MARINE SPATIAL PLANNING

concepts, current practice and linkages to other management approaches

Fanny Douvere

Thesis submitted in partial fulfillment of the requirements for the degree of Doctor in Political Sciences

UNIVERSITEIT GENT

FACULTEIT POLITIEKE EN SOCIALE WETENSCHAPPEN

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Academic year: 2009-2010

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This publication should be referenced as:

Douvere Fanny. 2010. Marine spatial planning: Concepts, current practice and linkages to other management approaches. Ghent University, Belgium.

Cover design and background graphic: Lore Rabaut

To Mama
Without whom I would not have become what I am today

An invasion of armies can be resisted,
but not an idea whose time has come

Victor Hugo
1802-1885

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Acknowledgment

Many people already helped me in building an inspiring and fulfilling career. I want to thank two people in particular, Marianne VanGheluwe and Peter Labens, for their early support and believe in my capabilities. Without their encouragement, I probably would never have made it to university.

My initiation into the marine spatial planning community began at the University of Ghent's Maritime Institute in 2003 as a member of an interdisciplinary team that worked on the GAUFRE project for two years. Professor Frank Maes coordinated the project. Despite its small size, Belgium's experience in developing an approach toward constructing one of the first, if not the first, marine spatial plans has had an inordinate influence on my thinking about this concept, and indeed, thinking about MSP throughout the world.

Another group that inspired my work was the Working Group on Ocean Zoning organized by the National Center for Ecological Analysis and Synthesis (NCEAS) at the University of California, Santa Barbara, organized by Gail Oshrenko, Oran Young, both from UCSB, Larry Crowder (Duke University), and Elliott Norse (Marine Conservation Biology Institute). I was able to attend three meetings of the working group between 2005-2007 and learned much from discussions with its members, especially Larry, Elliott, and John Day (Great Barrier Reef Marine Park). While the discussions started around ocean zoning, two years and two publications later, the organizing concept had turned to marine spatial planning and has now been accepted by the United States government as a crucial element of its new policy for the oceans.

Thanks to the financial support of The Gordon and Betty Moore Foundation and the David and Lucile Packard Foundation I was able to help set up the Marine Spatial Planning Initiative at UNESCO's Intergovernmental Oceanographic Commission. David Cox (Belgian Science Policy Office) and Simon Cripps (WWF-International) also provided critical financial support. I am sincerely grateful for their support over the past several years that allowed me to continue developing my work—and to co-write the first guide on marine spatial planning. I also want to thank Julian Barbiere at the Intergovernmental Oceanographic Commission for managing and supervising my work at UNESCO.

During the past five years, many international experts have helped me considerably in understanding how marine spatial planning works and helped straighten out my misconceptions. Especially Jon Day, Elliott Norse, Jeff Ardron (Marine Conservation Biology Institute), Paul Gilliland (Natural England), Nico Nolte (Germany's Bundesamt für Seschiffahrt und Hydrographie), Leo de Vrees (Rijkswaterstaat of the Netherlands), Erik Olsen (Norway's Institute of Marine Research), Richard Kenchington (Great Barrier Reef Marine Park), Deerin Babb-Brott (Commonwealth of Massachusetts), and Chu Hoi Nguyen (Vietnam Administration of Seas and Islands), all shared practical advice from their experiences about MSP.

In September 2009, I had the incredible opportunity to train professional staff during three days at the U.S. National Oceanic and Atmospheric Administration (NOAA) in Washington DC, as well as to present my viewpoints on MSP to the White House Council on Environmental Quality's Task Force on Ocean Policy. Dan Basta (NOAA) and Michael Weiss (White House/CEQ) were especially helpful in making these events possible. I look forward to continuing to work with them in the future.

Over the past five years I have had the opportunity to travel to over 40 workshops and conferences throughout the world to make presentations on MSP and to learn from discussions with international colleagues. Answering difficult questions about my work was always an inspiration to learn more. I thank all who asked those challenging questions and who made me think about how much I still had to learn.

Finally I want to thank Charles Ehler for the uncountable number of breakfasts, lunches, dinners, plane, train and boat rides that were filled with discussions about the concept and practice of ocean management and marine spatial planning. I also want to thank him for always looking at the bright side of life and inspiring me to do the same. It's a way of living that leads to many fulfilling journeys...

Fanny Douvere
Paris, March 2010

Acronyms

BPNS	Belgian Part of the North Sea
BELSPO	Belgian Science Policy Office
CBD	Convention on Biological Diversity
CEQ	Council on Environmental Quality
CFP	Common Fisheries Policy
COMPAS	Communication Partnership for Science and the Sea
DEFRA	Department for Environmental, Food, and Rural Affairs
DPNS	Dutch Part of the North Sea
EBM	Ecosystem-based management
EC	European Commission
EEZ	Exclusive economic zone
EU	European Union
FAO	Food and Agricultural Organization
FKNMS	Florida Keys National Marine Sanctuary
FON	Friends of Nature
GAUFRE	Research project towards a spatial structure plan for sustainable management of the sea
GBRMP	Great Barrier Reef Marine Park
GBRMPA	Great Barrier Reef Marine Park Authority
GIS	Geographic information system
GPS	Global positioning system
HELCOM	Baltic Marine Environment Protection Commission
ICES	International Council for the Exploration of the Seas
ICAM	Integrated coastal area management
ICZM	Integrated coastal zone management
IEA	International Energy Agency
IMO	International Maritime Organization
IMPNS	Integrated Management Plan for the North Sea
INSPIRE	Infrastructure for Spatial Information in the European Community Directive
IOC	Intergovernmental Oceanographic Commission
IOCAM	Integrated ocean and coastal area management
IUCN	International Union for the Conservation of Nature
JMM	Joint ministerial meeting
LOMA	Large ocean management area
MAB	Man and the Biosphere Programme
MARPOL	International Convention for the Prevention of Pollution from Ships, 1973, modified by the Protocol of 1978
MASH	Marine Protected Areas, Species, and Habitats Working Group
MBP	Marine bioregional planning
MEA	Millennium Ecosystem Assessment
MEC	Marine environment classification
MMO	Marine Management Organization
MPA	Marine protected area
MSP	Marine spatial planning or maritime spatial planning
MSSP	Marine Spatial Planning Pilot Project
NCEAS	National Center for Ecological Analysis and Synthesis
NOAA	National Oceanic and Atmospheric Administration
NSRAC	North Sea Regional Advisory Council

