



# Marine spatial planning for enhanced fisheries and aquaculture sustainability

## Its application in the Near East



***Cover illustration by Emanuela D'Antoni.***

This illustration aims to convey the main marine activities for inclusion in marine spatial planning for the Near East

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by

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## Preparation of this document

This technical paper provides national fisheries and aquaculture sector policy-makers and senior managers in the Regional Commission for Fisheries (RECOFI) region with an overview of procedures involved in marine spatial planning (MSP). It provides support for RECOFI members to plan and develop more sustainable fisheries and aquaculture sectors through a more unified approach to spatial planning and management of marine environments in the context of multiple users and uses.

This document will also be of relevance to aquaculture operators, industry organizations, non-governmental organizations and other groups interested in understanding MSP. This is particularly relevant given their respective influence and impact in the development of master plans, regulations and the management of aquatic resources. While of specific relevance to the RECOFI group of countries, this paper is also more generally relevant internationally, especially for those embarking on the use of spatial planning for fisheries and aquaculture.

The need for this technical paper derives from various meetings of RECOFI since 2009, and especially from the “Report of the Regional Technical Workshop on Spatial Planning Development Programme for Marine Capture Fisheries and Aquaculture”, which was held in Cairo, Egypt, in November 2012 (FAO/Regional Commission for Fisheries, 2013). At this meeting, the use of MSP to support aquaculture and fisheries development was highly recommended, being considered as one of the essential requirements for ensuring sustainable marine capture fisheries and aquaculture development in the RECOFI region. This technical paper responds to the needs of RECOFI member countries by providing a framework for marine spatial planning.

This document has been developed by the authors following an analysis of the best available information on MSP, including successful and less successful applications globally. The resulting process, which is intended to lead to the development, implementation, review and analysis of marine spatial plans for the RECOFI region, is modified to reflect the specific nature of the Gulf, the Gulf of Oman and the Arabian Sea, thereby providing an important RECOFI resource.

The key to successful implementation of the MSP process will be to identify appropriate government agencies within the RECOFI region that are willing to share data and that will cooperate productively by developing both national and regional marine spatial plans, thereby integrating the environmental, social, economic and governance objectives for sustainable development in the RECOFI region.

## Abstract

This document provides a clear and comprehensive account for the application of marine spatial planning (MSP) within the Regional Commission for Fisheries (RECOFI) region, focused predominantly on its application for fisheries and aquaculture. MSP provides a step-by-step approach to balance the uses and users of the marine environment with a view to providing a coordinated system that results in the development of a marine spatial plan, which defines the strategic, forward-looking planning for the regulation, zoning, management, protection and sustainability of the marine environment. It applies the ecosystem approach and the allocation of space, addressing the multiple, cumulative and potentially conflicting uses of the sea.

In order for fisheries and aquaculture prospects to be improved in the Gulf, a number of regional technical workshops were held under the auspices of the Food and Agriculture Organization of the United Nations (FAO) with RECOFI countries. As an outcome of these workshops, it was clear that spatial planning would be an ideal approach to aid development, but that for the long-term success and sustainability of all Gulf activities and the application of the ecosystem approach, a specific RECOFI MSP framework should be developed. The adoption of MSP is directed more specifically towards the Gulf waters, the Gulf of Oman and the Arabian Sea of the RECOFI countries. Identification of the range of users and activities pursued here necessitates an urgent need for cooperation among these groups in order to best coordinate their respective long-term futures.

Implementation of MSP is not a trivial undertaking. MSP can best function if an ordered set of procedures (or steps) are followed, and this paper carefully documents these procedures, giving illustrations and best practices where necessary, from other contexts where MSP has been successful. The MSP framework used here is based upon work carried out by the United Nations Educational, Scientific and Cultural Organization (UNESCO). Although the steps recommend specific procedures, the MSP framework is highly flexible and can be adapted to suit specific requirements, the scale of the marine area being evaluated and the objectives to be achieved. The need for contributors at the regional, national and local levels to work cooperatively during MSP development and for such development to be undertaken with stakeholder engagement and participation is emphasized throughout. The document concludes by providing three annexes. The first includes the main recommendations concerning the adoption of marine spatial planning taken from the RECOFI (FAO) Cairo workshop in 2012. The second describes the types of marine activities that must be considered, their relative importance to the national economy and to the sustainability of the marine environment. The third annex provides a comprehensive listing of additional information about MSP, including worldwide examples where MSP has been applied under varied local conditions at highly variable geographic scales.

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## Abbreviations and acronyms

COFI	FAO Committee on Fisheries
EBM	ecosystem-based management
EEZ	exclusive economic zone
GIS	geographic information systems
ICM	integrated coastal (zone) management
INMP	Integrated National Maritime Policy
IOC	Intergovernmental Oceanographic Commission
LNG	liquefied natural gas
MCZ	marine conservation zones
MPA	marine protected area
NOAA	National Ocean and Atmospheric Administration
MSP	marine (or maritime) spatial planning
NGO	non-governmental organization
RECOFI	Regional Commission for Fisheries
SCA	Sub-Committee on Aquaculture
SWOT	strengths, weaknesses, opportunities and threats
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization

## Foreword

Until the middle of the last century, the world's oceans were an almost inexhaustible source of high quality fish protein. Since then, the combination of human population pressure and technological progress in securing this resource has dramatically reduced the general availability of fishery resources. To alleviate this pressure, FAO has been at the forefront in promoting a range of positive measures, such as the FAO Code of Conduct for Responsible Fisheries, the adoption of the ecosystem approach to both fisheries and aquaculture, a broad range of relevant technical training, the promotion of regional fisheries bodies, the prevention of illegal, unregulated and unreported fishing under the Blue Growth Initiative, and encouragement for the conservation and sustainable use of the seas as part of the United Nations Sustainable Development Goals. Although these measures are contributing to significant successes with respect to fish protein supplies, it is also clear that the sustainability of fisheries can no longer be considered in isolation from the range of other activities that function in and use the marine space. To ensure long-term sustainability for all activities, it will become increasingly necessary to manage various marine areas holistically, and this necessity has promoted the concept and development of marine spatial planning.

The publication has emerged as an essential output from various Regional Commission for Fisheries (RECOFI) workshops held over the last few years to promote spatial planning for the sustainable development of marine capture fisheries and aquaculture in marine waters under the jurisdiction of eight countries in the Near East, i.e. Bahrain, Iran (Islamic Republic of), Iraq, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates, specifically in the Gulf. The Gulf is a relatively confined aquatic area, one that is extremely important to the social and economic well-being of citizens in the eight surrounding countries. As such, it is a hub for numerous, often distinct and conflicting activities. However, it is the potential for conflict between activities that has led to a sharp demise in the status of the Gulf's waters. Marine spatial planning offers the means to ensure each of these activities can sustainably coexist in the longer term; therefore, the aim of this publication is to inform readers about marine spatial planning and its application to the Gulf by RECOFI partners.

Marine spatial planning is primarily a process, and to function well this planning process adopts an ordered step-by-step approach, one that logically sequences marine activities in this finite area so as to achieve a balance between the various competing uses of the Gulf. Marine spatial planning has at its heart three overriding elements. First, it should have multiple objectives that address all the major aims of the different competing activities. Second, it must be spatially focused so that the use of a marine area is efficiently organized for the benefit of all; and third, the effort applied to the process must function in an integrated manner, such that the work undertaken, and the sharing of information and activity, builds trust and cooperation among the many stakeholders involved in the marine spatial planning process.

The implementation of successful marine spatial planning in the Gulf region may take some time to establish and to achieve the needed positive outputs. Thus, marine spatial planning is relatively wide ranging, is often complex, and relies heavily on cooperation between multiple partners. Although it is not easy, the outputs from marine spatial planning are very important in the context of, and for the future preservation of, the Gulf area and the resources it contains. The focus of this document is the better integration of fisheries and aquaculture among other sectors in the marine environment. It is not sufficient that the aquaculture and fisheries sectors act alone in

planning for use of marine space; marine spatial planning requires a more collective and holistic assessment, where each user has an equal and shared place at the planning table. This publication, therefore, offers a process that could and should be adopted by all users of the Gulf waters.

What marine spatial planning will do is to encourage co-development activity, provide for better use of marine space for aquaculture producers and artisanal fishers, and improve the security of fish supply. More generally, marine spatial planning will allow all users of the marine space to develop their plans in the knowledge that this is an overarching process that optimizes, in a socially, economically and environmentally sustainable manner, the use of the Gulf waters for all. Such goals are worth striving for, and this technical paper endeavours to persuade the reader that marine spatial planning is worth the effort.



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# 1. Introduction

Since 2009, the Regional Commission for Fisheries (RECOFI) has completed a number of meetings and workshops that have broadly focused on the desirability of introducing spatially based management of fisheries and aquaculture, including procedures, to address the long-term decline in fishery resources and productivity in the RECOFI region. The results from these meetings and workshops are given in the Report of the Regional Technical Workshop on “Spatial Planning for Marine Capture Fisheries and Aquaculture”, held in Doha, Qatar, in October 2010 (FAO/Regional Commission for Fisheries, 2011), and in the follow-up “Report of the Regional Technical Workshop on Spatial Planning Development Programme for Marine Capture Fisheries and Aquaculture”, held in Cairo, Egypt, in November 2012 (FAO/Regional Commission for Fisheries, 2013) (a brief summary is provided in Annex 1).

At the opening of the 2012 Cairo workshop, P. Mannini (Senior Liaison Officer, Policy, FAO Economics and Institutions Branch) reminded attendees that RECOFI was empowered to recommend measures for the conservation and management of marine resources. P. Mannini also noted that:

*The use of spatial planning tools for marine capture fisheries and aquaculture could greatly help in the identification, analysis and possible allocation of specific geographical areas to be used for marine capture fisheries and aquaculture, particularly in those countries that have limited natural resources, which are in high demand by competing users. (Ibid, p. 1.)*

At the Cairo workshop, RECOFI members defined a long-term vision on spatial planning for marine capture fisheries and mariculture in the region. The vision being:

*To illustrate how spatial planning frameworks and processes are essential elements to achieving sustainable clean, healthy, safe, productive and biologically diverse marine seas in the RECOFI region, and how they allow for mariculture and marine fishery production activities to be maximized whilst at the same time taking into account the other users of the marine space. (Ibid, p. 63.)*

To accommodate this vision, two sets of guiding principles were established:

- (i) “working” principles: including achieving good quality output, cooperation, compromise, trust, sharing and objectivity within the RECOFI group; and
- (ii) “sustainability” principles: leading to long-term sustainability in the use of marine resources through good planning, combined with replenishment of natural resources, conservation of resources, waste reduction, providing for enhanced ecosystem functioning and overall regeneration of the Gulf and other RECOFI waters.

To exercise these principles, it was suggested that long-term productivity in fisheries and aquaculture could be achieved, and at the same time a range of other marine activities and ecological services could also function optimally, including shipping, oil and gas extraction, recreation, conservation, habitats and ecosystems. Achieving harmony is the overriding goal of any spatial development programme. It is important to note that, on a much wider scale, these sustainability principles for marine areas have recently

been adopted by the General Assembly of the United Nations as part of its post-2015 sustainable development framework<sup>1</sup>. However, it poses the question: What working methodology should best be used to ensure achievement of the vision?

The Seventh Session of the Sub-Committee on Aquaculture (SCA) of the FAO Committee on Fisheries (COFI) expressed a strong desire to ensure the fair allocation of space for aquaculture growth and fisheries development, using marine spatial planning (MSP) as a mechanism to achieve this. MSP is an approach that is growing in favour with many international marine initiatives. MSP is already either implemented or being implemented for aquaculture and for other activities, examples of which are presented in this publication.

Aquaculture and many fishery activities use relatively little marine space compared with other uses and users, and these activities do not always have sufficient voice when the allocation of space is being considered (Hofherr, Natale and Trujillo, 2015).

To ensure development and expansion of the aquaculture and fisheries sectors in the RECOFI region in a sustainable and equitable way, the SCA emphasized the need for an MSP process that must follow an ecosystem approach, and thus consider the social, economic, environmental and governance objectives that result in the integrated management of land, water and living resources (FAO, 2013). FAO (2013) specifies that success could best be achieved through the adoption of an MSP<sup>2</sup> approach (paragraphs 31 to 39).

This document is aimed primarily at policy-makers, but will be of interest to other stakeholders such as regulators and developers, as it emphasizes the processes, frameworks and necessary steps to achieving successful MSP implementation within the RECOFI region. It is divided into three main chapters, which define:

- (i) The importance of MSP to the RECOFI area as a whole. This chapter assesses what MSP is and why it will be beneficial in the RECOFI region.
- (ii) The steps needed to implement MSP within the RECOFI region.
- (iii) A case study of Saudi Arabia, which provides an example of how MSP could be implemented to aid management of its marine waters.

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<sup>1</sup> See Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development” in the United Nations General Assembly Report A/68/970 (12 August 2014). UN. 2014. Report of the Open Working Group of the General Assembly on Sustainable Development Goals [online]. Presented at the 68th Session of the United Nations General Assembly (A/68/970). [Cited 17 October 2016]. Available at [www.un.org/ga/search/view\\_doc.asp?symbol=A/68/970](http://www.un.org/ga/search/view_doc.asp?symbol=A/68/970)

<sup>2</sup> MSP may also be referred to as maritime spatial planning, but this essentially has the same meaning.





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*This collage of photos conveys some of the main marine activities for inclusion in marine spatial planning for the Near East. Photos presented from left to right and top to bottom: Tankers in the Gulf of Oman; Oman anemonefish and scuba divers; Sharjah port on the coast of the United Arab Emirates; marine fish cages Saudi Arabia; Fishers in Iran (Islamic Republic of) deploying a fishing net; Yacht Club in Dubai Marina; Oil platform in Saudi Arabia; and Industrial cargo ships and cruise liner at a port in Abu Dhabi.*



## 2. The importance of marine spatial planning in the RECOFI area

### 2.1 What is marine spatial planning?

There are many definitions of marine spatial planning. A useful one is the one given by Ehler and Douvère (2009), who describe MSP as “a public process of analyzing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic, and social objectives that are usually specified through a political process”. MSP can be considered as a strategic planning process, undertaken through a consistent and agreed upon framework that enables integrated, future-looking and consistent decision-making on the spatial use of the sea.

Marine spatial planning aims to consider and integrate all uses and users of selected marine space, including retention of and improvement of ecological services provided by habitats, species and environment, so that coordinated management can be planned and implemented. An overall marine spatial plan for a large area allows for development of regional, national, sub-national and local marine spatial plans through a participatory and coordinated approach. However, the lack of an overarching marine plan does not mean that MSP could not be applied at lower levels, such as to a specific area of water.

Marine spatial planning does not preclude individual management of different marine activities. MSP allows for the development and implementation of an overall coordinated management plan based on an ecosystem approach, but recognizes that different activities (e.g. aquaculture development, oil and gas production, tourism), uses (e.g. marine parks, conservation areas) and services (e.g. ecology, habitats) will continue to require coordinated management in their own right. Implementation of MSP is achieved through the application of appropriate tools or activities, which could include regulations, integrated coastal management (ICM), zoning, mapping and collected data, databases, software packages, and other tools and information that contribute to the development of marine spatial plans.

Countries or wider regional seas will often have a “national or regional marine plan”, which sets out the aims, objectives and strategic policies on how specific marine areas will be managed into the future. For instance, in English waters of the United Kingdom of Great Britain and Northern Ireland (Marine Management Organisation, 2014), the recently established Marine Management Organisation notes that the main aims of its marine plans are to:

- set out priorities and directions for future development within the plan area;
- inform on the sustainable use of marine resources; and
- help marine users understand the best locations for their activities, including where new developments may be appropriate.

In this context, the marine plan provides the overall “narrative” on the optimum use of specific marine areas, while MSP may be thought of as the procedural mechanism by which space for all marine activities can be planned and implemented to achieve the marine plan’s aims and objectives. Conversely, and perhaps critically, where no marine plan exists, the activity undertaken through MSP should result in the development of a unified marine plan.

The application of an ecosystem-based approach to decision-making is a fundamental framework for sustainable development. This is implemented for aquaculture and fisheries through the ecosystem approach to aquaculture (FAO, 2010)

and the ecosystem approach to fisheries (FAO, 2003), respectively. In a broad sense, the ecosystem approach defines that aquaculture and fisheries should:

- (i) be developed in the context of ecosystem functions and services (including biodiversity) with no degradation of these beyond their resilience;
- (ii) improve human well-being and equity for all relevant stakeholders; and
- (iii) be developed in the context of other sectors, policies and goals.

Marine spatial planning complements these approaches by applying a step-by-step methodology that allows aquaculture and fisheries to have an equal voice in the allocation of space and play its role in supporting the sustainable use of the marine environment. The aquaculture and fisheries sectors cannot do this in isolation, and MSP is a framework for marine management that allows all marine interests and stakeholders to be given due consideration. This does not infer equal “distribution” (of space), but it does allow all parties, including aquaculture and fisheries, to contribute equally in the development of a marine spatial plan(s).

Although MSP is specifically aimed at achieving sustainability for all marine activities, it does not guarantee that any individual activity is being carried out sustainably. For instance, an area of the seabed may be zoned for aggregate extraction, but it is clear that aggregate supplies are not infinite. It will be expected that aggregate resource developers are aware of this and they should take care to make suitable management decisions and exploitation arrangements that provide for a sustainable future. A similar assumption is made with regard to fishing, such that fishery managers will need to constantly adjust their catch/fishing effort as the availability and location of specific fishery resources change. Equally, effective site selection, management and production techniques are needed for aquaculture to ensure that production is sustainable in the long term. These examples indicate how MSP is not a replacement for sectoral planning and management, but rather an enabling framework for more strategic management. “Zoning” does not imply “sole use” by a specific activity, and MSP can assist in the formal management of marine space for multiple users with appropriate representation and conflict resolution.

Marine spatial planning is concerned with coastal to oceanic waters over the full depth range, from surface waters to, and including, the seabed. At the national level, MSP can cover internal waters, territorial seas, exclusive economic zones and continental shelf areas, or any combination of these maritime zones. Regionally, transboundary issues and regional development of MSP also need to be considered (Flannery *et al.*, 2015), especially for relatively small marine areas such as the Gulf, and the resolution of any new or outstanding transboundary issues will be of primary importance within the RECOFI area.

Rationally, activities that take place at sea encroach to a certain extent with land, where spatial planning requirements will be subtly different from those required at sea, especially in coastal environments. Often, there is a need to ensure that there is no conflict between the implementation of MSP and similar initiatives that operate on land.

As far as possible, the main objective of MSP in the RECOFI region is to manage the allocation of marine space in a rational and agreed manner, allowed for through effective mediation obtained between different national, sectoral or user interests, and to produce an impartial framework to achieve this. The process of MSP is not an activity that is considered once and the “answer” simply implemented. MSP allows for the development of a marine spatial plan, the purpose of which is to offer a degree of certainty to marine users, developers, conservationists and so on, and allows for long-term strategic planning and investment. However, there is a need to review the marine spatial plan regularly through the coordinated process of MSP after a defined period, e.g. every five years. This allows for changes in circumstances to be considered, with decisions adapted and revised plans issued according to the new circumstances.

As an example, commercial aquaculture development requires a large investment and needs long-term planning and defined allocation of space for an aquaculture zone.<sup>3</sup> The MSP process can provide the certainty needed for that investment and for development to take place. MSP supports this through a reliable spatial planning process that helps to secure sustainable and integrated development of marine areas by balancing social, economic, environmental and governance needs. However, social, economic, environmental and governance needs are not fixed. This is especially so given the highly diverse, multiscalar and dynamic nature of the environment and its ever-changing character and changing societal priorities (governments, people). Fish consumption tends to increase as people become wealthier, and it is not certain that defining an aquaculture zone to satisfy demand predicted for 5 years' time will be the same in 10, 20 or 50 years.

Decisions made under an initial MSP assessment cannot be permanent; they must be reviewed and altered within the context of changed social, economic, environmental and governance (management) priorities. A decision to allocate space for aquaculture (or fisheries) can and should, under different circumstances, be changed. MSP provides a formal review procedure in which priorities can be considered thoroughly before any decisions can be made or revised marine spatial plans issued and implemented.

In the terrestrial environment, it has long been recognized that there are important advantages to be gained from land-use planning to provide coordinated infrastructure and activity. Where applied, there is often clear, spatially defined land use (for housing, industries, retailing, farming, forestry, etc.), along with the necessary infrastructure (roads, sanitation, schools, hospitals, etc.), to provide for considered and coordinated needs rather than a random mix of unlinked requirements. Each of these activities function much better if there is a reasoned and orderly logic behind the spatial distribution, and indeed this sensible land use distribution benefits the whole of society in terms of social, economic and environmental efficiency. It is only quite recently that a similar logic has been applied to marine areas.

Until the last quarter of the twentieth century, the vast majority of marine areas were relatively sparsely used, and thus there was no need for designating optimum areas for individual marine activities and no need for MSP. Exceptions to this existed; for example, in some heavily used coastal areas where ICM methods had been deployed, in dispersed areas that recognized shipping routes, in areas designated for military use, or for certain types of fishery or mariculture activity, marine parks and other protected areas.<sup>4</sup> ICM offers a good illustration of attempted coordinated planning and management, but this has often been implemented under voluntary codes of conduct, which lack statutory means to aid implementation. Statutory requirements are a key element within MSP. Moreover, in recent decades, the concept of an Integrated National Maritime Policy (INMP) has been emerging. Identification of the need for coordinated policies for maritime management and planning has now been endorsed through several international conferences, including the United Nations Conference on the Law of the Sea and the United Nations Conference on Environment and Development (Al-Bisher, Stead and Gray, 2012).

Work on MSP has emerged from this historical perspective. Initiated largely by developed countries, MSP has been introduced for marine waters that are heavily

<sup>3</sup> Recognition of these important aquaculture spatial needs has recently been made throughout the European Union (see Summary of the 27 Multiannual National Aquaculture Plans). European Commission. 2016. *Summary of the 27 multiannual national aquaculture plans*. Brussels, European Commission. Also available at [http://ec.europa.eu/fisheries/sites/fisheries/files/docs/body/27-multiannual-national-aquaculture-plans-summary\\_en.pdf](http://ec.europa.eu/fisheries/sites/fisheries/files/docs/body/27-multiannual-national-aquaculture-plans-summary_en.pdf)

<sup>4</sup> This multi-functional use of some maritime areas is well illustrated in the recently published European Atlas of the Seas. European Commission. 2016. European atlas of the seas [online]. Brussels. [Cited 17 October 2016]. [http://ec.europa.eu/maritimeaffairs/atlas/index\\_en.htm](http://ec.europa.eu/maritimeaffairs/atlas/index_en.htm)

used by a variety of exploitive activities or in areas where there have been specific conservation objectives or legal requirements that needed to be fulfilled.<sup>5</sup>

According to UNESCO and its Intergovernmental Oceanographic Commission,<sup>6</sup> development work on MSP has advanced such that there are 23 working MSP initiatives in Europe, 11 in the Americas, 5 in Australasia, and 2 in East Asia. Many other areas are in the process of developing their own MSP initiatives, and of 113 responses to a 2014 survey on MSP (UNEP and GEF-STAP, 2014), 79 initiatives were planning to follow recognizable MSP processes and 30 were described as already being in the implementation phase. The rest of the initiatives were still in some kind of preparation or planning phase.

MSP has underlying and fundamental characteristics, which UNESCO<sup>7</sup> defines as being:

- ecosystem-based: balancing social, economic, environmental and governance goals and objectives toward sustainable development;
- integrated: across sectors and agencies and among levels of government;
- place-based or area-based: defined by spatial boundaries;
- adaptive: capable of learning from experience;
- strategic and anticipatory: focused on the long-term and future planning; and
- participatory: with stakeholders<sup>8</sup> actively involved in the process.

This study provides a series of steps to achieve good MSP implementation, but it must be noted that the marine spatial plans developed will be highly variable from region to region. Variations in marine spatial plans can depend upon:

- the degree to which cooperation can be obtained between stakeholders in the MSP process;
- geographic size of a marine area being planned;
- the main objectives for a particular MSP;
- range or mix of marine activities in an area, and the extent to which one activity dominates;
- the level and mix of expertise of the stakeholders involved in the MSP process;
- the resources able to be deployed for MSP purposes; and
- quantity, quality and availability of data that can aid in planning.

With this in mind, marine spatial plan(s) will emerge gradually after what may be a relatively long process, with fully defined, developed, implemented and functioning plans taking some time to achieve. After this initial development, the plans will then continue to evolve through regular review via the MSP process, and adjusted to suit the prevailing situations or priorities in the future. As such, the spatial plan should be seen as an updateable vision rather than a one-off activity. As MSP progresses, the marine spatial plan(s) should be examined: in terms of the useful information it provides; the feedback that is given to improve its functioning; the necessary balance between the contributing requirements, activities and stakeholders; the data and other resource inputs; and any perceived deficiencies in MSP output. New science will also arise, and the MSP process and the derived marine spatial plans should reflect the best available science now and in the future.

If functioning correctly, MSP should result in both improved planning for all human-based marine activities in an area and enhanced and sustainable exploitation for fisheries and aquaculture, balanced with improved natural marine ecosystems.

<sup>5</sup> Douvere, F. & Ehler, C.N. 2009. New perspectives on sea use management: initial findings from European experience with marine spatial planning. *Journal of Environmental Management*, 90: 77–88. Much detail is provided here on the legal underpinnings of many MSP initiatives.

<sup>6</sup> See UNESCO. 2016, which provides short descriptions of all 41 of these MSP projects. UNESCO. 2016. Marine Spatial Planning Initiative. MSP around the world [online]. Paris. [Cited 17 October 2016]. [www.unesco-ioc-marinesp.be/msp\\_around\\_the\\_world](http://www.unesco-ioc-marinesp.be/msp_around_the_world)

<sup>7</sup> Ibid.

<sup>8</sup> Stakeholders are described in some detail in Step 3 of chapter 3.

Table 1 provides a summary of the key general issues associated with a lack of spatial planning and management, and the opportunities that could arise through implementation of MSP, although specific issues and opportunities will vary according to local circumstances.

For the RECOFI region, implementation of MSP is not as advanced as it could be. In this context, there are a few further important points to note to conclude this section:

- (i) The current lack of an “all-embracing” and unified marine spatial plan covering all MSP requirements does not mean that RECOFI fisheries and aquaculture sectors cannot start with implementation of MSP principles for the fisheries and aquaculture sectors. In fact, it is actively encouraged. As noted previously, part of the MSP process requires that whoever is undertaking the initiative to overcome a specific issue gives due consideration for and voice to other marine space users and uses. It is therefore perfectly feasible for the aquaculture and fisheries sectors, through RECOFI, to initiate MSP as a means to defining spatial areas where aquaculture (for example) could take place.
- (ii) The general situation, with respect to fisheries in the Gulf especially, is quite critical, meaning that management measures are urgently needed, irrespective of what progress is made with MSP adoption. Management decisions and planning for fisheries and aquaculture in the RECOFI region should proceed, even where this is a separate activity from full MSP implementation. Any management measures undertaken become a tool and can inform the MSP process.
- (iii) Where the aquaculture and fisheries sectors in RECOFI have ongoing spatially based plans and activities (for example, ICM plans), these can easily be integrated into any other MSP work that is undertaken. There is thus no need to start with a “clean page” if systems exist that could feed into an MSP process. Best practice advocates that ICM, terrestrial planning systems and MSP are coherent.
- (iv) MSP can be initiated in any body of marine water regardless of its size. However, it will be clear that the challenges of initiating MSP in a large marine ecosystem will be significantly costlier, more complex, time consuming and challenging than making a start within a more limited marine area. It is recommended that each RECOFI country commence its own MSP work at appropriate smaller scales. However, it would be advantageous to discuss some of the broader methodologies (as stated in chapter 3) with neighbouring countries at least and preferably with all RECOFI countries. This suggestion is given because at some future date it will be highly desirable to merge individual MSPs, so as to form a unified MSP approach for the whole RECOFI region.
- (v) Initiating MSP may not require a large financial investment in order to start, e.g. for discussions, stakeholder meetings and determining priorities. Further costs will depend to a large extent on the data and knowledge available, the sharing of this information among RECOFI partners, and the extent to which new data, knowledge and skills will need to be developed within and between the RECOFI partners. Development of an aquaculture spatial plan, for example, would require an assessment of carrying capacity and site selection criteria to be certain that any allocated zones are able to sustain the aquaculture production envisaged. To achieve this familiarity and expertise in areas such as geographic information systems, data sourcing, remote sensing, computer-based modelling, and familiarity with application-based tools would enhance MSP work in the short term and would be a necessity in the medium to longer term.

TABLE 1  
**General issues and opportunities for improvement through marine spatial planning within the Gulf (RECOFI) area**

Issues	Opportunities
<b>Social</b>	
<p><b>Social conflicts:</b>            Many stakeholders use marine waters within the RECOFI region, and thus often there are conflicting user groups with different goals, power relationships, interests and worldviews.</p>	<p><b>Reduction in social conflicts:</b></p> <ul style="list-style-type: none"> <li>• Stakeholders (or sectors) arrive at agreed and unambiguous goals for the MSP initiative and implement an agreed “path” towards successful MSP implementation.</li> <li>• Enables government (nationally and across regions), industries, conservationists and other stakeholders to work together to identify suitable locations for present development and uses.</li> <li>• Stimulates opportunities for new users of marine areas.</li> <li>• Ability to create order and negotiate conflict resolution between user groups who do not always share the same goals, and whose powers, interests and worldviews differ sharply (Jentoft and Knol, 2014).</li> </ul>
<p><b>Equity issues:</b>            Fisheries or aquaculture interests tend to be “smaller players” who are often fragmented and isolated and in danger of being displaced. Lack of equity among stakeholders, such as the possible “takeover” of a project by a more powerful stakeholder group.</p>	<p><b>Increased equity:</b></p> <ul style="list-style-type: none"> <li>• Reduces conflict and stimulates equity and social justice.</li> <li>• Increased confidence by stakeholders that their voice will be heard and that none will take dominance over others when important issues are discussed and implemented.</li> </ul>
<p><b>Complex working procedures:</b>            Procedures that reduce the ability to have cooperative interaction across a wide range of stakeholders in the public and private sectors.</p>	<p><b>Less complex procedures:</b></p> <ul style="list-style-type: none"> <li>• Integrates the interests of different stakeholders, such as fishing, offshore renewables, tourism and other users, and enables strategic conflict resolution, i.e. at a regional rather than project level.</li> <li>• Reduction in complexity and improvement in efficient use of human resources.</li> </ul>
<p><b>Poor cooperation and sharing of technical data and knowledge:</b>            Lack of means, ability, political or other social will to share data, information and technical expertise nationally and internationally with other RECOFI partners.</p>	<p><b>Good cooperation and sharing:</b></p> <ul style="list-style-type: none"> <li>• Helps to reduce complexity and duplication of effort and resources, and it increases integrated rather than sectoral management.</li> <li>• Utilizes existing data to best effect, identifies gaps, and ensures that management decisions are based on sound science.</li> <li>• Enables interdisciplinary activity.</li> </ul>
<b>Economic</b>	
<p><b>Risk financing:</b>            National governments cannot agree on the mechanism to derive necessary financial inputs and to commit resources to development.            Lack of financial resources.</p>	<p><b>Better and less risky financing:</b></p> <ul style="list-style-type: none"> <li>• Intergovernmental cooperation reduces financial burden on specific nations increasing the likelihood of investment.</li> <li>• Increased commitment to collective sharing of and reduction of risk.</li> <li>• Reduced financial resource requirements for stakeholders and partner governments.</li> </ul>
<p><b>Short-term investments:</b>            Piece-meal financing and investment increases long-term overall costs.</p>	<p><b>Long-term strategy:</b></p> <ul style="list-style-type: none"> <li>• Long-term vision for MSP allows industry and all stakeholders to manage risk by increasing certainty in respect of development proposals.</li> <li>• Improves investment decisions, reduces complexity and improves value for money.</li> </ul>
<p><b>Poor permitting and licensing procedures:</b>            Complex and long permitting and licensing procedures, which often lack transparency.</p>	<p><b>Improved procedures:</b></p> <ul style="list-style-type: none"> <li>• Improvement in capacity to facilitate the authorization procedures for new aquaculture farms.</li> <li>• Streamlining, transparency and fairness in permit and licensing procedures.</li> <li>• Greater certainty of access to desirable areas for new private-sector investments.</li> <li>• All stakeholders will make positive financial gains from the spatial zoning.</li> </ul>
<b>Environmental</b>	
<p><b>Lack of protection and conservation of various fragile ecosystems:</b>            Increasing likelihood that irreversible damage may be caused to fragile ecosystems such as coral reefs and mangroves.</p>	<p><b>Better protection:</b></p> <ul style="list-style-type: none"> <li>• Identifies sites or areas where important natural and cultural assets need safeguarding and where marine conservation should take precedence over other development.</li> <li>• Reduces likelihood of environmental degradation.</li> <li>• Reduces fragmentation of important natural habitats.</li> <li>• Increases provision of ecological and environmental services.</li> </ul>
<p><b>Degradation of marine environments and habitats from human-based activities:</b>            Increased risk from point sources of pollution, from dredging and from waste disposal.</p>	<p><b>Reduced degradation of environments and habitats:</b></p> <ul style="list-style-type: none"> <li>• Identifies areas where development can take place in an environmentally sustainable manner, one that does not cause undue environmental damage.</li> </ul>



<p><b>Large environmental effects and interactions:</b> Eutrophication and biodiversity and ecosystem service losses caused by uncoordinated development, such as too many farms or too much fishing in a given area or waterbody.</p>	<p><b>Reduced and managed environmental effects:</b></p> <ul style="list-style-type: none"> <li>• Better coordinated and integrated approaches to the use and management of natural resources.</li> <li>• Better assessment and understanding of cumulative and combined environmental effects and of interactions between users and the environment.</li> </ul>
<b>Governance</b>	
<p><b>Lack of collective governance:</b> Marine space lacking collective governance, especially where many countries are collectively using one relatively small and restricted waterbody.</p>	<p><b>Collective governance:</b></p> <ul style="list-style-type: none"> <li>• Cooperatively working at an international scale involving the participation of all eight RECOFI member countries.</li> <li>• Acceptance that “marine space” should be the subject of collective governance.</li> <li>• Contributes towards delivery of sustainable development objectives in the marine environment.</li> </ul>
<p><b>No agreed international legal framework:</b> Lack of legal framework leads to ad hoc arrangements, increasing the risk of poor governance.</p>	<p><b>International legal framework:</b></p> <ul style="list-style-type: none"> <li>• Development opportunity for a formal legal framework.</li> <li>• Provides a plan-led approach to marine use, rather than the current ad hoc arrangements.</li> <li>• Improvement in overall cooperation and governance of marine space.</li> <li>• Means to ensure unified interpretation of the United Nations Convention on the Law of the Sea.</li> </ul>
<p><b>No lead authority for managing marine space:</b> Overall lack of management for all locations.</p>	<p><b>Lead authority defined<sup>9</sup>:</b></p> <ul style="list-style-type: none"> <li>• Defining an authority for MSP.</li> <li>• Investment of authority in the organization, which allows efficient decision-making.</li> <li>• Promotes open and transparent governance, i.e. a planning process that is clearer, more accountable and more participative.</li> </ul>
<p><b>Lack of achievement of specific goals and benefits of managing marine space:</b> Ad hoc governance means broader benefits are not obvious, and the ability to formally review, change or otherwise alter marine management strategy is limited.</p>	<p><b>Achievement of goals and benefits:</b></p> <ul style="list-style-type: none"> <li>• Short, medium and long-term benefits can be derived during MSP implementation.</li> <li>• MSP provides a formal means to review progress and change.</li> </ul>
<p><b>Lack of a coordinated approach:</b> Lack of a coordinated approach on marine governance, spatial planning and implementation of the ecosystem approach.</p>	<p><b>Coordinated approach implemented:</b></p> <ul style="list-style-type: none"> <li>• Strategic development of objectives for spatial planning and ecosystem approach for aquaculture and fisheries development (and other marine activities).</li> <li>• Implements national objectives on spatial planning, the ecosystem approach and marine mapping for aquaculture and fisheries management (and other marine activities).</li> </ul>
<p><b>No understanding of the complexity of issues</b> Lack of understanding in the governance of social, economic and ecological systems that are inherently diverse, complex and dynamic and that work at multiple scales.</p>	<p><b>Complexity reduced through understanding and action:</b></p> <ul style="list-style-type: none"> <li>• Enables a strategic overview of development in marine and coastal environments.</li> <li>• Complexity better understood and actions taken that take account of this complexity.</li> <li>• MSP enables scale issues to be dealt with in decision-making and allocation of marine space.</li> <li>• Social, economic and environmental considerations considered together instead of separately.</li> </ul>

Source: Modified from Wildlife and Countryside. 2005. Marine spatial planning – question time: twenty questions [online]. London. [Cited 17 October 2016]. [www.wcl.org.uk/docs/Link\\_Marine\\_Spatial\\_Planning\\_Question\\_Time\\_14Sept05.pdf](http://www.wcl.org.uk/docs/Link_Marine_Spatial_Planning_Question_Time_14Sept05.pdf)

Note: MSP is focused on the marine environment, although there may be different approaches, especially to governance, for coastal regions and interactions between land and sea.

