MareFrame

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Authors	Paulina Ramirez, Jesper Raakjær, Kare N. Nielsen, Jose L. Santiago, Marta Ballesteros, Unn Laksá and P. Degnbol	IFM, UiT, CETMAR, SYNTESA, ICES	31/12/2014	PRM, JR, KN, JS, MB, UL and PD
WP leader	Rosa Chapela	CETMAR	09/01/2015 27/02/2015	RC
Coordinator	Anna K. Daníelsdóttir	Matis	27/01/2015	AKD
Administrative Coordinator	Oddur M. Gunnarsson	Matis	12/01/2015	OMG
Scientific Coordinator	Gunnar Stefánsson	UI	12/01/2015	GS

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Deliverable D1.1

State of the art of EAF - the science-policy-society interface in the European Union

31.12.2014

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Executive Summary

This report is the first deliverable of Work Pakcage 1 (WP1 – Co-creation & pathways for implementation), entitled: State of the art of EAF - the science-policy-society interface in the European Union. The report is set up as required by the reference peer reviewed journals in the field Marine Policy/Ocean and Coastal Management, were it will be submitted. Following the abstract, the manuscript explores how the Ecosystem Approach is introduced into the EU Fisheries, with a focus on current interfaces and collaborative dynamics between science, policy and society in the context of implementing an Ecosystem Approach to Fisheries Managament (EAFM). The article concludes with some of the perspectives and challenges ahead for EAFM in relation to the establishment of a 'co-creation process'as a means to integrate and utilise multiple sources of knowledge (policy makers, scientists and stakeholders) achieving extended outcomes moving towards an EAFM. There is a long pathway to secure adequate science-policy-stakeholder interactions in support of EAFM. This must be supported through institutional structures and through improved coordination across apresently fragmented policy landscape.

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Title Page

Ecosystem Approach to Fisheries Management (EAFM) in the EU

- Current science-policy-society interfaces and emerging requirements

Ramirez-Monsalve P[a]; Raakjær, J[a]; Nielsen, K.N[b]; Santiago, J.L.[c]; Ballesteros, M[c]; Laksá, U[d]; Degnbol, P[e]

[a] Innovative Fisheries Management (IFM) – An Aalborg University Research Center, Aaalborg, Denmark
[b] Faculty of Biosciences Fisheries and Economics, University of Tromsø, Tromsø, Norway
[c] Centro Tecnolóogico del Mar, Fundación CETMAR, Vigo, Spain
[d], Syntesa, Gøta, Faroe Islands
[e] International Council for the Exploration of the Sea, Copenhagen, Denmark

Abstract

The EU is aiming to apply an Ecosystem Approach (EA) to the management of all human activities in the marine environment, with the goal of establishing healthy and productive seas and oceans. This article explores how the EA is introduced into the EU Fisheries, with a focus on current interfaces and collaborative dynamics between science, policy and society in the context of implementing an Ecosystem Approach to Fisheries Managament (EAFM) in the EU. The scope of this work is limited to consider two EU policies that are of particlar importance to frame the EA in EU, namely the Common Fisheries Policy and the Marine Strategy Framework Directive. A short account of barriers that make the implementation of these two pieces of legislation difficult is given. Further, 'society' is considered through the Advisory Councils (AC) as a forum for articulating and representing a variety of civil society interests. The practical experiences of the the science – policy – stakeholder (AC) interface in relation to EAFM are described. The article concludes with some of the perspectives and challenges ahead for EAFM in relation to the establishment of a 'co-creation process'as a means to integrate and utilise multiple sources of knowledge (policy makers, scientists and stakeholders) achieving extended outcomes moving towards an EAFM. There is a long pathway to secure adequate science-policy-stakeholder interactions in support of EAFM. This must be supported through institutional structures and through improved coordination across apresently fragmented policy landscape.

Introduction

The EU is aiming to apply an Ecosystem Approach (EA) to the management of all human activities in the marine environment, with the goal of establishing healthy and productive seas and oceans (Jennings & Rice, 2011) (van Leeuwen, et al., 2012). The EA can be traced back to the concept of biodiversity, which emerged from the 1992 Convention of Biological Diversity. The concept forged a link between fisheries and environmental protection (Princen, 2010). Subsequent to this was the commitment – with the revision of the EU Treaty in 1997, to integrate environmental protection requirements into all Community policies and actions, including the fisheries sector (Jennings & Rice, 2011).

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The Convention for Biological Diversity (CBD) defines the EA as *"a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way*" (CBD, 2000). Prior to this, the Stratton Commission in the US back in 1969 recommended a systemic approach and a move away from a single sector approach for marine resource management. The recommendation of the CBD was to move towards ecosystem-based management, emphasising the needs of developing effective governance structures, of improving science for decision-making, and of strengthening educational programmes and stakeholder engagement.

In the EU the concept of EA became the heart of the 6th Environmental Action Plan (EAP) adopted in 2002 (Long, 2012). This EAP identified priorities for the marine environment, promoted greater integration of environmental considerations in the legislation that managed the fisheries resources of the Community- the Common Fisheries Policy (CFP), and developed a thematic strategy which subsequently was named as the Marine Strategy Framework Directive (MSFD) (Jennings & Rice, 2011). One of the stated aims of the 2002 CFP reform (2371/2002) was to minimize the impact of fishing activities on marine ecosystems and to ensure the progressive implementation of an EA to fisheries management (EAFM) (Long, 2012). The subsequent 2012 reform of the CFP (1380/2013) was widely seen as an opportunity to make additional progress towards formalizing the role of the CFP in supporting an EAFM (Jennings & Rice, 2011).

