Marine Policy 49 (2014) 59–65

Contents lists available at ScienceDirect

Marine Policy

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

How sustainable is sustainable marine spatial planning? Part I—Linking the concepts

Catarina Frazão Santos [a,b,*], Tiago Domingos [c], Maria Adelaide Ferreira [d], Michael Orbach [b], Francisco Andrade [a]

[a] Centro de Oceanografia, Laboratório Marítimo da Guia, Faculdade de Ciências, Universidade de Lisboa, Avenida Nossa Senhora do Cabo 939, 2750-374 Cascais, Portugal
[b] Duke University Marine Laboratory, Nicholas School of the Environment and Earth Sciences, Duke University, 135 Duke Marine Lab Road, Beaufort, NC 28516-9721, USA
[c] IN+, Centro de Estudos em Inovação, Tecnologia e Políticas de Desenvolvimento, Instituto Superior Técnico, Universidade de Lisboa, Avenida Rovisco Pais, 1049-001 Lisboa, Portugal
[d] e-GEO, Centro de Estudos de Geografia e Planeamento Regional, Faculdade de Ciências Sociais e Humanas, Universidade Nova de Lisboa, Avenida de Berna 26-C, 1069-061 Lisboa, Portugal

ARTICLE INFO

Article history:
Received 19 March 2014
Received in revised form
31 March 2014
Accepted 7 April 2014

Keywords:
Maritime spatial planning
Sustainability
Ecosystem-based approach
Adaptive management

ABSTRACT

Marine spatial planning (MSP) has emerged worldwide as a tool for sustainable ocean governance. This paper reviews how sustainability and ecosystem-based management (EBM) have been included so far within the MSP general framework, by carrying out: (1) a review on the links between sustainability, EBM and MSP in EU maritime policy initiatives; (2) an analysis on the differences between ecosystem-based MSP versus MSP focused on delivering blue growth; and (3) a discussion on how adaptive management may address some of the main challenges found in achieving sustainable ocean management. From the EU Green Paper (2006) to the MSP Directive Proposal (2013), MSP processes based on the principle of EBM have been recognized as a necessary tool to ensure maritime sustainable development. Although ecosystem-based MSP has been recently presented as the best way to ensure both ecosystem conservation and development of human activities, most national and European MSP initiatives seem to follow a MSP approach focused in delivering blue growth. A challenge, therefore, arises: how to adjust policy decisions to properly preserve ecosystems and the services they provide? If truly implemented, an adaptive approach seems to be a way forward in ensuring that spatial planning, management and policy-making in marine spaces can be continuously adjusted, thus allowing for sustainability.

1. Introduction

In 2007, the European Union (EU) adopted an Integrated Maritime Policy [1] that encompasses the regulation of all elements of maritime activity, while providing for a new ecosystem-based management approach (EBM) to human activities in the sea [2]. EBM is an integrated, place-based approach that focuses on a specific ecosystem and on the range of activities affecting it, recognizing the existing connectivity amongst all of its elements, including humans ("people are integral components of social–ecological systems[1] (…) [as they] both affect and respond to ecosystem processes" [3]), and thus aiming for both socioeconomic development and environmental preservation [4,5]. In 2008, the EU Marine Strategy Framework Directive (MSFD) reinforced this idea, while requiring member states to apply the EBM concept and to achieve and maintain a "good environmental status" (GES) in their marine environment [6].

Marine spatial planning (MSP) – or *maritime* spatial planning, as it is referred to in Europe – has been pointed out by some

* Corresponding author at: Centro de Oceanografia, Laboratório Marítimo da Guia, Faculdade de Ciências, Universidade de Lisboa, Avenida Nossa Senhora do Cabo 939, 2750-374 Cascais, Portugal. Tel. +351 214869211.
E-mail addresses: cfsantos@fc.ul.pt (C. Frazão Santos), tdomingos@ist.utl.pt (T. Domingos), adelaide.ferreira@fcsh.unl.pt (M.A. Ferreira), mko@duke.edu (M. Orbach), faandrade@fc.ul.pt (F. Andrade).

http://dx.doi.org/10.1016/j.marpol.2014.04.004
0308-597X/

[1] Although the term *socio-ecological system* is commonly accepted and used, we acknowledge that if humans are truly considered as part of ecosystems it is somewhat redundant to use it. The "ecological system" already encompass humans by definition (as any other occurring species) and, consequently, their social, cultural and economic dimensions; referring to *socio-ecological systems* is the same as referring to "a store that sells *fruits* and *apples*" or "an area to protect *marine mammals* and *whales*", assuming the second definition is not included in the first. This is why throughout the text we preferred the use of the term *ecosystem*.

