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RESEARCH ARTICLE

The Way Forward on Ecosystem-Based Marine Spatial Planning in the EU

Trine Skovgaard Kirkfeldt[a], Jan P. M. van Tatenhove[b] and Helena M. G. P. Calado[c]

[a]Department of Planning, Centre for Blue Governance, Aalborg University, Copenhagen, Denmark; [b]Department of Planning, Centre for Blue Governance, Aalborg University, Rendsburggade, Denmark; [c]MARE – Marine and Environmental Sciences Centre, University of the Azores, Ponta Delgada, Portugal

ABSTRACT

Marine spatial planning (MSP) is currently practiced by almost half of the world's nations. While some countries are working on their second, third or fourth round of MSP, many are going through their first round of marine spatial planning. Thus, there are experiences to share and to reflect upon. Current practices of MSP show a minimum of ecosystem-based approaches, which indicates a need to develop the practice further. This paper examines and compares best practices, selected by MSP experts, of how to take an ecosystem-based approach in MSP and presents a list of concrete actions for an ecosystem-based approach. The consulted experts consider close connections to other policies, such as the Marine Strategy Framework Directive and the Habitat Directive, as key to an ecosystem-based MSP process. While most experts think there is a need for more, preferably localized and specific, guidelines, some find the existing guidelines adequate but the knowledge of how to operationalize them inadequate. The selection of best practices is diverse and suggests many different ways to practice ecosystem-based MSP.

KEYWORDS

Ecosystem-based approach; marine spatial planning; marine strategy framework directive; ecosystem-based management; marine spatial planning directive

Introduction

Marine ecosystems all around the world are in demise due to pressures from human activities, such as fishing, shipping, resource extraction and climate change (Ehler and Douvere 2009; European Environment Agency 2019). Marine spatial planning (MSP) has been suggested as part of the solution by establishing "(…) *a more rational organization of the use of marine space and the interactions between its uses* (…)."(Ehler and Douvere 2009). A key element of MSP is to implement ecosystem-based management (EBM) (Ehler and Douvere 2009). In the EU Directive for MSP the concept of EBM is included through the ecosystem-based approach (EBA) concept (EU Directive 2014/89/EU). While there has been some debate, concerning the two concepts as well as the concept of Ecosystem Approach (EA), there is a substantial overlap among the three (Kirkfeldt 2019). The three concepts are all focused on having a holistic, systemic perspective on ecosystems rather than species. Also, they all include assessments of

CONTACT Trine Skovgaard Kirkfeldt tsk@plan.aau.dk Centre for Blue Governance, Department of Planning, Aalborg University, A. C. Meyers Vaenge, 2450 Copenhagen, Denmark.

the state of ecosystems as a foundation for the planning of activities (in contrast to having environmental assessments late in the planning process), with the purpose to manage cumulative impacts and to ensure ecosystem health (Kirkfeldt 2019). For this paper, EBA is applied as a representation for all three concepts.

While EBA is central to the MSP practice, signs of EBA in MSP are few, and there is currently a trend that MSP processes are more oriented toward blue growth than they are ecosystem-based. In a study of 44 marine spatial plans, 27 plans (two thirds) were not considered ecosystem-based, as defined in that publication (Trouillet 2020). As of now, 79 nations are practicing MSP. For most, it is their first MSP process while some (15 nations) already have implemented plans in place (UNESCO 2020). Being an adaptive practice, MSP is a continuous process that requires recurrent monitoring, evaluation and updating (Ehler and Douvere 2009). Thus, with the continuous degradation of marine ecosystems and the increasing level of maritime activities, MSP practices will continue to grow in numbers, and so will the importance of having sound EBA practices in MSP.

As of now, the concept of EBA has been widely debated, not only in terms of what it entails conceptually but also, more importantly, how to practice EBA in MSP (Arkema, Abramson, and Dewsbury 2006; Tallis et al. 2010; Katsanevakis et al., 2011; Ansong, Gissi, and Calado 2017). Within the EU Directive on MSP (MSPD, EU Directive 2014/89/EU) EBA is hardly defined, even though the Directive requires that "(…) *maritime spatial planning should apply an ecosystem-based approach* (…)". While EBA is not defined, three purposes are mentioned in the Directive; 1. To ensure "(…) *that the collective pressure of all activities is kept within levels compatible with the achievement of good environmental status* (…)", 2. To ensure "(…) *that the capacity of marine ecosystems to respond to human-induced changes is not compromised* (…), and 3. To contribute to "(…) *the sustainable use of marine goods and services by present and future generations* (…)" (EU Directive 2014/89/EU). The focus is thus on ensuring and improving the environmental status, ecosystem resilience and ecosystem health. Other documents on EBA/EA/EBM suggest similar objectives (CBD 2004; McLeod et al. 2005; Ehler and Douvere 2009; HELCOM-VASSAB 2016), however, examples of EBA practices in MSP have so far been scarce, partly due to a lack of general experience, with MSP being a recent planning practice (Trouillet 2020).

