects of this indicator:

- Definition: Past advice by ICES on the mathematical definition of this indicator, based on the weight of fish and a survey-specific threshold has been adopted by OSPAR.
- Suite of species and parameterization: ICES has explored species selection and parameterization in order to enhance regional performance of the indicator.

- **Reference levels:** ICES has defined these for some areas (e.g. North Sea, Celtic Sea), reflecting the level of sustainable exploitation.
- **Responsiveness:** ICES has provided an estimate of the lag of the indicator response that would follow a change in fishing pressure. ICES notes that this can amount to two or more MSFD cycles.
- **Consistency between descriptors:** ICES has reviewed modelling studies, exploring the consistency of LFI reference levels with the targets of Descriptor 3 (commercial fish and shellfish). No inconsistencies were found.

The progress in the development of (sub)regional LFIs was reviewed by ICES (Table 1.6.2.2.2). Areas that have specific thresholds and reference levels are good examples of how the LFI can be developed and applied (except in the Celtic Sea where the relevant survey was discontinued several years ago). Further work continues on the LFI in ICES and elsewhere towards completing coverage of the subregions by the LFI.

**Table 1.6.2.2.2** Overview of regional examples of relevant aspects of the Large Fish Indicator (GFCM = General Fisheries Commission for the Mediterranean, IBTS = International Bottom Trawl Survey, SP-N IBTS = Spanish north IBTS, WCGFS = Western Channel Ground Fish Survey, EVHOE = French West European Atlantic Bottom Trawl Survey, PT-IBTS = Portuguese IBTS, MEDITS = International Bottom Trawl Survey in the Mediterranean, BITS = Baltic International Trawl Survey, NA = not available).

<b>MSFD subregion</b>	<b>Survey and ICES Subarea or Subdivision/GF CM Geographic Subarea</b>	<b>Suite of species explicitly considered</b>	<b>Threshold (cm)</b>	<b>Reference level (proportion of weight)</b>	<b>Responsiveness (year)</b>
North Sea	Q1 IBTS Subarea IV excluding Norwegian Trench	Yes	40	0.3	12–20
Celtic Sea	Q1 WCGFS (ICES Division VIIe)	Yes	50	0.4	12–14
Bay of Biscay and Iberian coast	Q4 SP-N IBTS (ICES Divisions VIIIc and IXa north)	Yes	35	0.35	6
Bay of Biscay and Iberian coast	EVHOE (ICES Divisions VIIIa,b)	Yes	49	NA	NA
Bay of Biscay and Iberian coast	Q4 PT-IBTS (ICES Division IXa)	Yes	30	NA	NA
Western Mediterranean Sea	MEDITS (GSA 10)	Yes	No	NA	NA
Baltic Sea	BITS (Subdivisions 22–24)	Yes	30	NA	NA

## Sources

- EC. 2010. European Commission Decision of 1 September 2010 on criteria and methodological standards on good environmental status of marine waters (2010/447/EU).
- ICES. 2013. Report of the Workshop on DCF Indicators (WKIND), 21–25 October 2013. ICES CM 2013/ACOM:38.
- ICES. 2014a. Workshop to develop recommendations for potentially useful foodweb indicators (WKFooWI), 31 March–3 April 2014. ICES CM 2014/ACOM:48.
- ICES. 2014b. Report of the Working Group on the Ecosystem Effects of Fishing Activities (WGECO), 8–15 April 2014. ICES CM 2014/ACOM:26.
- Modica, L., Velasco, F., Preciado, I., Soto, M., and Greenstreet, S.P.R. 2014. Development of the large fish indicator and associated target for a Northeast Atlantic fish community. ICES Journal of Marine Science. doi:10.1093/icesjms/fsu101.

## **Annex 1.6.2.2 Selection of potentially useful indicators for MSFD Descriptor 4 (foodwebs)**

### *i. Biomass of trophic guilds*

A trophic guild is an aggregation of species/life stages that exploit the same resources. Time-series changes in the biomasses of a set of carefully selected trophic guilds can provide a measure of change in overall foodweb structure. Guilds can be selected from among all marine species if the information is available. For fish and shellfish, guilds could be based on the sum of biomass or production from groups of assessed stocks, especially when these cover a large proportion of biomass regionally. Work to date has largely focused on fish trophic guilds, but could include plankton, invertebrates including benthos, birds, and marine mammals. For the lower levels of the foodweb (e.g. phyto- and zooplankton) abundance may act as a proxy for biomass.

### *ii. Mean weight of zooplankton*

Mean weight of zooplankton is the ratio between total zooplankton biomass and total abundance (numbers) of carefully selected zooplankton species or groups. The indicator can be used to interpret foodweb capacity to sustain fish feeding conditions and exert grazing on primary producers. Total zooplankton community biomass (under *i.* above) and mean weight of zooplankton are both positively related to fish feeding conditions; however, total zooplankton biomass alone is just representative of grazing pressure and trophic transfer efficiency.

### *iii. Proportion of large fish (large fish indicator, LFI)*

The LFI is defined as the proportion by weight of large fish in the sample of a specified survey, where large fish are defined as those longer than a threshold length, a survey-specific threshold value. The LFI takes no account of species identity but rather of individual sizes. However, it was shown to reflect mostly the proportion (by weight) of large-bodied species in communities. The LFI is a common indicator for OSPAR in the Greater North Sea and a core indicator for HELCOM. It is part of the indicator suite that Member States have to report on under the data collection framework (DCF; 2010/93/EU) to evaluate effects of fishing on the ecosystem.

### *iv. Mean length of the surveyed community*

Several integrated size-based fish indicators exist, including mean length of all individuals of the selected species caught in a survey. Mean length quantifies relative abundances of large and small individuals and describes the size distribution of a community. Whilst this surveillance indicator is sensitive to fishing pressure, it can also be strongly influenced by environmentally driven recruitment events that introduce large numbers of small fish into the community. Work to date has largely focused on fish but could potentially be extended to invertebrates.

### *v. Primary production*

Primary production is fundamental to foodweb structure and function. Chlorophyll concentration in the water column is an indicator for primary production under D5 (Eutrophication).

The proportion of the primary production required to sustain fisheries could be used as a way to evaluate the effects of fishing on the ecosystem and therefore could be a candidate for future reporting under DCF.

### *vi. Seabird breeding success*

Seabird breeding success is measured as the number of chicks per nest for selected seabird species (e.g. those feeding on lower trophic levels such as krill, squid, and pelagic fish). The breeding success of seabirds responds to changes in forage species communities that in turn may be linked to patterns of exploitation. Breeding success/failure of marine birds is a candidate indicator for D1 under OSPAR.

### *vii. Mean weights-at-age of predatory fish*

Mean weights-at-age for predatory fish are calculated from individual weight and age information. These fish condition indicators provide information on productivity or energy flow in an ecosystem. Changes in these indicators can be caused by changes in relative food availability. These indicators will respond predominantly to changes in prey species that in turn may be linked to patterns of exploitation.