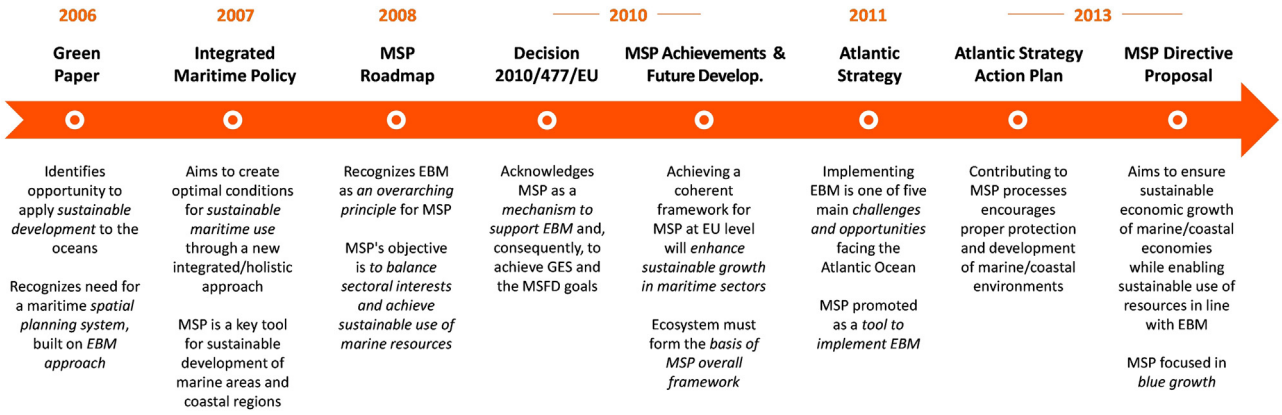

Fig. 1. Timeline of major European policy initiatives addressing marine spatial planning (MSP), with a brief description of each initiative's main ideas regarding MSP, ecosystem-based management (EBM) and sustainability.

member states as an operational tool to implement EBM and, subsequently, MSFD goals [2,7–9]. Commonly defined as a "public process of analyzing and allocating the spatial and temporal distribution of human activities in [coastal and] marine areas to achieve ecological, economic, and social objectives that are usually specified through a political process" [10], MSP consists of "data collection, stakeholder consultation and the participatory development of a plan" [8], as well as the ensuing stages of implementation, monitoring, evaluation and revision of such plan [11]. Given that EBM is to be the underlying principle of MSP [4,8], the planning process must always take into account the biophysical, human and institutional dimensions of a given ecosystem – its "total ecology" [12] – making the necessary trade-offs to achieve "the right mix of protection and use" [13], thus allowing for socioeconomic development without compromising the use of resources by future generations.[2] Ecosystem-based marine spatial planning and management has been presented, therefore, as the best way to ensure sustainability of marine ecosystems and the services they provide [10].

Given its relevance for the long-term adequacy of marine planning and management, the present work analyzes how *sustainability* and *EBM* have been included so far within the MSP general framework. It starts by (1) reviewing the links between sustainability, EBM and MSP in EU policy initiatives; (2) then it analyzes the differences between MSP focused on ecosystem conservation and MSP that prioritizes the development of a maritime economy; and finally (3) it discusses how an adaptive MSP approach could address some of the main challenges found in achieving sustainable ocean management.

2. Linking the concepts: sustainability, EBM and MSP

According to Katsanevakis et al. [14] in a recent review on the subject, EBM is an "emerging paradigm of ocean management" that has been promoted worldwide as the best way to ensure sustainability of marine ecosystems goods and services. Although there is a plethora of different definitions (e.g. [15–18]) and terminologies for EBM (e.g. ecosystem management, ecosystem approach, ecosystem-based marine spatial management), a set of common criteria to describe EBM was identified by Arkema et al. [19]. According to these authors, EBM is characterized, in general, by the concepts of "sustainability", "ecological health" and "inclusion of humans in the ecosystem" and, more particularly, by considering: (1) *specific ecological criteria*, such as "ecosystem complexity" or "ecosystems dynamic nature across temporal/spatial scales"; (2) *specific human dimension criteria* – e.g. "ecosystem goods and services", "economic factors" and "stakeholders engagement"; and (3) *specific management criteria*, such as "adaptive management", "co-management", "precautionary approach", "interdisciplinary knowledge" or "monitoring"[3] [19]. Concomitantly, Stojanovic and Farmer [20] recognize that although sustainability is constantly used to frame the intentions of ocean policies,[4] in practice, there also are a multiplicity of interpretations for it (i.e. it is highly differentiated).

In the last decade, EU maritime policy initiatives have continuously emphasized the importance of progressing towards EBM implementation, as well as of achieving a sustainable use of marine and coastal ecosystems (Fig. 1). In 2006, the *EU Green Paper*, recognizing that sustainable development was "at the heart of the EU agenda", identified the opportunity to apply such a principle to the oceans [21]. Aiming to promote a debate on the future of EU Maritime Policy, the Green Paper sought to achieve the right balance between the socioeconomic and environmental dimensions of sustainable development, and to consider a new and holistic approach to the management of marine/coastal areas. Here, for the first time, the Commission acknowledges the need for "a system of spatial planning for maritime activities" that must build on the EBM approach [21]. In fact, although the EBM concept had been previously mentioned in the Commission's communication *Towards a Strategy to Protect and Conserve the Marine Environment* [22] and in the proposal for a *Marine Strategy Directive* [23] (which later resulted in the MSFD, the "environmental pillar" of EU maritime policies) such documents have no specific reference to MSP.