While the openness of the MSPD pertaining to EBA can be attributed to a lack of experience and knowledge of MSP, the ambiguity also functions as a political tool that allows EU Member States to decide for themselves, what EBA means in their case and how they want to approach it. Policy ambiguity is a characteristic of policies that are likely to involve conflicts or in policies for new practices (Matland 1995; Stone 1997). MSP can be considered both prone to conflicts and a newly developed practice. The political scientist Henry Kissinger defined this type of policy ambiguity as 'constructive ambiguity' which is a "*deliberate use of ambiguous language in a sensitive issue in order to advance some political purpose*" (Berridge and James 2003). The less constructive or - in worst case – destructive outcome of policy ambiguity can be symbolic implementation, in which there is no real effect of the policy, or as an experimental implementation, in which actors might take advantage of the ambiguity to promote own agendas (Matland 1995).

Due to MSP being a recent practice, the high level of ambiguity concerning EBA and the outcomes of ambiguity, this paper sets out to decrease the level of ambiguity

concerning the practice of EBA, by examining some of the best practices of ecosystem-based MSP in the world. This results in a catalogue of concrete actions to take when attempting to perform an ecosystem-based MSP.

Methodology

The search for 'best practices' of ecosystem-based MSP is here based on MSP expert consultations (questionnaire questions can be found in Supplementary Materials SM0). Respondents were found through scientific and social networks (such as the MSP research network[1], the European MSP platform[2] and twitter). In some cases, respondents suggested other MSP experts for the survey. It led to 29 completed surveys in which the respondents were first asked to give account of their experiences within MSP. All respondents had substantial experience with ecosystem-based practices in MSP through research and/or practice, and the 29 respondents are therefore categorized as 'experts' in this paper. In the questionnaire, respondents gave their perspectives on 'best practices' of ecosystem-based MSP, as well as their own perception of what EBA entails. The content of the responses was coded in Nvivo in order to assess systematically which criteria the experts consider part of an ecosystem-based MSP process (see Figure 1). The full list of criteria for an ecosystem-based MSP, mentioned by the experts can be seen in the Supplementary Material SM1.

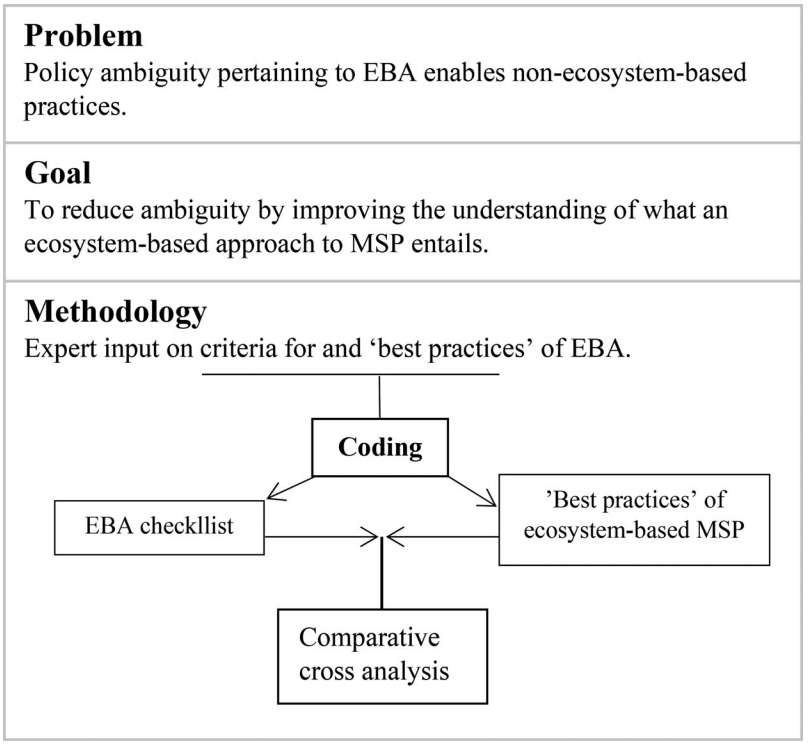

Figure 1. The methodological framework of the research presented in this paper.

The experts listed 24 different national MSP practices and eight MSP projects in which an EBA had been successfully performed (see Supplementary Material SM2 for the full list). In order to go more in depth, the selection was narrowed down to cases mentioned by more than one respondent. Eight practices were mentioned by more than one respondent, and these were chosen for further assessment. The eight MSP practices were studied through a desk study and were then compared with the list of criteria for EBA in MSP, suggested by the experts. The desk study was focused on gathering information on EBA initiatives in each of the eight MSP cases, which included the assessment of marine spatial plans, official MSP websites and environmental assessments, where applicable. The findings of each country were compared in order to locate potential similarities or differences among the 'best practices' of ecosystem-based MSP.

