Abstract

Sustainable development is the framing concept assuring that resources are exploited while maintaining the ability of these natural resources to provide for future generations. With human dependence on marine resources increasing, Ecosystem-Based Management (EBM) has been identified as a suitable approach to ensure sustainable development. In order to achieve this, the core principles and elements of EBM should be operational in the maritime/marine spatial planning (MSP) process to ensure that human activities in marine space are ordered to attain ecological, economic and social objectives. However, policies from various states and organizations sometimes do not set a clear precedence for translating principles of EBM and present different and complex approaches to an ecosystem-based marine spatial planning (EB-MSP). Again, a feasible methodology for EBM to be operational in MSP is still vague. This paper therefore presents results from a survey and review of MSP initiatives in Europe, Asia and the Americas. Results showed that essential MSP steps and elements such as adaptive management, setting of planning boundaries, understanding and analysing the ecosystem and future conditions are not fully operational. This paper focuses on a methodology for EB-MSP and gives recommendations on how to ensure that EBM is operational at each stage of an MSP process. It stresses the importance of setting planning boundaries beyond jurisdictional borders to consider bio/eco-regions and cover near-shore waters, the need to have a cross-sector integration, understanding the ecosystem through having an ecosystem service perspective and having a legal framework to ensure that results from monitoring and evaluating of plans are adapted through review and revision.

KEYWORDS: adaptive management; ecosystem-based marine spatial planning; operational framework; monitoring

1 Introduction

Marine resources play a vital role in social and economic development as industries such as fisheries, tourism, agriculture, pharmaceuticals, shipping and mining all benefit from the resources offered. Increase in consumer demands and improvements in technology, along with population growth rate, has increased the dependency on marine resources. There is the need to strike a balance between economic development, social needs and environmental sustainability when it comes to ocean use and management. One approach and concept that has been supported by many scientists after a merger between various disciplines is the ecosystem-based approach to sea use management, built on the recognition that "the nature of nature itself is integrated" (Misund, 2006).

In terms of a marine environment, ecosystem-based management (EBM) is defined as an environmental management approach that recognizes the full array of interactions within a marine ecosystem, including humans, rather than considering single issues, species, or ecosystem services in isolation (Christensen, *et al*, 1996). The goal of ecosystem-based marine management is to maintain marine ecosystems in a healthy, productive and resilient condition so that they can sustain human uses of the ocean and provide goods and services (McLeod, *et al*, 2005; Foley, *et al*, 2010). EBM represents a paradigm shift from other traditional management approaches which were focused on individual species, on a small spatial scale,

lacked research, and were based on a short-term perspective. EBM on the other hand, focuses on the ecosystem as a whole with a long-term perspective, performed at multiple scales with the involvement of stakeholders by using an adaptive management approach (Sherman and Duda, 1999).

Although most nations and practitioners support EBM and this concept is found in most literature, policies and legislation about coastal and marine management and the practicality and implementation of it is yet to be fully realised as often the concept and its principles are too broad, and complex for planners and resource managers to put into practice to ensure effective implementation of EBM (Arkema, *et al,* 2006). Even though EBM has received considerable attention over recent years and it is a popular term in the ocean management field, there are still few examples, which demonstrate its practical implementation and it still largely remains as a promise unfulfilled (Murawski, 2007).

The need for an effective marine management cannot be overemphasized as many concepts and processes such as integrated coastal zone management and ocean zoning amongst others have been established and implemented over the past decade. However, opportunities for misunderstanding are ripe in the marine management domain, and once misunderstanding or lack of clarity about objectives of management occurs, the investment of time and energy in spatial tools and approaches may be wasted as conflicts emerge (Agardy, *et al*, 2011).

Again, a feasible agreed method for translating this attractive concept into operational management practice has been largely discussed but EBM has been implemented in different forms based on different principles (Young, *et al,* 2007; Long, *et al*, 2015.). However, comprehensive, effective and balanced EBM requires a detailed understanding of environmental processes, and also ethical, social and economic processes (Christie, 2011). To address failures in ocean governance, new perspectives have emerged that explore a more holistic approach to manage complex seascapes. These include spatial management approaches such as marine spatial planning, which seek to implement ecosystem-based management (Koehn, *et al,* 2013).

MSP has been identified as one of the processes for effective implementation of an EBM of maritime use. MSP is defined as "a public process of analysing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic, and social objectives that usually have been specified through a political process" (Ehler and Douvere, 2009). MSP is supposed to ensure that maritime uses are planned to be compatible, considering ecosystem services by harmonizing ecological, economic and social objectives. MSP considers all the interactions, connections and structures that make up the marine ecosystem to ensure that ecosystem values are enhanced. MSP is an essential tool for delivering an ecosystem approach and should add value to existing management measures for the marine environment. It should be based on a clear set of principles with a sustainable development purpose (Gilliland and Laffoley, 2008).

Ecosystem-based MSP (EB-MSP) aims to the maintenance of marine ecosystems in a healthy condition, the sustainable exploitation of ecosystem goods and services, the reduction of conflicts among competing uses of the maritime territory, and the provision of multiple benefits to an as wide as possible array of involved sectors (Katsanevakis, *et al*, 2011).

This paper therefore presents best approaches and recommendations that were used from different contexts to serve as a learning point for other MSP initiatives. The questions still remaining are "how effective is EBM considering the MSP process"? What is needed to make EBM operational in MSP process? What are the recommendations to ensure that EBM is operational in MSP? The main objective of this paper is to examine the effectiveness of EBM in existing MSP initiatives and to explore, through an empirical methodological approach, how the MSP process can operationally implement EBM. The analysis of MSP case studies and the results of a survey with MSP practitioners is used to support recommendations for an EB-MSP process.

1.1 *Ecosystem-Based Management and Marine Spatial Planning*

EBM is an approach to natural resources management that considers human society as an integral part of ecosystems (Koehn, *et al,* 2013). The core elements of EBM (Agardy, *et al,* 2011), which were developed based on various case studies include the following:

- ✓ Element 1: Recognizing connections within and across ecosystems
- ✓ Element 2: Understanding and addressing cumulative impacts
- ✓ Element 3: Managing for multiple objectives
- ✓ Element 4: Embracing change, learning, and adapting

Recently, MSP has been envisaged as a tool to overcome the main challenge in operationalizing EBM, consisting in integrating the human components in ecological and environmental considerations (Domínguez-Tejo, *et al,* 2016). The coupling of MSP and EBM was argued by (Domínguez-Tejo, *et al,* 2016). to represent a new emerging paradigm in sustainable ocean management (Katsanevakis, *et al,* 2011; Crowder and Norse, 2008; Douvere, 2008).

MSP is an explicit planning approach within an integrated, policy-based approach to the regulation, management and protection of the ecosystem, including the allocation of space that addresses the multiple, cumulative and potentially conflicting uses of the sea and land and thereby facilitates sustainable development (MSSP, 2006). The overall aim of spatial planning is to create and establish a more rational organization of the use of space and the interactions between its uses, to balance demands for development with the need to protect the environment, and to achieve social and economic objectives in an open and planned way (DEFRA, 2006).
It is important, however, to recognize that marine spatial management can only influence the spatial and temporal distribution of human activities (Douvere, 2010). MSP is an essential tool for delivering an ecosystem approach (Gilliland and Laffoley, 2008) and a focus on the spatial and temporal aspects of EBM is one way to make an ecosystem based approach more tangible in MSP and as suggested by Douvere (2010) it can be accomplished by defining:

- The boundaries of the ecosystem to be managed;
- Ocean spaces with special ecological or biological value within the ecosystem;

- Ocean spaces with special economic value and potential;
- Ocean spaces where the effects of human activities interact positively or negatively with ecological functions and processes; and
- Where conflicts are occurring or might occur (uses vs. uses and uses vs. environment).

In order for MSP to serve as a tool to ensure that the objectives of marine EBM are achieved, the components, principles and tools of EBM as highlighted above have to be incorporated into the planning process and institutionalized through its implementation.

2 Methodology

This research used two key data bases from secondary and primary sources. The output therefore is a combination of a review of relevant reports and documents from literature and the views of EBM and MSP experts acquired through the use of a questionnaire.

A review of literature and international guidelines on EBM and MSP was done to identify the core elements and principles which this study focused on for the analysis of the MSP initiatives included in this survey literature review considered EBM publications from the main international organisations (as UNEP, IUCN, etc.) and also the texts resulting from a search based on key words such as the processes and approach for the implementation of EBM and MSP and his presented on Appendix A. The review came out with 7 core elements and principles for an EB-MSP process (Table 1) which were selected based on the number of times each of the literature recognised this element an important step for the implementation of EBM. Questionnaires were constructed based on how core elements of EBM should translate into MSP and to assess how effective this has been in implemented MSP initiatives.

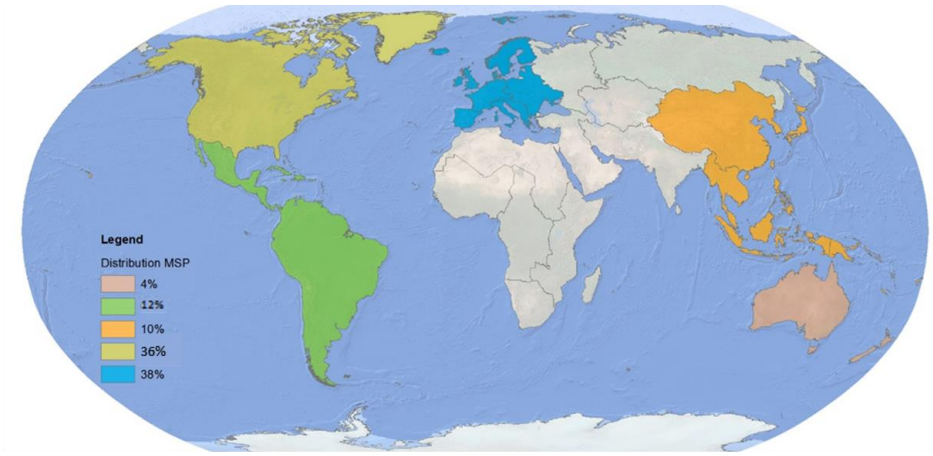
Table 1. 7 core elements for an EB-MSP process

Defining and analysing existing situation:	1. Selection of plan area and boundary 2. Scoping, Data collection and Mapping 3. Understanding structural and functional biodiversity 4. Cumulative impacts and ecosystem service perspective
Stakeholder participation	5. Cross-sector integration
Planning Phase	6. Setting of Management Measures and trade-off analysis
Implementation and Monitoring:	7. Adaptive Management

A purposive target audience was used to identify MSP initiatives and experts all over the world. This was done through the dissemination of a questionnaire through a contact list of MSP professionals. The questionnaire was also sent to EBM and MSP professionals platforms such as EBM Network and Open Channel. Experts from the International Council for the Exploration of the Sea (ICES) and the National Oceanic and Atmospheric Administration (NOAA) panels

were also part of the targeted audience who received the questionnaire. These experts in MSP and EBM were asked to answer the questionnaire based on the MSP initiative they were involved in. The results of the survey therefore represent the views of MSP experts involved in the various initiatives. The wide range and the vast nature of these platforms ensured that MSP initiatives covered were from different geographical areas, with different drivers and undertaken by different institutions. As a whole, 51 responses was received from experts; 39 MSP initiatives (shown in Figure 1) were covered from Europe, Asia, United States of America, Australia, Canada, South and Central America. Each plan that formed part of the survey was reviewed with a set of 25 questions (Appendix B) and their application at each stage of the traditional planning process. The recommendations and methodology to make EBM operational in MSP are focused and structured according to how the 7 core elements are applied in traditional planning process.