Later in 2007, however, the *EU Integrated Maritime Policy* (IMP) [1] clearly identified MSP as one of three major "horizontal planning tools" for integrated policy-making (that cut across maritime sectoral policies and support joined-up policy making). Aiming to create optimal conditions for sustainable ocean use (which is acknowledged by the Commission as a "major global challenge"), while enabling the growth of maritime sectors and coastal regions, the IMP highlights the need for a new, integrated and holistic approach that can provide "a coherent policy

[2] As pointed out by Chapin et al. [3] "efforts that fail to address the synergies and tradeoffs between ecological and societal well-being are unlikely to be successful" in the long-term.

[3] "Ecological" and "human dimension" criteria relate to specific components of ecological health and the inclusion of humans in the ecosystem, while "management" criteria include diverse approaches to administration as well as the use of science and technology.

[4] These authors analyzed seven maritime governance regimes – Australia, Canada, New Zealand, EU, South Africa, United Kingdom and United States of America – in order to study how sustainability is conceptualized for the oceans.

framework" for such a maritime sustainability. Here, MSP emerges as a "fundamental tool for the sustainable development of marine areas and coastal regions, and for the restoration of Europe's seas to environmental health" by addressing emerging challenges from growing competing uses in the maritime space (e.g. maritime transport, aquaculture, and off-shore energy production) [1].

Following the intentions expressed in the IMP, in 2008 the Commission released the *EU MSP Roadmap*, where the need for MSP is reaffirmed and EBM is identified as "an overarching principle for MSP"[5] [8]. The importance/role of sustainability in MSP is also clearly established: MSP's objective is "to balance sectoral interests and achieve sustainable use of marine resources in line with the EU Sustainable Development Strategy" [8]. In 2010, a second communication on MSP – *MSP in the EU – Achievements and future development* [24] – also recognizes the importance of achieving sustainability in marine planning and management. In fact, here the Commission considers that (1) it is important to achieve a coherent framework for MSP at EU level because it will "enhance sustainable growth in the maritime sectors", and (2) "without any MSP in place, the increased risk of spatial conflicts between expanding maritime uses, including the protection of the marine environment, may result in a suboptimal combination of growth and [environmental] sustainability" [24]. This communication further recognizes that "the ecosystem must form the basis of the overall framework for MSP" [24].

Also during 2010, the link between MSP and the MSFD was finally, and unequivocally, defined. In Decision 2010/477/EU [7] MSP is acknowledged as a mechanism – or a "practical approach" – to support EBM[6] and, consequently, to achieve GES and the MSFD goals. In fact, the MSFD aims to promote the improvement of environmental quality in accordance with the principle of sustainable development, through the achievement and/or the maintenance of GES. And because GES corresponds to an environmental status where marine areas are (1) ecologically diverse and dynamic, (2) clean, healthy and productive (within their intrinsic conditions), and (3) their use is at a level that is sustainable, an EBM approach needs to be consistently applied [6]. Being a practical way to support EBM – especially if "conducted as a continuous, iterative, and adaptive process" [4] –, MSP ends up being an instrument to support the wider concept of environmental sustainability. In fact, "ecosystem-based MSP" is to be "an integrated planning framework that (…) support[s] current and future uses of ocean ecosystems (…) [while ensuring] the delivery of valuable ecosystem services for future generations in a way that meets ecological, economic, and social objectives" [25].

In the *EU Atlantic Strategy* [26], in 2011, implementing the ecosystem approach is again a highlighted topic, this time as one of the five groups of "challenges and opportunities"[7] facing the Atlantic Ocean. Here, again it is recognized that MSP must be promoted "as a tool for implementing the ecosystem approach" and that "such a process [of implementing EBM] should strengthen coherence, connectivity and resilience (…) in the Atlantic". Among the main "tools" to be used by Atlantic stakeholders in programming decisions, MSP is also referred. In fact, "maritime policy flagship initiatives on maritime surveillance, marine knowledge and *maritime spatial planning* (…) will set standards at an EU level".[8] The *Action Plan* that recently complemented this strategy [27], and which is designed to deliver "smart, sustainable and socially inclusive growth", also recognizes that contributing to member states' MSP processes is a way to encourage proper protection and development of Atlantic's marine and coastal environments.