Commitment to the implementation of an EA to the management of human activities in the marine environment is apparent in the Integrated Maritime Policy (IMP) (COM(2007)575), which is the overall EU policy framework for the maritime field. The IMP states that the EA is one of the principles, together with stakeholder participation, subsidiarity and competitiveness, that guide the actions pursued by the Commission in achieving an integrated management of all human, environmental and economic interactions in the maritime field (COM(2007)575). The basis for implementing an EA to marine management in the EU are mainly included in the range of measures contained within the MSFD (2008/56/EC) and in the CFP (1380/2013). It should be noted the MSFD is considered to be the conservation pillar of the IMP and four of the 11 qualitative descriptors for determining Good Environmental Status (GES) are primarily targeting fisheries. According to Long (2012), the CFP is particularly well-suited to the implementation of the EAFM as the Treaty on the functioning of the European Union maintained that the responsibility for defining and implementing a CFP resides with the Union, granting it exclusive competence for the conservation of marine biological resources (EU, 2010).

Implementing the EAFM is a science-driven process (Long, 2012), which requires an effective relationship between science and policy-making in order to succeed (De Santo, 2010). However, as noted by Berkes (2012) an ecosystem based approach cannot be based on biological science alone, as this only adresses one of its dimensions. When moving towards an EAFM it is important to establish the institutional structures (interface) that allow for an appropriate science-policy-society interaction and facilitate stakeholder involvement in the advisory processes (Pitcher, et al., 2009)(Fletcher & Bianchi, 2014).

The aim of this paper is to explore the current status of the science-policy-society interface and co-creation processess that exist in relation to implementing EAFM in the EU. Co-creation is undersood as a "*theory of interactions that combines analytical and participatory tools to generate knowledge*

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that has scientific acceptability, policy relevance and social robustness" (Ballesteros, et al., 2014) (Jasanoff, 1990). Co-creation builds on stakeholders engagement (Mackinson, et al., 2011), co-production of knowledge (Pohl, 2008), and engaged scholarship (Van de Ven, 2007), assuming that EAFM implementation in the EU requires concerted action from multiple players. Fisheries issues are rarely high on the political agenda and society at large rarely take an interests in fisheries matters. The interface to society will be examined through the Advisory Councils (ACs), which are the main mechanism for stakeholder interaction in the CFP. Stakeholders will bring experience-based knowledge into the process, demanding arenas for deliberation with scientific knowledge to deal with complex trade-offs in complex social-ecological settings, including stakeholders balances the push and pull between science and policy within an iterative process that ensures cooperation (Watson-Wrigth, 2005).

This article is comprised of five sections. Section two is the methods section. Section three will explore how the EA is introduced into the EU Fisheries focusing on the CFP and the MSFD. A short account of barriers that complicate the implementation of these two pieces of legislation is given, as they also influence the implementation of an EAFM in the EU. Section four describes the practical experiences of the the science – policy – stakeholder interface in retion to EAFM. Section five discusses the perspectives and challenges ahead for EAFM particularly adressing the collaboration and interaction between science, policy and stakeholders.

Methods

In addition to a literature review on published papers and reports, this paper builds on data collected during a sequence of different activities carried out with ACs secretariats. A focus group meeting took place in June 2014 and it counted with the participation of the AC secretariats from the North Sea (NSAC), the North Western Waters (NWWAC), Pelagic AC (PAC) and Mediterranean AC (MAC) (MareFrame A, 2014). Focus groups is a research method that gains information from the interaction betwen participants.The method is well suited for examining how particpants discuss and think about a set of open ended questions. The method allows particpants to discuss issues in their own terms, revealing normative as well as substantive perceptions on these issues (Kitzinger, 1994). The main topic of the focus group meeting was to identify which type of advice was currently generated within the ACs and to explore alternatives for ACs to provide EAFM advice. During the meeting a presentation was given building up on the report of Le Quesne et al (2010) on providing EAFM advice in relation to the four MSFD's descriptors which need explicit consideration by fisheries managers: descriptors 1, 3, 4 and 6 relating to biodiversity, commercial species, food webs, and sea-floor processes respectively. Further, a set key informant interviews were conducted between July and October 2014. In addition to the secretariats of the AC who also attended the meeting in June, the secretariats from the South Western Waters (SWWAC) and the Baltic (BAC) were mainly interviewed on the topic of constrains in terms of resources, scope and processes (MareFrame B, 2014). In addition, an exchange of data took place from other EU projects working on similar issues (i.e Myfish and SocioEC).

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Ecosystem Approach and Ecosystem Approach to Fisheries Management in the EU

The development of EA can be traced back through institutional high-level agreements, conventions and consensual decisions at worldwide level Figure 1.