<sup>9</sup> In this document, the “lead authority” is defined as the group responsible for implementation and coordination of MSP. This should be differentiated from the “competent authority”, which we define as a government department or otherwise delegated group that has legal power to make decisions about subjects within its remit and is not necessarily undertaking MSP work.

## 2.2 Why an MSP approach is important for RECOFI waters

### 2.2.1 Introduction

This section briefly sets out the reasons why using marine spatial planning as an approach for the spatial management of marine waters in the RECOFI area of competence is essential to obtaining sustainability for all users and uses of the seas in this geographic area.

Since the beginning of this century, MSP has increasingly been recognized as the best approach to manage marine space by ensuring social, economic, environmental and governance sustainability in order to maximize the benefits of exploiting marine space in a sustainable way for all of its users and for future generations. Kelly *et al.* (2014) provide one of the few reviews of MSP that highlight the experiences learned from seven years of implementation in Scotland, confirming that MSP is an iterative process that develops as information, technology and learned experience is gained over time. Importantly, they agree with Symes (2005), who noted that: “The sustainable development of marine resources is unlikely to be fully achieved through separate policies for fisheries, mineral resources, renewable energy, recreational use, etc.” (p. 3), which, by inference, mandates a coordinated and collective approach, especially in restricted waterbodies with transboundary connectivity (Flannery *et al.*, 2015). In the marine environment especially, national boundaries, territorial seas and exclusive economic zones (EEZs) are arbitrary for fish and other marine resources.

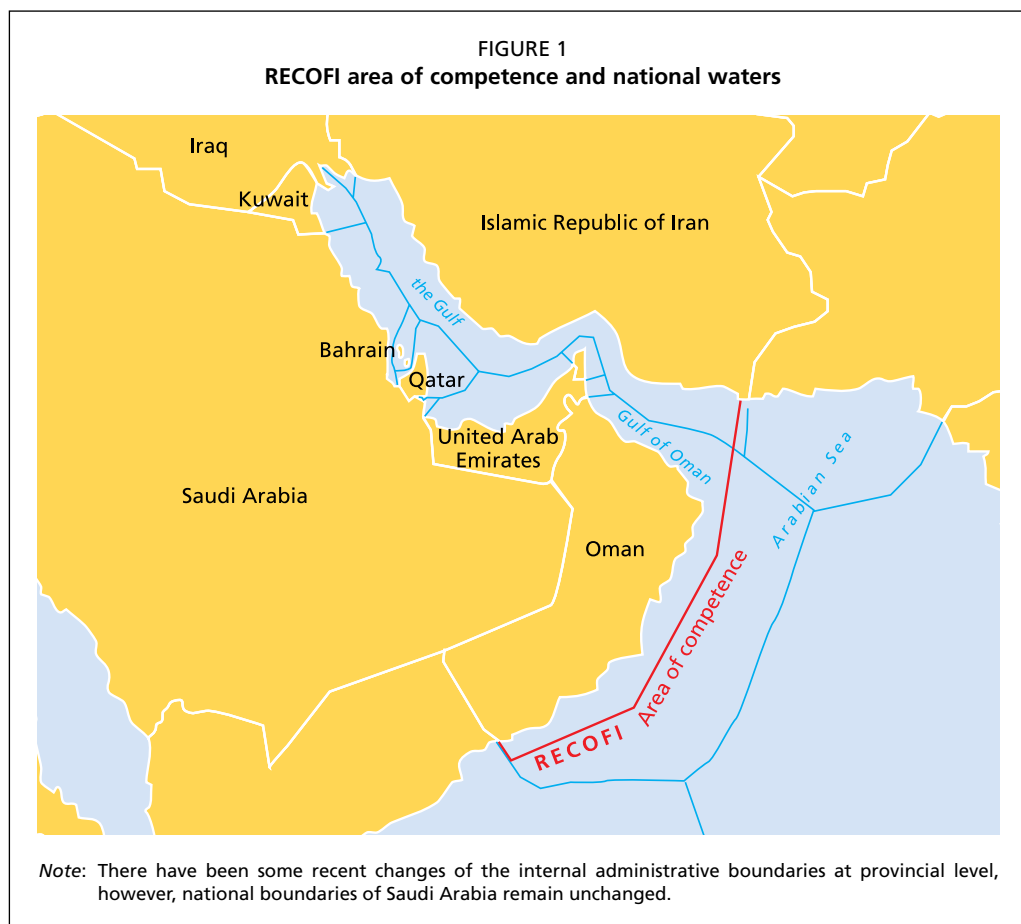
Table 1, through an analysis of social, economic, environmental and governance issues and opportunities in the RECOFI region, offers many examples of why an MSP approach provides a suitable framework for the management of regional marine space. The following subsections provide additional reasons why MSP would be a good approach within the RECOFI area.

### 2.2.2 Complex and unique marine systems

The RECOFI area is comprised of three marine areas (Figure 1), as follows:

- (i) The Gulf itself. In a global context, this is a relatively small marine area (~251 000 km<sup>2</sup>). It is shallow (mean depth of 50 m) and is almost enclosed from the open ocean, with a small connection through the Strait of Hormuz to the Gulf of Oman and to the Arabian Sea. This relative isolation gives rise to a unique set of physical characteristics, including a long water residence time (low water turnover), high water temperatures, and low freshwater input into the Gulf with high evaporation leading to very high salinity levels. These physical factors have allowed the evolution of marine ecosystems that are unique by world standards, a phenomenon which in turn has created a specific and highly adapted biological species range.
- (ii) The Gulf of Oman (*Halidj 'Umān*) connects to the Gulf via the Strait of Hormuz. These marine waters, situated mainly between Iran (Islamic Republic of) and Oman, lie at the head of the Arabian Sea. They are relatively sheltered, though they mostly exhibit a fairly typical local marine environment through its wide link to the Arabian Sea with which water is readily exchanged.
- (iii) The northern part of the Arabian Sea (*Bahr al-'Arab*) encompasses the coastal waters of the Oman EEZ and the waters within a rhumb line that crosses to the Iran-Pakistan border (Figure 1). These waters are best classified as exposed oceanic waters. They have a relatively wide continental shelf, and an offshore upwelling area that ensures natural marine biological productivity is high.

The variety of marine environments means that there will be contrasting marine ecological conditions in the three areas, and some human activities are pursued under differing conditions and to different extents. They could, and perhaps may,



be treated differently for MSP purposes; however, there are many commonalities between these systems in terms of how marine space should be managed, which indicates the need for an overarching MSP process, even where this results in the development of distinct marine spatial plans for each area or sub-areas therein. To avoid duplication of efforts and resources, and in order for management to be effective, all three marine types must be considered collectively within an integrated spatial management approach.

### 2.2.3 Improving sensitive habitats

Arguably, the most important ecosystems in the Gulf are coral reefs and mangroves. In order to be sustainable, coral reefs require very specific marine conditions and are highly vulnerable to even small changes in these conditions. The areas of live reefs, especially in the Gulf, are sparse and small in size, and in recent decades human activities have unfortunately reduced them further.

Likewise, a range of human developments along coastlines where mangroves once thrived has contributed to the demise of these ecosystems. Both of these depleted ecosystems are essential for fish productivity, for at least some, if not all, life stages. Unless the coral reefs and mangroves can be revitalized as part of any MSP approach, there is little hope that they can support an enhanced natural fish population and increased productivity for fishers. The MSP process can be used to determine conflicting areas of interest that may be affecting these habitats, allowing decisions to be made on marine uses within these areas.

### 2.2.4 Better fisheries management

Marine spatial planning is a necessary part of overall fishery management. Depletion of fishery stocks regionally is almost certainly caused by a combination of habitat loss and unregulated and/or excessive fishing, though it is difficult to compile exact quantitative data on this. However, in the Gulf, shrimp stocks are severely depleted, and in Bahrain and Qatar for example, catches have reduced by up to 90 per cent over the last two decades. Seasonal bans on shrimping have been implemented in these countries. It is known that fish landings in the Gulf of Oman and along the Arabian Sea coast have also suffered, though compiling precise data on this is difficult.

It should be noted that many thousands of artisanal fishers and their families have traditionally relied on fish resources from RECOFI waters for their livelihoods and well-being. The combination of depleted fish stocks and increased exploitation by larger commercial fishing vessels deployed from various ports make continued reliance on fisheries difficult. Irrespective of MSP activity, there is thus a real need to improve regional fishery management practices and to establish a variety of mariculture activities as a means of supplementing and sustaining fishers' livelihoods and increase fish protein output. MSP, however, provides a mechanism by which necessary improvement actions can be funded and undertaken.

### 2.2.5 Good aquaculture management

Globally, marine aquaculture (mariculture) has developed significantly over recent decades, and is proving to be successful in providing protein, food security, investment, income and jobs in many parts of the world. Although the largest production of marine finfish is presently achieved in temperate areas,<sup>10</sup> warmer marine waters are increasingly being exploited for the culture of finfish species. Kapetsky, Aguilar-Manjarrez and Jenness (2013) have stressed that there is also considerable worldwide potential for tropical and subtropical offshore mariculture.

Although the Gulf waters have high salinity and temperatures, the area offers several favourable locational advantages for mariculture. Waters are relatively sheltered, and there are large areas with depths suitable for surface or submerged cages (25–100 m), mainly in the northern portions of the Gulf. Many favourable sites are within a short distance of the coast, facilitating the servicing of cage installations. Fish cage culture is likely to be feasible in a number of locations, and MSP can be used to determine the most appropriate locations while respecting other users and uses through an assessment of carrying capacity, site selection, technology and avoidance of user conflicts. There may be a crossover between land-based planning and MSP for shrimp farming in ponds, where water is abstracted, flows through ponds and is released back to the marine environment. Whether or not such systems fall within land-based planning or marine-based planning needs to be determined, and any conflicts between the implementation of land planning and MSP will need to be resolved.

In order to avoid impacting local fisheries and ecosystems, and to provide acceptable fish products to local markets, it would be most appropriate for RECOFI fishery authorities to consider the culture of important native commercial finfish and shellfish species.

### 2.2.6 Understanding the effects of climate change

It has been well documented that climate change will have negative and accelerating consequences on a host of planetary ecosystems. In the marine environment, it

<sup>10</sup> This is mainly for salmonids, which are produced in fjord areas where ample shelter is available, e.g. in Chile, Norway and Scotland. Marine culture accounts for approximately one-third of all fish aquaculture. Two-thirds of global fish aquaculture production occurs in freshwater, including tilapia, carps and other freshwater species.

will most likely manifest through increasing water temperatures and lower oxygen availability in warm waters, increasing climatic events such as stronger winds, or via water acidification through absorption of more carbon dioxide, increasing marine water salinity, increased water turbidity and sea level rise (Pittock, 2009). Each of these will cause biological as well as chemical changes and lead to shifts in species distribution, including the loss of coral reefs and other natural ecosystems and affecting fishery stocks. Shifts in species distribution have already been noted in the Mediterranean and other areas, for example (IPCC, 2014). Other consequences include increased coastal flooding, difficulties for fishers in finding target species, and more dangerous conditions at sea.<sup>11</sup> While it may prove difficult without further research to be entirely precise about the effects and consequences for the Gulf and local environments as RECOFI countries develop country and regional spatial plans, MSP provides a mechanism in which such considerations can be included.

### 2.2.7 Improved and efficient data collection

Data, information and developed knowledge are critical to the MSP approach and underpin many of the decisions that need to be made about zoning, site selection and area management for aquaculture (FAO and World Bank, 2015), fisheries and other marine-based activities. In order that fisheries and other Gulf activities can be better managed, data collection in the region needs to be improved and strengthened.

For fisheries, data collection might include data on species-specific catch and effort, species stock/biomass assessment, species nursery and spawning areas, bottom sediments, and seasonal water temperatures. Fishery stocks have no political boundaries and many fishery resources straddle national boundaries, needing to be planned and managed as though they constitute one stock. In relatively small marine areas, such as the Gulf, many species will undoubtedly utilize different areas for their various life stages, having spawning areas, nursery areas and adult feeding areas that will be spatially distinct and not reside in any one territorial sea. Information and data on the location of these areas need to be understood and shared among RECOFI partners, and a degree of protection may need to be given through the MSP process. This is especially so for nursery and spawning areas, which could be protected through designation of marine parks for example, where capture is prohibited or at the very least restricted. Such designations can be clearly developed and assigned using the MSP process, provided there has been sufficient data collection to understand fish behaviour, movement and stock assessment.

For mariculture, this might include data on water quality, hydrography, wind speeds and wave heights to achieve an assessment of the carrying capacity for a region. Spatially, while mariculture site selection decisions can be taken at the farm scale, aquaculture in an aquaculture zone is best organized using common approaches with implementation of good management practices that ensure sustainable production. Data that underpin the spatial distribution of fish cages, or pond systems, therefore, need some form of collective management approach.

Ultimately, data collection activity is expensive because of the technical difficulty of collecting certain information, and the considerable time and effort needed in collection, processing and analysis. It is therefore best shared among the RECOFI partners rather than being repeatedly collected, processed and analysed at the country level, which is inefficient.

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<sup>11</sup> The implications of climate change on aquaculture and fisheries and strategies for dealing with it have been summarized in the Strategy for Fisheries, Aquaculture and Climate Change. Framework and Aims 2011–16. FAO. 2012. *Strategy for fisheries, aquaculture and climate change. Framework and aims 2011–16*. Policy brief. Rome. (also available at [www.fao.org/3/a-am434e.pdf](http://www.fao.org/3/a-am434e.pdf)).

### 2.2.8 Managing complex, multistakeholder users and uses

Much of the RECOFI marine area is used for more than one activity. Box 1 provides a summary of the many and varied uses of marine space within the region. For the RECOFI marine area to function well and sustainably, multiple activities and marine uses need to operate equitably and successfully. While this may be achievable with various combinations of users or uses, under some circumstances this may not be the case. Where activities clash, MSP can provide a means for consensus to be established on co-use, or alternatively for some kind of distinct spatial partitioning to be implemented. An example of the former would be an agreement of clear rules on locating aquaculture<sup>12</sup> or fisheries in Marine Protected Areas (MPAs), and for the latter spatial partitioning would include the separation of aquaculture structures from main shipping lanes to avoid collisions. Thus the results of spatial planning could result in complete separation of activities where the reason for the MPA designation requires it, such as protection for endangered species or ecosystems (FAO, 2011). The ability for multiple marine space users to establish this consensus and partitioning approach is one of the primary purposes for MSP.

Two seas that are similar in many ways to the Gulf are the North Sea and Baltic Sea in Europe; they are similar in terms of size and their enclosed nature, in the range of users, in the number of bordering countries, and in their general level of development. It is worth noting that both the North and Baltic Seas have made significant progress with respect to implementing MSP (see Douvere and Ehler, 2009; Blæsbjerg *et al.*, 2009; Gee, Kannen and Heinrichs, 2013).<sup>13</sup> Over the past decade, the various countries bordering these seas have seen the vital importance of maintaining a breadth of

#### BOX 1

##### Main users and uses of the RECOFI marine space

- Cables, pipelines, transmission lines
- Carbon sequestration sites
- Commercial fishing: beach seines
- Commercial fishing: hook/line
- Commercial fishing: nets
- Commercial fishing: pots/traps
- Commercial fishing: purse seines
- Commercial fishing: seine nets
- Commercial fishing: spears/harpoons
- Commercial fishing: trawls/dredges
- Conservation areas: MCZs/MPAs
- Cultural and historic conservation
- Dredged material disposal
- Marine transportation: cargo vessels
- Marine transportation: cruise ships
- Marine transportation: ferries
- Marine transportation: liquefied natural gas
- Marine transportation: tankers
- Military operations
- Multiple use marine parks
- Ocean desalination plants
- Offshore airports
- Offshore aquaculture/mariculture
- Offshore industrial production facilities
- Offshore liquefied natural gas terminals
- Offshore oil and gas development
- Offshore renewable energy: tidal/wave and currents
- Offshore renewable energy: wind farms
- Port and harbour dredging
- Port and harbour operations
- Recreation: boating/personal watercraft
- Recreation: sailing
- Recreation: scuba diving/snorkelling
- Recreation: wildlife watching
- Recreational fishing: hook/line/pots/traps
- Recreational fishing: spear fishing
- Sand and gravel mining
- Scientific research
- Urban and resort areas

Source: Modified from Bodiguel, Greboval and Maguire (2009).

<sup>12</sup> Aquaculture, especially small scale aquaculture, is one of the potential activities that may come as supporting MPAs viability, so it is important to understand all potential synergies between aquaculture and MPAs. (see also <https://portals.iucn.org/congress/session/10597>).

<sup>13</sup> It was recently reported that “Over the next decade over 40 countries will have produced about 60–70 marine spatial plans at the national (EEZ), sub-national (territorial sea), and state or provincial levels” (Ehler, 2014) - available at <http://unesdoc.unesco.org/images/0022/002277/227779e.pdf>

sustainable activities in these marine areas through the use of the MSP approach. As MSP is developed for the particular needs of the Gulf, the Gulf of Oman and the Arabian Sea, RECOFI partners could benefit from the lessons learned in other regions (e.g. Kelly *et al.*, 2014).

### 2.2.9 Improved cooperative management and improved efficiency

In an increasingly shrinking and globalized world it is becoming more important to work cooperatively.<sup>14</sup> In this chapter, it has already been established that many natural resources, including fisheries and to a lesser extent aquaculture, recognize no national or political boundaries, that data must be gathered and shared, and that human activities need to be seamlessly coordinated across the various territorial seas and EEZ waters. While the MSP process may lead to a number of distinct marine spatial plans, this is best achieved through a participatory approach; consequently, the Gulf must be seen initially as one planning space and be imagined as “shared space” for the development of an overall marine spatial plan. Specific national, sub-national, state or provincial level plans developed afterwards then form a seamless sustainable management strategy for the entire region.

Cooperative working has many advantages:

- There is no need to “reinvent the wheel” for each of the eight RECOFI countries, so a whole range of ideas and best practices can be shared.
- Different countries might best contribute specific knowledge and skills, so that they can take on particular tasks for the whole region.
- Issues that have been identified earlier in this chapter (Table 1) should gradually be overcome, so that activities and marine uses will be increasingly sustainable for the long term.
- Data can be shared, thus reducing data gathering time and costs.
- Data can be gathered using similar protocols, standards, parameters and formats.
- Reduces conflicts between sectors and creates synergies between different marine activities, so that no one marine sector (activity) should be able to gain dominance over others.<sup>15</sup>
- Provides for long-term planning that encourages investment by ensuring predictability, transparency and clear rules for implementation.
- Increases cross-border cooperation and sympathetic working practices that encourage more transparency and better understanding with respect to a host of social, economic, environmental and governance ideals.
- Protects the environment through identification of impacts on marine activities and multiple uses on marine space.

An ideal outcome from the MSP process would be to have one integrated spatial management plan for the whole of the RECOFI region, with equitable and sustainable management and operation of the full range of activities undertaken within that marine space (Box 1).

<sup>14</sup> This importance of working cooperatively is reinforced by the fact that the 28 countries of the European Union, in July 2014, adopted legislation to create a common framework for maritime spatial planning in Europe. See European Union. 2016. EUR-Lex. Access to European Union law [online]. Brussels. [Cited 17 October 2016].

[http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L\\_.2014.257.01.0135.01.ENG](http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2014.257.01.0135.01.ENG)

<sup>15</sup> This is important to note because throughout many areas of the world there is a strong perception that the fisheries sector is increasingly being squeezed out of marine areas, i.e. such that other activities gain access to an increasingly larger proportion of the available space. Undoubtedly, this has been a major cause for the demise of many fisheries simply because they too frequently lack the power and influence to defend their position. MSP provides the forum to achieve consensus and a more equitable distribution of marine space.

### 2.2.10 Improved governance of marine space

A final and important reason for developing MSP for the RECOFI region is that in terms of the laws and regulations applied there are wide variations among participating nations. Additionally, within any single nation there may be specific legislation for specific industrial sectors, or, for example, the management of protected areas will differ between countries. Although it is unlikely that MSP can provide a fully unifying approach to harmonization, MSP implementation requires an underlying legal framework to work successfully, not least in the development of agreed policies and rules to govern MSP implementation, where a harmonized approach would be beneficial and would improve the overall management of the Gulf as a regional resource.

### 2.2.11 Concluding – the importance of MSP

Marine spatial planning provides a vital process to coordinate decisions on the development of marine space into the future and compelling reasons for its implementation within the RECOFI region have been established. The next chapter provides the means to implement MSP through a step-by-step approach for the RECOFI region. But, to end this chapter, we pose the question: What if we do nothing? To quote UNESCO:<sup>16</sup>

*In the next 20 years, human activities in many areas of the ocean will have increased significantly. Traditional uses, such as marine transportation, sand and gravel mining, and marine recreation will continue to grow in importance. Oil and gas development will continue to push further and deeper offshore with many of its operations occurring only underwater. Fisheries will continue to exist, but at lower levels, due to the diminished stocks, and in more restricted areas because of competition for ocean space. New uses of the ocean, such as offshore renewable energy and offshore aquaculture, will compete with traditional uses for space. Climate change will have modified species distributions and habitats; increasing ocean acidification will raise new concerns about the survival of some species. In many areas, increasing public concern about the health of the ocean will lead to significant areas set aside for nature conservation. Conflicts among human activities in the marine environment will increase.*

Thus, if MSP is implemented for the management of human activities in the marine environment, long-term benefits will be secured for the whole of society and for nature and will provide long-term sustainable marine development.

<sup>16</sup> Modified from Ehler, C. & Douvère, F. 2009. Marine spatial planning: *a step-by-step approach toward ecosystem-based management*. Intergovernmental Oceanographic Commission and Man and the Biosphere programme. IOC Manual and Guides No. 53, ICAM Dossier No. 6. Paris: UNESCO.



## 3. Steps to implement marine spatial planning

While the previous chapter introduced marine spatial planning and established some important basic concepts and reasons for the approach, this chapter provides a step-by-step guide for the implementation of MSP for the RECOFI region. MSP is not activity specific and does not only present the step-by-step approach for aquaculture and fisheries needs. It has a broader approach that can be applied more generally within the RECOFI region, depending on the specific objectives of the MSP that are established in the early steps. The principles developed are based on Ehler and Douvere (2009), including contributions from Blæsbjerg *et al.* (2009) and Gilliland and Lafolley (2008). Where appropriate, the commentary under each heading for each step is adapted to reflect RECOFI circumstances.

Adoption of MSP cannot be implemented randomly, and being a process, it is logical to follow some well-considered practices in a rational sequence. This has been done where MSP has been successfully implemented, with lead and competent authorities having developed their own sets of MSP procedures or having adapted a pre-existing set of procedures to suit the prevailing circumstances in their geographic area.

A summary of the main steps for MSP is presented schematically in Figure 2, though it must be stressed that the steps are not prescriptive. However, given that MSP is new to the RECOFI region and needs to be adopted by all eight countries, it would be logical that the steps proposed in Figure 2 would be implemented in this order, at least initially. It is important to note that the MSP process is very dynamic, with potential for regular feedback and adaptation, allowing authorities to make regionally relevant improvements when new information becomes available to inform the whole process. As a dynamic, iterative and long-term process, the steps are not in strict chronological order, with, for example, Steps 8 to 10 feeding back to Steps 2 or 7 when the need and timing permits.

However, achievement of a workable marine spatial plan should have an agreed and defined time scale for development and for implementation. The plan should then be reviewed after a regular period to ensure relevance and to allow adaptation to new circumstances. This should not occur so often as to curtail stability and investment in the marine environment, but should not be so long that the status quo is simply maintained irrespective of new circumstances. In an analysis of various MSP programmes worldwide, a review period of every five years appears to be typical.

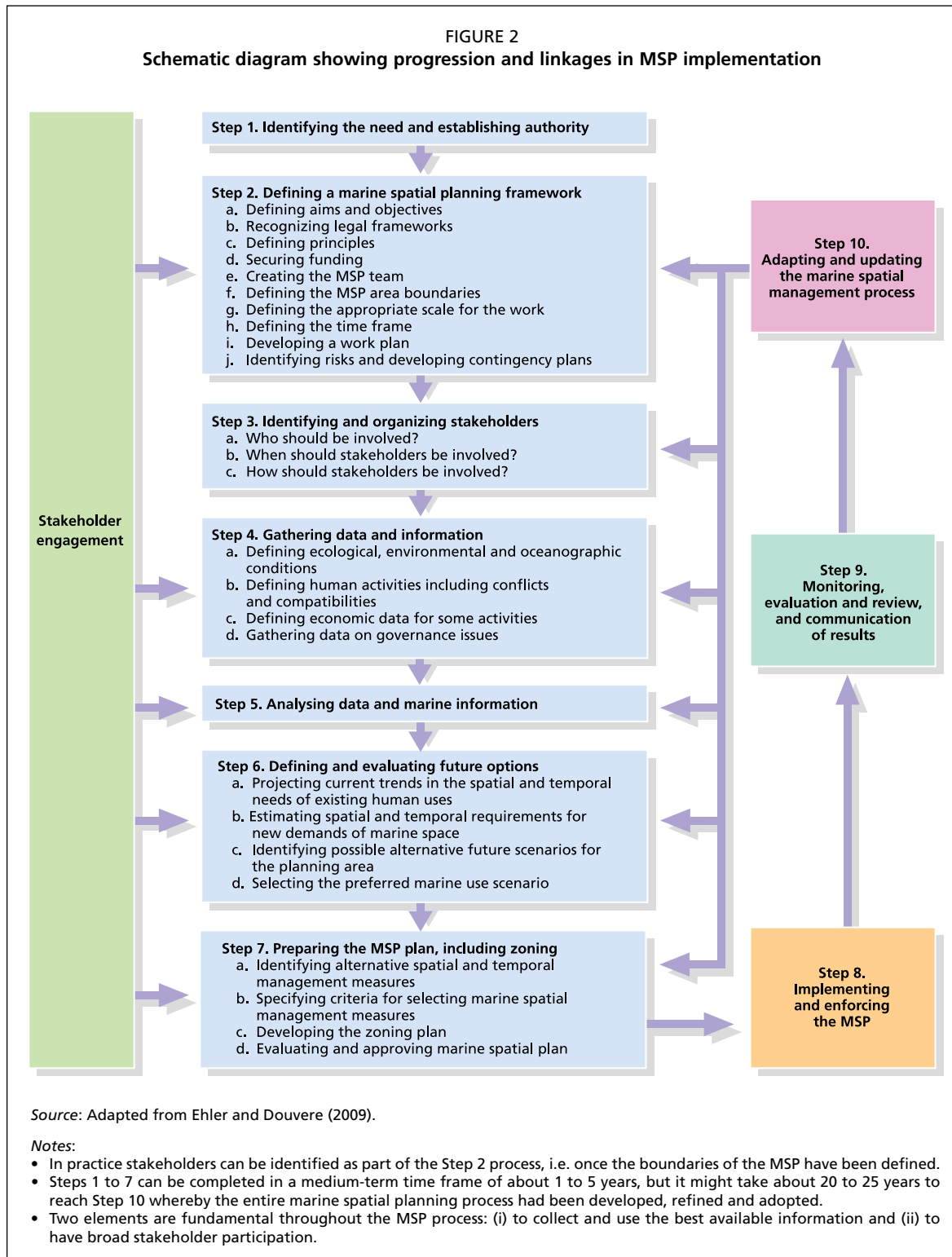
### Step 1: Identifying the need and establishing authority

Step 1 in the MSP process involves an analysis of the marine space, which includes the use it is currently put to, the vision for future use and the identification of issues and opportunities that determine the need for MSP. Part of Step 1 is to establish an authority to investigate, develop and implement MSP.

#### (a) Identifying the need

Chapter 2 has largely considered some of the broad-scale reasons why MSP is needed for the RECOFI waters. It is clear that activities undertaken in the marine space are many and varied, with increasingly conflicting requirements and with inequity in the ability to influence the use of marine space for all users. The present pressures being exerted by collective human marine-based activities are such that the natural environment and ecosystem functioning is “breaking down” and natural resources are

FIGURE 2  
Schematic diagram showing progression and linkages in MSP implementation



rapidly dwindling. If this were to continue unchanged, then serious consequences will likely follow for the marine environment, for some or many of the users identified in Box 1 and for society in general. What MSP offers is the ability to provide a “vision for the future” – through a careful holistic analysis of social, economic, environmental and governance objectives, consistently progressing in an integrated and sustainable manner.

Where MSP has been implemented successfully, much emphasis has been placed on carrying out an initial holistic evaluation of all marine waters. This typically results in a

publication that assesses the marine area in terms of its physical and oceanic attributes, climate and biodiversity and current conservation priorities, as well as the status of all human-based marine activities.<sup>17</sup> Such a report allows for an evaluation of the region's marine inheritance, including the overall environmental and ecosystem conditions, plus an assessment of strategies, priorities and actions that are necessary, all of which provide a valuable background to MSP. Once this has been established, the specific need for development of a marine spatial plan, or plans, would become self-evident.

### **(b) Establishing authority**

Marine spatial planning requires an unequivocal authority to plan for and then implement the developed marine spatial plan. At a national level in the RECOFI region, it is unlikely that a single ministry or government department is responsible for all activity in a respective territorial or EEZ marine space. Complexity is multiplied within the RECOFI region, with eight nations contributing to this varied use and management.

Given this complexity, it is imperative that, within each country, authority ("power") be given to one national organization to implement MSP, called here the "lead authority". This authority might be an existing government department, or a new one created that will best serve the needs of each country in implementing MSP. Once a lead national authority has been identified, the power to legislate nationally must be determined so that this authority is given the necessary high-level tools to ensure that MSP can be implemented effectively. Recall that earlier in this document the departments responsible for ICM often lacked legal basis and authority, which itself led to poor implementation of ICM plans. MSP should be considered stronger due to the fact that the lead authority is invested with the necessary legislative powers to "get things done". For most RECOFI states, it is likely that some new legislation will be needed.

It is difficult to give specific recommendations for each RECOFI member on how legislation will be enacted because theoretically there might be six or more government departments covering the varied marine activities and uses in each of the eight countries, with each country being subject to different political, social and other needs. If requested, FAO assistance would be available to help make such decisions.

Finally, as outlined earlier, it will also be necessary to have an additional management layer that reflects the international nature of the Gulf, the Gulf of Oman and the Arabian Sea. Some form of special organization, functioning as a "transnational MSP competent authority", should be developed, one that has government authority behind it to advance the whole RECOFI MSP. Such authority, if members collectively agree, could be vested in an existing institution.

## **Step 2: Defining a marine spatial planning framework**

While Step 1 established the needs for MSP and designated an appropriate lead authority at both the national and regional levels, the second step is primarily concerned with setting up a framework in which all MSP activities can function effectively.

To fulfil this objective, a variety of critical actions must be completed:

### **(a) Defining aims and objectives**

An essential component in defining the planning framework and to the success of MSP is to have well-defined aims and objectives. These will come from the needs identified in Step 1.

<sup>17</sup> See, for instance, Commonwealth of Australia. 2012. Marine bioregional plan for the Temperate East Marine Region. Australian Government. Department of Sustainability, Environment, Water, Population and Communities. Prepared under the Environment Protection and Biodiversity Conservation Act 1999. Australia, 209 pp. (also available at: [www.cbd.int/doc/meetings/mar/mcbem-2014-04/other/mcbem-2014-04-au-e-en.pdf](http://www.cbd.int/doc/meetings/mar/mcbem-2014-04/other/mcbem-2014-04-au-e-en.pdf)).

