

ICES response to: Systemic failure of European fisheries management

Colm Lordan (ACOM Chair), International Council for the Exploration of the Sea, H. C. Andersens Boulevard 44-46, 1553, Copenhagen V, Co Galway, International

Bjarki Thor Elvarsson (ACOM Member Iceland), Marine and Freshwater Research Institute, Fornubudir 5, 220, PO Box 1390, Hafnarfjörður, Iceland

Bjarte Bogstad (ACOM Member Norway), Institute of Marine Research, Nordnes, Nordnes, 5817, PO Box 1870, Bergen, Norway

Christopher Zimmermann (ACOM Member Germany), Thuenen Institute, Thünen-Institute of Baltic Sea Fisheries, Alter Hafen Süd 2, 18069, Rostock, Germany

Coby Needle (ACOM Member UK), Marine Directorate of the Scottish Government, Marine Laboratory, Marine Laboratory, 375 Victoria Road, AB11 9DB, Aberdeen, Scotland, United Kingdom

Dorleta Garcia (ACOM Vice Chair), International Council for the Exploration of the Sea, H. C. Andersens Boulevard 44-46, 1553, Copenhagen V, International

Els Torreele (ACOM Member Belgium), Flanders Research Institute for Agriculture, Fisheries and Food, Ankerstraat 1, 8400, Oostende, Belgium

Francisco Velasco Guevara (ACOM Member Spain), Spanish Institute of Oceanography, Centro Oceanográfico de Santander, Promontorio San Martín s/n, 39004, P.O. Box 240, Santander, Cantabria, Spain

Ivone Figueiredo (ACOM Member Portugal), Portuguese Institute for the Sea and the Atmosphere, R. Alfredo Magalhães Ramolho, 6, 1495-006, Lisbon, Portugal

Jan Horbowy (ACOM Member Poland), National Marine Fisheries Research Institute, ul. Kollataja 1, 81-332, Gdynia, Poland

Jari Raitaniemi ((ACOM Member Finland), Natural Resources Institute Finland, Natural Resources Institute Finland - Turku, Itäinen Pitkätatu 4 A, 20520, Turku, Finland

Joanne Morgan (ACOM Vice Chair), International Council for the Exploration of the Sea, H. C. Andersens Boulevard 44-46, 1553, Copenhagen V, International

Jonathan White (ACOM Member Ireland), Marine Institute, Rinville, H91 R673, Oranmore, Co Galway, Ireland

José De Oliveira (ACOM Alternate UK), Centre of Environment Fisheries and Aquaculture Science, Pakefield Rd, Lowestoft NR33 0HT, United Kingdom

Lauri Saks (ACOM Member Estonia), University of Tartu, Ülikooli 18, Vanemuise 46a, 50090, Tartu, Estonia

Linas Lozys (ACOM Member Lithuania), Nature Research Centre, Akademijos Str. 2, , 08412, Vilnius, Lithuania

Marie-Julie Roux (ACOM Vice Chair), International Council for the Exploration of the Sea, H. C. Andersens Boulevard 44-46, 1553, Copenhagen V, International

Massimiliano Cardinale (ACOM Member Sweden), Swedish University of Agricultural Sciences, SLU Department of Aquatic Resources, Stångholmsvägen 2, 178 93, Drottningholm, Sweden

Marc Taylor (ACOM Alternate Germany), Thuenen Institute, Bundesallee 50, 38116, Braunschweig, Germany

Robyn Forrest (ACOM Member Canada), Fisheries and Oceans Canada, 200 Kent Street, 12th floor, K1A 0E6, Ottawa, Ontario, Canada

Simon Jennings (ACOM Vice Chair), International Council for the Exploration of the Sea, H. C. Andersens Boulevard 44-46, 1553, Copenhagen V, Suffolk, International

Thomas Brunel (ACOM Member Netherlands), Wageningen University & Research, , , 1970 AB, P.O. Box 68, IJmuiden, Netherlands

Vanessa Trijoulet (ACOM Member Denmark), DTU Aqua, National Institute of Aquatic Resources, Kemitorvet, Bygning 202, 2800, Kgs. Lyngby, Denmark

Youen Vermard (ACOM Member France), French Research Institute for Exploitation of the Sea - IFREMER, Centre Atlantique, Rue de l'île d'Yeu, 44311, P.O. Box 21105, Nantes Cédex 03, France

Froese et al. use examples of the status of fisheries in the western Baltic Sea to claim there is a strong bias toward overfishing in the science advisory process and in the management process for setting total allowable catch (TAC) levels for European fisheries. They propose an EBFM-compatible MSY and harvest control rule (HCR) as a solution, combined with the creation of a new politically independent institution mandated to provide single-stock advice aligned with EBFM principles.

