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Common Fisheries Policy Monitoring Protocol for computing indicators

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Abstract:
Common Fisheries Policy Monitoring - Protocol for computing indicators
This document presents the protocol to compute indicators for monitoring the Common Fisheries Policy. A set of indicators both design-based and model-based are described mathematically. The list of stocks that should form the dataset on which the indicators are computed is also described as well as a set of rules to update the stocks' lists when needed. The protocol was presented and approved by the STECF's 2015 winter plenary (STECF-PLEN-15-03).

Common Fisheries Policy Monitoring Protocol for computing indicators

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1 Introduction

The monitoring of the Common Fisheries Policy (CFP, Reg (EU) 1380/2013) implementation is of utmost importance for the European Union (EU), European Commission (EC) and its Directorate-General for Maritime Affairs and Fisheries (DGMARE).

The EC's Scientific, Technical and Economic Committee for Fisheries (STECF), as the major scientific advisory body on fisheries policy to the EC, has received the task of reporting on the CFP implementation through the publication of a series of indicators.

To make the process as consistent as possible the following set of rules were developed to serve as the protocol for computing the required indicators, this way contributing to the transparency of the process.

The protocol is split in three sections:

1. Selection of stocks - describe the current list of stocks used to compute the indicators and updating rules;
2. Indicators of management performance - description of the indicators, computation and presentation;
3. Indicators of changes in advice coverage - description of the indicators, computation and presentation.

The ToRs given to STECF 15-04 set the basis of the work carried out to build the indicators, which are transcribed below for reference:

1. Determine, on the basis of the most recently available fish stock assessments, a list of fish stocks for monitoring the past performance of the Common Fisheries Policy according to the following criteria:
   - Quantitative assessments as used in the provision of formal quantitative advice on fishing mortality with respect to F_{MSY}.
   - Stocks in European Union waters, shared stocks which are jointly managed by the EU with nearby states, and stocks in international waters or third country waters that are fished by the EU and managed by an RFMO where the EU is a member of the decision making body.
2. For stocks within the sampling frame defined above, calculate the following annual quantities as far back in time as the data remain representative:
   - Number of stocks where fishing mortality exceeds F_{MSY}[1]
   - Number of stocks where fishing mortality is equal to or less than F_{MSY}[2]
   - Number of stocks outside safe biological limits
   - Number of stocks inside safe biological limits
   - The arithmetic average value of F/Fmsy
   - Number of stocks for which the state of the stock is unknown with respect to safe biological limits

   For the purposes of this term of reference, "outside safe biological limits" means that SSB is less than B_{PA} (where Bpa is defined), OR F is greater than F_{PA} (where F_{PA} is defined) for the year in question.

   Estimates should be provided separately for the Baltic Sea, the North Sea, Western Waters, for each area covered by RFMOs other than NEAFC. Parameter F should also be reported for the combined area of the Baltic Sea, North Sea and Western Waters. The list of stocks should be provided together with a mention of whether the stock is fished above or below F_{MSY}.

[1] Including, for short-lived species managed according to a biomass-escapement strategy, the number of stocks where the resulting biomass was less than the escapement biomass corresponding to MSY fishing.

[2] Including, for short-lived species managed according to a biomass-escapement strategy, the number of stocks where the resulting biomass was equal to or higher than the escapement biomass corresponding to MSY fishing.

3. For the purpose of assessing changes over time in the coverage of advice on TACs with respect to scientific advice concerning the northeast Atlantic:
    - define a sampling frame based on a large subset of TACs of EU interest that is stable over time;
    - assess the number and proportion of those TACs that are subject to scientific advice concerning:
        - the fishing mortality compared to F_{MSY}
        - the state with respect to Safe Biological Limits, as defined above

For the purposes of this exercise, a group of TACs covering one biological stock should be counted once only. For a TAC which covers several stocks, the biological state of the most abundant stock (by comparison with other stocks over an extended and representative period) should be taken into account.

The Commission services will provide STECF with an initial analysis for the purposes of the assessment under point 3.

1.1 Scope

The monitoring of the CFP should cover all areas were fleets operate under the flag of any EU member state. However, due to limitations on data and the mitigated responsibility of the EU on management decisions on waters outside the EU EEZ (Exclusive Economic Zone), the analysis will focus on stocks within the EU EEZ and some important shared stocks.

The analysis will have two perspectives, a global EU level lookout complemented with a regional overview, where the indicators are computed at a regional level for the:

- Baltic Sea
- Greater North Sea
- Western European
- Mediterranean
- Black Seas
- Widely distributed

1.2 Data sources

All indicators are computed using results from single species quantitative stock assessments. In detail, time series of fishing mortality, spawning stock biomass and the adopted reference points are required from ICES[3], GFCM[4] and STECF.

Results from surplus production models and delay difference models, which are mostly reported as ratios between F and F_{MSY} and/or B over B_{MSY}, are also included in the analysis.

Results from pseudo-cohort analysis are not included. These models don't estimate time series of fishing mortality or spawning stock biomass.