Finally, in 2013, the Commission released a proposal for a Directive establishing a framework for the effective implementation of MSP in EU waters [28] – together with the implementation of integrated coastal management (ICM).[9] Here, the concepts of MSP, EBM and sustainability are plainly linked, as the proposal's ultimate goal is to ensure "the sustainable economic growth of marine and coastal economies while enabling diverse and sustainable uses of marine and coastal resources by considering the economic, social and environmental pillars of sustainability in line with the ecosystem approach" [28]. However, this context relates to an MSP focused on ensuring "blue growth"[10] [29] and where ecosystem conservation is required, although not the ultimate goal. In fact, here EBM is first expected to allow for MSP to (1) prevent/reduce conflicts among competing sectoral activities and (2) ensure that the cumulative pressure of all activities is kept within levels compatible with GES; and, only then, to (3) ensure the protection and preservation of marine/coastal goods and services [28]. Nevertheless, this Directive proposal further acknowledges that, in order to effectively ensure sustainability: (1) "marine spatial plans" and "ICM strategies" must be properly coordinated/integrated (because marine and coastal activities are closely linked); and (2) governments, stakeholders, and the general public need to be consulted at an appropriate – i.e. early – stage of MSP and ICM processes.

3. Sustainable marine spatial planning?

Concomitantly to MSP dissemination in EU ocean policies, several nations worldwide have developed spatial planning processes in an effort to "advance sustainable ocean development" [30] – for reviews on national MSP processes and on MSP specificities see e.g. [30,31]. In effect, according to Jay et al. [30] this global dimension of MSP "reflects the international scientific and policy discourse calling for the adoption of MSP in the interests of environmental integrity and sustainable use of the world's seas and oceans". But a key question for the long-term adequacy of MSP is how it is actually addressing sustainability: Is it relying on *hard* or *soft* sustainability concepts (cf. [32])? Does it prioritize the *achievement of GES* or rather *blue growth*?

Many advocate that MSP "has its roots in marine nature conservation", as an extension of marine protected areas establishment (e.g. Australian Great Barrier Reef Marine Park[11]) and as a practical way to address broader concerns on biodiversity conservation (e.g. the goals of the *Rio+20 United Nations Conference on Sustainable Development*) [30]. Others believe that although MSP was not "created explicitly for conservation or protection" it does catalyze environmental sustainability, by fostering the

[5] Although, in effect, EBM is more than a "principle": it is a framework or a process.

[6] Decision 2010/477/EU states that "specific tools that can support an ecosystem-based approach to the management of human activities required to achieve good environmental status (…) include (…) spatial and temporal distribution controls, such as maritime spatial planning". Already in 2007, Ehler and Douvere stated that MSP could "provide a practical approach to long-term ecosystem-based management" [11].

[7] Together with (1) reducing Europe's carbon footprint; (2) sustainable exploitation of the Atlantic seafloor's natural resources; (3) responding to threats and emergencies; and (4) socially inclusive growth.

[8] Italics by the authors.

[9] The EU MSP Directive is still open for discussion (as it is still a working document) and expressed policy decisions may change in the short term.

[10] *Blue growth* is "the long term strategy to support sustainable growth in the marine and maritime sectors as a whole. It recognizes that seas and oceans are drivers for the European economy with great potential for innovation and growth".

[11] Merrie and Olsson [34] identify the original zoning scheme of the Great Barrier Reef Marine Park as one of four "preconditions for the emergence of MSP" – the others being (1) terrestrial land-use and conservation planning, (2) the development of Geographical Information Systems and (3) development of science to be used in marine planning processes.

Fig. 2. Hard (strong) and soft (weak) sustainability concepts. A socio-ecological system's overall utility (U) results from the sum of its natural capital (N), man-made capital (K) and human capital (L). Hard sustainability requires that U increases over time and that N never decreases. Soft sustainability also requires U to increase, but allows for trade-offs among N, K and L. Although conceptually pointing in different directions, near a tipping point of ecosystem's collapse the two sustainability concepts become equivalent, because N's value becomes infinite.

identification and allocation of areas for conservation purposes [31]. According to Qiu and Jones [32], a true "ecosystem-based MSP", focused in ecosystem conservation, builds on *hard* sustainability (or *strong* sustainability, as it is commonly referred to in Ecological Economics). And building on hard sustainability, ecosystem-based MSP must then ensure: (1) that the overall utility of a system increases over time – the sum of its natural (e.g. ecosystem services and goods), man-made and human capital (e.g. infrastructures, technology, knowledge); and (2) the system's natural capital never decreases [33]. This means that marine goods and services – here considered the basis or foundation for MSP – are not interchangeable with other types of capital and, should they collapse, socioeconomic sectors that depend on them are expected to collapse as well [32]. Due to the strong focus on ecosystems preservation, this "type" of MSP processes seems to prioritize the *achievement of GES* in marine ecosystems.

However, as Merrie and Olsson [34] recently pointed out "as MSP spread, the focus on ecosystem-based management and stewardship became diluted" (*ecosystem stewardship* is a framework, or strategy that intends to foster sustainability of ecosystems – including humans – under changing/uncertain conditions [3],[12]). This "shift" in MSP drivers seems to have occurred due to an increasing need to manage conflicting (existing and future) maritime uses, especially in highly industrial maritime areas [35]. Concomitantly, key points from the EU-funded MESMA project [36] highlight that "MSP in the case studies was more about integrated use than implementing ecosystem-based management. That is, the MSP was intended to provide for, or at least not obstruct, strategically important infrastructure development projects".