The authors fail to acknowledge the independence of the science advisory process already in place in the current management system. ICES is an independent science provider, committed to providing robust scientific advice to inform sustainable fisheries management decisions. ICES advice is developed in an open, inclusive and transparent framework following 10 principles. Safeguards are in place to ensure the advice is free of political influence [1]. Principle 4 mandates the use of best available science and data. Principle 7 involves an independent peer-review. Principle 8 ensures the advice is comprehensive, unambiguous, and consistent with the synthesized knowledge and follows existing advice frameworks. The advice development and approval processes, with the chairs and members of benchmark and advice drafting groups from outside the ecoregion of concern and approval by consensus of the whole ICES Advisory Committee (Principle 9), consisting of representatives of 19 countries, specifically avoids the biases inferred in this paper.

The Baltic Sea is affected by many human pressures other than fishing, especially eutrophication, pollution and climate change. As highlighted in existing ICES advice on this ecosystem [2], the cumulative impacts of these pressures cascade through the ecosystem, often in unforeseen and unpredictable ways, impacting on stocks and fisheries. Climate change is causing changes in water temperature, salinity, and stratification in the abiotic environment. Eutrophication, hypoxia, shifting plankton species composition, increasing cyanobacteria blooms and altered zooplankton composition are all affecting the overall productivity of the system. The abundance and distribution key of predators, prey, competitors and parasites of commercial fish species has also changed significantly over the last three decades.

The Maximum Sustainable Yield (MSY) proposed by the authors is derived from a “preliminary” stock assessment using a Bayesian implementation of the Schaefer production model. Some of the same authors previously cautioned that this model will not work if there is changing carrying capacity because of warming waters or due to predation [3]. There is strong evidence that carrying capacity is changing in the Baltic Sea [2]. Thus, it is currently highly unlikely that the EBFM-compatible MSY of 97,548 tonnes shown in Figure 1 could be achieved. ICES assessments include the declines in recruitment, growth, increases in natural mortality and changes in maturity. For example, for Eastern Baltic cod there has been a rapid decline in growth and a sudden increase in natural mortality heavily impacting on the carrying capacity for the stock. This has nullified the historical surplus production which the fishery previously relied on [4].

Ecosystem changes have undoubtedly impacted the quality and accuracy of the age-based stock assessments and forecasts used by ICES, because fishing mortality is just one driver of stock development and status. Froese et al. state that the situation in the western Baltic Sea provides a

basis for better understanding EU fisheries (mis)management. But this a false premise given that impacts of other human pressures and environmental change are far greater in the Baltic Sea than other EU waters of the northeast Atlantic.

The paper refers to the overestimation of SSB for Western Baltic Cod. Retrospective patterns, where the tendency of a stock assessment model to consistently over (but also under) estimate recent stock size, can be informative diagnostics to identify and confront model misspecification [5]. Changing ecosystem productivity can also cause retrospective patterns. Since 2020, ICES has adopted a framework to deal with retrospective patterns in assessments [6]. This framework contains a flow chart which specifies, depending on the magnitude of the retrospective pattern, how the advice should be developed to account of the existence of a retrospective pattern in an assessment.

This framework led, for example, to applying a correction to the stock assessment of North Sea sole (sole.27.4) to account for systematic stock overestimation, before calculating the catch advice for 2024 [7]. Such approaches are applicable if the scale of retrospective changes can be predicted, which is not always the case. In the case of WBC the retrospective pattern emerged suddenly and changed a lot over time linked to the fate of the 2016 year-class. An analysis of forecasts for 63 ICES stocks carried out in 2025 shows that estimation of SSB in the forecast was on average only slightly biased, with a 3% average difference in SSB at the beginning of the advice year compared to the subsequent stock assessment estimate of SSB. This finding shows that there isn't a systematic bias, but there are issues with some stocks such as WBC, which are difficult to address.