“Aims” define the broad and general purpose for MSP and may be perceived as high-level intentions or desired outcomes. Aims can sometimes be intangible or abstract and outline only the overall goal without the mechanism to achieve that goal. It is clear that individual stakeholders will have specific aims that will be directed towards ensuring that their use of marine space is secured for their future activities. Section 2.2.9, however, made it clear that all stakeholders must work cooperatively so that a set of overall aims can be identified for the RECOFI area. It will be important that the stakeholders for each activity are able to set mutually agreed goals or targets for the various marine activities. If this were not to occur, then it is likely that the activity with significant power over decisions, such as oil or gas supply where substantial economic gains can be made, could achieve more prominence than activities such as fishing, which might simply be seen as a subsistence activity or a conservation plan where “economic returns” are difficult to evaluate. Economic sustainability should not be seen as the only driving factor. Social and environmental sustainability must have equal status.

“Objectives” are the more specific means by which aims will be achieved and objectives could include any tasks or activities necessary to achieve the aims. Table 2 gives examples of aims and related objectives for a number of MSP needs. It can be seen that a large number of them will be necessary to cover the complete aspirations of MSP as part of an integrated marine spatial plan. In order to adapt to changing conditions and priorities,<sup>18</sup> planning frameworks need to deliver certainty in the short term and flexibility in the long term.

TABLE 2  
Examples of aims and objectives for a marine spatial plan

Aims	Objectives
Conserve or protect ecological structures so as to enhance biodiversity	Protect 80 percent of known nursery habitats for fish species x
Protect ecologically valuable areas and/or to restore degraded areas	Put into effect mangrove habitat restoration schemes in each relevant RECOFI country by 2020
Promote appropriate uses of marine space	Ensure that a minimum of 10 percent of marine space is available for offshore aquaculture by 2018
Conserve or protect marine resources	Implement a system of marine protected areas for the RECOFI marine waters by 2020
Seek alternative sources of fish protein	Establish culturing facilities for y number of fish species by 2022
Avoid and resolve spatial conflicts	Have clearly defined zones that are mutually agreed
Enhance the living standards and quality of coastal communities	Establish a range of social and economic parameters (targets) against which progress can be measured
Consider governance issues at local, regional, national and international levels	Ensure that all local to regional regulations are recognized and respected

### (b) Recognizing legal frameworks

Blæsbjerg *et al.* (2009) note that “Marine spatial planning should be based on statutory requirements, and legal and policy frameworks underpinning MSP are found at the international, regional, and national levels. These frameworks have developed progressively over the past two decades, based on the growing need for sustainable development and protection of marine areas and resources” (p. 19).

<sup>18</sup> This observation is from Beck *et al.* (2009); see [http://waterviewconsulting.com/files/MSP\\_Best\\_Practices.pdf](http://waterviewconsulting.com/files/MSP_Best_Practices.pdf)

Since a regional RECOFI MSP must involve cooperation among institutions from all eight RECOFI members, there will need to be appropriate legislation and laws developed that underpin the workings of MSP. These laws will principally be concerned with establishing agreed policies and regulations that will guide the MSP process towards achieving its aims. The laws might best be framed in a “regional marine framework”. This is a commitment maintained by all members to work towards the development of an MSP, following the established rules and policies. The framework might also include an “action plan”, which provides details on how the framework is to be realized.

### (c) Defining principles

Marine spatial planning should be guided by principles that dictate the nature of the MSP process itself and which reflect the types of results that the MSP seeks to achieve.

Examples of basic (underpinning) principles guiding MSP practices include:

- maintaining ecosystem integrity;
- the integration principle with stakeholders working cooperatively with others;
- the public trust principle that recognizes the marine area as a “commons” resource;
- the sustainability principle;
- the transparency principle so that procedures used are open to public scrutiny and challenge;
- the precautionary principle such that no irreversible environmental harm should be caused;
- the polluter pays principle where people should take responsibility for negative consequences that they cause; and
- enabling compliance with international, regional and national obligations.

As well as defining the basic principles that inform the need for MSP, it is possible to define another set of more specific “operating principles”.<sup>19</sup> These include more practical considerations, such as to:

- enable more efficient decision-making, offering benefits to marine managers and regulators, developers, users and their advisers;
- extend to all marine waters within the relevant jurisdiction, e.g. EEZ or equivalent;
- contain a hierarchy of spatial scales that comprise, as a minimum, national and sub-national (e.g. regional) levels;
- create a more efficient and rational use of marine space to provide a balanced view between competing uses, highlighting where one human activity might preclude another, helping avoid or minimize conflicts of interest, and where possible, optimizing the co-location of compatible activities;
- enable a better understanding of the cumulative effects of different types of human activities, both on marine ecosystems and each other; and
- promote participation of stakeholders by being transparent, open and inclusive, and ensure involvement of all relevant stakeholders, including marine users and local communities.

### (d) Securing funding

Implementation of MSP is not possible without adequate funding. Because the central government will likely be implementing the initiative, financing will mainly come from general revenues. Other sources of funding might also be considered, including stakeholder contributions, funding from external donors, international and multinational organizations, grant funding, foundations and the private sector.

Since many of the activities that stand to gain from MSP will be in the private sector, it is not unreasonable to expect that a range of business associations might be willing to help with financing. Other countries have tried alternative means, and in China, for

<sup>19</sup> These operating principles are clearly set out in Gilliland, P.M. and Laffoley, D. (2008) in Key elements and steps in the process of developing ecosystem-based marine spatial planning. *Marine Policy*, 32: 787–796.

example, all users of the sea must pay a “marine user fee” if they intend to carry out production and other economic activities in the marine environment.<sup>20</sup>

It is almost certain that the eventual financial support will come from more than one source. Ehler and Douvere (2009) advise that “Making financial mechanisms mandatory through legislation is beneficial. It allows you to enforce the funding and ensures the MSP process is not jeopardised because of a lack of resources” (p. 35). Given the enormous natural resource base in the RECOFI area, the relatively developed status of member countries and the huge financial benefits that MSP will undoubtedly bring, joint funding from member countries should be forthcoming. Funding will need careful planning ahead of the project’s inception.

#### (e) Creating the MSP team

Marine spatial planning requires both a multidisciplinary approach and a multidisciplinary team comprising experts from (at least) planning, sociology, economics, geography, ecology, biology and computing. Table 3 illustrates the functional roles and the desirable skills that are required. It is not a prerequisite list and not all of the skills have to be contained within the core MSP team. For example, some might be obtained from other governmental agencies or ministries, or from the scientific community, non-governmental organizations or consultants providing expertise in aquaculture, fisheries, shipping, oil and gas supply, tourism and so on.

A very important member of the team will be the leader or “champion”. A champion in this case is someone possessing great passion and enthusiasm for making the project successful, and this person is usually equipped with strong management and interpersonal skills. Without a dedicated champion, projects based on a new system of planning and integration are less likely to succeed.

TABLE 3  
Important roles and skills of MSP practitioners

Functional role	Skill types		
	Knowledge and general aptitudes	Programming skills	Administrative skills
Programme management	Strategic thinking about space and time	Strategic planning, financing, project implementation	Organizational management
Authority	Knowledge of spatial implications of legislation	Legal analysis	N.A.
Analysis	Analytical thinking about space and time	Spatial database management, geographic information systems	N.A.
Planning	Conceptualization and spatial systems thinking	Problem assessment, strategy design, plan development	Coordination
Implementation	Conflict resolution	Negotiation	N.A.
Monitoring and evaluation	Cause and effect thinking	Monitoring of planning assessment methods	Evaluation
Communications	Strategic communication	Product planning, product development	Routine communications

Source: Ehler and Douvere (2009).

<sup>20</sup> For details on this and other aspects of MSP in China, see UNESCO. 2016. Marine spatial planning initiative [online]. Paris. [Cited 17 October 2016].  
[www.unesco-ioc-marinesp.be/spatial\\_management\\_practice/china](http://www.unesco-ioc-marinesp.be/spatial_management_practice/china)

#### (f) Defining the MSP area boundaries

Within MSP, it is important to consider both administrative and management boundaries. For the RECOFI area, boundaries are generally well defined in that they wholly represent the territorial seas and EEZs for Bahrain, Iraq, Kuwait, Oman, Qatar and the United Arab Emirates (see Figure 1).<sup>21</sup> For Iran (Islamic Republic of), the area excludes the territorial waters of the Caspian Sea, and for Saudi Arabia only its Gulf waters are included.

For management purposes at a RECOFI-wide scale, it will be important for countries at the southeastern edge of the RECOFI region (i.e. Iran [the Islamic Republic of] and Oman) to take into consideration any externally imposed influences from the Arabian Sea that could affect their aquatic ecosystems, such as the location of fish catches, effects of ocean currents and location of nursery grounds. For spatial analysis, Saudi Arabia will need to ensure that any aggregated data that it might use, such as data on vessel numbers and types, species catches and artisanal fishing population, does not include data from its Red Sea resources.<sup>22</sup> For some of the more detailed analysis, it may be important to consider what the furthest landward limits of the project area should be, such as whether intertidal areas or estuaries are included.

In many contexts, areas covered by ICM are not included in MSP, but continue to be managed through an existing ICM hierarchy. Many RECOFI countries have considered ICM in the past, but it is currently unclear whether any specific ICM plans were implemented. Thus, for the purposes of MSP, it would be better to consider all marine space, including nearshore environments, to ensure that all marine areas are included and no specific areas are excluded.

#### (g) Defining the appropriate scale for the work

Just as ecosystems operate at different scales, so too should MSP. There are no rigid definitions of an ideal scale, but it is suggested that a hierarchy of scales be used according to circumstances. These might be depicted as:

- A local scale – for detailed work associated with small-scale areas or concerns.<sup>23</sup> Where local scale issues occur near national borders, it will be important to consider transboundary issues.
- A national scale – for intermediate work that is typically within national boundaries. However, where these areas might be spatially small, e.g. for Bahrain, Iraq and perhaps Kuwait, it would be best to work beyond national boundaries, especially with respect to fisheries.
- An international scale – this would be for work that encompasses the whole RECOFI area where a multinational MSP strategy would be devised.

Although different aspects of MSP will benefit from work at appropriate scales, it is essential that provisions are made for a holistic Gulf-wide analysis of any facet of the work. With this comes the need for all relevant data to be collected for various thematic areas at varying scales. It is impossible to be prescriptive on the scale because the correct resolution<sup>24</sup> of the data will depend on the purpose for which the data are being collected and what data are available.<sup>25</sup>

<sup>21</sup> RECOFI carries out its functions and responsibilities in the region, bounded in the south by the following rhumb lines: from Ras Dhabat Ali in (16° 39'N, 53° 3'30"E), then to a position in (16° 00'N, 53° 25'E), then to a position in (17° 00'N, 56° 30'E), then to a position in (20° 30'N, 60° 00'E), then to Ras Al-Fasteh in (25° 04'N, 61° 25'E).

<sup>22</sup> For more information about data requirements for MSP work, see Step 4 of this section.

<sup>23</sup> For details of a very small MSP adoption for the islands of Antigua and Barbuda, see Waitt Institute. 2013. Barbuda Blue Halo Initiative. Description and work plan. October 2013. [Cited 17 October 2016]. [www.cbd.int/doc/meetings/mar/mcbem-2014-04/other/mcbem-2014-04-ag-1-en.pdf](http://www.cbd.int/doc/meetings/mar/mcbem-2014-04/other/mcbem-2014-04-ag-1-en.pdf)

<sup>24</sup> Resolution here is the detail to which a map depicts the location and shape of geographic features. It can also be thought of as the area that is reasonably covered by one piece of spatial data.

<sup>25</sup> For an example of marine spatial mapping being used at varying scales, see the wide range of mapping at: Marine Management Organisation. 2016. Marine information system [online]. Newcastle, United Kingdom. [Cited 17 October 2016].

<http://defra.maps.arcgis.com/apps/webappviewer/index.html?id=3dc94e81a22e41a6ace0bd327af4f346>

It is strongly recommended that MSP work be initiated at a local scale. Working at this scale, perhaps to resolve a distinct issue, could be considered as a pilot activity before any wider MSP adoption and implementation. This would allow any locally adopted processes and systems to be put in place and tested before larger scale MSP (national, regional) is considered. At a local scale, it is likely that worker inputs to the MSP process could amount to only a few full-time team members, though they would need frequent but irregular access to a whole range of stakeholders in order to secure specific data and information. Moving successively to wider/larger scales of MSP operation would probably require a significant increase in the MSP team and its associates and resources.

#### **(h) Defining the time frame**

Having a specific start point and “implementation end-point” for MSP is critical. There is a need to decide upon a base year for the MSP initiative to represent a year (or period) against which future progress can be measured. The “implementation end-point” represents the first major target for implementation and is the date or period by which actions derived from the marine plan are perceived to be fully implemented. This target date does not represent the “end” of the activity, remembering that afterwards there is a need to regularly review the marine plan, to make changes according to the new situation, to update the marine plan and to implement further changes if needed. Such a review process under MSP should be conducted approximately every five years, while overall MSP should be envisaged as spanning a future time frame of perhaps 20 to 25 years.

#### **(i) Developing a work plan**

The work plan is a working document(s) that defines activities, what parts of the process should be carried out by whom, by what time, at what costs, and how the various parts of the plan relate to each other. Box 2 gives an indication of the main types of actions that need to be considered in a work plan. Having such a plan will ensure timely implementation of MSP, and will allow progress to be measured and assessed and corrective actions to be taken when deviations occur. The time schedule is important because without one there is a danger of the activity “drifting” and actions never reaching a conclusion. During the life of the initiative, it would be expected that adjustments to the work plan would be necessary, as unforeseen or new circumstances arise. The work-plan schedule is best portrayed in the form of a Gantt chart.<sup>26</sup>

Development of a work plan is particularly important because human resource inputs to MSP may be limited, at least initially, especially if team members retain other work duties. In practice, MSP initiatives will probably contain a number of specialist working committees who will engage in the necessary activities and form the basis for implementation. Given the wide RECOFI membership, it is essential that work ethics are agreed upon and that disagreements can be readily resolved. In part, this is achieved by defining specific roles and responsibilities, and that group or collective work is completed with total transparency as the accepted norm.

#### **(j) Identifying risks and developing contingency plans**

Risk analysis is a process that provides a flexible framework to systematically evaluate the adverse consequences resulting from a particular course of action. This approach permits a defensible decision to be made on whether the risk posed by a particular action or “hazard” is acceptable or not, and provides the means to evaluate possible

<sup>26</sup> This is a table on which the vertical columns show time periods (perhaps week or months) commencing from the start date, and the horizontal rows contain all the actions that need completing. Any conflicts are then highlighted. Critical path analysis can be undertaken to assess activities that are contingent on prior activities being completed to ensure the whole plan is workable, and will not fail completely when one task is not completed in time.



## BOX 2

**Actions required to develop a work plan**

- (i) List the main activities needed to develop the plan.
- (ii) Break each activity down into manageable tasks, i.e. a task that can be managed by an individual or group and that is easy to visualize in terms of resources required and the time it will take to complete. Be careful not to break the activities into too many small components.
- (iii) Choose appropriate time periods for specifying when activities will take place (by week, month, quarter).
- (iv) Clarify the sequence and relationships between tasks. Does one task have to be completed before another task can be started? Can two tasks be carried out at the same time?
- (v) Estimate the start time and duration of each task. This may be represented as a line or bar on a chart. Be careful to:
  - include all essential activities and tasks;
  - keep in mind the workload on individuals, and identify where additional assistance may be needed; and
  - be realistic about how long a task will take.
- (vi) Identify key events (milestones) to help monitor progress. These are often dates by which a task will be completed.
- (vii) Assign responsibilities for tasks utilizing talents of the various members of the MSP team.

*Source:* Developed from Ehler and Douvere (2009).

ways in which to reduce the risk from an unacceptable level to one that is acceptable. Risk analysis is intended to answer questions, such as: (i) What can go wrong? (ii) How likely is it to go wrong? (iii) What would be the consequence of its going wrong? and (iv) What can be done to reduce either the likelihood or the consequences of its going wrong?

Assessing possible risks, mitigation activities and contingency planning is vital to any MSP framework. There must be a critical analysis of factors that might delay any key steps in the planning process, with some assessment of how these might be overcome plus having adequate contingency plans developed to fall back on. While, for example, national MSP initiatives can be implemented within the context of national requirements and legislation, the international nature of the need for MSP in the RECOFI area has been identified. Thus, it is fairly certain that work on MSP will involve the integration of effort among the full group of eight countries, and that there will be different working practices that may result in different plan outputs, which could increase the overall risk factors. The work plan developed and the assessment of risks and development of contingency plans will no doubt result in compromise, which will need to be reached among all parties.

### Step 3: Identifying and organizing stakeholders

Although it is occupying a distinct “step”, Step 3 in reality might best be considered in conjunction with those tasks described in Step 2. However, it has been identified separately because of its considerable importance and impact on the success of the MSP work and processes. Step 3 involves the identification and organization of relevant stakeholders. In this context, stakeholders should be considered as any real or legal person or entity having a moral interest in relation to the activity being undertaken and who, as a consequence, has a right to be heard.

For MSP, the stakeholders will be representatives of all the main groups that have been identified as users of the marine space, but could also include regulators, policymakers, researchers and educators. Such stakeholders may not directly use marine space but they are nonetheless responsible in their own right for aspects of sea

use, whether for research or with the application and management of marine spatial plans. In its widest context, stakeholders can include the general public, though this is likely to be restricted to regular users of marine space through some form of group (scuba divers, for example). Box 1 exemplifies the range of specific activity groups that could reasonably be expected to require some form of stakeholder involvement in a specific MSP. Stakeholder engagement and involvement will increase the likelihood of success, and Box 3 provides important reasons why a variety of stakeholders must be involved in MSP work.

#### BOX 3

##### Reasons for involving stakeholders in marine spatial planning

- To encourage “ownership” of the spatial plan, engender trust among stakeholders and decision-makers, and encourage voluntary compliance with rules and regulations.
- To gain a better understanding of the complexity (spatial, temporal and other) of the marine management area.
- To gain a better understanding of the human influences on the management area.
- To deepen mutual and shared understanding about the problems and challenges in the management area.
- To gain a better understanding of underlying (often sector oriented) desires, perceptions and interests that stimulate and/or prohibit integration of policies in the management area.
- To examine existing and potential compatibility and/or conflicts of multiple use objectives of the management area.
- To generate new options and solutions that may not have been considered individually.
- To expand and diversify the capacity of the planning team, in particular through the inclusion of secondary and tertiary information (e.g. local knowledge and traditions).
- To foster the inclusion of local communities, including traditional knowledge and practices, so that assessment, designation and management of MSPs is done in a just and equitable manner.
- To stimulate the creation of livelihoods, thereby increasing the likelihood of MSP success and sustainability.

Source: Adapted from Ehler and Douvere (2009).

The extent and scope of stakeholder involvement varies between projects. However, the importance of stakeholder participation in MSP projects cannot be emphasized enough, and without a full range of participation, projects may be less successful. Wherever possible, bottom-up involvement from a diverse range of stakeholders should be facilitated.

The main considerations with respect to stakeholders are:

##### (a) Who should be involved?

In any MSP activity, stakeholders are likely to represent private companies, government departments, non-governmental organizations, and indeed any interested group or person. Stakeholder representatives who are engaged in MSP work will need to be able to speak for their organization from a position of authority and knowledge. Their existing roles may be as resource managers, as owners of resources, or perhaps as experts or consultants in the field being represented. In some cases, they could be legal representatives. All stakeholders need to have some knowledge of the spatial area under consideration and be conversant with temporal variations in activities or in resource distributions such as fishing and fish stocks, although it is recognized that each stakeholder will have different skills and knowledge.

Some stakeholders will play a major role in MSP development, but there may also be a wide range of stakeholders whose representation is small and who may be required for specific minor tasks. It is important that the stakeholder group is well balanced and that it represents all “activity scales” that function in a marine area, for example, small-scale nearshore fisheries, large-scale fishers, specialty fisheries, fish farmers, and so on. Occasionally, it may be necessary to empower persons or groups who may not possess the knowledge or skills to represent themselves. This might be achieved by delegating authority, or by some form of training or dissemination of information.

#### **(b) When should stakeholders be involved?**

Stakeholders may be involved at any time during the MSP process, but there are various activity periods when involvement might be crucial. There is a high likelihood of stakeholder participation during the MSP framework planning stage (Step 2) during which involvement might be on a full-time basis for an extended period. Other periods when stakeholder involvement will be high include MSP plan development (Step 7), plan implementation and activity management (Step 8), and monitoring and evaluating MSP performance (Step 9). It is possible that stakeholder personnel representing one group or organization may change during a project because someone with alternative and specific skills or knowledge is required.

#### **(c) How should stakeholders be involved?**

Stakeholder engagement in the MSP process is critical for success. Table 4 gives an indication of the main types of roles that stakeholders will be required to fulfil, which involves dialogue, good communication, negotiation and building consensus. Within this context, the roles will necessitate widely differing amounts of personal interaction, from wide-ranging consultation exercises to reach a large group (such as through a questionnaire, or commentary, on particular proposals) to one-on-one discussions, but in all cases there is a need to ensure that any results from such interactions are more widely publicized to demonstrate openness and transparency.

In considering stakeholder involvement, it is important to consider factors such as native language to ensure full participation is possible, and that the inputs and outputs required from each stakeholder are clearly understood. It may also be worth considering whether it is necessary to provide a professional facilitator, someone who has no specific vested interest other than to ensure that the process or discussions move forward and to support overcoming deadlock, or whether there should exist a suitable team leader whose role is to continually move the MSP process forward. Because the number of potential stakeholders representing even one RECOFI member country could be quite large, some delegation of representation and/or authority to act will be needed. Large stakeholder numbers will also necessitate inclusive, reliable and effective channels of communication. The importance of delegation and effective communications will be clearer when there is a need to work in conjunction with subgroups (or all) of the RECOFI countries.

Table 4

#### **The functional roles required from stakeholders**

Negotiation	This is typically higher-level decision-making
Consensus	The determination of a common agreed position among participants
Dialogue	Getting to know and understand one another
Consultation	Typically, the collection of opinions from other stakeholders
Information	The provision of objective data that allows for empowerment
Communication	Conveying messages to target audiences

#### Step 4: Gathering data and information

Having (i) identified the need and establishing authority to take charge of the work; (ii) defined a marine spatial planning framework; and (iii) identified and organized stakeholders, then definitive work on MSP can commence with Step 4 – data gathering.

The initial task for the MSP team will be to compile an inventory of relevant information that may be needed in order to meet MSP objectives. Essentially this will require the MSP team and the various stakeholder groups to list their possible information needs and to define likely data sources that can provide this information. Some of the data will be used to establish the baseline reference points pertaining to the wide variety of social, economic, environmental and governance factors, including for example, concepts of carrying capacity and risk analysis and mapping that will be relevant to successful MSP and the development of the marine spatial plan.

Data will form the basis of almost all MSP analyses and will almost certainly generate a lot of information from a range of sources. There is a need, therefore, to ensure that these data are accessed, gathered, logged, organized and displayed through the most appropriate means. It would be impossible to organize spatially based planning and management systems, for example, without recourse to a wide variety of digitally held data. While it will be perfectly possible to embark on MSP activity with a minimal amount of data, MSP project personnel should continually be attempting to procure additional data to meet future needs.

Data availability needs to relate to each of the main activities that are carried out in the RECOFI marine environment (see Box 1). Data can be collected from many sources, including scientific literature, expert opinion or advice, government sources, local knowledge, as well as information from aggregate sources (including, for example, satellite data collected by remote sensing<sup>27</sup> – see Step 5) and through direct field measurement. Data will need to be in a suitable format (or be convertible to it), typically digital, that includes geo-referenced material (i.e. being spatially referenced) in order to achieve accurate consideration of the spatial extent of the data and to achieve appropriate mapping output. Data may be at various scales that need to be integrated, and wherever possible should be up to date, objective, reliable, relevant and comparable.

What the exact purpose is for collecting data and what the exact boundary coordinates are for the data must be clear. The data collection process should be a structured, transparent process to ensure adequate data and metadata collation to enable the data to be effectively used in MSP. Metadata are information about the data, i.e. when was it collected, which area it covers, who collected the data, what format the data are held in, and a range of other attributes. Where appropriate, data can be aggregated and distributed for stakeholder consultation and feedback.

Data collection is a resource-intensive activity, in terms of both the time needed to gather, collate and present information, and in terms of the finances needed to support the data collection, especially if the data are collected in the field. The extent of the undertaking should not be underestimated, especially given the fact that some data sets may need to be frequently updated. The accumulation of data is likely to be a lengthy process, and in many cases will require that primary data<sup>28</sup> be gathered from the full variety of relevant marine environments. Data will need to be stored in databases typically held by the lead MSP authority.<sup>29</sup> The data collection processes and data limitations with respect to MSP are further elaborated in Shucksmith and Kelly (2014).

<sup>27</sup> Remote sensing is formally defined as “The science and art of obtaining information about an object, area, or phenomenon through the analysis of data acquired by a device that is not in contact with the object, area, or phenomenon under investigation” (Lillesand, Kiefer and Chipman, 2007).

<sup>28</sup> Primary data are unprocessed data that have been collected for later use.

<sup>29</sup> Data types, sources, gathering and storage are a very large subject. With respect to marine fisheries and aquaculture use, readers should consult Meaden and Aguilar-Manjarrez (2013).

To cover Step 4, four major thematic areas are identified:

#### (a) Defining ecological, environmental and oceanographic conditions

Intuitively defining ecological, environmental and oceanographic conditions is a matter of collecting and analysing data. What is important to consider, however, is that the marine environment is very dynamic both biologically and physically, and conditions change minute by minute, hour by hour, day by day, and with the seasons. Given this spatial and temporal variability, it is often not possible to collect data that precisely define the marine system under investigation. However, there are technical means to gain an understanding of water currents, wave actions, climate and environmental conditions – for example, advances in satellite remote sensing technology allow for the collection of some data in real time, particularly sea surface temperatures or chlorophyll-a distributions, both important factors in aquaculture and fisheries activity.

Special consideration needs to be given to important marine environments and ecosystems (Foley *et al.*, 2010) in terms of their rarity, resource value, contribution to ecosystem services and for defining space availability for other economic activities and the role that they may play in terms of sustaining marine biodiversity.

Table 5 provides an aid to illustrate biologically significant marine areas.

TABLE 5

#### Criteria for identifying ecologically or biologically significant marine areas

Marine area types	Function	Importance
<b>Uniqueness or rarity, e.g. deep sea trenches, sea mounts, thermal fronts</b>	Areas containing either: (i) unique, rare or endemic species, populations or communities; and/or (ii) unique, rare or distinct habitats or ecosystems; and/or (iii) unique or unusual geomorphologic or oceanographic features.	These areas or species/populations are irreplaceable, and their loss would mean the probable permanent disappearance of diversity or a reduction of the diversity.
<b>Special importance for life stages of species, e.g. nursery grounds, migration routes, feeding areas</b>	Areas required for a population to survive and thrive.	Various biotic and abiotic conditions coupled with species-specific physiological constraints and preferences make some marine areas more suitable to particular life stages and functions than others.
<b>Importance for threatened, endangered or declining species and/or habitats, e.g. mangroves, whale calving locations</b>	Areas: (i) containing habitat(s) for the survival and recovery of endangered, threatened, declining species; or (ii) with significant assemblages of such species.	To ensure the restoration and recovery of such species and habitats.
<b>Vulnerability, fragility, sensitivity or slow recovery, e.g. coral reefs, coastal zones, thermal vents</b>	Areas containing a relatively high proportion of sensitive habitats, biotopes (small, uniform environments occupied by a community of organisms), or species that are functionally fragile (highly susceptible to degradation or depletion by human activity or by natural events) or with slow recovery.	The criteria indicate the degree of risk that will be incurred if human activities or natural events in the area or component cannot be managed effectively or are pursued at an unsustainable rate.
<b>Biological productivity, e.g. upwelling areas, coral reefs, coastal shelves</b>	Areas containing species, populations or communities with comparatively high natural biological productivity.	Important role in increasing the growth rates of organisms and their capacity for reproduction, and in providing surplus production so as to stock adjacent areas.
<b>Biological diversity</b>	Areas: (i) containing comparatively higher diversity of ecosystems, habitats, communities, or species; or (ii) with higher genetic diversity.	Important for evolution and maintaining the resilience of marine species and ecosystems.
<b>Naturalness</b>	Areas with a comparatively higher degree of naturalness as a result of the lack of, or low level of, human-induced disturbance or degradation.	Natural areas can be used as reference sites and will be likely to safeguard and enhance ecosystem resilience.

Source: Ehler and Douvere (2009).

A wide variety of types of mapping exist, such as sensitive habitats, bioevaluation, ecological values and bioregional profiles within which data can be aggregated. It is essential to appreciate that certain marine features or attributes are rarely static or have defined boundaries, and thus any quality or quantity of marine features or areas may change through space and time. Thus, with respect to all marine environments, it will be necessary to consider carefully the categories and subcategories that make up the classification boundaries within each type of data, and this should be agreed upon (standardized) among all MSP participants.

**(b) Defining human activities, including conflicts and compatibilities**

Mapping human activities in MSP areas is important because it is the collective result of these activities (see Box 1) that has initially given rise to the need for MSP. Marine-based human activities may either impact one with another, or they may impact with the marine environments or ecosystems themselves. Many marine activities can easily coexist in the same marine space, but others, such as military operations at sea or trawling and gravel extraction, are likely to be incompatible with most other marine uses. Collection of relevant data (such as precise coordinates for defined existing activities) and the mapping of areas of marine activities may need to respond to shorter or longer term spatial variations because activities often make adjustments according to seasonality, species life stage changes, temporary natural or human disturbances or legally based adjustments. Major problems associated with marine mapping are those that occur when aquatic resources and environmental services are depleted or seriously disrupted, such as through overfishing or from larger-scale aggregate extraction. These major disruptions can have significant social and economic repercussions and the wholesale displacement of activities can occur. Data on the changes or displacement of human-related marine activities may need to be gathered at vastly differing spatial and temporal scales. Thus, fishers are likely to “follow” fish and therefore move to where fish move, possibly over short term durations. On the other hand, aquaculture facilities, once granted, are liable to remain relatively static over a relatively small spatial area for a period of 20 years or more, compared with oil extraction, for example, which is liable to retain a larger defined exclusion area (around offshore facilities) for many decades. Such temporal and spatial variation among different activities needs to be considered in plan development.

Data on local population centres around the Gulf will be an essential ingredient to MSP. This will include the location of all large and smaller communities, their populations plus an assortment of well-being data. These type of data will be essential in terms of overseeing economic and social well-being as the basis for longer term population sustainability, especially among the artisanal communities who are most likely to be in need of additional access to economic aid, education, health and welfare provision. It is likely that the exact needs for social data will gradually emerge once the MSP work progresses and thus stakeholder concerns can be addressed.

**(c) Defining economic data for some activities**

Decisions within MSP should be defined using sound economic approaches, where appropriate. The accelerating economic activity associated with the exploitation of marine-based resources, such as oil, gas, wind power and aggregates, has greatly hastened impacts on marine environments, as has the use of marine areas for dumping a range of waste products. The costs of targeting increasingly remote sources of oil brings into focus the need to collect data for some form of cost-benefit analysis (CBA) as a useful tool to support decisions made in later steps. Other economic dimensions that must be considered are the balance of costs involved with conservation, tourism

and recreation development, as well as the finances for maintaining coastal areas where subsistence activities or erosion takes place, especially where artisanal peoples make a livelihood from the sea.

It is likely that human activities will especially affect inshore marine areas, and impacts will progressively decline with distance from the coast. There are likely to be a range of external pressures that have a significant effect on the levels of individual marine activities. For instance, at the time of writing this publication, some members of the Organization of the Petroleum Exporting Countries (OPEC) in the Gulf have increased their oil output and this has had the effect of reducing oil prices and thus increasing demand, which in turn is likely to cause an increase in commercial oil tankers using Gulf waters. In contrast to this, a major financial depression may lead to an immediate reduction in tourist and recreational activities, thus affecting usage of resorts, hotel building, recreational yachting, etc. Collecting data on likely economic costs and benefits will prove useful in determining appropriate courses of action. For some marine activities, it is possible to construct economic cost surface maps. These maps show, at any given marine point, what the cost of an activity may be. Clearly, for instance, the financial returns made from selectively fishing for a species will vary largely with the fishing methods used and the distance from port, along with variable selling prices for the same species at different landing sites. In an aquaculture context, distance to port, environmental conditions farther offshore and the subsequent need for investment in appropriate offshore technology in future will be economically different from any existing nearshore activity. An economic assessment of existing aquaculture, and estimates for future potential development, would provide a useful comparison during the decision-making steps later in the MSP process. A similar logic will apply to other non-living marine resources (oil, gas, aggregates).

#### **(d) Gathering data on governance issues**

The implementation of governance within MSP is concerned with two primary elements. The first is the manner in which governance is performed and made operational through statutory rules and regulations, where implementation is generally within government control. The second element is social governance, which more generally influences how industry, markets and civil society respond to the statutory needs, and uses their knowledge to interact, use and alter marine environments. In respect to governance of marine areas, there are many facets that will require suitable data collection, including:

- The extent of all local, national or regional waters.
- The range of rights of access for various people, communities or groups to particular areas for specific activities.
- How limiting inputs for specific areas or activities could work, e.g. limiting fishing effort through catch quotas, vessel types, net sizes, area closures or fishing days allowed.
- Whether to, and how to, designate specified areas for certain activities, such as species no-take zones, marine conservation or protection areas, or the coordinates of shipping lanes.
- The manner in which rules or limitations on the size of outputs from marine areas are applied, including, for instance, fish lengths, aggregate or oil extraction rates, and seasonal variations in these.
- The extent to which marine planning, the desired development scenario for specified areas, the provision of licences for various activities, and the prohibition of specified activities can be enforced.
- How to encourage investments in a range of activities, such as marine aquaculture, port development, resource extraction or recreational or resort development.
- What monitoring and enforcement of rules and regulations are deemed necessary for successful governance.

The overall aims of marine governance are to ensure implementation of long-term changes to the way marine activity is coordinated, including equity of access and transparency in decision-making. Here, MSP is being used as a tool to achieve the required goals. Governance is concerned with ensuring long-term sustainability for a mixed and potentially conflicting range of marine activities, gathering sufficient data on how things are or could be governed to enable good decision-making. Data needs would cover all of the above activities, with special emphasis on the location and spatial, physical and/or temporal boundaries where specified rules and regulations apply.

### **Step 5: Analysing data and marine information**

Following the gathering of significant amounts of data in Step 4, Step 5 in MSP is to undertake a thorough analysis of the available data. There is a progressively increasing range of software tools that are designed for spatial analyses or for spatial modelling, and it is the new geo-technologies that make MSP both possible and desirable. Tools specifically designed for MSP applications are generally classified as ecosystem-based management (EBM) tools<sup>30</sup> (see Stelzenmuller *et al.*, 2009; Santos *et al.*, 2014). There are also virtual tools that can be used for MSP that do not require GIS or remote sensing expertise, such as Google Earth. The use of any of the wide range of tools will provide output in various formats that can aid analysis across a wide range of important thematic areas.

