Journal of Environmental Management 223 (2018) 503–516

Contents lists available at ScienceDirect

Journal of Environmental Management

journal homepage: www.elsevier.com/locate/jenvman

Research article

The role of technical protocols and partnership engagement in developing a decision support framework for fisheries management

Claire Macher[a,*], Michel Bertignac[b], Olivier Guyader[a], Katia Frangoudes[c], Marjolaine Frésard[c], Christelle Le Grand[a], Mathieu Merzéréaud[a], Olivier Thébaud[a]

[a] Ifremer, Univ Brest, CNRS, UMR 6308, AMURE, Unité d'Economie Maritime, IUEM, F-29280, Plouzane, France
[b] Ifremer, Unité Sciences et Technologies Halieutiques, France
[c] Univ Brest, Ifremer, CNRS, UMR 6308, AMURE, IUEM, 29280, Plouzane, France

ARTICLE INFO

Keywords:
Participatory approach
Stakeholder engagement
Decision-support
Bio-economic modelling
Fisheries management
Impact assessment

ABSTRACT

In the context of the Common Fisheries Policy Reform, the implementation of multiannual management plans for fisheries and the annual quota negotiations between EU member states has generated a growing demand from stakeholders and managers for integrated advice that goes beyond the usual biological advice. This has led to the emergence of bio-economic tools and methods for the comparison of the biological, economic and social tradeoffs associated with alternative options for fisheries management. A Decision Support Framework (DSF) has been developed in this context, with the objective to tackle technical and methodological challenges to be able to provide bio-economic advices to support decision at national and European level. It is based on a partnership approach involving the fishing industry, managers and scientists and on technical protocols. We present the development of a partnership DSF within three local case studies, highlighting key challenges and lessons learnt regarding appropriateness and application of a DSF. The data processing methods and collaborative platform were pivotal for scoping out objectives and management options, and for aligning DSF outcomes with decision makers' needs and agendas. Definition of common standards and institutionalization of the use of partnership DSF are still required to operationalize the integrated advice process at national and European levels.

1. Introduction

The implementation of Ecosystem-Based Management (EBM), defined as "an integrated approach that considers the entire ecosystem, including humans" (McLeod et al., 2005), and its application to fisheries have driven a search for new tools and approaches to facilitate the integration of social and environmental dimensions in decision making into an evidence-based policy approach. Among the challenges of implementing marine ecosystem-based management, Leslie and McLeod (2007) underline the need for tools to "better evaluate impacts of human activities on ecosystems and trade-offs among objectives" and the need for research that is "more connected to management and policy processes". They also argue for interdisciplinary development, communication and participation of stakeholders.

In Europe, the supra-national level creates a specific process for management where negotiation between member states plays an important role (Marchal et al., 2016). While scientific advice provided at European Union (EU) level is mainly biological advice, socio-economic dimensions are usually taken into account in the negotiation step.

In the context of the Common Fishery Policy (CFP) Reform (CEC, 2009), new regulations and balanced objectives between environmental, and socio-economic issues generated a growing demand for integrated scientific evaluations and impact assessments[1] beyond the usual biological advice (see impact assessment groups at the Scientific Technical and Economic Committee for Fisheries (STECF) level https://stecf.jrc.ec.europa.eu/). This has led to re-examination of the decision-support for fisheries management. In the EU context, STECF initiated the development of an operational framework for impact assessment of management plans, including stakeholder engagement (Impact Assessment protocol, STECF, 2010). The SOCIOEC European Project presented a framework for impact assessment including stakeholders at

* Corresponding author. Ifremer, Unité d'Economie Maritime, UMR AMURE, CS 10070, F-29280, Plouzane, France.
E-mail address: claire.macher@ifremer.fr (C. Macher).

[1] At European level, impact assessment conducted on new initiatives expected to have significant economic, social or environmental impacts makes up the DSF. It is defined as a "set of logical steps [] that prepares evidence for political decision-makers on the advantages and disadvantages of possible policy options by assessing their potential [economic, social and environmental] impacts" (EC, 2009, 2015). Impact assessment is thus not only about the implementation of evaluation tools, but also about the process by which the evaluation can be carried out.

https://doi.org/10.1016/j.jenvman.2018.06.063
Received 23 June 2017; Received in revised form 15 June 2018; Accepted 19 June 2018

different steps in Malvarosa et al. (submitted). This should help supporting negotiations for fisheries management between member states at EU level and between stakeholders and decision makers at national and EU levels.

Maximum Sustainable Yield, established as the management target for all the stocks, were to be applied where possible in 2015 and at the latest in 2020, with a timetable depending on socio-economic considerations. Scientific advice based on Maximum Sustainable Yield objectives are thus to be balanced in European negotiations to account for socio-economic and multi-specific issues during the decision-making process. To address such a growing demand and improve the European decision-making process, there is a need for the development of operational Decision Support Frameworks (DSF) designed to assess and compare the biological, economic and social trade-offs associated with management strategies and to highlight distributional issues between member states and/or fleet segments, thus providing information for decisions at the European supra-national level.

The need for integrated scientific assessment concerns alternative transition pathways to Maximum Sustainable Yield (MSY) objectives, as well as regional multiannual management plans for fisheries, landing obligations, or quota management that are other major issues addressed in the CFP reform.

