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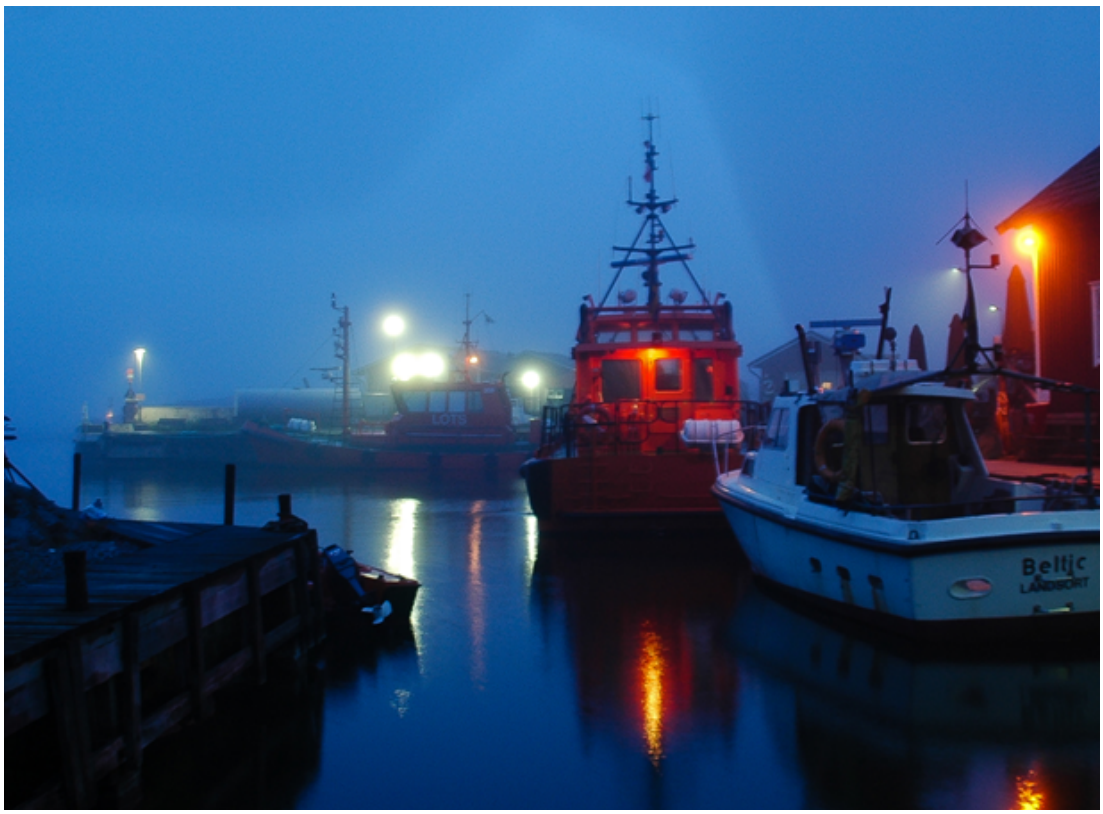

THE SOCIAL DIMENSIONS OF ECOSYSTEM-BASED FISHERIES MANAGEMENT

– A REVIEW AND IMPLICATIONS FOR IMPLEMENTATION IN SWEDEN

HAVSMILJÖINSTITUTETS RAPPORT NR 2018:4

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UPPDRAGSRAPPORT

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Inom Havsmiljöinstitutet samverkar Göteborgs universitet, Stockholms universitet, Umeå universitet, Linnéuniversitetet och Sveriges lantbruksuniversitet för att bistå myndigheter och andra aktörer inom havsmiljöområdet med vetenskaplig kompetens.

FÖRORD

Sweden has recognized the potentials for improving the health of its marine ecosystems and the management of its fishing resources and is committed to the implementation of an Ecosystem Approach for Fisheries. This implementation is expected to take place at the national level of governance. Consequently, the Swedish government instructed the Swedish Agency for Marine and Water Management (SwAM) to develop a national strategy to facilitate and guide the implementation of this new approach. Moreover, this national strategy should be informed by an examination of previous experiences of similar efforts in other countries adapted to the specific Swedish context. As the responsible national institution, SwAM envisages the Ecosystem Approach for Fisheries as an important complement to existing fisheries management that embrace the complex ecological and social and economic interactions in which fisheries takes place. In order to accomplish the development of the strategy, SwAM and the Swedish Institute for the Marine Environment (SIME) worked over 2016 and 2017 in a collaborative project to synthetize and analyze the social dimensions and governance implications to implement an Ecosystem Approach for Fisheries in Sweden. This report is the outcome of this collaborative project.

Under this context, this report is based on a literature synthesis on what is understood in the academic literature by the "social dimensions" in fisheries management and governance. In order to understand this "social dimension" the report focuses on what are the social objectives in fisheries management and what are the institutional reforms in governance that an Ecosystem Approach for Fisheries entails. The report presents also the results of a local workshop carried out on the 30th of November 2016 with the objective to initiate the analysis of the current Swedish fisheries management and governance system, and identify alternative arrangements leading to the implementation of the Ecosystem Approach.

The authors are grateful to Kajsa Tonnensson at SIME for her invaluable constant support and enthusiasm. We are also grateful for the relevant comments from two anonymous reviewers as well as from constructive discussions with Ulrika Gunnartz, Mårten Åström and Laura Piriz from SwAM. However, the authors are solely responsible for the content and the conclusions of the report.

Milena Arias Schreiber
Gothenburg, Novermber 30, 2018

INNEHÅLLSFÖRTECKNING

SVENSK SAMMANFATTNING

Ekosystembaserad fiskförvaltning (EBFM) hänvisar till antagandet av en ekosystemsstrategi för fiskeförvaltning och styrning. Genom att stärka antagandet och diskussionen om en slutgiltig definition av EBFM, främjar detta tillvägagångssätt bevarandet och hållbar användning av marina ekosystem genom att holistiskt balansera ekosystemhälsan och människors välbefinnande. I den meningen har ekologiska problem inte nödvändigtvis prioritet över sociala eller ekonomiska problem eller vice versa. EBFM föreslår således ett alternativ till konventionell fiskeförvaltning där fiskets effekter beaktas på ekosystemets nivå och människor med deras associerade institutioner inte bara tar emot varor och tjänster från naturen utan också bygger sina förståelser av naturvärlden och deras relationer till det. Dessa mänskliga institutioner, konstruktioner och överenskommelser ligger i centrum för EBFM: s sociala dimension. I stället för en metod som väljer mellan konkurrerande mänskliga natursynpunkter (t.ex. antropocentrisk eller eko-centrisk), erbjuder EBFM därför ett verktyg eller ett försök att förena dem.

Denna rapport är uppdelad i två huvuddelar och sex kapitel. Del I presenterar resultaten av en informell syntes av den akademiska litteraturen om sociala dimensioner av fiske och ekosystembaserad fiskehantering. För analytiska ändamål delas också del I i två delsektioner, den första om sociala mål för fisket och deras betydelse för fiskeriförvaltningen, och den andra om den styrande (eller institutionella) delen av detta tillvägagångssätt (för mer förklaring se kapitel 3). Del II i rapporten beskriver de första resultaten av en analys av staten och framtida sociala, politiska och juridiska konsekvenser för ett EBFM-genomförande i Sverige. För denna analys utvärderas både genomförandestatus och framtida konsekvenser mot sex principer för EBFM som tidigare har identifierats som relevanta av svenska nationella myndigheter. De sista kapitlen i rapporten ger slutsatser och rekommendationer baserade på tidigare kapitel.

EXECUTIVE SUMMARY

Ecosystem-based fisheries management (EBFM) makes reference to the adoption of the *Ecosystem Approach* to fisheries management and governance. As a conceptual model developed by the scientific community, the Ecosystem Approach was primarily designed as a strategy to deal with human-driven loss of biodiversity aiming at the conservation and sustainable use of ecosystems (see Convention on Biological Diversity at www.cbd.int/ecosystem/background.shtml) . Given the alarming state of worldwide coastal and marine ecosystems caused by fisheries - among various more human activities - the Ecosystem Approach was rapidly adopted as a useful proposal for solving the global fisheries crisis[1].

Central to the concept of EBFM is the notion that exploited marine species are interlinked to other species in the ecosystem, and also to a wider human organisation where socio-cultural, political, institutional and economic drivers play an important role (Garcia et al. 2003). In order to implement an EBFM, mainstream single-species fisheries management - or the management of single fish stocks as isolated units - increasingly needs to recognize the importance of other marine ecosystem components e.g. connected species and food webs but also human values, behaviour and institutions - and their yet not well-known linkages. (Harvey et al. 2017). For doing so, fisheries management is demanded to integrate ecological, social and economic dimensions and readjust management principles, goals, methods, instruments, decisions and policy processes that make up fisheries governance.

One first step to integrate a "social" or "human dimension" in fisheries management and governance is to understand the multiple facets by which fishers and fishing relate to the marine environment and to human welfare. Because fishing occurs at sea and mostly out of public sight, it has been suggested that fisheries contribution to human welfare has been in the past generally underestimated and neglected. Current figures however show that marine fisheries provide 3 billion people with their first primary source of proteins and employ around 40 million people worldwide (see FAO 2018). Fisheries collapses and declining commercial fish stocks are thus not only impacting – probably irreversibly – the marine environment; they are also threatening the supply of an important source of food for humans and the provision of employment and livelihoods of millions of people. Though usually out of the statistics, they are also affecting the *ways of life*, identity, use of knowledge, traditions and local institutions of fishers who had been fishing the seas for centuries, and the economies and wellbeing of coastal communities that rely on them. Despite this crucial human-sea interdependence, the social objectives of fisheries are often overlooked or not explicit in management and policy-making. In this sense, EBFM offers an opportunity to deal with this disconnection and holistically balance environmental health and human well-being for the stewardship of marine ecosystems. Furthermore, EBFM offers an alternative to conventional fisheries management in which the effects of fisheries are considered at the level of the ecosystem, and humans with their associated institutions not only obtain goods and services from nature but construct also their understandings of the natural world and their relations to it.

Finally, side-stepping the adoption and discussion about a concluding definition of EBFM, it is crucial to understand that while the approach fosters the conservation and sustainable use of

[1] For an older and a more recent explanation of what is meant by the "global fisheries crisis" see Roberts (1997) and Thang (2018, Chapter 1) respectively.

marine ecosystems, the aim is to balance ecosystem health and human well-being. In this sense, ecological concerns have not necessarily priority over social or economic concerns or *vice-versa*. Rather than an approach to choose among competing human-nature views (e.g. anthropocentric vs eco-centric) EBFM offers a tool or an attempt to reconcile them.

The social (or human) dimension of Ecosystem-Based Fisheries Management

Humans and its relation to the marine ecosystem are at the core of the EBFM and a "human dimension" for this approach needs to be understood, analysed, identified and implemented. Implementation of an EBFM without consideration of socio-cultural, economic, political and institutional dimensions (the "human dimension", see Charles 2014) is nowadays regarded as incomplete, delivering only partial and insufficient achievements that the approach aims to generate (Berkes 2012). For many scholars, EBFM is about "*putting humans back into the ecosystem*" (ibid.;465). Failure to consider human dimensions risks producing or reinforcing social inequalities with marginal groups, enhance conflicts and distrust hindering collaboration, ignoring local values, knowledge and skills essential for particular contexts, striping customary social norms, fostering unemployment, depriving individual and collective identities, altering socio-cultural relations and social capital; all of them critical for human well-being and the associated exploited marine ecosystems.

Although the institutional foundations of the EBFM dated at least three decades from now (Garcia et al. 2003), the "human dimension" entered the scene in a much later stage (Curtin and Prellezo 2010) and gained momentum in 2008 with the publication of the FAO report on *Human Dimensions of the Ecosystem Approach to Fisheries: An Overview of Context, Concepts, Tools and Methods* (De You*ng* et al. 2008*)*. Since then, social scientists have developed concepts and frameworks, derived principles and guidelines, and applied methods to operationalize a numerous and diverse aspects of the human dimensions of an EBFM. The amount of research on human and social objectives of fisheries is presently substantial, which is not surprising given the multifaceted interrelated aspects concerning human-nature(sea) relations.

For analytical reasons, the social dimension of an EBFM might be understood in two perspectives or levels. At one level, the question of "how social objectives can be integrated in fisheries management" needs to be addressed according to identified principles. At a broader level, the social, cultural, economic, institutional and political context in which an EBFM will be implemented needs to be understood in order to facilitate or make the process of implementation feasible. This analytical separation is backed up by Dillard et al. (2009;4) and their understanding of the social dimension of sustainability as both:

> *a) the processes that generate social health and well-being now and in the future; and*
> *b) those social institutions that facilitate environmental and economic sustainability now and for the future.*

Social objectives and their integration in fisheries management

Integrating social objectives in fisheries management has proven to be more difficult than expected (Brooks et al. 2015; Ounanian et al. 2013). Moreover, it has been precluded by certain reluctance based on the perceptions that ecological concerns are priorities (Harvey et al. 2017), that conflicts among ecological, social and economic dimensions are not negotiable "*you cannot have your fish and eat it too*" (Andersen et al. 2015;1395), that social objectives

are demanded by some romantic-driven social scientists or that social sciences provide "anecdotal" evidence that is not appropriate for policy and decision-making (Olson, 2005; Ounanian et al. 2013; Symes and Phillipson 2009; Pascoe et al. 2014). Scarce availability of social data, an absence of a critical mass of social scientists and awareness among managers and decision makers of the social character of the fishing industry have also contributed to the lack of identification of social objectives (Symes and Phillipson 2009; Pascoe et al. 2014).

Socio cultural values

The social objectives of fisheries or why fish and fisheries are important to societies are dependent on culture and socio-cultural values. Culture is not only something that could directly or indirectly impact or be impacted by - compatible to economic or ecological goals, since culture defines what economy and ecology mean for stakeholders and other actors (Paolisso and Dery 2010 cited in Poe et al. 2014). Socio-cultural values knowledge in the context of EBFM is needed for managers to understand why ecosystems, their resources and the fisheries are important among different stakeholder's groups and the actors involved in governance. To acknowledge the role of socio-cultural values in EBFM means to consider that humans in different social groups and places perceive different realities about the ecosystems they know, live with and depend on or are responsible to sustainable manage.

Social values are also not always the deduced combination of the individual values and in many cases deliberation processes are needed to articulate social values within diverse cultural groups. Such deliberation practices that produce the reaching of an agreement or decision enhances democratic outcomes in decision-making. In the case of fisheries, deliberation processes among stakeholders are unusual and values remain implicit in most of the cases (Kooiman and Jentoft 2009). Since, the importance or value of stakeholders is expected to be different and even in conflict to each other, explicit considerations of socio-cultural values are needed to reach trade-offs or agree on "hard choices" through democratic practices (Song et al., 2013). As stated by Jentoft (2006), social scientists can assemble together scientific knowledge with experienced-based knowledge of fishers, the values of conservationists and the various political and economic interests involved in a way that can make fisheries management pragmatic, feasible, and less likely to be overturned by opposition. Until democratic participatory processes are not in place, the values and interests of the most powerful governing actors will prevail (Kooiman and Jentoft 2009).

Fishers traditional knowledge

Fishers knowledge about the environment is one of the most important cultural aspects of inclusive and holistic fisheries management. Local fisher's knowledge is created and collective interpreted through experience from day to day interactions with the marine ecosystem. These knowledges and understandings are embedded in practices, beliefs and specific skills which cannot be found outside the fishers themselves or their sociocultural settings (Berkes 2009). It has been also established that the combination of fisher's knowledge systems with other kinds of knowledge increases the chances for more suitable management arrangements (Crona 2006; Olsson and Folke 2001), although in certain cases this knowledge has been sufficient to sustain fisheries over time (Hind 2015). Programs or projects for knowledge exchange and development of shared understandings are needed for practical incorporation of fisher's knowledge in EBFM. Such initiatives might also enhance social capital and empowerment of

actors; however, precaution is needed when knowledge is privileged or sacred based in cultural norms and social relations of certain indigenous fishing communities (Poe et al. 2014)

Cultural heritage

Among the several interconnections between humans and marine ecosystems, cultural heritage represents one cultural resource with relevant significance for the balance of ecosystem and human well-being. Cultural heritage is "*the value of the past that we distinguish in the present in order to be able to preserve it for the future"* (Maroevic 1998; 135). Cultural heritage is thus one way in which humans express their connections to the past and future with crucial consequences on societal well-being. Overlooking coastal cultural heritage can result in deterioration of cultural identity connected with certain habitats, loss of educational and recreational opportunities, decline in traditional local knowledge and social capital, and also loss of opportunities for alternative economic activities like tourism (Khakzad et al. 2015).

Gender and fisheries

Some of the key issues that underpin gender inequalities relevant to EBFM include lack of equal rights for women, and corresponding lack of access or ownership to resources, legal protection and exclusion in decision-making processes. In coastal communities, earlier work highlighted the labour women provide as "shore-side crew" taking part in such activities as contacting suppliers, taking care of the book keeping or preparing bait. There is subsequently a growing recognition that if fisheries agencies are to develop strategies for EBFM, there is a need to include an understanding of the linkages between ecological system and the condition of fishing communities where women's activities play a key role (Harper *et al* 2013; Kleiber *et al.* 2015). According to Barclay et al. (2017) gender analysis should be incorporated in any social evaluation of fisheries, since gender norms and gender relations fundamentally shape the ways fisheries and post-harvest activities operate, the ways natural resources are used, and thus the outcomes of policies.

The Governance component of Ecosystem-Based Fisheries Management

FAO defines fisheries governance as:

> *A continuing process through which governments, institutions and stakeholders of the fishery sector – administrators, politicians, fishers and those in affiliated sectors – elaborate, adopt and implement appropriate policies, plans and management strategies to ensure resources are utilized in a sustainable and responsible manner. It could be at global, regional, sub-regional, national or local levels. In the process, conflicting or diverse interests may be accommodated and cooperative action may be taken (Swan 2000).*

Furthermore, governance is characterized by:

- guiding principles and goals, both conceptual and operational;
- the ways and means of organization and coordination;
- the infrastructure of socio-political, economic and legal institutions and
- instruments;
- the nature and modus operandi of the processes;

- the actors and their roles;
- the policies, plans and measures that are produced; as well as
- the outcomes of the exercise.

The aim of governance can be understood as to manage individual behaviours or collective actions in acquirement of societal outcomes (Armitage et al. 2012) and understanding governance means to understand how decisions are taken and whether resultant policies and processes lead to environmentally and socially sustainable outcomes (Bennett and Satterfield 2018). Despite significant efforts in research and learning from experiences, and the reported beneficial impact of "good governance" to ecological status (Bundy et al. 2017), it remains unclear what kind of governance structures processes and institutions are most capable of delivering the ecosystem approach in fisheries in the longer term. Nevertheless, co-governance, interactive and polycentric governance are basic considerations heading towards EBFM implementation.

Co-governance

Co-governance is the type of governance where societal interested groups agree to collaborate and "*work for a common purpose in mind, and stake their identity and autonomy in the process* (Kooiman et al. 2008;9). It includes communicative governance, public-private partnerships, networks, regimes and co-management. Co-governance has received much attention in general and in fisheries the form of co-governance called co- management is particularly influential. A key assumption is that no one actor is in control; instead, interactions are of a horizontal kind avoiding hierarchical power structures. Linke and Bruckmeier (2015) highlight three key governance issues in fisheries co-management that are important for addressing EBFM: (a) everyday issues (short-term perspective); (b) institutional arrangements (long-term perspective); and (c) the construction of values and principles in fisheries policy-making (very long perspective)[2].

Interactive governance

Interactive governance theory involves diverse actors and institutions, interacting dynamically across various scales from local to global. The emphasis is put on the "interactions" between large number of actors that are constrained or enabled in their actions by structures. Actors, are any social unit possessing agency or power of action and include among others individuals, associations, leaders, firms, departments, international bodies. Structures refer to the frameworks within which actors operate and include culture, law, agreements, etc. Interactive governance holds basic social values and ethical principles to be issues of consideration and decision-making and recognizes the importance of contextual factors and local knowledge (Kooiman et al. 2008).

For interactive governance theory, fisheries and coastal governance may be seen as a relationship between two systems that could be termed a ''governing system'' and a ''system-to-be-

[2] Whether co-management experiences in Sweden have led to positive or negative outcomes is a matter of debate. For Bryhn et al. (2017), the Eight Fjords Co-management Initiative can serve as a guiding example for co-management towards ecological, economic, and social sustainability and for EBFM implementation in practice. On the other hand, Cardinale et al. (2017) claim that this experience was inefficient and unsuccessful since the results did not translate in the recovery of local fish populations (health of the ecosystem).

governed". The governing system is social, and therefore man-made: it is made up of institutions and steering instruments and mechanisms. The system-to-be governed is partly natural and partly social: it consists of an ecosystem and the resources that this encompasses, as well as a system of users and stakeholders who form political coalitions and institutions among themselves. Finally, concerning the interaction between the two systems forms a third system in its own right (Jentoft 2007).

Following interactive governance, two main considerations for EBFM come into focus 1) actors (scientists, policy-makers and stakeholders) and their interaction's outcomes, and 2) the scope of stakeholder participation in governance.

Governance actors and their interactions towards EBFM

The actors constellation in governance for EBFM includes scientists, decision makers and stakeholders working together to define the broad vision of EBFM and among others - the spatial scale or scales of interest, the social and ecological objectives, the deliberative process towards a common vision on principles and values that will be reflected in new rules, norms and institutions. Current experiences in EBFM implementation have defined how this work between scientists, managers and stakeholders needs to progress. Following Röckmann et al. (2015) EBFM implementation need actors interactions developing along a spectrum within a triangle (see Figure 2 in the report's text). The triangle of interactions shows that during the EBFM implementation, scientific salience develops from scientific information with "no salience" to research which is directly up taken and used in decision making. In the same model, participatory process evolves from centralized into self-management, and transdisciplinary knowledge production enhances credibility between scientists and stakeholders and is one of the final products of EBFM implementation.

Stakeholders participation for EBFM

Stakeholders can be defined as "*any group or individual that is or can be affected by the achievement of fisheries management objectives*" (Freeman 1984). Stakeholders participation for decision-making has shown to be applied by managers at different levels from the task to inform stakeholders about management decisions to the transfer of decision power to stakeholders (see Fig. 3 in report's text). For instance, Advisory Councils for fisheries in the EU were established to involved stakeholders at the "consultation" level (Griffin 2013). There is however agreement among academics and practitioners that despite its importance, consultation processes are not effective and are often carried out from the top-down with little opportunity for real participation (Reilly et al 2016). For EBFM, stakeholder's participation is understood as implementing the "delegation" level of participation for which representatives are assigned decision power to certain issues and become empowered in the process.

Polycentric (nested) governance

Polycentric governance systems refer to multiple centres of decision-making, which are formally independent of each other, but function in a coordinated manner and with consistent and predictable patterns of interacting behaviour (Vcitanovich et al. 2018). Two main advantages of polycentric governance over other types of decision-making processes have been identified: the provision of modularity and the provision of functional redundancy. Modularity enhances the resilience of the governance system by diminishing the impact of shocks or

disturbances spreading them though the entire network. Functional redundancy refers to individual units to perform parallel and overlapping functions. Thus, when one level or unit fails to respond, it can be compensated by the responses of other units within the same governance system. This allows individual units to retain their function even with the collapse of other units (Cvitanovic et al. 2018).

A key characteristic of decision making in polycentric governance for EBFM is that this process is non-hierarchical. Raakjaer et al. (2014) argue that it is more likely that EBFM is based on a network structure where the linkages facilitate self-organization, because of the numerous horizontal and vertical levels in geographic and jurisdictional scales. According to these authors by developing institutional connections with nested governance it could be possible "*to ensure a common discourse, policy objectives and decision-making and implementation of sectoral measures supporting EBMM objectives*" (2014;376). However, the effectiveness of governance networks over other types of governance arrangements is not obvious when ecosystem-based ecological objectives are the aim. Extensive and rigorous central governance strategies foster environmental conservation while vagueness and flexibility promote institutional fitness at the local level and stakeholder collaboration (Sandström et al. 2015).

Conclusions

Social dimensions of EBFM deal with the integration of social objectives into marine resources management as well as fisheries governance or the societal process, structures and institutions supporting or impeding its implementation. This however does not mean that social dimensions of EBFM are limited to implementation issues; they also apply to the fundaments and principles of the approach (meta-governance). Since EBFM is context specific and there is no single way or recipe to implement it, knowledge on socio-cultural values is needed for managers to understand why ecosystems, their resources and the fisheries are important among different stakeholder's groups and the actors involved in governance. Top-down fisheries management makes it difficult for fisheries managers to grasp social values and objectives of fisheries since this type of management requires minimal contact with stakeholders and relies mainly purely on scientific advice. This scientific advice is derived from scientists who also do not necessarily interact with stakeholders as in the case of scientists monitoring fish stocks or modelling fish market behaviour.

Once values and interests among governance actors are brought to a shared arena, the contextual fundaments, principles and goals of fisheries are identified and prioritize through participatory democratic processes reflecting expertise and other types of knowledge. As the importance, values and interests of stakeholders is expected to be different and even in conflict to each other, explicit considerations of them are needed to reach trade-offs or agree on "hard choices" through democratic deliberative participation. Stakeholders participation and knowledge integration are under these conditions crucial processes for EBFM implementation. Stakeholders participation is ineffective if only includes consultation processes and do not foster the assignment of responsibilities and decision-making power to certain issues through stakeholder empowerment. Regarding knowledge integration of different types of knowledge, this process is not limited to knowledge "sharing" or the use of data collected by stakeholders for scientific purposes; integration means dealing with different views about definitions and classes of entities, and the way "truth" is validated that result in co-production of new knowledge. Knowledge integration is also not exclusive to stakeholder-led knowledge,

scientists and experts need to understand the fundamental methodological differences between best available qualitative social sciences data and quantitative data to implement EBFM. Thus, interactions between governance actors is envisaged to develop along a spectrum where scientific salience develops from scientific information with "no salience" to research which is directly used in decision making; participatory process evolves from centralized into self-management, and last but not least, transdisciplinary knowledge production enhances credibility between scientists and stakeholders and is one of the final products of EBFM implementation.