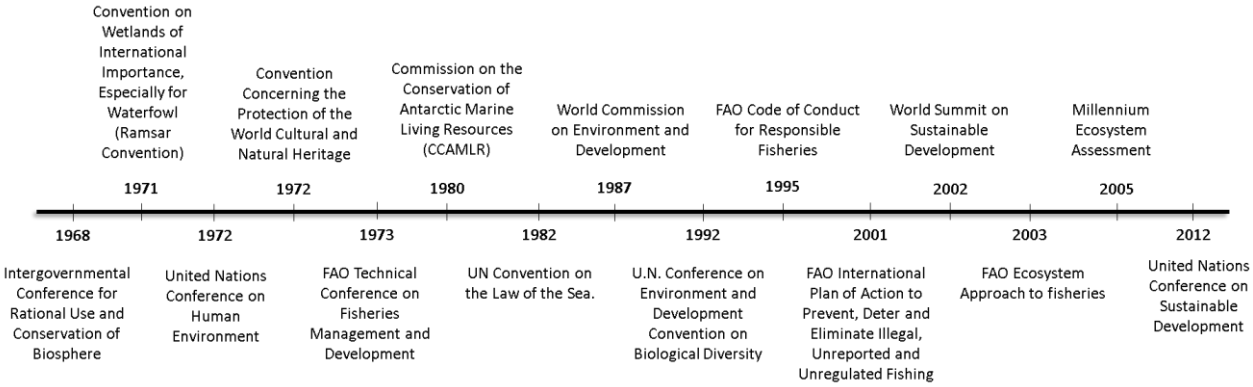

Figure 1: Major initiatives that have contributed to implement the EA to fisheries. After (IISD, 1997), (Garcia, et al., 2003) (FAO, 2003).

Characterised by a single species orientation, traditional fisheries management is perceived to have failed in a number of contexts. The need for a holistic way of understanding how the ecosystems work has been recognized (Levin, et al., 2009) (Curtin & Prellezo, 2010). It is suggested that management strategies should be developed for the entire social and ecological system rather than for individual components, taking into account the effects of the simultaneous and cumulative interactions among the different components (Arkema, et al., 2006) (Hilborn, 2007) (Christie, et al., 2007) (Murawski, 2007) (Levin, et al., 2009) (Walther & Möllmann, 2013). In an EA, the humans are a fundamental part of the ecosystem rather than an external influence deriving a portfolio of services from it (Larkin, 1996) (Christie, et al., 2007) (Gavaris, 2009) (Levin, et al., 2009). As such, the EA aims at identifying and addressing the trade-offs across multiple objectives e.g. ecological and human (Levin, et al., 2009) (Breen, et al., 2012) (Möllmann, et al., 2013) (Link & Browman, 2014) without jeopardizing the options for future generations (Garcia, et al., 2003) (Garcia & Cochrane, 2005). Decision-makers must consider the environmental, social and economic costs and benefits when making management decisions (Knights, et al., 2014).

Approaches to EA could be divided into two categories: those with a broader focus on Marine ecosystems and those with an approach focused on Fisheries (**Error! Reference source not found.**). The emphasis of EA on fisheries activities is due to concerns about the management of fish stocks as well as direct and indirect impacts of fishing (Christie, et al., 2007). However, it is increasingly acknowledged that pressures on the marine ecosystem, including fisheries, also occur from other activities taking place in and around the seas. Shipping and military activities as well as aquaculture, energy exploration, resource extraction, tourism and coastal developments contribute to environmental problems such as eutrophication and destruction of habitats (Curtin & Prellezo, 2010) underlining the relevance of the spatial dimension, the shortcuts of piecemeal governance and the need for operative socioeconomic tools (Katsanevakis, et al., 2011).

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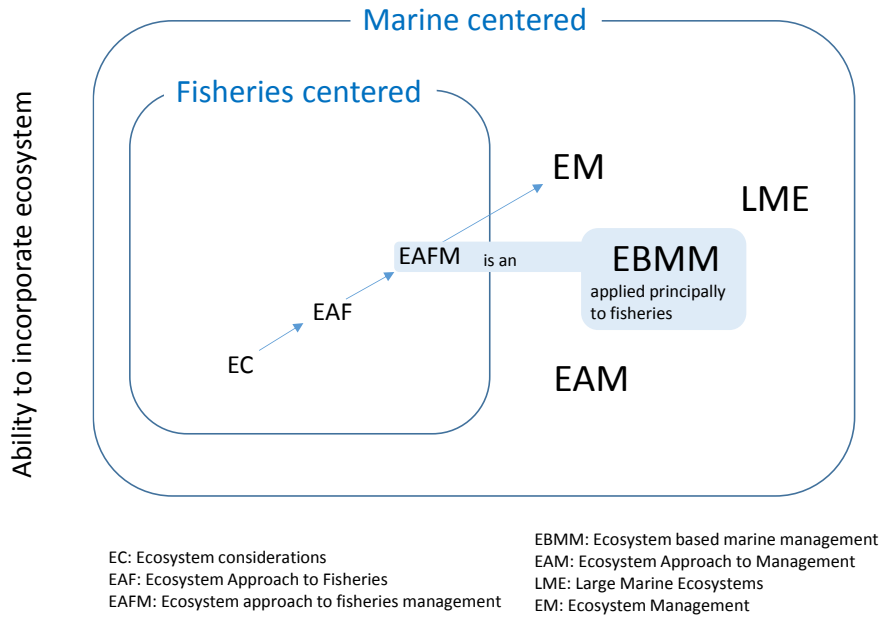

Figure 2: The approaches to EA could be classified into two categories: Fisheries centered and *Marine centered* (aftter Christie, et al. *(2007)*). Marine centered being broader than fisheries centered, and fisheries being part of marine approaches. T*he fisheries centered approaches could also be organized in a continuum as the ability to incorporate ecosystem information increases. At the end of this continuum is Ecosystem Management, one of the approaches categorized as marine-centered. (Christie, et al., 2007)*

A variety of terms are associated with implementation of EA to fisheries, including Ecosystem Based Fisheries Management (EBFM) by (Sainsbury, et al., 2000)(Pikitch, et al., 2004) (Hilborn, 2007)(Levin, et al., 2009) and Ecosystem Approach to Fisheries (EAF) by (FAO, 2003)(Garcia & Cochrane, 2005). In this paper the term EAFM will be used.