Other tools useful for MSP are those specially created for spatial analysis, including geographic information systems (GIS). GIS are integrated hardware, software and data (including satellite remote sensing) for capturing, managing, analysing and displaying all forms of geographically referenced information. They allow adequately geo-referenced data of all types to be input to the GIS as distinct data layers available for analysis, and the subsequent output is designed to provide answers to a vast range of questions relating to spatial relationships.<sup>31</sup>

Although it is not necessary to commence GIS work using expensive systems or highly trained personnel, or indeed any other expensive inputs such as specific hardware, software (free-access software is available such as Q-GIS; see pages 43–48 in Meaden and Aguilar-Manjarrez, 2013) and remote sensing expertise, the application of GIS can significantly improve analysis and presentation of spatially based data. The application of GIS can easily be expanded as analysts become more skilled and knowledgeable, the range of requirements expands, and as data sets accumulate.

Complementing GIS work is the analysis of data gained through remote sensing. Remote sensing itself requires the use of satellites or aircraft/drones that have on-board sensing instruments that automatically and continuously take measurements of a wide variety of marine (or terrestrial) variables. In the marine environment, measurements include surface water temperatures, wave heights, chlorophyll-a concentration, water depths in shallow waters, and coastline position. Remote sensing, collected directly or gained from other sources, allows data collection over larger spatial areas than other methods. The resolution<sup>32</sup> of such data is also becoming increasingly more detailed, and the cost of remote sensing data has been rapidly declining, with much of it now freely available. Other remotely sensed data can be obtained from a wide range of subsurface, static or mobile instruments

<sup>30</sup> The NatureServe Web site has a large section on tools for marine spatial planning, and the descriptions provided of the various tools are almost exactly matched to the steps in this document. NatureServe. 2016. Ecosystem-based management tools network [online]. Arlington, United States of America. [Cited 17 October 2016]. [www.ebmtools.org](http://www.ebmtools.org)

<sup>31</sup> A primary source on GIS for marine fisheries and aquaculture use is Meaden and Aguilar-Manjarrez (2013).

<sup>32</sup> Resolution here is the amount of detail that can be achieved at any particular mapped scale. Clearly, the more data samples that can be gathered for any mapping theme, the better the resolution that can be achieved.



that also contain a range of sensors, such as telemetry, sondes or sensing buoys, sonar and other techniques. Data gathered by such means can include the location of fish schools, tracks of larger fish or marine mammals, bottom sediment types, water temperature and depth, water chemistry, and many others depending on the techniques applied. All data from remote sensing are readily geo-referenced,<sup>33</sup> which allows the data to be used in GIS mapping and analyses.<sup>34</sup>

Outputs from GIS will be in various forms, but from the MSP perspective, it is the data tables and the mapping output that will be of greatest value. Interpretation of data outputs is a critical requirement, and personnel working with GIS should be able to offer expert opinions and judgements on data interpretation as an aid to MSP progress. Where economic data is gathered in Step 4, an activity such as CBA can be undertaken in Step 5. CBA allows for a consideration of the economic benefits of undertaking specific courses of action. Mapping will cover social, economic, environmental and governance themes and can be combined with any CBA undertaken, with output maps providing an inventory of all the major facets concerned with any specific theme. Pertinent integration of these thematic maps may indicate areas having specific pressures or conflicts, but also areas where compatibilities may be possible. An example of the types of output is given in Figure 3, where a large marine area in the north of Norway shows spatial demarcation for particular activities within the space identified. Here, it was necessary to manage the sea with respect to future oil (petroleum) activities, while still accounting for areas previously committed to licensed oil extraction before the MSP was developed (solid red line, Figure 3). The dark blue areas are near coastal zones where the Norwegian Government did not want oil extraction to take place because of the need to protect coastal aquaculture facilities and coastal fishing activities. Licensed oil and gas exploration, however, was possible in areas further offshore, as indicated. Although mapping outputs will be an extremely useful tool to inform plan development, it alone cannot deliver what is needed for MSP. Thus, MSP also encompasses shaping and delivering policies at the wider regional level, based on national and international policies, and including a wide range of other management practices.

### Step 6: Defining and evaluating future options

Marine spatial planning is an initiative that attempts to work towards a shared vision for the future with respect to optimizing the preferred and sustained functioning of a marine area. To achieve this, it is important to identify goals. Although goals should be identified as part of Step 1, the MSP process may have to work through Steps 2 to 5 before the goals can be properly defined, especially because of the need to include stakeholder engagement. In Step 6, the principal component is trying to define and evaluate future conditions and potential options. It will typically be completed by:

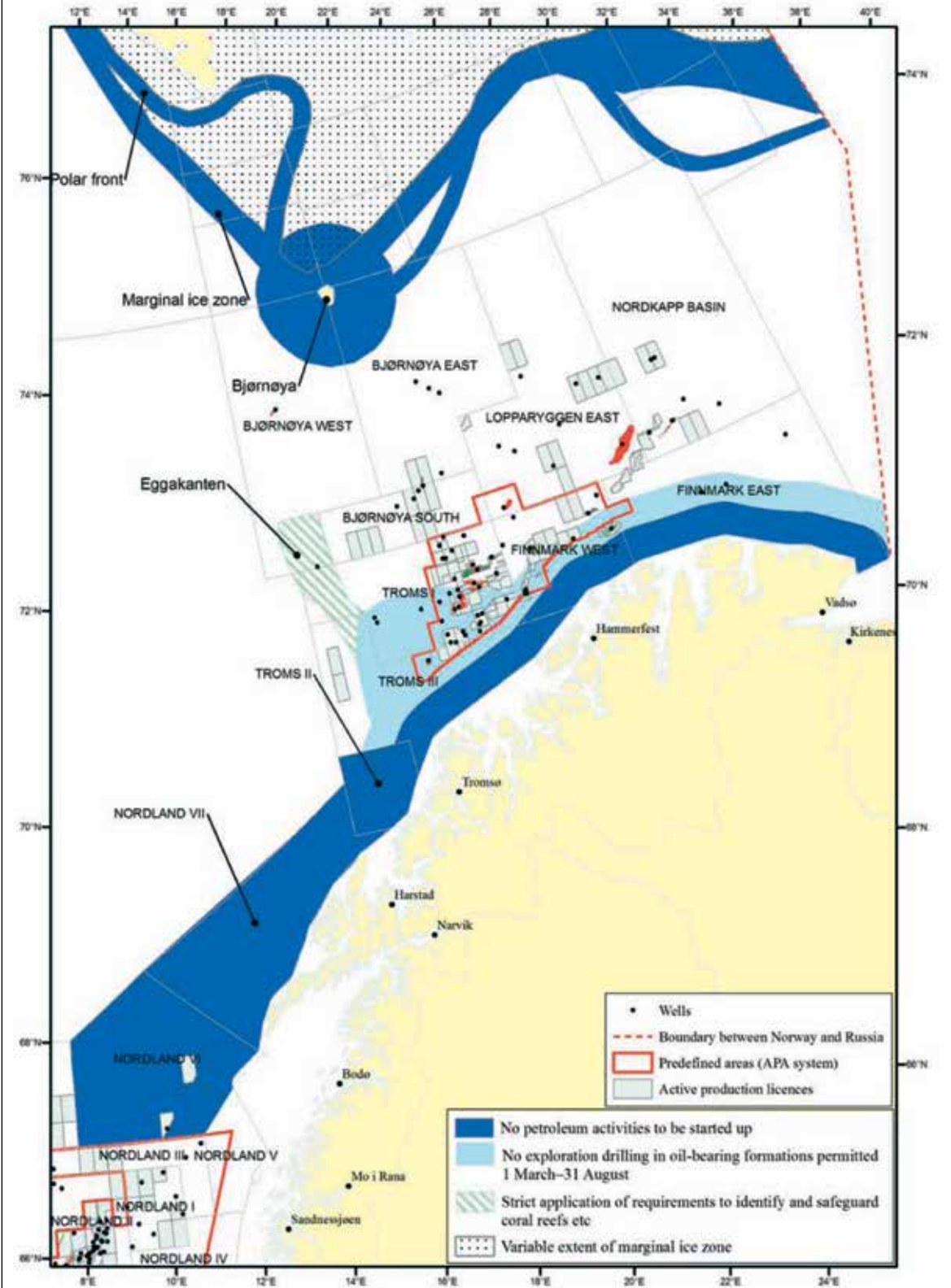
#### (a) Projecting current trends in the spatial and temporal needs of existing human uses

This task envisages what will happen if current trends in marine uses are continued without any interventions. Forecasts of this type can often be made by simply projecting historical trends for each of the relevant marine activities. As an example, the area used for gravel extraction might have been expanding at 2 percent per annum, so in a projected forecast period of 15 years, production might be expected to increase by a cumulative 30 percent. This would have to be mapped spatially and quantitatively, and the outcome may indicate specific problems or conflicts with other users that can be anticipated and managed.

<sup>33</sup> Meaning that the data has x and y spatial coordinates attached to it so that the variable being measured can be accurately mapped.

<sup>34</sup> Further details on remote sensing can be obtained from Dean and Populus (2013) and Dean and Salim (2013).

FIGURE 3  
 Framework for managing petroleum activities in northern Norwegian waters.  
 Land areas are shown in yellow.



Source: Norwegian Ministry of the Environment (2011).

**(b) Estimating spatial and temporal requirements for new demands of marine space**

Here, it is necessary to consider all new developments proposed in a marine area. These may include built developments (wind farms, port facilities, oil platforms, etc.), as well as new or expanded “activity areas” such as for fishing, mariculture and conservation. Most governmental authorities can give guidance on any planned major developments. New development locations will also need to be mapped as accurately as details permit.

**(c) Identifying possible alternative future scenarios for the planning area**

Developing scenarios for alternative future spatial marine use is a crucial step in the MSP process because it sets the stage for choosing the preferred direction for development during the selected time frame. Just as for terrestrial spatial planning, there will also be an almost unlimited number of spatial configurations for marine projects and activities in any defined area; it is very important to model them in space and time and to identify how they can best achieve any social, economic, environmental and governance objectives for the marine space.

**(d) Selecting the preferred marine use scenario**

The final task in Step 6 is to agree on an acceptable choice regarding the future scenario for the marine space. This will inevitably involve compromise because each marine sector is likely to support a preferred scenario that best suits its own objectives. It will be important to agree beforehand on an objective basis that can underlie the final decision-making.<sup>35</sup>

**Step 7: Preparing the marine spatial plan, including zoning**

While Step 6 covered specific decisions about the future prospects for marine space, Step 7 is concerned with identifying and assembling the best means of achieving a successful marine spatial plan.<sup>36</sup> The marine spatial plan will be a policy statement from the responsible competent authority, in partnership with other key stakeholders. It presents an integrated vision of the spatial components of the marine area, with respect to the primary activities listed in Box 1, including key elements for resource exploitation, marine transport, environmental protection, energy, fisheries, mariculture, recreation, military activities and tourism. The policy statement defines the boundaries, goals, framework, management requirements and funding requirements (see Box 4) that will define the future direction for marine area decision-making, allowing for successful and sustainable integrated social, economic and environmental developments. The number of possible combinations for management measures can be very large, and it is not possible or necessary to analyse all possibilities here. The marine spatial plan should adopt an appropriate approach focusing on priorities, key challenges, and identifying spatial locations where changes are anticipated.

To attain consensus on the content of the marine spatial plan, a number of tasks are required:

**(a) Identifying alternative spatial and temporal management measures**

Here, the concern is with identifying the specific combination of spatial management measures that should lead to achieving the future vision for the marine area. Spatial management measures are the controls that need to be put in place on each marine-based

<sup>35</sup> There are tools/methods available to assist in arriving at a consensus, see NatureServe. 2016. Conservation Tools & Services [online]. Arlington, United States of America. [Cited 17 October 2016]. [www.ebmttools.org/msptools.html](http://www.ebmttools.org/msptools.html)

<sup>36</sup> It should be remembered that MSP is not an end in itself; it is the means by which the desired goals and objectives for a marine area can best be achieved.

## BOX 4

**Key aspects of the marine spatial plan**

In general, the spatial management plan should include:

- a description of the boundaries of the MSP area, as well as a specified base year and time period of the plan;
- the spatial management goals and objectives;
- a description of a preferred future – a graphic portrayal of the vision of the physical development and conservation of the management area;
- the management measures required to achieve the preferred future;
- information on how stakeholders have been or can get involved in the process;
- a timetable for the formal actions needed to implement the plan (who does what, when); and
- funding requirements of the comprehensive plan and a financial plan that lays out sources of funding.

Source: Developed from Ehler and Douvère (2009).

activity to bring about any desired changes. They may be considered as: (i) input controls, where limits might be placed on, for instance, the amount of fishing activity or the number of oil platforms in an area; (ii) process controls, where the human activities are managed, such as regulating the type of fishing gear used or implementing a closed season for an activity; and (iii) output controls, where the outputs of a human activity are specified, such as a fish catch limit or the maximum quantity of aggregates that can be extracted from an area. Input, process and output controls can be applied to specified spatial areas or for specified time periods. The assignment of these controls means that zones will have been created in the marine area indicating what activities can take place during given time periods.<sup>37</sup> Most management measures will be implemented by the stakeholders who represent a specific marine sector, though this will need to be in agreement with other sectors.

In order to implement management measures successfully, it is likely that the participants involved in any sector will require some kind of incentive. The types of incentives may be either positive, to reinforce a specific action or activity, or negative, to sanction against a specific action or activity. As an example, if fish farmers are required under the new marine spatial plan to reduce their outputs from a particular area, they might want to receive compensation for abiding by the regulation, which can be done either directly (financially), or for example, through allocation of more space in other areas. Other positive incentives could include giving grants, subsidies or tax relief (which make up for lost earnings) that allow for investment in more sustainable technology. Negative economic terms could also be applied that are designed to modify behaviour and working practices or to discourage participation in an activity, and include, for example, issuing licences for which fees are paid, applying access fees or effluent charges, or fines for non-conformance. Management measures need not be only economic; applying regulations provides both positive and negative incentives for all investors in marine space, or by laying out the requirements in a clear and fair way that all must abide by, or by applying enforcement sanctions when regulations are not followed correctly. More generally, incentives can include giving technical assistance and providing public education and information.

#### **(b) Specifying criteria for selecting marine spatial management measures**

Not only must the spatial management measures be identified, but it is also essential to establish criteria upon which each of these measures can later be evaluated. These criteria include factors such as:

<sup>37</sup> Note that time periods can be for specified times, or for seasonal periods, or they can be for indefinite time periods, i.e. perhaps permanently – as might apply to a marine protected area.

- economic effects over time and space;
- physical, chemical and biological effects over time and space;
- administrative considerations;
- political considerations;
- feasibility of financing;
- resource use effects; and
- accuracy of estimates from analyses.

Decisions need to be made regarding which criteria to use and what is the relative importance of each, although this may change over the life of the project.

### (c) Developing the zoning plan

The application of zoning under MSP is another tool that allows for the spatial partitioning of marine space as a means to differentiate activities and their application and activity within specific zones (Box 5). Zoning is one of the primary management measures used in implementing MSP, with virtually all marine spatial plans containing zoned areas and maps for specific activities. The act of zoning itself can also inform the development of a legal basis through which officially designated zones can be regulated.

Each zone will represent a marine area requiring specific management measures, but zones can have multiple uses and therefore specific management measures will vary. A multiple-use zoning approach typically provides high levels of protection for specific activities while allowing for a range of other reasonable uses. For some purposes, it might be necessary to have three- or even four-dimensional zoning, especially where certain activities being zoned only occur in strategic sections of the water column. This allows the surface to be used at the same time, or zoned for certain activities at distinct times of the year for specific periods.

#### BOX 5

##### The main purposes of zoning in marine spatial plans

A zoning plan is intended to:

- provide protection for biologically and ecologically important habitats, ecosystems and ecological processes;
- separate conflicting human activities or to combine compatible human activities;
- protect the natural values of the marine management area while also allowing reasonable human uses of the area;
- allocate areas for reasonable human uses while minimizing the effects of these human uses on each other and nature;
- preserve some areas of the marine managed area in their natural state, undisturbed by humans except for scientific or educational purposes; and
- identify areas where financial investments in certain sectors (activities) should be beneficial.

Source: Ehler and Douvère (2009).

While developing the marine spatial plan, it is typical to consider and attempt to resolve any potential conflicts between any zones identified. At this stage, it is easy to imagine that a “conflict matrix” could be drawn up that gives an estimation of the degree of “conflict” that might be expected to occur between any of the various marine activities (Table 6).<sup>38</sup> Thus, looking in turn at each of the zones on the zoning plan, it should be possible to estimate a degree of conflict between zones, which in turn will allow for appropriate management measures to be derived and enacted. The reverse of

<sup>38</sup> See Hemingway and Cutts (2013) at [www.tide-toolbox.eu/pdf/tidetools/ConflictMatrixUserGuide.pdf](http://www.tide-toolbox.eu/pdf/tidetools/ConflictMatrixUserGuide.pdf) for a useful technical note on conflict matrices in a marine context. This covers a wide variety of matrix constructions.

a conflict matrix can also be envisaged whereby an “opportunities matrix” is produced showing potential synergies between the various users of a marine area (Jansen *et al.*, 2016). These evaluations can form the basis of the logic, fairness and acceptability of the zoning, which in turn should lead to the MSP approval. Zoning is rarely a simple task and not as easy as it might first appear; final zoning is liable to be the result of much compromise.

The draft marine spatial plan will likely be a document that outlines the need for the plan, provides a summary of the work undertaken to derive the plan and the decisions taken, gives the legal underpinning of the marine spatial plan, and defines the plan through words, tables and figures. Zoning itself will mainly be illustrated through the use of maps, and indeed mapping through the use of GIS will form a critical part of the overall plan outcome.

TABLE 6

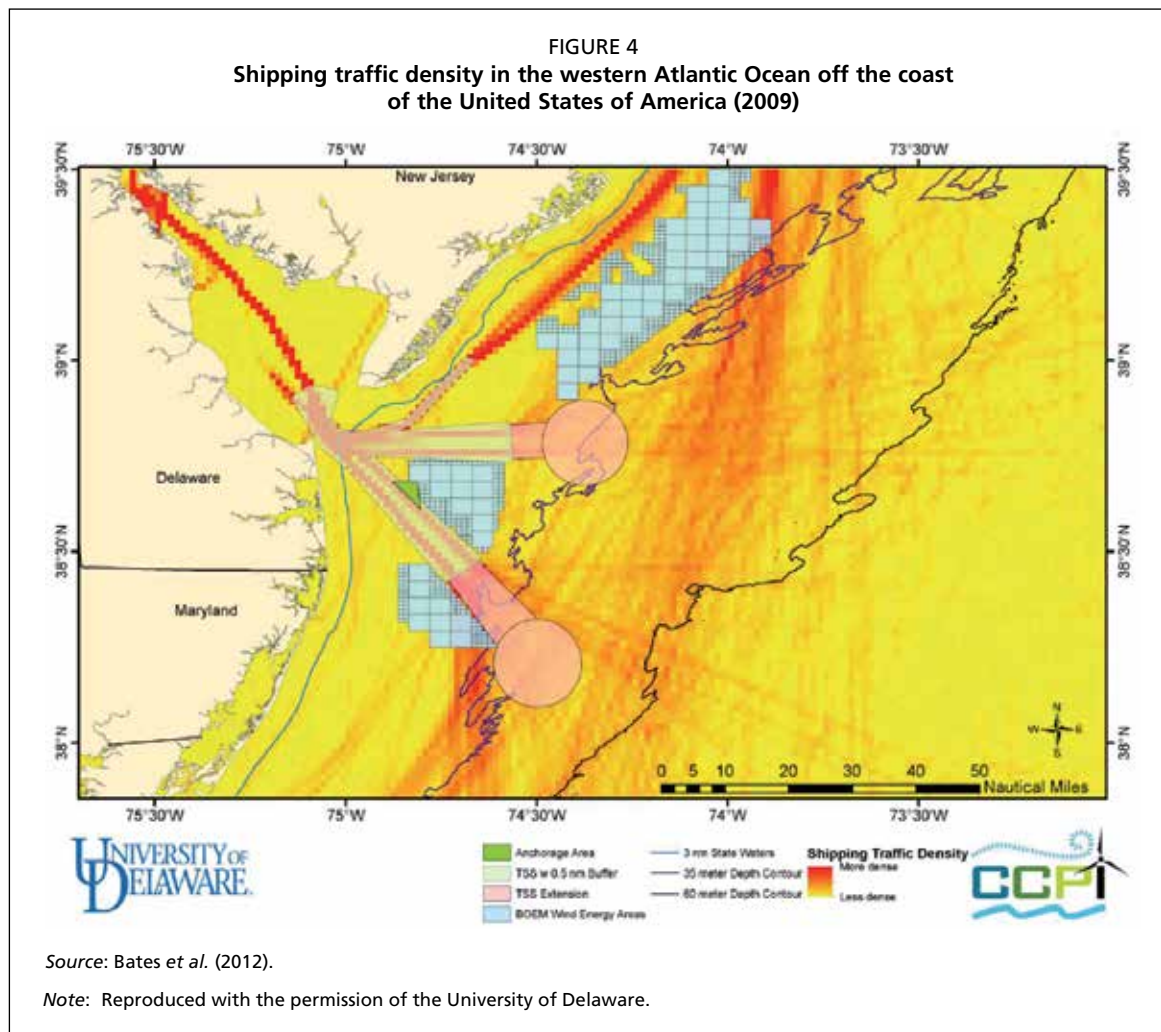
**Suggested conflict matrix for marine spatial planning<sup>39</sup>**

	Marine fishing	Mariculture	Energy production	Marine transport	Conservation areas	Military zone	Recreation	Aggregate dredging	Urban and resort areas
Marine fishing		Probable	Moderate	Minimal	Strong				
Mariculture	4		Minimal	Strong	Probable				
Energy production	3	2		Minimal	Moderate				
Marine transport	2	5	2		Strong				
Conservation areas	5	4	3	5					
Military zone	5	5	2	4	4				
Recreation	4	4	4	4	4	5			
Aggregate dredging	4	5	3	3	5	3	3		
Urban and resort areas	3	4	3	3	4	4	2	3	

Notes: Possible conflicts between different activities can be indicated by descriptions, e.g. potential conflict, no conflict, conflict unclear, etc., or conflicts can be scored (or weighted), such as: 1 = no conflict; 2 = minimal conflict; 3 = moderate conflict; 4 = conflict probable; 5 = strong conflict likely. The conflict matrix could either be completed in a textual written form or in a more objectively numerical (scored) form.

Figure 4 provides a clear example of the type of spatial output that might be expected from the use of GIS to map and analyse data for a specific marine area. Here, the area mainly coloured yellow is the western Atlantic Ocean off the east coast of the United States of America. The main shipping lanes are shown in red, which are overlain in pink where shipping traffic separation schemes (TSS) operate. Also shown are shipping anchorage areas (green), and zones that have been designated by the Bureau of Ocean Energy Management (BOEM) as shallow marine areas for potential wind power generation (light blue). Overall, mapping allows demarcation of distinct activities and areas for those activities, and can be used to test likely areas of conflict under single and multiple uses while accounting for other designations such as marine protected areas or areas of

<sup>39</sup> This conflict matrix is only illustrative. It can be constructed in more detail, i.e. such that a much wider range of activities are included (see Box 1) or such that a wider range of weightings are used. Sometimes interactions between two activities are not viewed in the same way by one or other partner, e.g. aggregate dredgers may not see urban areas as causing much of a conflict, whereas people in urban areas may see aggregate dredging as a major conflict. Note that not all of the boxes in the matrix have been completed.



coral reefs. It is clear that the map can be of major assistance in the designation of zones for different activities and that it brings together relevant marine variables for a range of spatial analyses. Although Figure 4 only shows a relatively small area at a specific scale, the use of GIS readily allows for mapping at any reasonable scale for any defined area.

As well as producing mapped information, GIS is capable of producing statistical outputs, such that data on area, length, quantities, etc., can be readily obtained for an almost infinite number of variables. Outputs depend on the questions posed. Thus, taking the RECOFI area as an example, the questions tested within GIS might include: What quantity of the marine area is available for fish cage culture in Saudi Arabia? Indicate the areas of the Gulf where there is a potential conflict between oil tanker vessels and artisanal fishing areas? Given the typical Kuwait shrimp fishery yield in x month, what would be the economic value of banning other activities in y area during February and March?

Additionally, once approved, it is easy to conceive that the MSP zoning information can be readily delivered to all stakeholders via the Internet and mobile mapping applications, and can be continually updated in order to reflect the current situation. This will be important for activities such as fisheries where the current resource availability may vary greatly according to numerous factors. With the wealth of potential information that can be derived for the whole of the Gulf area, it can readily be appreciated that all Gulf marine activities have a lot to be gained from MSP implementation.

**d) Evaluating and approving marine spatial plan**

The last activity under Step 7 is to provide a final critical evaluation of the spatial management plan prior to final approval. Social, economic, environmental and governance assessments are made based on how effective the major parts of the plan (or the established zones) are likely to be, with any final adjustments being made to the plan prior to approval.

Depending on the marine spatial plan developed (for example, whether it is a local plan, national plan or regional plan), it is important to carry out the plan cooperatively for the RECOFI region. Even local plans, if near areas bordering territorial or EEZ waters, may impact neighbouring countries, even if the other countries do not have any specific jurisdiction. At a national and regional level, it will be important that the interests of the region as a whole are evaluated prior to final approval.

Approval of the marine spatial plans should result in publication of the document for any party to read and understand. Additional resources, such as those suggested above (Internet availability, mobile application options and so on) should be available immediately after the plan is approved.

**Step 8: Implementing and enforcing the MSP**

Step 8 under MSP is the implementation and enforcement of the marine spatial planning requirements. There can be no specific details on how to implement the marine spatial plan, as each will have its own specific circumstances and requirements and legal underpinning. What is important to note is that implementation is a critical activity. According to Ehler and Douvère (2009) and based on the experience in other regions, “Implementation is a critically important step of the MSP process. It is the action phase and it continues throughout the existence of MSP programs. Effective implementation is integral to the success of any MSP program” (p. 83).

The transition from the planning and preparation phases of MSP implementation to full activation of MSP may produce the greatest challenges to successful progress (UNEP and GEF-STAP, 2014). Examples of the main challenges include:

- securing governmental commitment and engagement at an early stage in the process;
- obtaining meaningful engagement of relevant stakeholders at all required MSP stages;
- creating a well-designed process with unambiguous goals;
- having good governance arrangements and transparent decision-making;
- having a strong legal framework within a secure institutional capacity;
- securing adequate sources of funding covering an extended implementation process;
- having secured reliable data collection, sharing, quality and management issues;
- agreeing on baselines as a basis for monitoring and assessing progress; and
- having a local champion to sustain MSP progress.

What emerges from these challenges is that all steps in MSP adoption need to be addressed with scrupulous attention to detail and thoroughness, and must include the two post-implementation steps (Figure 2). The moment the implementation phase in the MSP initiative is active, it must be capable of being carried forward in a sustainable manner. A clearly identifiable body or organization, typically the “lead authority”, will be responsible for implementation of the marine spatial plan. Its future success will be dependent upon the legal basis that has been laid down and the framework that has been worked out, the cooperation of the various stakeholders, the support of a “champion”, and the willingness of the RECOFI countries to comply with the MSP work. Compliance and enforcement are two facets that underlie the successful continuance of any MSP.



Compliance requires that every participant (country, organization, sector, stakeholder, etc.) carries out the actions (“rules”) in the marine spatial plan. If the rules have been well designed through cooperation and stakeholder involvement, and are accepted by all, then this should not cause any undue problems. There will be a need, however, to ensure plans are publicized, and it may also be necessary to provide further information or to carry out training through seminars, workshops, courses, and so on, with any necessary rules being well communicated as the implementation is carried out. Compliance can be further promoted by actions such as issuing guidelines or codes of conduct, or through expert technical assistance, or perhaps even physical markers at sea that delimit zonal boundaries.

Enforcement is the action taken (usually by government personnel, but also through private inspectors) to make certain that compliance with the marine spatial plan and associated regulations is achieved. It must ensure that the objectives of MSP and the developed marine spatial plan are being implemented appropriately by those tasked to do so, and that unauthorized development and changes are not undertaken. For example, it would be difficult to achieve the implementation of the marine spatial plan if significant unauthorized development of any marine area is allowed to occur or where such development continues through a lack of enforcement to remove it. An important task in relation to enforcement is to ensure that strategies, plans and regulations are not too forbidding. Stakeholders will usually support effective enforcement if the rules are consistently applied on the basis of transparent policies and procedures.

### **Step 9: Monitoring, evaluation and review, and communication of results**

An MSP initiative needs appropriate monitoring of the implementation and a critical evaluation of progress and outcomes for its success. Additionally, it must be able to adjust plans according to new circumstances. Step 9 in the MSP process allows for formal monitoring, evaluation and review, while Step 10 enables adaptation of the MSP process and allows for changes to be made to the marine spatial plan(s) if needed.

Monitoring infers a continuous process, and there is liable to be an ongoing process of assessment throughout the life of the MSP initiative. In this context, such monitoring should be seen as management activity and should not lead to immediate and continuous changes to the overall marine spatial plan. Altering the plan might undermine public confidence, cause confusion, reduce investment and impact enforcement potential. In a wider context, monitoring can also infer assessment at predefined time points, and under MSP a formal monitoring and review process is required after an appropriate time period (every five years is suggested). Such monitoring of the MSP will mainly involve:

- (i) assessing the process of MSP to ensure it remains fit for purpose;
- (ii) assessing the state of the system; evaluated by asking appropriate questions, such as: What is the status of biodiversity in the marine management area?; and
- (iii) measuring the performance of management measures undertaken, for example, where it is possible to ask: Has implementation of the marine spatial plan and the management actions taken produced the outcomes we desire?

These are big questions that will require careful consideration, and the collection of data and other information that supports the monitoring and review process.

For all aspects of the MSP initiative and the marine spatial plan produced, it will be necessary to devise appropriate monitoring programmes, each of which will be designed to collect objective data that gives the ability to measure the progress that is being achieved. Box 6 provides the context for a good monitoring and review programme, where objectives need to be well established, data gathered and analysed, and the results made public. Monitoring can be relatively simple, for instance, counting the number of species currently recorded in a specific area or ecosystem and comparing that against pre-MSP levels could be a means to evaluate success; and, for example,

## BOX 6

**Factors important to MSP programme monitoring and review**

Good monitoring programme design depends on the following factors:

- The objectives need to be clearly articulated in terms of posing questions that are meaningful to the public and that provide the basis for measurement.
- Not only must data be gathered, but attention must also be paid to their management, analysis, synthesis and interpretation.
- Adequate resources are needed not only for data collection, but also for detailed analysis and evaluation over the long term.
- Monitoring programmes should be timely and should rely on the best available information.
- Monitoring programmes should be sufficiently flexible to allow for their modification where changes in conditions or new information suggests this need.
- Provision should be made to ensure that monitoring information should be reported to all interested parties in a form that is useful to them.

Source: Modified from Ehler and Douvere (2009).

assessing the well-being of artisanal fishers living in isolated communities prior to and post-implementation of the MSP process could indicate its impact. Other assessments may be far more complex and could include modelling, laboratory and field research, field measurements, quality assurance, data analysis, synthesis and interpretation.

For most larger-scale MSP projects, it will be necessary to develop a whole performance monitoring programme, one that sets out the recording methods that will be used to collect information covering at least all the factors shown in Box 6. An analogy here might be useful. Just as road vehicles in most countries require periodic inspections to test their road-worthiness against preset standards, so also does MSP need to be fit for purpose, and the plans implemented having the desired effect and impact, and should thus also pass a periodic review.

In a recent report, Ehler (2014) and coworkers studied a significant number of marine spatial plans that have been operational worldwide with respect to their monitoring and evaluation processes. They concluded that this step is possibly the most important of all the steps because the future success of marine spatial plans must be based on an accurate evaluation of their progress. The evaluation in turn must be dependent on the efficiency, comprehensiveness and validity of all of the monitoring procedures that are in place (Box 6). Ehler (2014) further suggests that monitoring, evaluation, review (and adjustment) could best proceed via the tasks shown in Table 7. A further recent attempt at evaluating the effectiveness of longer standing marine spatial plans is the study produced by Flannery (2014) for the Government of Ireland. Flannery noted that “One way to develop an MSP Framework is to learn from early adapters. Critical assessments of key elements of MSP as implemented in early initiatives can serve to inform the development of an appropriate framework.” This author has many valuable insights on a range of themes that are important to MSP, and reading the studies is recommended.

TABLE 7  
Performance monitoring and evaluation of marine spatial planning

Tasks in evaluation and monitoring	Comments on tasks
<b>Task 1.</b> Identify objectives of the marine spatial plan.	Make sure the objectives of the management plan (Step 2) are measurable to the best possible extent – this is a critical early step.
<b>Task 2.</b> Identify management action(s) for each objective.	Make sure each objective has at least one related management action – the effectiveness of the management action will be examined later.
<b>Task 3.</b> Identify performance indicators and targets.	If Steps 1–3 of the MSP process have already been completed, Task 3 can start here.
<b>Task 4.</b> Establish a baseline for selected indicators.	Some of this information may have already been acquired after developing the baseline information for the MSP.
<b>Task 5.</b> Monitor the selected indicators.	Ensure that the selected indicators are monitored on a regular and continuing basis.
<b>Task 6.</b> Evaluate the results of monitoring.	Periodically it will be necessary to analyse, evaluate and interpret the monitoring data.
<b>Task 7.</b> Communicate results of the evaluation to decision-makers and stakeholders.	Be sure to include communicating results of the evaluation in the evaluation plan (Step 2).

Source: Adapted from Ehler (2014).

Task 7 in Table 7 indicates that once the monitoring and assessment of MSP and the marine spatial plan(s) has reached a publishable stage, then this information needs to be disseminated to decision-makers, stakeholders and the public. This stage does not preclude the issue of earlier periodic reports on the progress of MSP if this is deemed appropriate. Ehler and Douvere (2009) note: “A good communications strategy is essential for disseminating and sharing information with key stakeholders. Sharing information with stakeholders helps bring them into the business of government and can help generate trust. Evaluations should be open, transparent and available to all stakeholders” (p. 91).