OECD	Organization for Economic Cooperation and Development
OSPAR	Commission for the Protection of the Marine Environment of the Northeast Atlantic
PSSA	Particularly Sensitive Sea Areas
SAs	Special Areas
SACs	Special Areas of Conservation
SEA	Socio-economic assessment
SLR	Sea level rise
SPAs	Special Protection Areas
TS	Territorial sea
UCSB	University of California, Santa Barbara
UK	United Kingdom
UNCLOS	United Nations Convention on the Law of the Sea
UNESCO	United National Educational, Scientific, and Cultural Organization
USA	United States of America
VMS	Vessel monitoring system
WSSD	World Summit on Sustainable Development
WWF	World Wildlife Fund

PART I
General introduction to the thesis

1. Introduction

In recent years, marine spatial planning (MSP) has gained considerable importance as a new paradigm toward a more integrated, ecosystem-based management of marine areas. Various countries, particularly in the densely-used marine areas of Northwest Europe, are developing and applying MSP. Germany, the Netherlands, and Belgium, for example, have developed marine spatial plans for their territorial seas and exclusive economic zones. Other countries are creating legislation or new policy frameworks that will enable MSP in the near future. The United Kingdom, for example, has passed a Marine and Coastal Access Act [1] that aims at ensuring clean, healthy, safe, productive and biologically diverse oceans and seas. MSP (referred to as "marine planning" in the UK) is proposed as one of the tools to deliver the aims of the Act. Late 2008, Sweden started drafting a new government bill "A coherent Swedish Maritime Policy" that will lay the groundwork for MSP in the near future [2]. Last December, United States President Barack Obama launched a draft framework that lays the foundation for a nation-wide system of effective MSP in the United States [3]. It is expected that new MSP legislation will be issued in Spring 2010. Additionally, MSP has also spurred interest and commitment at the supranational level (EU) and among Arctic countries where efforts are focused on designing MSP principles and incentives for transnational cooperation in an attempt to better underpin MSP with an ecosystem approach.

Many advocate MSP as a promising way to achieve simultaneously social, economic, and ecological objectives by means of a more rational and scientifically-based organization of the use of ocean space. Its supporters emphasize the potential of MSP to resolve conflicts among offshore uses and between uses and the environment and stress its marked departure from single-sector management that is currently applied and largely unsuccessful in achieving integrated management of our oceans.

A central problem and potential impediment to the future success of MSP, however, lies in the lack of research that illustrates what MSP is really about, what it entails to be successful, and how it is linked to other management approaches. Countries that currently consider, develop or apply MSP are doing so on an ad hoc basis, each with different time frames, costs, and results. Most professionals and government officials responsible for the planning and management of marine areas and resources usually have a scientific or technical training in areas such as ecology, biology, oceanography, or engineering, among others. Few have been trained as professional planners and managers. Hence, many professionals who develop MSP wind up "learning on the job" and tend to "re-invent the wheel" each time again. This practice is very expensive and an inefficient way to do business. The lack of understanding of what MSP entails also makes it difficult for governments to define what is essential in making sure their MSP efforts will actually lead to the proposed outcomes described in a variety of MSP definitions.

At the academic level, little research has been done so far to define what elements are critical to make sure MSP delivers its anticipated results. Both peer-reviewed academic literature and grey literature on MSP are fragmented and generally lack in-depth thinking about the full nature, development, implementation and evaluation of MSP and its linkages with other management approaches. The lack of literature that deals with MSP in a more comprehensive way might be attributable to the fact that MSP is a relatively new field of expertise and peer-reviewed literature has only started to become available in recent years. Where literature exists, it mostly deals with

one particular aspect of MSP. Halpern et al. [4], for example, focus on cumulative effects in the context of MSP, Degnbol and Wilson [5] focus on MSP for fisheries management, while Sivas and Caldwell [6] focus on the legal and institutional arrangements of MSP in California. Most literature relevant to MSP concentrates on ocean zoning, a concept that is often confused with MSP and wrongly assumes a similar meaning. Although each of these aspects are important research topics, none of them illustrates the full nature of MSP, what it entails, and what the essential elements are that can lead to successful outcomes. Particularly the latter is becoming urgent now, as many confusing and conflicting viewpoints about the true nature of MSP start to emerge. The research undertaken for this thesis attempts to fill this gap.

2. Research questions and structure of the thesis

With the aim of deriving a more comprehensive insight about the nature and scope of MSP, including what it entails to achieve its anticipated results, four essential research questions were identified:

1. Why do we need MSP?
2. How has MSP developed over time?
3. What are the essential characteristics of MSP?
4. How is MSP related to other management approaches?

The research undertaken uses an inductive approach and attempts to derive general conclusions about the nature and concept of MSP from studying and analyzing relevant literature and existing MSP practice. Through studying relevant literature, it is clear that MSP has primarily originated from within the ocean and environmental community with few inputs from other planning communities, including land-use planning. Despite the different context of sea versus land (e.g., ownership, resource access, three-dimensional nature), the general aims of MSP are not radically different from those of land-use planning. According to Kaiser et al. [7] the task of a land-use planner is to '*balance three competing sets of values or perspectives on urban change: social, market, and environmental*'. Land-use planning is seen as a future-oriented activity that is conducted as a *process* which is, in turn, *guided by a plan*. Similarly, MSP is 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 [8]. When making parallels to land-use planning, it is evident that MSP closely corresponds to the 'physical' planning discipline as it originated in the 1920s in response to the consequences of urban aggregation in the aftermath of the industrial revolution [9,10]. A number of research initiatives demonstrated that land-use planning methods and techniques are relatively easily applied to the marine environment [11,12]. Some of the thinking reflected in this thesis is undoubtedly inspired and influenced by the practices and perspectives in land-use planning. Certainly, the long experience of land-use planning could most likely highlight various aspects of spatial planning that are relevant to the future development of MSP, and could help prevent pitfalls already well-known and well- surveyed in land-use planning. However, research of the full nature of the relationship between land-use planning and MSP is beyond the scope of this thesis.