Considering social dimensions in EBFM demands to readjust fisheries management principles, goals, methods and policy processes. This can be done through a "revolution" or through an incremental but fundamental adjustment of mainstream processes. Accommodating to change is however something that individual and organizations find difficult to cope with, but as research has shown, failure to consider social dimensions in EBFM risks producing or reinforcing social inequalities with marginal groups; enhancing conflicts and distrust hindering collaboration; ignoring local values, knowledge and skills essential for particular contexts, striping customary social norms, depriving individual and collective identities, altering sociocultural relations and social capital; all of them critical for human well-being and the associated exploited marine ecosystems. This research has also made it clear that, to reduce social objectives of fisheries management to ensure employment or maximize economic profit is an oversimplification.

Interactive, nested and co-governance have been suggested as governance processes that foster EBFM implementation. Which governance structures and processes are better equipped to deliver EBFM objectives remains nevertheless a challenge. Already well-established roles, responsibilities, powers and jurisdictions of management authorities are not currently designed to match ecosystem boundaries, thus EBFM implementation requires a fundamental reorganization of these structures and institutions.

INTRODUCTION

Fisheries collapses and declining commercial fish stocks are negatively impacting the supply of an important source of food for humans and the provision of employment and livelihoods of millions of people worldwide. They are also affecting the *ways of life* of fishers who had been fishing the seas for many generations and the economies and wellbeing of coastal communities that rely on them. Despite this crucial human-sea connection, the social objectives of fisheries are often overlooked or not explicit in management and policy-making. Conventional fisheries management focuses principally on the biological and economic impacts of fishing in their efforts to halt the decline of key fish stocks (Urquhart et al. 2013; Voyer et al. 2017). While this bio-economic focus is justifiable, the overexploitation of fish resources is most likely to prevail if fisheries approaches do not integrate the ecological, economic and social dimensions of sustainability (Ounanian et al. 2013; Urquhart et al. 2011). One such integrated approach is the Ecosystem-based Fisheries Management (EBFM) that refers to the adoption of the *Ecosystem Approach* to fisheries management and governance. EBFM has gained international acceptance by those involved in fisheries research and management over the last two decades (Long et al. 2015, FAO 2018; Cochrane 2017). Central to the EBFM concept is the notion that exploited marine species are interlinked to other species in the ecosystem, and also to a wider human organisation where socio-cultural, political, institutional and economic drivers play an important role (Garcia et al. 2003). Mainstream fisheries management, based on single-species considerations- or management of single fish stocks as isolated units - increasingly needs to recognize the importance of other ecosystem components e.g. connected species, habitats, food webs but also human values, behavior and institutions - and their yet not well-known linkages. (Harvey et al. 2017). For doing so, fisheries management is demanded to readjust management principles, goals, methods and policy processes.

Whether a shift to EBFM needs a fundamental transformation or an adjustment to mainstream fisheries management is still a matter of debate (see Berkes 2012; Grumbine 1994; Hall and Mainprize 2004; Marshall et al. 2017; Murawski 2007). What is not a matter of debate is that an EBFM should be applied for the stewardship of marine ecosystems by holistically balance environmental health and human well-being (see ICES and Ecosystem-based management at www.ices.dk/explore-us/Documents/ICES%20and%20EBM.pdf) Humans and its relation to the marine ecosystem is at the core of the EBFM and a "human dimension" for this approach needs to be understood, analysed, identified and implemented. Implementation of an EBFM without consideration of socio-cultural, economic, political and institutional dimensions (the "human dimension") is nowadays regarded as incomplete, delivering only partial and insufficient achievements that the approach aims to generate (Berkes 2012). For many scholars, EBFM is about "*putting humans back into the ecosystem*" (ibid.;465). Failure to consider human dimensions[3] risks producing or reinforcing social inequalities with marginal groups, enhancing conflicts and distrust hindering collaboration, ignoring local values, knowledge and skills essential for particular contexts, striping customary social norms, fostering unemployment, depriving individual and collective identities, altering socio-cultural relations and social

[3] The terms "human dimension" and "social dimension" are used interchangeable in this report, meaning the whole range of non-ecological, non-economic dimensions of the EBFM. The term social dimension is however preferred over human dimension.

capital; all of them critical for human well-being and the associated exploited marine ecosystems.

Although the institutional foundations of the EBFM dated at least three decades from now (Garcia et al. 2003), the "human dimension" entered the scene in a much later stage (Curtin and Prellezo 2010) and gained momentum in 2008 with the publication of the FAO report on *Human Dimensions of the Ecosystem Approach to Fisheries: An Overview of Context, Concepts, Tools and Methods* (De You*ng* et al. 2008*)*. Since then, environmental social scientists have developed concepts and frameworks, derived principles and guidelines, and applied methods to operationalize a numerous and diverse aspects of the human dimensions of an EBFM. The amount of research on human and social components of fisheries is presently substantial, which is not surprising given the multifaceted interrelated aspects concerning human-nature(sea) relations.

With the aim to update and synthetize the current knowledge on the meaning and requirements of the human dimensions of EBFM (Part I) and analyze the Swedish case (Part II), this report has been elaborated to support and speed up the shift towards this approach's implementation. The report has been developed to inform the Swedish Agency for Marine and Water Management in their process of the integration of social dimensions in the development of EBFM for Swedish commercial fisheries.

Report structure and scope limitations

This report is organized in two main sections and six chapters. The first section (Part I) presents the results of an informal synthesis of the academic literature concerning social dimensions of fisheries management and ecosystem-based fisheries management. For analytical purposes, Part I is also divided in two subsections, the first one about social objectives of fisheries and their inclusion in fisheries management and the second one on the governance (or institutional) component of EBFM (for more explanation see Chapter 3).

Part II of the report describes the first results of an analysis of the state and future social, political and legal implications for an EBFM implementation in Sweden. For this analysis, both the state of implementation and future implications are evaluated against six principles of EBFM which have been previously identified as relevant by Swedish national agencies. According to these Swedish agencies these six principles represent a translation and concretization of the 12 Malawi Principles of the Convention for Biological Diversity (CBD) as follows (translation from Swedish):

- Common objectives and participation
- Nature's ability to produce goods and services is superior; the precautionary principle should be applied
- All kinds of knowledge should be considered
- Socio-economic ecosystem evaluation
- Delimitations in time and space
- Flexibility and adaptability

Part II of the report encompasses also the results of a one-day workshop carried out to discuss the social dimensions of EBFM implementation in Sweden. This workshop was attended by

interested academics from the natural and social sciences and managers from the Swedish Agency for Marine and Water Management. Two external participants from the Innovative Fisheries Management Center at Aalborg University in Denmark were also invited to attend.

It is important to note, that the structure of this report allows readers to select one of the two main report's parts according to their specific interests, purposes and academic background. Readers with no academic background in social sciences and fisheries, interested in acquiring a general understanding of what the social or human dimensions of EBFM entails, the associated concepts and the advances and challenges are advised to revise Part I. Alternatively, a reader with a social sciences background in relation to fisheries who wants information on how EBFM is conceptualized, which experiences exist and which steps have been and need to be taken towards its implementation in Sweden, will be interested in revising Part II. Since the connection between the two parts is not straightforward for non-fisheries social scientists, it is recommended in those cases to start reading Part I in order to understand the content of Part II.

Limitations

Considering the scale and scope of the subject matter, this report is inevitably constrained in what it can cover. The first constraint regards the different management regimes that exist for subsistence, commercial, recreational and high-seas fisheries. This report focuses on commercial fisheries but the concepts and definitions of Part I of the report are applicable to any fisheries. The second constraint relates to the synthesis of the literature review which does not comply with the requirements for a rigorous systematic review. In this report, an informal expert-based literature review has been performed in order to inform the readers and cover as many aspects as possible related to "human dimensions" of EBFM. Concerning a third constraint, although certain differences between the various definitions of EBFM are pointed out in relation to the scope of a social dimension integration (see 1.2), it is beyond the scope of this report to discuss in detail different definitions of this management approach. Similarly, the report does not examine the various models or "analytic visions" of the human-nature relation which shape the conceptual base for the diverse treatments of the social dimension in ecosystem management (see Glaser 2006). The report offers a synthesis of what is the current understanding of the social dimension of EBFM regardless of the relevance or treatment that each reader places or assigns to them according to their own modes or views of the human-nature relationship. For this report EBFM is not about choosing among competing human-nature views (e.g. anthropocentric vs eco-centric); it rather offers a tool or an attempt to reconcile them.

Objectives

Ecosystem-based Fisheries Management and its associated names such as "Ecosystem Approach for Fisheries" or "Ecosystem-based Approach" is a widely used and not well-defined term. Nevertheless, EBFM has been increasingly incorporated in regulations and policy instruments regarding the use of the marine environment in recent years. Debates about the operation of an EBFM no longer consider it solely as a marine environmental concern (see for example Pikitch et al., 2004), but also incorporate economic, social and institutional dimensions (De Young et al. 2008). However, while a social dimension to the EBFM is widely accepted, exactly what this means and requires has not been very clearly delimited or agreed upon (Paterson et al. 2014). The first part of this report aims to address this inconsistency

through a detailed exploration and informal expert synthesis of what is meant by a social dimension of an EBFM. Part II of the report analyses the steps taken and the steps needed for integrating social dimensions towards EBFM implementation in Sweden. Therefore, the objectives of this report are twofold:

- To synthetize and present a range of updated available scientific knowledge and experiences to explain the social dimension of the EBFM and it implementation process.
- To analyze and offer guidance for the inclusion of a social dimension in the process of implementation of the EBFM in Sweden.

PART I. REVIEW OF THE SOCIAL AND GOVERNANCE DIMENSIONS OF ECOSYSTEM-BASED FISHERIES MANAGEMENT

1. ECOSYSTEM-BASED FISHERIES MANAGEMENT – THE PARADIGM

The transition towards EBFM has been framed and discussed as a "paradigm shift" in marine science and management literature (Plaganyi 2016; Wenzel 2016; Prellezo and Curtin 2015; UNEP 2016; Dickey-Collas 2014) but not everyone agrees with this view. For instance, Murawski (2007;683) claims that the "paradigm shift" is just a myth fueled on false perceptions and perceived failures of existing institutions to address degradation of the marine environment, declines in fish stocks, and conflicts among user groups (ibid.). These different views have prompted discussions about the implementation of the approach. For the paradigm advocates, a shift to EBFM and its domination needs a *revolution*. Berkes (2012) explains that three crucial "revolutions" in the underlying philosophies on which fisheries management has relied upon, are implied in EBFM. The first refers to the acceptance that the problem with fisheries is and should be addressed as a "wicked problem" (Jentoft and Chuenpagdee 2009) that cannot be solve with straightforward recipes and needs interdisciplinary and co-production of knowledge; the second is the recognition of fisheries taking place embedded in social-ecological systems where boundaries are arbitrary selected and dynamic; and the third, is that management and technical solutions need to be translated to new forms of governance dealing with complexity, scales and uncertainty. According to Berkes (2012;473), EBFM needs to be revolutionary because "*it would involve dealing with multiple disciplines and multiple objectives (Cochrane and Garcia 2009) and expanding scope from management to governance (Kooiman et al. 2005) that includes cooperative, multilevel approaches involving partnerships, social learning and knowledge co-production*". However, from a more pragmatic and less radical perspective, the transition to an EBFM can be viewed as a continuum agenda, or "route", on which adaptive management constantly needs to move towards achieving more-and-more ecosystem-approach management and new understandings involving science, managers and increasingly other/all sectors of society (Dolan et al. 2016; Murawski 2007). In order to incorporate these, it is demanded that mainstream single-species management – or management of fish stocks as separated units - needs to be replaced by multispecies management (Möllmann et al. 2014; Schwach et al. 2007) that also integrates ecological, economic and social dimensions.

1.1 Single-species fisheries management

Single-species fisheries management is applied worldwide by fisheries managers with the aim to maximise sustainable catches and economic profits of one specific targeted fish species. The practise is frequently performed by governmental agencies usually after recommendations from independent scientific advice. Scientists estimate the harvest levels of a specific fish stock which will sustain its exploitation over time. For that estimation, scientists use a variety of fish stock evaluation methods and models from the discipline known as fish population dynamics. Models describe the growth or decline of the fish population over time - based on its mortality and reproduction rates - and set accordingly the maximum allowable harvest to maintain a healthy fish population. Harvest recommendations for each fish stock are given usually for periods of one year or one fishing season after which the same process starts

again. Harvest estimates are performed in similar manners for each targeted commercial fish stock which is subject to management. Finally, it is assumed that if this single-species management is applied to all fish stocks, the broad ecosystem will be sustainable managed (Wilson 2006). In the European Union, the system has been described as the "TAC-machine" (Holm and Nielsen 2004) because the annual scientific harvest recommendations for each fish stock are named "Total Allowable Catches".

However, fisheries managers and scientists have increasingly started to doubt if single-species management is the best fisheries approach to prevent overexploitation and degradation of marine ecosystems (Long et al. 2015; Pikitch et al. 2004; Wilson 2006; cf Mace 2004; Arias Schreiber 2012; Zacharias 2014). The inefficacy of this type of management has been related to its low capacity to predict and deal with some critical interactions causing unintended impacts of fisheries management such as (e.g. see Mangel et al. 2000; Guerry 2005):

- Changes in the populations of predators and preys of the target fish stock
- Impacts in the function and structure of the marine ecosystem, and fisheries induced irreversible ecosystem shifts.
- Habitat degradation through the use of destructive fishing methods.
- Incidental mortality of non-target catches which are considered key for ecosystem functioning, including culturally important "key" species.

Yet, a clear message derived from the main criticisms to the single-species models is related also to its failure to understand and acknowledge two basic principles of EBFM; first – as shown above, the interlinkages between exploited fish populations and other components of the marine ecosystem; and second, the embeddedness of fisheries within complex social-ecological systems or interlinked systems of humans and nature (Leenhardt et al. 2015; Marshall et al. 2017). At the ecosystem level, extensive losses of eelgrass coverage in the Swedish west coast (Eriander et al. 2017) and the shift from a cod-dominant to a sprat-dominant ecosystem in the Baltic Sea (Österblom et al. 2007) are examples of coastal and marine ecosystems experiencing visible degradation despite best single-species management efforts. Likewise, the loss of local traditional knowledge as a consequence of the reduction in number of coastal fishers along the Baltic Sea over the last decades (Arias Schreiber et al. 2018) had occurred in parallel to single-species management in this marine ecosystem. Despite discussions on the causality relation with single-species management to such developments, neglecting social data evaluation related to human-nature interactions in EBFM is now seen as an omission, which will erode the efficacy of any marine resource management or sustainability action (Redman 1999; Lade et al. 2015; Leenhardt et al. 2015; Heck et al. 2016).

In models to manage fisheries based on maximizing fish stock yields, the human-nature relation is simplistically assumed to imply self-interested individual humans (fishers) who aim to maximize their economic benefits from nature (Snyder and St. Martin 2015) and their behavior is not constrained by any social context (Berkes 2009). In this sense, the tools used for conventional single-species fisheries have tended to be dominated by ecological and economic components leaving social objectives to "fall from the agenda" (Barclay et al. 2017; Ounanian et al. 2013). In recent years, single species fisheries management based on bio-economic perspectives have been criticized because of (Zacharias 2014):

- An overemphasis on short term economic objectives and the maintenance of one single species.
- Removal of humans as ecosystems components from fishery models
- Political, economic and social values being either discounted or ignored
- Needs of commercial fishing stakeholders taking precedence over other stakeholder's interests
- A focus on population ecology rather than community ecology or ecosystem dynamics
- Modern tools, such as geographical information systems, ecosystem services, spatial planning, not used and ignored.

EBFM offers an alternative to conventional fisheries management in which the effects of fisheries are considered at the level of the ecosystem, and humans with their associated institutions not only obtain goods and services from nature but construct also their understandings of the natural world and their relations to it. Those human institutions, constructions and understandings are at the heart of the social dimension of EBFM.

1.2 Ecosystem-based or Ecosystem approach?

While Ecosystem-Based Fisheries Management (EBFM) and Ecosystem Approach to Fisheries (EAF) are used interchangeable in the literature, Prellezo and Curtin (2015) have lately suggested that a difference exists between the terms "ecosystem based" and "ecosystem approach", and that the use of both terms simultaneously as in "ecosystem-based approach" creates confusion. Referring to Garcia (2003), Prellezo and Curtis explain that the term "ecosystem-based" stands for the supremacy of environmental objectives over social and economic ones. In turn, the use of the term "approach" denotes a change of direction towards a more ecosystem consciously conventional fisheries management and governance. As it is explained below, the difference in both terms has consequences for the inclusion of a "social dimension" in the approach implementation.

"Ecosystem-based" and the ecosystem at the center of the human-nature relation

Placing the *ecosystem* - its health or integrity - at the center and as the prior goal of fisheries management might result in once more social objectives being regarded as less important or secondary. Such an assumption will thus have sound consequences during the process of definition and prioritization of fisheries management objectives. In this case, the advocated balance between ecosystem health and societal well-being turns to be trivial since ecological concerns are dominant. Consequently, both scientists and managers efforts are primarily directed to the maintenance of ecosystems function, structure and productivity. Among other assumptions, human well-being is maintained when the provision of goods of services from ecosystems is sustainable and human development is ensured. Usually, social objectives are identified in a top-down decision-making process. Some examples of ecosystem-based definitions that follow this "eco-centric" perspective and are still currently in use are:

> *"focusing on ecological systems that may cross administrative and political boundaries, incorporating a 'system' perspective sensitive to issues of scale, and managing for ecological integrity" (Endter-Wada 1998).*

"the comprehensive integrated management of human activities based on the best available scientific knowledge about the ecosystem and its dynamics, in order to identify and take action on influences which are critical to the health of marine ecosystems, thereby achieving sustainable use of ecosystem goods and services and maintenance of ecosystem integrity" (The Helsinki and OSPAR Commissions 2003).

"a much broader view than how marine ecosystems have been managed traditionally, taking into account the interconnectedness and interdependent nature of the components of ecosystems, and the fundamental importance of ecosystem structure and functioning in providing humans with the broad range of services that are taken for granted" (Curtin and Prellezo 2010)

"an integrated approach to management that considers the entire ecosystem, including humans. The goal of EBM is to maintain an ecosystem in a healthy, productive and resilient condition so that it can provide the services humans want and need. EBM differs from current approaches that usually focus on a single species, sector or activity or concern; it considers the cumulative impacts of different sectors" (COMPASS cited by Long. et al. 2015).

"Ecosystem approach to fisheries" and adjustments to conventional fisheries management

Using the term "ecosystem approach" the word "management" is purposely left out and two new perspectives to the "ecosystem-based" term are incorporated. First, the "approach" is not limited to management but applies to broader policy and legal frameworks, development, inter-sectoral planning, etc. (De Young et al. 2008). Others have noted the implications of the broader concept of governance in this relation, which includes beliefs, values and principles as well as a "more reflexive, deliberative and value-rational methodology than the instrumental, means-end oriented management concept" (Jentoft 2006;671). Second, the Ecosystem Approach does not necessarily denote fundamental transformations to conventional fisheries management but adjustments in order to incrementally replace the central place of fish populations with the marine ecosystem. Again, in this case, social objectives might be placed at a secondary level or as "something to be added" to the bio-economic directed conventional fisheries management. Examples of the definition of the Ecosystem Approach to Fisheries are:

"the Ecosystem Approach to Fisheries strives to balance diverse societal objectives, by taking into account the knowledge and uncertainties about biotic, abiotic and human components of ecosystems and their interactions and applying an integrated approach to fisheries within ecological meaningful boundaries" (FAO 2003).

1.3 Ecosystem-based Fisheries Management in this report

Despite the controversies regarding terminologies, this report uses the term "Ecosystem-based Fisheries Management" with an emphasis in the need to balance ecological and social objectives through the governance of fisheries. Ecological objectives are as important as social objectives and the conception that "managing fisheries is managing people" (Barclay et al. 2017; Lade et al. 2015; Samhouri et al. 2014), is highlighted. The objectives and goals of EBFM are contextual and are identified and prioritize though transparent, participatory, democratic processes reflecting expertise and other types of knowledge. EBFM is based on the

view that ecosystems provide goods and services for human-wellbeing but also *vice-versa*; that human well-being contributes to ecosystem health. Following Breslow et al. (2016;251) EBFM is defined as "*a shift from a single-species, extraction-oriented focus in resource management toward a more holistic philosophy that strives to balance the multiple interrelated dimensions of ecological integrity and human wellbeing".*

Similarly, based on a comprehensive compilation of academic and policy documents dealing with principles behind the Ecosystem Approach, Long et al. (2017;246) defined it as

> *"an interdisciplinary approach that balances ecological, social and governance principles at appropriate temporal and spatial scales in a distinct geographical area to achieve sustainable resource use. Scientific knowledge and effective monitoring are used to acknowledge the connections, integrity and biodiversity within an ecosystem along with its dynamic nature and associated uncertainties. EBM recognizes coupled social– ecological systems with stakeholders involved in an integrated and adaptive management process where decisions reflect societal choice."*

Adopting these definitions raises four important considerations from which this report relies upon:

- EBFM is not about choosing among competing human-nature views (e.g. anthropocentric vs eco-centric); it rather offers a tool or an attempt to reconcile them.
- EBFM is about balancing ecosystem health and human wellbeing in coupled social-ecological systems; ecological concerns have not necessarily priority over further concerns.
- Human dimension of EBFM deals with the integration of social objectives into marine resources management as well as the societal process, structures and institutions supporting or hampering its implementation (governance).
- Human dimension of EBFM is not relevant exclusively to remote rural fishing communities which are directly dependent on nearby marine resources; it encompasses principles and objectives with broader societal implications.

Box 1. Key features of the ecosystem approach to fisheries and aquaculture (EAF/EAA)
(from FAO 2018)

The key features of the EAF/EAA framework, as proposed in the FAO guidelines for both fisheries and aquaculture, are characteristic of a participatory risk-based management process adapted to the fisheries and aquaculture sectors and include:
(1) wide stakeholder participation at all levels of planning and implementation;
(2) comprehensive and explicit consideration of all key components of a fishery or aquaculture system (ecological, social, economic and governance) as well as external drivers (e.g. climate change);
(3) reconciliation of environmental/conservation and social/economic management objectives, including explicit consideration of trade-offs between them;
(4) decision-making based on "best available knowledge", including both scientific and traditional knowledge, with promotion of risk assessment and risk management, and recognition that in the absence of detailed scientific knowledge decisions must still be taken;
(5) focus on sustainability issues that need attention, identified and prioritized through a formal participatory process (e.g. risk assessment);
(6) reliance on a formal management plan developed for a specific area or system with operationally defined boundaries;
(7) an adaptive management process that includes mechanisms for feedback loops at different time scales to adjust the management plan based on past and present observations and experiences;
(8) building on existing management institutions and practices.
Full implementation of EAF/EAA entails establishing a management cycle that includes initial planning, implementation and feedback loops that are essential under an adaptive framework. None of the individual elements of EAF/EAA are new or exclusive to the approach; its novelty is to bringing these elements together in a common formal framework and demanding explicit accounting of many processes or assumptions that were often not considered in the fisheries management process.

2. THE SOCIAL DIMENSION OF ECOSYSTEM-BASED FISHERIES MANAGEMENT

The social or human dimension of an EBFM might be understood in two perspectives or levels. At one level, the question of "how social objectives can be integrated in fisheries management" needs to be addressed according to identified principles. At a broader level, the social, cultural, economic, institutional and political context in which an EBFM will be implemented needs to be understood in order to facilitate or make the process of implementation feasible. This analytical separation is backed up by Dillard et al. (2009;4) and their understanding of the social dimension of sustainability as both:

> *a) the processes that generate social health and well-being now and in the future; and*
> *b) those social institutions that facilitate environmental and economic sustainability now and for the future.*

These two levels are mutually dependant - for example, the integration of social objectives in fisheries management (the process for generating social health and well-being) will depend on the cultural local context (Brooks et al. 2015). At the other end, changes in the political setting (the institutions of governance) might require changes in allocation of fisheries resources among users impacting local well-being (see e.g. Arias Schreiber 2012). Nevertheless, the way in which this report has been organized will maintain this analytical division for clarity purposes. The concepts and recent scientific knowledge towards the identification and inte-

gration of social objectives in fisheries management is covered in Chapter 3 of the report under the title "Social objectives of Ecosystem-based Fisheries Management". Chapter 4 "The governance component of Ecosystem-based Fisheries Management" deals with the wider research and analysis of the institutional and political context to assist and guide EBFM's policies implementation.

2.1 Brief history and the emphasis in ecological considerations

The incorporation of a "human dimension" in EAF or EBFM was not explicitly demanded during the early stages of this approach's theoretical development over the last decades of the 20th century (Garcia et al. 2003). The awareness to address social dimensions into EAF have been described as a "later trend" (Curtin and Prellezo, 2010) or as a progressive process of recognition coupled with institutional development (Symes and Hoefnagel 2010). One important milestone for the "later trend" gained a momentum in 2008 with the publication of the FAO Technical Paper on the *Human Dimensions of the Ecosystem Approach to Fisheries: An Overview of Context, Concepts, Tools and Methods.* In this document, De Young et al. (2008). This document acknowledged four considerations that endorse the relevance of social, economic and institutional dimensions to the EAF:

- Social, economic and institutional arrays are driving forces behind an EAF
- Implementing an EAF comprise costs and benefits with social, economic and institutional implications.
- Social, economic and institutional instruments are all crucial for successful implementation of the EAF; and
- Social, economic and institutional factors of fishery systems can support or constrain EAF implementation.