### Step 10: Adapting and updating the marine spatial management process

In Step 9, a formal monitoring and review process is undertaken, which may highlight the need for specific changes to the process, the plans or the management decisions made. Step 10 in the RECOFI MSP process allows for adaptation of the MSP and the resulting marine spatial plan(s) and the implementation strategy if this is needed. Effectively, what is being advocated in this step is the implementation of all the “learning” that has taken place thus far, and the adoption of any new research and research methods, new software tools, and new experience gained from the implementation of the MSP process and from other projects. Certain adaptations might have proceeded throughout the working of the MSP project, but it is important that this is recognized as an individual step in MSP because all projects benefit from the new knowledge gained, whether through the process itself or through the experience of others.

It is difficult to estimate the extent to which this step has been successfully deployed elsewhere because most marine spatial plans are insufficiently mature to have fully reported on their effectiveness. Notwithstanding this, Box 7 provides some examples from three mature MSP projects where adaptation and changes were made as a result of a formal monitoring and review step.

Another important adaptation that will almost certainly occur over the longer term is the incorporation of new data resulting from ongoing research activity. In the marine environment, changes are constant, and frequently data collected over longer time periods will be needed to better understand distributions, processes or impacts, for example.

## BOX 7

**Examples of MSP adaptations from Australia, United States of America and the Netherlands**

The Great Barrier Reef Marine Park (Australia) used monitoring and evaluation information in its Representative Areas Programme (1999–2004) to re-zone and increase its strictly protected areas from 5 percent to 33 percent of its total area. The Florida Keys National Marine Sanctuary (United States of America) used monitoring information to extend its boundaries in 2001 to include a new ecologically important area (the Tortugas Ecological Reserve). Both of these MSP programmes are well documented in the literature and described on the UNESCO marine spatial planning Web site.

In the Netherlands, the implementation of the first Integrated Management Plan for the North Sea 2015 project began in 2005. With a new government elected in 2007, more ambitious goals for wind energy at sea were set. The previous method of licensing wind farms had not worked well; in fact, it created large problems in light of the government's new goals and objectives (namely, 6 000 megawatts or 1 000 km<sup>2</sup> of wind farms by the year 2020). Therefore, it was decided to develop a new, improved plan in which more attention could also be given to the implementation of a 2008 recommendation made by the National Committee on Adaptation to Climate Change and Sea Level Rise. This committee recommended the continued protection of the coast by sand nourishment, a requirement that effectively demanded up to seven times more sand from the sea. Taking additional sand from the seabed is then an activity that would need to take place before marine-based wind farms could be established. This new marine spatial management plan is now part of the National Water Plan. The Integrated Management Plan 2015 will be updated accordingly to reflect the new management strategies, especially for wind and sand.

Source: Ehler and Douvère (2009)



*Cage aquaculture has grown rapidly during the past decades and there has been a move towards the development and use of more intensive cage-farming systems to access and expand into untapped open water areas, particularly in marine offshore waters. The integration of aquaculture into marine spatial planning and the improvement of aquaculture's contribution to local communities are some of the key elements to assist the sustainable development of the fisheries sector at local level. This photo illustrates a floating marine finfish cage farm (Tabuk Fisheries Company) located off the Red Sea coast of Saudi Arabia in the northern coastal province of Tabuk. Owing to the versatility of the materials used, these high-density polyethylene (HDPE) floating cages are currently widely deployed in modern industrial marine aquaculture in many parts of the world.*

*Courtesy of Francesco Cardia*



## 4. Case study of marine spatial planning – Saudi Arabia

### 4.1 Introduction and background

This chapter outlines a case study that provides a practical illustration of how MSP might be adopted in a sample area within the RECOFI region. Because it is an illustration, it is by no means comprehensive. It is written with little reference to the marine waters of neighbouring countries (which would be an essential component of a regional MSP) for example, and the procedures described may not be uniformly deployed throughout the RECOFI region. Here, the procedures necessary to obtaining a successful MSP are worked through in the same chronological order (by logical steps) as in chapter 3, and are also derived from the work of Ehler and Douvère (2009) and Douvère (2010). However, the emphases will not be the same since in practice the completion of the various tasks will involve wide ranging differences in time, detail and complexity.

It is important to note that, while this case study illustrates the process developments necessary for establishing a Saudi Arabian MSP, in reality this MSP will be contributing to a much wider Gulf MSP. Since a Gulf MSP will only emerge with the full cooperation of all eight RECOFI partners, it is essential that there be a strong degree of cooperation among partners. Cooperation will be seen mainly in terms of:

- shared aspirations and objectives for marine areas and a recognition of priorities;
- agreement on certain fundamental needs such as willingness to draw up legal bases for an international MSP or who might take specific leadership roles;
- a willingness to share data and other relevant information;
- agreement on the partitioning of workloads and responsibilities;
- a willingness to contribute necessary funding under an agreed formula; and
- agreement on timelines for individual tasks and completion dates for all work.

Once a cooperative RECOFI-wide MSP environment is agreed upon, part of the Saudi Arabian MSP development will continually need to review how specific steps described below will usefully contribute to the whole Gulf MSP. It is important that, while each RECOFI country might be developing MSP-related tasks for its own territorial seas, in reality this work's main aim will be to contribute to a single Gulf MSP.

Saudi Arabia's marine waters consist of two distinct bodies – the Red Sea in the west and the Gulf in the east. In this case study both marine areas are included, although it is recognized that within RECOFI only the Gulf territorial waters and EEZ would be included in any wider RECOFI regional MSP activity.

Saudi Arabia's total EEZ is 221,725 km<sup>2</sup> of which approximately 84 per cent is in the Red Sea and 16 per cent in the Gulf.<sup>40</sup> In most ways, the two marine areas are highly contrasting. The Gulf waters are very enclosed, resulting in a slow water exchange rate with the open ocean, and its waters are relatively shallow (18 per cent of the Gulf is <5 metres deep). The water temperature range in the Gulf is higher than in the Red Sea, as are salinity and turbidity. In contrast, the Red Sea is far less enclosed, water temperatures are less variable (both annually and spatially), waters are generally clearer and deeper, and the water quality usually high. The Gulf waters are shared between eight countries meaning that any unified management regime will have to encompass a wide range of social, economic, environmental and governance considerations. The Red Sea also has eight countries bordering it, three of which have only limited

<sup>40</sup> Claus, S., De Hauwere, N., Vanhoorne, B., Souza Dias, F., Oset García, P., Hernandez, F. & Mees, J. (Flanders Marine Institute). 2016. MarineRegions.org. Towards a standard for georeferenced marine names. [online]. Ostend, Belgium. [Cited 17 October 2016]. [www.marineregions.org](http://www.marineregions.org)

coastlines (Djibouti, Jordan and Israel), and problems of coordinated management for this much larger marine area have yet to emerge.

There are recent indications that various activities are proliferating in Saudi Arabia's marine waters, many of which will have a major impact on the marine environment. Marine shipping is undergoing considerable expansion, which typically involves harbour development, wetland infilling, harbour dredging and spoil dumping. There are also additional marine desalination plants and oil refining capacity being established as well as new offshore oil and gas fields being investigated and opened up. Other industrial activities include wastewater treatment facilities, power plants, coastal mining and quarrying. Urban development is often located on the coast, which will nearly always include a range of infrastructural provision, e.g. the Al Kurnaysh coastal motorway near Jeddah. There has been a major expansion of tourist resorts, mainly along the Red Sea coast and especially in the vicinity of Jeddah. Offshore aquaculture is set for considerable expansion along the Red Sea coast of the country and this will necessitate the availability of high-quality environmental conditions. But all of this coastal-based development, and assorted offshore activities, can severely impact the environment, with extensive habitat modification and depletion and with the entrainment of suspended sediments that may be severely detrimental to nearshore habitats. Clearly, there is an urgent need for the coordinated management of the many sectors using Saudi Arabian marine space.

Finally, as recognized by Al-Bisher, Stead and Gray (2012), several factors have obstructed the development of coordinated management of marine activities within Saudi Arabia, including:

- a tradition of individual sectoral policies for maritime activities;
- the absence of a national strategy for prioritizing the various sea uses;
- uncoordinated marine information systems and databases;
- rapid industrialization and urbanization;
- inadequate maritime skills; and
- insufficient marine scientific research.

These challenges must be addressed, and it is hoped that this case study can contribute to resolving some of the existing deficiencies.

## **4.2 A step-by-step approach to MSP adoption for Saudi Arabia**

### **Step 1. Identifying the need and establishing authority**

In Section 4.1, the causes of marine-based problems were briefly identified, as were the main barriers to organized marine management. Therefore, "What needs to be done in order that the marine space is properly managed?" With respect to Saudi Arabian marine waters, the major needs can be summarized as:

- better management of marine fishing of most species, especially shrimp, groupers and a range of reef fishes;
- develop aquaculture as a key contributor to food security, for the generation of employment and to diversify the overall economic development of the country;
- halt the degradation of coastal and reef marine habitats caused by poorly regulated human activities;
- reduce pollutants, mainly from energy extraction, coastal industries and human wastes;
- better accommodate the large increase in marine-based shipping;
- allow continuing livelihoods for artisanal fishers; and
- foster conservation and sustainability as intrinsic human goals.

Clearly, these needs will vary greatly from area to area, from time to time, in the magnitude of their impacts and in the urgency with which they should be addressed. Needs also span a wide range of human activities, and therefore responsibility for their maintenance and continued well-being will be delegated to a number of mainly government departments and ministries and other agencies. Table 8, based partly on



the work of Al-Bisher, Stead and Gray (2012), attempts to identify the principal bodies and authorities that are involved in Saudi Arabian marine affairs. It can immediately be seen that this list is extensive, that it includes groups that are disparate and varied in their size and aims, and that there is no single marine authority that is outstanding or has pre-eminence<sup>41</sup>.

However, it is important that a single authority can be identified who will take control of, or coordinate, all future MSP activities. Deciding on this authority is thus a pre-eminent task, one that might best be initiated or guided by FAO or by external consultants who can exercise objective decision-making by reviewing individually any potential lead organization(s). The lead authority would typically be that group that has the largest interest in marine affairs, such as a fisheries or a marine mapping (hydrographic) department. In a given time frame, this might be the Ministry of Environment, Water and Agriculture (Marine Fisheries Department) or perhaps the General Commission for Survey – Marine Survey Department. Of course, it may be considered that an entirely new body is created with sole responsibility to comprehensively manage marine developments and operations in the foreseeable future.<sup>42</sup> It is important to recognize that whichever organization takes control will need to have the authority to initiate and implement necessary legal statutes.

## Step 2. Defining a marine spatial planning framework

Recall from Step 2 in chapter 3 that a “framework” can be described as a set of procedures that have been identified and agreed upon as being necessary so that MSP can be successfully developed, i.e. they are the essential ingredients in the success of the MSP process. A Saudi Arabian MSP will need to function within a framework that has been agreed upon by all parties who are participating in the MSP work.

These parties will be identified in Step 3 and, indeed, it would be practicable to integrate Steps 2 and 3, i.e. work on them simultaneously. As indicated in Step 2 of chapter 3, ten factors contribute to the framework, as follows:

- a. defining aims and objectives;
- b. recognizing legal frameworks;
- c. defining principles;
- d. securing funding;
- e. creating the MSP team;
- f. defining the MSP area boundaries;
- g. defining the appropriate scale for the work;
- h. defining the time frame;
- i. developing a work plan; and
- j. identifying risks and developing contingency plans.

All of these factors will need to be addressed by the lead authority (established in Step 1). It could be anticipated that this work will involve a range of specific Saudi Arabian national experts who have knowledge of particular workings of government agencies, planning principles and of general marine affairs. The work will be performed at a high level within the lead authority, perhaps by a small team having advanced marine-based knowledge as well as communication and organizational skills. It is suggested that a report be produced for deliberation by relevant decision-makers across all participating institutions, ministries and other agencies that cover at least the ten framework areas listed above.

<sup>41</sup> It is important to mention that a search of various Web sites for ministries or agencies concerned with marine affairs of any kind fails to identify any appropriate authority see: The Saudi Arabian market information resource [online]. The Kingdom of Saudi Arabia. [Cited 17 October 2016]. [www.saudinf.com/main/c6.htm](http://www.saudinf.com/main/c6.htm) or [www.the-saudi.net/directory/sag.htm](http://www.the-saudi.net/directory/sag.htm)

<sup>42</sup> For instance, in the United Kingdom of Great Britain and Northern Ireland, an authority called the Marine Management Organisation was created in 2012 primarily to undertake this type of work.

TABLE 8

**Ministries, departments and agencies having some control over marine space in Saudi Arabia**

ENTITY	ROLE
<b>MINISTRIES</b>	
<b>Ministry of Environment, Water and Agriculture</b>	This ministry has jurisdiction over fisheries and aquaculture
• <b>Aquaculture Department</b>	Planning and permitting aquaculture, biosecurity in aquaculture
• <b>Marine Fisheries Department</b>	Responsible for capture fisheries issues, including data collection and statistics reports, regulation for fisheries management and fish stock assessment
• <b>Aquatic Environment Department</b>	Marine environmental research and management services
• <b>Fisheries Research Centres</b>	Advisory bodies for Ministry of Environment Water and Agriculture and private sector for capture fisheries and aquaculture issues. Performs research on fisheries and aquaculture
- <b>Qatif</b>	Mainly working on capture fisheries
- <b>Jeddah</b>	Mainly working on aquaculture, involved in research, test and demonstration of new technologies and species diversification
- <b>Jazan</b>	Mainly working on capture fisheries
<b>Ministry of Defense and Aviation</b>	This ministry should be consulted on the location and extent of military exclusion zones
• <b>Saudi Coast Guard</b>	The military authority under the Ministry of Defense and Aviation in charge of ensuring the safety at sea and the maritime border control. No access to the sea can be attained without preliminary clearance from the coast guard.
<b>Ministry of Municipal and Rural Affairs</b>	Responsible for land allocation and coastal use, clearances at municipality level. Leases facilities for fisher communities.
• <b>Municipalities</b>	They have control on the coastal areas and are involved in the aquaculture licence release process
<b>Ministry of Social Affairs</b>	Support to fisher cooperatives
<b>Ministry of Transportation</b>	Release and manage the licences for vessels
<b>Ministry of Trade and Industry</b>	Responsible for regional trade negotiations and trade agreements
<b>Ministry of Economy and Planning</b>	This ministry should be consulted regarding future major coastal planning and development schemes

<b>Ministry of Petroleum and Mineral Resources</b>	This ministry has a major interest in managing sustainable oil and gas resource exploitation and exports
<b>Ministerial Environmental Committee (or Ministerial Committee for Environment)</b>	Coordinates the activities of government bodies involved in environmental protection
<b>COMMISSIONS AND AUTHORITIES</b>	
<b>Presidency for Meteorology and Environment</b>	Agency responsible for environmental permitting and monitoring in both terrestrial and marine ecosystems
<b>Saudi Ports Authority</b>	Provides governance and supervision of multiple commercial ports in the country
<b>Saudi Wildlife Authority</b>	Develops plans to protect wildlife, including the establishment of marine protected areas; responsible for identification and protection of native species, their habitats and environmentally sensitive areas
<b>Saudi Commission for Tourism and National Heritage</b>	Potential interactions have been identified, mainly in the preservation of traditional fishing methods or to integrate fish market-restaurants areas. This ministry also has competences for the development of tourism along the Saudi Arabian coast and islands.
<b>General Commission for Survey (GCS) – Hydrographic Survey Department</b>	The GCS is the benchmark organization in the Kingdom of Saudi Arabia, for surveying, mapping, geographical information and hydrography.

#### ORGANIZATIONS AND COMMISSIONS

<b>Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA)</b>	Intergovernmental body dedicated to the conservation and regional management of the coastal and marine environments found in the Red Sea, Gulf of Aqaba, Gulf of Suez, Suez Canal and Gulf of Aden
<b>Regional Organization for the Protection of the Marine Environment of the Arabian Gulf (ROPME)</b>	Regional organization under the United Nations Environment Programme (UNEP), developing a framework of conservation and management of the marine environment for the Gulf area
<b>Regional Commission for Fisheries (RECOFI)</b>	FAO-based fishery regional body; this commission promotes the well-being of marine and aquaculture resources in the eight Gulf-centred countries

Note: Artisanal fishers may be represented by associations of fishers (typically cooperatives) who are working in small-scale capture fisheries, e.g. three main cooperatives on the Red Sea coast are Thuwal, Meccah and Jizan, and one on the Gulf coast is at Qatif.

### Step 3. Identifying and organizing stakeholders

Stakeholders are the people, groups or organizations who represent all the marine sectors having an interest in ensuring that the Saudi Arabian marine space functions in a sustainable way so that the long-term future of all the activities can be assured. Annex 2 of this paper identifies the main marine activities carried out within Saudi Arabian territorial seas that should be covered by the MSP framework, and Table 8 provides a list of ministries and other authorities who should have some degree of “control or representation for” these activities. Individuals from the relevant agencies need to be selected who will represent the interests of each, who can speak on behalf of these agencies, including making decisions, and it is vital that all interests are included. As well as the direct representatives of the Gulf marine water users (the stakeholders), there will be important groups who directly support the stakeholder activity, such as mapmakers, hydrographers, conservation organizations and legal representatives.

How this stakeholder representation will be structured and organized will be a major factor in ensuring the success of the MSP. Clearly, an initial meeting (conference or workshop) will be required where, after introductory matters have been made, this event might consider such issues as the structure of a MSP committee; the physical premises where the MSP will be based; important roles necessary in the committee; what subgroups might be necessary; frequency of meetings; means of communications to be used; and the actual representation from each marine sector. These are all essential tasks that are aimed at the launching of the MSP, and no doubt many more tasks will be readily identified.

#### **Step 4. Gathering data and information**

Here, information is defined as “general facts about a topic or theme”, and data as “the individual readings or samples that are collected in order to provide the information”. For instance, it can be claimed that a particular area of the sea is polluted with highly toxic chemicals. This is a piece of useful information. However, to compile this information it would be necessary to gather water quality data for a range of chemicals at numerous “data (or sampling) points” in the sea. Only with these data could the necessary geo-referenced information be assembled, allowing for some form of mapping through GIS, to make the claim that a particular marine area is polluted.

Therefore, a most important part of defining the MSP work plan will be the consideration of data needs and data sources pertaining to the wide variety of social, economic, environmental and governance factors, including concepts of carrying capacity and risk analysis and mapping; this would be a sensible addition to the framework tasks in Step 2. The representatives of each marine sector (as identified in Step 3) will need to define their sector’s data needs and explore possible data sources. During this task, data deficiencies may arise, and so plans will be required on how the deficiencies can be overcome. Indeed, the task may also highlight where the same data are being collected by more than one government department or ministry. Likely this will involve some kind of data collection exercise. It must be remembered that data can be obtained in a variety of formats, including paper maps, digital maps, remote sensing imagery, tabular data, spreadsheets and other databases. It is also vital to consider the data scale(s) required. Because MSP is to cover the whole marine territory of Saudi Arabia, the data required will be mainly at a relatively small scale (covers a larger area), though for specific areas where there is lots of marine activity, the scale will need to be much larger.

Since MSP is essentially concerned with zoning or the management of spatial areas, it will be important that most of the data is “geo-referenced”. This means that the data are able to be mapped, i.e. that data have a location name attached, or that the data include a map reference for every point such as a grid reference or a latitude and longitude.

Within Saudi Arabian sources, there are undoubtedly a large array of marine-based data that can possibly be useful. All possible data sets for each main topic need to be assembled together (or coordinated) in order to form databases. Data sets and databases should include metadata. These show, for each set of data, factors such as what the data are showing, the date of the data, who collected the data, how the data are structured, what area the data covers, and the level of accuracy. Although these data can be stored at a central location, this is not usually vital since data can be easily transferred via the Internet. There are many other data considerations that need to be investigated: whether there are costs involved in acquiring data; copyright; can the data be freely used or are some confidential; can the data be safely stored; the actors concerned with data structure and format, and so on. Advice on many of these considerations can be obtained from the General Commission for Survey – Hydrographic Survey Department, or from the owners of the data. This entire step is best administered by people or departments having access to and experience in the use of GIS.

### Step 5. Analysing data and marine information

The analyses that are carried out will relate to the MSP objectives established under Step 2, and these will all be aimed at achieving improvements in the marine environment in order that all users can perform their activities in a sustainable manner. For Saudi Arabia, a non-exhaustive list of analyses could include the following:

- Are oil or gas platforms all sited away from the main shipping routes?
- What areas can provide the best conditions for the future siting of mariculture facilities?
- Are there additional areas where endangered marine ecosystems need protection?
- Which coastal areas need to be conserved as fish spawning or nursery grounds, and do any of these areas need regenerating?
- Which marine areas should be designated as no-take zones for the fishing of certain species?
- Are there marine areas where recreational activities should be prohibited?

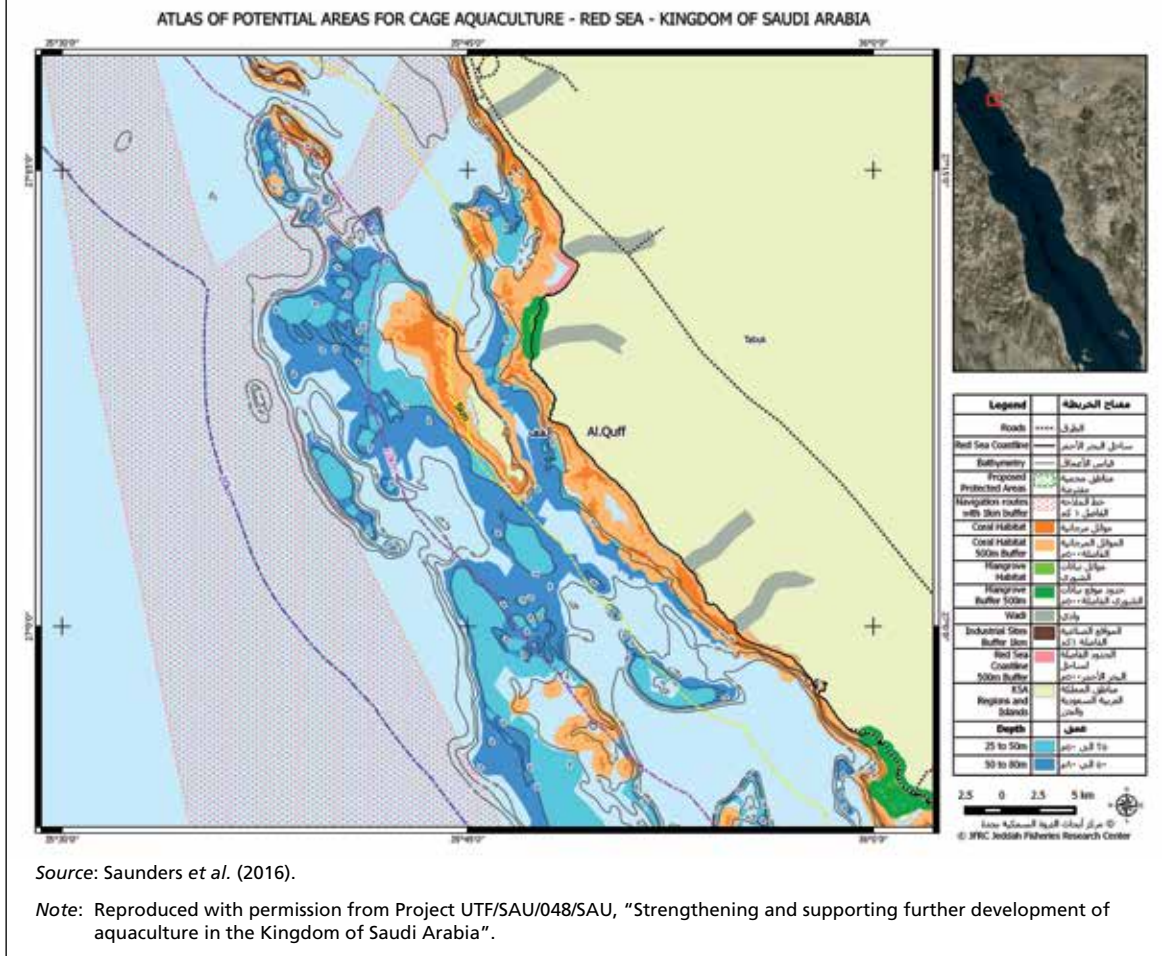
Analyses will be performed via a range of ecosystem and other modelling tools and the use of GIS. It is likely that this work will be performed at the premises of the lead authority established in Step 1, though there might be specialist work that is better performed by stakeholders and/or consultants who have specialist knowledge of a particular topic. It is important that all stakeholders are familiar with the analysis work that is carried out, as there are possible interactions between the marine activities within the area to which MSP applies. Output from any of the analyses will be in the form of maps with explanatory written information, and it is this information that will contribute to a final MSP.

Figure 5 provides an extract from an atlas of potential areas for cage aquaculture in the Red Sea that can contribute to MSP.<sup>43</sup> Most of the data used in this atlas has been collected by satellite-based remote sensing to delineate the coastline and coastal natural resources such as wadis, mangroves and coral reefs. Human settlements, roads, industrial zones and ports were also mapped. Additional data from various sources and field surveys include shipping lanes, landing sites, location of existing aquaculture facilities and bathymetry. GIS was used to create buffers<sup>44</sup> around some sensitive areas such as wadis, mangroves and the coastline, i.e. to exclude (or protect) these areas from human activities. Buffers were also created around navigation routes to prevent conflicts with other area users. GIS has further been used to identify areas where there is the potential for cage aquaculture based on some relevant locational criteria, and to identify some of the main areas that users need to avoid because of competition for access to water and space. Areas shown in light blue have a greater potential for fish cage culture than areas in dark blue. Potential areas were mainly identified for their depth suitability and their distances from coral reefs, shipping lanes, coastline, landing sites, larger urban areas and other aquaculture facilities, and distance to shore (Saunders *et al.*, 2016). Figure 5 has been purposefully created to show areas that have the potential for fish cage culture. It is likely that similar mapping procedures can identify overlapping marine activities, and will advise on the advantages or disadvantages of cage culture relative to any potential competitors for the marine space.

<sup>43</sup> There are differences between “marine aquaculture spatial planning” and “marine spatial planning”. The atlas of potential areas for cage aquaculture in the Red Sea is an example of “marine aquaculture spatial planning” in which the analysis is primarily focused on mariculture, whereas MSP is a cooperative approach that integrates all marine users in identifying issues, opportunities and challenges to securing the sustainable use of marine space. Clearly, marine aquaculture spatial planning contributes to MSP

<sup>44</sup> Buffering is the process of drawing zones around features. These zones are mostly drawn at specified distances from the feature, though they could include time distance zones. For example, in Figure 5 grey buffers have been drawn representing 500 metre zones on either side of the course of wadis. This could be an exclusion zone for many activities because of the danger of flooding. Similar zones have been drawn around mangrove areas because mangroves need protection from a variety of mainly human-based exploitation.

FIGURE 5  
Map of a northern section of the Red Sea coast of Saudi Arabia to show potential for marine-based aquaculture



### Step 6. Defining and evaluating future options

The work undertaken in Step 5 should enable the identification of the current marine situation with respect to the various activities that are taking place in any of the Saudi Arabian waters. It should thus be possible to identify any locations where there are activities that are not being pursued in a sustainable way or where one or more activities are being carried out to the detriment of others. Having this information will allow marine authorities to take action, which will take the form of evaluating strategies that might best be deployed to improve any negative situations, user conflicts or cumulative impacts. Referring to Steps 1 and 2, it will be necessary to:

- (i) Estimate the consequences of utilizing the marine space as at present. This will give a picture of the longer term seriousness of the situation.
- (ii) Make an estimate of new marine initiatives that might perhaps be started over the next decade. Obviously, these need to be integrated into any future marine spatial plans.
- (iii) Identify a range of possible future spatial scenarios for Saudi Arabian marine waters. Thus, there might be a range of possible ways in which the marine space can best be organized, and some of these possibilities could be trialled via the spatial modelling tools that are available.
- (iv) Finally, it will be necessary to agree on a specific marine spatial plan that is to be deployed. Evidently, there will be future opportunities to make changes to the marine spatial plan if success is not being achieved.

Box 8 is included here because it is important to convey the fact that establishing the marine spatial plan is not an exact science. In practice, it is likely that an efficient MSP process will take several years to evolve, during which time there will be changes occurring with respect to each of the marine activities that contribute to the marine spatial plan. It is therefore important to consider MSP as a continuously evolving plan that needs to always be subject to “fine tuning”.

**BOX 8****A useful reminder for defining future options (Step 6)**

“Defining and analysing future conditions is not an exact science. Contrary to mapping existing conditions (see Step 5, Analysing data and marine information), the maps developed to visualize future conditions do not need to reflect “exact” locations. Instead, they should indicate patterns, trends and direction. You will typically involve planners (not necessarily scientists) who will rely on drawing programmes and other tools rather than geographic information systems (GIS)”.

*Source:* Ehler and Douvere (2009).

**Step 7. Preparing the marine spatial plan, including zoning**

This step essentially involves writing a report based on the findings derived in Step 5. The report, which will basically be a draft marine spatial management plan, will need to set basic parameters such as the geographic area(s) to be covered, identify the stakeholders and the lead group, and detail the approximate time period for each of the steps in the plan. Further, it should: (i) describe the general aims and objectives that best fit Saudi Arabia’s present marine circumstances; (ii) specify criteria for selecting marine spatial management measures; (iii) identify alternative spatial and temporal management measures; (iv) develop a time line through means of a Gantt chart<sup>45</sup> so that all partners know who is doing what and when they are doing it; (v) develop the zoning plan; and (vi) conduct a final evaluation before seeking MSP approval.

The main content of the report will have resulted from a great deal of discussion among the groups involved and many deliberations over alternative strategies. This means that consideration will have been given to achieving the ideal combination of measures that could influence the likely success of the emerging marine spatial plan. Here, the concern is with the controls that might achieve successful management of the marine space, i.e. input, process and output controls; Step 7 of chapter 3 describes these in more detail. In arriving at an apparent ideal situation, it should be realized that different marine sectors will have made gains and losses and that sometimes difficult compromises will have to be reached. The contents of the report, including the zoning, may need to be adjusted on a more-or-less constant basis, but without necessarily altering the report or adjusting the plan radically, which might for example, act to deter investment.

Some marine activities will have a much more powerful social and economic status than others. In the case of Saudi Arabia, it is well recognized that the country is heavily dependent on the petroleum and gas industries and the corporations that manage them. However, it will be very important that this sector is not given a special or more powerful status with respect to preparing the MSP. So, for instance, although economic revenues from oil and gas sales contribute towards the bulk of GDP, the number of Saudi Arabians directly employed by the fishery sector is almost certainly much higher than that of the oil sector, giving the fisheries sector significant status, but for different reasons.

<sup>45</sup> See footnote 24.

Having identified potential spatial conflicts between marine activities, including their location, and the main strategies to be deployed so that all or most marine activities might best be carried out sustainably, the MSP group will need to develop zoning for each activity. The first step is to identify the marine activities that cannot be moved or should not be altered (at least in the short term), i.e. these will be areas committed to specific activities. For Saudi Arabian waters, these are likely to comprise mainly oil and gas platforms,<sup>46</sup> the already established marine conservation areas, future planned conservation areas, those areas designated for military purposes, some major shipping lanes and port areas. Once these areas are agreed upon, it will be necessary to identify any future planned areas for development – areas that will undoubtedly be dedicated for oil and gas extraction, but also for aquaculture zoning, fish spawning and nursery areas, fish stock enhancement areas, coastal resort locations, and perhaps areas to be designated for certain types of fishery activity such as areas restricted to artisanal fishing, no-take zones for trawlers and areas closed for fishing for certain identified species. Referring back to Figure 3, it can be seen that the actual zoning agreed upon will frequently be configured in rectangular blocks. Thus, these are “generalized” marine areas allocated for each activity, which take this shape because it would be impossible to agree and to monitor zones that followed more precise feature boundaries, e.g. such as the potential aquaculture sites shown in Figure 5.

#### **Step 8. Implementing and enforcing the MSP**

This step is critical for the success of the MSP. Although all of the varied stakeholders will have agreed on the necessity of having a well-defined MSP, and presumably they will want it to succeed, it will be essential that both compliance and enforcement of the plans can be vigorously pursued into the indefinite future. Problems might occur because in a country such as Saudi Arabia, which has a very long coastline, a large area of territorial seas, and two completely separate and diverse marine areas, it will be difficult to have developed standardized procedures that are recognized and understood (or interpreted) uniformly by all the stakeholders. Achieving this may take some time and involve almost continuing adjustments of procedures. The large marine jurisdiction will also mean that enforcing MSP rules could be difficult because many individuals may not respect the obligations that are supposed to prevail. The costs associated with enforcement may also be hard to justify in terms of any actual negative actions that are taking place. It will be the responsibility of the lead marine management authority to be vigilant in seeing that MSP implementations are adequately carried out and sustained and that rules are consistently applied.

#### **Step 9. Monitoring, evaluation and review, and communication of results**

Step 9 in chapter 3 made clear what procedures are required at this stage for monitoring, evaluating, reviewing and adjusting the MSP that has been developed; of course, these procedures are not specific to Saudi Arabian marine waters. These are all tasks that will also be carried out under the jurisdiction of the lead authority. At this stage, the prevailing situation with respect to the progress of the MSP should be both evaluated against the list of tasks set out in Table 7 and discussed with the FAO/RECOFI team.

#### **Step 10. Adapting and updating the marine spatial management process**

As mentioned in Step 10 of chapter 3, very few MSPs have yet reached and reported on this stage, so it is difficult to give advice here. However, from the reports that have materialized, it is important to acknowledge that MSPs are extremely likely to receive

<sup>46</sup> In the longer term, these platforms will reach the end of their viability, but it is possible that agreements on climate change reductions may oblige Saudi Arabia to reduce its fossil fuel output.



adjustments, most of which may have been unpredictable at the early stages of the whole project. Adjustments will occur throughout the inception of MSP, but it will be essential that a thorough review is carried out of the MSP at regular intervals during its progress – perhaps every five years. As part (or all) of this review, it may be useful to engage external assessors who have the necessary experience to undertake this activity, for example, from other MSP adoptions and implementation of the processes (steps) involved.



