

1.6.2.2 EU request to provide guidance on operational methods for the evaluation of the MSFD Criterion D3C3

Advice summary

To provide the requested guidance, ICES evaluated the proposed indicators for MSFD Criterion D3C3 of the size distribution of the stock, the selectivity pattern of the fishery, and the genetic effects of exploitation on the stock, concluding that the indicators are currently neither operational nor fit for the purpose of the assessment of good environmental status (GES). Consequently, ICES advises that these indicators should not be used until usable reference points have been developed.

Hence, ICES recommends that the assessment of GES for Descriptor D3 should focus on indicators for criteria D3C1 and D3C2.

Request

Guidance on development of operational methods for the evaluation of the MSFD criterion D3.3. The first and second stage of development of D3.3, as described in the formal ICES advice.

Elaboration on the advice

For the purpose of this advice, ICES uses the terminology proposed in the revision of the decision (i.e. D3C3 instead of C3.3).

Basis of the advice

Rationale

“ICES is requested to organise and steer a process for the evaluation, testing and validation of the proposed indicators for the criterion 3.3 in support of the MSFD CIS. This will develop and test methods using selected stocks (as advice), which will then be rolled out as a broader analysis across the MSFD regions and subregions (as a technical service).

The initial phase will require dedicated data call (for length and maturity information for 10 stocks), with preparation of draft documents and dissemination of outcomes leading to an advice of the most appropriate indicators to be used in the assessment and evaluation of the GES for the criterion 3.3.

The second phase will use the recommended indicators on 30-40 more stocks from across the region. This will not result in formal advice but show the potential value of the use of the indices. JRC need to be asked to assist with Mediterranean and Black Sea stocks and data calls.”

ICES (2015) advised that:

“[Criterion D3C3] should reflect that healthy stocks of many species are characterized by a high proportion of old, large individuals.

Specifically, new indicators for Criterion 3.3 [i.e. now D3C3] are needed to take account of varying selectivity patterns in commercial catches. This new suite of indicators should aim to capture three relevant properties that describe or are directly linked to this criterion.

Size distribution of the species (state)

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

Selectivity pattern of the fishery exploiting the species (pressure)

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

Genetic effects of exploitation on the species (state)

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

ICES convened a workshop WKIND3.3i (14–17 March 2016 at ICES Headquarters in Copenhagen, Denmark) to further investigate, test, and evaluate the proposed suite of indicators in order to address this request (ICES, 2016).

Results and conclusions

1. Size distribution of the species

ICES (2014) stated that *“Criterion 3.3 relies on the concept of a healthy size/age structure of the stocks, and it is not essential [in order] to assess the exploitation status of resources in terms of pressure (F) and status (SSB). However, it provides the ability to track biological improvements in stock development, although possibly with a time delay, as MSY-based management is achieved.”*

ICES evaluated six size-based indicators (SBI) (L_{95} , P_{mat} , P_{mega} , $CPUE_{mega}$, LCH, L_{max_n}) against the high-level ICES criteria for the selection of indicators (Box 1 in Methods (below) and ICES, 2016). Only three indicators were considered for further development to describe the proportion or abundance of old, large individuals: the 95th percentile of the length–frequency distribution (L_{95}), the proportion of mega-spawners (P_{mega}), and the absolute abundance of mega-spawners ($CPUE_{mega}$). Based on the analysis of the stocks considered, it is currently not possible to derive validated reference points for these indicators with respect to sustainable exploitation. In addition, the relative SBIs (L_{95} and P_{mega}) have been shown to be sensitive to the abundance of small individuals, and the indicators considering proportion or abundance of mega-spawners still lack an agreed definition of “mega-spawners”. The redundancy of the SBI with respect to MSFD Criterion 3.2 (reproductive capacity) needs to be further assessed. In the short to medium term it is not possible to make these indicators operational, and ICES advises against their use in the assessment of GES.

2. Selectivity pattern of the fishery exploiting the species

The selectivity pattern of the fishery was analyzed by two chosen indicators: the size-at-first-capture (L_c) and the mean-size-in-the-commercial-catch (L_{mean}). Both of these indicators have reference points (L_{opt} as reference level for L_{mean} and L_{c_opt} for L_c ; technical details in ICES, 2016) and are operational. However, their application would lead to a definition of GES consistent with MSY only if the fishery targets the mature and large component of the stock. Hence, their application would make fisheries targeting juvenile individuals inconsistent with the objectives of the MSFD, while being consistent with the objectives of the Common Fisheries Policy (CFP). Until this is resolved, ICES advises not to use these selectivity indicators in the assessment of GES.