While a large range of integrated bio-economic models have been developed in recent years to help environmental and resource management and have demonstrated their utility in impact assessment of scenarios at national, EU or international levels, their application for decision support still requires a great deal of time and resources (see Nielsen et al., 2017 for a review of fisheries model approaches and their operational use and STECF, 2015 for examples of applications in the EU management plan impact assessment context). Moving from applied bio-economic tools to effective decision-support frameworks, i.e., frameworks providing integrated advice addressing both biological and socio-economic issues, still means facing a number of technical and methodological challenges. The main challenges highlighted in the literature concern the appropriateness of tools and data used in impact evaluation for specific management questions (e.g., Plagányi, et al., 2014; Punt et al., 2016) and the requirement to involve stakeholders, scientists and decision makers to improve the use and usefulness of models for decision making (e.g., Reed, 2008). There has thus been a growing consensus on the value of stakeholder participation in fisheries management decision-support and decision-making processes (Leslie and McLeod, 2007; Berghöfer et al., 2008; Thebaud et al., 2014), following evidence from a broad range of contexts (e.g., Hartley and Robertson, 2006; Luyet et al., 2012; Mackinson et al., 2011 or Röckmann et al., 2012). The move from biological advice towards more integrated scientific advice including socio-economic aspects, has also initiated a trend towards more involvement from stakeholders, with varied degrees and types of involvement in research, from simple consultation to stronger collaborations (Mackinson et al., 2011).

Among DSF used for fisheries management, the Management Strategy Evaluation (MSE) framework provides interesting examples and applications for comparing and selecting management strategies, particularly in South Africa, in the International Whaling Commission (IWC) or in Australia (e.g., Butterworth and Punt, 1999 or Smith et al., 1999). MSE is widely acknowledged as the reference for assessing robustness of management strategies to uncertainty in observation, model and implementation. It has mainly been used in mono-specific contexts to address uncertainty issues rather than trade-offs between different dimensions, but is being extended for application in the Ecosystem Based Management Context (Fulton et al., 2014; Plagányi et al., 2014). Literature on MSE building from experience and on lessons learnt on its use for decision-making also indicate technical issues regarding data and model and the importance of stakeholder involvement in collaborative modelling (e.g., Punt et al., 2016).

These challenges need to be addressed at national and EU levels if decision-support frameworks are to provide integrated bio-economic advice within partnership approaches useful to stakeholders and managers.

Participatory modelling provided a first basis for greater engagement of stakeholders in the decision-support process. Voinov and Bousquet (2010) reviewed different types of approaches and the lessons learnt on both the social aspects of participation and the methodological aspects of modelling. They highlight that co-learning, transparency and the process of stakeholder engagement are essential. They also underline that processes included (or not included) in the models, assumptions and limits need to be made explicit to potential users of the results, and that models should be flexible and of a complexity adapted to the question, objectives and available data. These authors conclude that participatory modelling can assist decision-making and tackle the high complexity of socio-ecological systems and the difficulties of evaluating different options. The benefit of participatory modelling in fisheries management is also to facilitate and structure discussion, and to increase transparency and co-learning (Röckmann et al., 2012).

Participatory modelling has been developing approaches in recent years, favoured by incentives to engage stakeholders in research projects and management strategy evaluation approaches (Dutra Leo et al., 2015). Development of DSF fully integrating scientific and empirical knowledge from the fishing industry, managers and scientists, beyond modelling questions to provide bio-economic assessment and highlight trade-offs from a multi-criteria perspective remain limited, however. Stakeholder and manager engagement should enable adequate scoping, implementation and knowledge integration in a partnership framework to support an evidence-based policy approach implemented through impact assessment procedures.

In this paper, we present the development and application of a partnership DSF able to provide bio-economic advice for national and European decision support. By DSF, we refer to a process for the integration of existing data and knowledge (biological, socio-economic, scientific and empirical) to provide relevant information on potential trade-offs between alternative management options to support decisions. It thus covers technical issues and development of tools for integration and assessment but also issues related to the process itself (Boleman et al., 2018). The DSF is designed to assess the biological and socio-economic trade-offs of alternative transition schemes to MSY[2] through management plans, Total Allowable Catches (TAC) and quotas, considered as major issues by stakeholders and managers. The aim of this paper is to highlight the role of technical protocols and partnership engagement in developing a DSF for fisheries management. The paper focuses on the phase of decision-support involving science[3] to provide information on trade-offs between different management options for the decision-making process. It was not possible to address the effective use made of information from the decision-support process and its importance in the decision-making process within the scope of this paper.

The paper will first present the context of the Bio-Economic Partnership Working Group project (BEPWG) and the collaborative definition of the objectives of the DSF. The methods and tools developed as part of the DSF (including the partnership platform with the fishing industry, managers and scientists, the data processing methods and the bio-economic integrated model) will then be described. The protocol for the use of the DSF and results of its application to the impact assessment of the Multiannual Management Plan for South

[2] MSY was defined as one of the main management objective in the European Fisheries policy. The question of fishing rights and transferable fishing concessions, largely debated during the CFP reform, was eventually left to each Member State's decision. The framework developed was applied in the CFP reform context to transition schemes to MSY however it was also used in other contexts to explore the trade-offs existing between different institutional arrangements regarding quota management (Bellanger et al., in press) or to explore impacts of scenarios to Maximum Economic Yield instead of the adopted MSY target in Guillen et al. (2013).

[3] In Europe, the decision-support process and the decision making process are separated processes.