## 5. Conclusions

*Of course, closing fishing grounds is hurtful. We are fishers! For generations, our family has been fishing at the North Sea. But today's world is different; fishers are no longer kings in a sole domain. We have to deal with all kinds of other marine activities demanding space. And we have to face that NGOs, consumers and the whole public is watching us. Collaboration and finding compromises are the only way forward.<sup>47</sup>*

As recognized by these Dutch fishers, the future use of the marine environment is changing rapidly on a planet where population pressures and associated developments are putting accelerating demands on all natural resources. For these fishers, what matters is how best their activities can be maintained in a way that is sustainable, and works within the constraints placed by other marine uses, users and ecosystem requirements. They have recognized that if they are to survive, then the only way to do so is through collaboration and cooperation, working together with other marine sectors and stakeholders to develop an overall sustainable plan for marine spatial use.

The RECOFI group find themselves in a similar situation, needing to establish an appropriate mechanism that improves fisheries and aquaculture activity within the Gulf, the Gulf of Oman and the northern waters of the Arabian Sea, and to do so in a sustainable way that is socially, environmentally and economically acceptable. Integration of management through MSP is a comprehensive way of delivering a healthy future for the Gulf, in particular given the reduced catches and environmental problems. MSP provides clear steps in a process to achieve such an aim, allowing for development of local, national and regional marine spatial plans in the context of the cooperative arrangement between the eight nations that make up the RECOFI group. This document provides a general approach to MSP that can be used to provide a sustainable future for marine fisheries and aquaculture in the changing landscape of use and users of RECOFI waters.

But, of course, there are many challenges to the full implementation of this management system. Some groups, such as small-scale fishers or fish farmers, will likely have to fight hard to be heard among the currently larger users of the RECOFI marine space, particularly the oil and gas and shipping sectors. Fishers also face the problem that their geographical focus is less static and more widespread than is the focus of most other users, which may produce some resistance toward zoning in MSP. They fear that their much needed mobility will be reduced as they might become bound by their own mapped zones (Jentoft and Knol, 2014). Thus, MSP must also be about creating order and negotiating conflict between user groups who do not always share the same goals, and whose powers, interests and world views differ sharply.

MSP is likely to be much easier in theory than in practice. Box 9 provides an assessment of the probable strengths, weaknesses, opportunities and threats (SWOT) associated with the implementation of MSP for the RECOFI area. This SWOT analysis indicates that MSP implementation clearly presents challenges, but that there should be confidence that, from a holistic perspective, the opportunities to be gained from engaging with MSP will offer considerable long-term benefits not only to fisheries and aquaculture but also to other sectors, including emerging sectors. Thus, although MSP involves risks and the need for compromise, spatial planning will certainly provide opportunities to reduce vulnerability for all marine users, and provide long-term

<sup>47</sup> Quote from a fishing community in the Netherlands, taken from Toonen and Mol (2013).

provision for investment through clearly defined marine spatial plans. MSP processes and inceptions are at a very early stage, and it is not known how successful they will be. Without MSPs in one form or another, we can rest assured that matters may be a whole lot worse. Box 10 provides key messages with regard to MSP implementation.

#### BOX 9

##### **Strengths, weaknesses, opportunities and threats (SWOT) analysis of major MSP considerations**

###### **Strengths:**

- most shipping lanes are well documented and controlled;
- relatively strong financial inputs are available;
- already building up a knowledge of shrimp aquaculture;
- allows for the promotion of unity among RECOFI member countries;
- will provide sound justification for the monitoring of fishing effort;
- encourages wider consultation and participation in a range of decision-making;
- should prevent the further loss of important marine habitats;
- promotes the fundamental ethos of sustainability; and
- allows for rationalization of the marine space.

###### **Weaknesses:**

- little knowledge of MSP;
- much of the coastal land around urban areas is degraded;
- lack of access to decision-making by artisanal marine users;
- coral reefs and mangrove areas are often degraded;
- length of time taken to verify conservation (marine protected) areas;
- ascertaining the existence and whereabouts of necessary data;
- the lack of marine spatially referenced data in some of RECOFI countries;
- marine matters appear to fall under many ministries;
- insufficient personnel trained in spatial analyses;
- many artisanal fishers will not appreciate the need for interactivity cooperation and data collection;
- lack of resources to collect the wide range of marine data;
- need to place extensive legal statutes in place for international cooperation; and
- agreeing to work using standard methodologies.

###### **Opportunities:**

- lots of suitable mariculture sites and a willingness to identify them;
- some very positive desires to increase aquaculture/mariculture output;
- opportunity to improve the status of fisheries, and thus coastal artisanal fishers and their families, especially in the Gulf;
- to achieve sustainability for a range of marine-based activities;
- provides an opportunity to work cooperatively with stakeholders from a range of countries;
- to diversify the economy from an over-reliance on oil and gas;
- will provide an opportunity to set up a baseline for fisheries and aquaculture data and some other marine activities;
- increase familiarity and competence with a range of computer-based modelling tools;
- will contribute to the improvement of the aquatic marine environment;
- raises the awareness of mixing economic, social, environmental and governance considerations into marine activities; and
- likelihood of increasing future supplies of high-quality fish protein.

###### **Threats:**

- growing impacts of human developments along both of the coasts;
- suspected overfishing (too much effort), e.g. unsustainable rates of shrimp fishing in the Gulf, and this could lead to a loss of fishery-based jobs;
- insufficient conservation ethos in the country;
- fishing is not properly monitored or catches recorded;
- the number of oil and gas rigs in the Gulf;
- tourism development is likely to threaten conservation efforts;
- huge political and economic power of the oil and gas companies;
- legal requirements across eight nations could be difficult to agree; and
- high-quality results might be expected too early in the MSP process.

## BOX 10

## Marine spatial planning – key messages

- For busy or enclosed marine areas, MSP will be vital to ensure a sustainable future for the environment, ecosystems and activities in the area.
- MSP will help ensure that all users of the marine space will receive rewards from their activities.
- MSP allows everyone to participate in what is going on, i.e. it allows for fairness, and thus prevents powerful interests from dominating marine activities.
- Local management schemes can still take place within participating regions, countries or activities.
- MSP is not static; it is a process that is adaptable, and thus it is constantly evolving in order to accommodate changing developments.
- MSP encourages different sectors to coexist, which should see the integration of work effort, and thus avoiding future conflicts.
- The measured, integrated and transparent approach develops a framework that has mechanisms to involve all stakeholders and to convey progress of, and outcomes from, the process.
- Early and effective engagement with stakeholders should address a number of mutual challenges – information gaps, data gathering, data standardization, etc.
- MSP will build on the body of existing work, much of which could readily be shared to the advantage of all participants.
- The adoption of MSP will introduce practical training and familiarity with a range of useful social, environmental, technical and economic skills.
- MSP is not just the production of maps, or a plan or zoning – as well as these, it is the development of a longer-term strategic process and management system whose aims are to best develop the marine area for the benefit of all.
- High-quality results might be expected too early in the MSP process.

## REFERENCES

- Al-Bisher, H., Stead, S. & Gray, T.** 2012. *Saudi maritime policy – integrated governance*. Regional Studies in Middle East Politics. Oxford, UK, Routledge.
- Bates, A., Samoteskul, K., Callahan, J. & Firestone, J.** 2012. Delaware marine spatial planning. Offshore Wind Context. Final Report. University of Delaware. 107 pp. (also available at [www.deseagrant.org/sites/default/files/attachments/CCPI-DE-MSP-OSW-Context-2012.pdf](http://www.deseagrant.org/sites/default/files/attachments/CCPI-DE-MSP-OSW-Context-2012.pdf)).
- Beck, M.W., Ferdaña, Z., Kachmar, J., Morrison, K.K., Taylor, P. & others.** 2009. *Best practices for marine spatial planning*. Arlington, Virginia, USA, the Nature Conservancy. (also available at [http://waterviewconsulting.com/files/MSP\\_Best\\_Practices.pdf](http://waterviewconsulting.com/files/MSP_Best_Practices.pdf)).
- Blåsbjerg, M., Pawlak, J.F., Sørensen, T.K. & Vestergaard, O.** 2009. *Marine spatial planning in the nordic region – principles, perspectives and opportunities*. Copenhagen, Denmark, Nordic Council of Ministers. 98 pp. (also available at [www.imr.no/filarkiv/2011/03/msp\\_nordic\\_region.pdf/en](http://www.imr.no/filarkiv/2011/03/msp_nordic_region.pdf/en)).
- Dean, A.M. & Populus, J.** 2013. Remote sensing and GIS integration. In G.J. Meaden & J. Aguilar-Manjarrez, eds. 2013. *Advances in geographic information systems and remote sensing for fisheries and aquaculture*, pp. 147–189. CD-ROM version. FAO Fisheries and Aquaculture Technical Paper No. 552. Rome, FAO. 98 pp. Includes a CD-ROM containing the full document. 425 pp. (also available at [www.fao.org/docrep/017/i3102e/i3102e00.htm](http://www.fao.org/docrep/017/i3102e/i3102e00.htm)).
- Dean, A.M. & Salim, A.** 2013. Remote sensing for the sustainable development of offshore mariculture. In J.M. Kapetsky, J. Aguilar-Manjarrez & J. Jenness. *A global assessment of offshore mariculture potential from a spatial perspective*, pp. 123–181. FAO Fisheries and Aquaculture Technical Paper No. 549. Rome, FAO. 181 pp. (also available at [www.fao.org/docrep/017/i3100e/i3100e00.htm](http://www.fao.org/docrep/017/i3100e/i3100e00.htm)).

- Douve**, F. 2010. *Marine spatial planning: concepts, current practice and linkages to other management approaches*. Belgium, Ghent University. (also available at [www.unesco-ioc-marinesp.be/uploads/documentenbank/f65e104ce9fcc7ec74f6eda0167d57d9.pdf](http://www.unesco-ioc-marinesp.be/uploads/documentenbank/f65e104ce9fcc7ec74f6eda0167d57d9.pdf)).
- Douve**, F. & **Ehler**, C.N. 2009. New perspectives on sea use management: initial findings from European experience with marine spatial planning. *Journal of Environmental Management*, 90 pp. 77–88.
- Ehler**, C. 2014. *A guide to evaluating marine spatial plans*. IOC Manuals and Guides No. 70; ICAM Dossier No. 8. Paris, UNESCO. (also available at <http://unesdoc.unesco.org/images/0022/002277/227779e.pdf>).
- Ehler**, C. & **Douve**, F. 2009. *Marine spatial planning: a step-by-step approach toward ecosystem-based management*. Intergovernmental Oceanographic Commission and Man and the Biosphere Programme. IOC Manual and Guides No. 53, ICAM Dossier No. 6. Paris, UNESCO. (also available at <http://unesdoc.unesco.org/images/0018/001865/186559e.pdf>).
- FAO**. 2003. *The ecosystem approach to fisheries*. FAO Technical Guidelines for Responsible Fisheries. No. 4, Suppl. 2. Rome. 112 pp. (also available at [www.fao.org/3/contents/a037e392-f6e6-52ab-88c1-7ff7453dad82/y4470e00.htm#Contents](http://www.fao.org/3/contents/a037e392-f6e6-52ab-88c1-7ff7453dad82/y4470e00.htm#Contents)).
- FAO**. 2010. *Aquaculture development. 4. Ecosystem approach to aquaculture*. FAO Technical Guidelines for Responsible Fisheries No. 5, Suppl. 4. Rome. 53 pp. (also available at [www.fao.org/docrep/013/i1750e/i1750e00.htm](http://www.fao.org/docrep/013/i1750e/i1750e00.htm)).
- FAO**. 2011. Fisheries management. 4. Marine protected areas and fisheries. *FAO Technical Guidelines for Responsible Fisheries*. No. 4, Suppl. 4. Rome, FAO. 198 pp. (also available at [www.fao.org/docrep/015/i2090e/i2090e00.htm](http://www.fao.org/docrep/015/i2090e/i2090e00.htm)).
- FAO**. 2012. *Strategy for fisheries, aquaculture and climate change. Framework and aims 2011–16*. Policy brief. Rome, Italy. (also available at [www.fao.org/3/a-am434e.pdf](http://www.fao.org/3/a-am434e.pdf)).
- FAO**. 2013. *Applying spatial planning for promoting future aquaculture growth*. Seventh Session of the Sub-Committee on Aquaculture of the FAO Committee on Fisheries, St. Petersburg, Russian Federation, 7–11 October 2013. Discussion document: COFI:AQ/VII/2013/6. 10 pp. (also available at [www.fao.org/cofi/43696-051fac6d003870636160688ecc69a6120.pdf](http://www.fao.org/cofi/43696-051fac6d003870636160688ecc69a6120.pdf)).
- FAO/Regional Commission for Fisheries**. 2011. *Report of the regional technical workshop on spatial planning for marine capture fisheries and aquaculture*. Doha, the State of Qatar, 24–28 October 2010. FAO Fisheries and Aquaculture Report No. 961. Rome. 118 pp. (also available at [www.fao.org/docrep/014/i2054e/i2054e00.pdf](http://www.fao.org/docrep/014/i2054e/i2054e00.pdf)).
- FAO/Regional Commission for Fisheries**. 2013. *Report of the regional technical workshop on spatial planning development programme for marine capture fisheries and aquaculture*. Cairo, the Arab Republic of Egypt, 25–27 November 2012. FAO Fisheries and Aquaculture Report No. 1039. Rome. 127 pp. (also available at [www.fao.org/docrep/018/i3362e/i3362e00.htm](http://www.fao.org/docrep/018/i3362e/i3362e00.htm)).
- FAO & World Bank**. 2015. *Aquaculture zoning, site selection and area management under the ecosystem approach to aquaculture*. Policy brief. Rome. (also available at [www.fao.org/documents/card/en/c/4c777b3a-6afc-4475-bfc2-a51646471b0d/](http://www.fao.org/documents/card/en/c/4c777b3a-6afc-4475-bfc2-a51646471b0d/)).
- Flannery**, W. 2014. *Review of marine spatial planning: best practice of relevance to Ireland*. Belfast, Northern Ireland, School of Planning, Architecture and Civil Engineering, Queen's University Belfast. 44 pp.
- Flannery**, W., **O'Hagan**, A.M., **O'Mahony**, C., **Ritchie**, H. & **Twomey**, S. 2015. Evaluating conditions for transboundary marine spatial planning: challenges and opportunities on the island of Ireland. *Marine Policy*, 51: 86–95.

- Foley, M.M., Halpern, B.S., Micheli, F., Armsby, M.H., Caldwell, M.R., Crain, C.M., Prahler, E., Rohr, N., Sivas, D., Beck, M.W., Carr, M.H., Crowder, L.B., Duffy, J.E., Hacker, S.D., McLeod, K.L., Palumbi, S.R., Peterson, C.H., Regan, H.M., Ruckelshaus, M.H., Sandifer, P.A. & Steneck, R.S. 2010. Guiding ecological principles for marine spatial planning. *Marine Policy*, 34(5): 955–966.
- Gee, K., Kannen, A. & Heinrichs, B. 2013. *BaltSeaPlan vision 2030: towards the sustainable planning of Baltic Sea space*. BaltSeaPlan, Hamburg, Germany. (also available at [www.baltseaplan.eu](http://www.baltseaplan.eu)).
- Gilliland, P. & Lafolley, D. 2008. Key elements and steps in the process of developing ecosystem-based marine spatial planning. *Marine Policy*, 32: 787–796.
- Hemingway, K.L. & Cutts N.D. 2013. *TIDE tool: conflict matrix management tool – user guide*. University of Hull, UK, Institute of Estuarine and Coastal Studies (IECS).
- Hofherr, J., Natale, F. & Trujillo, P. 2015. Is lack of space a limiting factor for the development of aquaculture in EU coastal areas? *Ocean & Coastal Management*, 116: 27–36.
- IPCC. 2014. *Climate change 2014: impacts, adaptation and vulnerability. Part A: global and sectoral aspects. Contributions of Working Group II to the fifth assessment report of the Intergovernmental Panel on Climate Change*. [Field, C.B. et al.]. New York, USA, Cambridge University Press. 1132 pp.
- Jansen, H.M., Van Den Burg, S., Bolman, B., Jak, R.G., Kamermans, P., Poelman, M. & Stuiver, M. 2016. The feasibility of offshore aquaculture and its potential for multi-use in the North Sea. *Aquaculture International*, 24(3), pp.735–756. (also available at <http://link.springer.com/article/10.1007/s10499-016-9987-y>).
- Jentoft, S. & Knol, M. 2014. Marine spatial planning: risk or opportunity for fisheries in the North Sea. *Maritime Studies*, 12:13–29. (also available at <http://maritimestudiesjournal.springeropen.com/articles/10.1186/2212-9790-13-1>)
- Kapetsky, J.M., Aguilar-Manjarrez, J. & Jenness, J. 2013. *A global assessment of offshore mariculture potential from a spatial perspective*. FAO Fisheries and Aquaculture Technical Paper No. 549. Rome, FAO. 181 pp. (also available at [www.fao.org/docrep/017/i3100e/i3100e00.htm](http://www.fao.org/docrep/017/i3100e/i3100e00.htm)).
- Kelly, C., Gray, L., Schucksmith, R. & Tweddle, J.F. 2014. Review and evaluation of marine spatial planning in the Shetland Islands. *Marine Policy*, 46: 152–160.
- Lillesand, T., Kiefer, R.W. & Chipman, J. 2007. *Remote sensing and image interpretation (6th ed)*. Chichester, UK, Wiley.
- Marine Management Organisation. 2016. *Marine planning in England. Planning and development – collection* [online]. United Kingdom. [Cited 17 October 2016]. <https://www.gov.uk/government/collections/marine-planning-in-england>
- Meaden, G.J. & Aguilar-Manjarrez, J., eds. 2013. Advances in geographic information systems and remote sensing for fisheries and aquaculture. Summary version. FAO Fisheries and Aquaculture Technical Paper No. 552. Rome, FAO. 98 pp. Includes a CD-ROM containing the full document (425 pp.). (also available at [www.fao.org/docrep/017/i3102e/i3102e00.htm](http://www.fao.org/docrep/017/i3102e/i3102e00.htm)).
- National Commission for Wildlife Conservation and Development. 2005. *The National Strategy for Conservation of Biodiversity in the Kingdom of Saudi Arabia*. Dul Al-Hijja, Saudi Arabia. January 2005.
- Norwegian Ministry of the Environment. 2011. *First update of the integrated management plan for the marine environment of the Barents Sea – Lofoten area*. Meld St. 10 (2010–2011). Report to the Storting (white paper). 149 pp. [English version.] Also available at [www.miljodirektoratet.no/Global/Havforum/Meld.%20St.10%20\(2010-2011\)%20Report%20to%20the%20Storting%20\(white%20paper\)%20First%20update%20of%20the%20Integrated%20Management%20Plan%20for%20the%20Marine%20Environment%20of%20the%20Barents%20Sea-Lofoten%20Area.pdf](http://www.miljodirektoratet.no/Global/Havforum/Meld.%20St.10%20(2010-2011)%20Report%20to%20the%20Storting%20(white%20paper)%20First%20update%20of%20the%20Integrated%20Management%20Plan%20for%20the%20Marine%20Environment%20of%20the%20Barents%20Sea-Lofoten%20Area.pdf)

- Pittock, A.B.** 2009. *Climate change: the science, impacts and solutions*. London, UK, Earthscan.
- Santos, C.F., Domingos, T., Ferreira, M.A., Orbach, M. & Andrade, F.** 2014. How sustainable is marine spatial planning? Part1: Linking the concepts. *Marine Policy*, 49: 59–65.
- Saunders, J., Cardia, F., Hazzaa, M.S., Rasem, B.M.A., Othabi, M.I. & Rafiq, M.B.** 2016. Atlas of potential areas for cage aquaculture: Red Sea - Kingdom of Saudi Arabia. FAO Project UTF/SAU/048/SAU, “Strengthening and supporting further development of aquaculture in the Kingdom of Saudi Arabia”. FAO and Saudi Ministry of Agriculture KSA. 104 pp. (also available at [www.fao.org/documents/card/en/c/c486bfa2-8b80-4b26-9906-37377d110968/](http://www.fao.org/documents/card/en/c/c486bfa2-8b80-4b26-9906-37377d110968/)).
- Shucksmith, R.J. & Kelly, C.** 2014. Data collection and mapping – principles, processes and application in marine spatial planning. *Marine Policy*, 50: 27–33.
- Stelzenmuller, V., Lee, J., South, A., Foden, J. & Rogers, S.I.** 2009. *Review of practical tools for marine planning*. Lowestoft, UK, Centre for Environment, Fisheries, and Aquaculture Science (CEFAS). 28 pp.
- Symes, D.** 2005. *Marine spatial planning: a fisheries perspective*. Report to English Nature. (Unpublished). 35 pp. (also available at [www.unesco-ioc-marinesp.be/uploads/documentenbank/b796f2b7d0494fcb9c52c3df21894d35.pdf](http://www.unesco-ioc-marinesp.be/uploads/documentenbank/b796f2b7d0494fcb9c52c3df21894d35.pdf)).
- Toonen, H.M. & Mol, A.P.J.** 2013. Putting sustainable fisheries on the map? Establishing no-take zones for North-Sea plaice fisheries through MSC certification. *Marine Policy*, 37: 294–304.
- UNEP & GEF-STAP.** 2014. *Marine spatial planning in practice – transitioning from planning to implementation. An analysis of global marine spatial planning experiences*. H.L. Thomas, S. Olsen & O. Vestergaard, eds. Nairobi, UNEP. 36 pp. (also available at [www.cbd.int/doc/meetings/sbstta/sbstta-18/information/sbstta-18-inf-23-en.pdf](http://www.cbd.int/doc/meetings/sbstta/sbstta-18/information/sbstta-18-inf-23-en.pdf)).



# Annex 1

## Recommendations concerning the adoption of marine spatial planning taken from the RECOFI (FAO) Cairo workshop in 2012

The following consists of material abstracted from the FAO/Regional Commission for Fisheries. (2013) report. This report covers an FAO-led technical workshop on a spatial planning development programme for marine capture fisheries and aquaculture. The workshop was held in Cairo, Egypt, from 25–27 November 2012. The material included below relates directly to marine spatial planning (MSP). After a general summary of this MSP-related material, the second section provides proposals of how best the necessary MSP work could be fitted into the overall RECOFI programme. Finally, the “Closing Remarks” makes further conclusion comments with respect to MSP’s importance. Paragraph numbers are retained from the original document and no text has been changed.

### SUMMARY OF THE PROPOSED REGIONAL STRATEGY FOR SPATIAL PLANNING

13. The introductory part of the strategy sets out its evolution beginning with a recommendation of the RECOFI for a joint workshop between the Working Group on Aquaculture (WGA) and the Working Group on Fisheries Management (WGFM) on the use of spatial planning tools. As a background to the strategy, the status of both aquaculture and capture fisheries in the RECOFI area waters is described, thus providing part of the rationale for spatial planning. Also outlined is the main purpose, which is to present a strategy to enhance and accelerate spatial planning for mariculture and marine capture fisheries in the region. The vision of the strategy is “To illustrate how spatial planning tools are one essential element to achieving sustainable clean, healthy, safe, productive and biologically diverse marine seas in the RECOFI region, and how they allow for mariculture and marine fishery production activities to be maximized while at the same time taking into account the other users of the marine space.” The guiding principles that underlie the outlined components of the strategy are founded broadly on the ecosystem approach to aquaculture (EAA) and the ecosystem approach to fisheries (EAF), allied to the need to ensure that all legitimate uses of the marine space can continue on the basis of sustainability. The strategy is more specifically guided by the principles of MSP.
14. In a further presentation on MSP, the participants were introduced to its main concepts and steps. An explanation was first provided as to why RECOFI’s “Regional Strategy” for spatial planning should be embedded within the overall context of MSP. Thus, it was explained that the marine space was becoming crowded in terms of marine resource exploiters, and that if these exploiters were all to be successful in the future, then activities would have to be rationalized with respect to their use of this space. In addition, it was explained that MSP is a framework that is gaining considerable importance around the world. It

consists of a public process for analysing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic and social objectives that have usually been specified through a political process. Marine spatial planning is ecosystem-based, area based, integrated, adaptive, strategic and participatory. Various countries have started to use marine spatial management to achieve sustainable use and biodiversity conservation in ocean and coastal areas. If all marine activities are to continue in a successful and sustainable way in a crowded, enclosed and stressed marine area such as the Gulf, it is essential that MSP be applied.

## **REVIEW OF THE PROPOSED CONTENT OF THE SPATIAL PLANNING DEVELOPMENT PROGRAMME**

27. Overseeing fisheries and aquaculture GIS work. For fisheries to be successfully managed in an area such as the Gulf, where numerous other activities also take place in a shared marine space, it will be essential to introduce MSP. Marine spatial planning will cover the integration of these marine activities, with additional ecosystem approaches being adopted to best promote both fisheries and aquaculture management. These facts mean that all of the spatially based work will have to be carefully planned and managed, i.e. in a working environment that requires multiple stakeholder involvement, extensive cooperative working, the establishment of joint legal structures and major inputs of higher-level decision-making. Both MSP and EAA/EAF considerations will need to be operative at national and regional levels, with “general spatial planning committees” at both levels, as well as establishing “fisheries and aquaculture spatial committees”, and perhaps committees for: (i) marine recreation; (ii) energy; (iii) coastal development; (iv) mineral and marine resources; and (v) shipping. At both regional and national levels, it will be important to appoint a “fisheries/aquaculture GIS champion”, i.e. a person who at each level can take overall responsibility for ensuring that the GIS work is progressing satisfactorily and in unison across the RECOFI countries. See also concept note on “Marine spatial planning in marine waters for the State of Qatar and three neighbouring countries” in Annex 1 of Appendix 9.
28. Capacity building for higher-level decision-makers. For any programme of work to be successful, it is important that decision-makers at various levels are familiar with what the work will be concerned with, and that they firmly support its aims. This almost certainly means that some level of capacity building will be required. It is important to establish who the decision-makers are, in what sectors they may be employed, and what are the preferred ways of imparting the required information to people who are usually extremely busy. Briefing meetings and/or succinct literature (leaflets, summaries or brochures) are possibly optimum ways of conveying the required information. For those decision-makers having more direct involvement with spatial activities, then it is likely that more extensive familiarization may be required, possibly in a workshop environment.

## **CLOSING REMARKS**

46. A key regional activity and a core component of the Regional Strategy will be to identify RECOFI countries and appropriate agencies (i.e. private and public departments, or institutions that use the marine space) that are willing to cooperate in developing regional plans (MSPs) to improve the environmental, social and

economic conditions of the RECOFI region and to agree on cooperative working environments, including the need to share data. It will be up to RECOFI members to address issues concerned with governance-related recommendations contained in the Regional Strategy at government level, including, most importantly, acceptance by RECOFI countries on current approaches to MSP, fishery zoning and the adoption of the EAA and EAF.

**SOURCES:**

- FAO/Regional Commission for Fisheries.** 2011. *Report of the regional technical workshop on spatial planning for marine capture fisheries and aquaculture. Doha, the State of Qatar, 24–28 October 2010.* FAO Fisheries and Aquaculture Report No. 961. Rome. 118 pp. (also available at [www.fao.org/docrep/014/i2054e/i2054e00.pdf](http://www.fao.org/docrep/014/i2054e/i2054e00.pdf)).
- FAO/Regional Commission for Fisheries.** 2013. *Report of the regional technical workshop on spatial planning development programme for marine capture fisheries and aquaculture. Cairo, the Arab Republic of Egypt, 25–27 November 2012.* FAO Fisheries and Aquaculture Report No. 1039. Rome. 127 pp. (also available at [www.fao.org/docrep/018/i3362e/i3362e00.htm](http://www.fao.org/docrep/018/i3362e/i3362e00.htm)).



## Annex 2

### Main marine activities to be included in marine spatial planning for Saudi Arabia

Some marine-based activities that might need to be considered within a Gulf MSP have not been considered here because at present they are of almost no concern to Saudi Arabia, e.g. marine aggregate supplies<sup>48</sup> and offshore renewable energy.

Individual marine activities in Saudi Arabian waters that are likely to be involved in marine spatial planning initiatives are mentioned briefly (in alphabetical order).

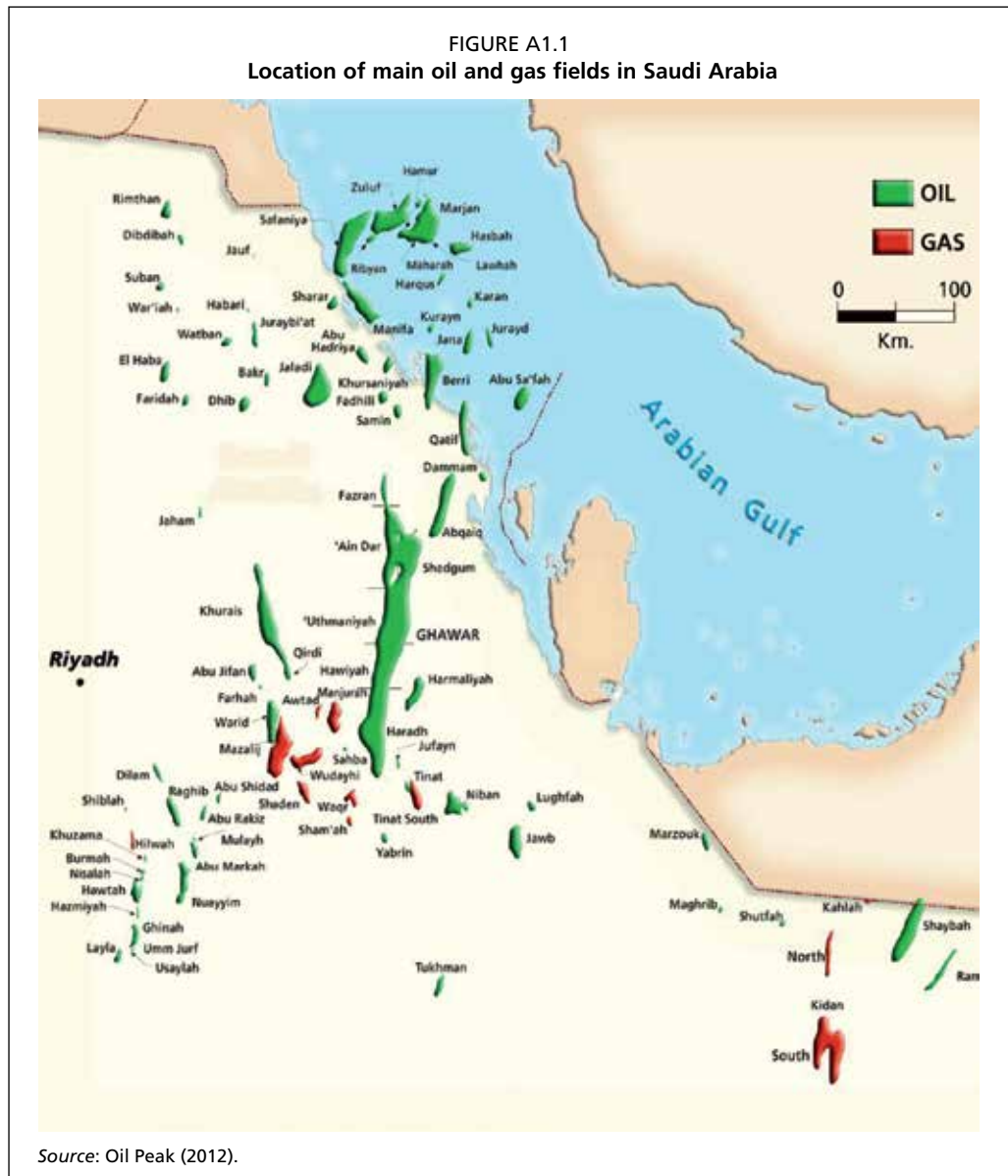
- A. Energy exploitation:** With 25 percent of the world's oil reserves, the extraction of oil is a major Saudi Arabian activity. Since most of the oil is exported, its production tends to be concentrated near marine waters. Major refinery and/or shipping capacity is based at and near Dammam, Ras Tanura, Jeddah and Yanbu. Saudi Aramco is the national oil company with interests in gas, oil and shipping. Figure A1.1 shows that all of Saudi Arabia major oil and gas fields are located in fairly close proximity to the Gulf, with many of them being sited within the marine exclusive economic zone (EEZ).<sup>49</sup> To exploit the Gulf-based oil fields, many production platforms are in the shallow coastal waters.
- B. Mariculture:** The marine aquaculture sector has been identified as a prime activity for promotion. This is because marine conditions in many Saudi Arabian waters are very favourable to further expansion, i.e. with there being sheltered, shallow waters having high water quality and temperatures to encourage rapid growth. During the last decade, the commercial aquaculture of white shrimp has expanded in waters along the Red Sea coast. For the future, there is also good potential to increase finfish production, especially of groupers, seabass and seabreams, and this can greatly supplement the diminishing wild fish stocks (Cardia, Aguilar-Manjarrez and Lovatelli, 2015). Identifying and reserving sites for cage-based mariculture is of vital importance to the success of this activity.<sup>50</sup>
- C. Marine conservation:** The National Strategy for Conservation of Biodiversity in the Kingdom of Saudi Arabia (National Commission for Wildlife Conservation and Development, 2005) notes "Considering the comparatively small sizes of the Red Sea and Arabian Gulf anything that affects biodiversity in one country will affect all others that share these two seas." This is an important recognition of the need for integrated marine management of Saudi Arabian waters. Although some 61 marine protected areas (MPAs) have been declared for Saudi Arabia, the World Conservation Society notes that in 2014 only about six MPAs appear to have been formally adopted<sup>51</sup> (see Marine Conservation Institute, 2016). However, some

<sup>48</sup> This mainly comprises the exploitation of sand and gravel from the seabed, but at present Saudi Arabia can supply all requirements from land-based mining facilities.

<sup>49</sup> The Gulf EEZ boundary for Saudi Arabia runs down the middle of the Gulf with the Iranian EEZ to the east of this boundary.

<sup>50</sup> See FAO (2016) for further details on marine and other aquaculture in Saudi Arabia. FAO. 2016. FAO Fisheries and Aquaculture Department [online]. Rome. [Cited 17 October 2016]. [www.fao.org/fishery/countrysector/naso\\_saudi Arabia/en](http://www.fao.org/fishery/countrysector/naso_saudi Arabia/en)

<sup>51</sup> The Marine Protection Area Global database shows that 3 out of 58 potential MPAs have been designated see Wood, L.J. 2007. MPA Global: A database of the world's marine protected areas. Sea Around Us Project, UNEP-WCMC and WWF. [online]. British Columbia, Canada. [Cited 17 October 2016]. [www.mpaglobal.org](http://www.mpaglobal.org)



2.14 percent (or 4 700 km<sup>2</sup>) of Saudi Arabian seas are declared as no-take reserves,<sup>52</sup> and even this small protection coverage area places Saudi Arabia as having the second highest percentage of nearshore marine areas protected in the world.<sup>53</sup> Most protection thus far has been offered to areas harbouring specific species, such as dugong, turtle nesting grounds, mangroves<sup>54</sup> and seagrass beds, or on areas that are depleted of named fish species.