Instead, this research starts from the viewpoint that much can be learned from existing MSP practices. Australia, Canada, Germany, Norway, Belgium, the Netherlands, among others, all have

developed marine spatial plans in recent years. Both the Netherlands and Norway are currently completing 'second generation' marine spatial plans, while Belgium has set up a *think tank* to initiate discussions about a potential second round of MSP. While most of the MSP developments are still in an early stage (less than 10 years old) and will only over time demonstrate how successful they really are, some initial lessons can be drawn from these experiences.

First, it is clear that MSP, as it is perceived today, has originated in response to the increasing demands for ocean space and, perhaps more importantly, as a means to tackle a variety of conflicts (both existing or potential ones) that arise from this ocean sprawl. A closer look at the goals of MSP initiatives worldwide reveals that early forms of MSP focus on achieving nature conservation objectives only. Both Australia's Great Barrier Reef Marine Park [13] and the United States Florida Keys National Marine Sanctuary [14] used early forms of MSP to influence the spatial and temporal distribution of human activities to minimize their impact on nature conservation. About ten years ago, MSP initiatives in countries around the North Sea started to employ a multiple-objective approach to MSP and aimed at achieving simultaneously social, economic and ecological objectives. Very recently, emphasis in MSP efforts lies on trying to achieve an ecosystem-based approach to the management of marine areas. Both the EU Maritime policy (2006) [15] and associated roadmap (2009) [16] and the United States Draft Framework for MSP (2009) [3] endorse a regional approach to MSP, aiming for MSP development at a scale that is more meaningful from an ecosystem perspective. Not only do these MSP efforts try to achieve multiple objectives simultaneously, these objectives are now embedded in a broader ecosystem context that takes into account the functioning of the marine ecosystem as well as the services it provides. Both the need and evolution of MSP form the subject of Chapters 1 and 2 of this thesis.

Second, based on analysis and - to some extent - comparison of MSP initiatives around the world, it is possible to extract some of the key elements that should be inherent to any MSP process. Belgium was one of the first countries to complete and implement a multiple-objective marine spatial plan for all marine waters under its jurisdiction. Detailed analysis of the MSP process in Belgium revealed (among other things) that although a legal basis for MSP is not needed to get started, it does clearly provide for a more comprehensive and strategic form of MSP in addition to an existing permitting system. While some countries create new legislation, others start with or modify existing ones. All have benefited from having a legally enforceable marine spatial plan at the end of the road. When having such an enforceable marine spatial plan, implementation of the plan is often left to existing authorities and institutions.

Once a legal basis is in place, however, several other characteristics can be identified as crucial to any MSP process. A one-time plan that primarily documents current conditions and deals with existing conflicts is unlikely to deliver its anticipated results in the long run. Instead, MSP should be conducted as an iterative and continuous process that is flexible enough to *adapt* to changing circumstances. As any other planning effort, MSP is a future-oriented activity. Practice in the Netherlands illustrates how such *future-orientation* can be embedded in a marine spatial plan and allow pro-active decision-making when new challenges arise in the marine environment. Also, as MSP aims to achieve multiple objectives it should reflect as many expectations, opportunities, or conflicts occurring in the MSP area - information that can only be truly incorporated through a *participatory* form of MSP. Further, it is evident that MSP needs to *integrate* a wide range of uses and issues and ideally requires consistency across state, federal-state, and international

boundaries. When aiming at achieving multiple-objectives, MSP needs integration across the various sectors that operate in the planning area and/or are responsible for managing a part of it. Finally, MSP is based on the premise that the ocean is heterogeneous, with some areas being more important than others (economically and socially as well as ecologically). By taking this heterogeneity into account, MSP enables guidance of single-sector decisions (permits, licensing, etc.) toward integrated management of the ocean, thereby enhancing synergies and preventing conflicts both among users and between users and the marine environment. To do this properly, MSP needs to reflect ecosystem patterns and processes at appropriate spatial and temporal scales - or in other words, apply an *ecosystem* approach. Each of the above mentioned characteristics of MSP is dealt with in more depth in the chapters 3-6 of this thesis.

Third, MSP does not stand on its own but is connected with other management approaches, applicable in adjacent geographies. In many countries, the coastal zone is dealt with through integrated coastal zone management (ICZM). Ultimately, marine spatial plans should be consistent with plans developed in the coastal zone. It is therefore important to prevent discussing MSP in isolation, but instead explore the linkages among relevant plans. Research reveals that one such linkage might be the potential of MSP to help making ICZM more operational and advance its implementation accordingly. Chapter 7 of this thesis explores these linkages and illustrates how the spatial and temporal focus embedded in MSP could contribute to the further application of ICZM principles in Europe.

3. The added value of this research

The research undertaken for this thesis has a considerable added value to the further development of MSP worldwide. In the short run, intermediate results of this research are beneficial to countries that currently design MSP legislation or policy frameworks (see above). A better understanding of what MSP really entails could help ensure new legislation or policy addresses essential elements necessary for successful MSP implementation and results. Countries that have already designed and implemented MSP might find the results of this thesis helpful when monitoring and evaluating the performance of their plans and help guide initiatives toward plan adaptation and improvement. In the longer run, the results of this research could inform the current academic debates about MSP by bringing a broader and more comprehensive perspective. Insight in the essential elements of MSP, gained through systematic analysis and research of relevant literature and existing MSP practice, could help place current discourses on specific or related MSP issues "within the bigger picture", and can help guide the identification of future research needs in the field of MSP. All of the above together could help raise the standards for the further development of MSP in general, and potentially elevate its success in reducing conflicts and achieving a truly integrated, ecosystem-based management of our ocean areas.

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PART II
The need and evolution of marine spatial planning

CHAPTER 1

The need and evolution of marine spatial planning worldwide

Published as:
Douvere F and Ehler C. 2009
Ecosystem-based marine spatial management:
An evolving paradigm for the management of coastal and marine places
In: Chricop A., Coffen-Smout S., and McConnell M. Ocean Yearbook 23:1-26. Issues and prospects.
Dalhousie University, Canada

Abstract

Over the past decades, the demand for ocean space has grown immensely, primarily as a result of the expansion of traditional ocean uses (fisheries, maritime transportation, among others) and the development of new uses like renewable energy through wind and waves or aquaculture. This growth is not without challenges for the ocean. While some ocean uses are incompatible with one another, the cumulative impact of all of them continues to deteriorate the quality and health of the ocean and the goods and services it provides. A number of countries, however, have started to organize uses in the ocean in such way that they have the least impact on one another, while simultaneously enabling protection of the most valuable ecological and biological places. The approach is called marine spatial planning (MSP).