In accordance, most national (e.g. Portugal, Belgium, Germany, Norway, United States of America [30,31,37]) and European MSP initiatives (e.g. MSP Directive Proposal [28]) follow what Qiu and Jones [32] define as "integrated-use MSP", based on *soft* sustainability (or *weak* sustainability, as it is commonly referred to in Ecological Economics). In this context, ecosystem conservation is seen as just "one" of the sectors/pillars upon which MSP builds – the other being fisheries, energy, tourism, navigation, security, etc. – and the ultimate goal of MSP is to foster economic growth related to maritime sectors in a sustainable way [32]. That is to say, *blue growth* seems to be its priority.

Contrary to the hard sustainability concept, soft sustainability allows for compensations among natural, man-made and human capital, provided the system's capacity to supply utility increases over time [33]. But it is clear that these substitutions of ecosystem services/goods by socioeconomic development can only happen up to a "tipping point" of ecosystem change, beyond which marine services and goods collapse (cf. [38] for more information on such "boundaries"). In fact, if such threshold is crossed and ecosystems collapse irreversibly, related socioeconomic sectors will consequently come to an end, and society's overall utility decreases – and, ultimately, *soft sustainability* is replaced by *unsustainable development* [33]. This means that as such a threshold is approached, natural capital's value becomes infinite and the two sustainability concepts – hard versus soft, or strong versus weak – if correctly understood, become equivalent (Fig. 2). However, within an integrated-use MSP context, there might be a real risk of overshadowing the importance of ecosystems preservation, namely by underestimating how close such tipping points may be.

An additional problem of integrated-use MSP is that ecosystem concerns, although still part of the planning and management process, are commonly limited to the establishment of "small, unconnected networks of marine reserves" [34] – which, in turn, present a number of limitations regarding their effectiveness for nature conservation (cf. [39,40]). Concomitantly, the discussion on whether conservation should be considered a marine "use" or a policy goal underpinning the entire MSP process [41] is far from being resolved. According to Kyriazi et al. [42] "the plethora of interpretations regarding the meaning, role and position of NC [nature conservation] in planning, makes such an attempt [of integrating NC in MSP decision-making] more complex".

[12] Ecosystem stewardship integrates three overlapping sustainability approaches (for detailed information cf. [3]): (1) reducing vulnerability to expected changes, (2) fostering resilience to sustain desirable conditions in face of perturbations/uncertainty and (3) transforming to potentially more favorable trajectories.

These authors conclude that, so far, there is no common approach to encompass ecosystem conservation in MSP initiatives, but further highlight that ecosystem conservation should be put in a central position during MSP processes in order to achieve GES.

Two major challenges, therefore, arise. First, how to deal with the "risks" inherent to integrated-use MSP, and how to adjust policy decisions that are based on it in order to properly preserve ecosystems and the services they provide? Second, how to identify tipping points before they are crossed? According to Costanza et al. [43] the answer for sustainable ocean governance relies on an integrated approach – across disciplines, stakeholder groups, and generations – based on the "adaptive management" concept. The next section addresses such a potential approach in more detail.

4. Adapting marine planning and management: a pathway toward sustainability?

Adaptive management (AM) is a management approach that focuses on systematic learning of a given ecosystem through experimentation, monitoring and evaluation, and subsequent adaptation of management and policy options based on obtained results. A key characteristic of AM is that it acknowledges uncertainty and assumes that it should not be used to prevent or delay the implementation of policy/management decisions, meanwhile allowing damaging pressures to occur – this is especially relevant regarding preservation of ecosystems goods and services [44–46]. In fact, Ludwig et al. [47] suggest managers to "confront uncertainty" and to "act before scientific consensus is achieved (…) [stating that] we do not require any additional scientific studies before taking action". Moreover, "adopting processes that enable existing data to be used, whilst taking account of further information when it becomes available, is (…) critically important (…) [and] so too are measures to ensure that management processes adapt to meet the needs of changing circumstances" [45].

Dealing with the allocation of maritime space and uses, while making the necessary trade-offs among the biophysical, human and institutional dimensions of a given ecosystem to achieve socioeconomic development without compromising resources use for future generations [48], MSP needs to be able to incorporate "change" over time – e.g. environmental change, technological change, changes in political priorities, new economic realities, or new knowledge, information and data[13] [49]. Likewise, the degree to which MSP measures are meeting planning and management goals needs to be evaluated (and measures need to be adapted, when they are not). For these two reasons, an adaptive approach that allows the revision and adaptation of planning objectives and management decisions from time to time seems to be the best course to ensure MSP suitability and sustainability [10]. In fact, as Chapin et al. [3] point out, "flexibility in governance to deal with change is crucial for long-term social–ecological resilience and sustainability".