<sup>52</sup> See Marine Conservation Institute. 2016. MPAAtlas [online]. Seattle, United States of America. [Cited 17 October 2016]. [www.mpatlas.org/region/nation/SAU](http://www.mpatlas.org/region/nation/SAU)

<sup>53</sup> Countries such as the United States of America, United Kingdom of Great Britain and Northern Ireland, and South Africa claim to have large proportions of their seas protected, but these are nearly all distant waters over which they have governmental administration.

<sup>54</sup> The overwhelming importance of mangroves to fisheries production has been recently recognized by Hutchison, J., Spalding, M. & zu Ermgassen, P. 2014. The role of mangroves in fisheries enhancement. *The Nature Conservancy and Wetlands International*. 54 pp. (also available at [www.conservation.cam.ac.uk/sites/default/files/file-attachments/Hutchison,%20J.,%20Spalding,%20M.,%20and%20zu%20Ermgassen,%20P.,%202014,%20The%20Role%20of%20Mangroves%20in%20Fisheries%20Enhancement.pdf](http://www.conservation.cam.ac.uk/sites/default/files/file-attachments/Hutchison,%20J.,%20Spalding,%20M.,%20and%20zu%20Ermgassen,%20P.,%202014,%20The%20Role%20of%20Mangroves%20in%20Fisheries%20Enhancement.pdf)).

- D. Marine fisheries:** Both Saudi Arabian seas have large numbers of mostly artisanal fishers, and a small but growing number of commercial fishing vessels. Small-scale artisanal fishing utilizes many different vessel and gear types, and locally the activity may be very important. In the Red Sea, a wide range of mostly pelagic species are landed, and the reported total commercial catch has been fairly static at about 40 000 tonnes per annum for the last 30 years. Monitoring and enforcement of fishery activities are almost non-existent in the Red Sea. In the Gulf, catches are of a much more limited species range, and shrimp are far more important. Annual catches in Saudi Arabian Gulf waters average about 80 000 tonnes, but this catch rate is now unsustainable.<sup>55</sup> Although fisheries represent only a minor contribution to the Saudi Arabian economy, they remain very important to the livelihood of coastal communities. An overview of these fisheries can be found in De Young (2006), Moussalli and Feidi (2010), and in Bruckner, Alnazry and Faisal (2011).
- E. Marine transport:** Marine traffic is focused on the two very large port areas of Jeddah on the Red Sea coast and Dammam on the Gulf coast. The former specializes in passenger traffic, food, livestock and miscellaneous cargos, while the latter concentrates overwhelmingly on oil and gas exporting. Shipping lanes from Dammam through to the Gulf of Hormuz are intensively used by very large vessels. Shipping to and from Jeddah primarily uses the Suez Canal route. Many of the vessels leaving Dammam also traverse the Red Sea on their way to European ports. There is additionally a limited amount of coastal shipping, and two major new industrial ports are at Jubail and Yanbu. Marine transport, in terms of cargo transported, has been growing by about 6 percent per annum during the last decade.
- F. Military:** Military marine space usually comprises those areas that are dedicated to military training activities. Some of these areas are permanent and are typically excluded from any other activity. Other marine areas may be temporarily seconded for perhaps large-scale military exercises, but this would presumably cause a halt to all other activities in the selected area. The location of many military areas may not be revealed, so an MSP would have to assume that, unless otherwise told, all marine areas were in fact available. As Saudi Arabia has around 100 smaller military naval vessels (see Global Firepower, 2016) these vessels would undoubtedly require training areas at specified times. It is highly likely that most military training would occur on land, but given the fact that the country has extensive marine coastlines, then marine activities by both aircraft and army units are also inevitable.
- G. Recreation and resorts:** With a high per capita income, Saudi Arabians are spending increasing amounts on recreation. Given the exceedingly high summer temperatures, many people are drawn towards the coast for a range of activities, which include scuba diving and snorkelling, wind surfing, sailing, recreational angling, shorter duration cruises, hunting, and underwater exploration (mainly of the coral reefs). Some major coastal resorts are beginning to develop, though use of the coast is generally widespread, especially in areas of higher population density. From the MSP perspective, it will be essential that at least minimal coastal stretches of water are designated for the more popular recreational pastimes, certainly in more populous areas.
- H. Urban and port development:** Because most of this development occurs along the coastal fringe, it may not always be thought of as a marine area that needs to be considered in a larger scale MSP. However, these areas of major development,

<sup>55</sup> The total per annum landings figure of about 120 000 tonnes varies considerably from the figure of 77 600 tonnes (2006) given, but the latter may just be recording finfish, i.e. excluding crustaceans.

as well as areas designated for future development, may have major impacts on the surrounding seas, especially as populations are increasingly gravitating towards the coastline.<sup>56</sup> Impacts are caused by building and dredging disturbance, increased shipping activities, increases in recreation, loss of coastal habitats, increasingly turbid waters and aquatic pollution, etc. These types of impacts have already been felt in various coastal developments in the Gulf, and it can be anticipated that this trend will continue.

#### SOURCES:

- Bruckner, A.W., Alnazry, H.H. & Faisal, M.** 2011. A paradigm shift for fisheries management to enhance recovery, resilience, and sustainability of coral reef ecosystems in the Red Sea. In W.W. Taylor, A.J. Lynch & M.G. Schechter, eds. *Sustainable fisheries: multi-level approaches to a global problem*, pp. 85–111. Bethesda, Maryland, USA, American Fisheries Society. (also available at [www.livingoceansfoundation.org/assets/2013/08/Bruckner-AFS2011-Red-Sea-Fisheries.pdf](http://www.livingoceansfoundation.org/assets/2013/08/Bruckner-AFS2011-Red-Sea-Fisheries.pdf)).
- Cardia, F., Aguilar-Manjarrez, J. & Lovatelli, A.** 2015. Zoning and site selection for the sustainable development of fish cage culture in the Kingdom of Saudi Arabia. *FAO Aquaculture Newsletter*. March 2015. No. 53. pp. 32–34.
- De Young, C.** 2006. *Review of the state of world marine capture fisheries: Indian Ocean*. FAO Fisheries Technical Paper No. 488. FAO, Rome, Italy. (also available at [www.fao.org/docrep/009/a0477e/a0477e00.HTM](http://www.fao.org/docrep/009/a0477e/a0477e00.HTM)).
- Global Firepower.** 2016. Saudi Arabia military strength [online]. The Kingdom of Saudi Arabia. [Cited 17 October 2016].  
[www.globalfirepower.com/country-military-strength-detail.asp?country\\_id=saudi-arabia](http://www.globalfirepower.com/country-military-strength-detail.asp?country_id=saudi-arabia)
- Marine Conservation Institute.** 2016. SeaStates G20 2014: No-take reserves in the world's largest economies [online]. Seattle, United States of America (Cited 17 October 2016).  
<http://marine-conservation.org/seastates/g20/2014>
- Moussalli, E. & Feidi, I.H.** 2010. Red Sea and Gulf fisheries. In R.Q. Grafton, R. Hilborn, D. Squires, M. Tait & M. Williams, eds. *Handbook of marine conservation and management*, pp. 426–443. USA, Oxford University Press.
- Oil Peak.** 2012. Saudi Arabia Energy Report. Useful information and discussion about energy, including oil and gas reserves, climate change, renewable energy, ethanol and other bio fuels, hydrogen, Peak Oil and geopolitics. [online]. United States of America. [Cited 17 October 2016].  
[www.endofcrudeoil.com/2012/05/saudi-arabia-energy-report.html](http://www.endofcrudeoil.com/2012/05/saudi-arabia-energy-report.html)

<sup>56</sup> The MPAtlas for Saudi Arabia (see Marine Conservation Institute, 2016.). It notes: "Population growth in the coastal zone has increasingly threatened the sustainability of the country's marine ecosystems...". Marine Conservation Institute. 2016. MPAtlas [online]. Seattle, United States of America. [Cited 17 October 2016].  
[www.mpatlas.org/region/nation/SAU](http://www.mpatlas.org/region/nation/SAU)



## Annex 3

### Information sources on marine spatial planning

1. Recommended further reading (relevant papers not cited in main document). They have been categorized into specific thematic areas, but as there is a large amount of overlap between themes, it is best to consult all categories.

#### BASIC PRINCIPLES AND GENERAL FRAMEWORKS

- Arkema, K.K., Abramson, S.C. & Dewsbury, B.M. 2006. Marine ecosystem-based management: from characterization to implementation. *Frontiers in Ecology and the Environment*, 4(10): 525–532.
- Collie, J.S., Adamowicz, W.L., Beck, M.W., Craig, B., Essington, T.E., Fluharty, D., Rice, J. & Sanchirico, J.N. 2013. Marine spatial planning in practice. *Estuarine, Coastal and Shelf Science*, 117: 1–11.
- Dickinson, M., Rutherford, M. & Gunton, T. 2010. Principles for integrated marine planning: a review of international experience. *Environments Journal*, 37(3): 21–46.
- Douvere, F. 2008. The importance of marine spatial planning in advancing ecosystem-based sea use management. *Marine Policy*, 32: 762–772.
- Douvere, F. & Ehler, C., eds. 2008. Special issue on marine spatial planning. *Marine Policy*, 32(5): 759–843.
- Douvere, F. & Ehler, C. 2009. Ecosystem-based marine spatial management: an evolving paradigm for the management of coastal and marine places. *Ocean Yearbook*, 23: 1–26.
- Duck, R.W. 2012. Marine spatial planning: managing a dynamic environment. *Journal of Environmental Policy and Planning*, 14(1): 67–79.
- Frazão Santos, C., Domingos, T., Ferreira, M.A., Orbach, M. & Andrade, F. 2014. How sustainable is sustainable marine spatial planning? Part I – linking the concepts. *Marine Policy*, 49: 59–65.
- Frazão Santos, C., Michel, J., Neves, M., Janeiro, J., Andrade, F. & Orbach, M. 2013. Marine spatial planning and oil spill risk analysis: finding common grounds. *Marine Pollution Bulletin*, 74(1): 73–81.
- Gazzola, P., Roe, M.H. & Cowie, P.J. 2015. Marine spatial planning and terrestrial spatial planning: reflecting on new agendas. *Environment and Planning C: Government and Policy*, 33: 1156–1172.
- Jay, S. 2010. Built at sea: marine management and the construction of marine spatial planning. *Town Planning Review*, 81: 173–192.
- Jay, S. 2012. Marine space: manoeuvring towards a relational understanding. *Journal of Environmental Policy and Planning*, 14(1): 81–96.
- Jay, S., Flannery, W., Vince, J., Liu, W-H., Guifang Xue, J., Matczak, M., Zaucha, J., Janssen, H., van Tatenhove, J., Toonen, H., Morf, A., Olsen, E., Suárez de Vivero, J.L., Rodríguez Mateos, J.C., Calado, H., Duff, J. & Hanna, D. 2013. International Progress in Marine Spatial Planning. *Ocean Yearbook*, 27(1): 171–212.
- Katsanevakis, S., Stelzenmüller, V., South, A., Kirk Sørensen, T., Jones, P.S., Kerr, S., Badalamenti, F., Anagnostou, C., Breen, P., Chust, G., D’Anna, G., Duijn, M., Filatova, T., Fiorentino, F., Hulsman, H., Johnson, K.R., Karageorgis, A.P., Kröncke, I., Mirto, S., Pipitone, C., Portelli, S., Qiu, W., Reiss, H., Sakellariou, D., Salomidi, M., van Hoof, L., Vassilopoulou, V., Vega Fernández, T., Vöge, S., Weber, A., Zenetos, A. & ter Hofstede, R. 2011. Ecosystem-based marine spatial management: review of concepts, policies, tools, and critical issues. *Ocean & Coastal Management*, 54(11): 807–820.

- Kidd, S. & Ellis, G.** 2012. From the land to sea and back again? Using terrestrial planning to understand the process of marine spatial planning. *Journal of Environmental Policy and Planning*, 14(1): 49–66.
- Kidd, S., Plater, A. & Frid, C.** 2011. *The ecosystem approach to marine planning and management*. London, Earthscan. 230 pp.
- McCann, J., Smythe, T., Fugate, G., Mulvaney, K. & Turek, D.** 2014. *Identifying marine spatial planning gaps, opportunities, and partners: an assessment*. Narragansett, Rhode Island, USA, Coastal Resources Center and Rhode Island Sea Grant College Program. pp. 60. (also available at [http://seagrant.gso.uri.edu/wp-content/uploads/2014/10/CRC\\_MSPassessmentreport\\_FINAL.pdf](http://seagrant.gso.uri.edu/wp-content/uploads/2014/10/CRC_MSPassessmentreport_FINAL.pdf)).
- McLeod, K. & Leslie, H., eds.** 2009. *Ecosystem-based management for the oceans*. Washington, DC, Island Press. 392 pp.
- Mengerink, K., Schempp, A. & Austin, J.** 2009. *Ocean and coastal ecosystem-based management: implementation handbook*. Washington, DC, Environmental, Law Institute. 158 pp. (also available at [www.eli.org/sites/default/files/eli-pubs/d19\\_03.pdf](http://www.eli.org/sites/default/files/eli-pubs/d19_03.pdf)).
- National Ocean Council.** 2013. *Marine planning handbook*. (available at [https://www.whitehouse.gov/sites/default/files/final\\_marine\\_planning\\_handbook.pdf](https://www.whitehouse.gov/sites/default/files/final_marine_planning_handbook.pdf)).
- Patraiko, D. & Holthus, P.** 2013. *The shipping industry and marine spatial planning. A professional approach*. London, the Nautical Institute and the World Ocean Council. 14 pp. (also available at [www.nautinst.org/en/forums/msp/](http://www.nautinst.org/en/forums/msp/)).
- Smith, H.D., Maes, F., Stojanovic, T.A. & Ballinger, R.C.** 2011. The integration of land and marine spatial planning. *Journal of Coastal Conservation*, 15: 291–303.
- Tallis, H., Levin, P.S., Ruckelshaus, M., Lester, S.E., McLeod, K.L., Fluharty, D.L. & Halpern, B.S.** 2010. The many faces of ecosystem-based management: making the process work today in real places. *Marine Policy*, 34: 340–348.
- World Ocean Council.** 2016. *Ocean Industries and Marine Planning*. (available at <https://www.openchannels.org/sites/default/files/literature/Ocean%20Industries%20and%20Marine%20Planning.pdf>).

## **SOCIAL AND STAKEHOLDER**

- Gopnik, M., Fieseler, C., Cantral, L. & McClellan, K.** 2012. Coming to the table: early stakeholder engagement in marine spatial planning. *Marine Policy*, 36: 1139–1149.
- Kidd, S. & Shaw, D.** 2014. The social and political realities of marine spatial planning. *ICES Journal of Marine Science*, doi:10.1093/icesjms/fsu006.
- Le Cornu, E., Kittinger, J.N., Koehn, J.Z., Finkbeiner, E.M. & Crowder, L.B.** 2014. Current practice and future prospects for social data in coastal and ocean planning. *Conservation Biology*, 28(4): 902–911.
- Léopold, M., Beckensteiner, J., Kaltavara, J., Raubani, J. & Caillon, S.** 2013. Community-based management of near-shore fisheries in Vanuatu: what works? *Marine Policy*, 42: 167–176.
- Olsen, E., Fluharty, D., Hoel, A.H., Hostens, K., Maes, F. & Pecceu, E.** 2014. Integration at the round table: marine spatial planning in multi-stakeholder settings. *PLoS ONE*, 9(10): e109964, doi:10.1371/journal.pone.0109964.
- Ritchie, H. & Ellis, G.** 2010. A system that works for the sea? Exploring stakeholder engagement in marine spatial planning. *Journal of Environmental Planning and Management*, 53(6): 701–723.
- Vaartjes, V., Hanich, Q. & Delisle, A.** 2015. *Empowering community-based ecosystem approaches to fisheries management: strategies for effective training and learning*. Australia, University of Wollongong. (also available at <http://ro.uow.edu.au/uowbooks/11>).

- Vierros, M., Douvere, F. & Arico, S.** 2006. *Implementing the ecosystem approach in open ocean and deep sea environments. An analysis of stakeholders, their interests and existing approaches.* Tokyo, Japan, United Nations University – Institute for Advanced Studies. 44 pp. (also available at [http://collections.unu.edu/eserv/UNU:3096/DeepSea\\_Stakeholders.pdf](http://collections.unu.edu/eserv/UNU:3096/DeepSea_Stakeholders.pdf)).
- WorldFish.** 2013. *Community-based marine resource management in Solomon Islands: a facilitator's guide. Based on lessons from implementing CBRM with rural coastal communities in Solomon Islands (2005–2013).* Penang, Malaysia, CGIAR Research Program on Aquatic Agricultural Systems. Manual: AAS-2013-17. 52 pp. (also available at [http://pubs.iclarm.net/resource\\_centre/AAS-2013-17.pdf](http://pubs.iclarm.net/resource_centre/AAS-2013-17.pdf)).

## ECONOMICS

- Barbier, E.B., Hacker, S.D., Kennedy, C., Koch, E.W., Stier, A.C. & Silliman, B.R.** 2010. The value of estuarine and coastal ecosystem services. *Ecological Monographs*, 81(2): 169–193.
- Bartelings, H., Hamon, K.G., Berkenhagen, J. & Buisman, F.C.** 2015. Bio-economic modelling for marine spatial planning application in North Sea shrimp and flatfish fisheries. *Environmental Modelling & Software*, 74: 156–172.
- Berkenhagen, J., Döring, R., Fock, H.O., Kloppmann, M.H.F., Pedersen, S.A. & Schulze, T.** 2010. Decision bias in marine spatial planning of offshore wind farms: problems of singular versus cumulative assessments of economic impacts on fisheries. *Marine Policy*, 34: 733–736.
- Holland, D.S., Sanchirico, J.N., Johnston, R.J. & Joglekar, D.** 2010. *Economic analysis for ecosystem-based management: applications to marine and coastal environments.* RFF Press. 236 pp.
- White, C., Halpern, B.S. & Kappe, C.V.** 2012. Ecosystem service trade-off analysis reveals the value of marine spatial planning for multiple ocean uses. *Proceedings of the National Academy of Sciences*, 109(12): 4696–4701.

## ENVIRONMENTAL

- Agardy, T.** 2000. Information needs for marine protected areas: scientific and societal. *Bulletin of Marine Science*, 66(3): 875–888.
- Bogaert, D., Cliquet, A. & Maes, F.** 2009. Designation of marine protected areas in Belgium: a legal and ecological success? *Marine Policy*, 33: 878–886.
- Caldow, C., Pittman, S.J., Kendall, M.S., Goedeke, T.L., Menza, C., Kinlan, B.P. & Costa, B.M.** 2015. Biogeographic assessments: a framework for information synthesis in marine spatial planning. *Marine Policy*, 51: 423–432.
- Crain, C.M., Kroeker, K., & Halpern, B.S.** 2008. Interactive and cumulative effects of multiple human stressors in marine systems. *Ecology Letters*, 11: 1304–1315.
- Fulton, E.A., Smith, A.D.M., Smith, D.C. & Johnson, P.** 2014. An integrated approach is needed for ecosystem based fisheries management: insights from ecosystem-level management strategy evaluation. *PLoS ONE*, 9(1): e84242. doi:10.1371/journal.pone.0084242.
- Kyriazis, Z., Maes, F., Rabauta, M., Vincx, M. & Degraer, S.** 2013. The integration of nature conservation into the marine spatial planning process. *Marine Policy*, 38: 133–139.
- Secretariat of the Convention on Biological Diversity and the Scientific and Technical Advisory Panel–GEF.** 2012. *Marine spatial planning in the context of the Convention on Biological Diversity: a study carried out in response to CBD COP 10 Decision X/29.* Montreal, Canada, CBD Secretariat. 44 pp.

**LEGAL AND GOVERNANCE**

- Archer, J.H.** 1992. Sovereign rights and responsibilities: applying public trust principles to the management of EEZ space and resources. *Ocean & Coastal Management*, 17: 253–271.
- Backer, H.** 2011. Transboundary maritime spatial planning: a Baltic Sea perspective. *Journal of Coastal Conservation*, 15(2): 279–289.
- De Santo, E.M.** 2011. Environmental justice implications of maritime spatial planning in the European Union. *Marine Policy*, 35(1): 34–38.
- Drankier, P.** 2012. Embedding maritime spatial planning in national legal frameworks. *Journal of Environmental Policy & Planning*, 14(1): 7–27.
- Eagle, J., Sanchirico, J.N., & Thompson, B.H.** 2008. Ocean zoning and spatial access privileges: rewriting the tragedy of the regulated ocean. *NYU Environmental Law Journal*, 17(1): 646–668.
- Hassan, D., Kuokkanen, T. & Soininen, N.** 2015. *Transboundary marine spatial planning and international law*. Oxford, UK, Earthscan, Taylor & Francis.
- International Federation of Surveyors (FIG).** 2006. *Administering marine spaces: international issues*. A publication of FIG Commissions 4 and 7 Working Group 4.3. Copenhagen, Denmark, FIG. 180 pp.
- Jones, P.S.J., Lieberknecht, L.M. & Qiu, W.** 2016. Marine spatial planning in reality: Introduction to case studies and discussion of findings. *Marine Policy*, 71: 256–264.
- Kidd, S. & McGowan, L.** 2013. Constructing a ladder of transnational partnership working in support of marine spatial planning: thoughts from the Irish Sea. *Journal of Environmental Management*, 126: 63–71.
- Mengerink, K. & Armsby, M.** 2010. *Coastal and marine spatial planning: legal considerations*. Washington, DC, Environmental Law Institute and the Center for Ocean Solutions. 79 pp. (available at [www.eli.org/sites/default/files/docs/cmstp\\_legal\\_workshop\\_background\\_paper.pdf](http://www.eli.org/sites/default/files/docs/cmstp_legal_workshop_background_paper.pdf)).
- Ruckelshaus, M., Klinger, T., Knowlton, N. & Demaster, D.R.** 2008. Marine ecosystem-based management in practice: scientific, and governance challenges. *BioScience*, 58: 53–63.
- Silver, J.J.** 2013. Neoliberalizing coastal space and subjects: on shellfish aquaculture projections, interventions and outcomes in British Columbia, Canada. *Journal of Rural Studies*, 32: 430–438.
- TPEA.** 2014. *Transboundary planning in the European Atlantic: pilot areas report*. Liverpool, UK, University of Liverpool. 31 July 2014.

**MARINE FISHERIES**

- Campbell, M.S., Stehfest, K.M., Votier, S.C. & Hall-Spencer, J.M.** 2014. Mapping fisheries for marine spatial planning: gear-specific vessel monitoring systems (VMS), marine conservation and offshore renewable energy. *Marine Policy*, 45: 293–300.
- Flower, K.R., Atkinson, S.R., Brainard, R., Courtney, C., Parker, B.A., Parks, J., Pomeroy, R., & White, A.** 2013. *Toward ecosystem-based coastal area and fisheries management in the Coral Triangle: integrated strategies and guidance*. Coral Triangle Initiative Support Program for the United States Agency for International Development, Jakarta, Indonesia. 114 pp. (also available at [www.coraltriangleinitiative.org/library/guidelines-toward-ecosystem-based-coastal-area-and-fisheries-management-coral-triangle](http://www.coraltriangleinitiative.org/library/guidelines-toward-ecosystem-based-coastal-area-and-fisheries-management-coral-triangle)).
- Fock, H.O.** 2008. Fisheries in the context of marine spatial planning: defining principal areas for fisheries in the German EEZ. *Marine Policy*, 32(4): 728–739.
- Jennings, S., Lee, J. & Hiddink, J.G.** 2012. Assessing fishery footprints and the trade-offs between landings value, habitat sensitivity, and fishing impacts to inform marine spatial planning and an ecosystem approach. *ICES Journal of Marine Science*, 69: 1053–1063.

- Möllmann, C., Lindegren, M., Blenckner, T., Bergström, L., Casini, M., Diekmann, R., Flinkman, J., Müller-Karulis, B., Neuenfeldt, S., Schmidt, J. O., Tomczak, M., Voss, R., & Gårdmark, A. 2014. Implementing ecosystem-based fisheries management: from single-species to integrated ecosystem assessment and advice for Baltic Sea fish stocks. *ICES Journal of Marine Science*, 71(5): 1187–1197.
- Norse, E.A. 2010. Ecosystem-based spatial planning and management of marine fisheries: why and how? *Bulletin of Marine Science*, 86(2): 179–195.
- Stelzenmüller, V., Rogers, S.I. & Mills, C.M. 2008. Spatio-temporal patterns of fishing pressure on UK marine landscapes, and their implications for spatial planning and management. *ICES Journal of Marine Science*, 65: 1081–1091.

## MARICULTURE

- Brigolin, D., Lourguioui, H., Taji, M., Venier, C., Mangin, A., & Pastres, R. 2015. Space allocation for coastal aquaculture in North Africa: data constraints, industry requirements and conservation issues. *Ocean & Coastal Management*, 116: 89–97.
- McGinnis, M.V. & Collins, M. 2013. A race for marine space: science, values, and aquaculture planning in New Zealand. *Coastal Management*, 41(5): 401–419.
- Olofsson, E. & Andersson, J. 2014. *Spatial planning guidelines for Baltic Sea Region aquaculture*. Report from the Aquabest project. Helsinki, Finland, Finnish Game and Fisheries Research Institute (also available at [www.aquabestproject.eu/media/14378/aquabest\\_3\\_2014\\_report.pdf](http://www.aquabestproject.eu/media/14378/aquabest_3_2014_report.pdf)).

## National examples and best practice

Country or Region	Reference
Australia	Day, J. 2002. Zoning – lessons from the Great Barrier Reef Marine Park. <i>Ocean &amp; Coastal Management</i> , 45: 139–156. Day, J. 2008. The need and practice of monitoring, evaluating and adapting marine planning and management – lessons from the Great Barrier Reef. <i>Marine Policy</i> , 32: 823–831. Day, V., Paxinos, R., Emmett, J., Wright, A. & Goecker, M. 2008. The marine planning framework for South Australia: a new ecosystem-based zoning policy for marine management. <i>Marine Policy</i> , 32: 535–543. Paxinos, R., Wright, A., Day, V., Emmett, J., Frankiewicz, D. & Goecker, M. 2008. Marine spatial planning: ecosystem-based zoning methodology for marine management in South Australia. <i>Journal of Conservation Planning</i> , 4: 37–59.
Baltic, Barents and North Seas	Backer, H. & Frias, M., eds. 2012. <i>Planning the Bothnian Sea – key findings of the Plan Bothnia project</i> . Turku, Finland, Finepress. pp. 160. (also available at <a href="http://helcom.fi/Lists/Publications/Planning%20the%20Bothnian%20Sea.pdf">http://helcom.fi/Lists/Publications/Planning%20the%20Bothnian%20Sea.pdf</a> ). Blæsbjerg, M., Pawlak, J.F., Sørensen, T.K. & Vestergaard, O. 2009. <i>Marine spatial planning in the Nordic region – principles, perspectives and opportunities</i> . Nordic Council of Ministers, Copenhagen, Denmark. pp 98. (also available at <a href="http://www.imr.no/filarkiv/2011/03/msp_nordic_region.pdf/en">www.imr.no/filarkiv/2011/03/msp_nordic_region.pdf/en</a> ). Degnbol, D. & Wilson, D.C. 2008. Spatial planning on the North Sea: a case of cross-scale linkages. <i>Marine Policy</i> , 32: 189–200. Knol, M. 2010. Scientific advice in integrated ocean management: the process towards the Barents Sea plan. <i>Marine Policy</i> , 34: 252–260. Olsen, E., Gjosæter, H., Røttingen, I., Dommasnes, A., Fossum, P. & Sandberg, P. 2007. The Norwegian ecosystem-based management plan for the Barents Sea. <i>ICES Journal of Marine Science</i> , 64(4): 599–602.
Canada	Flannery, W. & Ó Cinnéide, M. 2012. Deriving lessons relating to marine spatial planning from Canada's Eastern Scotian Shelf Integrated Management Initiative. <i>Journal of Environmental Policy &amp; Planning</i> , 14: 97–117. Hall, T., MacLean, M., Coffen-Smout, S. & Herbert, G. 2011. Advancing objectives-based, integrated ocean management through marine spatial planning: current and future directions on the Scotian Shelf off Nova Scotia, Canada. <i>Journal of Coastal Conservation</i> , 15(2): 247–255. McCuaig, J. & Herbert, G. 2013. <i>Review and evaluation of the Eastern Scotian Shelf Integrated Management (ESSIM) Initiative</i> . (available at <a href="http://publications.gc.ca/collections/collection_2013/mpo-dfo/Fs97-6-3025-eng.pdf">http://publications.gc.ca/collections/collection_2013/mpo-dfo/Fs97-6-3025-eng.pdf</a> ).

Country or Region	Reference
Caribbean	<b>Fanning, L., Mahon, R. &amp; McConney, P.</b> 2009. Focusing on living marine resource governance: the Caribbean Large Marine Ecosystem and adjacent areas project. <i>Coastal Management</i> , 37: 219–234. <b>Pomeroy, R.S., Baldwin, K. &amp; McConney, P.</b> 2014. Marine spatial planning in Asia and the Caribbean: application and implications for fisheries and marine resource management. <i>Desenvolvimento e Meio Ambiente</i> , 32: 151–164.
Croatia	<b>Katavic, I., Herstad, T.-J., Kryvi, H., White, P., Franicevic, V. &amp; Skakelj, N., eds.</b> 2005. <i>Guidelines to marine aquaculture planning, integration and monitoring in Croatia</i> . Output of the “Coastal zone management plan for Croatia” project. Zagreb, Croatia. pp. 78. (also available at <a href="http://ccrm.vims.edu/publications/pubs/aquaculture%20guidelines.pdf">http://ccrm.vims.edu/publications/pubs/aquaculture%20guidelines.pdf</a> ).
Europe	<b>C-Scope.</b> 2012. <i>Why one size won't fit all: marine spatial planning in Belgium and Dorset</i> . Key messages from the “Combining sea and coastal planning in Europe” (C-SCOPE) project. (also available at <a href="http://www.cscope.eu/files/results/c-scope-report.pdf">www.cscope.eu/files/results/c-scope-report.pdf</a> ) <b>Flannery, W. &amp; Ó Cinnéide, M.</b> 2012. A roadmap for marine spatial planning: a critical examination of the European Commission's guiding principles based on their application in the Clyde MSP Pilot Project. <i>Marine Policy</i> , 36: 265–271.
France	<b>Trouillet, B., Guineberteau, T., de Cacqueray, M. &amp; Rochette, J.</b> 2011. Planning the sea: the French experience – contribution to marine spatial planning perspectives. <i>Marine Policy</i> , 35(3): 324–334.
Germany	<b>Jay, S., Klenke, T., Ahlhorn, F. &amp; Ritchie, H.</b> 2012. Early European experience in marine spatial planning: planning the German exclusive economic zone. <i>European Planning Studies</i> , 20: 2013–2031. <b>Kannen, A.</b> 2012. Challenges for marine spatial planning in the context of multiple sea uses, policy arenas and actors based on experiences from the German North Sea. <i>Regional Environmental Change</i> , 14(6): 2139–2150.
Ireland	<b>Flannery, W.</b> 2014. <i>Review of marine spatial planning best practice of relevance to Ireland</i> . School of Planning, Architecture and Civil Engineering. Belfast, Queen's University Belfast. pp. 44.
Middle East	<b>Portman, M.E.</b> 2015. Marine spatial planning in the Middle East: crossing the policy-planning divide. <i>Marine Policy</i> , 61: 8–15.
Scotland (UK)	<b>Kelly, C., Gray, L., Shucksmith, R. &amp; Tweddle, J.</b> 2012. <i>Review of the marine spatial plan for the Shetland Islands</i> . Scalloway, Shetland, Scotland, NAFC Marine Centre. pp 41. (also available at <a href="https://www.nafc.uhi.ac.uk/research/msp/simsp/SIMSP_Review_2012.pdf">https://www.nafc.uhi.ac.uk/research/msp/simsp/SIMSP_Review_2012.pdf</a> ). <b>Tweddle, J.F., Marengo, I., Gray, L., Kelly, C. &amp; Shucksmith, R.</b> 2014. Developing regional locational guidance for wave and tidal energy in the Shetland Islands. <i>Marine Policy</i> , 50: 53–66.
Transboundary	<b>Wadden Sea Forum.</b> 2010. <i>Without frontiers: achievements in cross-border, cross-sector communication and cooperation</i> . (available at <a href="http://www.waddensea-forum.org/index.php/strategy/without-frontiers">www.waddensea-forum.org/index.php/strategy/without-frontiers</a> ).

## ZONING

- Agardy, T.** 2010. *Ocean zoning: making marine management more effective*. London, UK, Earthscan. 213 pp.
- Agostini, V.N., Margles, S.M., Schill, S.R., Knowles, J.E. & Blyther, R.J.** 2010. *Marine zoning in Saint Kitts and Nevis: a path towards sustainable management of marine resources*. Florida, USA, the Nature Conservancy and USAID. pp. 288. (also available at [http://marineplanning.org/pdf/StKitts\\_Nevis\\_Full\\_Report.pdf](http://marineplanning.org/pdf/StKitts_Nevis_Full_Report.pdf)).
- Boyes, S.J., Elliott, M., Thomson, S.M., Atkins, S. & Gilliland, P.** 2007. A proposed multiple-use zoning scheme for the Irish Sea: an interpretation of current legislation through the use of GIS-based zoning approaches and effectiveness for the protection of nature conservation interests. *Marine Policy*, 31: 287–298.
- Courtney, F. & Wiggin, J.** 2002. *Ocean zoning for the Gulf of Maine: a background paper*. Boston, USA, Gulf of Maine Council for the Marine Environment. 31 pp.
- Doherty, P.A. & Butler, M.** 2006. Ocean zoning in the Northwest Atlantic. *Marine Policy*, 30(4): 389–391.

Klein, C.J., Steinback, C., Watts, M., Scholz, A.J. & Possingham, H.P. 2010. Spatial marine zoning for fisheries and conservation. *Frontiers in Ecology and the Environment*, 8: 349–353.

#### DATA AND INFORMATION RELATED

Calado, H. & Gil, A. 2010. *Geographic technologies applied to marine spatial planning and integrated coastal zone management*. Ponta Delgada, Portugal, Universidade dos Açores. 166 pp. (also available at <https://repositorio.uac.pt/bitstream/10400.3/569/4/Geographic-Technologies-Applied-to-Marine-Spatial-Planning-and-ICZM.pdf>).