Due to the number of respondents, and thus the influence of their personal experiences with MSP, the cases and findings of this paper should be seen as a selection of good EBA practices in MSP, rather than a representative list of the best EBA practices. Had the pool of respondents been different with different geographical origins of MSP experiences, the list of EBA practices would most likely be different.

Results

The 29 experts have a combined experience from 24 different countries, (see Supplementary Materials SM3). Most of them identify as researchers (15), while nine identify as planners, three identify as consultants and six as something else (e.g., analyst). Some identified with more than one category. The following two sections present a list of criteria for an EBA and 'best practices' of ecosystem-based MSP respectively, as suggested by the experts.

Defining good EBA practice

The list of criteria for EBA practice provided by the respondents was far from unanimous and short (see Table 1 for the most cited criteria and the Supplementary Materials SM1 for the full list of code categories). The list consists of different criteria that relate to different stages and elements of an ecosystem-based MSP.

The criterion to have close connections to other frameworks was mentioned most frequently (9). The experts mentioned the Marine Strategy Framework Directive (Directive 2008/56/EC, MSFD), the Water Framework Directive (Directive 2000/60/EC, WFD), the Habitat Directive (Directive 92/43/EEC, HD) and the Convention on Biological Diversity (CBD), of which the MSFD was the most emphasized. As one respondent stated: "*In the European context it* [ecosystem-based MSP] *should be integrated and in synergy with the MSFD framework*". Five respondents further emphasized how the MSP process should be linked to the MSFD through the objective for good environmental status and the 11 related descriptors listed in the MSFD, from the first planning stage of MSP. As a respondent suggested: "*Countries should firstly gather data as regards the Good Environmental Status (GES) quality of their marine, and seek to implement a plan to improve this status where necessary. Spatial planning plays a part*

in this, in that no activities that cause further deterioration in areas already not at GES should be allowed to take place". This respondent sees the importance of setting a good environmental status as both a framework for data collection and as an overall objective of MSP, which was a perspective shared by many of the respondents. Another respondent suggested using MSFD indicators and descriptors in the monitoring stage of MSP.

Several of the criteria in Table 1 are concerned with data/knowledge inputs to the MSP process. While some experts (5) emphasize the data driven character of MSP processes (as opposed to driven by political/stakeholder agendas), others (6) highlight the importance of stakeholder involvement early in the process "(…) *in order to collect as much useful information as possible and to get alerts when things might get wrong*", as formulated by one expert. Another respondent brought attention to the importance of closing important data gaps: "*MSP should be based on sound scientific data and efforts should be made to fill in some major knowledge gaps (where I have worked there is usually hardly any data available, even most basic data is missing.)*". Significant knowledge gaps can therefore be seen as a main barrier for a data-driven EBA.

The assessment of the environmental status and environmental impacts of activities are two other criteria that are challenged by an insufficient data foundation. Several of the criteria in Table 1 relate to these practices. Two respondents mentioned the importance of a strategic environmental impact assessment (SEA). Cumulative impact assessments (CIA) and assessments of the environmental/ecological status were both mentioned by four respondents. The performance of a CIA was seen as a guarantee "*(…) that ecosystems are fully included and that land–sea interactions also are indirectly included*", which involves another action, mentioned by two respondents, i.e., 12. Consider land–sea interactions. Again, data gaps were mentioned as a main barrier, this time pertaining to CIA. One respondent stated: "*(CIA) is a very important process to ensure that the many marine uses do not put too high pressures on the environment. However, it is very difficult to evaluate this in practice due to knowledge gaps*". Once again, this emphasizes the dependency on data if an ecosystem-based MSP is to be ensured.

Another theme on the EBA criteria list (Table 1) is the uncertainty that comes with MSP. Four respondents highlighted the importance of building scenarios, in which climate change should be included (mentioned by three): "*Visioning and scenario planning is essential to make operative steps toward forward looking MSP, also considering uncertain futures and changing conditions because of – for instance – climate change effects*", as formulated by one expert. In relation to this uncertainty, four

Table 1. A check-list of criteria for ecosystem-based MSP; criteria that were mentioned by more than one respondent; number of citations in ().