This chapter discusses the need for MSP and highlights the fact that current single-sector management approaches are not sufficient to deal with the emerging ocean sprawl. It further argues that an evolution can be identified in the development of MSP. While early forms of MSP concentrated on nature protection, the more recent applications, particularly in Northwest Europe, aim at achieving multiple objectives. The future, however, lies in achieving multiple objectives embedded in an ecosystem approach. While this can be seen as a more challenging form of MSP, some very promising work has been done already in Australia, Canada and to some extent New Zealand and Europe.

1. Introduction

The development and industrialization of the world's oceans has evolved rapidly since the 15th century [1]. Ongoing population growth, technological development, and growing consumer demand increased considerably the need for more food, energy, and trade. Future outlooks for offshore activities confirm that this evolution has not come to an end and is even likely to accelerate in the coming decades. The share of natural gas production derived from offshore exploitation, for example, is expected to grow to nearly 40 percent by 2030 (compared to 20–25 percent in 1990), as exploration and developments will shift to more lucrative offshore sites, a trend partly stimulated by ongoing high oil prices. A substantial contribution is expected from renewable energy (e.g., offshore wind farms and wave parks) by 2030, mainly because of decreasing exploitation costs [2]. Future global growth of the cruise ship industry is estimated at an annual rate of 8 percent, while eco-tourism has grown to a multi-million dollar business in nearly 25 years, on an average annual growth rate of 12 percent since 1990 [3]. Aquaculture is expanding and intensifying in almost all regions of the world and has grown to about 43 percent of current global fish consumption (in comparison to only 9 percent in 1980) [4]. An inevitable question arises: how can development be sustained, keeping marine industries economically viable, while conserving places that are critical for the health of the marine environment and its biodiversity?

While in the past, industrialization of ocean use has been most prominent in fisheries, maritime transport, communications, oil and gas exploitation, marine recreation, and coastal engineering, it is particularly the rise of new uses, such as renewable energy and nature conservation initiatives, which has made decision-makers recognize the need to develop and implement an integrated and more rational use of ocean space. In most cases it has been because growing and interactive pressures, often driven by incompatible demands for ocean space, which have forced governance systems to face complex, multi-sectoral issues. In New Zealand, for example, the issues of Maori rights and marine conservation came to sharp political focus at the same time. In European examples, the cumulative crush of shipping, fisheries, renewable energy, recreation, land-based pollution sources, and conservation requirements could no longer be ignored. In the case of the Australian Great Barrier Reef, the pressures of mineral exploitation, developing tourism, and national pride in an iconic ecosystem drove the process toward an adaptive, integrated marine spatial management process.

Ocean resources are limited both in space and abundance and the pressure on the marine environment, resulting from an expansion of existing use and the rise of new ones, has been devastating to many places. Essentially, increased activity in the marine environment has led to two important types of conflict. First, not all uses are compatible with one another and are competing for ocean space or have adverse effects on each other (*user vs. user conflicts*). Numerous examples exist of conflicts between ocean users both globally and locally and include, for example, incompatibilities between the fast-growing, billion-dollar submarine cable industry and fisheries, causing damage to, or loss of, fishing gear or huge repair costs and lost revenues for cable disruptions [5]. Other user conflicts include wind farms located near shipping routes or traffic separation schemes, causing high risks of collisions and loss of cargo. In New Zealand, spatial conflicts have arisen from legislative obligations to uphold the historic and indigenous rights of fishers with more recent obligations toward nature conservation [6]. Spatial use conflicts also occur within one particular use and refer, for example, to the use of different gear types for fisheries in certain areas, or the competition over use of space between commercial and recreational fisheries. Studies in California have illustrated that new commercial ocean activities will only exacerbate conflicts between users [7].

Second, not all uses are compatible with the needs of a healthy and sustainable environment and cause conflicts between users and the environment (*user vs. environment conflicts*). Too often, ocean uses are located in sensitive biological and ecological areas without much consideration of their impact. Many scientific studies document the degradation of the world's oceans, the decline of marine ecosystems, and the collapse of important fish species, illustrating that this is increasingly impairing the ocean's ability to produce the goods and services essential for life on Earth [8]. Recent research measured the cumulative impacts of human offshore activities on the marine environment at a global scale and concluded that almost half (41 percent) of the world's oceans is strongly affected by multiple stresses. Highly affected regions include the Eastern Caribbean, the North Sea, and Japanese waters. Only a few areas around the North and South poles remain relatively unaffected by human activities. Negative cumulative impacts of human activities on coastal and marine ecosystems would probably be higher if historical effects, unreported extraction, recreational use (including fishing), disease, and point-source pollution were incorporated in future measurements [9].

Many of the conflicts described above can and have been avoided or reduced through marine spatial management by influencing the location of human activities in space and time. During recent years, marine spatial management (which includes marine spatial planning) has become increasingly important as a way to make ecosystem-based management [10] a reality in coastal and marine environments [11]. While concepts regarding ecosystem-based management are often considered too broad, too abstract and too complex to enable effective implementation [12], marine spatial management proves to be a way to make this process more tangible [13]. Innovative and successful initiatives toward the development and implementation of ecosystem-based marine spatial management have been taken in both highly-used marine areas such as the North Sea, the Baltic Sea, the coastal area around China, and in large ocean areas such as Canada, Australia and New Zealand. A key characteristic of these marine spatial management initiatives is their ability to provide integration across multiple uses and sectors, to minimize conflicts, to maximize sustainable economic development, and to protect important habitat and biodiversity areas.

2. Ecosystem-based marine spatial management: challenges and opportunities

Most coastal countries already allocate ocean space. Among the most obvious are concession zones for resource exploitation (offshore oil and gas and development areas), designation of dumping sites, delineation of shipping routes and traffic separation schemes, and the designation of areas for nature protection.