In the EU, while the CFP focuses on the implementation of an EA to the management of fisheries activities, the MSFD focuses on the implementation of an EA to the management of all human activities taking place in the marine environment.

The Common Fisheries Policy (CFP)

The CFP is the primary instrument for sustanable fisheries management. As such it adresses the impacts of fishing on target stocks as well as impacts on other ecosystem components. Following the reform of the CFP in 2013:

"The CFP shall implement the ecosystem-based approach to fisheries management so as to ensure that negative impacts of fishing activities on the marine ecosystem are minimised, and shall endeavour to ensure that aquaculture and fisheries activities avoid the degradation of the marine environment" (1380/2013, pp. Article 2, section 3). Where the EBFM is defined as:

"an integrated approach to managing fisheries within ecologically meaningful boundaries which seeks to manage the use of natural resources, taking account of fishing and other human activities, while preserving both the biological wealth and the biological processes necessary to safeguard the composition, structure and functioning of the habitats of the ecosystem affected, by taking into account

the knowledge and uncertainties regarding biotic, abiotic and human components of ecosystems" (1380/2013, p. article 4 section 9).

Advances towards implementation of the EAFM in Europe has been slow (Jennings & Rice, 2011), although significant advances can be found with regards to habitat protection (NATURA 2000) and the development of legal administrative frameworks (Jennings & Rice, 2011).

The slow progress may in part be explained by the fact that the EU has not formalized a strategy for implementing EAFM, and most of the operational details of implementation have yet to be agreed upon (Jennings & Rice, 2011). Furthermore, there is clear gap in providing useful information to decision-makers (Möllmann, et al., 2013), and policies are not embedded in EAFM (de Jonge, et al., 2012). The fact that the objectives of the CFP are broad and un-prioritized presents an obstacle to its task of providing the basis for the implementation of EAFM (Österblom, et al., 2011). Whilst the importance of achieving EAFM is explicitly stated in the CFP, there is no agreed guidance on the relative priorities that should be given to the various objectives or on how trade-offs amongst them might be addressed (Jennings & Rice, 2011). In addition, the fact that the objectives of the CFP appear to be short-termed goes against the central goal of an EAFM with long-term objectives (Jennings & Rice, 2011).

The Marine Strategy Framework Directive (MSFD)

As mentioned above, the MSFD is considered the environmental pillar of the IMP. Through an EA to the management of human activities, the MSFD pritorities the achievement and/or maintainence of GES in the European marine environment (Long, 2012). GES should be achieved/maintained for the ecosystem components and attributes. Achievement of GES is suggested by operationalizing 11 descriptors (van Hoof, et al., 2012) which broadly describe the natural environment and the pressures related to it (Breen, et al., 2012).

Although the descriptors are not sector specific (van Hoof, et al., 2012), four of the descriptors are partiucarly important in relation to EAFM. These include desciptors 1, , 3, 4 and 6 that respectively relate to biodiversity, commercial species, food webs, and sea-floor processes (Le Quesne, et al., 2010). Attempts have been made to operationalize these four descriptors. For example, classes of indicators have been proposed by the Joint Research Centre and the International Council for the Exploration of the Sea (ICES) and reviewed -and in some cases adopted by the European Commission (EC) (Jennings & Rice, 2011). Le Quesne, et al. (2010) made a selection of indicators to operationalize the four descriptors. Breen, et al (2012) assessed the status -high/moderate/low, of 10 descriptors for each of the four seas: North-east Atlantic, Mediterranean, Baltic and Black sea. Additionally, it is reported that in some of the Regional Sea Conventions (RSC) –particularly OSPAR and HELCOM, a process of defining basic principles of operationalizing GES and developing an action plan is underway (van Hoof, et al., 2012) (van Leeuwen, et al., 2014).

Challenges have been perceived with the achievement of GES, something which also influences the implementation of the MSFD in the EU. Among the perceived challenges is the definition of the descriptors. For example, some wording in the definitions still remains unclear and uncertain (Jennings & Rice, 2011). There are also divergences between the definition of environmental quality given by the RSC and the aim of achieving GES by the MSFD (van Hoof, et al., 2012) (van Leeuwen, et al., 2012). It

has also been reported that the achievement of GES is impaired by a lack of information about social and economic impacts of human activities that utilitise the marine environment (van Leeuwen, et al., 2014)

Other aspects which act as impediment for the implementation of the MSFD relate to management of scientific uncertainty; to the mismatch that exist between the policy levels and the ecosystem levels; to the institutional ambiguity that exist at the regional and EU level with regards to the coordinated implementation of this framework directive, and to the challenge of ensuring an adequete information flow through the governance system (van Leeuwen, et al., 2012)(van Leeuwen, et al., 2014).

The missing links between the CFP and the MSFD

The implementation of an EA to the marine environment takes place in a fragmented European governance system (Raakjær, et al., 2014). The present governance system can be characterised by lack of coordination between relevant Directorate Generals within the EC, governing bodies of the RSC and the Member States (MS) (Hegland, et al., forthcoming). In addition, there is limited coordination within and between existing sectorial governance arrangements with regard to an EAFM. The sectorial governance arrangements have their own set of legal/political instruments, institutional settings and guidelines for stakeholder involvement (Hegland, et al., forthcoming) (Santiago, et al., forthcoming). Morever, the sectors have to cope with the highly fragmented nature of the governance system (Raakjær, et al., 2014)(van Leeuwen, et al., 2014). The cultural diversity and geographic spread of European fisheries makes it difficult and inefficient to operate by a 'one size fits all' management system (Jennings & Rice, 2011)(Raakjær, et al., 2012).