The role played by social, economic and institutional elements as drivers, constrain or supportive factors (De Young et al. 2008) of EAF and at the same time being affected by EAF implementation, are an indication of the centrality of the "human dimension". In addition to the view of the embeddedness of the EAF in social, economic and institutional arrangements, the conception that *"managing fisheries is manging humans and not fish"* (Berkes 2009; Couper and Smith 1997; Hilborn 2007; Lade et al. 2015; Urquhart et al. 2013) gained acceptance and claims to include the "human dimension" in management became evident.

During the last decades, the "human dimension" of EBFM has expanded and it is not limited to implementation issues but also applies to the fundaments and principles of the approach. An analysis of the evolution of the EAF showed that during the 1980s EAF principles were clearly omitting social objectives (Long et al. 2015). It was almost at the end of the last century that social objectives were introduced in the literature about EBFM principles (ibid.). An overemphasis on the ecological aspects of EBFM at earlier stages might explain this development (Curtin and Prellezo, 2010). However, this overemphasis can still be observed among mostly natural scientists and managers in countries with highly developed fisheries managements systems. In the EU for instance, the Marine Strategy Directive Framework (EC 2008) has been regarded as one policy that imposes and clarifies the superior importance of ecological objectives (Good Environmental Status) for marine environmental and fisheries management (Dickey-Collas 2014).

While reasonable, the overemphasis on ecological objectives might be also responsible for a current certain disagreement on what a "human dimension" means and advocates. A "human dimension" of EBFM is still sometimes confused in the literature as meaning the consideration and the management of the impacts or pressures of humans in the ecosystem (see e.g. Francis et al. 2007; Trenkel 2017). In this confusion, protecting the ecosystem is the main objective leaving social and economic objectives aside. As Dickey-Collas (2014;1176) describes the attitudes of scientists at International Convention of the Exploration of the Seas (ICES) explaining that *"there still appears to be a reluctance to think conceptually about the human dimension. Some appear challenged with the concept that indicators can exist that address societies priorities rather than ecosystem functioning"*. The confusion makes the integration of social sciences into EBFM difficult to grasp or places it – as explained above-in a secondary position. As Marshall et al. (2017) report, the main challenges for the implementation of an EBFM in the U.S. fisheries are:

- EBFM has often been viewed as a framework for protecting the biophysical marine environment over other social and economic goals.
- The people and institutions responsible for managing fisheries are over-challenged and overworked with EBFM implementation.
- Managers have often approached EBFM as an added layer of science or modeling that informs conventional management (e.g., adding new parameters to stock assessments), without considering the goals, strategies, or allocation processes inherent to EBFM.

Although confusion and unclear perceptions, the human dimension of EBFM is widely recognized by social scientists (e.g. Symes and Hoefnagel 2010; Urquhard et al. 2014; De Young et al. 2008) and natural scientists (e.g. Samhouri et al. 2014; Cochrane 2017) and significant research efforts over the last decade are clearing the path making progress undeniable.

2.2 Defining social dimensions of fisheries management and policy

Defining the social dimensions of EBFM can be a difficult task. As stated by Symes and Phillipson (2009;2), the social dimension of fisheries policy:

> *"comprises a broad compendium of issues ranging from individual human rights through concerns for the future of local social structures to much broader societal anxieties concerning the marine environment and sustainability of living resources of the sea. In general, the focus of political attention has shifted from the needs of the individual to the viability of coastal communities and the wishes of society as a whole".*

It is thus perhaps less difficult to describe what a "social dimension" to fisheries policies is not or not enough. For example, in the EU, following a single-species management system, the evaluation of economic and social status of fisheries is carried out independently from the ecological status assessment (Trenkel 2017). Socio-economic status - the social dimension - is assessed through collection and analysis of data on economic returns of the fishing fleets, which is used as an indicator of the status of dependent jobs (ibid.). While employment and jobs are undoubtedly important for society, crucial aspects for well-being of the workforce (fishers and associated jobs) are ignored under these partial and uncomplete assessments. In

this case, the "social dimension" of fisheries management and policy is underestimated and neglected.

Even with the collection of socio-economic data - with the exception of EU policies directed to downsize the fishing fleet - how these data on economic returns and employment is traduced into fisheries policies and decision making remains unknown, if done at all[4]. An alternative for integrating social objectives could be evaluated in terms of the accessibility or trends related to for instance "decent jobs" or levels of job satisfaction of the workforce. Indicators for decent jobs can be derived from data collection of the following variables: 1) the job is productive and secure, 2) it ensures respect of labour rights, 3) provides an adequate income, 4) offers social protection, and 5) includes social dialogue, union freedom, collective bargaining and participation (derived from OECD jobs indicators).

Some approaches inherited mostly from economics have also tend to reduce the social dimensions through the maintenance of natural capital which cannot be replaced by human-made capital. For instance, the World Bank takes a ''four capital approach to sustainable development'': (1) natural capital is considered the ''stock of natural assets such as land, water, wood, minerals, flora and fauna,'' which is the ''environmental dimension''; (2) produced or manmade capital includes machinery, factories, buildings, and infrastructure such as roads, and is regarded as the economic dimension; (3) human capital is people's capacities based on skills, education, health; and (4) social capital includes social networks, associations and institutions tied by common norms and trustful relationships that facilitate cooperation (World Bank 1997). Together, human capital and social capital constitute the social dimension. From this approach, social capital has been advocated as a suitable indicator for fisheries social sustainability, but it is only one of the components that play a role under an EBFM perspective. The same might apply to "social justice" or equity or the fair distribution of risks and benefits from ecosystems management, that has been used probably more in discourses or narratives that implemented in practical terms. More recently conceptualizations of this terms argued that it is not only about fair distribution but about the ability of individuals to decide about the "life" they choose to live through empowerment and participation (Biedenweg et al. 2017).

As it will be explained in the next sections of this report, a social dimension in EBFM, is in itself a multidimensional project which embraces a multitude of interconnections and process that reflect the diverse scopes and complexities inherent to human-nature relations. Under such a broader perspective, the human dimensions can be defined as "*the ways in which individuals, communities, and societies interact with, affect, and are affected by natural ecosystems and environmental change through time"* (Kittinger et al. 2012*;*17*)*. This definition acknowledges three key elements: reciprocity in relationships between societies and ecosystems; the scale of the systems being considered (both social and ecological), and; the role of dynamism, feedbacks, and complex interactions as critical in determining the past and future trajectories of social-ecological relationships (ibid).

2.3 New key concepts and considerations

Additional to implementation and governance issues, the introduction of a human dimension

[4] As Gallizioli (2014; 76) argues "the EU's harvesting sector is today generally worse off than at the outset of the CFP (EU Common Fisheries Policy) where there are now fewer, but larger and more powerful vessels, which employ less crew on board".

of EBFM arose in a later stage from a current understanding of two main aspects that underpin the approach. First it is understood that humans cannot be regarded as external "stressors" to the ecosystem (Berkes 2004) or as "careless extractors" in the ecosystem trophic chain (Grumbine 1994); and second, that social objectives of fisheries management cannot be reduced to just ensure employment or maximize economic profit (see e.g. Jentoft 2000). The key concept of "*social-ecological systems*" as coupled systems of humans and nature provide an alternative view that support the above understandings and the central role of humans and therefore of a human dimension in EBFM. Conceptualizing fisheries as social-ecological systems is one important step of any EBFM implementation (Berkes 2012). In this perspective complex, human systems and ecosystems are interlinked through many diverse interactions and can co-evolve towards desired sustainable pathways. In social-ecological systems, human activity changes the ecological part of the system, and the resources characteristics and availability in turn changes the social subsystem (Berkes 2009). The Stockholm Resilience Center defines social-ecological systems (SES) as:

> *"linked systems of people and nature. The term emphasizes that humans must be seen as a part of, not apart from, nature — that the delineation between social and ecological systems is artificial and arbitrary. Scholars have also used concepts like 'coupled human-environment systems', 'ecosocial systems' and 'socioecological systems' to illustrate the interplay between social and ecological systems. The term social-ecological system was coined by Fikret Berkes and Carl Folke in 1998 because they did not want to treat the social or ecological dimension as a prefix, but rather give the two a same weight during their analysis".*

The incorporation of the SES concept has consequences for an EBFM. It is deduced from the concept the need of an understanding of a social system which is complex, interconnected and coupled to the ecosystem. Acknowledging systems complexity impose the acceptance of non-linearity and blurred cause-effect relations that need to be dealt though risk assessments and precaution. It also implies that adaptive methodologies and solutions together with monitoring need to be design incorporating multiple sources of knowledge and scientific disciplines (transdisciplinarity). The concepts of "Precautionary Principle" and "Adaptive Management" are hence crucial for capturing the essence of SES in the context of EBFM.

The Precautionary Principle and the way to implement it (the precautionary approach) are embedded in the UNCED Declaration (Principle 15) which explicates that "the precautionary approach should be widely applied and that, where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing cost-effective measures to prevent environmental degradation". The approach has been adopted for fisheries in the UN Fish Stock Agreement and the FAO Code of Conduct, and guidelines are available for its practical implementation (FAO 1996). The precautionary approach is used in decision making when judgment is rapidly needed about certain issue that is unknown or uncertain. In this case, the decision should be taken in order to provoke the less impact possible given the limited information available.

Similarly, it is widely recognized that adaptive management is one key tool for fisheries management and for implementing EBFM (Curtin and Prellezo 2010; Dickey-Collas 2014). Adaptive management takes into account the uncertainties in the scientific knowledge and allows the absorption and adaptation of new knowledge at the time when it becomes available. This

flexibility is essential for the timely use of the new knowledge and to allow "learning by doing". Consequently, adaptive management need systematic and regular monitoring, evaluation and flexible decision systems that allow for continuous improvement and learning. FAO defines adaptive management as "a management strategy that can be readily adapted to take account of new knowledge obtained during implementation, including performance assessments" (Garcia et al. 2003).

A further important concept in EBFM is trade-offs. Regarding this concept, as pointed out in the definition of SES, ecological and social dimensions (and economic) deserve the same analytical weight and consideration. In this sense, EBFM is similar to sustainability and exhibits a multidimensional agenda. When incompatibility of ecological, social and economic objectives is perceived - usually for short-term policies - trade-offs need to be negotiated and harmonized. Trade-offs will be negotiated when for example desired population levels of certain preys and predators affected by fisheries management need to be decided within ecological objectives – for instance seals and fish. Trade-offs are thus needed for balancing conflicting interest related to a holistic EBFM (McLeod and Leslie 2009). Because not all components and objectives can be maximized simultaneously, society must make decisions about their relative preferences. Fisheries managers make these types of decisions on a regular basis, but often do so without the explicit consideration of the embedded trade-offs (see Lester et al. 2013).

3. SOCIAL OBJECTIVES OF ECOSYSTEM-BASED FISHERIES MANAGEMENT

Integrating social objectives in fisheries management has proven to be more difficult than expected (Brooks et al. 2015; Ounanian et al. 2013). Moreover, it has been precluded by certain reluctance based on the perceptions that ecological concerns are priorities (Waylen et al. 2013), that conflicts among ecological, social and economic dimensions are not negotiable "*you cannot have your fish and eat it too*" (Andersen et al. 2015;1395), that social objectives are demanded by some romantic-driven social scientists or that social sciences provide "anecdotal" evidence that is not appropriate for policy and decision-making (Olson, 2005; Ounanian et al. 2013; Symes and Phillipson 2009; Pascoe et al. 2014). Scarce availability of social data, an absence of a critical mass of social scientists and awareness among managers and decision makers of the social character of the fishing industry have also contributed to the lack of identification of social objectives (Symes and Phillipson 2009; Pascoe et al. 2014).

Social data is obviously provided by social scientists. Social sciences are in simple words the scientific bunch of disciplines that deal with the study of human groups and individuals, social systems and their structures, social institutions and social behavior. Thus, social science can be defined as "*the branch of science that studies society and the relationships of individuals within a society*" (Barclay 2009;45). Within this broad definition, social sciences are divided in various subdisciplines including -among others- social anthropology, environmental sociology, social history, human geography and political sciences dealing with public policy and administration (Symes and Hoefnagel 2010).[5] The broad spectrum of social sciences dis-

[5] Symes and Hoefnagel (2010) explain why economics is not considered within the social sciences while recognizing its questionable argument. Economics is excluded because of its utter different methodological approaches and widespread use of mathematical modelling, its preference for theoretical development rather than empirical research and its emphasis on rational choice.

ciplines is parallel to the natural sciences dealing with marine ecosystems, which also encompass many disciplines and fields such us biology, ecology, biochemistry, oceanography, etc., which do not preclude the EBFM implementation. Thus, one step for the inclusion of a social dimension to an EBFM is to explore which disciplines within the social sciences have relevance in order to follow and fulfill the principles of this approach. Sociology - and especially environmental sociology together with anthropology (Urquhart et al. 2011) and political sciences are social sciences that have contributed significantly to the conceptualization of the social dimension of fisheries management. Environmental sociologists have been forward in developing an understanding of what balancing human well-being is about and how to measure it. Anthropologists have nowadays a large history of research on cultural dimension of fisheries that necessarily conform the "social dimension" of EBFM. Political scientists have contributed by identifying marine resources types, allocation regimes and governance systems and their implications for fisheries management.

3.1 Balancing ecosystem health and human well-being

As explained in section 2.1, societal concerns about ocean degradation from human activities had been gaining ground in the public and academic arena since the 1970s (Garcia et al. 2003). The need to maintain ecological health was grasped relatively rapidly, with governments collecting data on environmental impacts and expecting to orient their marine regulation of the economy to manage these (Barclay 2012). In the EU for example, marine legislation such as the Water Framework Directive (EC 2000) and the Marine Strategy Framework Directive (EC, 2008) developed in order to "*protect and restore ecological quality or integrity, within estuarine, coastal and offshore systems"* (Prellezo and Curtin 2015;44). Yet, for an EBFM implementation fisheries management goals should guarantee that fishing does not negatively impact the marine ecosystem neither human or societal well-being. This is done by recognizing that the relations between nature and human well-being are far more complex and driven by numerous interconnections at different scales.

Human well-being

Human well-being is a broad concept that encompasses many dimensions of people's life and its quality. The concept has gained notoriety in academic and policy spheres in recent years because of the poor performance of the traditional methods governments were using to measure social progress (Gross Domestic Product or GDP) (Stiglitz et al. 2009).

Given the broadness of the concept, theoretical foundations of well-being can be found in several social sciences like anthropology, economics and psychology. For instance, in psychology, some environmental factors have been found to be associated with happiness and well-being, which is divided between hedonic (increase pleasure and less pain) and eudaimonic (development of individual strengths and virtues) (Biedenweg et al. 2017). A recent surge of interest in measuring well-being from local to national levels has improved the consensus around what and how to measure it (see McGregor et al. 2015, Hicks et al. 2016). It is currently recognized, that well-being should be conceptualized as "multidimensional" and cannot be captured by a single indicator such as Gross Domestic Product or happiness. As Coulthard et al. (2011;457) point out accordingly, malnourished fishers cannot be described as experiencing well-being "*even if they do occasionally experience happiness or feel good about their life and work"*. Another important aspect in the context of EBFM is the need to understand people's subjective cultural meanings associated with fisheries and well-being,

like cultural heritage or "sense of place" (Urquhart et al. 2011). Within economics and sustainable development, Sen (1999) identified subjective satisfaction, material support, and the ability to fulfill an autonomous life as three critical components of well-being. To translate these diverse perspectives from the social sciences into a cohesive framework to meet the demands of environmental science and policy, Breslow et al. (2016) have recently suggested defining human well-being as:

> *"a state of being with others and the environment, which arises when human needs are met, when individuals and communities can act meaningfully to pursue their goals, and when individuals and communities enjoy a satisfactory quality of life".*

The achievement of this state has three components which may be measured by three different kinds of data and are referred as *the three dimensions of well-being*. The first kind of data is related to economic indicators about people's income and their capacity to procure goods and services, which have in the past and still are considered as the "hard" components of social sustainability together with employment equity standards of education and access to healthcare. The second type of social data are related with empowerment, participation and access; which similarly are to some extent well established. The third type of data is subjective information about how people feel about their lives and societies. Consequently, the above definition accounts for a material, a relational and a subjective dimension (Britton and Coulthard 2012). According to Voyer et al. (2017) the three dimensions of well-being are explained as follows:

- Material dimension: the extent to which fisheries provide resources to meet their needs, including food, income and assets, employment, access to services and environmental quality.
- Relational dimension: the extent to which fisheries contributes to the development and maintenance of social relationships that enable communities to achieve (their own conception of) wellbeing. This includes many types of interactions with others, including relations with the state, social institutions, rules and norms which can dictate access to resources, forms of collective action, aspects of conflict and security, law, cultural and political identities, and relationships of power.
- Subjective dimension: the level of satisfaction with the contributions made by the fisheries to the quality of life and the values and beliefs that shape these levels of satisfaction. It concerns people's own perceptions and how they feel about their situation and quality of life.

These established, multidimensional elements have well-tested indicators. As Voyer et al. (2017) explain, measuring material well-being is fairly straightforward; i.e. income, assets, educational and health status and government statistics can usually provide these data. Relational well-being may be determined through an analysis of the social relationships people have that enable them to pursue their livelihoods, and this is captured through questionnaires about satisfaction with important relationships (Coulthard 2012). Subjective well-being, denoting the quality of life people perceive themselves as achieving, including the meanings they give to the goals they achieve and the processes in which they engage, has been measured by diverse methodological tools such as the Global Person Generated Index (GPGI) (Britton and Coulthard 2013).

Relative consensus also exists among social sciences related to the need of well-being frameworks and measurements to be based on "bottom-up" consultations about what matters for the well-being of the people to whom these measures are supposed to refer (Ricci and Rondinela 2015). It has been also suggested that well-being indicators need to be developed simultaneously by stakeholders, social scientists and policy makers in order to guarantee and ensure relevance, robustness and political acceptance respectively (Biedenweg et al., 2014; Röckmann et al., 2015).

Well-being has been used to track social progress (Mcgregor et al. 2015), to understand the well-being of particular fishing communities (Britton and Coulthard, 2013) and to identified the contributions of commercial fishing to the well-being of the broader community (Voyer et al. 2017).

Box 2. Ecosystem Health

Ecosystem health is a concept of wide attention within the scientific community and as a mean of communicating and clarifying the state of ecosystems to decision makers and general public. Some differences exist between the way in which ecosystem health is used and defined. For example, (Costanza 2012) describes ecosystem health as "a *comprehensive, multiscale, measure of system vigor, organization and resilience*. *Ecosystem health is thus closely linked to the idea of sustainability, which implies the ability of the system to maintain its structure (organization) and function (vigor) over time in the face of external stress (resilience).*" A second approach evaluates health as a departure from some preferred (often "pristine") state, or the current state of the ecosystem in comparison to its initial state before the impact of human activities. A more anthropocentric approach which views ecosystems as providers of good and services relates health to the ability of an ecosystem to continue to provide a particular set of societal benefits.

Ecosystem health is commonly used as a synonym of "ecosystem integrity", however this is a matter of discussion among researchers. Ecosystem integrity is defined as "*the capability of supporting and maintaining a balanced, integrated, adaptive community of organisms having species composition, diversity, and functional organization comparable to that of natural habitats of the region*" (Karr and Dudley 1981;171). Ecosystem integrity can be regarded as one aspect of ecosystem health related to the second approach (see above); the term is used to refer to comparisons of the development of the ecosystem with and without human disturbance (Nielsen 1999).

For the specific case of marine ecosystems, Paul Epstein's definition of marine ecosystem health is: ''To be healthy and sustainable, a [marine] ecosystem must maintain its metabolic activity level, its internal structure and organization, and must be resistant to stress over a wide range of temporal and spatial scales'' (Epstein 1999, 2000). Ecosystem health assessments (EHA) have intensively developed since the 1980s (Jorgensen 2005) and a non-systematic literature review resulted in more than 200 different indicators used for measuring marine ecosystem health (Christensen and Cury 2005). A wide spectrum of indicators of EHA are currently available and have been classified in seven mutually consistent levels (Jorgesen et al. 2005):

(1) application of specific species;
(2) ratio between classes of organisms;
(3) specific chemical compounds;
(4) trophic levels;
(5) composite indicators included E.P. Odum's attributes and various indices;
(6) holistic indicators as, for instance, biodiversity and resistance;
(7) thermodynamic indicator

Indicators for EHA have been criticized because of their limited capacity to engage traditional knowledge or other kinds of knowledge that can provide practical insights into ecosystems (van Oudenhoven et al. 2011).

3.2 Socio-cultural values of fisheries

EBFM requires a holistic assessment of the ecosystem that includes not only the structure and functioning within the ecosystem but also between the ecosystem and society (Ignatius and Haapasaari 2018). For the assessment and understanding of the linkages between ecosystem and society, culture and socio-cultural values have to be integrated since they reflect why fish and fishing are important to society (ibid.). Socio-cultural values are often examined from the perspective of cultural goods and commodities, or objects of value (Gee et al. 2017). Culture is a broad term that has many definitions in both the social sciences and in everyday language (Barclay 2012) but to understand culture as a component of EBFM it is needed to think of culture as the beliefs, values and principles that a group of people share. Thus, Bates and Plog definition of culture as *"the system of shared beliefs, values, customs, behaviors, and artifacts that the members of society use to cope with their world and with one another"* (1990;7) is used in this report. In this sense, culture conditions individuals' perceptions of the world, influences what they consider important, and suggests courses of action that are appropriate and inappropriate (Song et al. 2013). Consequently, culture is not solely a characteristic of national or indigenous ethnic groups but also professions (i.e. scientists) and organizations (i.e. governmental agencies) work within certain cultures, and in that sense, an individual may reconcile more than one culture simultaneously (Alcamo 2003, cited in Barclay et al. 2012). Moreover, culture is passed from one generation to the other through the process of learning but it is at the same time influenced and changed by discourses and narratives from the media, governments, political groups, etc. (ibid.).

To acknowledge the role of socio-cultural values in EBFM means to consider that humans in different social groups and places perceive different realities about the ecosystems they know, live with or are responsible to sustainable manage. These cultural ideas might also significantly change the views about the social dimensions of fisheries policies and its consequences (Olson 2005). For example, prioritizing ecological dimensions in fisheries policies have resulted in the idea of fishing communities being impacted with an emphasis on "what has been done" to fishermen, neglecting "what they can achieve" (ibid). Hence culture is not only something that could directly or indirectly impact or be impacted by - compatible to economic or ecological goals, since culture defines what economy and ecology mean for stakeholders and other actors (Paolisso and Dery 2010 cited in Poe et al. 2014).

Socio-cultural values are not only behind the content of the decisions of fishers and the decisions regarding fisheries management but also shape the institutional arrangements were these decisions are taken (Kooiman and Jentoft, 2009). Social values are also not always the deduced combination of the individual values and in many cases deliberation processes are needed to articulate social values within diverse cultural groups. Such deliberation practices that produce the reaching of an agreement or decision enhances democratic outcomes in decision-making. In the case of fisheries, deliberation processes among stakeholders are unusual and values remain implicit in most of the cases (ibid.). Thus, socio-cultural values knowledge in the context of EBFM is needed for managers to understand why ecosystems, their resources and the fisheries are important among different stakeholder's groups and the actors involved in governance. Since, the importance or value of all of them is expected to be different and even in conflict to each other, explicit considerations of socio-cultural values are needed to reach trade-offs or agree on "hard choices" through democratic practices (Song et al., 2013). As stated by Jentoft (2006), social scientists can assemble together scientific

knowledge with experienced-based knowledge of fishers, the values of conservationists and the various political and economic interests involved in a way that can make fisheries management pragmatic, feasible, and less likely to be overturned by opposition. Until democratic participatory processes are not in place, the values and interests of the most powerful governing actors will prevail (Kooiman and Jentoft 2009).

Recent methodologies to identified and understand values related to marine ecosystems have been developed by Song (2015) in the case of small-scale fishers, and by Ignatius and Haapasaari (2018) for the salmon fisheries in the Baltic.

Fishers and their socio-cultural values

The importance of recognizing socio-cultural values attached to fishers and to incorporate them in fisheries decision-making is increasingly recognized (Ignatius and Haapasaari 2018). Ignoring values diversity might promote inequalities (Carothers et al. 2010; Norton 2015), generate conflict, trust and hinder collaborative processes (Poe et al. 2014). Although there has been significant progress in measuring human well-being, socio-cultural interactions with the marine ecosystems remain poorly understood.

Fishers and their diverse connections to ecosystems develop beliefs and values though interactions with places and resources, which involve cognitive and emotional processes (e.g., knowledge and mental models) and bring up practices based in skills, experiences and relationships (Poe et al. 2014). Values can *therefore enhance understanding of the deeply felt and emotional basis of people's interactions with natural systems, can further understanding of how SES function, and can strengthen their management* (Jones et al. 2016;15). Values can be divided into assign values and held values (Gee 2013). Assign values refer to "*a benefit, worth, or merit that is given to an object or place, most often assessed through valuation techniques*" (Song et al. 2013;168). Held values are defined as *means of what is important* and, as described by Rokeach (1979;2) are "*guiding not only action but also judgment, choice, attitude, evaluation, argument, exhortation, rationalization and, one might add, attribution of causality"*. Although held by humans, beliefs and valuess are also dynamic, changing over time and space, as individuals and their communities communicate, negotiate, and redefine their placements based on their practices, social relationships, and novel understandings (Poe et al. 2014). Research on values is common in anthropological literature related to fisheries. Cultural values within anthropology refer to the held and assign values that are shared among a group of people and may differentiate one group from another (Robbins 2012).