1. Close connection to other policies such as the MSFD (9)	12. Considers land–sea interactions (2)
2. Monitoring (6)	13. Having clear objectives (2)
3. Stakeholder engagement/involvement (6)	14. Identify existing ecosystems, habitats and ecosystem services (2)
4. Data driven (5)	15. If negative effects, look for alternatives (2)
5. Best available data/knowledge/technology (5)	16. Last option is mitigation and compensation (2)
6. Adaptive management (4)	17. Multi-dimensional (2)
7. Assessments of environmental/ecological status (4)	18. Promote conservation and restoration activities (2)
8. Building scenarios (4)	19. Promoting MPAs (2)
9. Cumulative impact assessments (4)	20. Strategical environmental assessments (2)
10. Precautionary principle (4)	21. Use of software for modeling (2)
11. Climate Change considerations (3)	

respondents also highlighted that ecosystem-based MSP applies the precautionary principle, which entails only allowing activities with negative impacts if all other options are considered, having mitigation and compensation as the very last option (mentioned by two).

The list of EBA criteria provided by the experts shows that performing an EBA is not a simple task. It should be strongly connected to the MSFD and other relevant policy frameworks and draw on objectives and indicators within these frameworks. It also involves highly data-demanding assessments of ecological and environmental statuses, monitoring as well as impact assessments, and it involves taking a precautious approach, by building scenarios including impacts of climate change. Not least, EBA requires that any degradation of the current environmental status should be avoided, for example by having mitigation and compensation as last resort. How to integrate all of these actions and considerations in one MSP process may seem impossible but some countries have shown different ways of approaching this task. These are evaluated in the following.

Best practices

The consulted MSP experts predominantly mentioned national practices as examples of 'best practices' for ecosystem-based MSP, thus the focus of the following is on national practices, followed by a short summary of other examples of 'best practices'. Eight national practices were mentioned by more than one expert and were therefore further evaluated. The eight countries as well as the origin of MSP experience of the experts, who pointed to these practices, can be seen in Table 2.

National practices

While Sweden has not yet finalized their first MSP process, the Swedish practice was mentioned by the highest number of experts. Experts pointed in particular to the Swedish current status report, the use of the tool SYMPHONY and the Green Infrastructure Approach, for why the Swedish practice is a good example of ecosystem-based MSP. Initial steps of the Swedish process involved the assessment of the current status (SwAM 2015) and the building of a roadmap (Havs-och vattenmyndigheten 2016). Both processes

Table 2. The eight national practices pointed to by two or more experts and the expert's answer *to "In which country have you primarily built your knowledge/experience on MSP?"*; some experts had primary experience from more than one country. Numbers in () indicate if more than one expert have experience from this country.

'Best practice' of MSP	Primary origin of experts' experience in MSP
Sweden	Denmark (2), Germany, Italy, Latvia, Sweden, United Kingdom
Latvia	Bulgaria, Denmark, Germany, Latvia, United Kingdom
Shetland islands	Italy, Portugal, Scotland, United Kingdom (2)
Belgium	Belgium, Bulgaria, Portugal, Spain
Australia	Barbados, Bulgaria, Costa Rica, Greece, Italy, Mexico, Namibia, Portugal
Scotland	Ireland, Latvia, Scotland (2), United Kingdom,
The Netherlands	Cyprus, The Netherlands (2)
Palau	Barbados, Costa Rica, Greece, Italy (2), Mexico, Namibia

had close connections to the MSFD. A key element of the SYMPHONY tool is the assessment of cumulative impacts from the combined pressure of maritime activities, a criteria for EBA (see Table 1) (Hammar et al. 2020; SwAM 2020). Another element of the Swedish MSP process, mentioned by the experts, was the Green Infrastructure Approach, which aims at ensuring conditions for the promotion of natural values "*by introducing different types of spatial protection measures for natural values and their coherent structure*"(Translated from Swedish) (Havs-och vattenmyndigheten 2016) (For more on the Green Infrastructure Approach see (HELCOM-VASAB 2016). In addition, other experts pointed to the Swedish focus on environmental protection, inclusion of climate change refugia analysis (see e.g., Morelli et al. 2016) for more on climate refugia analysis) and their use of spatial decision support tools.

The Latvian marine spatial plan has been in place since its implementation in May 2019 (Ministry of Environmental Protection and Regional Development 2019). The plan was developed by the Latvian Ministry of Environmental Protection and Regional development, who followed the HELCOM-VASAB guidelines for the implementation of EBA through MSP (HELCOM-VASSAB 2016). By following these guidelines, EBA is practiced from the very beginning, ensuring an assessment of the current status of the marine environment as the first step (number 7 in Table 1), in which MSFD indicators and descriptors were used as a framework for how to assess the environmental status (Veidemane, Ruskule, and Sprukta 2017). Furthermore, a monitoring programme was developed, and social and economic impacts of the plan were evaluated in close connection to the national implementation of the MSFD (Ministry of Environmental Protection and Regional Development 2019). Another important element of the HELCOM-VASAB guidelines is the assessment of ecosystem services, which two of the respondents mentioned as their reason for why Latvia was considered to be among 'best practices'.