Results from the survey were analysed in themes to reflect the various stages of the MSP process as presented in the results. Most of the results are shown and discussed in percentages whiles others (question 9,11,16 and 19) which ask respondent to rank some attributes of the planning process are discussed in weighted averages. This was crafted from the summed point values according to the responses of experts after which a weighted average was calculated to show ranking. The themes and review of literature and marine spatial plans also formed the basis for the recommended EB-MSP framework proposed in section 4.



1. English East inshore and offshore plans 2.US National Ocean Policy 3.Chinese national MSP for 2011-2020 4. Swedish National MSP 5. Belgian MSP 6.Portuguese Maritime Spatial Plan (POEMA) 8.Korean MSP 9.Oregon Territorial Sea Amendment Process 10. TPEA transboundary MSP project 11. Raja Ampat MSP (Indonesia) 12. Shetland Islands' Marine Spatial Plan 13.Our Florida Reefs 14.Semporna Marine Spatial Planning 15.Babitonga Ativa 16. Rhode Island Ocean Special Area Management Plan (Ocean SAMP) 17.Oregon Marine Reserves 18. Marine Planning Partnership for the North Pacific Coast 19. Management Plan for Peninsula Valdés Protected Area 20. Washington State Marine Spatial Plan 21.Polish pilot maritime spatial plans 22.PartiSEApate project in the Baltic Sea 23. Netherland's Integrated Management Plan for the North Sea 2015 24.New York Statewide Action Plan (SWAP) 25. The Representative Areas Program (RAP) in the Great Barrier Reef 26.Marine renewable energy/ fishing SW UK 27. Coastal Zone Soil Survey of Rhode Island - USDA NRCS 28.US Federal Offshore Renewable Energy Lease Planning 29. Spatial Plans for the German EEZ. 30. Belize Coastal Zone Management Plan 31.Plan Bothnia 32Sao Paulo's MPA's zoning 33. Integrated Management Plan for the Placentia Bay/Grand Banks 34. Florida Keys National Marine Sanctuary Zoning and Regulatory Review (2013-2014) 35. South Australian Marine Planning Program 36.Dogger Bank Cross Border spatial planning process 37. Identification of conservation priorities associated with ecosystems and biodiversity (Fachada Atlantica-Venezuela) 38. The Norwegian holistic open sea EBM plans for large scale ecosystems 39. Blue Halo Barbuda.

Fig. 1. MSP initiatives involved in the study

3 Results and Discussion: Analysis of the effectiveness of EBM in MSP

This survey covered mostly MSP initiatives in Europe (38.0%), United States of America (32.0%) with others from Asia (10.0%), South and Central America (12.0%) Australia (4.0%) and Canada (4.0%). Experts involved in this survey mostly came from academia and governmental agencies with 39.2% and 37.3% respectively coming from these institutions (Figure B.1, Appendix B). Major drivers for the MSP initiatives involved in the survey were conservation (33.0%) and energy (28. 0%).About 47.0% of energy-driven MSP initiatives were from Europe and the same percentage was from the USA, although USA had 31.0% of the MSP initiatives being conservation-driven MSP as compared to Europe that had none. The European MSP were mainly driven by energy or blue growth goals or for transboundary purposes.

3.1 *Defining and Analysing Existing Situation*

In setting the planning boundary, only 14.0% of the plans set the plan boundary solely based on the ecosystem boundary (ecological and scientific consideration) as most of the time they are restricted by jurisdictional boundaries. Only 7.8% of plans set their boundaries based on bioregions and coastal watershed and near-shore waters, one of the most dynamic and essential ecosystems with regards to land and sea interaction, are mostly not considered and their impact not analysed during most MSP processes and this is proven by the fact that only 7.8% of plans considered it in their planning area (Figure B.2, Appendix A).

It would be preferable for planning units to follow meaningful ecosystem boundaries. In practice, they will also need to take into account socio-political and administrative factors and what is practical and recognisable on the ground and in the water (Gilliland and Laffoley, 2008).

It is not surprising that at the stage of understanding the ecosystem and detailing, only 57.0% of plans looked at connectivity between biotic, abiotic and socio-economic patterns and conditions which are important for the life stages of species (Figure B.4, Appendix A).

When it comes to how the existing conditions were analysed and understood, 70.0% of responses mentioned that EBM was stated as a principle of the plan, and others analysed the ecosystem; only 59.0% was truly operational by making the ecosystem a priority or by using it as a criterion for trade-offs and decision-making. In effect, it is not enough to state EBM as a principle as EBM can be truly operational in MSP when the ecosystem (services and values) becomes a priority in taking decisions and implementing them accordingly. Only 24.0% of the MSP initiatives analysed ecosystem services and valuation and actually map them out for analysis. Although ecologically/biologically valuable areas were identified (78.0%) and this was a criterion for management or decision making, the ecosystem (value and services) is not really a priority for management as it is not well understood and analysed (Figure B.8, Appendix B). The ecosystem services perspective which is necessary at the analysis stage helps to establish priorities for management by focusing on ecosystem services of highest value and the most critical threats to the delivery of ecosystem services or highly valuable areas (Agardy, *et al,* 2011).

Another important step at this stage is cumulative impact assessment to understand how human activities impact on the ecosystem and overlap with each other. From the results of the survey,

only 53.0% made a cumulative impact analysis, while only 28.0% went ahead with mapping or performing any spatial analysis of these impacts (Figure B.7-B.8, Appendix B).

3.2 *Stakeholder Participation*

In terms of stakeholder participation in MSP, frequencies from this survey showed that participation is higher at an information and communication phase (Table B.1, Appendix B). These two types of participation are on a horizontal level where interaction is not made in an active way. One of the core element of EBM is cross sectoral integration, in examination of this element it was realised that traditional users of the sea such as conservation and fisheries are engaged in the process at a high level with relatively new users such as renewable energy getting engaged more and more. Tourism and cultural heritage had 58.0% of their stakeholders involved, which is relatively low as compared to other traditional uses above (Table B.3, Appendix B). This might be due to the fact that most MSP initiatives do not usually include coastal and near-shore waters (areas where tourism is mostly dominant) as was discovered at the stage of setting planning boundaries. This point is seconded by the fact that only 25% of MSP initiatives had tourism management plans integrated into the process and only 43% of them integrated coastal development (Figure B.11, Appendix B).

For factors that determined the level of stakeholder participation, 33.3% was based on a representation of all sectors affected by the plan and political and legal issues. About 20.0% was based on key sectors which are affected by the plan. About 2.2% by population demographics, while other factors (20.0%) included a combination of political requirement and key sectors affected by the plan and sectors affected by the plan but outside the jurisdiction of the planning area (Figure B.9, Appendix B).

Stakeholder participation is important at all stages of the planning process and this was carried out in all stages of the MSP initiatives that were assessed. However, some critical stages had relatively less engagement of stakeholders. Two of these critical stages is in setting the planning boundaries 48.0% and monitoring and evaluation (33.0%) (Figure B.10, Appendix B).

3.3 *Planning Phase*

During the planning phase, more than half of the management or planning measures that were proposed sought to strengthen knowledge-based decision-making (58.3%) and mainstream conservation issues (77.8%). However, less than half of them (47.0%) considered uncertainty and changes in the dynamics of the ecosystem, for example climate changes. Only 17% of them consider incentives and financing possibilities for the protection of ecosystem biodiversity (Figure B.15, Appendix B). This is of no surprise as most plans discussed above do not extensively understand and analyse ecosystem services and valuation therefore cannot look to innovative ways of financing to protect ecosystem services and support EB-MSP implementation as shown in Figure B.8, Appendix B. Analysing future conditions forms a critical part of the MSP process, however in terms of coming out with a spatial sea use scenario, 52.0% of them did not consider scenario generation as it was mostly not undertaken. Most processes just looked at a single sector or use such as conservation (55.0%), 31.0% considered renewable energy orientation while 26.2% and 23.8% considered tourism development and

transport and safety management respectively as a scenario for the future. (Figure B.13, Appendix B).

With respect to the criteria used in making trade-off analysis, the following ranking was derived in a descending order: Ecologically and biologically valuable areas were listed most as the number one priority with 15 responses as shown in Appendix 1 and a highest weighted average (4.4), Areas of National Security (4.2), Shipping routes and traffic separation schemes (4.1), Ecological areas under international agreements (3.9), Operationalisation of a particular maritime use due to technical requirements (3.7) and Preferential areas and conditions of national importance (3.3) (Table B.4,Appendix B).

3.4 *Implementation and Monitoring Phase*

Different MSP initiatives employ different forms of monitoring and evaluation. About 51.3% did this by monitoring the state of the ecosystem. About 30.8% measured the performance of the management measures and measured a set of indicators against quantitative goals respectively, while 15.4% measured the time and rate of implementation of management measures to assess if the plan is being followed. About 35.9% did not have monitoring in place yet and it was mostly discussed in concept (Figure B.17, Appendix B). In determining how the results from monitoring the ecosystem were adapted into the plan, 41% modified plan goals and objectives. About 28.2% modified management measures whiles 20.5% modified desired plan outcomes. About 41.0% did not have their management measures/actions implemented yet although adaptation was planned for. Another approach that was used is the modification of policies (Figure B.16, Appendix B).

Finally, although adaptive management is stated as a concept and principle in most of these planning processes, when it comes to how it was implemented or operationalized only 21.0% of the plans that were analysed had an operative mechanism for adaptive management. This was either through having a legal instrument which ensures adaptation or revision of plans over time or had a mechanism for turning monitoring into a retroactive process for new measures or goals to be set (Figure B.18, Appendix B)

4 Operational EB-MSP approach

MSP is a promising way to simultaneously achieve social, economic and ecological objectives by means of a more rational and scientifically-based organization of the use of ocean space (Douvere, 2010). However, to achieve these objectives, the ecosystem-based approach, which is one of the attributes for an EB-MSP, should operational and integrated. The recommendations that are made in this section seeks to ensure that the planning process and the EBM (principles, issues and approach) are fitted into each other within a structured process for EB-MSP along with other attributes such as adaptation, integration, future orientation and participation (Douvere, 2010). Figure 2 is a representation of the EB-MSP framework and methodology with specific elements of EB-MSP indicated under each step of the process. Detailed description of each stage of the framework is explained in this section.