Besides fishing as a mean of supporting livelihoods, it is known that fishers value fishing for representing a lifestyle, or specific *way of life* with a meaning in itself, where profit is as valuable as other social commitments (Sonvinsen 2014; van Ginkel 2001; Brookfield et al. 2005; Jacob et al. 2001; Nuttall 2000; Berkes, 2009). Fishing is also valued because it provides fishers with a communal and personal identity (Urquhart and Acott 2014) or a sense of independence, self-reliance and freedom (McGoodwinn 1990; Onyango 2011; Islam and Chuenpagdee 2017; Delaney 2003) and job satisfaction (Pollnac and Poggie 2006). Similarly, Song and Chuenpagdee (2015) showed that in Korea, coastal fishermen valued the health of the ecosystem and the equal distribution of resources relatively to their level of effort, diligence or/and investment. These fishers, much like in the "lobster gangs" of Maine (Acheson 1988) and the fishing cooperative association system in Japan (Makino 2010), considered the adjacency

principle (i.e., access to use a fishing ground should be first granted to those who live near it) as a central norm to guide resource access decisions (Song et al. 2015). Explicitly regarding EAF, Atlantic Canadian fishermen prioritized sustainability, stakeholder involvement, long-term planning, use of all forms of knowledge and equity as the most important principles of the approach (Long et al. 2017).

Fishers cultural values are also often implicit in sense of place or the way through which fishers related to places and which configures their individual, community and professional identities. This place attachment is represented in cultural expressions like e.g. folklore, painting, food festivals and spiritual traditions**.** Sense of place also provide fishing communities with shared narratives and is important for social cohesion (Urquhart and Acott 2014). Sociocultural groups are also often culturally connected to certain species in the ecosystem. The "cultural keystone species" concept may be used as an important tool to assess the relation between ecosystems health and "cultural well-being" (Poe et al. 2014). Fishers and their communities that have co-evolved with the marine environment are prompt to value one specific species that represent their multifaceted dependence and interconnections with nature. Keystone species are crucial to define community identity and are highly value by fishers who often find themselves responsible for the "health" of these species. Many of these culturally significant fish species also play key ecological roles in the ecosystems and their prioritization in monitoring and management should promote and sustain the balance between ecosystem health and societal well-being (Noble et al. 2016).

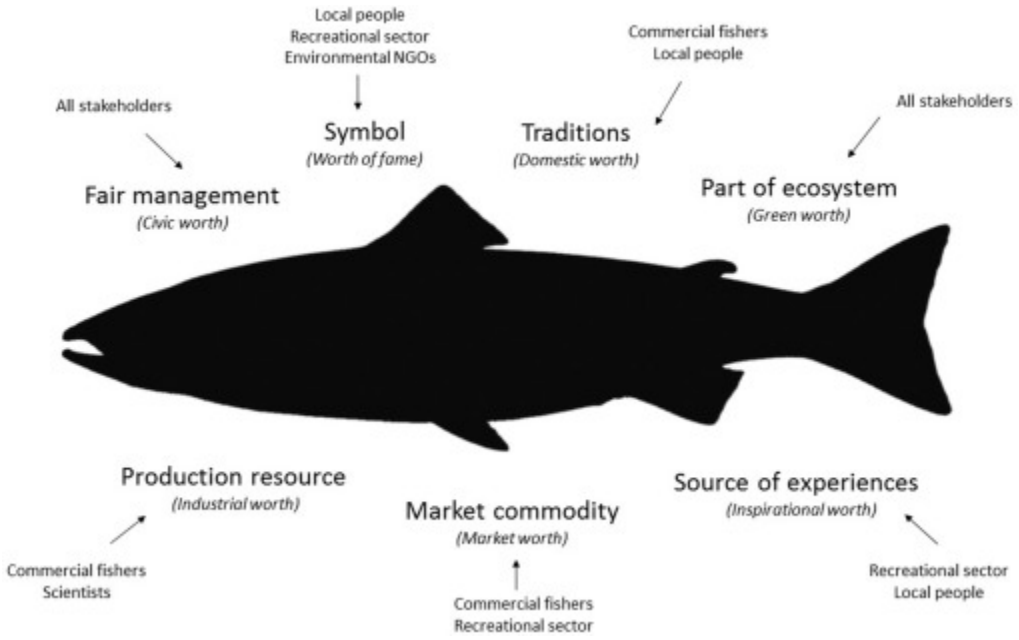

Fig. 1. Stakeholders socio-cultural value of Baltic salmon according to different orders of worth (from Ignatius and Haapasaari 2018).

Box 3. A *Biocultural* approach for balancing ecosystem and human wellbeing
(from Caillon et al. 2017)

A novel, perhaps more crucial perspective of culture in resource and fisheries management is related to the perception of "culture" as not being separated from "nature". This perception is helpful to understand that a dichotomy between nature and humans might not always the best tactic or attitude. Most importantly, a "biocultural" approach has been suggested to alleviate tensions between views according to which healthy ecosystems and human well-being are opposing targets (Raudsepp-Hearne et al. 2010; Jennings and Rice 2011). By outplaying the human-nature dichotomy and integrating peoples' diverse forms of relating to nature, biocultural approaches might also overcome tensions between different global and local scale perspectives.

Caillon et al. (2017;27) have suggested that "*in order to develop effective, culturally appropriate, and equitable conservation strategies that ensure social-ecological resilience, conservation planners and practitioners must conceive of human and ecological well-beings as an interrelated system"*. The authors argue that integrated human-focused and ecological goals need to address feedbacks and interaction between both as well as flexible frameworks transcending different metrics, knowledge systems and realities. In practical terms, area-placed "biocultural" indicators need to be co-constructed in relation to the peoples who manage that place considering multiple realities and their complex interactions, and giving nature a place-contextual voice. Indicators recognize multiple types of knowledges including classification systems (how to see, order, rank and categorize the world). Societies are understood through society's own construct of knowledge on the environment, and not isolated from the environment its processes and health. Examples of indicators for human-nature wellbeing are the number of sacred sites revitalized and maintained or the number of cultural festivals celebrated. More recently, so called "resilience indicators" have been also developed, for example, the number of names of varieties of a certain plant.

Finally, co-created biocultural indicators can lead to effective local action and support vertical institutional interactions though communication about local needs to national and international actors (Sterling et al. 2017).

Local and traditional fisher's knowledge

EBFM acknowledges humans and their cultural diversity as an integral component of ecosystems (Convention on Biological Diversity 1993). Fishers knowledge about the environment is one of the most important cultural aspects of inclusive and holistic fisheries management. Local fisher's knowledge is created and collective interpreted through experience from day to day interactions with the marine ecosystem. These knowledges and understandings are embedded in practices, beliefs and specific skills which cannot be found outside the fishers themselves or their sociocultural settings (Berkes 2009). The consideration of fisher's knowledge in an EBFM is relevant because cultural diverse knowledge systems generate different insights about social-ecological systems and enrich their understanding (Ernstson and Sörlin 2009). It has been also established that the combination of fisher's knowledge systems with other kinds of knowledge increases the chances for more suitable management arrangements (Crona 2006; Olsson and Folke 2001), although in certain cases this knowledge has been sufficient to sustain fisheries over time (Hind 2015). Programs or projects for knowledge exchange and development of shared understandings are needed for practical incorporation of

fisher's knowledge. Such initiatives might also enhance social capital and empowerment of actors; however, precaution is needed when knowledge is privileged or sacred based in cultural norms and social relations of certain indigenous fishing communities (Poe et al. 2014)

Despite the relatively long tradition of research on fisher's knowledge, this knowledge generally fails to be integrated in mainstream fisheries management where scientific knowledge dominates (Hind 2015). Traditional knowledge of fishers has been proved to be an important source of data to complement scientific research (Mackinson et al. 2011). This use of traditional knowledge – likewise in projects of citizen science – is more about information "sharing" and does not necessarily mean that fisher's knowledge is integrated in fisheries management. As showed in Box 3; traditional knowledge is embedded in particular "views" or "realities" of the relation between humans and nature developed contextually and through daily contact, experiences and dependence on the marine environment. In many cases, these realities entail also definitions and classifications of entities; for instance, fishermen can classify marine currents according to their colour or the fish species that inhabit some kind of currents. For EBFM, traditional knowledge - such as the understandings of the human-nature relation and classifications - is needed to be co-identified and considered when fisheries objectives and management decisions are deliberated (see also Part II, Principle 3). Deliberation is "*the process for communication and collective consideration of issues and answers*" (Martin 2015;153). yourself." Appropriate deliberative tools for decision-making under conditions of complexity and uncertainty include mental maps, scenario development and problem-oriented scenario analysis (ibid).

According to Raymond et al. (2010) traditional knowledge integration can be challenged by the following factors:

- differences in world views of stakeholders and external experts
- differences in institutional power or control over access to and management of local resources
- changes in perception about the benefits generated by the integration. Kothari (2001)
- argues that knowledge integration processes can promote the interests of local elites if attention is not paid to how the outputs will be applied or used by different stakeholders (cf. Stringer et al. 2007).

Participatory monitoring and evaluation of EBFM objectives can offer a way of managing differences in world views and power (see Estrella and Gaventa 2000). According to Raymond et al. (2010), if management objectives and outputs are not effectively evaluated the participatory process can lead to "intellectual robbery" (use of local knowledge without providing a benefit in return) and a subsequent loss of trust among stakeholders. Prior to monitoring, knowledge integration needs first an evaluation of the different types of knowledge and the multiple views or truth validation methods that influence knowledge claims. Failing to identified knowledge types risk the selection of actors that represent the interests of those responsible for managing (ibid.). Finally, the authors stress the need for adaptive management where local and scientific knowledge can support learning through dialogue and deliberation.

Cultural heritage

Among the several interconnections between humans and marine ecosystems, cultural heritage represents one cultural resource with relevant significance for the balance of ecosystem and human well-being. Cultural heritage is "*the value of the past that we distinguish in the present in order to be able to preserve it for the future"* (Maroevic 1998; 135). Cultural heritage is thus one way in which humans express their connections to the past and future with crucial consequences on societal well-being. Overlooking coastal cultural heritage can result in deterioration of cultural identity connected with certain habitats, loss of educational and recreational opportunities, decline in traditional local knowledge and social capital, and also loss of opportunities for alternative economic activities like tourism (Khakzad et al. 2015). Although cultural resources have been neglected in holistic attempts to manage marine ecosystems like Integrated Coastal Zone Management and Marine Spatial Planning (ibid), methods for their identification and management are currently in development (see Andreou et al. 2017; Callegari and Vallega 2002; Tengberg et al. 2012). From a case study of a boat restoration project in the UK, Martindale (2014) argues that heritage conservation can maintain rather than supplant fishing livelihoods.

Gender and fisheries

There is growing international awareness about the different ways by which marine social-ecological systems are impacted and impact the livelihoods and well-being of men, women and children, and recognition that gender perspectives need to be incorporated into policy-making. Some of the key issues that underpin gender inequalities relevant to EBFM include lack of equal rights for women, and corresponding lack of access or ownership to resources, legal protection and exclusion in decision-making processes. Recent studies have revealed that women not only participate and often control key aspects fisheries processing and marketing (Bennett 2005; Williams 2010; Harper *et al*. 2013) but are also participating directly in fishing and landing fish and other marine resources (e.g., Willson 2014; Kleiber 2014; Weeratunge *et al*. 2010; Harper *et al.* 2013). In coastal communities, earlier work highlighted the labour women provide as "shore-side crew" (van Ginkel 2009) taking part in such activities as contacting suppliers, taking care of the book keeping or preparing bait (e.g. Frangoudes and Keromnes 2008, Resurreccion 2006). Gender research in fisheries has also shown that women play an important role at the family and community levels (e.g. Britton 2012; Zhao 2013; Frangoudes et al. 2014). There is subsequently a growing recognition that if fisheries agencies are to develop strategies for EBFM, there is a need to include an understanding of the linkages between ecological system and the health of fishing communities where women's activities play a key role (Harper *et al* 2013; Kleiber *et al.* 2015). According to Barclay et al. (2017) gender analysis should be incorporated in any social evaluation of fisheries, since gender norms and gender relations fundamentally shape the ways fisheries and post-harvest activities operate, the ways natural resources are used, and thus the outcomes of policies.

3.3 Developing social objectives and indicators for EBFM

Fisheries management has often multiple objectives that are implicit in fisheries strategies and policy documents but weakly specified specially in the case of social objectives (Pascoe et al. 2013). EBFM implementation is driven by clearly defined management objectives; consequently, the approach purposefully begins by identifying priority management objectives to be addressed. Clear objectives in fisheries management have proven to enhance compliance

and community resilience (Pascoe et al. 2014) and are identified as a crucial step of fisheries management (Domínguez-Tejo and Metternicht 2018; Link and Browman 2017). Poorly defined objectives show often language ambiguity, lack of prioritization and clear time frames, or overly ambitious unreal planned outcomes (Domínguez-Tejo and Metternicht 2018). Undesired consequences are expected if clear, transparent social objectives are not developed as an early stage in the policy process (Symes and Phillipson 2009). Inclusion of social objectives at later stages or at the end of the decision process risks take the form of informal arrangements in the hands of interested politicians and less informed by scientific evidence (ibid.).

Indeed, at present, there is no single set of social objectives in EBFM as they change according to culture and diverging values and worldviews between study perspectives of scientific disciplines, but also among managers and other stakeholder's views (Pascoe et al. 2014; Pascoe et al. 2013). Moreover, there is limited guidance to assist managers in identifying the social objectives for the fisheries they are managing for, or in collecting information to manage for these objectives (Brooks et al. 2015; Voyer et al. 2017)

Despite the recognized lack of explicit inclusion of social objectives in fisheries management, Pascoe et al. (2014) describe an extensive series of social objectives reported in fisheries literature. Based on a literature review, the authors report 15 social objectives for commercial fisheries; the most common objectives (in terms of number of studies in which they were considered) were: maintaining or enhancing family incomes and livelihoods, maintaining or maximizing employment, maintaining communities and equity (see Pascoe et al. 2014). Social objectives identified in this study were:

1. Maintain or enhance family incomes and livelihoods
2. Maintain or maximize employment
3. Maintain communities
4. Equity
5. Maintain social capital
6. Ensure health and safety
7. Conserve traditional activities, culture and products
8. Maintain or improve recreational access
9. Maintain or enhance resilience
10. Enhance quality of life
11. Avoid social exclusion (improve public perception)
12. Minimize conflicts between alternative users
13. Ensure food supply
14. Ensure management stability
15. Ensure management acceptability

Among the countries from which experiences can be learned Australia, Canada and the USA are countries were social objectives for fisheries management have been developed and tested (see Brooks et al. 2015; Marshall et al. 2017). These countries can be considered at the forefront in international research and progress in this area. Although social objectives could be in practise be developed for each fishery, the need for a "national relevant" framework for identifying objectives and indicators across different fisheries was promoted in the case of Australian fisheries (Triantafillos et al. 2014) and in the US, through so called Integrated Ecosystem Assessments (Samhouri et al. 2014). This wider coverage is important for incorporating

objectives in fisheries strategies and legislation at the national level and for purposes of assessments to fit national fisheries state reports. In Australia, it was however also recognized the values-based nature of objectives and therefore the need for their revision over time, as social values and expectations are prone to changes (Triantafillos et al. 2014).

In the case of the Australian commercial fisheries, social objectives were developed divided into social objectives for the industry, indigenous groups and social objectives for local/regional relevance. According to Brooks et al. (2015), the developed social objectives for the fishing industry and for local/regional fisheries were:

For the fishing industry:

- Provide flexible opportunities to ensure fishers can maintain or enhance their livelihood, within the constraints of ecological sustainability.
- Maximize cultural, recreational and lifestyle benefits (including health benefits) of fishing for those who participate in fishing activities, within the constraints of ecological sustainability.
- Ensure appropriate mechanisms exist for fisher involvement in development of fisheries management advice. Improve the management skills of industry participants in co-management arrangements.
- Improve the ability of fishers to participate effectively in fisheries management advisory processes.
- Industry stakeholders have a high level of trust in the management of fisheries.
- Maximize stewardship of fisheries resources.
- Ensure transparent decision-making process by fisheries agencies.
- Ensure equitable treatment and access for fishers.
- Ensure adequate access to infrastructure needed for successful operation of fishing activities, within the constraints of ecological sustainability.
- Ensure fisheries information is available in a timely and publicly accessible manner.

For local/regional fisheries:

- Positively influence fisheries related socio-economic benefits for regional communities, within the constraints of ecological sustainability.
- Facilitate and support the cohesion and connectedness of fishers with their regional communities through fisheries management.
- Maximize community trust in fisheries agencies to manage fisheries.
- Ensure fisheries management contributes to the maintenance of cultural and heritage values related to fishing activities.
- To facilitate capacity building (through skills and knowledge development) for community members to enhance stewardship of fisheries resources.

- Ensure fisheries information is available in a timely and publicly accessible manner.

Similarly, Benson and Stephenson (2017) identified the following social objectives for fisheries management:

- Provide flexible opportunities to ensure fishers can maintain or enhance their livelihoods
- Maximize cultural, recreational and lifestyle benefits of fishing.
- Ensure transparency of decision-making process by management bodies.
- Ensure equitable treatment and access for fishers.
- Ensure access to adequate infrastructure.
- Maintenance of cultural and heritage values related to fishing activities in fishing communities.
- Facilitate and support the cohesion and connectedness of fishers with their adjacent communities.

Last but not least, the prevalence of central, top-down fisheries management makes it difficult for fisheries managers to grasp social objectives of fisheries since this type of management requires minimal contact with stakeholders and relies mainly purely on scientific advice (Jentoft 2000). This scientific advice is derived from scientists who also do not necessarily interact with stakeholders as in the case of scientists monitoring fish stocks or modelling fish market behavior.

Indicators

Once social objectives are identified, most management agencies will need to complete the process of selecting indicators for effective monitoring and evaluating change. Indicators represent features of the social system that are scalable and can be easily measured and recorded over time. Each social objective needs at least one indicator in order to understand how the system is responding, evaluate further actions necessary, identify stabilizing processes and drivers of positive or negative change, inform management and planning, and communication (Mascia et al. 2014). As for social objectives, indicators are also context specific and scientists, managers and stakeholders have different preferences among them. For example, scientists tend to rate potential indicators based on scientific rigor (Samhouri et al. 2009), decision makers may be more concerned with whether the potential indicators are significantly impact directions for collective action and understandable to the broad public; and stakeholders may be motivated by the factors that will enable their individual daily happiness. To make the identification of indicators transparent, explicit criteria representing the values of the various actors in the participatory process of decision making are needed. Data for these indicators can come from census data and also be collected via interviews and questionnaires (see Schirmer and Casey 2005).

Indicator development need also to be done with the involvement of stakeholders, managers and scientists in a process of co-production to capture the social, cultural, and environmental

context for managing coupled human and natural systems (Ens 2012; Preuss and Dixon 2012). Co-developed indicators and criteria greatly facilitate local understanding of their development and use and are powerful tools to ensure accountability (Hicks et al. 2016) therefore may also increase community ownership, adoption, and acceptance. There are currently four areas of research were promising social sustainability indicators - that can be applied also to EBFM - have been identified (Hicks et al. 2016): human well-being, values, agency an inequity. From these areas, human-well-being indicators have been reported to be relevant for fisheries (Coulthard et al. 2014; Voyer et al. 2017) and have well-tested indicators (see ibid.). For instance, societal well-being indicators have been developed for the New South Wales coastal fisheries in Australia (Table 1).

Table 1. List of indicators and methods developed for monitoring long-term societal well-being for the New South Wales coastal fisheries in Australia (Source: Voyer et al. 2017).

DIMENSION OF WELLBEING	INDICATOR	METHOD
A resilient local economy	GVP Business profitability Regional inputs Beliefs about economic importance of the industry (including amongst recreational fishers) Use of seafood industry images in tourism promotion	Sydney Fish Market/ DPI, ABS input/ output Economic questionnaire Economic questionnaire Social questionnaire – coastal communities Social questionnaire – Tourism and hospitality businesses
Community health and safety	Purchasing patterns – local seafood Seafood preferences – local seafood	Social questionnaire – community and fish merchants
Education and knowledge generation	Education and training levels	Socio-economic questionnaire of fishers
	Opportunities for informal learning	Qualitative interviews
A healthy environment	Involvement in environmental stewardship activities Community trust in industry	Qualitative interviews and socio-economic questionnaire of fishers Social questionnaire – community
Integrated, culturally diverse and vibrant communities	Social capital	Qualitative interviews Socio-economic questionnaire of fishers Social questionnaire – community
	Product Markets	
	Importance of seafood for community celebrations	
Cultural heritage and identity	Concern over loss of identity	Social questionnaire – community
Leisure and recreation	Importance of local bait	Social questionnaire – community

As in the case of social objectives, the qualities of indicators vary among different actors. For communication purposes to stakeholders, indicators need to be simple and understandable by the ordinary citizens. For managers, indicators must be comprehensible for the sector. For the scientist, the indicator must be an element of evidence. These different perspectives create tensions between the requirements of scientific rigor, political relevance and communication simplicity. A solution might be to have a battery of indicators of scientific standard and a smaller suite of indicators, derived from the scientific set, meeting political requirements (Garcia et al. 2009)

3.4 Challenges for integrating social objectives in fisheries management

There is currently no single method or approach to guide the explicit integration of social objectives in fisheries management. In the USA, experiences from the implementation of Integrated Ecosystem Assessments (IEAs) has shown that the way human dimensions research could be incorporated into IEAs are as varied as the academic disciplines that study humans in marine ecosystems (e.g. history, political science, geography, anthropology, sociology, economics, psychology, etc.) (Samhouri et al. 2014). In substantially researched coral reefs ecosystems, although existing social indicators and assessment protocols can guide the collection and analysis of social data, substantive approaches or frameworks for linking social information to ecological conditions or outcomes are still missing (Kittinger et al. 2012).

Benson and Stephenson (2017) argue that the lack of practical integration of social, ecological and economic objectives in fisheries management has been limited by gaps in governance, objectives, disciplinary breadth, and development of *ad hoc* methods. Additionally, social, economic and ecological indicators differ considerably in the scale over which they should be evaluated, the intended application (strategic vs. tactical) and the nature of advice required to inform decisions toward that end (ibid.). Among eight possible evaluated integration methods, these authors identified only one method (the Management Strategy Evaluation method) with prospects for fisheries objectives integration; however, these authors claim that social and institutional integration remains a challenge.

Box 4. Market-based approaches and the social objectives in fisheries management

For economics, fisheries overexploitation is often regarded as a typical example of "market failure". Fishers overfished the oceans because they take the fish from a common resource pool where no-one has property rights. Therefore, the costs of overfishing are not internalized in transactions but treated as an externality. This eventually leads to the well-known "Tragedy of the Commons" (Hardin 1968) or the absence of property rights to the fish resulting in fishers trying to catch as many fish as possible, knowing that any fish they did not catch would likely be taken by another fisher.

Market failures will most likely be solved by market-based approaches. In fisheries, market-based management means the establishment of so-called Individual Transferable Quotas (ITQs). Similar to many other types of fisheries management, the ITQ system starts with an allowable harvest level set by scientists to achieve bio-economic goals, such as maximum sustainable yield. The allowable total harvest quota is then distributed to individual fishers (via individual quotas) who are normally allowed to freely trade (sell or lease) their quotas in the market. This transferability of quotas is the distinguishing characteristic of ITQs. Proponents of ITQs management expect that competitive quota markets will lead to outcomes that are economically efficient as well as sustainable in biophysical terms (Costello et al. 2008).

While ITQ's effectivity to improve the health of fish stocks is highly controversial among fisheries scientists (see Costello et al. 2008 and Essington et al. 2012 for opposite views), the social impacts of marked-based systems have been empirically identified and include (from Olson 2011):

LOCATION AND FISHERY	REFERENCES	IMPACTS
Alaskan Halibut and Sablefish IFQ	Carothers (2008), Carothers et al. (2010), Hartley and Fina (2001), McCay (2004)	Consolidation and concentration of quotas; reduction in crew employment; increase in crew income; changes to traditional and indigenous labour and community patterns

Australian South East Trawl fishery	Connor and Alden (2001), Dwyer and Minnegal (2006), Pascoe (1993)	Less consolidation than other ITQ fisheries, but still favouring larger-scale operations
Australian Southern Bluefin Tuna fishery	Campbell et al. (2000)	Consolidation favouring larger-scale operations; reduction in crew employment
British Columbia Halibut	Casey et al. (1995), Davidson (2010), Donkersloot (2006), Grafton (1996), Pinkerton and Edwards (2009, 2010), Turris (2010)	Reduction in crew employment; debt dependence; violation of cultural norms; movement from shares to wages; reduction in crew income; better vessel profitability
Canadian ITQ fisheries	Binkley (1989), Charles et al. (2007), McCay (2004), McCay et al. (1995), Wiber et al. (2004)	Emergence of privileged groups; diminished quality of life; violation of cultural norms; impacts to community sustainability; new trends in co-management
Iceland ITQ fisheries	Eythórsson (1996, 2000), Helgason and Pálsson (1997), Pálsson (1998), Pálsson and Helgason (1995)	Consolidation and concentration, favouring larger-scale operations; increase in crew employment; decrease in shore-side employment; increase in vessel capacity; high leasing costs; debt dependence; violation of cultural norms; income reduction; impacts to community sustainability
New Zealand QMS	Batstone and Sharp (1999), Bourassa and Strong (2000), Connor (2001), Dewees (2008), Gibbs (2008), Memon and Cullen (1992), Stewart et al. (2006), Stewart and Walshe (2008), Yandle (2008)	Consolidation and concentration, favouring larger-scale operations; increase in employment; changes to traditional and indigenous labour and community patterns
Norwegian Cod fisheries	Brox (1996), Hersoug et al. (2000), Holm and Ránes (1996), Johnsen (2005), Maurstad (2000), Munk-Madsen (1998), Olson (1997)	Entrenched access, including gender; emergence of privileged groups; increased capacity; change in social incentives and characteristics
Tasmanian Rock Lobster fishery	Bradshaw (2004), Phillips et al. (2002), van Putten and Gardner (2010)	Increased leasing costs, favouring larger-scale operations; movement from shares to wages; impacts to community sustainability
U.S. Ocean Quahog & Surf Clam	Brandt (2005), Brandt and Ding (2008), Final rule (1977), McCay (1995, 2004), McCay et al. (1995)	Consolidation and concentration, favouring larger-scale operations; reduction in crew employment; reduction in crew shares; mixed results for crew income; impacts to community sustainability

Olson (2011;353) argues that an understanding of these impacts is necessary so that "*communities come to be seen less oppositional to economy, but rather constituted by multiple scalar processes and by economic relations comprising different motivations and behaviours*".