Ultimately the best way to solve retrospective patterns is through the benchmark process [8]. To make assessments and advice more robust, increasingly ICES has started to integrate structural uncertainty, another potential cause of retrospective patterns. For example, the assessments for Central Baltic herring and Northern shrimp now use ensemble models with different plausible natural mortality assumptions as a basis for the advice [9,10].

Cadrin [11] also recommends that if retrospective patterns cannot be reduced with respecified models, they should be communicated as measure of uncertainty for consideration in the context of precautionary management. ICES also routinely communicates the most up-to-date understanding of uncertainties in the advice provided. For example, in 2022 the ICES advice stated for WBC that *"The sources for the additional mortality are presently unclear but could involve e.g. increased natural mortality (due to increased predation, hypoxia, decreased condition, increased water temperatures) and unreported catches. However, the effects associated with these drivers are presently not possible to identify and quantify and are therefore difficult to account for in the forecast"* [12]. Managers can and do use such information to set the TACs below the headline advice, for example, in 2019 the TAC for Western Baltic cod was set at the $F_{MSY\ lower}$ level, based on an ICES suggestion in the advice sheet [13].

A further criticism raised in the paper was that ICES does not report MSY or B_{MSY} in the advice sheets, so that stakeholders are unable to compare actual with maximum sustainable catches or actual biomass with the biomass consistent with MSY (B_{MSY}). It is true that for most of the age-based stock assessments these values are not shown. This is primarily because these values are not used in the ICES advice rule, which is specifically designed and simulation tested to achieve MSY in the long term [14]. ICES has already agreed to systematically report MSY or B_{MSY} in the future within the assessment benchmark process (in many cases the values are already available). It is important to note that B_{MSY} and F_{MSY} are already routinely reported for ICES assessments that use surplus production models (like those used by Froese et al.).

The ICES advice framework is specifically designed to integrate the precautionary approach with the objective of achieving maximum sustainable yield (MSY) and is in line with existing laws and regulations [15]. Furthermore, the Baltic advice is framed in the context of EU multiannual plan for stocks in the Baltic Sea [16] and includes F_{MSY} ranges for target stocks as specified in the plan.

The authors propose an EBFM-compatible HCR which implies fishing below F_{MSY} (0.75 MSY) with a biomass trigger at B_{MSY} . ICES is proactively and incrementally broadening the scope of its advice to facilitate ecosystem-based management decision-making. Examples of this include the provision of advice on conservation aspects for fish stocks since 2023, and continued developments and operationalisation of ICES fisheries and ecosystem overviews. ICES has been exploring alternative types of HCRs at the Workshop on ICES reference points (WKREF2) [16] although Froese et al. have not cited this work. ICES also is often requested to evaluate the compatibility of long-term management strategies with PA and MSY objectives. More recently Workshop on the calculation and evaluation of new reference points for category 1–2 stocks (WKNEWREF) [17] also highlighted the benefits of exploitation levels below F_{MSY} .

ICES is in constant dialogue with advice requesters to improve future ICES advice framework and ensure that it remains compatible with their legal frameworks and commitments in the context of the CFP, MSFD and the basic principles of EBFM. ICES has articulated to advice requesters that alternatively formulated harvest control rules could be more robust to an uncertain future. For example, ICES has very recently shown that fishing at levels that are around 75% of F_{MSY} or even lower [9, 10, 18] will result in a minimal loss of long-term yields and produce a much larger SSB, which is *de facto* compatible with EBFM and in line with current legislation given the large, often unaccounted uncertainty in any assessment model.

Requesters and stakeholders expect that any changes to the current ICES advice rule would be justified with data and evidence showing the short-term impacts, long-term benefits and various trade-offs. The social and economic consequences of the EBFM-compatible HCR should be explored in the context of competing objectives, changing environments and socioeconomic landscapes. ICES is committed to continuously evolving and improving the advisory framework, learning from past performance, and is open to alternative approaches and perspectives.

In conclusion, the evidence from ICES fisheries overviews covering EU waters and from the STECF CFP performance review clearly shows that on average fishing mortality has been declining over the past 25 plus years and on average biomass has been increasing in most sea basins or ecoregions [19, 20, 21, 22]. This strongly suggests that current science-based management based on ICES advice is systematically improving the status of fisheries resources in EU waters.

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