The foundation for EAFM is provided in the objectives of the MSFD and the CFP (Farmer, et al., 2012), but there is not a common definition for EAFM agreed for both pieces of legislation. Nevertheless, the CFP needs to be made compatible with the MSFD objective of achieving GES (Jennings & Rice, 2011).

There is a need to create better links between the MSFD and the CFP in terms of regions, objectives, data collection, advisory support and research (Jennings & Rice, 2011) in order to improve the prospects of operationalizing an EAFM in Europe. The absence of an appropriate regional framework is considered a reason why the influence of EAFM on fisheries policy has remained latent (Symes, 2012). Despite sincer political ambitions, there is no integrated legal framework and little practical guidance on how to set-up governing structures to ensure coordination and cooperation between EU MSs at the scale of the regional seas (van Tatenhove, et al., 2014). Despite the formation of the ACs, decision making within the CFP has remained centralized (Jennings & Rice, 2011) and adaptiveness remains a scarcity to the sake of institutional inertia.

In relation to the MSFD, a lack of coordination can be detected between the Commission's Common Implementation Strategy, the RSC and the MSs Further, there is a lack of harmonization between national policies and institutions (van Leeuwen, et al., 2014). Details of implementation are left to the individual MS, which opens up for the possibility for the MS to make interpretations that deviate somewhat from the intentions of the directive (van Hoof, et al., 2012).

The MSFD does not seem to be adequately addressing all relevant sectors and policies (Freire-Gibb, et al., 2014), and clearly there is the need to ensure harmonization between the existing sectorial policies and their relevant institutions (van Leeuwen, et al., 2014). The systems perspective of the MSFD

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represents challenges as it deviates from the conventional sector-based approach to implementing legislation within the EU governance system (van Leeuwen, et al., 2014).

Ultimately two main barriers hamper the interplay between the CFP and the MSFD, and therefore the advances in the EAFM in Europe: first, there is an institutional mismach between the European policies respectively for fisheries and the marine environments. Individual MSs have the final say, and there is no arena for regional interaction. The second barrier, which we adress in the following section, is a inappropripate interface between science-policy-and civil society groups with a focus on the Advisory Commitees.

Co-creation as a generic model for science, policy and stakeholder interactions in EAFM

EAFM emerges with a requirement for a different set of roles and interactions between science, policy-makers and civil society interest groups (here referred to as 'stakeholders') as compared to that of a traditional and sector based approach to management of fisheries and marine environments. This requirement appears to be based on different types of reasons. It might stem from dissatisfaction with the mode of interactions between these groups within the established frameworks for science and decision making in a marine context. It might relate to the specific needs of an EAFM process as opposed to the traditional fisheries mananagement approach. Finally, it may relate to generic changes related to the production and use of scientific knowledge in society (Wynne, et al., 2007)

It is premature to provide a comprehensive account on the practical experiences of the science – policy – stakeholder interface in implementing EAFM, as this approach is first slowly entering into the decision-making process in relation to fisheries and marine management in the EU. Nevertheless, we believe that some general lessons can be drawn from contemprorary intercations betwen science, stakeholders and policy makers. Experiences from existing fisheries management arrangements can be used as a stepping-stone for a shift towards EAFM.

The standard approach to scientific advice and political decision making in the CFP

The roles and relationships between science, policy-makers and civil society is reflected in the basic institutional framework that supports policy-making, decision making and the implementation and control of regulations, and is underpinned by democratic norms. The CFP could, in particular prior to the 2002 reform, be seen to mainly reflect a notion of representative democracy, in which the insterests of society is formally represented through elected representatives in the Council of Ministers (Coffey, 2005). This system is a centralized and bureaucratic governance system, which decision making relies on advisory science (ICES advice) to provide predictive advice (Degnbol, 2003). One of the regulative ideals underpinning this relationship has been that science should provide "facts" (or more precisely: Total Allowable Catches (TACs) options related to a set of stock objectives, based on single stock projections) and leave decision making to policy makers. This ideal of a clear separation of science and politics is consistent with the Mertonian norm of "disinterestedness" of science (Merton, [1942] 1996) which has been difficult to realise in practice, not least in the context of scientific fisheries advice and political decision making (Hauge, et al., 2007)(Nielsen, 2008). The ideal

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mode of interaction between scientific knowledge production and advice on the one hand, and policitical decision-making on the other, is in this system is understood to be 'linear' in the sense that the former is independent from, and prior to, the latter. In this system, neither the fishing industry, nor other civil society interests, are included in the principal processes of advice and decision-making, and mainly exerts influence by way of lobbying national representatives with access to the decision making arena (Raakjær, 2009). The main interfaces between science, policy and stakeholders in this traditional fisheries governance system is portayed in Figure 3 (left side).

In recent years, however, the EU has promoted a shift towards participatory governance through inclusion of stakeholders in policy processes. With a starting point in general considerations on the interactions between science, policy making and stakeholders, we adress reasons why the prevalent science-policy dynamics of established fisheries management in the EU is perceived to be inappropriate for EAFM, and present a more suitable 'co-creation' model in its place (Figure 3 – right side). Furthermore, some preliminary lessons from practical experiences in relation to EAFM are presented.