As a consequence of these impacts, marked-based approaches have been heavily criticized because of their ethical and economic repercussions of a *de facto* privatisation of fisheries resources (which are otherwise a public resource) and the diversion of wealth from fishing communities to private investors[6]. The advocacy of ITQs for fisheries management has been also lately criticised for promoting a "panacea" that is likely to fail and is only a "*simple formulaic policy prescriptions believed to solve a given problem in a wide range of contexts, regardless of their actual consequences*" (Young et al. 2018;1). Moreover, following panaceas can undermine the use of other management tools producing major difficulties to already highly stressed marine ecosystems and fishing communities (ibid).

4. THE GOVERNANCE COMPONENT OF ECOSYSTEM-BASED FISHERIES MANAGEMENT

Governance theories developed in the 1990s with an emphasis on problem-solving and opportunity-creation for new decision arrangements with an interactive responsibility between state, market and civil society (Berkes 2009). The concept has its basis in social sciences, becoming widely used when the World Bank introduced the concept of "good governance" to international development (Kooiman et al. 2005). After the arrival of the present century, the governance concept burst into the ocean and fisheries management landscape (Suárez de Vivero et al. 2008). In a narrow definition, the World Bank (2004) identified fisheries governance as an institutional framework including the policies, rules and organizations that provide a set of social prescriptions and procedures that control fishing activity. There is however a general consensus that governance goes beyond just what governments do or is the act of "governing without the government" (Rhodes, 1996; Rosenau and Czempiel, 1992, Chuenpagdee and jentoft 2009). In this sense, more broader definitions of governance defined it as:

> *"the whole of public as well as private interactions taken to solve societal problems and create societal opportunities. It includes the formulation and application of principles guiding those interactions and care for institutions that enable them" (Kooiman et al. 2005;17).*

The second element of the governance definition that is also largely agreed upon by governance scholars is that governance is broader than management. Berkes (2009) distinguished between governance and management where management is about action and governance is about politics and setting the policy agenda (sharing of responsibility and power on how those policies are determined, who enforces the decided policies and how, and how conflicting interests among stakeholders are managed). According to this author, governance is a more broad and inclusive term, following various steps beginning with policy-making and finishing with management. In that sense, governance defines the setting in which management takes

[6] For a detailed description see Special Issue in Marine Policy "Neoliberalism and global small-scale fisheries" edited by E. Pinkerton (June 2017).

place, and management refers to the resources, plans, and actions that result from the functioning of governance (Lockwood 2010). The aim of governance can be understood as to manage individual behaviors or collective actions in pursuance of societal outcomes (Armitage et al. 2012) and understanding governance means to understand how decisions are made and whether resultant policies and processes lead to environmentally and socially sustainable outcomes (Bennett and Satterfield 2018).

Governance includes thus the deliberation and determination of basic relevant values and principles that should underpin the way governors define their tasks and roles (i.e."meta-order" governance)(Chuenpagdee and Jentoft 2009). In the case of fisheries governance, those values and principles have provided governance a sense of prestige in the scientific community, and are well founded, such as the principles of sustainability, participation, transparency, accountability, flexibility and precaution, among others (Suárez de Vivero et al., 2008). Bundy et al. (2017) also derived well established governance principles based on the FAO Code of Conduct for Responsible Fisheries (FAO 1995) used by Pitcher et al. (2006). Governance principles thus provide guidelines for analysis (the analytical dimension or *how it is*) and intervention (the normative dimension *or how it should be*) (Heidbreder, 2015; Kooiman and Bavinck, 2005). In other words, as a normative theory, values, principles and goals are not exogenous to governance but where it should start (Chuenpagdee and Jentoft 2009). As an analytical theory, the analyst is encouraged to discern what these meta-order values and principles are and how they play a role in the way structures and processes are institutionalized and work, while keeping in mind that they may well be implicit and tacitly agreed upon by those who form the governance system (ibid).

Reinforcing the analytical dimension, governance is generally defined as the "*institutions, structures, and processes that determine who makes decisions, how and for whom decisions are made, whether, how and what actions are taken and by whom and to what effect*" (Bennett and Satterfield 2018;1). While the concept of governance has different interpretations in the different areas of the social sciences, governance approaches show three common features (Kooiman and Bavinck 2005): First, governance addressing societal goals and opportunities is a task of governments and many other public and private actors including voluntary associations, companies, NGOs, village councils, international organizations, political parties and militant groups. Second, the dividing lines between public and private sectors are blurred and societal problems and opportunities require the commitments of a broader set of actors and approaches. Third, governance has a basis in societal developments and is a reflection of a globalized world (Berkes 2009).

Different modes of governance have been described according to the different approaches to governance and as a reflection of their emphasis on the polity (the organized society like the nation or local governments), the politics (the theory and practice of power struggles inside the polity) and the policy (the planned formation of social domains through collective decisions) (Treib et al. 2007). While no society operates solely along one type of governance mode, based on a socio-political dimension, (Kooiman and Bavinck 2005) distinguish between three modes of governance:

Hierarchical governance is the most conventional of the governance modes where to-down policy making is the central procedure and steering and control are fundamental concepts.

Self-governance refers to the governance mode in which actors take care of themselves, outside the influence of government where governments may choose to deregulate or privatize, withdrawing from the public sector or incorporating self-regulatory capacities in their governance frameworks. Self-governance is not a government-created capacity but comes about based on mutual agreement and understanding. Political scientists dealing with collective action have made the most systematic analysis of self-governance with regard to the exploitation of common-pool natural resources (CPR) [7], such as capture fisheries. Based on a review of self-governance empirical case studies, Ostrom (1990) criticized the "Tragedy of the Commons"[8] hierarchical governance solution for CPR management and derived eight principles for successful community-based management of common pool resources:

- The boundaries where the resources are to be found or used are clearly defined (effective exclusion of external unentitled parties).
- There is congruence between appropriation and provision rules and local environmental conditions.
- Decisions are made through collective choice arrangements that allow most resource appropriators to participate.
- Rules are enforced through effective monitoring by monitors who are part of or accountable to the appropriators.
- Violations are punished with graduated sanctions.
- Conflicts and issues are addressed with low-cost and easy-to-access conflict resolution mechanisms.
- Higher-level authorities recognize the right of the resource appropriators to self-govern.
- In the case of larger common-pool resources, rules are organized and enforced through multiple layers of nested enterprises.

Co-governance is the type of governance where societal interested groups agree to collaborate and work for a common purpose in mind and stake, their identity and autonomy in the process. It includes communicative governance, public-private partnerships, networks, regimes and co-management. Co-governance has received much attention in general and in fisheries the form of co-governance called co- management is particularly influential. A key assumption is that no one actor is in control; instead, interactions are of a horizontal kind avoiding hierarchical power structures. Referring to Symes (2006), Linke and Bruckmeier (2015) highlight three key governance issues in fisheries co-management that are important for addressing EBFM: (a) everyday issues (short-term perspective); (b) institutional arrangements (long-

[7] a common-pool resource is a type of economic good consisting of a natural or human-made resource (e.g. an irrigation system or fishing grounds), where the exclusion of users or beneficiaries from obtaining benefits is costly but possible. Common-pool resources may be owned by national, regional or local governments as public goods, by communal groups as common property resources, or by private individuals or corporations as private goods. When they are owned by no one, they are used under a regime known as open access.

[8] Aristotle statement that "For that which is common to the greatest number has the least care bestowed upon it." was the powerful metaphor of human-nature interaction to the earth's natural resources shared commonly by much of the earth's population applied by Hardin in his seminal paper "The tragedy of the Commons" Hardin (1968). That the earth's commons are endangered is widely accepted, but that institutions, further privatization, evolve to rule the commons and prevent tragedy is a subject of much research and goes beyond the scope of this report.

term perspective); and (c) the construction of values and principles in fisheries policy-making (very long perspective).

Box 5. Fisheries and aquaculture governance
(FAO 2001-2018)

FAO defines fisheries governance as:

A continuing process through which governments, institutions and stakeholders of the fishery sector – administrators, politicians, fishers and those in affiliated sectors – elaborate, adopt and implement appropriate policies, plans and management strategies to ensure resources are utilized in a sustainable and responsible manner. It could be at global, regional, sub-regional, national or local levels. In the process, conflicting or diverse interests may be accommodated and cooperative action may be taken (Swan 2000).

Modern fishery governance is a systemic concept relating to the exercise of economic, political and administrative authority. It is characterized by:

guiding principles and goals, both conceptual and operational;
the ways and means of organization and coordination;
the infrastructure of socio-political, economic and legal institutions and instruments;
the nature and modus operandi of the processes;
the actors and their roles;
the policies, plans and measures that are produced; as well as
the outcomes of the exercise.

Policy and frameworks
Fishery governance establishes the overriding principles and objectives of the sector. It develops the policy and regulatory frameworks. It connects government with civil society, harmonizing individual, sectoral and societal perspectives and maintaining social order and productive socio-ecological systems. It legitimates and balances stakeholder's interaction, enforces decisions and regulations and maintains coherence across jurisdictional, space and time scales. Finally, it conditions the allocation of power, resources and benefits and maintains the governance system capacity to learn and change.

Governance at all levels
Fishery governance has international, national and local dimensions. It includes legally binding rules, such as national policies and legislation or international treaties as well as customary social arrangements. It is multiscale, covering long-term, strategic, planning as well as short-term operational management and local fisheries as well as whole ecosystems. It has public, private, and hybrid components that interact in ensuring administration and regulation of the sector.

More environmentally conscious, precautionary and participative forms of fishery governance are emerging from the UNCED process in which the keywords are: commitment, legitimacy, credibility, transparency, performance assessment, oversight, duty of care, equity, science and other knowledge, traditional values, ethics, systemic, multiscale, integration, coordination, adaptive, affordable and context sensitive.

4.1 Identified governance problems associated with EBFM

The relation between governance and EBFM is not a gratifying one. Literature on the impediments to operationalize and implement an EBFM is very often associated with a lack of adequate governance structures and frameworks (Marshak et al. 2017; Patrick and Link 2015; Samhouri et al. 2014). According to Patrick and Link (2015) discussions over governance and

EBFM have been centered in: the lack of legal mandates, the stakeholder and jurisdictional challenges of managing within a large marine ecosystem, the ability to incorporate social and economic dimensions into the decision-making process and, the ability to identify long-term goals and prioritize among conflicting goals.

Marshak et al. (2017) reported that establishing a clear governance structure to adopt EBFM was identified as a big challenge for the adoption of such an approach among fisheries scientists from mostly industrialized countries. However, the legal framework to incorporate an EBFM in various sectors regarding the marine ecosystem had clearly advanced through the Marine Strategy Framework Directive in the EU (O'Higgins and Gilbert 2014), Oceans Act in Canada (Jessen 2011), Australia Oceans Policy (Vince et al. 2015), the Norwegian Integrated Management plans (Olsen et al. 2007; 2015), the National Ocean Policy (National Ocean Council, 2013), and Ecosystem-Based Fisheries Management Policy (NOAA 2016) in the United States.

Besides legal frameworks, the need to (re)consider institutional structures and frameworks to introduce knowledge generated for EBFM has been also reported (e.g. Link and Browman 2014; Samhouri et al. 2014). In this sense, despite knowledge on the benefits to jointly decision-making considering diverse values for adopting an EBFM, governance structures constraint the process (Samhouri et al. 2014) or do not have the capacity for the uptake of ecosystem information (Harvey et al. 2017). Scientists inputs need to be specifically tailored to the management needs and matching of data and different levels governance jurisdictions need to be consider (ibid.).

In a similar direction Varjopuro et al. (2008) present, based on synthesizing several European research projects focusing on EBFM (i.e. FRAP and IBEFISH), a conceptual framework for dealing with the interaction between fisheries and the environment in an EBFM. According to this synthesis, a well-informed reduction of complexity requires that four key governance issues be taken into account: information management, legitimacy, social dynamics, and costs. Furthermore, issues of relevant knowledge and/vs. scientific expertise emerge and need to be addressed in a new way under EBFM requirements (for further explications see Part II, Principle 3).

Despite significant efforts in research and learning from experiences and the reported beneficial impact of "good governance" to ecological status (Bundy et al. 2017), it remains unclear what kind of governance structures and institutions are most capable of delivering the ecosystem approach in fisheries in the longer term. The following sections offers scientifically backed-up proposals for improving governance structures, processes and institutions towards EBFM implementation.

Box 6. Interactive governance theory
(Kooiman et al. 2005 and Jentoft 2007)

The interactive governance theory is broader than a simple theory of government regulation of a particular sector. This theory involves diverse actors and institutions, interacting dynamically across various scales from local to global. The emphasis is put on the "interactions" between large number of actors that are constrained or enabled in their actions by structures. Actors, are any social unit possessing agency or power of action and include individuals, associations, leaders, firms, departments, international bodies. Structures refer to the frameworks within which actors operate and include culture, law, agreements. Interactive governance holds basic social values and ethical principles to be issues of consideration and decision-making and recognizes the importance of contextual factors and local knowledge.

For interactive governance theory, fisheries and coastal governance may be seen as a relationship between two systems that could be termed a ''governing system'' and a ''system-to-be-governed''. The governing system is social, and therefore man-made: it is made up of institutions and steering instruments and mechanisms. The system-to-be governed is partly natural and partly social: it consists of an ecosystem and the resources that this encompasses, as well as a system of users and stakeholders who form political coalitions and institutions among themselves. We should also be concerned with the relationship and interaction between the two systems, which forms a system in its own right. The social system affects change in the natural system, but it is also dependent and therefore vulnerable to these changes since they set limits to resource users' potential. This interaction is co-evolutionary but not necessarily linear. Rather—according to interactive governance theory—it is diverse, complex, dynamic and vulnerable. The governing system aims to influence the interaction between the social and the natural sub-systems that are to be governed. To get at the natural sub-system—in order to halt ecological degradation, for instance—the governing system must work with and through the social sub-system.

Interactive governance theory relates governability to qualities of the object of governance (the system-to-be-governed), its subject (the governing system) and the relation between the two (Kooiman et al. 2008). Governors, the governed and the type of interactions among governors and the governed all contribute to governability. Governability can there-fore be defined as: the overall capacity for governance of any societal entity or system (ibid.). Since the first major publication on interactive governance, Fish-For-Life (Kooiman et al. 2005), interactive governance theory has been applied as an analytical tool to many different fisheries internationally (Bavinck et al. 2013; Jentoft and Chuenpagdee 2015) and to establish frameworks to assess the governability of fisheries (see Chuenpagdee and Jentoft 2009).

4.2 Governance actors and their interactions towards EBFM

Governance, is a broader concept that emphasizes the importance of structures, processes and institutions (formal and informal) and the involvement of actors and stakeholders. Governance also goes beyond guiding collective actions towards certain objectives to providing mechanisms that enable relevant actors to articulate their interests, establishing institutions that allow them to exercise their rights and meet their obligations, and formulating principles that serve as a basis for mediating differences and making decisions affecting society (Bundy et al. 2017). Governance actors in EBFM aim at holistically deliver healthy marine ecosystems and at the same time enhance the social relations (including economic benefits) from which societies depend upon. Thus, one main objective of EBFM includes maintaining the commercial fish stock at healthy levels but also the other biotic components of the marine

ecosystem. A healthy marine ecosystem is one which function and productivity is maintained over time (see Box 3). In the case of the social dimension, the main social objectives of fisheries management are broad, contextual and not always straightforward; moreover, they need to be identified and prioritize by the involved stakeholders in transparent participatory processes (Pascoe et al. 2014).

The actors constellation in governance for EBFM includes scientists, decision makers and stakeholders working together to define the broad vision of EBFM and among others - the spatial scale or scales of interest, the social and ecological objectives in order to balance ecological health and societal well-being and the common vision on principles and values that will be reflected in new norms and institutions. Current experiences in EBFM implementation have defined how this work between scientists, managers and stakeholders needs to progress. Following Röckmann et al. (2015) EBFM implementation involves scientists, decision makers and other stakeholders whose interactions need to develop along a spectrum (Figure 2). The triangle of interactions shows that during the EBFM implementation, scientific salience develops from scientific information with "no salience" of scientific data to research which is directly up taken and used in decision making. In the same model, participatory process evolves into self-management, and transdisciplinary knowledge production enhances credibility between scientists and stakeholders and is one of the final goals of EBFM implementation.

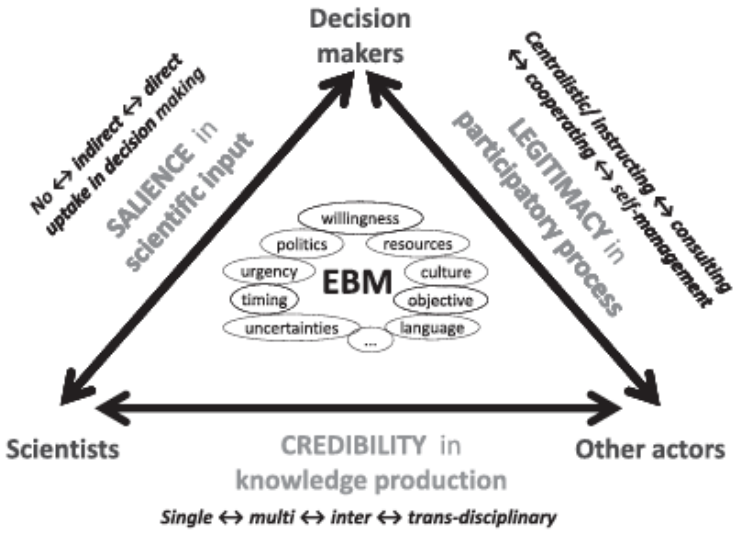

Fig. 2. The EBFM triangle of interaction from Röckmann et al. (2015); contextual factors are showed encircled within the triangle.

Science and governance for EBFM

The view and assumption that increasing scientific underpinnings on the dynamics and interactions of aquatic ecosystems would lead directly to improvements in the implementation of an EBFM is nowadays generally accepted as an oversimplification (Wondolleck and Yaffee 2017). As it has been shown in this report, EBFM comprises also some complicated processes of governance that incorporate many, at times conflicting, interests among governments and other stakeholders. The processes by which options are identified, conflicting interests and values are mediated, and courses of action are negotiated are as important as the application

of scientific information (ibid.). Moreover, when conflicts arise during the governance process, opponents often point to scientific uncertainty to justify their positions (Linke at al. 2016). Scientific advice includes inevitably various levels of uncertainty that varies with the complexity and degree of understanding of the system and the amount of information available. Adaptive management, in which uncertainty is reduced through an experimental approach to management, has been recognized as an effective method for managing resources in complex social-ecological systems (see 2.3).

According to Wondolleck and Yaffee (2017;X) scientific information in EBFM implementation was important as a way to legitimize the efforts and "as a relatively comfortable and logical place to start". Regarding the science-policy infrastructure for fisheries management Sullivan (2006) recommended the following governance features:

- The responsibilities for science and regulatory decisions should be formally separated within agencies.
- There should be formally recognized advocates and/or watchdogs of best available science in the management and policy processes.
- Professional societies should assume a more prominent role in assessing and documenting whether the science under their purview is properly applied to policy and management decisions.
- The leadership in fisheries and environmental management agencies should proactively guide democratization of the science relevant to their management issues.

For political scientists, the institutions of governance, the interventions they employ, and the knowledge systems that support these choices reflect sources and differences in power and equity. It has been also claimed that governance authorities (local, regional or national) may oppose the power sharing or usurpation of power that a broader stakeholder participation in decision-making implicitly requires (Murawski 2007). Moreover, this opposition is often not manifested by authorities and interested groups expressing their self-interest but by claiming lack of validity and scientific data or unclear messages from the approach (ibid). This is specially the case for the social dimensions of EBFM where the messages from social scientists are often claimed to be unclear or even "anecdotal" (Ounanian et al. 2013). In this sense, Jentoft (2006) argues that a starting point for improving fisheries governance is to recognize the fundamental methodological differences that exist between qualitative social science and the natural sciences. This recognition needs to be back up by an understanding on what qualitative social science can add to the field as showed and reported by Barclay et al. (2017).

Stakeholders participation in governance for EBFM

Based on Freeman (1984;X) for management of firms and organizations, stakeholders can be defined as "*any group or individual that is or can be affected by the achievement of fisheries management objectives*". The concept of stakeholder's participation is at least 20 years old when participation was recognized by the UN Conference on Environment and Development as one of the key principles for solving the social and environmental crises of the world (UNCED 1992 cited in Castell 2012). Stakeholders participation for decision-making has shown to be applied by managers at different levels from the task to inform stakeholders about the management decisions to the transfer of decision power to stakeholders (Fig. 3). For

instance, Advisory Councils for fisheries in the EU were established to involved stakeholders at the "consultation" level (Griffin 2013). There is however agreement among academics that despite its importance, consultation processes are not effective and are often carried out from the top-down with little opportunity for real participation (Reilly et al 2016). For EBFM, stakeholder's participation is understood as implementing the "delegation" level of participation for which representatives are assigned decision power to certain issues.

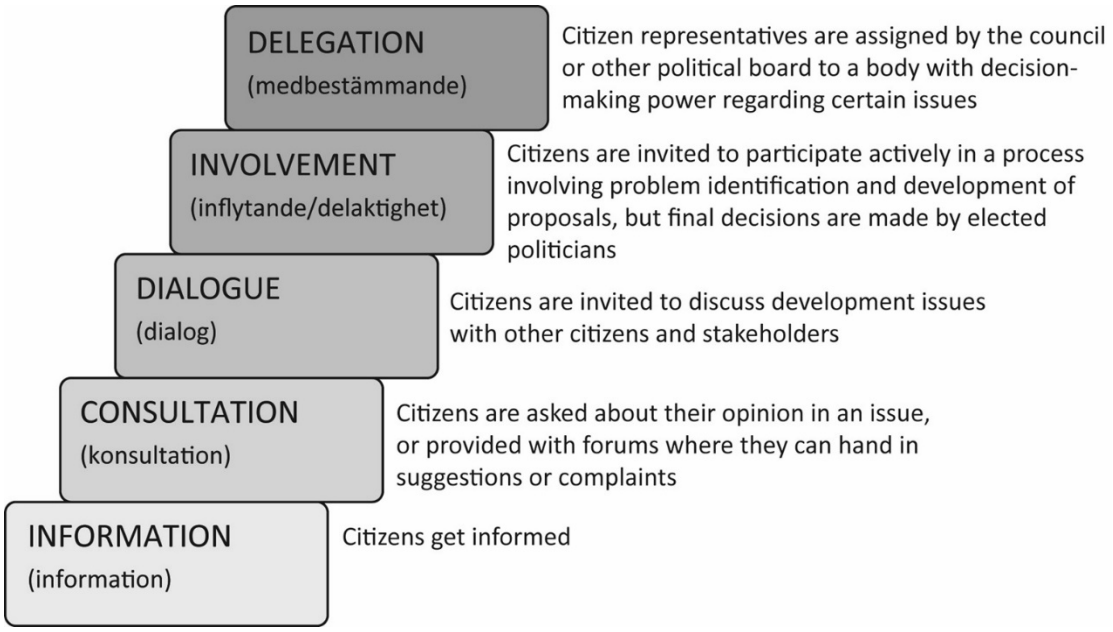

Fig. 3. Different levels of stakeholder's involvement in participatory decision-making processes (from Castell 2012 adapted from Arnstein's (1969) Ladder of citizen participation).

4.3 Institutional coordination and polycentric governance for EBFM

The implementation of EBMM requires the development of governance process and structures that allow institutional coordination at horizontal and vertical levels or "institutional interplay". This process of coordination of governance arrangements might be facilitated by the nesting of individual sectoral governance arrangements. While various governance frameworks exist, the concept of polycentric (nested) governance has gained prominence in the environmental sector and is posited as a key principle underpinning the resilience of complex socio-ecological systems (Cvitanovic et al. 2018). Polycentric governance deals with the existing multi-level governance arrangements that have emerged and evolved over the last decades to govern activities such fisheries or that focus on marine environmental protection more generally. According to Raakjaer et al. (2014;X) by developing institutional connections with these governance arrangements it could be possible "to ensure a common discourse, policy objectives and decision-making and implementation of sectoral measures supporting EBMM objectives".

Polycentric governance systems refer to multiple centres of decision-making, which are formally independent of each other, but function in a coordinated manner and with consistent and predictable patterns of interacting behavior. This independence provides the ability to develop autonomous norms and rules within specific domains (Ostrom 2010). Two main advantages of polycentric governance over other types of decision-making processes have been

identified: the provision of modularity and the provision of functional redundancy. Modularity enhances the resilience of the governance system by diminishing the impact of shocks or disturbances spreading them though the entire network. This allows individual units to retain their function even with the collapse of other units (Cvitanovic et al. 2018). Functional redundancy refers to the characteristic in polycentric networks for individual units to perform parallel and overlapping functions. Thus, when one level or unit fails to respond, it can be compensated by the responses of other units within the same governance system (Folke et al. 2009).

It is also argued that polycentric governance enhances feedbacks between social and ecological objectives of a system improving institutional fitness allowing society to respond more adaptatively to disturbances across multiple spatial scales (Cvitanovi et al. 2018). Over processes of institutional interaction, or the influence of one institution on the development and effectiveness of another (Oberthür and Gehring 2011) causal mechanisms that can be used to create institutional interaction are transfer of knowledge, discourses and ideas, shared or competing commitments, shared or competing expected changes in behavior (Rakjaer et al. 2014) and shared or competing objectives of impact on society and the environment.