The first marine spatial plan for the Shetland Islands was in place in 2008, and the plan has since then been updated three times with the most recent one being the fourth edition (Shetland Islands Council and NAFC Marine Center 2015). In 2016, a new planning process for a marine regional plan was initiated, which is currently under consultation (Shetland Islands Marine Planning Partnership 2019). The regional plan aims to contribute to the achievement of good environmental status "(…) *particularly in relation to spatial measures. The policies in the SIRMP* [Shetland Islands Regional Marine Plan] *consider how activities can shape the marine area to support the goals of these Directives [WFD and MSFD], as well as those of other relevant pieces of EC legislation.*" (Shetland Islands Marine Planning Partnership 2019), which indicates a close connection to other policies. The Sustainability Appraisal estimates the cumulative impact of the planned activities based on three scenarios (Shetland Isles Council and UHI and Marine Scotland 2019), and the plan puts strong emphasis on incorporating climate change mitigation and adaptation measures, with an inherent use of the precautionary principle (Shetland Islands Council and NAFC Marine Center 2015).

MSP was implemented into Belgian legislation in 2012 with an amendment of the Marine Environment Act (European MSP Platform, 2020). In 2014, the first plan was adopted through the enactment of the Royal Decree to establish the marine spatial plan (FPS Public Health Food Chain Safety and Environment, 2014). In 2017, a revision of the first plan was initiated. The second marine spatial plan (2020–2026) came into force in March 2020. The process involved stakeholders both informally and

formally, and an SEA was carried out as according to EU legislation. One of the basic principles in the new plan is the establishment of thresholds, which involves a continuous updating of data on, and monitoring of, the environmental and ecological status as defined in the MSFD and WFD. Good environmental and ecological status are mentioned as two of the main environmental objectives of the MSP process (Royal Decree MSP 2020). With the new plan, a new MPA is created, in addition to four already existing MPAs, and one area for bird protection will be expanded (FPS Public Health Food Chain Safety and Environment, 2020).

The Great Barrier Reef Marine Park (GBRMP) was established in 1975 with the adoption of the Great Barrier Reef Marine Park Act 1975 (Australian Government, 2016). While the main objective of the GBRMP is to "(…) *provide for the long-term protection and conservation of the environment, biodiversity and heritage values*" (Australian Government, 2016), the act sets a list of goals to be achieved if they are not in conflict with the main objectives. The goals are focused on sustainable use, recreational, economic, cultural and research activities (Australian Government, 2016). One of the experts pointed to the use of the DPSIR (Driver-Pressure-State-Impact-Response) framework, which is a "*causal framework for describing the interactions between society and the environment*"(European Environment Agency 2020). It has been used in the management of the GBRMP to structure environmental assessments and with the purpose of assessing and understanding cumulative impacts (Anthony et al. 2013; GBRMPA 2013; Great Barrier Reef Marine Park Authority 2017).

The Netherlands has had a formal marine spatial plan in place since 2009. The National Water Plan, which contains the Marine Spatial Plan 2009–2015, was the first formal MSP. Priority was given to activities of national importance for the Netherlands, such as sand extraction and replenishment, sustainable (wind) energy, oil and gas extraction, CO_2 storage, shipping, and military areas. In 2015, the second formal MSP (Second National Water Plan that contains the North Sea Policy 2016–2021) was published (de Vrees 2019; Keijser, Toonen, and van Tatenhove 2020). The Policy Document of the North Sea 2016–2021 was developed in close connection to the implementation of MSFD, the HD, the WFD and the Malta convention (Dutch Central Government 2015). In particular, the objective for good environmental status (as formulated in the MSFD) is a key objective of the Dutch marine plan. The Dutch plan includes an assessment framework for permit applications e.g., for wind farms or sand extractions (Dutch Central Government 2015). In addition, permit applicants for wind farms are assessed according to the Framework for Assessing Ecological and Cumulative effects (in Dutch: Kader Ecologie en Cumulatie (KEC)), that has the objective "*to clarify how cumulative ecological effects must be charted*" (Dutch Central Government 2015), in addition to determining which mitigation measures are needed. Climate change impacts are addressed with information from the monitoring and analysis of the marine strategy, and sought mitigated by encouraging renewable energy and CO_2-storage technologies. Land–sea interactions are considered "*insofar as this pertains to the direct physical relationship, such as the location of a port and a shipping route* (…)" and additional information is sought from neighboring countries on how to integrate land–sea interactions into MSP (Dutch Central Government 2015). The plan suggests and presents four MPAs in addition to the three already existing MPAs.