3. Genetic effects of exploitation on the species

Two indicators of genetic effects were considered, the size-at-first-maturity (L_{m50}) and the probabilistic maturation reaction norm (PMRN = L_{p50}), which is data demanding for its calculation. There was no clear relationship between the fishing mortality (pressure) and the indicators, and it is very unlikely to observe a short-term response to a decrease in fishing pressure. In relation to MSY, reference points for these indicators of genetic effects of exploitation could not be defined.

Hence, ICES advises not to use these indicators in the assessment of GES.

Methods

ICES used data from a suite of stocks (Table 1.6.2.2.1) representing a range of guilds (functional groups) and areas to test the proposed indicators. In each case the performance of these indicators was evaluated against the ICES high-level criteria for indicator selection (Box 1). Details are given in ICES (2016).

Table 1.6.2.2.1 List of stocks (WKIND3.3i) used in assessing the proposed indicators.

Stocks	Functional group	Stock ID/area	Advisory body
Western Baltic cod	Demersal	cod-2224	ICES
Eastern Baltic cod	Demersal	cod-2532	ICES
North Sea cod	Demersal	cod-347d	ICES
North Sea herring	Pelagic	her-47d3	ICES
North Sea plaice	Demersal	ple-nsea	ICES
Spurdog	Elasmobranch	dgs-nea	ICES
Northern hake	Demersal	hke-nrtn	ICES
Anchovy	Pelagic	GSA17/18	GFCM
Mediterranean hake	Demersal	GSA9	GFCM
Giant red shrimp	Demersal	GSA11	GFCM
Swordfish	Large pelagic	swo-sa	ICCAT

Box 1 ICES high-level criteria for indicator selection.

- Availability of data. *Measurability*, robust quantifiable data covers range of spatial & temporal natural variability of suitable (historic) duration and resolution, availability of historic data or other reference points for benchmarking,
- 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 timescale. A *tangible* indicator that is intuitive to understand.
- Conceptual. *Theoretical basis*, with indicator behaviour (in response to pressure) that is understood to support management advice,
- Communication, an indicator that is simple, credible, *unambiguous*, *comprehensible* and can be easily communicated
- Manageable, an indicator that is relevant to management, with estimable targets and thresholds and which is *responsive*, *sensitive* and *cost-effective* to develop.

Additional information

ICES advises that the indicators for D3C3 should not currently be used for the GES assessment because of unresolved issues:

- For SBI on stock size structure, potential redundancy of indicators for D3C1 (F, catch ratio) and indicators for D3C2 (spawning-stock biomass (SSB), abundance) needs to be further tested. For example, as stock biomass rebuilds from a depleted state, the abundance of large individuals should increase. This needs to be further investigated as situations may exist in which indicators of stock size and length structure are not correlated. Currently, there is no SBI for which reference points are fully tested and validated.
- Indicators of genetic change can be expected to be slow in response to recovery (decades) from high fishing pressure and the direction of change difficult to predict, especially under changing environmental conditions. Only the L_{m50} can be applied to a wide range of stocks, but the suitability of this indicator to detect genetic change needs to be proven.

In the absence of indicators for criteria D3C1 and D3C2, ICES recommends the use of the selectivity indicators for surveillance purposes (technical guidelines in the WKIND3.3i report; ICES, 2016).

Sources and references

ICES. 2014. EU request on draft recommendations for the assessment of MSFD Descriptor 3. *In* Report of the ICES Advisory Committee, 2014. ICES Advice 2014, Book 1, Section 1.6.2.1.

ICES. 2015. EU request on revisions to Marine Strategy Framework Directive manuals for Descriptors 3, 4, and 6. *In* Report of the ICES Advisory Committee, 2015. ICES Advice 2015, Book 1, Section 1.6.2.1.

ICES 2016. Report of the Workshop on guidance on development of operational methods for the evaluation of the MSFD criterion D3.3 (WKIND3.3i), 14–17 March 2016, ICES headquarters in Copenhagen, Denmark. ICES CM 2016/ACOM:44, in prep.