A key characteristic of decision making in polycentric governance system for EBFM is that this process is non-hierarchical. A nested system could also be conventional top-down if one unit is predominantly and controls from upper to lower levels. However, Rakjaer et al. (2014) argue that it is more likely that EBFM is based on a network structure where the linkages facilitate self-organization, because of the numerous levels in geographic and jurisdictional scales. Likewise, Gruby and Basurto (XXXX) argue that "*nested polycentric systems are advantageous because, through the broader involvement of resource users, local knowledge can inform the design of diverse, context-specific rules, while larger organizations (including but not limited to governments) can enhance local capacity to deal with non-contributors or local tyrants, share and invest in information, and coordinate cross-boundary problems, for example*".

Based on empirical data from Sweden, Sandström et al. (2015) argue that the effectiveness of governance networks over other types of governance arrangements is not obvious when ecosystem-based ecological objectives are the aim. Extensive and rigorous central governance strategies foster environmental conservation while vagueness and flexibility promote institutional fitness at the local level and stakeholder collaboration (ibid).

PART II. IMPLEMENTING ECOSYSTEM-BASED FISHERIES MANAGEMENT IN SWEDEN: SOCIAL, POLITICAL AND GOVERNANCE IMPLICATIONS

Introduction

As generally recognized, the concept of Ecosystem Based Fisheries Management (EBFM) has different interpretations and meanings for different persons and making EBFM operational remains a key challenge for managers and policy-makers. In the Swedish governmental agencies context, EBFM is interpreted as formulated in six principles, taken from the report on the application of the ecosystem approach to marine planning (Swedish Marine and Water Agency Report 2012 14), which presents an adaptation of the Environmental Protection Agency's guidance on the ecosystem approach (Environmental Protection Agency Report 2007;5782). These six principles reflect a translation/concretization of the 12 Malawi principles of the Convention for Biological Diversity (CBD) for the implementation of EBFM in Sweden and are as follows (translation from Swedish):

- Common objectives and participation
- Nature's ability to produce goods and services is superior; the precautionary principle should be applied
- All kinds of knowledge should be considered
- Socio-economic ecosystem evaluation
- Delimitations in time and space
- Flexibility and adaptability

The following sections in this report evaluate the social, political and legal implications and considerations for implementing the six principles under the current Swedish marine and water resources governance. For each principle an overview of the current level of implementation in Sweden is presented and the implications to move forward are formulated. The implementation of the principles is evaluated for two levels of the governance system: EU international and national. For this analysis:

- Social implications consider the integration of values, norms and institutions in EBFM implementation**.**
- Political implications regard the power relation reforms in the Swedish governance structures and processes.
- Legal implications are framed based on European Union’s regulations embracing fisheries and water management and includes the EU *Common Fisheries Policy* (CFP), the *Marine Strategy Framework Directive* (MSFD) and the *Marine Spatial Planning Directive* (MSPD).

To support this analysis and better understand the social dimension of EBFM in Sweden, a one-day workshop took place on the 30th of November 2016. The purpose of the workshop was to gather social, political, legal and interdisciplinary researchers to initiate a discussion of the current governance and management system and identify alternative arrangements and

policy tools leading to the implementation of EBFM in Sweden. The proceedings of the workshop are included in Annex 1.

Principle 1. Common objectives and participation

According to SwAM (2012;14), "Common objectives and participation" summarizes principles 1, 2 and 12 of the Malawi Meeting (Prins and Henne 1998) and stresses the importance of managing ecosystems for the benefit of society. Accordingly, management should be decentralized at the lowest appropriate level facilitating accountability, participation and use of local knowledge along with expert knowledge.

Overview and pilot projects in Sweden

Swedish fisheries management under the EU Common Fisheries Policy has enhanced the level of stakeholder participation since the establishment of the Regional Advisory Councils (nowadays Advisory Councils ACs) in 2002. Advisory Councils (ACs) are stakeholder-led organizations that provide the Commission and EU member states with recommendations on fisheries management matters. They were established to include fishermen, vessel owners, processors, traders, fish farmers, women's groups and other environmental and consumers organizations. Advisory Councils are today composed of representatives from the industry and from other interest groups (with a 60% - 40% allocation of the seats in the general assembly and the executive committee) (Linke and Jentoft 2016). They were set up to "*ensure that they include all the interests affected by the CFP' while recognizing a primacy of the fishing interests given the effects on them of management decisions and policies*" (COM 2004;17).

ACs receive EU financial assistance as bodies pursuing an aim of general European interest. Their advice may include conservation and socio-economic aspects of management, as well as simplification of rules, etc. Advisory Councils should also function as new institutional actors that help to improve collaborative EU fisheries science and management approaches in terms of contributing to ways and procedures of data treatment for stock assessment, long term management plans as well as their evaluations. Swedish fisheries organisations are member of the North Sea AC, the Pelagic AC and the Baltic Sea AC[9].

At the national level, a number of initiatives promoted by the Swedish government in the last decades, aimed at implementing the local participation of stakeholders in Swedish coastal fisheries management. Three important such initiatives are described in the following sections.

a) The 8- fjords initiative

According to Johansson (2015), at the end of the 90's diverse people from the municipalities in Kungälv, Orust, Stenungsund, Tjörn and Uddevalla were interested in the state of their surrounding fjords and the depletion of fishing resources. As a result of meetings and discussions among them, a background report was issued (Municipalities of 8-fjords, 2006) and in 2008 a project manager was hired to start taking action in the area. The main objective was aiming for an ecological balance with sustainable commercial resources and outdoors recreation. The organization of the 8-fjords co-management project is shown in Figure 4. Whether this co-management initiative was a successful experience or an ineffective one is a matter of sound

[9] https://ec.europa.eu/fisheries/partners/advisory-councils_en

debate. For Bryhn et al. (2017), the eight fjords initiative can serve as a guiding example for co-management towards ecological, economic, and social sustainability and for EBFM implementation in practice. On the other hand, Cardinale et al. (2017) claim that the eight fjords experience was inefficient and unsuccessful since the results of this co-management experiment did not translate in the recovery of local fish populations (health of the ecosystem).

b) The Co-management initiative

In 2004, SwAM (previously the Swedish Board of Fisheries or SBF) launched a co-management initiative (Samförvaltningsinitiativet) and supported the establishment of six pilot projects covering different regions and types of fisheries (Eliansen et al. 2008). In this case, funds and expertise were provided by the governmental agency to establish local organizations to participate with the elaboration of fisheries management regulations for a period of two years. Among the stakeholders, the groups varied; depending on each case and included different categories of fishermen, water owners, municipalities, county boards and scientists. Collaborating in the definition of problems and solutions, every project delivered different outputs ranging from new regulations to marine ecology education courses for fishermen and local labelling of fish products (Berg 2009). For example, the co-management initiative in Northen Bohuslän was instrumental in the Kosterhavet National Park building process and the co-management initiative in Halland was instrumental in the process of the establishment of a no take zone in Kattegatt (Berg 2009).

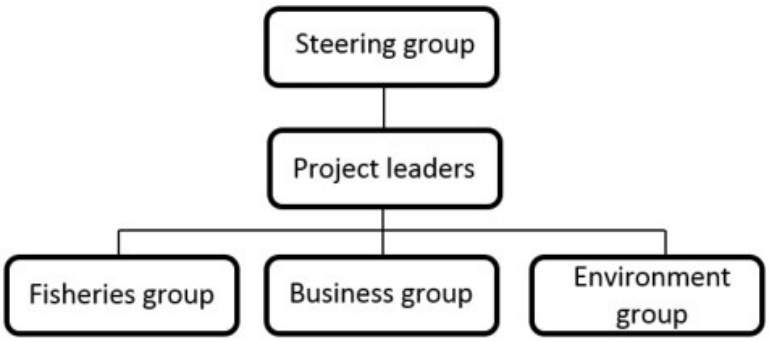

Figure 4. The 8-fjords project organization (from Bryhn et al. 2017, based on Johanson 2015).

c) The "Collaboration Plans for Valuable Coastal and Marine Areas"

The Swedish Environmental Agency (SEPA) conducted between 2008 and 2011 a national project aiming at establishing through inter-sectoral and local participation, new regional management plans incorporating and ecosystem approach for marine and coastal areas (Sandström et al. 2014). Five pilot coastal areas were selected in an attempt to contribute to the fulfilment of Swedish commitments to international conventions such as the Helsinki Convention HELCOM and the Oslo-Paris Convention (OSPAR). The aim of the project was "*to develop collaboration plans for the conservation, protection and sustainable use of the five pilot*

areas, as a basis for their future management" (SEPA 2011;13), with a focus on local participation and collaboration. The experiences of this national project had been used to develop hypothesis in the field of social network analysis (see Bodin et al. 2016).

Additional ongoing co-management experiences in Sweden have been reported for the shrimp's fishery as part of the eight fjords initiative (see above) in the Gullmar Fjord (Eggert and Ulmestrand 2008) and for the vendice fishery in the Bay of Bothnia (Popescu 2010).

Social, political and legal implications

The work of the EU Advisory Councils (ACs) and the other initiatives for co-management and participation of stakeholders in fisheries governance provide valuable information, examples and experiences for how the implementation of Principle 1 may succeed. The influence of local resource users has proved to be multi-functional, making stakeholder participation a strengthening instrument for applying EBFM (FAO 2018). Various forms of co-management[10] have evolved as solutions to specific, limited problems (such as the overfishing of fish stocks), to broader solutions for complex problems in multi-functional management systems as part of ecosystem-based management (Linke and Bruckmeier 2015).

On the same trajectory at the EU-level, ACs present a remarkable step towards realising the Principle 1 of the EBFM aiming to reach "Common objectives and participation". ACs contribute further by realizing the EU's principles of good governance (such as transparency, participation and coherence) into the CFP and represent a way of implementing the EUs' subsidiarity principle, as it incorporates lower levels of authority and organization into the EU fisheries governing system. Nevertheless, *they may represent an "interim institutional stage" by "facilitating better information sharing and cultivating stakeholder relationships*" (Raakjær and Hegland 201;7)

The ACs have however also been criticised for their somewhat unclarified consultative participation purpose and for constraining the involvement of stakeholders for collective setting of objectives for fisheries management (for examples on North, respectively Baltic AC see Griffin 2013; Linke and Jentoft 2016). Their role and function may therefore be questioned because they mostly serve as an add-on to existing single species TAC-management, instead of providing for working progressively towards new and more innovative perspectives of sustainable fisheries management. As Ramirez et al. (2016) report that management in the EU remains still highly centralized despite efforts for regionalization and that there are unclear rules for collaboration between ACs and more recently established regional institutions such as BALTFISH.

At the national level, analyses of co-management experiences have shown the factors that support or constraint the implementation of participation in Swedish fisheries management. For example, the extensive stakeholder involvement with authorities was crucial for the progress towards EBFM in the 8-fjords area (Bryhn et al. 2017). These co-management experiences presented various lessons influencing the outcomes of the initiative. These can be summarised as:

[10] Co-management is defined as "systems in which responsibility for management is shared between the state and user groups, usually at the local level" Symes (2006;113) and thereby differentiated form community-based resource management with purely local approaches of self-management by users.

- Co-management is a process that consumes large amounts of time and resources. Co-management groups that are provided sufficient time and resources by the government are able to develop trust and deliver common goals and rules for fisheries governance.
- Co-management initiatives that do not deliver expected outcomes might result in stakeholders losing confidence in the co-management system.
- Conflicting interests between national and local levels should be considered and managed. Lack of integration between levels restrained success of the pilot projects.
- Cross sector perspectives with participation of all interested parties has been limited.
- The structure of networks of actors is important for building collaboration and the fulfilment of the co-management objectives.
- Authorities and not-included pilot areas actors have had limited social learning as a result from this participatory initiative.
- Long-term follow up of the pilot initiatives has been a limitation for adaptive management.
- Absence of national legal frameworks for full participation of stakeholders limits co-management success.

Despite requests form SwAM for the institutionalisation of the co-management arrangements and their incorporation in national fisheries law, the Swedish government has not act upon this yet.

The implementation of Principle 1 in Swedish fisheries governance is confronted with the question about the desired degree of stakeholder involvement. This degree of participation needs to be decided for each fishery and each group of stakeholders and can differ from one fishery to the other. While different levels of participation have been encouraged, co-management under EBFM is understood and achieved when the participatory process leads to:

> *the creation and implementation of management arrangements through which a set of agreed-upon stakeholders – fishers, fisher organizations, communities, corporations, nongovernmental organizations or other entities – share decision making and management functions with government, and work jointly to develop and enforce fishery regulations and management measures (Charles 2001, cited by De Young et al 2008; 28).*

In addition, co-management and participation implementation should include:

- participation of government agencies and research institutes
- a set of clear rules on how the process (e.g. the selection of participating stakeholders) will take place
- a plan for integration and negotiation with cross-sectoral horizontal and vertical institutional interactions
- an arena for conflicts discussions, resolution mechanisms and collective choice arrangements

- a full recognition of governmental authorities at local and national levels
- a plan for institutionalisation of the co-management arrangement

Co-management for an EBFM implementation will delegate powers to users. These powers need to be translated in new rights and obligations for all stakeholders involved including governmental agencies responsible for fisheries management. An attempt to outline the flow of responsibilities or new roles under EBFM is presented in Table 2.

Last but not least, SwAM is responsible for the "regulation, licensing, and monitoring regarding living aquatic resources" and cannot delegate exercises of authority regarding these fisheries management issues. In other words, the agency cannot delegate the responsibility of fisheries management entirely to co-management groups unless there is a change in the agency responsibilities and related Swedish legislation. National legislation needs to be adapted in order to implement the delegation of powers and the institutionalisation of these participatory co-management arrangements.

Table 2. Outline of roles and responsibilities played by different actors under single-species and EBFM approaches in a co-management governance regime.

CO-MANAGEMENT ACTIVITIES WHAT	SINGLE- SPECIES MANAGEMENT WHO	EBFM WHO
Guaranteeing funds and resources	Government agency responsible for fisheries management	Government at the major organizational level
Designation of stakeholders	Government agency responsible for fisheries management	Stakeholders
Setting the objectives of fisheries management	Government agency responsible for fisheries management, industry lobbying	Stakeholders and researchers
Illustration, communication, negotiation and legal settlement of trade-offs	Government agency and natural scientists	Stakeholders and Government agency
Delimiting, monitoring and licensing of user's rights	Government agency responsible for fisheries management	Stakeholders and researchers
Assessment of welfare and distributional effects	Independent social sciences researchers	Government agency, stakeholders, scientists
Assessment of ecological status	Governmental agency and natural scientists	Governmental agency, scientists with collaboration of stakeholders and citizens
Management of horizontal and vertical institutional interactions	Absent	Government agencies with stake on marine health and fisheries management
Reflective learning and working methods	Absent	Government agency responsible for fisheries management

Principle 2. Nature's ability to produce goods and services is superior; the precautionary principle should be applied

Principle 2 is based on principles 5, 6 and 10 of the Malawi Meeting (SwAM 2012). This Principle put emphasis in the balance between conservation and use of ecosystems preserving

their structure and functions. It also focuses on the implementation of the precautionary principle. For the purposes of this report, Swedish efforts to accomplish this principle are reviewed based on the last conservation status reports of its marine ecosystems. This information is used to test the level of imbalance between conservation and marine resources use.

Overview

Sweden as a member of the European Union follows the regulations from the EU environmental policy. The European Commission published in April 2008 a Communication (EC 2008) on the role of fisheries management in implementing the ecosystem approach in marine management; an outline on how to achieve the ecological balance of the marine environments as sustainable sources of wealth and well-being of future generations. The basic key objectives are thus for the CFP management decisions to fully consider the EU Marine Strategy Directive (Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy), the Habitats (Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora) and the Birds Directive (Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds), and to apply the "precautionary principle".

The Marine Strategy Directive (see http://ec.europa.eu/environment/marine/index_en.htm) aims to achieve Good Environmental Status (GES) of the EU's marine waters by 2020 and identifies four marine regions in Europe – the Baltic Sea, the North-east Atlantic Ocean, the Mediterranean Sea and the Black Sea. In order to achieve GES by 2020, each Member State is required to develop a strategy for its marine waters (or Marine Strategy). In addition, the Marine Strategies must be kept up-to-date and reviewed every 6 years The objectives and obligations related to the Habitats and Birds Directives are reported at http://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm and http://ec.europa.eu/environment/nature/legislation/birdsdirective/index_en.htm respectively.

To accomplish EU directives, "Health of the Sea" (Havet) reports are regularly published and present a thorough knowledge base on the current environmental state of Swedish marine waters. Reports are a result of close collaboration between the Swedish Institute for the Marine Environment SIME, SwAM and SEPA. As stated by the latest report for the period 2015-16, eutrophication in the Central and South Baltic is still a major problem and phosphorus concentrations have risen steadily in the past few years. The drastic decline of cod may also contribute to troublesome algal blooms. The number of predatory fish in the Baltic has fallen to one-quarter, while certain fish that live on plankton, such as sprat, have multiplied. Intensive fishing has played a major role causing changes in the marine systems and fish species like skate, spiny dogfish, halibut, cod, pollack and eel are all on the "Red List", Sweden's list of endangered species.

Environmental Quality objectives

Swedish environmental policy is aimed at solving the major environmental problems faced by Swedish society by 2020 and defined in sixteen Environmental Quality Objectives since 1999. Environmental quality objective 10: A Balanced Marine Environment, Flourishing Coastal Areas and Archipelagos, concerns the ecological status and health of the North Sea and the Baltic Sea. Likewise, despite cooperation to reduce the impacts of activities that deteriorate the marine environment is taking place under the EU's Marine Strategy and Water

Framework Directives and the Helsinki and OSPAR Conventions, no clear trend in the state of these environments can be seen (see http://www.miljomal.se/sv/Environmental-Objectives-Portal/). The last assessment of the Environmental Quality Objectives states that:

> *Eutrophication, toxic pollutants and to some extent weak fish stocks remain major problems for the marine environment. Other concerns are marine litter, oxygen depletion, alien species, and the disturbance or destruction of sensitive habitats and cultural heritage. To achieve this objective, much remains to be done to develop and implement key policy instruments, both in Sweden and at EU level. (SEPA 2016; 27)*

Sweden is a party also of the Convention of Biological Diversity (CBD). According to the last report to the CBD, most of the reported habitats and species in marine and coastal areas in Sweden are not in favourable conservation status. The only known marine populations that have improved conservation status since 2007 are the harbour seal (*Phoca vitulina*) and the ringed seal (*Pusa hispida*), which are slowly increasing in numbers.

Swedish marine areas protected from human use according to Marine Protected Areas definition such as national parks, nature reserves and Natura 2000 areas cover approximately 9,900 km2, or approximately 6.3 % of the marine area nationally (SwAM 2015;16).

Social, political and legal implications

Current status of many Swedish marine environments is still in an unfavourable conservation status and the balance of Principle 2 is still "work in progress". The social and political implications for achieving this EBFM principle rest upon actions with implications at the level of individuals and the society as a whole. Individual values will have to improve their level of acting with more responsibility to the natural environment. Individuals need for example be able to avoid inefficient consumption habits and accept that institutional changes will be necessary to disrupt and solve current environmental problems. In the case of societal governance implications, the Swedish society should support values and actions that are known to be advantageous concerning their ecological impact. In the case of fisheries, for example, coastal fisheries are known to embrace practises that are more environmental friendly (Jacquet and Pauly 2008). The inclusion of values of vulnerable groups and gender issues in fisheries management has been so far neglected and should also be considered. These changes should at the end be backed up by respective legislation.

One important step towards the inclusion of social values in fisheries governance has been the adoption of the FAO Guidelines for small-scale Fisheries in 2015. Sweden, committed to the Guidelines as member country of the European Community, is therewith obliged to implement these new Guidelines, which deliberately not only focus on the ecological perspective but stand, as written into their name "in the Context of Food Security and Poverty Eradication" (for a discussion on the challenges to implement the FAO Guidelines in Sweden see Arias Schreiber et al. 2017, for a broader perspective see Jentoft et al. 2017; Jentoft 2014).

Principle 3. All kinds of knowledge should be considered

This principle is based on Principles 11 and 12 of the Malawi Convention, stating that an ecosystem approach needs to take into account all information, both from scientific sources as well as traditional and local knowledge, innovations and methods. According to SwAM this translates into requests to collect, process and make available all relevant knowledge includ-

ing those on the societal processes that impact on the marine environment and its management (SwAM 2012;12). Furthermore, applying the ecosystem approach is seen by the agency to implicate a "transdisciplinary holistic perspective", which includes the handling of different types of uncertainties. How can this broadened knowledge perspective be developed and applied to manage fisheries in (better) accordance with an EBFM? Apart from the pilot experiences with the three co-management cases in Sweden mentioned under Principle 1 above, the knowledge-integration aspect to be addressed under Principle 3 is rather underdeveloped on the local and national level in Sweden. However, while for example Bryhn et al. 2017, mention the scarcity of social indicators as a major weakness of EBFM and heavily emphasise the importance of involving stakeholders to promote EBFM as well as their collaboration with scientists (by refereeing to 15 key principles for EBFM posed by Long et al. 2015), these authors don't discuss how the knowledge from different stakeholders such as fisher's and scientists can be brought together. Emerging research about these issues on the European level provides some more insights into how such knowledge integration from different sources might be accomplished and which hindrances and challenges can be revealed. The following overview is meant to summarise some of these insights (for further discussion see Linke et al. 2011; Linke and Jentoft 2013; 2014; 2016).

Overview

Various EU policy concepts and projects and their implementation in Sweden exemplify attempts to accomplish Principle 3 for knowledge integration to promote the implementation of an EBFM. Two main experiences from the EU level, the above mentioned Advisory Councils (ACs) initiated through the CFP and Fisheries Local Action Groups (FLAGS), the European Maritime and Fisheries Fond (EMFF). While ACs serve, as their name suggests, as *advisory* organizations to the EU Commission for policy and decision-making, FLAGS focus on coastal communities to promote local solutions through numerous projects all-over Europe. The experiences with knowledge integration in these two initiatives are summarized in the two boxes below (based on Linke and Bruckmeier 2015).

Box 7. Knowledge integration for EBFM through ACs.

A decade of experiences from the ACs' work reveal a number of problems and challenges regarding the best way to balance the knowledge from scientific research with the practical experiences from the fisheries sector and the NGOs. They range from technical questions, e.g., how to systematize and integrate data and knowledge from the fisheries sector in scientific assessments, or consequences of specific gear use, to basic issues of how to communicate different types of knowledge across the various actor-groups to synchronize different knowledge cultures such as those of fishers and scientists, where the understanding of topics such as scientific uncertainty and anecdotal local experiences often differs substantially. Such communication problems constitute major challenges for the ACs when moving towards new and more inclusive forms of governance requested e.g. by EBFM. The research on ACs also highlights difficulties for other attempts to bridge the gaps between different forms of knowledge e i.e., between researchers, fisheries practitioners, NGOs and decision-makers (cf. Verweij et al., 2010). While the green paper for the 2002 CFP reform, which resulted in the establishment of ACs, stated that research and scientific advice *"must maintain an open channel to fishermen's own knowledge"* (COM 2001; 40), more than a decade later, this issue is still an important research priority, with increased efforts sought for collaboration between scientists and fisheries stakeholders (see e.g. http://gap2.eu/). At meetings between ICES and the ACs, best ways to address the knowledge complexity of science and fisheries perspectives within the EU system have been discussed intensively, and the topic has developed into one of the most important issues for advancing EU fisheries (co-)management. Accordingly, the way towards generating and implementing new approaches for joint knowledge production and problem framing between science and the stakeholder sector is still cumbersome and requires significant further efforts in the EU system, which are exacerbated by legal obligations for centralization and member state harmonization. The EU situation, which Sweden is part of, differs significantly from, for example, Norway, where one of the most advanced forms of collaboration between science and fisheries has been established, with the so-called Reference Fleet serving "as a new trust-based cooperation between fishers and scientists" (Bjørkan 2011).

Box 8. Knowledge integration for EBFM through FLAGs.

The EMFF regulation mandates the provision of opportunities to activate local knowledge through FLAGs and that this local knowledge be made accessible for management processes at higher levels. It therefore recommends that FLAGs be built in a "bottom-up approach", involving a cross-sector representation of all relevant local stakeholders. The objective of this stakeholder involvement is two-fold: first, to ensure the full utilization of unique and relevant local knowledge; and second, to engage the local knowledge holders in the FLAG development process. FLAGs should act as organizations that enable stakeholder knowledge use for innovation processes by providing an *"opportunity to bring together the local knowledge of fishermen with the expertise of scientists and the dynamism of local entrepreneurs to explore and launch products in this field*" (EU 2013a;24). The establishment of such public-private-partnerships under the FLAG approach depends on resources, not only financially but also on appropriate responsible actors and uses of time and, perhaps most crucially, on the successful mobilization of the local knowledge from the fisheries sector. Particularly in areas facing decline and other economic or social challenges, the focus on partnership is seen as the most promising solution to problems that are too complex to be handled independently within separate sectors (EU 2013b;11). The knowledge of the local area and its specific social, economic and environmental characteristics are therefore highlighted as core aspects for the FLAGs' practical work.

To sum up, we can conclude that studies on how to best integrate different types of knowledge such as those from fishermen and scientists in policy, management and decision-

making is still an emerging field of research. As highlighted by Stephenson et al. (2015;X) "*FKR [Fishers knowledge research] is part of the new and different information required in evolving ecosystem-based and integrated management approaches"*. Based on their research experiences with knowledge integration in fisheries management in Europe, Canada and Australia, these authors predict a wave of new interdisciplinary research on FKR and its integration in management through providing credible and useable results for EBFM from participatory research. They also highlight that EBFM implementation requires such broadened collaboration: "*Management authorities will increasingly embrace collaboration, in part because they will be unable to do all that is expected of them to meet commitments, given the expanding nature of ecosystem-based and integrated management approaches and budgetary constraints*" (ibid.;X).