Several of these allocations of ocean space result from international and regional agreements. At the global scale, the United Nations Convention on the Law of the Sea (UNCLOS) provides an overarching framework for the allocation of ocean space to national States through the codification of concepts such as the Territorial Sea of 12 nautical miles, the Exclusive Economic Zone of 200 nautical miles, the Contiguous Zone, the Continental Shelf, and the High Seas [14]. Others include agreements on the delineation of special areas for the prevention of sea pollution introduced by the International Maritime Organization (IMO) [15], the protection of cultural and natural world heritage (World Heritage Convention) [16], or the designation of areas for the conservation of birds and habitat under the European Union directives [17] and OSPAR Convention.

The problem with current practice, however, is that the designation of areas for both economic activities and nature protection is done on a single-sector basis [18]. Current practice has no plan-based approach and has little or no consideration of the policies and plans of other uses or sectors or conservation requirements that may be conflicting or compatible. For example, as nations move progressively toward establishing networks of marine protected areas as an alternative to individual sites, the management of ocean spaces outside the protected area becomes increasingly more important. Establishing boundaries for management and planning efforts are also most often based on political considerations and not necessarily meaningful from an ecological perspective.

Triggered by the consequences of the industrial revolution, a similar situation was found on land about 100 years ago. Today, comprehensive land use planning is commonly used as a central component of developmental and environmental planning of land areas in both North America and Europe. The traditional project-by-project, permit-by-permit approach is now often guided by a comprehensive planning process that lays out a vision for the future development, growth, use, and protection of terrestrial areas. Today, this approach has become the standard for land-use planning and management. With only a few exceptions, no clearly articulated spatial vision for the future use of marine areas exists. In most cases, ocean management policies have not been translated into integrated, strategic and comprehensive spatial planning of all activities taking place in marine areas. The lack of such planning often translates into [19]:

1. Spatial and temporal overlap of human activities and their objectives, causing user vs. user and user vs. environment conflicts in the marine environment;
2. Lack of connection between the various authorities responsible for individual activities or the protection and management of the environment as a whole;
3. Lack of connection between offshore activities and resource use and onshore communities that are dependent on them;
4. Lack of conservation of biologically and ecologically sensitive marine areas; and
5. Lack of investment certainty for marine developers and users of ocean resources.

Marine spatial planning is not radically different from spatial planning on land. Although the context and outcomes are different because of the dynamic and three-dimensional nature of marine environments, land use planning concepts and methodologies can rather easily be translated to the marine environment. As on land, spatial planning in the marine environment is a means to:

> Create and establish a more rational organization of the use of marine space and the interactions between its uses, to balance demands for development with the need to protect the environment, and to achieve social and economic objectives in an open and planned way [20].

In its broadest sense, marine spatial management is about

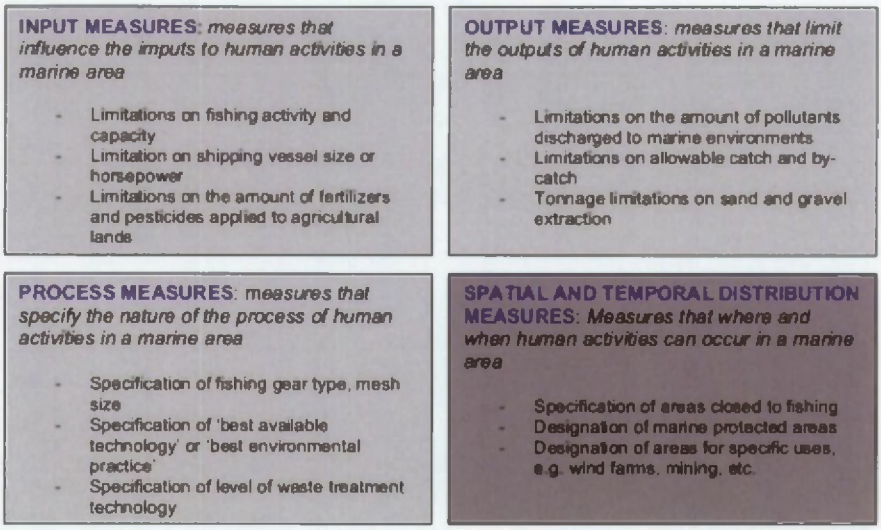
> Analyzing and allocating parts of three-dimensional marine spaces to specific uses, to achieve ecological, economic, and social objectives that are usually specified through the political process [21].

Marine spatial management aims to provide a mechanism for a strategic and integrated plan-based approach for marine management that makes it possible to look at the "bigger picture" and to manage current and potentially conflicting uses to reduce the cumulative effects of human activities, and to deliver marine protection. It is meant to enhance the present sector-oriented management with a more

comprehensive and coordinated approach to the multiple and increasingly expanding and conflicting uses of the sea [22]. It provides an opportunity not only to better manage and understand the marine environment, but also allows long-term planning so that processes become more transparent with greater certainty in permitting, planning, and allocation for both developers and environmental managers [23]. In doing so, it can replace the current piecemeal view and make sure that commitments made in international and national marine policy and legislation, including commitments to apply an ecosystem approach, can be fulfilled [24].

It is important, however, to recognize that marine spatial management can only influence the spatial and temporal distribution of human activities. To implement the multiple objectives of an ecosystem-based management approach, a range of tools will be needed including measures that influence the input, the output, and the processes of human activities (Figure 1).

Figure 1: Types of measures for ecosystem-based sea use management



Source: Douvere F. and Ehler C. 2008.

A focus on the spatial and temporal aspects of ecosystem-based management is one way to make this approach more tangible. Marine spatial management (including planning) does this by:

- Defining the boundaries of the ecosystem to be managed;
- Defining ocean spaces with special ecological or biological value within the ecosystem;
- Defining ocean spaces with special economic value and potential;
- Defining ocean spaces where the effects of human activities interact positively or negatively with ecological functions and processes; and
- Defining where conflicts are occurring or might occur (user vs. user and user vs. environment conflicts).