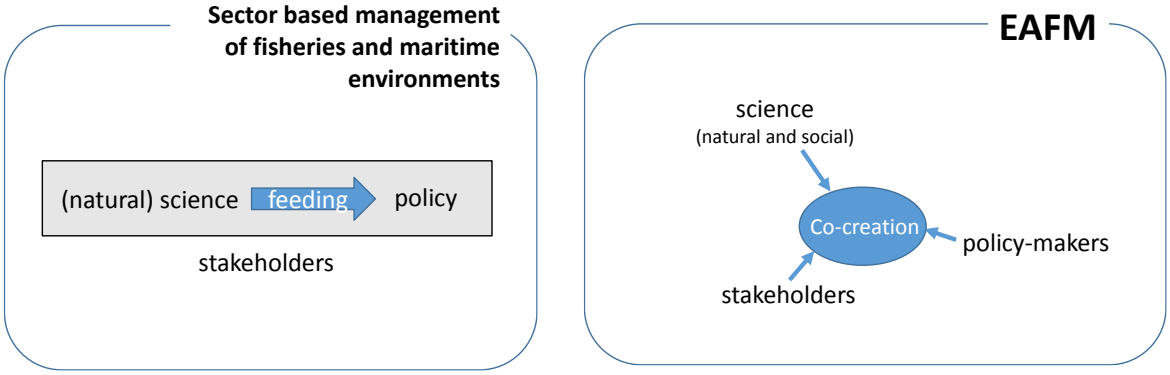

Figure 3: Models for science-policy-stakeholder interaction. To the left is a simplistic representation of a the "traditional" interaction mode with natural sciences feeding the policy-making process, without involving stakeholders. To the right is a generic model for interactions between science, stakeholders and policy appropriate for EAFM. Where sciences (both natural and social) interact on equal terms with policy makers and stakeholders through a co-creation process.

Towards a co-creation model for EAFM

Stakeholder involvement is a key principle of the EAFM (FAO, 2012)(van Leeuwen, et al., 2014). Stakeholder involvement in EAFM might enhance knowlegde about the social, economic and cultural context, as well as about ecological conditions. The inclusion of varios sources of knowledge is required to succeed with implementing EAFM (Pitcher, et al., 2009). Mackinson et al (2011) and Stange et al (2014) argue that there is an apparent disconnect between stakeholders, researchers and policy e.g. the dialogue among stakeholders, government and experts has not been completed, hindering for example, the definition of GES indicators or reference points in sufficient detail to support their application (Jennings & Rice, 2011).

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The presence of ACs, as representatives of civil society interest, is required in the science-policy dialogue if the fisheries resources are to be managed under an ecosystem approach. The ACs[4] are predominately organised along specific sea areas corresponding to large marine ecosystems/EU regional seas, although two ACs are covering straddling and highly migratory species. ACs primarily give advice on issues directly linked to fisheries, like TACs setting and long-term mangement plans (Long, 2010). More recently, however, the ACs have also been providing advise on diverse topics that indirectly affect fisheries, like research, wind farms, aggregates or oil extraction, and conservation planning (Mackinson, et al., 2011).

The introduction of ACs opened up the fisheries advisory process to other stakeholders, especially environmental e-NGOs (van Hoof, et al., 2012) and encouraged closer interaction between environmental and fisheries stakeholders. This observed to have facilitated discussions of environmental perspectives and the integration of environmental concerns into the fisheries advise (Aanesen, et al., 2012). Nevertheless, agreements between fishers and e-NGOs have proven difficult. e-NGOs have shown unwillingness to abandon partisan organisational positions (Carter, 2013; MareFrame A, 2014) and stakeholders involvement is often not as good as anticipated (Mackinson, et al., 2011). Nonetheless, changes in practices in some of the ACs (NSAC and PAC) have taken place through dismantling science/politics boundaries and operationalising beliefs from both sustainable development and ecosystem management traditions (Carter, 2013).

In relation to EAFM, the ACs will be in collaboration with the newly established structures to regionalise the CFP e.g. Baltfish, Scheveningen, NWW and SWW groups. Apparently, links also need to be established to the RSCs to ensure regional cooperation and stakeholders' participation in relation to MSFD and dealing with trade-offs within the social-ecological system (van Hoof, et al., 2012). Clearly, the existing institutional structures are not really allowing for close science, stakeholder and policy interface nor securing integration on ecoregion level to support EAFM and EBMM. The interaction is further complicated by the fact that the policy environment calls for environmental indicators which are '*easy to understand*' and '*cheap and simple to measure*' (Jonge et al 2012), but doing this in practise is far from straightforward and such indicators are not developed yet.

Dealing with science

The role of science has changed from provider of truth (Wilson, 2009) to providing transparency about trade-off choices (Degnbol, 2014). The tensions between the political decision-making process and the scientific advice is well known, particularly related to the CFP (Raakjær, 2009) (Wilson, 2009)(Princen, 2010) (Symes & Hoefnagel, 2010), but the realibity of scientific fisheries advice has also been challenged. For instance, until the mid-1990s, it was argued by both politicians and industry stakeholders that a problem existed with the modelling process; measurement of impacts on stocks from other factors than fishing e.g. climate change were not included (Carter, 2013). This situation has changed and the policy interface has moved toward dealing with uncertainties. In the "ideal" science-

[4]In the 2013 CFP reform, Advisory Councils (ACs) were replacing Regional Advisory Councils (RACs) as known from the 2002 CFP reform. Throughout the paper the term AC will be used althought this is not fully correct for the period 2003-2013.