The importance of AM to MSP is recognized in EU policies: (1) the MSP Roadmap acknowledges that AM is necessary to ensure that MSP evolves with knowledge [8]; (2) the communication on MSP's achievements and future development identifies the AM role in MSP by concluding that "monitoring and evaluation are needed for adaptive management of sea areas and should cover socio-economic, environmental and governance" dimensions [24]; and (3) the MSFD states that an *ecosystem-based adaptive management* needs to be applied to achieve GES [6]. Concomitantly, UNESCO's document *Marine spatial planning: a step-by-step approach toward ecosystem-based management* also recognizes that MSP processes need to implement an AM approach in order to be sustainable [10]. For that reason, the last step of this ten-step guide for a full MSP process is "adapting the spatial management plan" and, within it, two major outcomes are expected: (1) proposals for adapting management goals, outcomes and strategies (in each new round of planning); and (2) identification of knowledge gaps [10].

Monitoring and evaluation are, in effect, key to AM [45]; they are the "vehicles" that allow responsible entities to learn about the effects of management measures, and further adjust planning and management processes. In fact, "only by integrating monitoring and evaluation into the overall MSP process, can the benefits of an adaptive approach be fully realized" [49]. According to these authors, monitoring of MSP processes can be separated into (1) "state-of-the-environment monitoring", which measures the ecosystem's quality/health, and (2) "performance monitoring" that assesses the effects of management measures/actions. The latter is especially relevant for adapting MSP because it is what will allow responsible entities to establish if observed changes in the "managed" system are due to MSP measures or to other factors. To assess MSP "performance", a set of socioeconomic, ecological and governance indicators – closely attached to MSP goals – needs to be used [49]. In fact, these authors further acknowledge that MSP general goals need to be translated into "clear, measurable objectives and outcomes" to make performance evaluation possible.

Results obtained through monitoring are then used to evaluate MSP. Such evaluation is done on the basis of whether MSP measures are contributing to achieve established goals or not, and according to three main criteria: (1) effectiveness – achievement of goals; (2) efficiency – cost/benefit balance; and (3) equity – distribution of benefits [49]. Furthermore, Carneiro [50] proposes a specific framework for MSP evaluation based on four essential steps: (1) evaluation of the plan-making process;[14] (2) analysis of the contents of the plan document; (3) evaluation of plan implementation; and (4) evaluation of plan outcomes and impacts. A fifth aspect considered by this author is the importance of actually communicating results and promoting their use.

However, despite the recognized importance of AM to both sustainable ocean governance in general, and MSP in particular, a challenge arises from its actual implementation [10,44,49]. Such challenge may result from the absence of a well established framework for AM implementation, together with a relatively small number of implementation cases, or the dominance of management approaches based on "reactive" – instead of proactive – ways of avoiding environmental degradation [44,46]. The analysis of results from monitoring and evaluation of existing marine spatial plans, as well as the definition of strong frameworks for monitoring/evaluation processes are, therefore, necessary to assess MSP successes and failures and to "better inform new and emerging MSP initiatives around the world" [49]. In addition, limitations to AM resulting from the short implementation time of MSP initiatives – and subsequent reduced practice and results from monitoring/evaluation – are expected to be overcome in coming years due to the "broad endorsement of MSP globally" [50].

5. Final remarks

Although recognized as an essential tool to implement ocean policies goals, as well as sustainability and EBM approaches, MSP still faces challenges on how to translate principles into practice.

[13] Douvere and Ehler recognize that although these changes are most commonly "external" to the MSP process they will probably affect MSP outcomes.

[14] This includes the evaluation of: (1) involvement of relevant stakeholder, (2) validity of data and analyses, (3) consideration of different alternatives, (4) prospective assessment of impacts, and (5) adequacy of human, technical and financial resources.

In effect, although general discussions on MSP acknowledge it as "necessary, efficient, and useful" challenges still lie "in the process and ability to translate principles, with workable tools and methods, into implementable reality" [51]. Nevertheless, an adaptive, ecosystem-based and integrated approach for the management of human activities in coastal and marine spaces seems to be the best course for MSP to follow. As Young et al. [35] point out: "like good relationships, governance systems [and planning processes] require constant attention and a capacity to adapt to changing circumstances to perform well and to remain resilient over time". In accordance, adaptive management is essential to ensure the sustainability of ecosystems, and therefore MSP long-term adequacy, by means of allowing responsible entities to revise, reconsider and redesign their planning and management options along time.

In what regards having soft versus hard sustainability concepts underpinning MSP processes, there are real differences and risks. However, although ecosystem-based MSP (hard sustainability) is more "precautionary", by putting the emphasis in achieving/maintaining ecosystems good environmental status, there is no assurance that it will be more effective than integrated-use MSP (soft sustainability) in delivering sustainable ocean management. Ultimately, it will all depend on how marine planning and management processes are conducted, and how marine ecosystem thresholds are accounted and assessed within such processes.