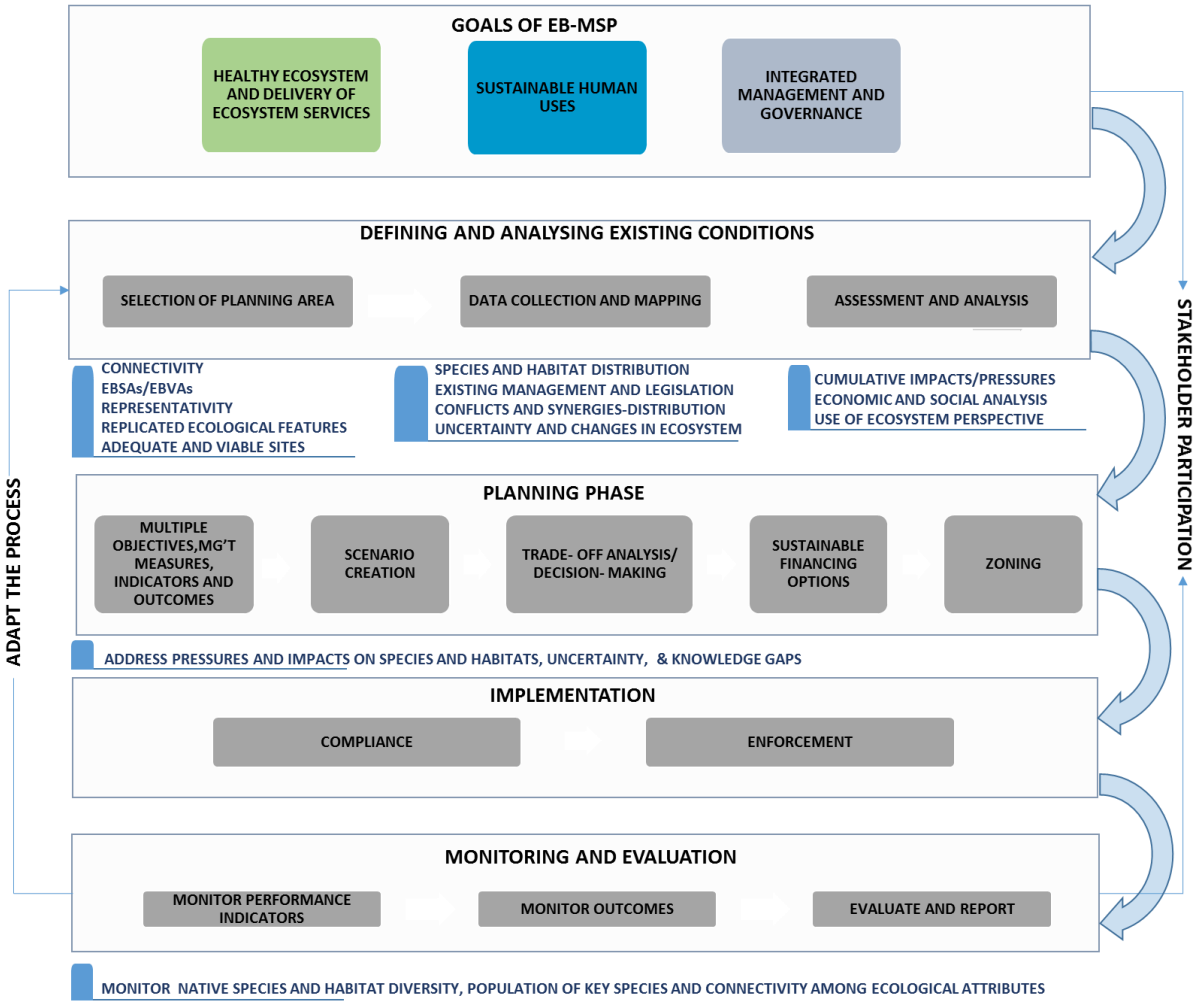


Fig. 2. Proposed Framework and Methodology for EB-MSP.

4.1 *Goals of EB-MSP*

EB-MSP deals with multiple objectives in the marine area so in setting the goals of EB-MSP, the objective-based approach should be employed as it promotes management and use of marine areas and resources in a manner that addresses the multiple needs and expectations of society, without jeopardizing the options for future generations to benefit from the full range of goods and services provided by the ocean (Fisheries and Oceans Canada, 2007).

The goals for an EB-MSP as developed in the Eastern Scotian Shelf Integrated Management (ESSIM) Initiative (Fisheries and Oceans Canada, 2007) should ensure the following as shown in Table 2:

Table 2. Goals of an EB-MSP process

<table>
<tr><td colspan="2">1.1.1 Healthy Ecosystem and Delivery of Ecosystem Services
The ecosystem should be a priority at this stage where goals and objectives are set. EB-MSP should optimize and harmonize the ecological, environmental and social objectives concerning the ordering of marine space and uses. This can be ensured when the objective is to:
Ensure resilient and productive ecosystems with diversity of species and habitat
Ensure strong environmental quality that supports ecosystem functioning and delivery of ecosystem services</td></tr>
<tr><td>1.1.2 Sustainable Human Uses
The goal for an EB-MSP should also ensure that human activities in the marine space are sustainably used for economic and social benefits while not impacting the environment. The objective of this goal is to ensure:
Ecologically sustainable use of ocean space and resources.
Sustainable communities and economic well-being.</td><td>1.1.3 Integrated Management and Governance
An effective EB-MSP process should be based on effective management and governance structures to ensure that stakeholders are empowered and effectively involved. The objective of this goal will be to ensure:
Effective governance structures and processes.
Capacity building among stakeholders.
Knowledge building to support integrated management</td></tr>
</table>

4.2 *Defining and Analysing Existing Conditions*

This stage of the EB-MSP process mainly involved defining the planning area, stock taking and the analysis of data and maps from the stock taking and data collection stage.

4.2.1 Selection of the planning area and boundary

It was realised that for existing MSP initiatives, the boundary of the planning area was set normally based on a combination of scientific, environmental, and jurisdictional/political considerations as well as areas of ecological or biological importance. From these aspects jurisdictional boundaries are considered a major factor.

However, one of the principles and elements of EBM that should be operational at this stage is to ensure connectivity within and among ecosystems. This can be ensured by setting planning areas based on bio/eco-regions, as has been exemplified by Australia's national marine bio regionalisation where spatial patterns in the benthic and pelagic environments in Australia's marine jurisdiction were set at scales appropriate for regional marine planning (Commonwealth of Australia, 2005). This approach ensures that planning and management units are defined ecologically, and provides a systematic and spatial framework for finer scale planning and environmental assessment. It also assists scientist in understanding biogeographical patterns and as a vehicle for communicating information.

This approach first of all assists with management of marine resources to ensure that marine industries are ecologically and economically sustainable. Again, it serves as a tool for organising spatial information, provides a clear focus on conservation, education, science,

environmental inventories and ensures the delineation of biophysical distributions and sustainable management of the marine environment (Commonwealth of Australia, 2005).

Similar approaches have been implemented in New Zealand and Canada (Douvere, 2010). However, in areas such as Europe where marine jurisdictional boundaries are so close to each other with many states also involved, this approach has not been successful and indeed the analysis of results shows that only 7.8% of MSP initiatives carried out the process based on bioregions. Although MSP initiatives have been carried out in Europe and there are measures to protect ecologically and biologically valuable areas, it happens that ecosystem patterns and processes are often not consistent with administrative boundaries – that is instead of being set on bioregions or on ecosystem boundaries (Douvere, 2010).

A solution to this challenge is the implementation of MSP on a transboundary level based on the bioregions that have been demarcated by the ICES in 2004. This would ensure that EB-MSP is implemented at a bioregional level and the overlaps and conflicting issues between countries are identified and addressed before each country goes into developing MSP for their various jurisdictional areas. Examples can be drawn from the Baltic Sea MSP initiatives (Zaucha, 2014). International agreements and policies are critical in ensuring planning beyond jurisdictional boundaries by developing common visions and goals. Countries with shared high level goals and commitments can use them as a point of departure for developing cooperation in cross boarder MSP (Secretariat of the Convention on Biological Diversity and the Scientific and Technical Advisory Panel-GEF, 2012).

In addition to using a bioregional approach in setting an ecosystem boundary, the planning area should cover coastal and near-shore waters and the uses and impacts from this area analysed and addressed. This step is important as it was realised from the results of the survey that most MSP plan boundaries are set in a single geographical area and rarely look at an interconnected geographical scope.

Apart from using the bio regionalisation approach in setting the boundary of the planning area, it is important that scientific and ecological/environmental consideration (ecosystem boundary) is predominant over just jurisdictional. The planning boundary should ensure that connectivity; ecologically and biologically significant areas; representativity; replicated ecological features; and adequate and viable sites are covered in the area (Convention on Biological Diversity, 2009).

Another approach to curtail this challenge is to ensure that even if EB-MSP is planned in a stepwise fashion, as in the starting-small case, the outer limits of the larger ecosystem or ecoregion, and the links between habitats within it are considered, in order to lay the groundwork for future adaptive management (Agardy, *et al,* 2011)]. For cross boarder MSP where the area includes different administrations, legal barriers should be identified and adequate legal approaches should be employed to facilitate MSP to ensure that there is a proportional connectivity among the jurisdictional zones (Muñoz, *et al*, 2015). The need for international agreement and policies is therefore necessary to achieve this goal.

In setting the boundary, the biophysical and community design principles which have been used for MPA purposes can be explored in MSP (Kirkman, 2013). It is also important to note that there are two different types of boundaries which are boundaries for management (designated by political process and limited in covering natural processes and the ecosystem boundary) and boundaries for analysis or planning (Ehler and Douvere, 2009). The boundaries for planning therefore should not be limited to the coverage of the management area but go further to be set based on a bioregional approach or with an ecosystem boundary perspective. A boundary that is set based on the ecosystem or with biological and ecological consideration sets a strong basis for the planning process to be ecosystem-based. Setting a planning area beyond that of the management area helps to identify and to a large extent capture external sources of influence that have an effect on the management area. This also makes it easy to identify the connected stakeholders in order to propose solutions and measures to any kind of externality that might impact the ecosystem.

4.2.2 Data Collection and Mapping

It is important that information on ecological, economic, environmental and oceanographic conditions are collected and mapped for further analysis. Information on important human uses such as both commercial and recreational fishing; marine transportation; renewable and non-renewable energy production; and sand and gravel mining, among others should be collected and mapped (Ehler and Douvere, 2009). In order to make EBM operational in MSP it is also important, that key ecological features are identified for protection and this can easily be achieved through the bio-profiling process. Apart from using the bio-profiling process, the condition of the ecosystem can be analysed based on the following criteria which is adapted to the Azores scientific criteria and guidance for identifying Ecologically or Biologically Significant Marine Areas (EBSAs) and designing representative MPAs (Convention on Biological Diversity, 2009).

- Connectivity between biotic, abiotic and socio-economic patterns and conditions which are important for the life stages of species
- Biological diversity
- Biological productivity
- Uniqueness or rarity of habitats and species
- Endangered or species and habitats under threat/vulnerable
- Natural areas (areas with low level of human degradation)
- Areas of community and cultural value
- Areas of high-level importance to human use

4.2.3 Assessment and Analysis

It is important that during all EB-MSP processes, mapping and spatial analysis of cumulative impact are undertaken to understand areas under immense pressures and threat. Having a cumulative impact perspective allows for tailored management and planning measures to help

conserve and protect habitats and species that are under pressure. Again, it also serves as a criterion to be considered when making trade-offs and decisions about siting of activities and uses. The Ecosystem-based Risk Assessment (ERA) methodology which involves ranking data based on the identified significant positive and negative interactions between two activities and also incorporates a range of pressures and impacts serves as an approach to make informed management decisions (Kelly, *et al,* 2014).