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policy model, uncertainty can be controlled and everything that is relevant for making a decision is provided to the policy maker by science (Hauge, 2011). However, criticism of fisheries management and its science were made that uncertainty was not managed well (Hauge, 2011). Complexity in marine ecosystems is also related to the conflicting interests involved and to the different perspectives of fishermen and scientists (Hauge, 2011). Uncertainty undermined the (ideal) science-policy relationship (De Santo, 2010) and the need was recognized to address, more adequately, the issue of uncertainty in order to solve the transparency problems in scientific advice (Hauge, 2011).

Managing uncertainty can be obtained through dialogue and exchange with fishers about their knowledge, where certainty is connected in important ways to consensus (Carter, 2013), and were institutions for providing advice and decision-making will allow for non-quantifiable knowledge, not necessarily scientific, to clarify or even to some degree reduce the epistemic uncertainty in relation to fisheries management (Hauge, 2011). Stakeholders are called to be included in the science-policy interaction to help filling in knowledge gaps (Carter, 2013) and providing experience-based information. ACs appear to be managing uncertainty by means of frank exchange between fishers and scientists to resolve discrepancies of the stock size and explain unaccounted mortality, and between fishers and e-NGOs when agreeing to the contents of their advice (Carter, 2013). Somehow the ACs have became arenas of co-creation where multiple sources of knowledge are combined and tested on an continuous learning-by doing dialogue.

Changing the role of science in decision-making can be evidenced by the call for stakeholder participation (Van de Ven, 2007)(Wilson, 2009). Stakeholders are included as a way to improve the problems of credibility and legitimacy that are reported in the relationship between science and society (van Leeuwen, et al., 2014) and as a way to address the issue of no transparency in the highly centralized decision making process (Österblom, et al., 2011). Policy questions are as well reframed through stakeholder involvement (Hauge, 2011). Solutions to policy related issues are the product of interactive dialogues between the biological, economic and social sciences and the main stakeholders (Symes & Hoefnagel, 2010).

The uncertainties and complexities in fisheries systems are to be addressed by means of a cross-disciplinary approach through a co-creation process (Ballesteros, et al., 2014). The goal is to redefine the way that science-policy and stakeholders interact. Traditionally it has been (natural) science the source providing the main input for fisheries policy making. Natural sciences controlling uncertainty and providing the "truth", policy-makers having a strong belief in quantitative predictions, and stakeholders left out of this interaction (left of Figure 3). However, environmental problems need for combined advance of knowledge and action; to deliver so science (both natural and social) has to interact in equal terms with society and policy in the policy making process through a co-creation process. The EAFM facilitates this process, where a multidisciplinary approach exists, all conflicting interests are involved, uncertainty is managed through dialogue and exchange with stakeholders and non-quantifiable knowledge is used to help clarify uncertainty (right of Figure 3).

In consequence, a linear process for linking science, the articulation of various affected interests, and the process of planning decision making neither appears as a attainable nor as a desirable ideal for EAFM. In this context, a 'recursive model' (Weingart, 1999) of making and using knowledge seems more appropriate, as it allows for continues scoping and rescoping of problems, and for adaptative planning and management (Dickey-Collas, 2014).

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Stakeholders- science interaction

Improvements in the relationship of stakeholders with science have been reported. Scientists, although not official AC members, have been invited and are present at the meetings and Working Groups of the ACs (Hadjimichael, forthcoming, p. 19).“*Scientist are always invited to the working groups since they are the pillars of the discussion*” (MareFrame A, 2014). Request have been also made for scientists to help ACs in developing long-term management strategies (Mackinson, et al., 2011).

Interaction of AC with scientists have also increased thanks to the participation of ACs in EU funded projects. As a NSAC representative stated when referring to identifying where specialists are “*we are involved in 'Mareframe' and 'Myfish' […] with all of the experience that we had through all these projects we can identify who would be best and has the experience*” (Hadjimichael, forthcoming, p. 18). It is also the case that by means of the EU funded projects, scientists collaborate and have frequent dialogues with the ACs as part of their working schedule and methodology (Hadjimichael, forthcoming, p. 19).

Increased transparency has also been reported for the NSAC and the PAC (Carter, 2013). Fishers sharing data with scientists to facilitate interpretation of models, and in some cases, being open about misreported landing and discards to make sense of the graphs. Scientist have also been more transparent about the assumptions behind their models, and prepared to run different cause-effect scenarios (Carter, 2013).

AC secretariats describe the relationship with scientist as one of mutual respect and where there is good understanding with scientists “*don't argue with scientific advice in terms of scientific validity*”(MareFrame A, 2014). Science-society relationships is not a one-shot process but a reflection to maintain all the time (MareFrame A, 2014).

ACs secretariats also report as excellent the relationship of ACs with ICES “*always having [ICES] persons to present the advice, and this is the same person so there is consistency from year to year*” (MareFrame A, 2014). The commitment of AC to be engaged with ICES can be evidenced by the participation of ACs in the annual meeting, as well as participation in workshops, and data compilation exercises. ACs have also been invited to participate in working groups, for example, in the Working Group MARS (Maritime Systems), where several ACs are members jointly with scientist in a forum to articulate interdisciplinary perspectives regarding sustainable ecosystem science and advice. ACs also receive newsletters and communications about future meetings; “*persons in ICES are very easy to approach*” (MareFrame A, 2014).

Other set of request have been made for ICES to participate in additional AC activities, but ACs are aware of ICES's constraint on budget (MareFrame A, 2014). The same applies for ACs, where it was manifested their desire to participate more on ICES workshops (i.e data compilation workshops) but not possible due to the ACs limited resources. ACs also manifested a desire for more participation in the creation of advisory drafts and that there are still some limitations regarding the understanding of tools and technical measures (MareFrame A, 2014).