Acknowledgments

The authors would like to acknowledge Charles N. Ehler, who kindly agreed to review this paper providing thorough and constructive comments that undoubtedly improved the paper's quality. Portuguese Foundation for Science and Technology - FCT supported this study through Doctoral Grants to C. Frazão Santos (SFRH/BD/77057/2011) and to M.A. Ferreira (SFRH/BD/88549/2012).

References

[1] Commission E. An integrated maritime policy for the European union. Brussels: communication from the commission, 575 final; 2007, p. 16.
[2] Meiner A. Integrated maritime policy for the European Union – consolidating coastal and marine information to support maritime spatial planning. J Coast Conserv 2010;14:1–11.
[3] Chapin FS, Carpenter SR, Kofinas GP, Folke C, Abel N, Clark WC, et al. Ecosystem stewardship: sustainability strategies for a rapidly changing planet. Trends Ecol Evol 2010;25:241–9.
[4] Douvere F. The importance of marine spatial planning in advancing ecosystem-based sea use management. Mar Policy 2008;32:762–71.
[5] Crowder L, Norse E. Essential ecological insights for marine ecosystem-based management and marine spatial planning. Mar Policy 2008;32:772–8.
[6] Commission E. 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 (Marine Strategy Framework Directive). Off J Eur Union 2008;L164:19–40.
[7] Commission E. Commission Decision 2010/477/EU of 1 September 2010 on criteria and methodological standards on good environmental status of marine waters. Bruss: Off J Eur Union 2010;L232:14–24.
[8] Commission E. Roadmap for maritime spatial planning: achieving common principles in the EU. Brussels: communication from the commission, 791 final; 2008. p. 11.
[9] Maes F. The international legal framework for marine spatial planning. Mar Policy 2008;32:797–810.
[10] Ehler C, Douvere F. Marine spatial planning: a step-by-step approach toward ecosystem-based management. Paris: UNESCO, Intergovernmental Oceanographic Commission and Man and the Biosphere Programme, IOC Manual and Guides 53, ICAM Dossier 6; 2009.
[11] Ehler C, Douvere F. Visions for a Sea Change: Report of the First International Workshop on Marine Spatial Planning. Paris: UNESCO, Intergovernmental Oceanographic Commission and Man and the Biosphere Programme, IOC Manual and Guides 46, ICAM Dossier 3; 2007.
[12] Orbach M. Social science contributions to managing ecosystems. In: Cicin-Sain B, editor. Improving interactions between coastal science and policy: proceedings of the Gulf of Mexico Symposium. Washington, DC: National Academy Press; 1996, p. 37–49.
[13] Agardy T. In trade-offs and choices, there is one simple rule. Mar Ecosyst Manag 2012;5:5.
[14] Katsanevakis S, Stelzenmüller V, South A, Sørensen TK, Jones PJ, Kerr S, et al. Ecosystem-based marine spatial management: review of concepts, policies, tools, and critical issues. Ocean Coast Manag 2011;54:807–20.
[15] McLeod KL, Leslie HM. Why ecosystem-based management? In: McLeod KL, Leslie HM, editors. Ecosystem-based Management for the Oceans. Washington, DC: Island Press; 2009. p. 3–12.
[16] McLeod KL, Lubchenco SR, Palumbi SR, Rosenberg AA. Scientific consensus statement on marine ecosystem based management. The Communication Partnership for Science and the Sea (COMPASS). ⟨http://www.compassonline.org/sites/all/files/document_files/EBM_Consensus_Statement_v12.pdf⟩ [viewed in 30.09.13]; 2005.
[17] Cury PM. Tuning the ecoscope for the ecosystem approach to fisheries. In: Browman HI, Stergiou KI, editors. Perspectives on ecosystem-based approaches to the management of marine resources: marine ecology progress Series, vol. 274; 2004. p. 272–5.
[18] Slocombe DS. Defining goals and criteria for ecosystem based management. Environ Manag 1998;22:483–93.
[19] Arkema KK, Abramson SC. Dewsbury BM. Marine ecosystem-based management: from characterization to implementation. Front Ecol Environ 2006;4:525–32.
[20] Stojanovic TA. Farmer CJQ. The development of world oceans & coasts and concepts of sustainability. Mar Policy 2013;42:157–65.
[21] Commission E. Green paper – towards a future Maritime policy for the union: a European vision for the oceans and seas. Brussels: communication from the commission, 275 final; 2006, p. 49.
[22] Commission E. Towards a strategy to protect and conserve the marine environment. Brussels: communication from the commission, 539 final; 2002, p. 64.
[23] Commission E. Proposal for a directive of the European parliament and of the council establishing a framework for community action in the field of marine environmental policy (marine strategy directive). Brussels: communication from the commission, 505 final; 2005, p. 31.
[24] Commission E. Maritime spatial planning in the EU – achievements and future development. Brussels: communication from the commission, 771 final; 2010, p. 10.
[25] Foley MM, Halpern BS, Micheli F, Armsby MH, Caldwell MR, Crain CM, et al. Guiding ecological principles for marine spatial planning. Mar Policy 2010;34:955–66.
[26] Commission E. Developing a maritime strategy for the Atlantic Ocean Area. Brussels: communication from the commission, 782 Final; 2011, p. 10.
[27] Commission E. Action plan for a maritime strategy in the Atlantic area – delivering smart, sustainable and inclusive growth. Brussels: communication from the commission, 279 Final; 2013, p. 12.
[28] Commission E. Proposal for a directive of the European parliament and of the council establishing a framework for maritime spatial planning and integrated coastal management. Brussels: communication from the commission, 133 Final; 2013, p. 35.
[29] Commission E. Blue growth – opportunities for marine and maritime sustainable growth. Brussels: communication from the commission, 494 Final; 2012, p. 12.
[30] Jay S, Flannery W, Vince J, Liu W, Xue JG, Matczak M, et al. International progress in marine spatial planning. In: Chircop A, Coffen-Smout S, McConnell M, editors. Ocean yearbook 27: coastal and marine spatial planning. Leiden, Boston: Martinus Nijhoff Publishers; 2013. p. 171–212.
[31] Secretariat of the Convention on Biological Diversity. Marine spatial planning in the context of the convention on biological diversity: a study carried out in response to CBD COP 10 decision X/29. Montreal: Technical Series No. 68; 2012, p. 44.
[32] Qiu W, Jones PJS. The emerging policy landscape for marine spatial planning in Europe. Mar Policy 2013;39:182–90.
[33] Common M, Stagl S. Ecological economics: an introduction. Cambridge, UK: Cambridge University Press; 2005.
[34] Merrie A, Olsson P. An innovation and agency perspective on the emergence and spread of marine spatial planning. Mar Policy 2014;44:366–74.
[35] Young OR, Osherenko G, Ogden J, Crowder LB, Ogden J, Wilson JA, et al. Solving the crisis in ocean governance: place-based management of marine ecosystems. Environment 2007;49:20–32.
[36] Jones PJS. MSP theory vs. reality: preliminary governance findings of MESMA project. Mar Ecosyst Manag 2014;7:7.
[37] Frazão Santos C, Domingos T, Ferreira MA, Orbach M, Andrade F. How sustainable is sustainable marine spatial planning? Part II—The Portuguese experience. Mar Policy 2014. ⟨http://dx.doi.org/10.1016/j.marpol.2014.04.005⟩ [in this issue].
[38] Rockstrom J, Steffen W, Noone K, Persson A, Chapin FS, Lambin EF, et al. A safe operating space for humanity. Nature 2009;461:472–5.
[39] Halpern BS. Making marine protected areas work. Nature 2014;506:167–8.
[40] Edgar GJ, Stuart-Smith RD, Willis TJ, Kininmonth S, Baker SC, Banks S, et al. Global conservation outcomes depend on marine protected areas with five key features. Nature 2014;506:216–20.
[41] Davis JB. Poll: should conservation be considered a use of the marine environment? Mar Ecosyst Manag 2009;3:1–2.