Through this process of defining spaces, marine spatial management:

- *Addresses the heterogeneity of marine ecosystems in a practical manner.* MSP takes into account that some things only occur in certain places. Important ecological areas, for example, are located in areas of high diversity, endemism or productivity, spawning and nursery areas, and migration stopover points. At the same time, economic activity will (and can) only take place where the resources are located, as for example, oil and gas deposits, sand and gravel deposits, and areas of sustained winds or waves;
- *Focuses on influencing the behavior of humans and their activities over time.* Although goals and objectives for a certain area are usually set for both ecosystem or natural processes and human activities, it is only the human component (human activities and resource use) that can be managed (not the ecosystem itself), e.g., through management measures (incentives) that change behavior of humans and their activities over time;
- *Provides a management framework for new and previously inaccessible scientific information.* Through remote sensing, tracking technologies, and global positioning technologies, science is making visible what had previously been hidden or inaccessible and increases the need for a management framework that allows the effective integration and use of new scientific information in decision-making processes;
- *Makes conflicts and compatibilities among human uses visible, and therefore tangible.* Through the mapping of ecosystems, their characteristics, and human activities affecting it one can see where conflicts are or will be located; and
- *Guides single-sector management toward integrated decision-making.* The development of a marine spatial plan for an entire region visualizes alternative scenarios (drawn from a specified set of sectoral objectives) for ecosystem-based management, which in turn can provide guidance to a range of decision-makers, each responsible for only a particular sector or activity of the entire area (e.g., fisheries managers will see what conflicts and compatibilities their management plans will have with plans for the offshore development of wind farms).

3. The practice of ecosystem-based marine spatial management

During the last decade, marine spatial management has gained considerable importance in establishing ecosystem-based management in the marine environment. Several countries have begun to move the conceptual work forward and have started implementing, or at least experimenting with, spatial management in the marine and coastal environment. Analysis of marine spatial management initiatives in various countries shows a clear evolution from early spatial plans designed to establish and manage marine protected areas (Australia and USA), to multiple-use marine spatial management (Northwest Europe and China), to more recent, systematic efforts to underpin the design of multiple-use marine spatial management with an ecosystem approach (Australia, New Zealand and Canada).

3.1 Marine spatial management for nature protection

Early marine spatial plans were first used to manage marine protected areas. The focus of these plans has mainly been to ensure that conservation objectives were not impaired by human activity. One of the best-known examples is Australia's Great Barrier Reef Marine Park (GBRMP). Spatial planning and zoning, largely considered as the cornerstone of the management strategy for the protection of the Great Barrier

Reef, permit various human activities, including fisheries and tourism, while simultaneously providing a high level of protection for specific areas. Spatial management in the GBRMP is based on eight zones, ranging from the least restrictive "general use zone" in which shipping and most commercial fishing is allowed, to the most restrictive "preservation zone" where virtually no use is permitted [25]. The spatial plan, first developed in 1981, has evolved and changed considerably in response to the dynamic nature of both the marine environment and perceived effectiveness of the first zoning plan [26]. When monitoring results showed that ecosystem protection goals were not being achieved, preservation zones were increased, up to about a third of the entire area.

Marine spatial planning is also an important element in the management of the Trilateral Wadden Sea Cooperation Area. The Wadden Sea Plan, developed as a trans-boundary initiative between the Netherlands, Germany and Denmark to protect and manage a shared coastal wetland system, is an interesting example of the use of spatial management in an international context. While spatial differentiation of functions and activities are used according to national legislation, the various national zoning systems have similar structures. Essentially, they consist of no-use zones, high-level protection zones, and general access zones [27].

Another well-known example of marine spatial management as a means to conserve nature is the Florida Keys National Marine Sanctuary in the United States. Similar to the GBRMP, spatial management has been implemented through temporal and geographic zoning to ensure the protection of the Sanctuary and its resources and lessen the concentrated impact to marine organisms on heavily used reefs. In addition to the existing management areas, four new zone types were implemented throughout the Sanctuary, including: Wildlife Management Areas focusing on sensitive wildlife populations and ranging from no-access buffer zones to closed zones; Ecological Reserves focusing on large, contiguous diverse habitats, allowing activities that are compatible with resource protection; Sanctuary Preservation Areas focusing on heavily used reefs, prohibiting all consumptive activities; and, Special-use Areas reserved for scientific research, education, restoration and monitoring, only allowing specific uses and limited in their length of duration [28].

While the long-standing experience of the GBRMP and Florida Keys National Marine Sanctuary provides valuable lessons about the elements of a successful marine spatial management process (see below), it is important to realize that their context and associated challenges (each of them is of iconic value and implemented in large, relatively low impact areas) is substantially different from the highly-used and industrialized marine areas in most other places around the world.

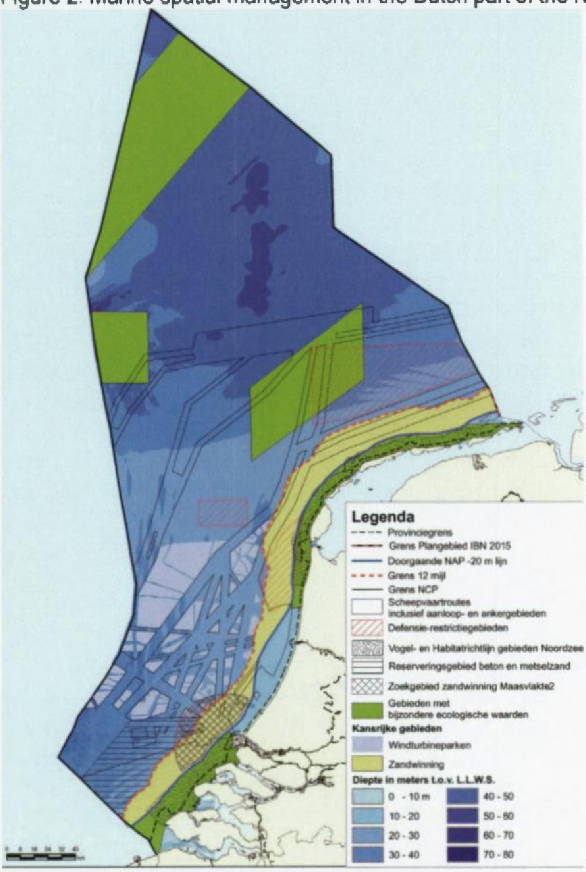
3.2 Marine spatial management for multiple-use objectives

More recent attention has been placed on managing the multiple use (which includes nature protection) of marine space. This is especially the case in densely used areas such as the North Sea (North-West Europe) where conflicts among users and the environment are already clear. Here marine spatial management has developed quickly, although often on an *ad hoc* basis. The main drivers for the implementation of marine spatial management in these areas come from both the demand for new ocean uses, such as offshore wind energy generation and aquaculture, and international requirements for the protection and conservation of ecologically and biologically valuable areas. The Netherlands and Belgium have both implemented marine spatial planning. Marine spatial planning is also underway in Germany and

the United Kingdom, but both countries have chosen to first establish a strong legal basis for marine spatial planning before starting to develop spatial plans and initiatives.