Interaction between the marine area and the coastal area should be something to look at during the analysis stage. EB-MSP should go beyond other traditional approaches by ensuring that the marine area is managed in such a way that the impact of human activities on the marine and coastal ecosystem are considered and the connectivity between these two geographical scopes is managed such that one does not have a negative impact on the other.

Again, EBM and adaptive management can be operational at this by analysing uncertainties that can happen within the planning area. This could mainly be climatic changes that might affect the dynamics of the ecosystem or any other unexpected constraints that can hinder the proper functioning of the ecosystem or the implementation of planning measures (economic or political constraints).

The use of EBM tools is also a means of ensuring that EBM is operational in MSP. However, if there are constraints such as lack of resources and time, expert advice and review can be relied on, as was done with some MSP initiatives that formed part of this survey.

4.3 *Stakeholder Participation*

The participation and involvement of stakeholders is the backbone of a successful EB-MSP process. The fact that ecosystem goods and services are, in many instances, external to the market economy or lack proper market valuation is thought to hamper effective planning and management of ecosystems (Kidd, *et al,* 2011). The only sure way to ensure that ecosystem goods and services are properly maintained is through effective stakeholder engagement processes and participation. According to results of the study, stakeholder participation is based on the following factors:

- Political and legal requirement;
- A representation of all the sectors affected by plan;
- Cultural setting of the planning area;
- Key sectors which are affected by plan; and
- Population demographics (size of the planning and management area).

However, it is important that apart from political and cultural dynamics and requirements of the planning area, stakeholder participation should reflect and be based on all sectors which are affected by the plan. An effective stakeholder participation should ensure that local community actors, environmental NGO's and key sectors are empowered through the process and involved at each stage so that community and societal values will be reflected in the process and that implementation and monitoring of measures are effectively done. Results of this study showed that stakeholders from tourism and coastal development sectors are relatively not fully engaged as compared to other marine sectors as most plans normally focus on sectors from the marine

area. Again, only a quarter of the marine spatial initiatives that were studied integrated tourism management plans into the MSP process. It is essential in an EB-MSP process that stakeholders from tourism, cultural heritage and coastal development sectors are all engaged as are the other marine sectors.

Due to the complexity of ecosystem functioning and management of multiple objectives and sectors, EB-MSP should ensure that there is a cross-sectorial integration throughout the process. Sectorial integration should move from mainly considering traditional marine sectors such as transportation and conservation, to integrating other emerging marine sectors. Fully operationalizing EBM in MSP would involve a cross-sectorial mechanism to facilitate overall planning and coordination of individual sector policies, such as fisheries, shipping, energy, tourism, and so forth – through which each sector can apply sector policies to implement EB-MSP (Agardy, *et al,* 2011). Management measures from these sectors should all be in tandem with the overall goal and objectives set through the EB-MSP process.

Although stakeholder participation is not a clear-cut procedure to follow and its application is dependent on the particular political and cultural setting, participation should, as much as possible, be effective across all forms which are information, communication, consultation, dialoguing, concertation and negotiation to build interest and create a platform for involvement and empowerment.

Stakeholder involvement and participation should also be of prime importance at each stage of the EB-MSP process. According to the results of the study, there were two critical stages where there was less stakeholder participation, which are when setting the boundary of the planning area and at the monitoring and evaluation stage. It is important that during the stage of setting the planning boundary, the local community, science community and all the sectors involved are brought together so that a decision about the setting of the planning area would reflect the shared goal and knowledge of the community and institutions and this should follow the concept used in bioregions where "boundaries of a bioregion are best described by the people who live within it" (Miller, 1996). This is a major step as management or planning boundaries should be more bio-or ecological-based with stakeholder involvement. The same applies at the monitoring and evaluation stage where NGOs, the indigenous community and all marine sectors should be all involved in analysing the results, outcomes and achievement of the plan to serve as a basis to ensure easy adaptation.

4.4 *Planning Phase*

The planning phase of an EB-MSP should look at coming up with planning and management measures, making trade-offs where the ecosystem is a priority and analyse future conditions by scenario creation, innovative and sustainable financing options and zoning for the implementation of regulations.

4.4.1 Multiple Objective, Management Measures, Indicators and Outcomes

Specifying clear goals for MSP increases efficiency and efficacy of the process and EB-MSP process should address multiple sector objectives and issues as against a single or dual sector approach. This raises the need to have common goals and objectives among stakeholders. A multiple objective approach will ensure a holistic thinking across management sectors, so that trade-offs among sectors and objectives can be identified and addressed for a mutually beneficial outcome (Beck, *et al,* 2009).

Potential trade-offs of proposed management measures should be explicitly identified and quantified. Planning and management measures are the means by which the desired goals and objectives of the plan would be achieved. This would include spatial and temporal distribution, output, input, and process measures. Management and planning measures should look at addressing the following issues (Kidd, *et al,* 2011):

- Reducing of threats and impact of human activities on the environment;
- Ensuring that information is available and research done to make knowledge-based decisions;
- Seeking to ensure the conservation and sustainable use of the ecosystem but by mainstreaming conservation concerns in all sector management tools;
- Representation of all the ecosystem components and sectors;
- Uncertainties and changes in the ecosystem to be addressed, especially climate change and how it affects future uses and future actions in the planning or management area; and
- Management practices and measure for effective responsibility should lie at the local level as the ecosystem functions on variety of scales

For effective evaluation of the implementation of management and planning measures against the goals and objectives, outcome and performance indicators should be set while objectives are being specified during this stage of the planning process (Fisheries and Oceans Canada, 2007).

4.4.2 Scenarios and Analysing future conditions

EB-MSP should be a future oriented activity and results from this study show that only half of the MSP initiatives actually made scenario analysis and analysed future conditions. The following represents steps in undertaking scenario and future condition analysis (Ehler and Douvere, 2009):

- Projecting current trends in the spatial and temporal needs of existing human uses;
- Estimating spatial and temporal requirements for new demands of ocean space;
- Identifying possible alternative future scenarios for the planning area; and
- Selecting the preferred spatial sea use scenario.

In projecting current trends, uncertainty and changes in the marine environment and its effect on ecosystem services have to be looked at. Furthermore, the implications for human uses have

to be examined and measures proposed for that purpose. In estimating current and temporal ocean space, it is essential that areas for conservation purposes such as MPAs and areas under international conservation agreement are all factored into the process. Various alternatives for future scenarios can be generated; however, conservation-oriented scenarios should be reflected in the preferred spatial sea use scenario that would be chosen. The protection and conservation of biologically and ecologically valuable areas which ensures the maintenance and provision of ecosystem services should be a high priority when selecting a preferred spatial scenario for the future development of a particular marine area.

4.4.3 Trade Offs

In ensuring that EBM is truly operational in MSP, the ecosystem should be a priority when it comes to making trade-offs. Existing MSP initiatives include in this survey made trade off based on a combination of the following factors:

- Political informed choice;
- National legislation;
- Comments from the sectors involved;
- Environmental Impact Assessment of the uses considered; and
- Comprehensive evaluation involving all the sectors.

It is important that decisions on spatial distribution and trade-offs among uses are made after comprehensive evaluation involving all sectors with the ecosystem being a priority. The following are prioritized criteria according to its order of importance that can be used to ensure that environmental and ecosystem priorities are addressed at this stage of the planning process.

- Ecologically and biologically valuable areas
- Areas of National Security, e.g. Military Defence area
- Ecological areas under international agreement e.g. Natura 2000
- Shipping routes and traffic separation routes
- Operationalization of a particular maritime use due to technical requirement, (e.g. offshore wind energy is more economically viable when close to the coast)
- Preferential areas and conditions of national cultural and social importance

It is important that in making trade-offs between uses, the environment and the maintenance of ecosystem services is a top priority as proposed in the criteria above. Again, in selecting the preferred spatial use scenario or preferred management strategies instead of political consideration, and with economic effects/benefits being the top most priority, as is the case of existing MSP initiatives that this survey covered, the physical, chemical, and biological cumulative effects of uses should be the prime consideration. Again other factors such as financial feasibility and timing for implementation should also be considered.

4.4.4 Innovative and sustainable financing for EB-MSP

As the plans are being formulated, there is the need to ensure that government has apportioned budgets for planned actions and measures to be implemented, especially those related to

ensuring that the ecosystem (services, values, functioning and biodiversity) is maintained and the environment is conserved. Only 17% of plans considered incentives and financing possibilities that strengthen the protection of ecosystem biodiversity. Without specifically looking at how to finance the protection of the ecosystem during the planning process, EBM cannot be truly operational in MSP and the ecosystem (services, value, functioning and biodiversity) cannot be maintained. Other innovative financing options to ensure that the ecosystem services and values are maintained and sustainable use is ensured include (Agardy, *et al,* 2011):

- Revenue from fees– user fees from marine parks, fees for eco-labelling and certification, non-renewable resource extraction, tourist-related fees, collection of licensing fees (fishing and hunting, for example) to set up conservation funds;
- Private sector investment in conservation e.g. management of marine parks;
- Public/private partnerships such as municipal governments teaming up with chambers of commerce, or private financing of public sector resource management;
- Fines for illegal activities;
- Trust funds;
- Income derived from local enterprises (such as the sale of handicrafts); and
- Payment for Ecosystem Services (PES) systems and associated market offsets by allowing managers of coastal lands or marine resources, be they government agencies or local communities and user groups, to "sell" the protection of ecosystem services to the buyers who most benefit and value them. New revenue streams for management can thus be generated.

4.4.5 Zoning

One important element that should be introduced at this stage of EB-MSP is ocean zoning. Ocean zoning is defined as 'a regulatory measure to implement MSP usually consisting of a zoning map and regulations for some or all areas of a marine region' (Ehler and Douvere, 2007). Zoning has the ability to ensure that regulations are enforced in particular sections of the planning and management area. Zoning ensures minimizing conflicts between incompatible uses by addressing interaction between many uses and takes a holistic view of areas of ecological importance and environmental vulnerability to ensure the delivery of ecosystem services, making it a tool to EBM operational in MSP (Agardy, 2010)

4.5 *Implementation Phase*

The implementation stage involves three stages (Ehler and Douvere, 2009). These are implementation of management and planning measures, ensuring compliance and enforcement. It is important to ensure that all sectors are involved in the implementation of management measures and zoning regulation. It is essential to ensure that stakeholders, especially the community, are involved from the onset to make implementation smooth and effective. In trying not to reinvent the wheel and to reduce costs it may be necessary to use existing institutions for the implementation process. To make EBM operational all single-sector management

institutions should comply in implementing existing measures and also in generating future plans and programmes in accordance with the spatial management plan and measures.

Enforcement of measures can be ensured through inspections, negotiations and legal actions and regulations should be consistently applied on the basis of transparent policies and procedures (Ehler and Douvere, 2009). NGOs should be involved at this stage to detect and report non-compliance.

4.6 *Monitoring, Evaluation and Adaptive management*

Limited relevant knowledge, information and data in addition to unforeseen changes (economical, political and environmental) in the marine environment and ecosystem are challenges that are common to most MSP initiatives. This calls for an EB-MSP process that is iterative, continuous, and adaptive. At each stage of the process, there should be an evaluation to ensure that set procedures are followed to inform the next stages. Again, to make EBM operational in MSP the process has to be continuous. The first planning cycle should end in a monitoring and evaluation step and results and lessons learnt should be adapted into the next planning cycles.