Center for Ocean Solutions. 2011. *Decision guide: selecting decision support tools for marine spatial planning*. Stanford University, California, USA, the Woods Institute for the Environment. 56 pp. (also available at [www.centerforoceansolutions.org/sites/default/files/publications/cos\\_msp\\_guide\\_6.pdf](http://www.centerforoceansolutions.org/sites/default/files/publications/cos_msp_guide_6.pdf)).

Cravens, A.E. 2015. Negotiation and decision making with collaborative software: how MarineMap ‘changed the game’ in California’s marine life protected act initiative. *Environmental Management* [online]: 1–24. (available at [www.amandaecravens.com/uploads/3/7/2/9/37297517/cravens\\_marinemap\\_postprint\\_sept2015.pdf](http://www.amandaecravens.com/uploads/3/7/2/9/37297517/cravens_marinemap_postprint_sept2015.pdf)).

Delavenne, J., Metcalfe, K., Smith, R.J., Vaz, S., Martin, C.S., Dupuis, L., Coppin, F. & Carpentier, A. 2012. Systematic conservation planning in the eastern English Channel: comparing the Marxan and Zonation decision-support tools. *ICES Journal of Marine Science*, 69(1): 75–83.

Gimpel, A., Stelzenmüller, V., Grote, B., Buck, B., Floeter, J., Nunez Robinn, I., Pogoda, B. & Temming, A. 2015. A GIS modelling framework to evaluate marine spatial planning scenarios: Co-location of offshore wind farms and aquaculture in the German EEZ. *Marine Policy* 55: 102–115.

NOAA. 2010. *Mapping human uses of the ocean informing marine spatial planning through participatory GIS*. Maryland, USA, NOAA. 12 pp. (also available at [http://marineprotectedareas.noaa.gov/pdf/helpful-resources/mapping\\_human\\_uses\\_nov2010.pdf](http://marineprotectedareas.noaa.gov/pdf/helpful-resources/mapping_human_uses_nov2010.pdf)).

Olson, J. 2010. Seeding nature, ceding culture: redefining the boundaries of the marine commons through spatial management and GIS. *Geoforum*, 41(2): 293–303.

Portman, M.E. 2014. Visualization for planning and management of oceans and coasts. *Ocean & Coastal Management*, 98: 176–185.

Shucksmith, R., Gray, L., Kelly, C. & Tweddle, J.F. 2014. Regional marine spatial planning – the data collection and mapping process. *Marine Policy*, 50: 1–9.

Smith, G. & Brennan, R. 2012. Losing our way with mapping: thinking critically about marine spatial planning in Scotland. *Ocean and Coastal Management*, 69: 210–216.

Stamoulis, K.A. & Delevaux, J.M.S. 2015. Data requirements and tools to operationalize marine spatial planning in the United States. *Ocean and Coastal Management*, 116: 214–223.

Stelzenmuller, V., Lee, J., South, A., Foden, J. & Rogers, S.I. 2013. Practical tools to support marine spatial planning: a review and some prototype tools. *Marine Policy*, 38: 214–227.

Watts, M.E., Ball, I.R., Stewart, R.S., Klein, C.J., Wilson, K., Steinback, C., Lourival, R., Kircher, L. & Possingham, H.P. 2009. Marxan with Zones: software for optimal conservation based land- and sea-use zoning. *Environmental Modelling & Software*, 24: 1513–1521.

Wichorowski, M., Fidler, K. & Zwierz, M. 2011. *Data exchange structure for maritime spatial planning*. BaltSeaPlan Report 20. 92 pp. (also available at [www.baltseaplan.eu/index.php/Reports-and-Publications;809/1#data](http://www.baltseaplan.eu/index.php/Reports-and-Publications;809/1#data)).

## 2. Tools for marine spatial planning and management

TABLE A1

**Web sites giving information on tools for marine spatial planning. Tools listed include both GIS-based programmes for MSP development as well as actual real-life examples.**

Tool	Description	URL address
Atlantis	Atlantis was developed as a full ecosystem simulation model that incorporates climate, oceanography, nutrient availability, food web interactions, and other aspects of ecology in a spatially explicit way. The model is intended for use as a strategic planning tool (long-term decision-making) that can complement annual cycles of stock assessment and policy decisions by allowing users to test management policies and assessment methods against representations of complex ecosystems. Atlantis is primarily used in fishery applications where it allows users to identify trade-offs between and among species, fishing gear types, management goals, and the direct and indirect effects of different management policies. Atlantis can also address issues related to marine habitat, nutrients and biodiversity.	<a href="http://atlantis.cmar.csiro.au">http://atlantis.cmar.csiro.au</a> (Registration required)
Coastal and Marine Spatial Planning Advancement Training (Duke University: Nicholas School of the Environment)	Tool for managers to improve decision-making for the marine resources, users and uses within their jurisdiction. It is primarily aimed at United States managers, but has a range of resources useful to other areas.	<a href="http://sites.nicholas.duke.edu/cmspat">http://sites.nicholas.duke.edu/cmspat</a>
Cumulative Impacts	Cumulative Impacts model has been used primarily to set conservation and management priorities and assess the most vulnerable locations in an area. It has also been used by state agencies in the United States of America as a foundation for an environmental impact assessment.	<a href="https://www.nceas.ucsb.edu/globalmarine">https://www.nceas.ucsb.edu/globalmarine</a>
EBM Tools Network	The EBM Tools Network is an alliance to promote awareness, use and development of tools that can help implement ecosystem-based management (EBM) in coastal and marine environments. As MSP is a means of implementing EBM, virtually all of the EBM toolbox is relevant to MSP.	<a href="http://www.ebmtools.org/msptools.html">www.ebmtools.org/msptools.html</a> <a href="https://ebmtoolsdatabase.org">https://ebmtoolsdatabase.org</a>
EcoGIS	Aims to apply GIS, marine data and custom analysis tools to better enable fisheries scientists and managers to adopt an ecosystem approach to fisheries management (EAFM).	<a href="http://www.st.nmfs.noaa.gov/ecogis/index.html">www.st.nmfs.noaa.gov/ecogis/index.html</a>
GIS tools for marine planning and management	This site provides a publication entitled GIS tools for marine planning and management. As such, it complements the information shown on the ebmtools.org Web site.	<a href="http://www.cbd.int/doc/meetings/mar/mcbem-2014-04/other/mcbem-2014-04-gis-tools-for-msp-and-management-en.pdf">www.cbd.int/doc/meetings/mar/mcbem-2014-04/other/mcbem-2014-04-gis-tools-for-msp-and-management-en.pdf</a>
Managing marine protected areas	The Toolkit aims to act as a first point of call in the search for information on issues that MPA managers and practitioners face in day-to-day operations. Focused on the West Indian region.	<a href="http://wiomsa.org/mpatoolkit/Home.htm">http://wiomsa.org/mpatoolkit/Home.htm</a>
MarineMap	Originally designed to support California's Marine Life Protection Act (MLPA) Initiative, but has also been used to assist in the design of marine protected areas by helping users easily visualize oceanographic, biological, geological, chemical and human dimensions of the ocean and coastal areas. Oregon State has since developed Oregon MarineMap, which works in a similar fashion.	<a href="http://msi.ucsb.edu/marinemap">http://msi.ucsb.edu/marinemap</a>
Marine Planning: Practical approaches to ocean and coastal decision-making	Helps marine and coastal decision-makers navigate real-world challenges and reach effective solutions. Useful sections on decision support, case studies and resources.	<a href="http://marineplanning.org">http://marineplanning.org</a> <a href="http://www.marineplanning.org/Case_Studies/USA_WCoast_AssessFish_Habitat.html">http://www.marineplanning.org/Case_Studies/USA_WCoast_AssessFish_Habitat.html</a>
Marxan/Marxan with Zones	Freely available conservation planning software. Provides decision support to a range of conservation planning problems, including the design of new reserves, reporting on the performance of existing reserve systems, and developing multiple-use zoning plans for natural resource management.	<a href="http://www.uq.edu.au/marxan">www.uq.edu.au/marxan</a>



Tool	Description	URL address
MSP Challenge	This site provides two MSP-based simulations, developed in the Netherlands, which allow “participants” to experience: (i) the social interactions involved in obtaining maximum inputs from stakeholders; and (ii) a simulation that makes specific reference to international coordination.	<a href="http://www.mspchallenge.org/msp-challenge">www.mspchallenge.org/msp-challenge</a>
Offshore Marine Cadastre	This is an example from the United States of America of an integrated marine information system that provides data, tools and technical support for ocean and Great Lakes planning. It was designed specifically to support renewable energy siting on the U.S. Outer Continental Shelf, but is also being used for other ocean-related efforts.	<a href="http://www.marinecadastre.gov">www.marinecadastre.gov</a>
Open OceanMap	Data collection tool used to effectively collect local expert knowledge in support of MSP and inform fisheries management and marine habitat protection.	<a href="https://launchpad.net/openoceanmap">https://launchpad.net/openoceanmap</a>
SeaSketch	Users can generate hundreds of alternative proposals representing a range of perspectives and interests in our accessible map interface. Zoning, regulatory or management plans can incorporate the diverse ideas of stakeholders most affected by those decisions, in addition to those of the planners and scientists involved. SeaSketch can be configured to support both large participatory projects or small group exercises.	<a href="http://www.seasketch.org/home.html">www.seasketch.org/home.html</a>

Note: Tools in the context of this document is given a wide definition and refers to a means or method of implementing MSP as well as training for it.

### 3. Marine spatial planning in practice: official documents

#### Australia

Australia has developed a series of marine bioregional plans for exclusive economic zone (EEZ) waters to improve the way oceans are managed and to help them remain healthy and productive. The plans are statutory and binding on users. The plans describe the marine environment and conservation values of each marine region, set out broad biodiversity objectives, identify regional priorities, and outline strategies and actions to address these priorities. Links to the various plans and specific elements are:

- General information: [www.environment.gov.au/marine/marine-bioregional-plans](http://www.environment.gov.au/marine/marine-bioregional-plans)
- Benthic regionalization: [www.environment.gov.au/resource/benthic-marine-bioregionalisation-australia%E2%80%99s-exclusive-economic-zone](http://www.environment.gov.au/resource/benthic-marine-bioregionalisation-australia%E2%80%99s-exclusive-economic-zone)
- Pelagic regionalization: [www.environment.gov.au/resource/pelagic-regionalisation-national-marine-bioregionalisation-integration-project](http://www.environment.gov.au/resource/pelagic-regionalisation-national-marine-bioregionalisation-integration-project)

One of the best-known examples of spatial planning and zoning as a management approach is the Great Barrier Reef Marine Park. There, spatial planning and marine zones were established to: maintain the biological diversity and ecological systems that create the Great Barrier Reef; manage the impacts of increasing recreation and expanding tourist industry; manage the effects of recreational and commercial fishing; and manage the impacts of risks of land-based pollution and shipping.

- General information: [www.gbrmpa.gov.au](http://www.gbrmpa.gov.au).
- Plans and permits: [www.gbrmpa.gov.au/zoning-permits-and-plans](http://www.gbrmpa.gov.au/zoning-permits-and-plans).
- Zoning plan: [www.gbrmpa.gov.au/zoning-permits-and-plans/zoning](http://www.gbrmpa.gov.au/zoning-permits-and-plans/zoning).

#### Canada

While Canada has no formalized approach to MSP per se, five Large Ocean Management Areas (LOMAs) have been created to plan and manage marine activities in an integrated way. These are overseen by different departments within the provincial governments that exercise authority over different spatial components of the marine area. Examples of the LOMA plans can be found at these links:

- **Beaufort Sea Partnership.** 2009. *The Beaufort Sea integrated oceans management planning atlas*. Available at [www.beaufortseapartnership.ca/wp-content/uploads/2015/04/November-2008-Beaufort\\_Sea\\_Atlas.pdf](http://www.beaufortseapartnership.ca/wp-content/uploads/2015/04/November-2008-Beaufort_Sea_Atlas.pdf).
- **Fisheries and Oceans Canada.** 2007. *Eastern Scotian Shelf integrated ocean management plan*. Fisheries and Oceans Canada, Dartmouth, Nova Scotia. Available at [www.dfo-mpo.gc.ca/Library/333115.pdf](http://www.dfo-mpo.gc.ca/Library/333115.pdf).
- **Fisheries and Oceans Canada.** 2012. *Placentia Bay/Grand Banks Large Ocean Management Area integrated management plan 2012–2017*. Fisheries and Oceans Canada, St. John's, Newfoundland. Available at [www.icomnl.ca/files/PBGB%20LOMA%20IM%20Plan.pdf](http://www.icomnl.ca/files/PBGB%20LOMA%20IM%20Plan.pdf).
- **Fisheries and Oceans Canada.** 2013. *Gulf of St. Lawrence integrated management plan*. Fisheries and Oceans Canada, Quebec, Gulf and Newfoundland and Labrador Regions. Available at [www.icomnl.ca/files/GOSLIM%20Plan.pdf](http://www.icomnl.ca/files/GOSLIM%20Plan.pdf).
- **PNCIMA/Fisheries and Oceans Canada.** 2013. *Draft Pacific North Coast integrated management area plan*. PNCIMA Initiative. Fisheries and Oceans Canada, Vancouver. See [www.pncima.org](http://www.pncima.org).

There are also initiatives convened by First Nations and state governments, such as the Marine Plan Partnership in British Columbia (see <http://mapocean.org>), which has developed four subregional marine plans and a regional action framework.

### Caribbean

There are limited examples to date of MSP for tropical island states. Saint Kitts and Nevis has commenced a marine zoning plan for its EEZ area. The development of the zoning plan was undertaken on a project basis initially and is intended to provide a strong basis for future implementation of MSP.

- **Agostini, V.N., Margles, S.W., Schill, S.R., Knowles, J.E. & Blyther, R.J.** 2010. *Marine zoning in Saint Kitts and Nevis: a path towards sustainable management of marine resources*. Florida, USA, the Nature Conservancy. Available at [www.marineplanning.org/pdf/StKitts\\_Nevis\\_Full\\_Report.pdf](http://www.marineplanning.org/pdf/StKitts_Nevis_Full_Report.pdf)
- **Department of Maritime Affairs, Ministry of Tourism and International Transport.** 2013. *Draft St. Kitts and Nevis National Maritime Policy and Action Plan*. Basseterre, Saint Kitts, West Indies, Department of Maritime Affairs. Available at <http://intfish.info/wp-content/uploads/2015/09/skn-oceanpolicy.pdf>

Elsewhere in the Caribbean, in Saint Vincent and the Grenadines, efforts to develop a transboundary marine multi-use zoning plan for the area have been funded by the National Ocean and Atmospheric Administration (NOAA) and the Global Environment Facility Small Grants Programme. A range of documents relating to this can be found at [www.grenadinesmarsis.com/Files\\_and\\_Maps.html](http://www.grenadinesmarsis.com/Files_and_Maps.html).

### Germany

Multiple-use marine spatial plans, and accompanying environmental reports, for the German EEZs in the North Sea and the Baltic Sea entered into force in 2009. The need for these was driven primarily by potential for conflicts between competing sectors, such as the offshore wind sector, shipping and nature conservation. In Germany, the federal states (*Länder*) have powers to develop plans for territorial seas out to 12 nautical miles.

See [www.bsh.de/en/Marine\\_uses/Spatial\\_Planning\\_in\\_the\\_German\\_EEZ/index.jsp](http://www.bsh.de/en/Marine_uses/Spatial_Planning_in_the_German_EEZ/index.jsp).

### New Zealand

New Zealand has a strong regional planning system, which can incorporate coastal and marine areas up to 12 nautical miles from the shore. There is currently no MSP in place for the EEZ or continental shelf zones, though there is a policy basis for marine protected areas.

- **Department of Conservation and Ministry of Fisheries.** 2006. *Marine protected areas: policy and implementation plan*. Available at [www.doc.govt.nz/Documents/conservation/marine-and-coastal/marine-protected-areas/mpa-policy-and-implementation-plan.pdf](http://www.doc.govt.nz/Documents/conservation/marine-and-coastal/marine-protected-areas/mpa-policy-and-implementation-plan.pdf).
- The country's first marine park, Hauraki Gulf Marine Park, was created in 2000 and its intensive use has necessitated the development of a marine spatial plan driven by stakeholders. See [www.aucklandcouncil.govt.nz/en/planspoliciesprojects/plansstrategies/seachange/Pages/home.aspx](http://www.aucklandcouncil.govt.nz/en/planspoliciesprojects/plansstrategies/seachange/Pages/home.aspx) and [www.seachange.org.nz](http://www.seachange.org.nz).

### Norway

The Norwegian Marine Resources Act 2009 (*Havressursloven*) provides for integrated management plans, primarily to halt the loss of biodiversity. Management decisions are therefore taken with that objective in mind. To date, three plans have been developed, but they are advisory in nature. The Barents Sea-Lofoten area plan (2002–2006) was approved by the Norwegian Parliament in 2006 and updated in 2011. This plan is unusual in that it covers all marine economic activities, including fisheries management measures.

- **Norwegian Ministry of the Environment.** 2011. *First update of the integrated management plan for the marine environment of the Barents Sea-Lofoten area*. Meld. St. 10. 2010–2011. Report to the Storting (white paper). [English version.] Also available at [www.miljodirektoratet.no/Global/Havforum/Meld.%20St.10%20\(2010-2011\)%20Report%20to%20the%20Storting%20\(white%20paper\)%20First%20update%20of%20the%20Integrated%20Management%20Plan%20for%20the%20Marine%20Environment%20of%20the%20Barents%20Sea-Lofoten%20Area.pdf](http://www.miljodirektoratet.no/Global/Havforum/Meld.%20St.10%20(2010-2011)%20Report%20to%20the%20Storting%20(white%20paper)%20First%20update%20of%20the%20Integrated%20Management%20Plan%20for%20the%20Marine%20Environment%20of%20the%20Barents%20Sea-Lofoten%20Area.pdf)

### Portugal

Portugal has a comprehensive nested system of marine plans. An initial plan was published in 2012, and since then a range of legal instruments have been enacted to give effect to the approach advocated. All this information, including the various elements of the plans, can be viewed at [www.dgpm.mam.gov.pt/Pages/POEM\\_PlanoDeOrdenamentoDoEspacoMarinho.aspx](http://www.dgpm.mam.gov.pt/Pages/POEM_PlanoDeOrdenamentoDoEspacoMarinho.aspx)

### United Kingdom of Great Britain and Northern Ireland

The country's Marine and Coastal Access Act 2009 provides a legal basis for marine planning. It also established the Marine Management Organisation, which has responsibility for marine planning in English inshore waters (to 12 miles) and the offshore areas (from 12 to 200 miles). Elsewhere, the devolved administrations have responsibility for marine planning in those areas (i.e. Scotland, Wales and Northern Ireland), but marine planning in Wales and Northern Ireland is currently under development, so links to those documents are not included here. All information and documents associated with marine planning in the country are available on the Web; some key ones are listed below:

General information on marine planning in the United Kingdom of Great Britain and Northern Ireland:

[www.gov.uk/government/collections/marine-planning-in-england#about-marine-planning](http://www.gov.uk/government/collections/marine-planning-in-england#about-marine-planning).

## England

- See [www.gov.uk/government/publications/the-marine-planning-system-for-england](http://www.gov.uk/government/publications/the-marine-planning-system-for-england)
- Example plans and supporting documents, see [www.gov.uk/guidance/east-inshore-and-east-offshore-marine-plan-areas](http://www.gov.uk/guidance/east-inshore-and-east-offshore-marine-plan-areas) and [www.gov.uk/guidance/south-inshore-and-south-offshore-marine-plan-areas](http://www.gov.uk/guidance/south-inshore-and-south-offshore-marine-plan-areas)

## Scotland

- General information: [www.gov.scot/Topics/marine/seamanagement](http://www.gov.scot/Topics/marine/seamanagement)
- National marine plan: [www.gov.scot/Topics/marine/seamanagement/national](http://www.gov.scot/Topics/marine/seamanagement/national)
- Regional marine planning: [www.gov.scot/Topics/marine/seamanagement/regional](http://www.gov.scot/Topics/marine/seamanagement/regional)
- Sectoral marine planning: [www.gov.scot/Topics/marine/marineenergy/Planning](http://www.gov.scot/Topics/marine/marineenergy/Planning)

## United States of America

Nine regional marine spatial planning areas will be developed following the recommendations of an Interagency Ocean Policy Task Force. These planning areas will cover territorial seas, the EEZ and the continental shelf and extend inland to the mean high water line. Many states already have initiated work on marine planning for their waters; see, for example, the NOAA Web site on coastal and marine spatial planning at <http://cmsp.noaa.gov/activities/index.html>

- Massachusetts: [www.mass.gov/eea/waste-mgmt-recycling/coasts-and-oceans/mass-ocean-plan](http://www.mass.gov/eea/waste-mgmt-recycling/coasts-and-oceans/mass-ocean-plan) and [www.mass.gov/eea/waste-mgmt-recycling/coasts-and-oceans/mass-ocean-plan/2015-final-ocean-plan.html](http://www.mass.gov/eea/waste-mgmt-recycling/coasts-and-oceans/mass-ocean-plan/2015-final-ocean-plan.html)
- Oregon: [www.oregon.gov/LCD/OCMP/pages/ocean\\_tsp.aspx](http://www.oregon.gov/LCD/OCMP/pages/ocean_tsp.aspx)
- Rhode Island: <http://seagrant.gso.uri.edu/oceansamp>
- Washington: [www.msp.wa.gov](http://www.msp.wa.gov)

## Regional seas

### Baltic

In the Baltic Sea, HELCOM has published the Baltic Sea Action Plan so as to restore the good ecological status of the Baltic marine environment by 2021. MSP is one of the action areas within the plan, with a range of resources available at:

- See <http://helcom.fi/action-areas/maritime-spatial-planning>
- Helsinki Commission. 2007. *HELCOM Baltic Sea action plan*. Available at [www.helcom.fi/Documents/Baltic%20sea%20action%20plan/BSAP\\_Final.pdf](http://www.helcom.fi/Documents/Baltic%20sea%20action%20plan/BSAP_Final.pdf)
- *Regional Baltic MSP roadmap 2013–2020*. Available at <http://helcom.fi/Documents/HELCOM%20at%20work/Groups/MSP/Regional%20Baltic%20MSP%20Roadmap%202013-2020.pdf>
- Fishing for space meeting outputs; see <http://helcom.fi/helcom-at-work/events/events-2013/fishing-for-space>.

### Wadden Sea

Denmark, Germany and the Netherlands have cooperated to protect the Wadden Sea as an ecological entity since 1978. While many marine activities occur within the territorial seas, these are managed by the individual states concerned; the Trilateral Wadden Sea Plan represents a good model of transnational cooperation for agreed management targets.

See [www.waddensea-secretariat.org/management/wadden-sea-plan-2010](http://www.waddensea-secretariat.org/management/wadden-sea-plan-2010).

#### 4. MSP Research Projects from the European Union

Project acronym	Thematic area	Web site and further resources
Aquabest	Developing responsible aquaculture in the Baltic Sea region (dedicated work package on spatial planning)	<a href="http://www.aquabestproject.eu">www.aquabestproject.eu</a>
Aquafima	Integrating aquaculture and fisheries management in the Baltic Sea Region	<a href="http://www.aquafima.eu/en/index.html">www.aquafima.eu/en/index.html</a>
AquaSpace	Ecosystem approach to making space for sustainable aquaculture	<a href="http://www.AquaSpace-H2020.eu">www.AquaSpace-H2020.eu</a>
BaltSeaPlan	Planning the future of the Baltic Sea. Numerous deliverables on involving stakeholders in plan development.	<a href="http://www.baltseaplan.eu">www.baltseaplan.eu</a>
BaltSpace	Towards sustainable planning of Baltic marine space	<a href="http://www.baltspace.eu/index.php">www.baltspace.eu/index.php</a>
BlueBRIDGE	Building research environments fostering innovation, decision-making, governance and education to support Blue Growth	<a href="http://www.bluebridge-vres.eu/about-bluebridge">www.bluebridge-vres.eu/about-bluebridge</a>
Celtic Seas Partnership	Collaborative and innovative approaches to managing the marine environment of the Celtic Sea involving stakeholders	<a href="http://celticseaspartnership.eu">http://celticseaspartnership.eu</a>
COEXIST	Interaction in European coastal waters: a road map to sustainable integration of aquaculture and fisheries	<a href="http://www.coexistproject.eu">www.coexistproject.eu</a>
GAUFRE	Towards a spatial structure plan for the sustainable management of the North Sea	<a href="http://www.vliz.be/projects/gaufre">www.vliz.be/projects/gaufre</a> <a href="http://www.vliz.be/projects/gaufre/output.php?lang=nl">www.vliz.be/projects/gaufre/output.php?lang=nl</a> (Flood of space book)
KnowSeas	Knowledge-based sustainable management for Europe's seas	<a href="http://www.knowseas.com">www.knowseas.com</a>
MARIBE	Marine investment for the Blue Economy	<a href="https://maribe.eu">https://maribe.eu</a>
MEFEPO	Making the European fisheries ecosystem plan operational	<a href="http://www.liverpool.ac.uk/mefepo">www.liverpool.ac.uk/mefepo</a>
MESMA	Monitoring and evaluation of spatially managed areas	<a href="http://www.mesma.org">www.mesma.org</a>
ODEMM	Options for delivering ecosystem-based marine management	<a href="http://www.liverpool.ac.uk/odemmm">www.liverpool.ac.uk/odemmm</a>
PartiSEApate	Multi-level governance in MSP throughout the Baltic Sea region	<a href="http://www.partiseapate.eu">www.partiseapate.eu</a>
PISCES	Partnerships involving stakeholders in the Celtic Sea ecosystem, predecessor to the Celtic Seas Partnership	<a href="http://www.seaweb.org/initiatives/pisces.php">www.seaweb.org/initiatives/pisces.php</a>
PlanBothnia	Testing of transboundary MSP in the Baltic Sea	<a href="http://planbothnia.org">http://planbothnia.org</a>
Seanergy	Policy recommendations on how to deal with MSP and remove obstacles to the deployment of offshore renewables	<a href="http://www.seanergy2020.eu">www.seanergy2020.eu</a>
TPEA	Transboundary planning in the European Atlantic – developing a common approach to cross-border MSP	<a href="http://www.tpeamaritime.eu/wp">www.tpeamaritime.eu/wp</a>

## 5. Other Web sites and resources of relevance

Project acronym	Thematic area	Web site and further resources
ABP MER Marine Planning Web site	Web site dedicated to highlighting research into marine planning practice and learning from relevant experiences, structured around a number of key themes	<a href="http://www.abpmer.net/marine-planning">www.abpmer.net/marine-planning</a>
Center for Ocean Solutions	Decision guide: selecting decision support tools for marine spatial planning (Webinar presentation)	<a href="http://www.openchannels.org/sites/default/files/webinars/foley%20prahler_presentation.pdf">www.openchannels.org/sites/default/files/webinars/foley%20prahler_presentation.pdf</a>
Coastal Aquaculture Planning and Environmental Sustainability Program (CAPES-NOAA)	Assesses aquaculture and environmental interactions to support sustainable coastal aquaculture development. Web site contains information on relevant projects and publications.	<a href="http://coastalscience.noaa.gov/research/scem/marine_aquaculture">http://coastalscience.noaa.gov/research/scem/marine_aquaculture</a>
Coastal Resilience	This Web site is devoted to ensuring that coastal areas are more able to withstand the numerous threats to the coastline caused primarily by human interference (in its many guises). It contains very useful mapping information with respect to flooding and sea level rise and access to other tools and apps. Mostly covers the Americas.	<a href="http://coastalresilience.org">http://coastalresilience.org</a>
European Commission Maritime Spatial Planning	General information on MSP in the European Union	<a href="http://ec.europa.eu/maritimeaffairs/policy/maritime_spatial_planning/index_en.htm">http://ec.europa.eu/maritimeaffairs/policy/maritime_spatial_planning/index_en.htm</a>
	Fisheries and aquaculture stakeholders explore the benefits of maritime spatial planning (workshop)	<a href="http://ec.europa.eu/information_society/newsroom/cf/mare/itemdetail.cfm?item_id=13118">http://ec.europa.eu/information_society/newsroom/cf/mare/itemdetail.cfm?item_id=13118</a>
	MSP and the marine environment (workshop)	<a href="http://ec.europa.eu/maritimeaffairs/events/2015/12/events_20151207_01_en.htm">http://ec.europa.eu/maritimeaffairs/events/2015/12/events_20151207_01_en.htm</a>
Evaluating marine spatial plans	A guide to evaluating marine spatial plans by UNESCO's Intergovernmental Oceanographic Commission (IOC), Green Fire Productions and OpenChannels	<a href="http://www.openchannels.org/msp-eval-guide/homepage">www.openchannels.org/msp-eval-guide/homepage</a>
Fishery Councils guidance on MSP	U.S. Regional Fishery Management Councils: decades of knowledge and experience in coastal and marine spatial planning	<a href="https://static1.squarespace.com/static/56c65ea3f2b77e3a78d3441e/t/579147278419c2b0469d2162/1469138731491/MSP-Flier+v4.pdf">https://static1.squarespace.com/static/56c65ea3f2b77e3a78d3441e/t/579147278419c2b0469d2162/1469138731491/MSP-Flier+v4.pdf</a>
GRID-Arendal	GRID-Arendal is a centre collaborating with the United Nations Environment Programme, supporting informed decision-making and awareness-raising. One of its programme areas is marine spatial planning.	<a href="http://www.grida.no/programmes/marine-spatial-planning/">www.grida.no/programmes/marine-spatial-planning/</a>
ICES	Extended abstracts from ICES conferences	<a href="http://www.ices.dk/sites/pub/ASCExtendedAbstracts/Shared%20Documents/Forms/AllItems.aspx">www.ices.dk/sites/pub/ASCExtendedAbstracts/Shared%20Documents/Forms/AllItems.aspx</a>
	Marine spatial planning and fisheries: a stock-take on approaches, examples and future needs	<a href="http://www.ices.dk/news-and-events/asc/ASC2015/Pages/Theme-Session-O.aspx">www.ices.dk/news-and-events/asc/ASC2015/Pages/Theme-Session-O.aspx</a>
	Report of the working group on marine planning and coastal zone management (WGMPCZM)	<a href="http://www.ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/SSGHIE/2013/WGMPCZM13.pdf">www.ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/SSGHIE/2013/WGMPCZM13.pdf</a>

Project acronym	Thematic area	Web site and further resources
Marine Ecosystems and Management (MEAM)	Monthly information service on ocean planning and ecosystem-based management	<a href="https://meam.openchannels.org">https://meam.openchannels.org</a>
Marine planning and aquaculture (United Kingdom)	Conference presentation on how aquaculture interests have been incorporated into the United Kingdom marine planning	<a href="http://www.seafish.org/media/1391570/acig_april2015_mmo.pdf">www.seafish.org/media/1391570/acig_april2015_mmo.pdf</a>
MESMA	This Web site makes accessible the output from a four-year (2009–2013) European Union financed project on the monitoring and evaluation of spatially managed marine areas. The “Wiki” part of the site contains a range of information on tools and useful documents relating to MSP and spatial management more generally.	<a href="http://www.mesma.org/default.asp?ZNT=50T1O474">www.mesma.org/default.asp?ZNT=50T1O474</a> <a href="https://publicwiki.deltares.nl/display/MESMA/Useful+documents">https://publicwiki.deltares.nl/display/MESMA/Useful+documents</a>
Marine Planning Concierge/ “NatCap”	“NatCap” has compiled lessons from seven use-cases from around the world. At the bottom of each stepwo additional resources for exploring examples from around the world.	<a href="http://msp.naturalcapitalproject.org/msp_concierge_master">http://msp.naturalcapitalproject.org/msp_concierge_master</a>
MSP Initiative (UNESCO/IOC)	UNESCO/IOC Web site comprising information on MSP generally, key documents, approaches adopted in specific locations around the world, and key reference documents, good practice guides and frequently asked questions	<a href="http://www.unesco-ioc-marinesp.be">www.unesco-ioc-marinesp.be</a> and links on this site to MSP status in selected countries
Marine Spatial Planning Research Network	An informal grouping of scientists, policy-makers and practitioners who wish to contribute to the development of marine spatial planning through academic-based research	<a href="http://www.msprn.net">www.msprn.net</a>
Open Channels	Forum for Ocean Planning and Management. Reference point for the latest news, literature, online events, grant opportunities, jobs and Webinars of relevance.	<a href="http://www.openchannels.org">www.openchannels.org</a>
OceanSAMP	Example of a Special Area Management Plan (SAMP) from Rhode Island, United States of America. This is an adaptive planning tool that promotes a balanced and comprehensive ecosystem-based management approach to the development and protection of Rhode Island’s ocean-based resources. The Web site houses a broad range of information, including research, maps, stakeholders and training.	<a href="http://seagrant.gso.uri.edu/oceansamp">http://seagrant.gso.uri.edu/oceansamp</a>
ScotMap	Spatial information on the fishing activity of Scottish-registered commercial fishing vessels under 15 m in overall length. Used for planning purposes.	<a href="http://www.gov.scot/Topics/marine/science/MSInteractive/Themes/ScotMap">www.gov.scot/Topics/marine/science/MSInteractive/Themes/ScotMap</a>

This document provides a clear and comprehensive account for the application of marine spatial planning (MSP) within the Regional Commission for Fisheries (RECOFI) region. It builds on regional technical workshops, held under the auspices of the Food and Agriculture Organization of the United Nations (FAO), aimed principally at improving the prospects for fisheries and aquaculture in the Near East.

Marine spatial planning provides a step-by-step process that allows for the cooperative integration of the major marine uses and users within a defined marine area. These ordered procedures allow all stakeholders to work towards ensuring the long-term sustainability of identified marine activities.

The principles of the ecosystem approach to both fisheries and aquaculture can readily be incorporated into the process. The output of MSP is the development of a plan that addresses any potentially conflicting uses of the sea, thus enabling the strategic, forward-looking planning for the regulation, zoning, management, protection and sustainability of the marine environment. MSP can best function if it includes continuing reinforcement and adjustments of learned experiences over a long time period.

The document includes three important annexes. The first includes the main recommendations concerning the adoption of marine spatial planning taken from the RECOFI (FAO) Cairo workshop in 2012. The second describes the types of marine activities that must be considered, their relative importance to the national economy and to the sustainability of the marine environment.

The third annex provides a comprehensive listing of additional information about MSP, including worldwide examples where MSP has been applied under varied local conditions at highly variable geographic scales.



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