In 2005, The Netherlands developed an overarching spatial planning framework for the Dutch area of the North Sea, with the primary objective to "enhance the economic importance of the North Sea and maintain and develop the international ecological and landscape features by developing and harmonizing sustainable spatial-economic activities in the North Sea, taking into account the ecological landscape features [29]." Implementation of the spatial policy is described in the Integrated Management Plan for the North Sea 2015 (IMPNS 2015), in which the overall objective for spatial planning is translated into the need for a healthy, safe and profitable sea.

Figure 2: Marine spatial management in the Dutch part of the North Sea



Source: Rijkswaterstaat Noordzee, 2005.

The Dutch marine spatial policy provides the private sector flexibility to develop offshore initiatives and projects. To limit the risks involved in complete market freedom, the spatial policy provides a guiding spatial

management framework in which location-based uses (usage zones), a zoning scheme for growth options, and several exclusion policies, are defined. Central to the Dutch marine spatial management framework is a system of permits for the regulation of offshore activities. Additionally, a set of other tools has been developed to provide insight into spatial developments and potential problems and to facilitate managing the use of ocean space. These new tools include "opportunity maps" that show where a use is permitted in the current framework and is most likely to develop in the future; a spatial monitoring and permit tracking system; an integrated, spatial, assessment framework for issuing permits; exploratory spatial studies for specific functions; a compensation possibility for users harmed by another legal ocean use; and a system to support joint initiatives in which parties combine the use of ocean space (Figure 2). The Dutch spatial planning initiative is designed for the period 2005–2015 and will be reviewed after its first five years. Current experiences, especially with regard to the offshore wind industry, tend to stimulate a bigger role for spatial planning (e.g., more zones and accompanying criteria for specific uses) in future sea use management in The Netherlands.

Belgium recently implemented an operational, multiple-use planning system covering its territorial sea and exclusive economic zone [30]. The core objectives of the Belgian spatial planning policy framework include the development of offshore wind farms, the delimitation of marine protected areas, a policy plan for sustainable sand and gravel extraction, the mapping of marine habitats, protection of wrecks valuable for biodiversity, and the management of land-based activities affecting the marine environment. Together, these objectives provided the basis for a Master Plan that has been implemented incrementally since 2003. The spatial plan has led to a more diverse zoning system for sand and gravel extraction that includes new management zones with sequential rotation for the most intensive exploitation areas, seasonally closed zones in which extraction is prohibited during fish spawning seasons, and an exploration zone where potential future use is examined. The zones defined for wind farms now allow companies to submit proposals without the former risks of denial of permit or compensation costs to other marine resource users (e.g., fisheries) resulting from the lack of a spatial framework for the area as a whole. Future initiatives concerning spatial planning in Belgium will focus on the protection of marine shipwrecks for archeological, biodiversity, and ecological interests, development of a marine component for existing terrestrial protected areas, and the allocation of a research zone for alternative fishing methods [31].

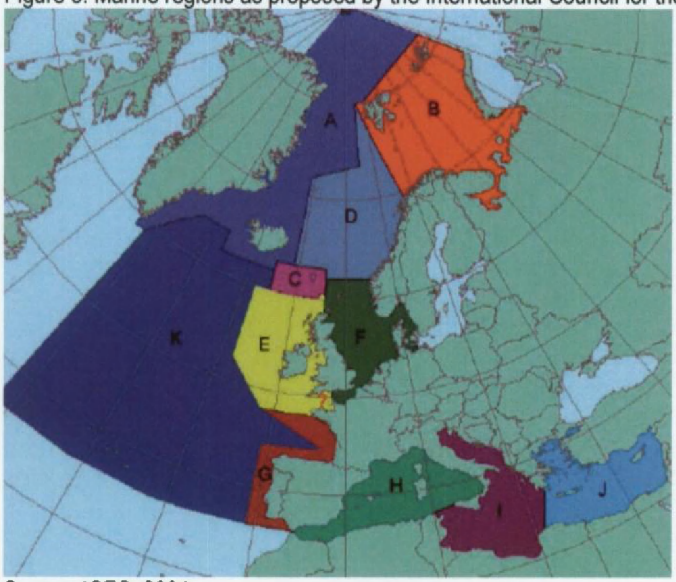
Marine spatial management is also underway in the United Kingdom and Germany. In March 2007, the United Kingdom government released its Marine Bill White Paper. A key element of the Marine Bill is the introduction of a new system of marine spatial management for the entire UK marine area that will allow a strategic, plan-led approach to the use of marine space and the interactions between its uses. Marine spatial management in the United Kingdom aims to "look more strategically at the whole of the marine environment, the way that we use and protect our resources and the interactions between different activities that affect them [20]." A spatial planning system will encompass all activities and will be directed to deliver sustainable development by facilitating proactive decision-making. Marine plans will be developed by a newly established "Marine Management Organization", that will guide decisions on license applications and other issues, and provide users of the sea with more certainty. The potential and ability of spatial management to judge the combined effects of many activities over time is one of the key considerations toward implementation of spatial management in the United Kingdom. The feasibility and practicality of developing and applying marine spatial management in the waters of the United Kingdom have been extensively researched and tested through a pilot project conducted in the Irish Sea, concluded in 2004 [31]. The Marine Bill is expected to be introduced to the Parliament of the United Kingdom toward the end of 2008.