Results from this research showed that the monitoring stage of EB-MSP should include the following:

- Monitoring the state of the system: focuses on assessing, for example, the status of biodiversity in the marine area, the quality of water, or the overall health of a particular ecosystem (Ehler and Douvere, 2007);
- Performance monitoring: measuring the actual performance of management measures for example ‘are the boundaries of the protected area sufficient to conserve the special habitat?' (Ehler and Douvere, 2007); and
- Time and rate of implementation: measuring the time and rate of implementation of the management measures to assess if the plan is being followed.

For the monitoring process to be easy and effective with meaningful results monitoring should be based on indicators referred to at the setting of goals and objectives stage above. This calls for objectives of the EB-MSP to be specific, measurable, action-oriented and time-bound. The indicators for monitoring should also be readily measurable, cost effective, concrete, interpretable, grounded on scientific theory, sensitive, responsive and specific (Koehn, *et al* 2013).

Evaluation should be a continuous process in which measures or indicators of performance are defined and systematically compared with programme goals and objectives (Ehler and Douvere, 2009). Reporting of the information from evaluation would serve as a basis to adapt the EB-MSP process.

Adaptive management in MSP can be achieved by (Ehler and Douvere, 2009):

- Modifying MSP goals and objectives (for example, if monitoring and evaluation results show that the costs of achieving them outweigh the benefits to society or the environment);

- Modifying desired MSP outcomes (for example, the level of protection over a large marine protected area could be changed if the desired outcome is not being achieved); and
- Modifying MSP management measures (for example, alternative combinations of management measures, incentives and institutional arrangements could be suggested if initial strategies are considered ineffective, too expensive, or inequitable).

In order to ensure the implementation of an EB-MSP, a framework for monitoring and evaluating spatially managed areas must explicitly consider interactions between ecosystem components, management sectors, institutions and key actors, as well as the cumulative impacts of human activities. This approach has been shown through a 7 step framework based on existing concepts of adaptive management and considers a number of practical examples (Stelzenmüller, *et al,* 2013).

For adaptive management, which is one of the essential element of an EB-MSP process to be achieved there should be a legal framework or instrument to ensure that plans and initiatives are adapted from time to time. Adaptive management should not only be stated in concept or only as a principle of the plan but there should be an operational tool that would ensure that experiences, lessons and results from the monitoring and evaluation are adapted to ensure that the EB-MSP is iterative.

5 Conclusions

Demand for ocean space is on the rise as traditional uses such as fisheries, maritime transport and tourism as well as new ones such as renewable offshore energy and aquaculture are expanding. Maritime space is limited and there is a need to optimize social, economic and environmental objectives. EB-MSP is an approach to ensure that sustainable development is achieved through ordering human activities in marine space to guarantee that resources satisfy the need of the current population while maintaining its resilience to provide for future generation. The methodology and process for an EB-MSP should be robust and inculcate EBM principles. There is the need to situate EBM principles and elements into MSP and have a robust and functional EB-MSP. An operational EB-MSP process should consider the following:

Firstly, the process should look at setting a boundary for planning which is based on the ecosystem patterns, functions and connectivity (bioregions). In doing this, it has to be ensured that coastal and near-shore waters are covered in the planning boundary. Secondly, it should look at understanding the ecosystem (services, values and functions) to make informed decisions. Again, it should build the interest of the citizenry, expand participation, ensure a cross-sectorial integration and empower the stakeholders that are involved in the process. The process should also be future-oriented to be able to analyse future conditions and provide a direction for future development and maintenance of ecosystem services. Furthermore, it should provide management and planning measures that seek to reduce threats and pressures on the environment, address uncertainty and changes in the marine environment and enforce a knowledge-based decision-making process where the ecosystem is a priority. Lastly, a robust process and methodology should be one which is iterative: to ensure that there is a legal

instrument in place so that results from monitoring and evaluation are adapted into the next planning cycles.

Apart from all the recommendations above, there should be governance processes to ensure that appropriation of marine resources would not lead to less prioritisation of the environmental conservation goals and ensure that community values and involvement are not limited in the decision-making process. There should also be a conscious effort to ensure that experts from academia who have worked with MSP are more involved at the national level of MSP to influence decision-making.

In a nutshell, EBM can be operational in MSP on the whole if there is the political will to apply the principles and methodology of an EB-MSP. To ensure sustainable development, governments of various countries should be committed to the process by ensuring that the methodology is facilitated through adequate financial allocation and legal instruments.

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830 Appendix A: Literature that was reviewed to select the core elements and principles

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832

Literature	Stakeholder involvement	Selection of plan area and boundary	Scoping, Data collection and Mapping	Understanding structural and functional biodiversity	Economic Issues	Dealing with complexity and uncertainty	Assessment and Analysis (cumulative impacts and trade off analysis)	Setting of Management strategies and actions	Interaction between sectors	Adaptive Management
UNEP (2011)Taking Steps toward Marine and Coastal Ecosystem-Based Management- An Introductory Guide										
IUCN's CEM. The Ecosystem Approach: Five Steps to Implementation (Shepherd, 2004)										
Principles and practice of Ecosystem-based management. A guide for conservation practitioners in the tropical western PACIFIC (Clarke and Jupiter, 2010)										
The Ecosystem Approach to Marine Planning and Management (Kidd et al., 2011)										
Key elements and steps in the process of developing ecosystem-based marine spatial planning (Gilliland and Laffoley, 2008)										
Ecosystem-Based Management for the Oceans (Mc Leod and Leslie, 2009)										
	6	4	4	5	1	3	4	4	3	5

Appendix B: Questionnaire and Results

1. What is the name of the maritime spatial planning process that you were involved in?

Defining and Analysing Existing Situation

2. Which of the following Institutions were you representing at the time of Plan elaboration?

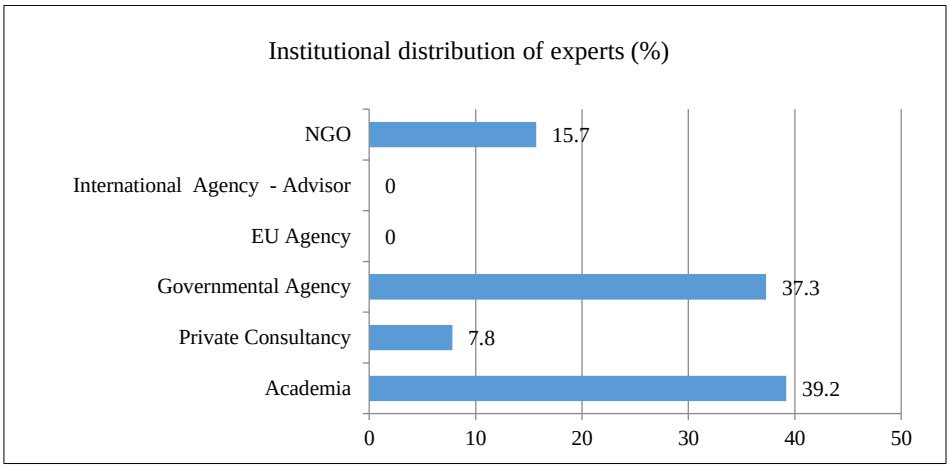

Fig. B.1. Institutional distribution of experts involved in survey

3. Which of the following geographical scope were included in the planning area?

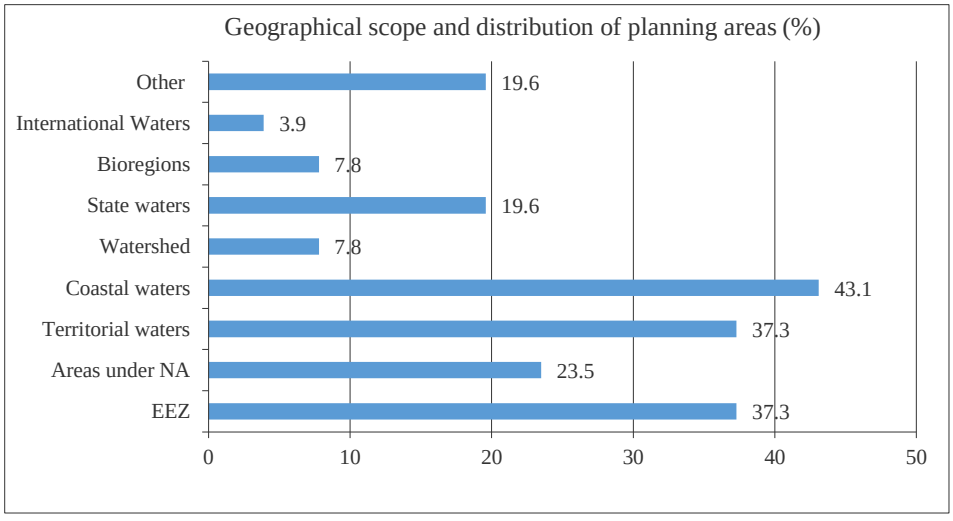

Fig. B.2. Geographical scope and distribution of planning areas

4. What mechanism was put in place to ensure that the plan is ecosystem based (ecosystem services, values and functions are considered in the planning process)?

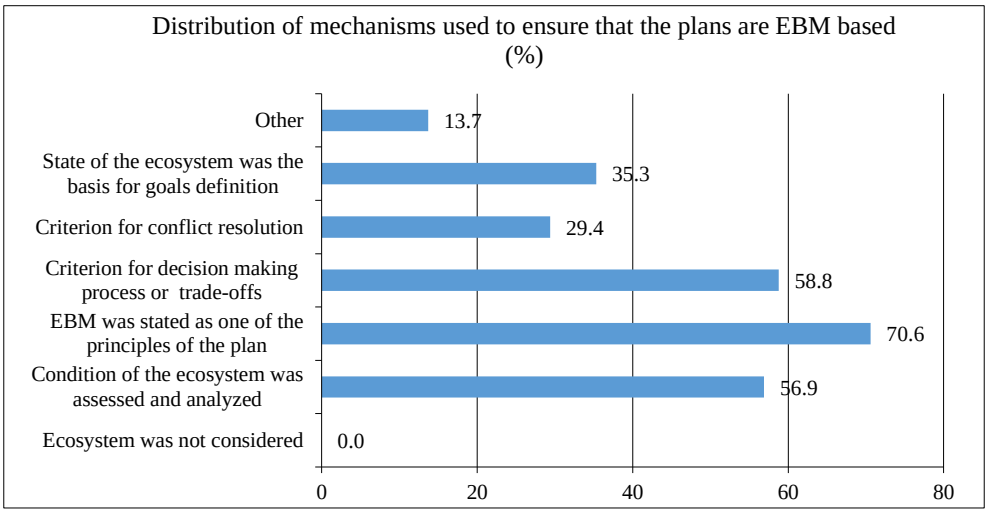

Fig. B.3. Distribution of mechanisms used to ensure that plans are ecosystem-based

5. Which of the following represent how the ecosystem was detailed and understood at the stage of defining and analysing the existing condition? (more than one option)