The objectives of the Marine Plan of Scotland 2015 were formulated in relation to the achievement of good environmental status and the 11 descriptors of the MSFD. In addition to specific sectoral, legislative requirements for the regional planning processes, the plan also sets out basic legislative requirements, including "1) *Assessing the condition of the region.* 2) *Summarizing the significant pressures and impact of human activity.* 3) *Setting economic, social, marine ecosystem and climate change objectives.*" (numbers added) (Scottish Government 2015), which address several of the key EBA criteria of Figure 1 (mainly: 7, 9 and 11). To support the regional MSP processes, the planning process of the national marine plan involved the development of Scotland's Marine Atlas, which presents an assessments of the condition of the Scottish seas, as well as a summary of impacts and pressures from human uses (Scottish Government 2011). The atlas presents climate change as one of the most threatening pressures (along with fishing), and thus the national marine plan considers actions for climate change mitigation and adaptation for each sector (Scottish Government 2015).

The Palauan plan was established with the enactment of the Palau Marine Sanctuary Act in 2015 (Republic of Palau, 2015). With this act, the ancient, Palauan, conservation tradition, *Bul* (a local practice in which the Council of Chiefs placed restrictions on fishing in vulnerable reef areas (IOC AND UNESCO 2020), was applied to the entire EEZ. The act establishes one of the largest conservation areas in the world, a no-take zone covering 80% of the Palauan EEZ. The remaining area is dedicated to domestic fishing activities, i.e., landings are going to the domestic market instead of export (Republic of Palau, 2015). The plan will be fully implemented at the end of 2020 (Global Island Partnership 2019; PEW 2020). With the enactment of the Palau Marine Sanctuary Act, an environmental impact fee of 100$is required from each international visitor. A portion of the environmental impact fee goes to a trust fund, which has the purpose to enable surveillance and monitoring activities and to support eco-tourism. With this initiative, tourists are providing financial support to the conservation of the nature that likely brought them to Palau (Republic of Palau, 2015).

In Table 3, each of the eight countries is evaluated according to the criteria presented in Table 1.

Other EBA initiatives

While the focus has so far been on national practices, the consulted experts also mentioned a list of projects that were not related to one single, national MSP process. In particular, projects of the Baltic Sea were mentioned. These include the ECOMAR[3], Pan Baltic Scope and BALANCE[4] projects. The BALANCE project ran from 2005 to 2007 with the purpose to develop tools for MSP, which involved the development of the "blue corridor" concept and habitat mapping (BALANCE 2007). Pan Baltic Scope ran from 2018 to 2019 and was likewise focused on tool development through cross-border collaboration on topics such as EBA, cumulative impact assessment and green infrastructure concept (Pan Baltic Scope 2018). The ECOMAR project ran from 2018 to 2020 and was focused on performing a cumulative impact assessment for the Danish EEZ, including the development and testing of tools (NIVA Denmark 2018). Other projects that were mentioned by the experts include case studies in the SIMWESTMED[5] and SUPREME[6] projects and the Adriplan[7]

Table 3. The performance of the MSP practices, pointed to by MSP experts, for each EBA criteria, presented in Table 1; Deep blue: yes, light blue: to some extent, white: no/lacking information. SWE: Sweden, LAT: Latvia, SHT: Shetland Islands, BEL: Belgium, AUS: Australia, SCT: Scotland, NED: The Netherlands, PAL: Palau.

	SWE	LAT	SHT	BEL	AUS	SCT	NED	PAL
1) Close connection to other policies such as the MSFD								
2) Monitoring								
3) Stakeholder engagement/involvement								
4) Data driven								
5) Best available data/knowledge/technology								
6) Adaptive management								
7) Assessments of environmental/ecological status								
8) Building scenarios								
9) Cumulative impact assessments								
10) Precautionary principle								
11) Climate Change considerations								
12) Considers land–sea interactions								
13) Having clear objectives								
14) Identify existing ecosystems, habitats and ecosystem services								
15) If negative effects, look for alternatives								
16) Last option is mitigation and compensation								
17) Multi-dimensional								
18) Promote conservation and restoration activities								
19) Promoting MPAs								
20) Strategic Environmental Assessment								
21) Use of software for modeling								

project. The Adriplan project took place in the Adriatic–Ionian region and ran from 2013 to 2015. It was aimed at delivering an approach for cross-border MSP and included *inter alia* the assessment of cumulative impacts for selected areas (European MSP platform 2020). The SUPREME and SIMWESTMED projects both took place from 2017 to 2018 in the Eastern and Western Mediterranean Sea, respectively. Both projects aimed at supporting national implementations of the MSPD with a particular focus on cross-border collaboration. Pilot projects were as well carried out involving the assessment of cumulative impacts (Loyer and Carval 2019; SUPREME 2020).

In addition to the projects presented above, experts also mentioned specific analytical approaches for EBA, both as part of a national MSP process or as a standalone approach. These included the Large Marine Ecosystem (LME) approach and the Biological Valuation Mapping (BVM) practice. The LME approach is aimed at operationalizing ecosystem-based management through a five-moduled strategy for assessing and monitoring LMEs and for the planning of actions for healthy ecosystems (GEF LME:LEARN 2017). BVM functions as a baseline map in which the value and distribution of ecological and biological elements are mapped. In particular, it is used to locate areas with high biological value to inform planning and management processes and to reduce the level of risk by facilitating a more precautious approach (Ehler and Douvere 2009).