[42] Kyriazi Z, Maes F, Rabaut M, Vincx M, Degraer S. The integration of nature conservation into the marine spatial planning process. Mar Policy 2013;38:133–9.
[43] Costanza R, Andrade F, Antunes P, Van den Belt M, Boersma D, Boesch DF, et al. Principles for sustainable governance of the oceans. Science 1998;281:198–9.
[44] Allen CR, Fontaine JJ, Pope KL, Garmestani AS. Adaptive management for a turbulent future. J Environ Manag 2011;92:1339–45.
[45] Laffoley DdA Maltby E, Vincent MA, Mee L, Dunn E, Gilliland P, et al. The ecosystem approach – coherent actions for marine and coastal environments. A report to the UK Government. Peterborough: English Nature; 2004; 65.
[46] Linkov I, Satterstrom FK, Kiker G, Batchelor C, Bridges T, Ferguson E. From comparative risk assessment to multi-criteria decision analysis and adaptive management: recent developments and applications. Environ Int 2006;32:1072–93.
[47] Ludwig D, Hilborn R, Walters C. Uncertainty, resource exploitation, and conservation: lessons from history. Science 1993;260:17–36.
[48] Frazão Santos C, Teixeira ZG, Janeiro J, Gonçalves RS, Bjorkland R, Orbach M. The European marine strategy: contribution and challenges from a Portuguese perspective. Mar Policy 2012;36:963–8.
[49] Douvere F, Ehler CN. The importance of monitoring and evaluation in adaptive maritime spatial planning. J Coast Conserv 2011;15:305–11.
[50] Carneiro G. Evaluation of marine spatial planning. Mar Policy 2013;37:214–29.
[51] Calado H, Ng K, Johnson D, Sousa L, Phillips M, Alves F. Marine spatial planning: lessons learned from the Portuguese debate. Mar Policy 2010;34:1341–9.