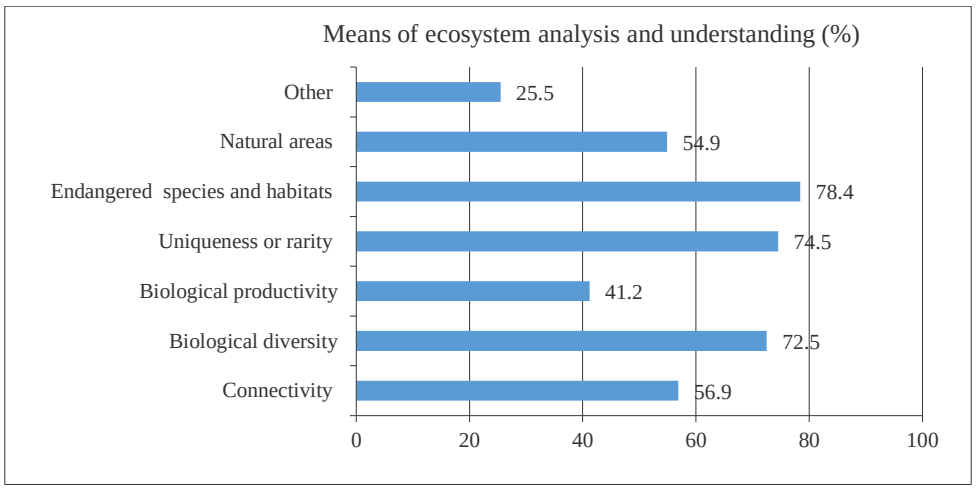

Fig. B.4. Means of analysing and understanding the ecosystem

6. Which of the following ecosystem based management tools were used in the characterization phase?

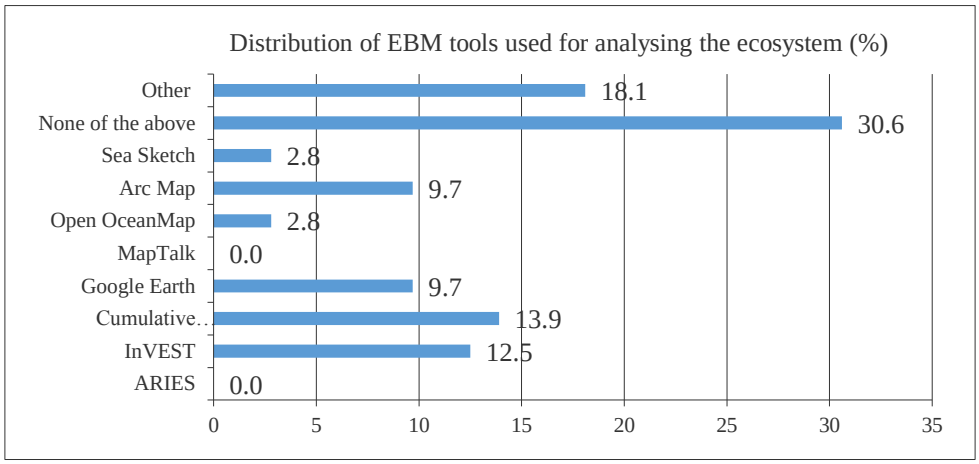

Fig. B.5. Distribution of EBM tools used for the analysing the ecosystem

8. In setting the boundary of the planning area and for analysis which of the following factors was taken into consideration?

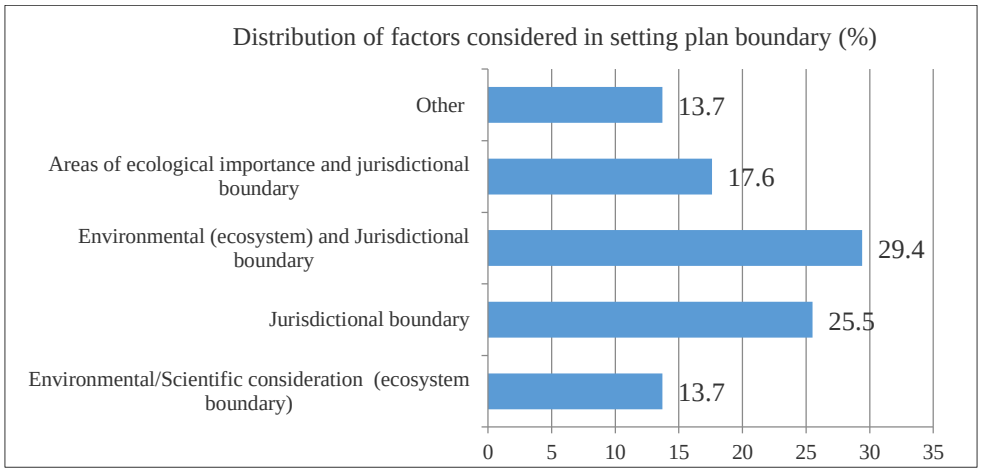

Fig. B.6. Distribution of factors considered in setting the plan boundary

8. In characterizing the ecosystem, which of the following environmental and ecological conditions were data or information collected? (You can choose more than one option)

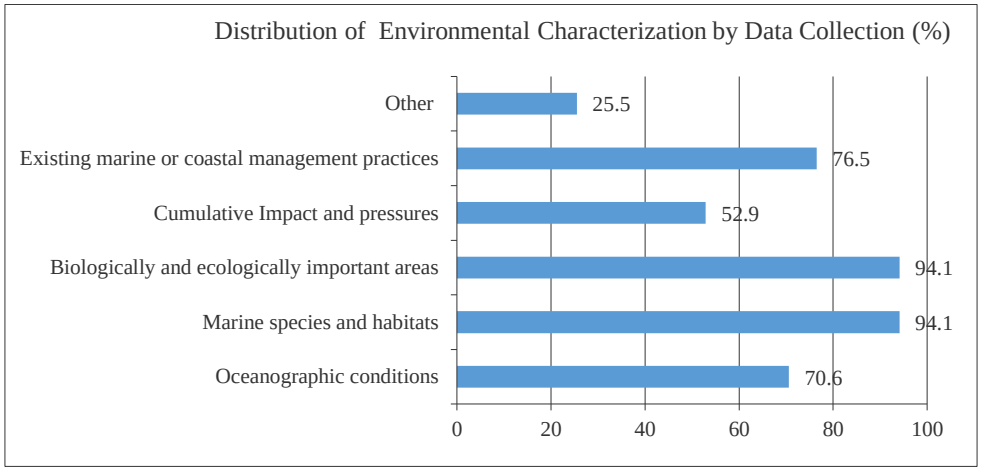

Fig. B.7. Distribution of Environmental Characterisation by Data Collection

9. Which of the following environmental characteristics were mapped out? (You can choose more than one option)

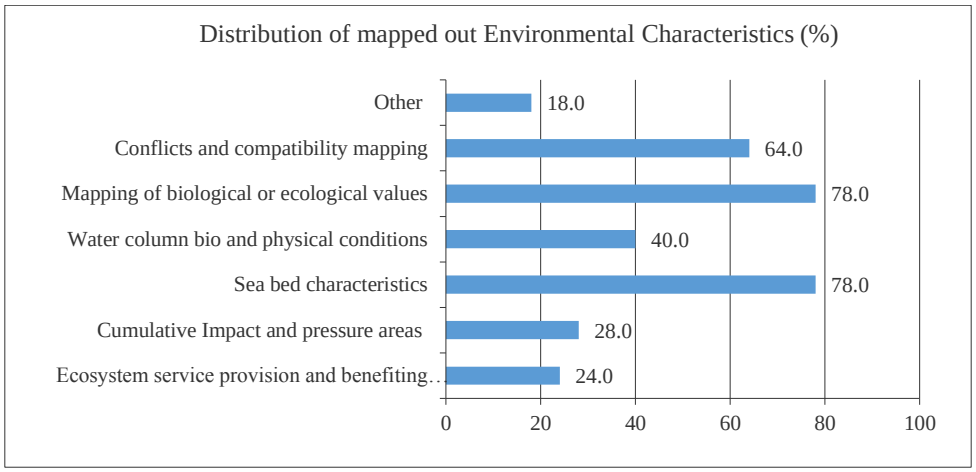

Fig. B.8. Distribution of mapped out environmental characteristics

Stakeholder Participation

Table B.1. Ranking of the level of engagement of stakeholders

10.How would you rank the level of engagement of stakeholders in the planning process? (From 1 to 5, with 5 really high and 1 really low level?						
Answer Options	**1.Really High**	**2.High**	**3.Moderate**	**4.Low**	**5.Really Low**	**Rating Average**
Information	9	22	12	3	0	3.80
Communication	10	20	10	6	0	3.74
Dialogue (develop an understanding)	8	20	13	4	1	3.65
Consultation	6	22	11	5	1	3.60
Concertation (determine a common position)	3	17	10	13	3	3.09
Negotiation (reach decision)	3	15	13	12	3	3.07

11. The level of stakeholder participation was based on which of the following factors?

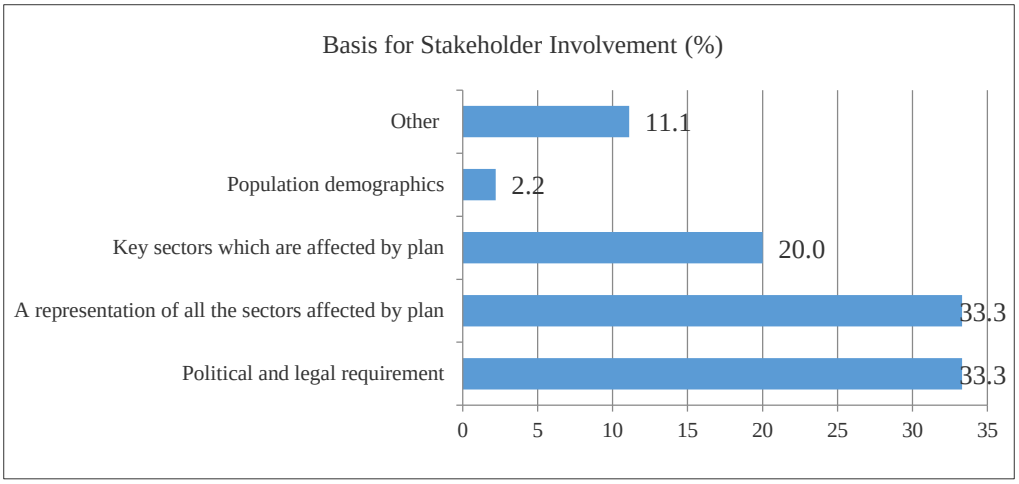

Fig. B.9. Factors for Stakeholder Involvement

Table B.2. Ranking of sectors and stakeholders engaged and integrated

12.Please rank the level that the following sectors and stakeholders were actively engaged and integrated into the process (From 1 to 5, with 5 really high and 1 really low level)						
Answer Options	**1.Really High**	**2.High**	**3.Moderate**	**4.Low**	**5.Really Low**	**Rating Average**
Marine conservation/protection	18	18	10	0	0	4.17
Fisheries	16	16	8	3	3	3.85
The science community	16	15	8	6	1	3.85
Renewable energy	14	11	4	5	10	3.32
Heritage (cultural)	11	11	8	8	7	3.24
Tourism	8	14	11	5	7	3.24
Maritime Transport	3	16	13	6	7	3.04
Military Defence	8	9	7	7	13	2.82
Aquaculture	4	8	15	1	15	2.65
Oil and Gas Mining	5	6	6	6	19	2.33
Sand and Gravel Mining	3	5	7	10	18	2.19