Discussion

Having gone through the suggested practices for EBA, no unanimous model for EBA appears. On the contrary, none of the presented practices has approached the EBA practice in the same way. However, in this diverse picture, the differences are what

makes the practices alike. In some way, they have all approached the task in an innovative manner, developing and using tools or frameworks in new ways. While Australia is seen as a frontrunner for MSP and MPAs in the establishment of the GBRMP, Sweden is praised for the development and application of the SYMPHONY tool. Latvia is complimented for its inclusion of an ecosystem service assessment, and Palau was one of the first nations in the world to make conservation a main priority. The Netherlands is recognized for its development of the KEC framework and in Scotland, it was the development of the Marine Atlas that was noticed by respondents. It is clear from the national initiatives that each country is trying to find their own way of interpreting EBA and figuring out how to implement it. It is also clear, that so far, there is no single way of doing this. However, in their diversity, the studied cases have some general characteristics in common. The ecosystem is a top priority for all eight cases, either through spatial analysis of the ecosystem and impacts or through the precautionary approach (in the case of Palau). Common for most of the initiatives is the use of spatial tools, modeling and analysis. From the list of EBA criteria given by the respondents (Tables 1), the presented practices seemed to be performing particularly well on promoting MPAs, assessing (cumulative) impacts, and evaluating ecosystem services. The more recent, European, practices (Sweden, Latvia, Belgium, the Shetland Islands, the Netherlands and Scotland) were in general well connected to the MSFD and WFD frameworks (the most mentioned EBA criteria), in particular through the objective for good environmental status and related descriptors. What can be learned from the studied ecosystem-based MSP practices is how EBA can be practised in many ways, albeit following the same overall objectives and approaches.

Most of the presented initiatives require a substantial amount of spatial data on ecosystem components and pressures from activities, which is required for several of the actions in Table 1. Assessments of ecosystem services and impacts as well as monitoring all require a substantial amount of data as well as resources and competences for analysis and dissemination. It would therefore seem that a well-performed EBA requires an extensive supply of data along with a spatial (potentially modelled) analysis of this data, however "(…) *the practice requires quite a lot of data, which is generally still sparse for the marine areas*", as formulated by one respondent. The findings of this paper suggest that the collection and generation of data is not restricted by technology nor a lack of acknowledgement of its importance. Rather, other barriers, such as limited monetary resources, restrict the generation and analysis of data. In practices where data is lacking, an EBA can be practiced by implementing the precautionary approach to the fullest, and focus on conservation objectives, such as the Palauan plan.

The list of EBA criteria located for this paper as well as the studied MSP cases suggest the way forward for EBA in MSP is through improved spatial analysis. The studied cases showed new and improved ways of analyzing ecosystem services and cumulative impacts, which are both activities with a high demand for data, tools and competencies but with great outcomes to use in the planning process (Arkema et al. 2015; Kirkfeldt and Andersen 2021). In order to advance EBA practices on a global scale, more MSP processes need to improve in this area, for instance by following the examples presented in this paper or others (cf. e.g., Tallis et al. 2012; Korpinen and Andersen 2016).

The importance of data was as well highlighted by several respondents as a main barrier for EBA practices, along with the lack of knowledge for how to practice an EBA and lack of political will. One respondent pointed to the policy ambiguity of the directive as a major barrier for creating an operational guideline for EBA: "*The flexibility among countries on how to do MSP* (…) *makes it difficult to create an ecosystem-based approach guideline.* (…) *I think the flexibility as well as the knowledge gaps will probably mean that such a guideline will not be created in the near future*". This respondent believes the outcome of said flexibility, i.e., the ambiguous formulations of the MSPD, will be destructive for the environment *"the tradeoffs* [of the flexibility] *being political decisions instead of being first-and-foremost environmental concerns*". This tradeoff, in which political decisions steer the agenda instead of environmental objectives, is a common outcome of experimental implementations (as defined by Matland 1995). According to Matland (1995), experimental implementation can take place when levels of ambiguity are high as is the case of the MSPD.