Social, political and legal challenges

Sweden as a member of the European Union is strongly influenced by the developments on the EU level, such as in the regional management context of the Baltic Sea and its agenda to implement an EBFM (see e.g. http://balticeye.org/en/fisheries/ebfm-workshop-june-2016/). Also on the local level EU processes influence fisheries management, such as through the various FLAGs that have been established in Sweden (see Linke and Bruckmeier 2015). However, the knowledge base needed for implementing EBFM in Sweden seems far from sufficiently developed in order to meet the requirements of Principle 3. It may in general also be difficult to know exactly in concrete cases what kind of knowledge is necessary before decisions regarding specific objectives are made. As concluded by Varjopuro et al. (2008;150) in an overarching analysis of the transition from single-species management towards EBFM: "Science-based methods of assessing progress towards the stated goals of EBFM must be developed and agreed among the stakeholders. Monitoring of the progress supports an effective implementation and improves transparency of management." According to a related synthesis, the institutional innovations necessary for a transition to EBFM call for more quickly applicable information, improved legal backing for continued collaboration, efficient and clearly defined practices of participatory decisions, the specification and just distribution of costs, multi-scale spatial planning; and cross-sectorial integration of fisheries management (Berghöfer et al. 2008;251; Linke and Bruckmeier 2015). In a similar perspective Gray (2005), by analyzing the broadening discourse of fisheries governance towards EBFM, discusses three key themes: the value of participation, the transition from single-species management to ecosystem-based management, and the relationship between local or experiential and scientific knowledge. The discussion on stakeholder participation in fisheries management often persists in a somewhat narrow policy perspective, as typically summarized in normative messages such as that "all stakeholders have responsibility and public duty to act as stewards of the marine environment". Therefore, it seems of paramount importance to look closely into the actual "performative practices" of such procedures of knowledge inclusion and stakeholder participation in order to go beyond overly positive or pessimistic views. It is necessary to appreciate both intended and unintended forms of participation and knowledge inclusion as meaningful and legitimate processes in flexible and dynamic experiments with more democratized forms of governance (Turnhout et al. 2010; Linke and Jentoft 2016; Griffin 2013).

While unsurprisingly major attention is drawn on the European experiences with EBFM in our research and policy communities, it might be beneficial to also look at how EBFM is addressed and implemented overseas, such as in the US and/or Australia. For example in the US

there has been for some time a strong interdisciplinary research focus on collaborations between scientists and other actors that also highlights the need for social fisheries research, as concluded e.g. by St. Martin et al. (2007;222): "*Promising initiatives that align with ecosystem-based approaches include the documentation and incorporation of Local Ecological Knowledge (LEK), cooperative research that bridges communicative and epistemological gaps between fishermen and scientists and community-level data collections and analyses emerging from legislative mandates and community-based advocacy. These examples suggest a reorientation of fisheries social science in step with ecosystem approaches"*. As these authors discuss, the EBFM approach requires to include valuable knowledge and experiences from the fishing sectors while at the same time enabling such opening up of traditional science-policy interfaces of the single species TAC approach: "*These results suggest that LEK is not only compatible with single-species assessments but with a broad ecosystem-based approach to fisheries management as well"*. Indeed, an ecosystems approach might better incorporate fishermen's qualitative knowledge of habitat, species interactions, spawning locations, etc. Assembling knowledge through talking to fishermen provides valuable insight into microscale processes, conditions and variability because it is built from the 'bottom up'. Drawing on different sorts of information broadens the diversity of available information, fundamentally involves fishermen in the very process of knowledge creation and strengthens the basis for truly participatory, future-oriented discussions" (ibid.;227).

Principle 4. Socio-economic ecosystem evaluation

Based upon Principle 4 of the Malawi Meeting, this principle emphasizes the need to understand the ecosystem in an economic context. More recently, this principle has been translated into an instruction to use "Ecosystem Services"[11] and their valuation as a tool to implement the ecosystem approach.

Overview

In 2014, the Swedish Parliament adopted a strategy on strengthening biodiversity and securing ecosystem services. The strategy is based on the bill "A Swedish strategy for biodiversity and ecosystem services" (Gov. Bill 2013/14:141). The objectives of the strategy aim at, by 2018, the importance of biodiversity and the value of ecosystem services are to be generally known and integrated into economic positions, political considerations and other decisions. In 2015, the governmental report from SwAM on *Ecosystems Services of the Swedish Seas – status and impacts* (SwAM report 2015;12) classified the status of marine ecosystem services in Sweden and evaluated their main anthropogenic pressures in three different marine sub-regions of the Swedish economic zone: the Kattegat and Skagerrak, the Baltic Proper, and the Gulf of Bothnia. The status of the ecosystem services was established according to three status levels: good status, moderate status and poor status. Economic valuation of these ecosystems services was not carried out. The results of this report are presented in Table 3.

[11] The definition of Ecosystem Services (ES) for the 2006 Millennium Ecosystem Assessment (MA) is, ecosystem services are "the benefits people obtain from ecosystems." The MA also delineated the four categories of ecosystem services of supporting, provisioning, regulating and cultural ES.

Table 3. Ecosystem services status of the three marine sub-regions in Sweden (source SwAM report 2015;12).

Ecosystem service	Kattegat and Skagerrak	Baltic Proper	Gulf of Bothnia
S1: Biogeochemical cycling	Moderate	Moderate	Moderate
S2: Primary production	Moderate	Moderate	Good
S3: Food web dynamics	Poor	Poor	Poor
S4: Biodiversity	Moderate	Moderate	Moderate
S5: Habitat	Poor	Poor	Good
S6: Resilience	Moderate	Moderate	Moderate
R1: Climate and atmospheric regulation	Moderate	Moderate	Moderate
R2: Sediment retention	Moderate	Moderate	Good
R3: Regulation of eutrophication	Moderate	Moderate	Good
R4: Biological regulation	Moderate	Moderate	Good
R5: Regulation of toxic substances	Moderate	Moderate	Moderate
P1: Food	Poor	Poor	Poor
P2: Raw material	Poor	Moderate	Good
P3: Genetic resources	Good	Good	Good
P4: Chemical resources	Good	Good	Good
P5: Ornamental resources	Good	Good	Good
P6: Energy	Good	Good	Good
C1: Recreation	Moderate	Moderate	Moderate
C2: Aesthetic values	Moderate	Moderate	Moderate
C3: Science and education	Good	Good	Good
C4: Cultural heritage	Moderate	Moderate	Moderate
C5: Inspiration	Good	Good	Good
C6: Natural heritage	Moderate	Moderate	Moderate

Around the Baltic, ecosystem services of the Baltic salmon (Kumala 2013) and their cultural and recreational values have been evaluated in D'Amato et al. (2013).

Social, political and legal challenges

While Sweden is on its way for the accomplish of this Principle, the "question of whether and how to formalize the values of these services to society remains a difficult and, at times, controversial subject" (De Young et al. 2008;11). Some problems that should be consider during socio-economic evaluations are:

- Not all services (non-market) can be valuated in economic terms
- There might be different values of ecosystem services for different stakeholders

- The perception of the impacts of fisheries management on some services might differ between different stakeholders
- Different values for individuals, communities or society in general
- Services and their values might change in time
- Not all services can be maximized at the same time, standardization and priorization processes are needed and decisions remain under the decision-making system

Challenges for science

For a number of years, ICES has invested immense resources to adapt scientific work and advice for the transition to an EBFM, which mainly has to work side-by-side to the traditional single species assessments and advisory procedures (Wilson 2009). ICES is deeply committed to the EBFM as expressed in the ICES Strategic Plan 2014-2018, is stating the main elements on how ICES is about to take a lead role in providing the knowledge for EBFM:

- in advancing integrated scientific understanding of ecosystems
- in providing advice on the sustainable use and protection of ecosystems
- Integrated Ecosystem Assessments (IEA)

As part of this trajectory the ICES Strategic Initiative on the Human Dimension in Integrated Ecosystem Assessments (SIHD) has been formed with a work plan from 2015-2018. The aim of this initiative (placed under ICES' Scientific Committee, SCICOM) is to explicitly address the Human Dimension in Integrated Ecosystem Assessment, not only considering the pressures of human activities on the ecosystem but to take into account social, cultural, economic and governance conditions when assessing the marine system and giving advice on its use (see http://www.ices.dk/community/groups/Pages/SIHD.aspx).

It will be an extremely challenging task for a traditional scientific organisation like ICES, which for a long time was used to speak "truth to power" (Collingridge and Reeves 1986) to react to these current changes in fisheries management and implement new scientific approaches required by EBFM. As Dickey Collas aptly describes in his article on how science needs to adapt to the complex nature of EBFM and IEAs, these challenges basic assumptions of the role of science in society: "*Linking a scientific investigation to a societal debate on management objectives, trade-offs, and tools for analysis may well challenge those that see science as a search for pure truth and not part of a societal debate*" (Dickey-Collas 2014;1175).

Principle 5. Delimitations in time and space

This principle follows Principles 3,7 and 8 of the Malawi Meeting and considers the needed trade-offs to avoid unintentional effects of management to other/adjacent ecosystems, the definition by users, managers and scientists of scale and temporal boundaries for management objectives and the long-term character of ecosystem management.

Overview

On the EU level, Multi Annual Plans (MAPs) for all managed fishing stocks should be developed under the last reform of the CFP in 2014. MAPs include the target of fishing at maximum sustainable yield (MSY) and a deadline for achieving this target emphasizing the need

to replace short-term fisheries management plans. The Multiannual Plan for the stocks of cod, herring and sprat in the Baltic Sea was enacted in 2016 and aims at achieve the MSY for these fish species by 2020.

SwAM published in 2015 a report on the current status of Marine Spatial Planning compiling information regarding the utilization of marine resources, status of knowledge, and possible future demands. As states in the report "*Our ambition is to convey a cross-sectoral perspective as a starting point for the first phase of the national marine spatial planning"* (SwAM 2015;7). The report is the first step for the process of marine spatial planning in territorial and the Exclusive Economic Zone Swedish waters. Based on the information in this report, 3 sketches for Marine Spatial Plans in Gulf of Bothnia Bay, the Baltic Sea and the Skagerrak and Kattegat areas are currently under a consultation process.

Social, political and legal implications

At the EU level, Ramirez et al. (2016) use the design of the Multispecies Multiannual Plans (MMPs) for the Baltic Sea and for Atlantic Pelagic fisheries to identified the institutional challenges for implementing the EBFM under this lately EU fisheries policies. Three important steps toward the implementation of EBFM through the Baltic Sea MMPS were identified:

- The plan can be used as a prototype and offers an appropriate case study to be learn from
- Despite that the management of not all species of the ecosystem are considered, the plan has a broader environmental and social approach
- The plan shows that collaboration between interested actors is possible in order to set common objectives

The authors describe the institutional gap between fisheries and environmental policies as one important challenge but also the difficult interactions between fisheries policies like Advisory Groups and MAPs Regional groups or the European Commission.

Regarding Swedish attempts to Marine Spatial Planning, Morf (2012) acknowledges that using a spatial dimension as a point of departure locates Marine Planning in a privileged position to allocate problems, its analysis and the management at appropriate scales in time, space and organization. The author identifies the following areas in need of further development:

- Theory and practice of cross-border international collaboration
- Temporal and spatial mobility ecosystem characteristics and the need for coping with adaptation and flexibility

On the governance system the implementation of the delimitation in space and time principle remains in the challenge of organizing institutions with a function responsibility at higher levels (more neutral) that the management sectors to be integrated (Kay and Adler 1999). In other words, the functions of an organization in charge of the implementation of Marine Spatial Planning with an Ecosystem Approach – that includes other sectors like tourism and recreation, should not be an organization in charge of management of marine and water resources. While three marine sub-regions have been identified (the Kattegat and Skagerrak, the Baltic Proper, and the Gulf of Bothnia), setting the boundaries at geographical and temporal

scales for EBFM has apparently not been regarded as a priority for management authorities until now. Furthermore, how these boundaries will match or correspond to current institutional structures and process and their jurisdictions will need substantial changes and re-organization of power structures.

Principle 6. Flexibility and adaptability

The principle is based on Principle 9 of the Malawi Meeting and deals with the recognition that ecosystems change is inevitable. Ecosystem management needs thus constant follow up, evaluation and re-definition of goals in a rapid and flexible manner.

Overview

Sweden has an extensive Marine Environmental Monitoring Program lead by the Swedish Environmental Protection Agency and in collaboration with other central agencies like the Swedish Meteorological and Hydrological Institute, the Swedish Institute for the Marine Environment, universities and regional and local administrative authorities.

The purposes of this monitoring are (SEPA 2000;2):

- to describe the status of the marine environment
- to follow changes in the marine environment
- to follow up the effects of measures applied

Social, political and legal implications

The EU Common Fisheries Policy does not consider clear obligations regarding for specific adaptive planning stages (Michaneck and Christiernsson 2013). Moreover, the highly focus on fish stocks of the CFP has probably prevented other policies like the Marine Strategy Directive and the Water Framework Directive to pay attention on monitoring non-commercial fish species. Without this monitoring, adaptive learning is hardly to envisage.

In Sweden, monitoring of marine environmental status has been well organized to allow for adaptation and flexibility on measures to follow up and learn. On the other hand, social and even political dynamics - that are in many cases the main drivers of environmental marine changes (Wondolleck and Yaffee 2017)- have been neglected. Social well-being indicators are measured at levels that cannot be applied at local levels of management or are scattered between different organizations and their interests. Research on political changes driving changes to the environment are in the hands of irregular academic work. The implications for the implementation of Principle 6, are not however limited to the improvement in monitoring efforts but in creating the capacity at governmental agencies to institutionalized at informal and formal levels a continuous and regular evaluation and adaptation of management decisions. Lack of social indicators, monitoring and assessments of fisheries management cycles remain a challenge for the flexibility and adaptation of the current system which will need substantial learning and fitting of governance processes. Co-management initiatives in Sweden have reported to foster flexibility and adaptation.

Summing up what has been done and what needs to be done at the institutional level for an EBFM implementation in Sweden is shown in Table 4.

Table 4. Status of institutional implementation and needs for EBFM at the national level in Sweden.

PRINCIPLE	STATUS/IMPLEMENTED	NEEDS IMPLEMENTATION
Common objectives and participation	Centralized management remains (only experimental co-management). Participation in the best cases at the level of involvement (see Figure 3)	Establish a co-management body with decision-making responsibilities among stakeholders. Identify common objectives for fisheries management among stakeholders, scientists and policy-makers.
Nature's ability to produce goods and services is superior; the precautionary principle should be applied.	Legislation for protecting ecosystems exists but marine ecosystems are not healthy enough.	Change in behaviour is needed at individual and collective levels. Through participation change influence levels of certain powerful economic actors.
All kinds of knowledge should be considered.	Scientific knowledge is used for fisheries management.	Add and establish transdisciplinary projects for co-production of knowledge in EBFM implementation strategy. Establish fisheries management assessments mechanisms (in cycles) for integration of new co-created knowledge in management and adaptive management
Socio-economic ecosystem evaluation	Status of ecosystems services in three marine sub-regions has been determined.	Establish projects for participatory ecosystem services identification at ecosystem levels and economic valuation.
Delimitations in time and space	Marine ecosystem divided in three major sub-regions. Management plans do not have time coordinated time spans.	Delimit ecosystems boundaries and fisheries management jurisdictions that fit these boundaries. Establish management objectives within certain number of years and accountability processes.
Flexibility and adaptability	Management regulations are not connected to changes in marine social-ecological systems, there are no mechanisms in place for adapting management.	Establish monitoring, assessment and accountability circular systems for fisheries management.

5. CONCLUSIONS

Marine fisheries employ around 40 million people worldwide and provide 3 billion people with their first primary source of proteins (FAO 2018). At the same time, marine fisheries are probably one of the most conspicuous examples of unsustainable use of natural resources and while some improvements have been reported for EU marine ecosystems (see Gascuel et al. 2016) fisheries collapses and declining fish stocks are the rule in the global oceans. This degradation of the marine environment is also affecting the ways of life, identity, use of knowledge, traditions and local institutions of millions of fishers who had been fishing the seas for many generations and the economies and wellbeing of coastal communities that rely on them. Despite this crucial human-sea connection, the social components and goals of fisheries are often overlooked or not explicit in fisheries management and policy-making.

According to ICES, Ecosystem-based Fisheries Management (EBFM) offers a new tool for marine stewardship that aims at holistically balance ecosystem health and human-wellbeing. To highlight the importance of a "human" or "social dimension" many fisheries scholars have interpreted EBFM as a new paradigm to "put humans back into the ecosystem" (Berkes 2009;465) and to foster the notion that "managing fisheries is managing people" (Barclay et al. 2017; Lade et al. 2015; Samhouri et al. 2014). Thus, the implementation of EBFM has a "social dimension" that needs to be understood and implemented. Based on the literature review performed in this report (Part I) on what this "social dimension" means and how can be integrated in EBFM implementation, the following conclusions are presented:

With regard to EBFM

- EBFM is not about choosing among competing human-nature views (e.g. anthropocentric vs eco-centric); it rather offers a tool or an attempt to reconcile them. EBFM is thus about balancing ecosystem health and human wellbeing in coupled social-ecological systems; ecological concerns have not necessarily priority over further concerns.
- EBFM offers an alternative to conventional fisheries management in which the effects of fisheries are considered at the level of the ecosystem, and humans with their associated institutions not only obtain goods and services from nature but construct also their understandings of the natural world and their relations to it.
- EBFM builds a shared discourse that could foster the development of shared principles, values and interests, shared expected changes in behaviour and shared objectives while making visible existing conflicts between them.
- In anti-democratic EBFM practices, trade-offs will benefit stakeholders with the

power to imposed their values and interests.

- In EBFM fishers cannot be regarded as external "stressors" to the ecosystem or as "careless extractors" in the ecosystem trophic chain; human-nature relations are far more complex and multifaceted driven by numerous contextual interconnections at different scales.
- There is no single manner or tool to implement EBFM. EBFM implementation is context specific and will depend on the human capacities and financial resources available.

With regard to the "social dimension" of EBFM

- Central to the concept of EBFM is the notion that exploited marine species are interlinked to other species in the ecosystem, and also to a wider human organisation where socio-cultural, political, institutional and economic drivers (the "human dimension") play an important role.
- Social dimensions of EBFM deal with the integration of social objectives into marine resources management as well as the societal process, structures and institutions supporting or impeding its implementation (governance). For analytical purposes the social dimension of EBFM can be divided in two sub-dimensions: 1) the identification and integration of social objectives in fisheries management, and 2) the identification and changes in fisheries governance; or processes, structures and institutional settings that support or constrain EBFM adoption.
- Social dimensions of EBFM are not limited to implementation issues but also applies to the fundaments and principles of the approach (meta-governance).
- Social dimensions of EBFM are not relevant exclusively to remote rural fishing communities which are directly dependent on nearby marine resources; it encompasses principles and objectives with broader societal implications.
- Failure to consider social dimensions in EBFM risks producing or reinforcing social inequalities with marginal groups, enhancing conflicts and distrust hindering collaboration, ignoring local values, knowledge and skills essential for particular contexts, striping customary social norms, fostering unemployment, depriving individual and collective identities, altering socio-cultural relations and social capital; all of them critical for human well-being and the associated exploited marine ecosystems.

With regard to the "social dimension" of EBFM implementation

- For EBFM to be implemented, fisheries management is demanded to readjust management principles, goals, methods and policy processes. This can be done through a "revolution" or through an incremental but fundamental adjustment of mainstream processes.

- Since fisheries (single-species) institutional and management structures are already well established and the roles, responsibilities, powers and jurisdictions of authorities are not designed to match ecosystem boundaries, EBFM implementation requires a fundamental reorganization of these structures and institutions.
- EBFM implementation needs clear social objectives and indicators. The objectives and goals of EBFM are contextual and are identified and prioritize though transparent, participatory, deliberative and democratic processes reflecting expertise and other types of knowledge.
- Principles, methods and tools for defining fisheries social objectives and indicators exist, however their integration in mainstream fisheries management remains a challenge.
- To reduce social objectives of fisheries management to ensure employment or maximize economic profit is an oversimplification.
- Top-down fisheries management makes it difficult for fisheries managers to grasp social objectives of fisheries since this type of management requires minimal contact with stakeholders and relies mainly purely on scientific advice. This scientific advice is derived from scientists who also do not necessarily interact with stakeholders as in the case of scientists monitoring fish stocks or modelling fish market behavior.
- In EBFM culture and socio-cultural values need to be considered since they reflect why fish and fishing are important to society. Socio-cultural values knowledge is needed for managers to understand why ecosystems, their resources and the fisheries are important among different stakeholder's groups and the actors involved in governance.
- In the process of defining boundaries for EBFM implementation consideration of a shared sense of place or identities and "keystone cultural species" can be useful.
- For EBFM, there is a need to include an understanding of the linkages between ecological system and the health of fishing communities where women's activities play a key role.
- Different types of knowledge integration is not limited to knowledge "sharing" or the use of data collected by fishers for scientific purposes; integration means dealing with different views about definitions and classes of entities, or the way "truth" is validated through deliberative tools such as mental maps and scenario building.
- Scientists and experts need to understand the fundamental methodological differences between best available qualitative social sciences data and quantitative data.

- Since, the importance, values and interests of stakeholders is expected to be different and even in conflict to each other, explicit considerations of socio-cultural values are needed to reach trade-offs or agree on "hard choices" through democratic deliberative practices.
- Stakeholders participation is ineffective if it only includes consultation processes and do not lead to the assignment of responsibilities and decision-making power to certain issues through stakeholder empowerment.
- Interactive, polycentric (or nested) and co-governance have been identified as promoting EBFM implementation and adaptive management.
- Without disregarding contextual factors like culture or ecological settings, for EBFM implementation scientific output should be salient, legitimacy of decision-makers can be obtained through participatory practices and credibility in knowledge production can be achieved though transdisciplinarity.

Part II of this report is based on the six principles of EBFM identified by Swedish state agencies and the social, political and legal implications for their implementation. Whether these social, political and legal repercussions in the system will be achieved through a "revolution" or adjustment to mainstream fisheries management should be decided in Sweden by deliberative participatory processes including scientists, policy-makers and stakeholders. A brief summary of these implications at the national level of governance are presented here:

Common objectives and participation

Sweden is missing processes and channels (also legal) for the identification, priorisation and integration of social objectives in fisheries management and stakeholder participation. New formal and informal institutions and delegation of power from policy-makers and scientists to stakeholders to influence decision making will be needed in order to apply participation and co-management. Previous co-management initiatives in Sweden should be used to learn from them.

Nature's ability to produce goods and services is superior; the precautionary principle should be applied

Legislation to protect and sustainable use ecosystems is regarded as sufficient; however marine ecosystems are still far from desired levels of health. Changes in individual and collective behaviour are needed, and influence levels of certain powerful economic actors that hinder the application of the precautionary principle need to be minimized if not eliminated.

All kinds of knowledge should be considered

Identification and integration of local traditional knowledge is absent in fisheries management at national level. Transdisciplinary projects for co-production of knowledge and social objectives identification that incorporate this knowledge need to be coupled to the

EBFM implementation strategy. Adaptive management based on new co-created knowledge need to be foster via required management assessment cycles.

Socio-economic ecosystem evaluation

Sweden has demonstrated progress in identifying marine ecosystem services and classifying their status however the economic valuation of these services and how these socio-economic evaluations will be used in fisheries management is still very much "work in progress".

Delimitations in time and space

While three marine sub-regions have been identified (the Kattegat and Skagerrak, the Baltic Proper, and the Gulf of Bothnia), setting the boundaries at geographical and temporal scales for EBFM has apparently not been regarded as a priority for management authorities until now. Furthermore, how these boundaries will match or correspond to current institutional structures and process and their jurisdictions will need substantial changes and re-organization of power structures.

Flexibility and adaptability

In Sweden, monitoring of marine environmental status has been well organized to allow for adaptation and flexibility on measures to follow up and learn. On the other hand, social and even political dynamics - that are in many cases the main drivers of environmental marine changes have been neglected. Lack of social indicators, monitoring and assessments of fisheries management cycles remain a challenge for the flexibility and adaptation of the current system which will need substantial learning and fitting of governance processes. Co-management initiatives in Sweden have reported to foster flexibility and adaptation.

6. FINAL RECOMMENDATIONS

Various recommendations - in no particular order - for the implementation of EBFM based on reported challenges identified in this report are:

Challenge:
EBFM is an unclear concept and different persons interpret the concept differently. EBFM can be perceived as a framework for protecting the biophysical marine environment over other social and economic objectives and goals.

Recommendations:
Regard EBFM as an approach that seeks holistic management and overcomes fragmentation by finding ways to link different values and principles, areas of authority and jurisdiction, pieces of geography and periods of time – from the past to the future.

Challenge:
The people and institutions responsible for managing fisheries are over-challenged and overworked with EBFM implementation.

Recommendations:
Invest in individual and collective capacity building. Provide training for negotiation, collaborative processes and facilitation. Employ a dedicated, neutral program officer, skilled in facilitation.

Challenge:
Managers have often approached EBFM as an added layer of science or modelling that informs conventional management (e.g., adding new parameters to stock assessments), without considering the goals, strategies, or allocation processes inherent to EBFM.

Recommendations:
Accommodating to change is something that individual and organizations find difficult to cope with. Ensure the implementation team share an understanding of the principles and objectives of EBFM. Work with visionaries. Regard the implementation of EBFM as a "process", which constantly requires social, political and legal changes and adaptations, and not as a mandate to fulfil through accommodating current institutional and governance settings. The nature of existing structures and processes will affect the cost-benefit relation and the time frame for the EBFM implementation. It should therefore be also highlighted that the process is time and funding consuming.

Challenge:

A "human dimension" of EBFM is still sometimes confused in the literature as meaning the consideration and the management of the impacts or pressures of humans in the ecosystem.