[3] International Council for the Exploration of the Sea
[4] General Fisheries Commission for the Mediterranean

2 Selection of stocks

2.1 List of stocks to monitor

The list of stocks to be used for computing the indicators, has to include those that are subject to direct management from the EU, as such better reflecting changes in stock status due to the CFP implementation.

Because of the differences in the nature and availability of data and information in different regions, region-specific lists of stocks were adopted.

The lists of stocks are:

- Northeast Atlantic (FAO area 27) - The list of stocks comprises all stocks subject to a TAC.
- Mediterranean and Black Seas (FAO area 37) - The list of stocks comprises all stocks subject to a minimum conservation reference size.

For the indicator "Annual mean value of F/F_{MSY}" (Section 3.5), stocks managed under escapement strategies and stocks for which fishing mortality was reported as a harvest rate are not included.

2.2 Updating rules

Due to changes in scientific knowledge, mostly related with spatial boundaries of stock units, the list of stocks may need to be adjusted in the future. These changes can have an impact on the quantification of the effects of the CFP's implementation. Although the impact is expected to be small as stock units changes shouldn't be numerous, and shouldn't unduly affect the overall perspective on trends in time of the indicators.

The following rules should be used to update the sampling frames:

- The updates consider the stock units existing in the reported year. Exploratory assessments or assessments not yet approved by the advisory bodies are not considered.
- When several stocks are merged in a single stock, the individual stocks must be removed from the list and the new stock added.
- When a stock is split in two (or more), the aggregated stock must be removed and the new ones added to the list.
- Stocks that cross regions will be allocated to the region where most of the stock's biomass exists.

3 Indicators of management performance

The analysis will use the following definitions:

- f represents fishing mortality;
- b represents biomass or spawning stock biomass;
- F^{MSY} represents fishing mortality that produces catches at the level of MSY in an equilibrium situation, or a proxy;
- B^{REF} the biomass reference value, *e.g.* the biomass that produces MSY when fished at F^{MSY}, but also any other relevant proxy considered by the scientific advice body;
- indices:
  - $j = 1 \ldots N$ indexes stocks where N is the number of stocks in the sampling frame;
  - $t = 1 \ldots T$ indexes years where T is the number of years in the reported time series;

- operations:
  - $\vee$ stands for "or" in boolean logic;
  - $\wedge$ stands for "and" in boolean logic;
- models:
  - u is a random effect;
  - s is a thin plate regression spline;
  - y is a fixed effect on year.

3.1 Number of stocks where fishing mortality exceeds Fmsy

$$I_t^1 = \sum_{j=1}^{j=N} (f_{jt} > F_j^{MSY})$$

3.2 Number of stocks where fishing mortality is equal to or less than Fmsy

$$I_t^2 = \sum_{j=1}^{j=N} (f_{jt} \leq F_j^{MSY})$$

3.3 Number of stocks outside safe biological limits

$$I_y^3 = \sum_{j=1}^{j=N} (f_{jt} > F_j^{MSY} \vee b_{jt} < B_j^{REF})$$

3.4 Number of stocks inside safe biological limits

$$I_t^4 = \sum_{j=1}^{j=N} (f_{jt} \leq F_j^{MSY} \wedge b_{jt} \geq B_j^{REF})$$

3.5 Annual mean value of F/F_{MSY}

This indicator can have two forms, a design-based form

$$I_t^5 = N^{-1} \sum_{j=1}^{j=N} \frac{f_{jt}}{F_j^{MSY}}$$

or a model-based form, build using a LMM[5]. The indicator is build using the model predictions to compute the values of F/F_{MSY}.

$$z_{jt} = \frac{f_{jy}}{F^{MSY}}$$

$$z_{jt} = \beta_0 + y_t + u_j + \sigma_{jt}^2$$

This model was tested in a simulation study[6] and in an application to Mediterranean stocks[7]. The tests showed that the chosen model was the stablest estimating the mean.

[5] Linear Mixed Model

[6] Coilin Minto. 2015. Testing model based indicators for monitoring the CFP performance. Ad-hoc contract report. pp 14

[7] Chato-Osio, G., Jardim, E., Minto, C., Scott, F. and Patterson, K. 2015. Model based CFP indicators, F/Fmsy and SSB. Mediterranean region case study. JRC Technical Report No XX, pp 26.

4 Indicators of changes in advice coverage

4.1 Number of stocks for which estimates exist of $(\frac{F}{F^{MSY}})$

$$I_t^6 = \sum_{j=1}^{j=N} (\frac{f_{jt}}{F_j^{MSY}} > 0 \wedge \frac{f_{jt}}{F_j^{MSY}} < \infty)$$

4.2 Number of stocks for which estimates exist of $(\frac{B}{B^{REF}})$

$$I_t^7 = \sum_{j=1}^{j=N} (\frac{b_{jt}}{B_j^{REF}} > 0 \wedge \frac{b_{jt}}{B_j^{REF}} < \infty)$$

5 Transparency

Changes or additions to this protocol shall be approved by STECF.

To promote transparency of scientific advice and allow the public in general and stakeholders in particular, to have access to the data and analysis carried out, all code and data must be published online once approved by STECF.

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