Lessons from ACs providing EAFM type of advice

After a decade of operative functioning and a major policy reform (1380/2013), the ACs feel better suited for the tasks ahead thanks to their increased organizational capacities, the improved and

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sustained communication with the scientific community and the potential for regionalizaiton in cooperation with MS (MareFrame A, 2014).

Nevertheless, the expansion of their playing field[5] from fisheries to an ecosystem approach creates serveral puzzles: i) EAFM is percived as an overwhelming topic (MareFrame B, 2014), far from their areas of knowledge (MareFrame A, 2014) and barely linked to their day to day priorities (landing obligation, management plans, etc.); ii) there is scepticism about providing advice on topics different than fish exploitation as "*fishing mortality rules, that is the only thing that can be controlled*" (MareFrame A, 2014); the lack of resources aggravates the lack of priority for the AC members, that do not see the need for EAFM; furthermore, ACs are lacking internal structures for generating to go beyond fisheries-related advice. "*Who is going to provide EAFM advice within the AC?*" (MareFrame B, 2014)

And yet all ACs have been involved -to some degree- in providing EAFM type of advice. One of the AC secretariats refered to activities linked to the MSFD decriptors: "*Something that could be associated to the seafloor descriptor, is that we're currently looking into finding the herring spawning grounds so that it could be avoided to disturb the bottom activities, the collaboration started but is not progressing forward*" (MareFrame A, 2014). Others are related to spatial planning, where AC advice during the assessment of wind farm zones "*was taken into account and/or replied point by point*" (MareFrame A, 2014). And there is room to optimize on-going actions, as "*voluntary surveys implemented by ACs members that could improve data- collection*" (MareFrame A, 2014)

Despite these incipient efforts, the ACs conclude that there is a low to non-existing awareness about the EAFM among their members. The little emphasis on the role for ACs in EAFM shall be seen in the light that "*We cannot afford the ecosystem approach. It is not a matter of willing or knowing, but considering the top priorities [discard plans and management plans] the ACs do not have neither the time nor the money to address the EAFM*"(MareFrame B, 2014). In addition confusion also exist with all the different pieces of legislation "*we need to sort all these legal instruments, how do they interact? how are we going to put the different concerns (fishers and no-fisheries) together?; are we going to be able to fish ever again?"*(MareFrame B, 2014).

Nevertheless, despite these barriers, ACs have an aspiration to provide EAFM advice "*because if they don't do it, then other organization would […]there is no option, it is something that is coming and that it will impact the members*" (MareFrame A, 2014). The question remains on how to overcome these barriers and not have that *"The advice we have is anecdotic compared to the one from the other industries […] it will just ends up as being nice exercises of fact finding but not impacting the overall policy […] at the end is lobby what this advice is competing against"*(MareFrame A, 2014).

[5]- The scope of ACs is focused on the provision of advice on fishery management measures and "*does not extend to providing advice on regulatory measures governing other maritime sectors such as transport, renewable energy, the offshore hydrocarbon industry, or indeed coastal development in general*" (Long, 2012).

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Perspectives and challenges ahead

The aim of this paper has been to explore the current status of the science-policy-stakeholder interface and co-creation processes that exist in relation to implementing EAFM in the EU. This section presents some of the perspectives and challenges ahead in relation to the establishment of a co-creation process as a mean to improve the collaboration and interaction between policy and particular science and stakeholders, represented by the ACs. The move towards an EAFM increases the need for multiple sources of knowledge and the need to bring this knowledge into compatible formats and to connect it (Linke, et al., 2011) to the relevant policy foras. However, due to the missing or very fragmented European governance system for implementing EAFM, and in the absence of a clear a link between the CFP and the MSFD, the establishment of a co-creation process becomes difficult as no clear guidence is provided on how to combine the two sets of policies and their associated governance systems.

From a fisheries perspective, the ability of ACs to provide stakeholder knowledge into a compatible and connected format under the EAFM approach is uncertain. Although, ACs are the relevant forums where trade-offs can be discussed and agreed upon. The ACs need to establish a suitable role for themselves, not only within the context of EAFM, but also with regard to the requirements of the reformed CFP.

The question of how the CFP and the MSFD objectives can be linked remains unresolved as the latter are yet vaguely defined and and are given little priority. A further complication is that advice from scientists and advice from stakeholders are obtained from "*parallel and separate channels"* (Linke, et al., 2011). The absence of a specified governing structure for EA to fisheries management and to marine management to secure cooperation and coordination at the policy level and the lack of clarify for the width and depth of stakeholder participation in the decision-making has created a vaccum in EAFM implemantation.

Moving towards EAFM and establishing a genuine co-creation process is suffering from the lack of institutional structures and further undermined by the fact that the policy environment is fragmented and policy implemention is highly uncoordinated. Practical experimentation may currently be the most realistic way to make progress and develop capacity with regard to EAFM.

The vision of the EAFM as a long-term mainly scientific appraoch limits the implementation hereof. The described "rapprochements" made by the scientific, policy and stakeholders communities in the EU are a step on the path, but there is a long way to integrate the EAFM in the real policy context. Clearly , there are large challenges ahead to secure the science-policy-stakeholder interaction in support of EAFM and facillitating a genuine co-creation process. This will not be a reality unless the institutional structures are revised to provide coordination of the present fragmented policy landscape.

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