Table B.3. Sectors and stakeholders engaged and integrated

13. Which of the following sectors and stakeholders were actively engaged and integrated into the process? (You can choose more than one option)	
Answer Options	**Response Percent**
Marine conservation/protection	95.6%
Fisheries	88.9%
The science community	80.0%
Renewable energy	62.2%
Tourism	57.8%
Maritime Transport	55.6%
Heritage (cultural)	53.3%
Aquaculture	48.9%
Military Defence	46.7%
Oil and Gas Mining	31.1%
Other (please specify)	28.9%
Sand and Gravel Mining	22.2%

14.Please select at which stages stakeholders and the science community were engaged? (You can choose more than one option)

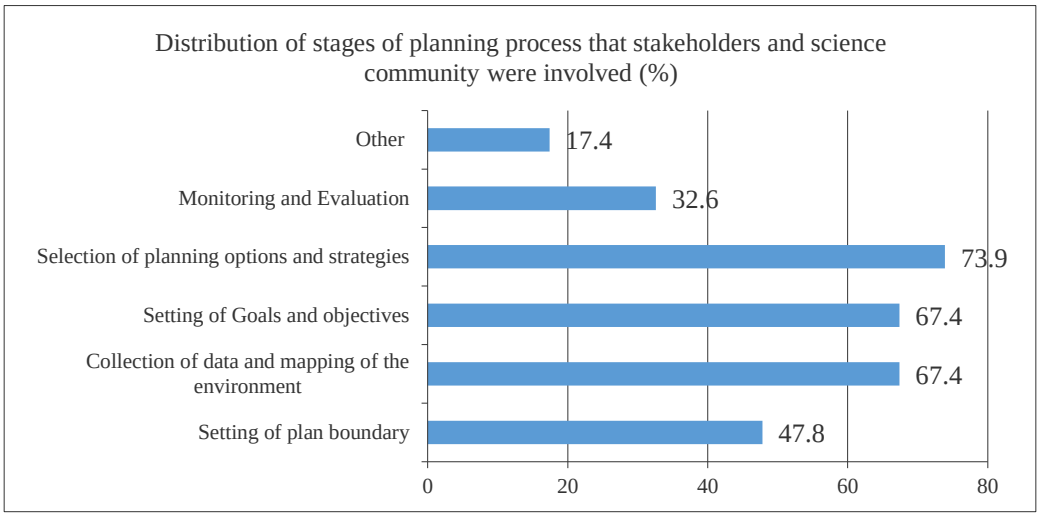

Fig. B.10. Distribution of stages that stakeholders were involved

15. Please select from the following sectors have their management plans and actions linked and integrated into the plan. (You can choose more than one option)

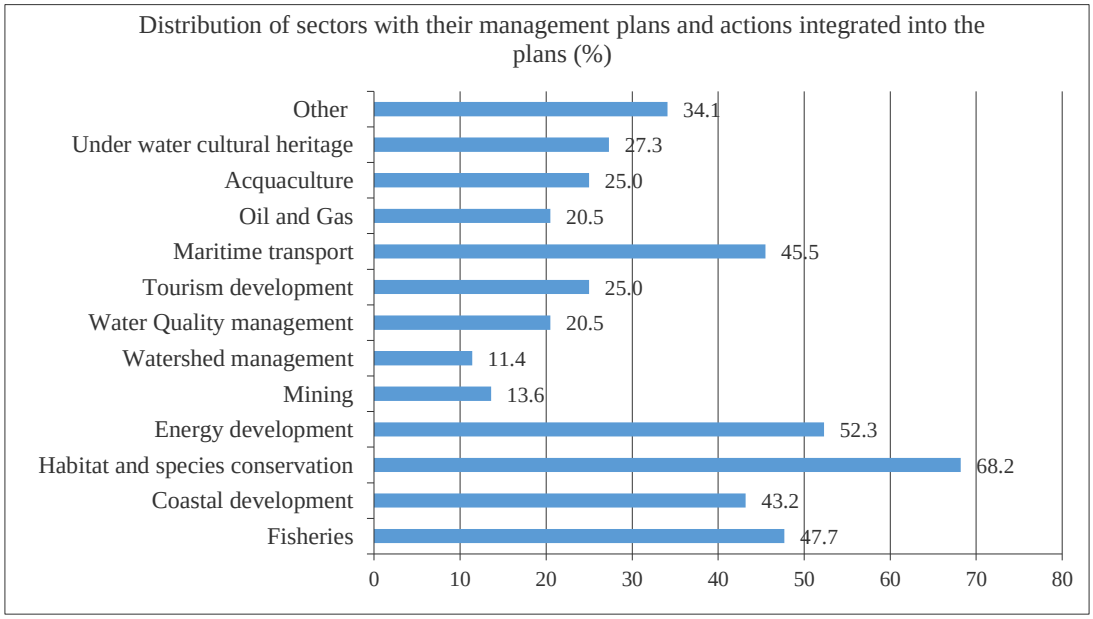

Fig. B.11. Distribution of sectors with their management plans integrated into the plans

Planning Phase

16. Which of the following would best describe how trade-offs between uses and sectors were established?

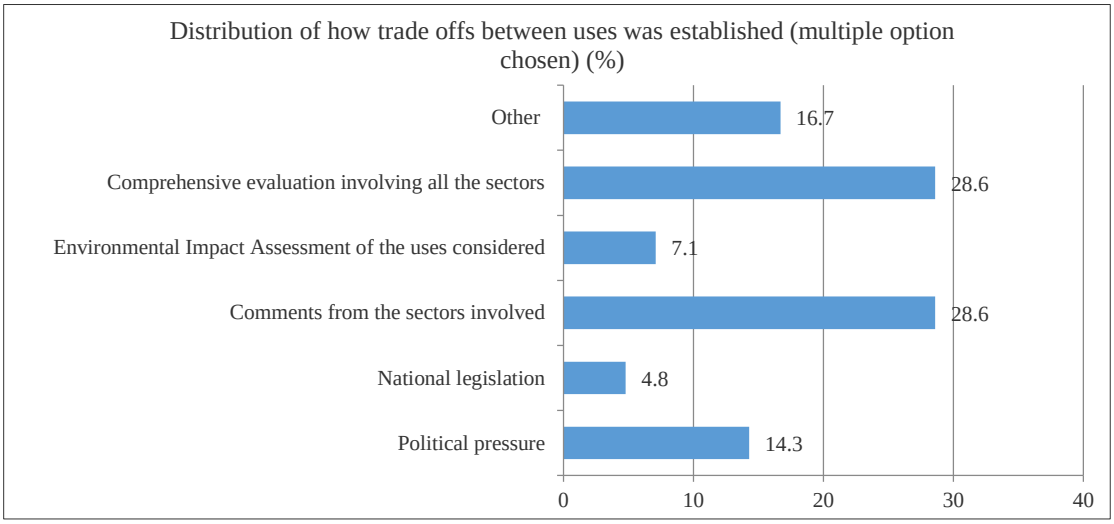

Fig. B.12. Distribution of how trade-offs between uses was established

Table B.4. Ranking of criteria for making trade offs

17.Please rate the following criteria according to the order of priority for making trade-offs or decisions among maritime uses from 1 to 6. 1 being the topmost priority and 6 being the least								
Answer Options	**1**	**2**	**3**	**4**	**5**	**6**	**N/A**	**Rating Average**
Ecologically and biologically valuable areas	15	3	5	3	5	2	1	4.42
Areas of National Security e.g. military defence area	9	4	4	4	3	2	11	4.23
Shipping routes and traffic separation schemes	4	12	9	7	2	2	5	4.08
Ecological areas under international agreements e.g. Natural 2000, water framework directive etc...	5	3	6	4	3	2	12	3.87
Operationalization of a particular maritime use due to technical requirement E.g. offshore wind energy is more economically viable when close to the coast	4	6	7	9	5	2	7	3.67
Preferential areas and conditions of national cultural and social importance	0	11	6	3	6	6	4	3.31

18.Which of the following sea use scenarios were developed to represent the future goal and objective for development direction of your planning area? (You can choose more than one option)

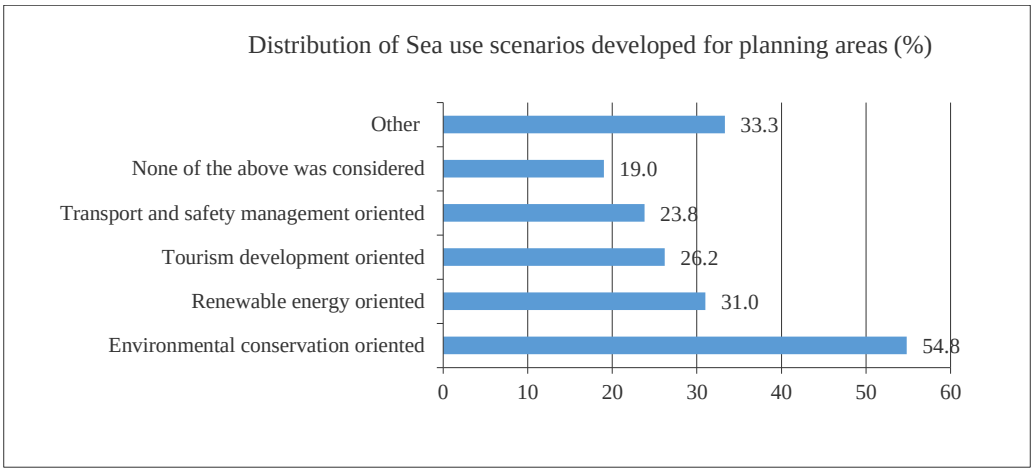

Fig. B.13. Distribution of Sea use scenarios developed

19.Which of the following tools were used at the decision making/trade off phase for planning strategy or scenarios? (You can choose more than one option)