Scientists reluctance about indicators can exist that address societies priorities rather than ecosystem functioning. The perception that social objectives are demanded by some romantic-driven social scientists or that social sciences provide "anecdotal" evidence not appropriate for policy and decision-making

Recommendations:

Create a safe space or arena to explore different views and facilitate mutual learning. The implementation strategy should include a "Plan of Action" towards a common understanding of what is meant by EBFM, considering different points of views and avoiding top-down imposed definitions. The same applies for the development of fisheries objectives and indicators were co-production and transdisciplinary methods are indispensable. Work with social and natural scientists with much more open-minds, and encourage open, curious and mutually respectful minds.

Challenge:

Scarce availability of social data, an absence of a critical mass of social scientists and awareness among managers and decision makers of the social character of the fishing industry.

Recommendations:

Invest in social data collection and recruitment of social scientists. The implementation strategy should secure adequate funding resources for research to understand social and political processes and change, as well as more developed transdisciplinary frameworks for monitoring and adapting EBFM implementation. The growing body of research from the social sciences of fisheries management needs to be more seriously considered for policy and decision-making to take account of the social, political and legal implications of EBFM.

Challenge:

Social objectives integration in fisheries management remains a challenge.

Recommendations:

Learn from global experiences in fisheries management systems where social objectives and indicators have been developed and are in the process of integration e.g. in Australian fisheries. Use recommended tools from the literature.

Challenge:
Scientists and stakeholders consider EBFM as a "buzzword" and are getting frustrated with endless planning processes.

Recommendations:
Plan and discuss, but also act! Where possible, processes should identify how to carry out actions and how to influence decision-making and who will provide funding.

Develop an overarching EBFM strategy where all parties involved in implementing remain accountable for the consequences of management actions (i.e. clarification of actor roles, accountability and responsibilities). Following the Malawi Meeting "the ecosystem approach should include a system of accountability that addresses performance of managers and decision-makers, and achievement of management objectives" (Prince and Henne 1998).

Challenge:
Complexity provides multiple opportunities for vested interest groups within the system to manoeuvre in pursuing their own interests. Vested interests of the different stakeholder groups are unlikely to buy into integrated approaches if they think that they are better served by the existing approach.

Recommendations:
The EBFM implementation strategy should account for changes in social values and power relations at different levels of the governance system and be prepared for the emergence and needs for resolution of normative and ethical disputes. Governance values should be aligned with stakeholder's values to improve the governability of the fishery in a legitimate and transparent process.

Continue working towards a renovation of the current fisheries management policy process to allow for co-management implementation following the recommendations given in Table 2. In this case, previous co-management initiatives in Sweden should be considered as valuable experiences providing numerous lessons to learn from.

The design for the structure of the governance in the implementation strategy should consider neutral and multidisciplinary actors at the high level of the organization. The supremacy of one discipline among managers and policy-makers should be avoided.

Challenge:
Different types of knowledge integration is about using knowledge or data collected by stakeholders to support scientific knowledge.

Recommendations:
Beyond science, EBFM implementation also needs to transcend the domain of scientific

expertise and take account of other relevant knowledge sources such as the local ecological knowledge of fishers and other actors (see Principle 3). Experiences with stakeholder interactions and participation, e.g., at the EU-level with ACs, at local or national levels with FLAGs and other initiatives (e.g. Bryhn et al. 2016) should be considered as relevant cases to learn from. Programs or projects for knowledge exchange and development of shared understandings are needed in EBFM for practical incorporation of fisher's knowledge. Such initiatives might also enhance social capital and empowerment of actors; however, precaution is needed when knowledge is privileged or sacred based in cultural norms and social relations of certain indigenous fishing communities (Poe et al. 2014)

Challenge:

Lack of legal mandate.

Recommendations:

With respect to the legal implications, the EU Common Fisheries Policy is explicit in the "need to implement an ecosystem-based fisheries management" (EC 1380/2013): Likewise, further regulations like the Marine Strategy Directive Framework are implicit in the need of EBFM implementation. Even if, no sanctions mechanisms are in place for the compliance of these regulations, the Swedish government should use this legislation as the appropriate umbrella to develop its own national legislation Domestic and micromanagement rules for EBFM should be evolved regardless of gaps or overlaps in EU current legislation. For guidance on how to revise fisheries legislation and how to proceed to legislate towards EBFM see FAO (2016) "A How-to Guide on legislating for an ecosystem approach to fisheries" available online at http://www.fao.org/3/a-i5966e.pdf.

GLOSSARY

Adaptive co-management a process whereby institutional arrangements and ecological knowledge are tested and revised in an ongoing, self-organized and dynamic process of learning-by-doing, in simple words, when participative co-management is combined with learning by doing. (Armitage et al. 2007).

Adaptive management is the contemporary scientific version of the age-old, trial-and-error or "learning by doing" of traditional societies. Adaptive management starts with the assumption of incomplete information and relies on repeated feedback learning in which policies are treated as experiments from which to learn (Berkes 2009).

Capacity-building is the sum of efforts needed to nurture, enhance and utilize the skills and capabilities of people and institutions at all levels, towards a particular goal, for example participatory management. The logic of capacity-building is simple: involving fishers in the management process depends on their ability to self-organize to help in the making and enforcing of rules.

Co-management a resource management partnership in which local users and other stakeholders share power and responsibility with government agencies (Armitage et al. 2007), or, a partnership arrangement in which government, the community of research institutions and other fisheries and coastal resource stakeholders (boat owners, fish traders, credit agencies or moneylenders, tourism industry, etc.) share the responsibility and authority for decision-making over the management of a fishery. However, all these parties do not have a stake equal to fishers, and the sharing of responsibility and authority is not likely to be equal.

Co-production of knowledge the collaborative process of bringing a plurality of knowledge sources and types together to address a defined problem and build an integrated or systems-oriented understanding of that problem (Armitage et al. 2011;996). Co-production of knowledge, is a process by which managers and fishers interact to define important questions and relevant evidence, sometimes carry out participatory research, and engage in a joint deliberation to make sense of the observations (Berkes 2009).

Cultural keystone species the culturally salient species that shape in a major way the cultural identity of a people, as reflected in the fundamental roles these species have in diet, materials, medicine, and/or spiritual practices (Garibaldi and Turner 2004).

Empowerment is having the power and responsibility to do something; the ability of a person or a group of people to control or to have an input into decisions that affect their livelihoods. Effective participation, after appropriate capacity-building, can bring about empowerment.

Fisheries management the integrated process of information gathering, analysis, plan-

ning, consultation, decision-making, allocation of resources and formulation and implementation, with enforcement as necessary, of regulations or rules which govern fisheries activities in order to ensure the continued productivity of the resources and the accomplishment of other fisheries objectives. (Cockrane 2002)

Institutional interplay, horizontal and vertical is about linkages among institutions, at both the same level of social and political organization and across levels. Institutional interplay can involve the linkage of institutions horizontally (across the same level of organization or across geographical space) and vertically (across levels of organization). The simplest kind of vertical institutional linkage is a two-party co-management arrangement between a resource user group and the government. A multi-stakeholder process usually creates horizontal linkages among the players.

Institutions are socially constructed codes of conduct (rules and norms) that define practices, assign roles and guide interactions. This definition of institutions, as the set of rules actually used, is different from the common use of the term generally to mean agencies.

Multi-stakeholder process Multi-stakeholder bodies bring together stakeholders, including government agencies, for consultation and assessment. The distinction between multi-stakeholder processes and co-management is not always clear. Such processes are often used.

Salience of research refers to the most noticeable and important or adequate scientific research to be used in decision making.

Social learning the collaborative or mutual development and sharing of knowledge by multiple stakeholders through learning-by-doing (Armitage et al. 2007).

Stakeholder analysis is a process that seeks to identify and to describe the interests of all of the stakeholders in a fishery. It is considered to be a necessary stage to carry out participatory management.

Stakeholders are individuals or groups (including governmental and non-governmental organizations or NGOs, traditional communities, universities, research institutions, development agencies and banks, donors, etc.) with an interest in the fishery management processor a claim on the resource.

Transdisciplinary research is a reflexive, integrative, method driven scientific principle aiming at the solution or transition of societal problems and concurrently of related scientific problems by differentiating and integrating knowledge from various scientific and societal bodies of knowledge (Lang et al. 2017). In transdisciplinary research, research questions are framed in ways that transcend scientist's disciplinary origins and require new integrative understanding. Transdisciplinary research refers to research that (1) tackles real life problems, (2) addresses the complexity of these problems by involving a variety of actors from science and practice and accounting for the diversity of their perspectives, and (3) creates knowledge that is solution-oriented, socially robust, and transferable to both scientific and societal practice (Hoffman et al. 2017;26).

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ANNEXES

Annex 1. Proceedings of the workshop "Implementing Ecosystem-based Fisheries Management in Sweden: social, political and legal governance implications"

Purpose:

Gathering social, political, legal and interdisciplinary researchers to initiate an analysis of the current governance and management system and identify alternative arrangements and policy tools leading to the implementation of ecosystem-based fisheries management (EBFM) in Sweden.

Expected results:

- An initial overview of the current governance system highlighting critical social, political and legal governance issues, structures and processes that enable or disable implementation of EBFM.
- Initial recommendations for governance reforms to further enable implementation of EBFM in Sweden – including alternative arrangements for both formal and informal structures and processes.
- Identification of social, political and legal research priorities for supporting EBFM governance reforms in Sweden.

The results of the workshop will inform the further development of a Swedish EBFM strategy and associated stakeholder dialogues during 2017/18. The intention is that the workshop will lead to further collaboration between researchers, stakeholders and management authorities on governance research to enable EBFM in Sweden.

Context: The Swedish government has commissioned the Swedish Agency for Marine and Water Management (SwAM) to develop a strategy for how ecosystem-based fisheries management can be developed in Sweden. EBFM is to become an integrated part in achieving objectives for marine and water management while considering cost-effectiveness (for background see Regeringsbeslut I:46 2015-12-17 and SOU 2014: 15).

The strategy should bring up suggestions on how primarily Swedish, and in extension European and international, governance systems concerning the management of fish and fisheries, can evolve to enable an ecosystem approach. In the context of EBFM, scientific attention has often been directed at researching and modelling the ecological linkages of fish and fisheries in aquatic systems - in very few cases social and economic drivers have been overlooked or neglected. There is now a growing recognition that studying the social, political and legal aspects of governance systems is also crucial to enable implementation of the key working principles of the ecosystem approach.

Key questions:

- How to achieve a collective (trans-disciplinary) selection and prioritising of fisheries management objectives?
- How are social welfare and distributional effects of fisheries management being assessed?
- How are trade-offs going to be illustrated, communicated, negotiated and legally settled?
- What type of stakeholder participation should be enabled and at which stages of the governance process?
- What are the choices of appropriate EBFM spatial and temporal scales?
- How is the effectiveness of management approaches monitored and assessed?
- Which incentives for learning and adaptation in the governance system could be introduced?
- Which legal frameworks and procedures exist for EBFM in Sweden and what reforms may be required?

The workshop will open a discussion on these social, political and legal dimensions of fisheries governance to support the definition of innovative arrangements (composition and interactions) aiming to combine the three pillars of EBFM - ecological, economic and social sustainability and apply its six working principles (see Definitions below). Therefore, both bottom-up and top-down structures and procedures on different geographic and administrational scales require consideration.

Proceedings:

The one-day workshop was divided in 3 sessions, which included keynote presentations, a panel and roundtable discussion among participants.

Session 1: Synthesis of Social dimensions of EBFM Implementation in Sweden - state of the art and experiences

The first session consisted of six presentations. A summary of the discussed topics is presented in the text below:

Paulina Ramirez (IFM-Denmark) presented the institutional challenges for implementing EBFM based on a three-layer framework were the principles, operational level and challenges under the *Common Fishery Policy* (CFP) are displayed. The analysis categorized the operationalization and challenges of EBFM principles in: 1) Large challenges were

new innovative solutions might be needed, 2) Medium level of EBFM principles implementation and medium level challenges, 3) Challenges to be coped with by careful rethinking, and 4) Challenges that need a "one step at the time" approach. The results of the analysis are presented in Table A1.

Marine governance regionalization in the EU context was introduced with the presentation *Towards holistic regionalized marine governance – a challenge to ecosystem-based fisheries management?* by Troels Hegland (IFM- Denmark). A regionalization process is currently taking place under the CFP aiming at efficiency, process and content legitimacy. Despite perceptions among stakeholders that this process has delivered benefits to EU marine governance some difficulties have arisen. Strengthening transparency, fostering a co-management "spirit", clear outlining of multilevel interplay and working procedures are among the most conspicuous perils. Finally, the transition from sectorial to multisectorial ecosystem management remains a question of whether the new process and outcomes can be regarded as a "better" governance approach than the older system.

In the Swedish context, the developments of implementing the Ecosystem Approach (EA) were examined for the period 2002 and 2015 by Henrik Österblom from the Stockholm Resilience Center (*Tinkering with a tanker – slow evolution of a Swedish ecosystem approach*). The slow progress for this EA implementation was attributed to mainly a lack of political will and various structural problems. These problems have been identified as: difficult establishment of a bridging organization, competences disputes between scientists, limited capacity to react after crisis and limited innovation. A programme for strategic learning and evaluation and promoting political leadership were tasks recommended to impulse EA implementation.

Advances in the developments for a framework to assess EBFM implementation considering social and ecological outcomes were also presented and discussed in the first workshop session. The framework uses a three-step questions procedure related to level of system thinking, specificity and integration of five ecosystem principles of EBFM. The advantages of this framework were identified during the presentation *Towards ecosystem-based management - assessing progress and managing processes* (by Beatrice Crona from the Stockholm Resilience Center and Annica Sandström from Luleå Tekniska Universitet) as:

- provides a meaningful, transparent, and fairly robust assessment process for the multi-facet concept EBM
- allows for the breaking out, and examination, of isolated parts of the assessment matrix and accommodates contextual variability
- can be used to evaluate both single and multiple cases of EBFM
- is particularly useful for longitudinal studies of governance transformations

The relevance of collaboration among stakeholders and networks for an EBFM process was also stressed. Networks that have more chances to success were networks with high

stakeholder diversity, were guided by a central coordinator or presented close communication levels and showed commitment of formal (government) actors.

Table A1 Institutional principles analysis and future challenges (in grey) for an EBFM implementation in the EU (adapted from Ramirez et al. 2016).

LARGE CHALLENGES	MEDIUM LEVEL CHALLENGES	NEED CAREFULLY RE-THINKING	NEED A "ONE STEP AT THE TIME" APPROACH
Development of framework/tool to evaluate multiple objectives (env., eco., socio.) simultaneously and with transparency	Best available knowledge to manage human activities	Reduce negative impacts of fisheries activities on marine ecosystems	Negative impact of non-fisheries related pressures on marine habitats
Institutional support to move from short-term to long-term	Resource users gaining more sense of ownership		
	Management at appropriate scale		
Different weights are applied by different agencies to env., eco. and social objectives	Scientific-based advice vs. Experience-based advice	MSFD and CFP: some of its measures are questioned as to really promoting an EAFM	Challenging to design all-inclusive policy tools
No framework/tool to evaluate multiple objectives	AC's position appears to be strengthened (but still, neither COM or MS obliged to follow their recommendations)	Mismatch between MSFD and CFP in terms of competences, discourse, and decision-making	
Surrounding institutional and legislative context remains thinking short term	Are all users really involved/represented?		
	Centralized management remains		
	"Voluntary" regionalization; unclear rules of collaboration between ACs and MS's regional groups		
	RSC having a role?		

The presentations *The Swedish Fisheries Co-management Initiative 2004-2007: What can it tell to the implementation of Ecosystem- based Fisheries Management in 2016? by Laura Piriz from the Swedish Agency for Marine and Water Management (SwAM) and Co-management Norra Bohuslän - success or?* by Kerstin Johanesson from Gothenburg University dealt with past Swedish initiatives to implement stakeholder participation in fisheries management and decision-making. Based on experiences in Norra Bohuslän, the strengths of a local management experience between fishermen, local politicians, scientists and authority representatives were identified as:

- Shared visions
- Trust
- Local knowledge
- Continuous dialogue
- Local leadership

Local management is advantageous also for biological health allowing for specific fish populations management at the genetic level. For the implementation of EBFM, fisheries agencies and the state provincial offices - as administrative authorities, must recognize and internalize in their work that:

- the management of fisheries has always distributional effects
- the fact that governance at sea is distributed
- there is a complex institutional structure
- single leaders and representativeness in complex systems is problematic
- he governance of fish resources runs also in parallel to the established dominant framework

The main conclusions from the local co-management initiatives in Sweden were identified as follows:

- Each case is unique. EBFM implementation is context specific.
- New themes and topics to negotiate evolve along the process.
- Professional fishermen engage actively when they see clear benefits.
- The larger the number of user's groups and stakeholders the more likely it is that problems with for resource allocation will arise.
- Project/program leaders should facilitate, not be "influential".
- Co-management means disruption of the established system, takes time, needs incentives, demands communication and constructive vertical institutional interplay and adaptive capacity.

Last but not least, an outline of the role of law in EBFM implementation under EU legislation was presented by David Langlet from University of Gothenburg. In his presentation *The Role of Law in Ecosystem-Based Fisheries Management: An Outline* Langlet explained that the CFP recommends member states to implement an ecosystem-based approach to fisheries management (Article 2). However, one main problem is that there are no legal measures to sanction member states that do not implement EBFM.

Session 2: Roadmap for EBFM implementation in Sweden – Recommendations for governance reforms in Sweden to further enable EBFM implementation.

This session was organized in one presentation and four roundtable discussions. Results of the discussions are presented in Table A2 below.

The presentation *National regulation of fisheries in Sweden* by Martin Rydgren from SwAM, explained the role of the Unit for Fisheries Policy at SwAM to regulate fisheries under the CFP and national legislation. This Unit deals mainly with regulations for small-scale inshore commercial fishing and recreational fishing. New regulations are triggered by recommendations by experts' researchers from SLU Aqua and by County Administrative Boards and then prioritize mainly based on expert's advice. Regulation proposals are sent to stakeholders for consultation and the General Director of SwAM takes the decision. Monitoring of regulation effectiveness is limited. Under this system, the main challenges for EBFM implementation are:

- Geographical delimitation - in many cases the "ecosystem" is larger than the area SwAM can regulate. National regulation is not enough in many cases and international cooperation is necessary.
- Institutional fragmentation - Mandate to address other impacts on fish and their environments is limited. SwAM can only regulate fishing activities, other legislation and agencies carry the mandate to address other impacts such as marinas, seals, etc.
- Coordination with other agencies.

Likewise, recommendations and requirements for Swedish EBFM under national regulation are:

- Knowledge - of the ecosystems but also about fisheries including recreational fisheries (currently no obligation to report catches from recreational fisheries, no need for national license, etc.).
- Assessment and follow up of regulations to enable adaptive management (both biological and socio-economic).
- Enable stakeholder involvement – how to make this cost/time effective?
- Resources - funds are needed for all of this – where will it come from? What is feasible and how shall we prioritize?

Session 3: Research priorities to support EBFM implementation in Sweden – Identification of social, political and legal research priorities for supporting EBFM governance reforms in Sweden

This session was organized in four roundtable discussions. Results of the discussions are presented in Table A3.

Panel discussion

Workshop participants discussed a diverse set of topics. The characteristics of EBFM as a process were problems like overexploitation may persist and new management challenges will evolve with time was one point of view discussed. Despite a clear definition of EBFM there are experiences in Sweden and internationally that should be used in an implementing process. For example, the need for a transparent and accountable implementing process was stressed. At the same time some questions persist:

- Can EBFM be implemented in isolation or does it need to be implemented simultaneously with changes in the management of other important economic sectors in the marine environment (e.g.energy, shipping, etc.)?
- Are ecological objectives a priority in EBFM?
- EBFM principles are clear defined for SwAM, but what about stakeholders, county authorities, politicians and scientists? Do they agree with this EBFM definition?
- What is the meaning of and what are the expectations of "stakeholder participation" for SwAM, other authorities, politicians, stakeholders, etc
- How are vested interests an obstacle for EBFM implementation, at the level of SwAM for example?
- How can we deal with lack of leadership?
- What goes on in the minds of managers and "mandates" hindering EBFM implementation?
- How to cope with institutional competition and scarce funds?
- How to solve the problem of different capacities and agendas among CFP member states to implement regionalization?
- What can we learn from marine spatial planning experiences?
- What is the role of ecosystem services in EBFM?
- How can behavioral sciences research be used for implementing EBFM?
- To want extent do we access or do not access the distributional effects of the decisions taken in fisheries governance?

Finally, a discussion on the organization of SwAM to deal with EBFM also took place.

Regarding this topic, SwAM was previously organized in terms of viability to accomplish certain functions from data collection to regulations enactment, and from regulations to monitoring. The current organization of the agency reflects the "tools" that are at hand like Marine Protected Areas, Fisheries Management, Marine Spatial Planning; and it is not appropriate for EBFM since tools are methods to achieve specific goals and shouldn't be used to define the goals. The data gathered by SwAM is also deficient for EBFM since no social data is collected or analysed. SwAM seems to be governed under a top-down regime were aims, objectives and tools are many times imposed by international EU policy.

Table A2: Results of the four workshop roundtable discussions of Session 2: Roadmap for EBFM implementation in Sweden.

QUESTIONS	GROUP 1	GROUP 2	GROUP 3	GROUP 4
How to prioritise- trans-disciplinary fisheries management objectives?	Tools and methods are available for prioritization, e.g. Ecological Risk Assessments; and placed-based methods for dealing with trade-offs. Balance between ecological and social-economic objectives? or is the ecosystem setting the boundaries?	The EBFM mandate and the expectations should have clear objectives and clear boundary conditions. Boundaries and mandates exist, like the mandate of setting MSY and use the precautionary approach of the CFP and good environmental quality of the MSFD; these cannot be negotiated with stakeholders. A national authority should prioritize the problems and use a problem-specific approach for implementing EBM.	Defining strategic objectives and tactic objectives. Strategic objectives are more important than tactic. Strategic objectives should be discussed at international regional levels within the EU CFP. Tactic objectives should be discussed at local levels. The costs of implementing should be considered while setting the objectives. Without a balance on the ecological system there is nothing to be exploited, therefore the balance for ecological, economic and social objectives of EBFM does not apply. The ecological objectives are prior to other objectives. What kind of ecosystems should be aim for needs also to be solved during prioritization e.g. a cod dominated system or a sprat dominated system.	The objective of EBFM is "long-term sustainable ecosystems" and no prioritization is needed. Experts should set the objectives and not necessarily stakeholders.
What structures for stakeholder participation should be enabled and at	Ad-hoc approaches have been developed in Swe-			Avoid common skewed stakeholder's

which stages of the governance process?	den. Many good examples to engage stakeholders for participation. There are clear mandates in Sweden and good examples of good structures to use.			participation e.g. towards the fishery sector. Maybe not all stakeholders are interested in participating in all stages of governance. Costs and efficiency of large groups should be discussed a priori.
What kind of knowledge should be considered (what research do we need)			EBFM demands large quantities of knowledge, ecological and social.	Natural scientific knowledge is the most important.
What are the choices of appropriate EBFM spatial and temporal scales?		The ecosystem is setting the scale. No stakeholder discussions in setting the scale. Many ecosystems in Sweden. Goals are defined by authorities following a problem-specific approach e.g. dealing with eutrophication.	Sweden should implement Ecosystem-based FISH management, managing fish stocks and their surroundings. No multi-sectoral EBM is possible at this point.	
How should trade-offs be illustrated, communicated, negotiated and legally settled?	Through stakeholder participation and clear rules.	Clear objectives and how to handle trade-offs should be in the EBFM mandate.		Trade-offs should be subject to research, discussed with stakeholders and communicated by the media. People negatively affected by trade-offs

				should be financially compensated.
How do existing governance frameworks and procedures need to be changed for EBFM in Sweden?	Drawing from good examples. Using structures in place, no necessary need for major changes.	Administration needs units that are constant on a temporal scale while leading with problems will be a constant change.	There is a late general trend of recovering of fish populations in the EU, thus "good" structures should be kept.	Environmental and fisheries management should be integrated and fishermen should be on-board.

Table A3. Results of the 4 workshop roundtable discussions from Session 3: Research priorities to support EBFM implementation in Sweden.

THEMES	GROUP 1	GROUP 2	GROUP 3	GROUP 4
Common goals, participation, and knowledge for EBFM (trade-offs and how to evaluate costs and benefits)	Positive effects of stakeholders. Comparison within Sweden and international examples of implementing EBM. Contribution of non-scientific knowledge. How can scientific knowledge be used outside academia for EBFM.	Not always more research is needed. Better to understand the process how knowledge can be used for EBM and how to engage scientists. Improvement of science-policy interface and communication between managers and scientists. Scientists in the board of SwAM?	How to link ecological and socio-economic disciplines using a common language. Social sciences research. Study of current decision-making process. E.g. What are the mandates of BAC, Baltfish, HELCOM, etc and the roles of stakeholders in these? How to define and reach stakeholders? Understanding of mechanisms for non-compliance. Definition of stakeholder's role in participatory management. Dangerous to leave all decisions to the experts.	What do managers. stakeholders and general public perceive as the objectives of EBFM? How to identify stakeholders? And how to avoid marginalization of groups? How to make stakeholders with different agendas agree?
Nature's ability to produce goods and services - sets limits (uncertainty and risk management)	Cost and benefits of fisheries in their cultural socio-ecological context in which they operate.		Quantitative data from social sciences. Models of social outcomes of management scenarios.	How are common resources use? More cost-benefits studies. Cost-effectiveness effects of ecological measures e.g. sea grass transplantation.

Delimitations in time and space – what are the appropriate scales (geographically and long-term)		Long-term management needs to be studied. Stakeholder's stakes are present but what about in 100 years?		Whether managers or social scientists should design limits?
Flexible and adaptable institutions (formal and informal) and governance	Monitoring capacities for ecosystem changes and compliance.			How do institutions adapt to societal and environmental changes? Social and economic indicators.

Annex 2. Workshop - List of participants

Implementing Ecosystem-based Fisheries Management in Sweden: social, political and legal governance implications.

Gothenburg, 30 November 2016

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