When asked if there are sufficient guidelines on how to perform EBA, the majority of the respondents replied 'No, not quite' (see Figure 2). Some respondents believes EBA "*is still perceived as a theoretical concept*" and that "*the definition is quite abstract*", as two of the respondents stated, which means that "(…) *there are many guidelines, but little guidance on what the theoretical means in practice*!" as formulated by a third respondent. There was however also a substantial part of the respondents (9) who thinks the level of guidelines is sufficient (or almost sufficient). Some emphasized that it is impossible to provide guidelines for all cases: "*MSP is complex. Even if guidelines do exist they are rarely used (…)*" and another respondent suggested "*(…) it is more*

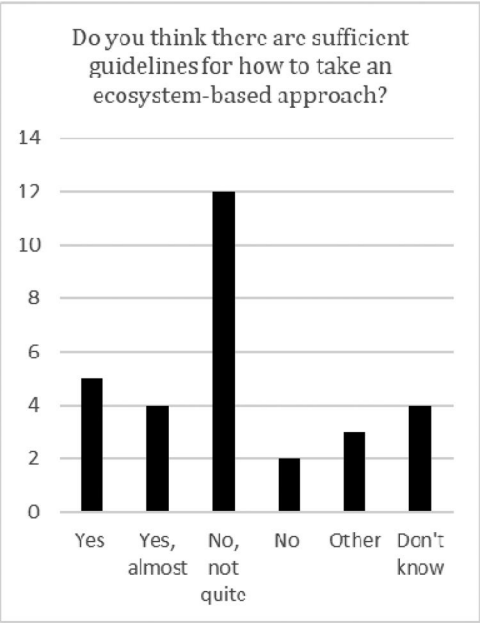

Figure 2. Answers for the question: Do you think there are sufficient guidelines for how to take an ecosystem-based approach?

likely that lack of guidelines isn't the problem but lack of political will". One respondent thought the number of global guidelines is sufficient, but that more localized guidelines are needed: "*There are quite a few examples of guidance documents providing clarification of the approach on a conceptual level, and largely on a global scale. Far fewer examples of regional/local guidance documents can be found which may be useful in management at implementation level*". Attempting to develop one guideline for all MSP processes is likely to be inefficient as cases such as the Netherlands and Palau vary immensely. Another respondent supports the suggestion of having more operational guidelines: "*more precise guidelines are needed on how to better apply an EBA in the different steps/actions carried out in MSP*". It would seem that in general, respondents agree that the number of conceptual, overall guidelines on EBA are sufficient, but that more specific, localized and operational guidelines are needed. One respondent suggested the MSPD could be supplemented by a Common Implementation Strategy, which are strategical documents made by experts aimed at supporting the implementation of particular EU directives such as the MSFD and the WFD (European Commission 2020a, 2003). A Common Implementation Strategy on the MSPD could provide more localized, specific and operational guidelines on EBA. The process for the Common Implementation Strategy for the MSFD involved over more than 450 experts and stakeholders and has so far resulted in 15 guidance documents (available at European Commission 2020b). A similar process and resulting guidance documents for the MSPD could reduce the level of policy ambiguity and thus reduce the risk of unfortunate tradeoffs for the environment.

Conclusion

The assessment of criteria for ecosystem-based MSP and best practices as suggested by MSP experts exemplified the ambiguous and complex nature of EBA. The list of criteria was long, and best MSP practices perform EBA in widely different ways. Experts point to the ambiguity of the MSPD as cause for the diverse practice. While this can have constructive outcomes such as innovative approaches to, and developments of, EBA, it also challenges the implementation of EBA in MSP as it remains to be perceived as a theoretical concept, challenging to operationalize. Ultimately, this results in a lack of EBA practices, as indicated by Trouillet (2020).

The list of criteria presented in this paper proposes a guideline for EBA. In particular, experts highlight the importance of having close connections to other policy frameworks, together with an initial assessment of the environmental/ecological status through (cumulative) impact assessments, as main criteria for ecosystem-based MSP. While impact assessments require a substantial data foundation, if data is scarce, EBA can be practiced by prioritizing conservation measures and practicing the precautionary principle.

Based on the findings of the paper, the authors recommend a formulation of more operational and context specific guidelines, e.g., developed through a Common Implementation Strategy. Future guidelines could e.g., address how to integrate EBA with other key actions of MSP, e.g., how to use EBA to reduce conflicts, and how to apply stakeholder information in EBA practices. Furthermore, a continued sharing of experiences and methodologies is encouraged to support a continuous development of EBA practices to aim for a future in which all MSP practices are ecosystem-based.

By strengthening the current EBA practice, MSP gets closer to achieving its full potential and mission of ensuring a sustainable future for the management of the sea.

Notes

1. https://www.msprn.net/home
2. https://www.msp-platform.eu/
3. Short for: Development and testing of a data-driven framework for ecosystem-based marine spatial planning
4. Short for: Baltic Sea Management – Nature Conservation and Sustainable Development of the Ecosystem through Spatial Planning
5. Short for: Supporting Implementation of Maritime Spatial Planning in the Western Mediterranean region
6. Short for: Supporting Maritime Spatial Planning in the Eastern Mediterranean
7. Short for: Adriatic Ionian maritime spatial Planning

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