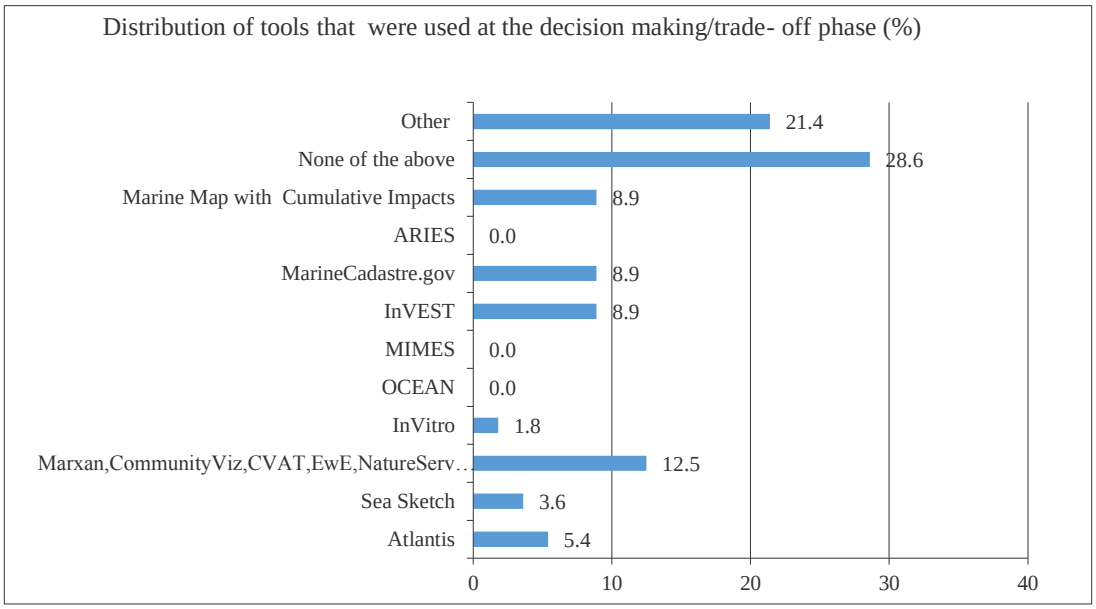

Fig. B.14. Distribution of tools used at the decision making and trade off stage

21.Please rate from the following in the order of priority the criteria for selecting the preferred spatial use scenario/preferred management strategies? From 1 to 5. 1 being the topmost priority and 5 being the least .							
Answer Options	**1**	**2**	**3**	**4**	**5**	**N/A**	**Rating Average**
Economic effects and their distribution, e.g., direct and indirect costs and benefits, who wins and who loses;	9	6	10	2	0	8	3.81
Political considerations, e.g., acceptability to public; relation to other management plans;	10	11	9	2	3	5	3.66
Physical, chemical, and biological effects over time, including cumulative effects;	11	7	3	4	4	6	3.59
Timing considerations, e.g., time required to achieve results;	0	7	2	10	7	9	2.35
Feasibility of financing, e.g., financial requirements for implementation	3	2	8	8	10	8	2.35

20. How was the maintenance of ecosystem services considered in your preferred spatial use scenario/management strategy?

Table B.5. Distribution of criteria for selecting the preferred scenario and management strategy

21.Please rate from the following in the order of priority the criteria for selecting the preferred spatial use scenario/preferred management strategies? From 1 to 5. 1 being the topmost priority and 5 being the least .							
Answer Options	**1**	**2**	**3**	**4**	**5**	**N/A**	**Rating Average**
Economic effects and their distribution, e.g., direct and indirect costs and benefits, who wins and who loses;	9	6	10	2	0	8	3.81
Political considerations, e.g., acceptability to public; relation to other management plans;	10	11	9	2	3	5	3.66
Physical, chemical, and biological effects over time, including cumulative effects;	11	7	3	4	4	6	3.59
Timing considerations, e.g., time required to achieve results;	0	7	2	10	7	9	2.35
Feasibility of financing, e.g., financial requirements for implementation	3	2	8	8	10	8	2.35

22. Please choose from the following the attributes of planning measures and actions that were formulated in the process? (You can choose more than one option)

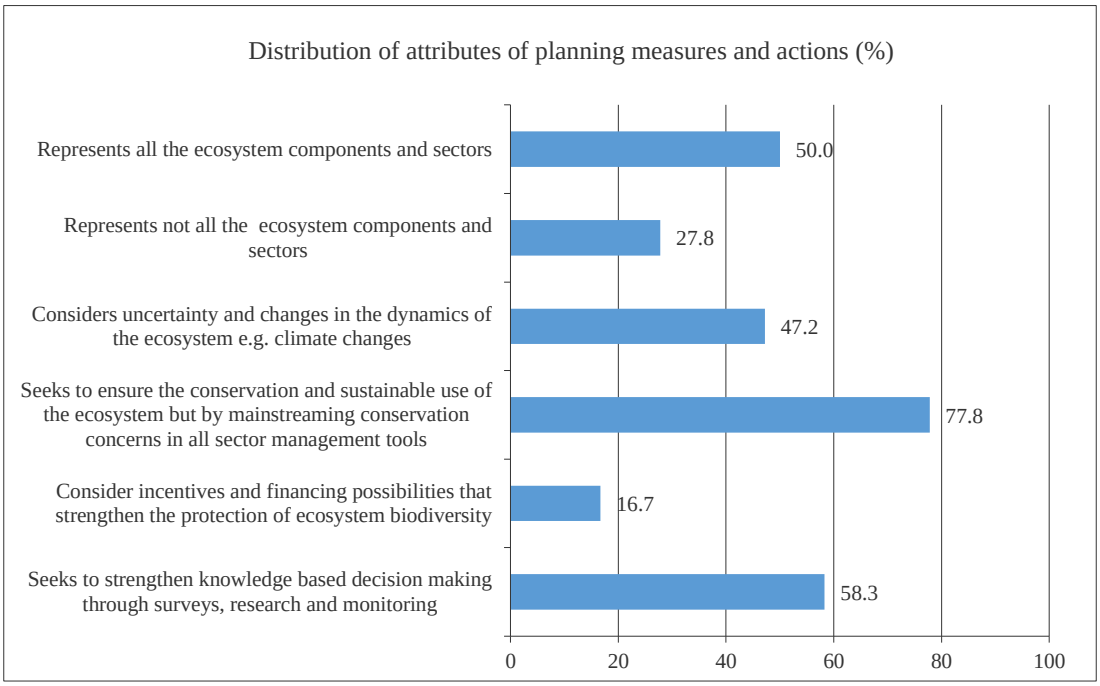

Fig. B.15. Distribution of attributes of planning measures and actions

Implementation and Monitoring

23. How was the results from the monitoring and evaluation of the ecosystem adapted into the management process or the plan?

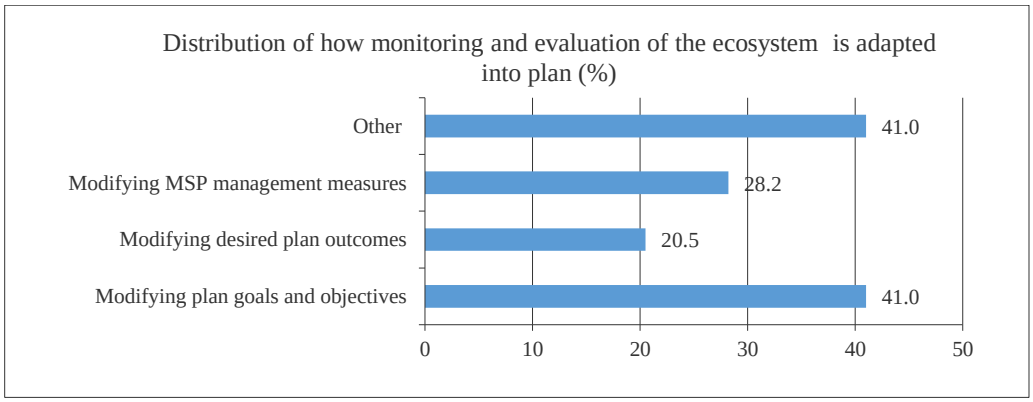

Fig. B.16. Distribution of how monitoring of the ecosystem is adapted

24. Which of the following options represents the kind of monitoring that is undertaken by the process?

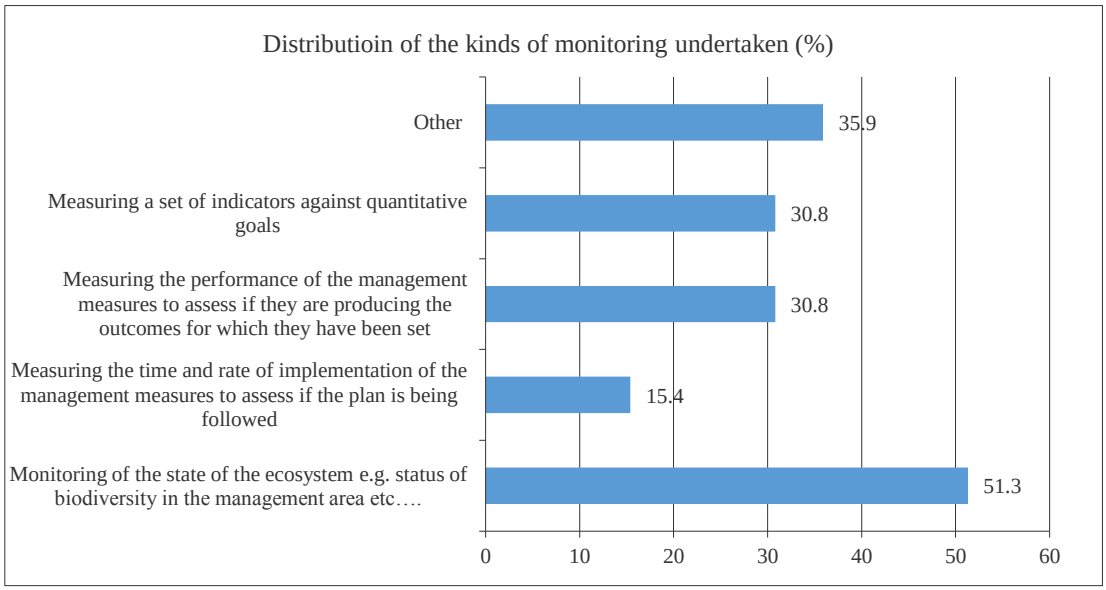

Fig. B.17. Distribution of the kinds of monitoring

25. How was adaptive management considered in the plan?

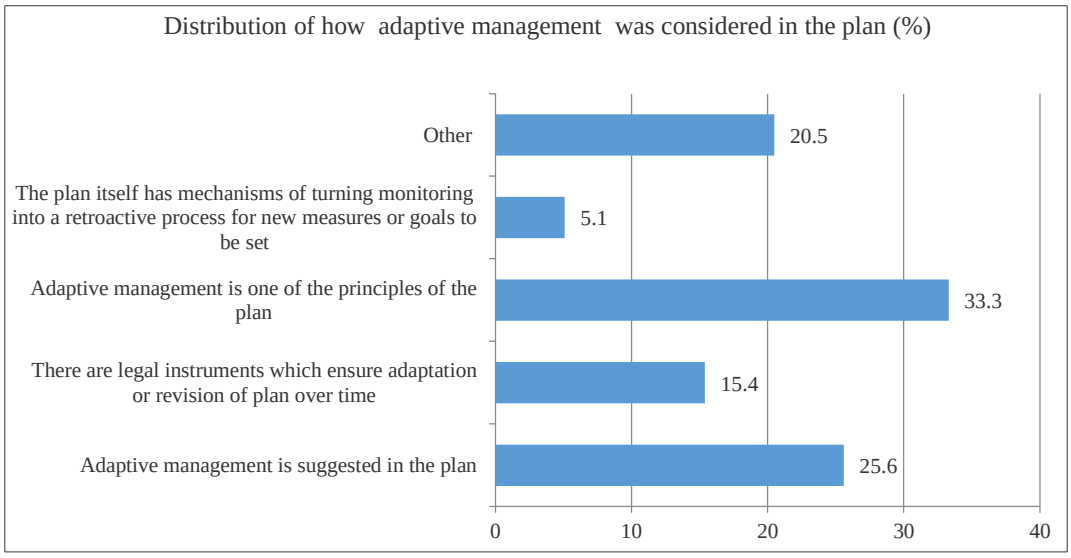

Fig. B.18. Distribution of how adaptive management was considered