Finally, Germany extended its Federal Spatial Planning Act to the EEZ in 2004. The spatial planning initiative for the EEZ started with the development of a set of goals and principles for spatial planning in the framework of UNCLOS. In 2007, the Federal Maritime and Hydrographic Agency completed a draft spatial plan and an associated environmental report for the German EEZ in both the North Sea and the Baltic Sea. The aim of the spatial plan is "to establish sustainable development of ocean space, in which social and economic demands for space are consistent with the ecological functions of space [32]." The associated environmental report aims to identify and evaluate the likely significant effects on the environment that could result from implementing the spatial plan. The German spatial management approach includes the possible designation of "priority areas" and "reservation areas," reserved for defined use in which other conflicting uses are excluded, and "suitable areas" in which defined uses are allowed inside, but excluded outside, the designated areas. A final plan has been published in June 2008 [33]. In the German territorial sea, the Länder (states) are responsible for spatial management, including planning. Mecklenburg-Vorpommern (Baltic Sea) and Niedersachsen (Lower Saxony; North Sea) expanded their existing spatial plans from the landside to the coast area. In 2005, Mecklenburg-Vorpommern extended its Spatial Development Programme to "ensure conflict management between the demands of new technologies, tourism and nature protection and traditional sectors like shipping, fishing and defense at an early stage [34]."

Of considerable importance in the examples of The Netherlands, Belgium, Germany, and the United Kingdom, is their use and application of marine spatial management to govern multiple-uses in the entire marine area under their jurisdiction. While marine protected areas in all countries will be part of the tools used for marine conservation, they are considered in the wider context of a marine spatial management strategy for the entire area that balances them with the need to ensure economic growth and stability for infrastructure investments (e.g., port extensions, aquaculture facilities, and wind farms).

A major challenge in all four of the countries, however, is the need to underpin marine spatial planning efforts with an ecosystem approach. The North Sea is a dynamic and interconnected ecosystem that should be considered as a whole. The interconnectedness of adjacent ocean spaces, the cross-boundary impact of ocean uses, and the broader scale needed to be ecologically meaningful, require that marine spatial plans developed at the national level are embedded in a broader, international context and integrate, or at least address, the dynamics of the system as a whole. None of the spatial planning initiatives described above have integrated or addressed this broader international context, nor do they have a framework in place that might allow cooperation in the future [24]. However, the new turn that European marine management is taking is very promising. The 2007 EU Green Paper "Towards a Future Maritime Policy for the Union: A European Vision for the Oceans and Seas [35]" (Maritime Policy) and the Marine Strategy [36] introduced the principle of ecosystem-based marine spatial planning and initiated the concept of "marine regions" as larger, ecologically meaningful, management units that can stimulate cooperation between Member States in achieving the EU objectives for the marine environment, including ecosystem-based marine spatial management (Figure 3) [37].

Figure 3: Marine regions as proposed by the International Council for the Exploration of the Sea (ICES)



Source: ICES, 2004.

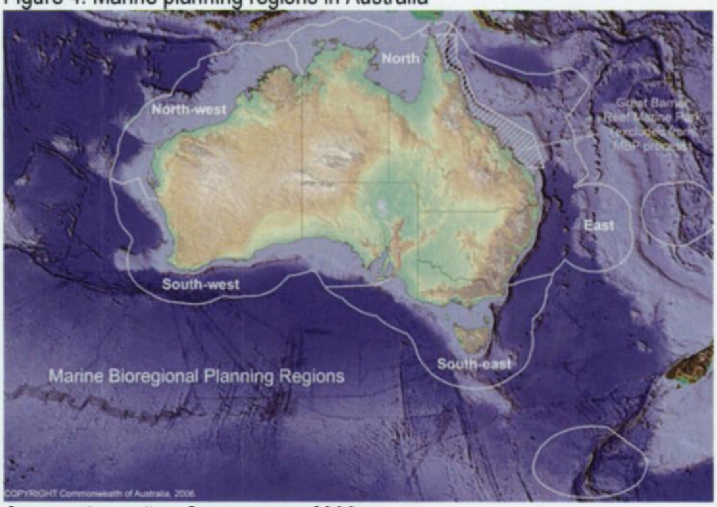
Similar efforts toward multiple-use marine spatial management are also underway in China. In January 2002, the Law on the Management of Sea Use came into force, establishing an initial regional planning system and an integrated management framework for marine development and conservation in China. Starting in 2000, under the overall supervision of the State Council, along with other relevant ministries and coastal provinces, autonomous regions and municipalities formulated a nation-wide Marine Functional Zoning Scheme. Over two-thirds of the zoning schemes of the 11 coastal provinces, autonomous regions, and municipalities of China have been completed and approved by their respective provincial or local governments for implementation [38].

3.3 Marine spatial planning based on an ecosystem approach

More systematic approaches toward the establishment of ecosystem-based marine spatial management have started to emerge in Australia (outside the GBRMP), New Zealand and Canada. For example, Australia has used the concept of "marine bio-regionalization" as a platform for the development of marine spatial management since the late 1990s. Bio-regionalization describes the spatial patterns in the benthic (on or near the sea floor) and pelagic environments at scales appropriate to marine spatial management. Bio-regionalization is used, among other purposes, to define ecologically-based planning and management units, to map their location, structure and composition, to provide the basis to select biologically and ecologically important areas for protection, to provide a systematic framework for finer-scale planning and management of ocean uses, and to provide a spatial framework for environmental assessments [39]. The bio-regionalization process has the overall objective to provide a "clearer focus on conservation and sustainable management of the marine environment and offer greater certainty for industry [40]." The

waters around Australia (outside the GBRMP) have been divided into five marine regions: South-East, South-West, North-West, North, and East (Figure 4). Each marine region is further divided into "bioregions" based on ecological similarities, species distributions, and oceanographic and seafloor characteristics. These bioregions reflect the understanding of the region's ecology and underpin the spatial management process [41].

Figure 4: Marine planning regions in Australia



Source: Australian Government, 2006.

For each of these marine regions, a bioregional plan is being completed that contains:

- A description of the regions' key habitats, plants and animals, natural processes, human uses and benefits, and threats to the long-term ecological sustainability of the region;
- Detailed description of the various statutory obligations that apply to the region;
- Identification of regional priorities for protection of conservation values, based on an appreciation of threats; and
- Identification of how environmental quality and condition of the area will be monitored in the future.

The development of marine bioregional plans is comprised of three main stages. The first stage of the planning process involves developing a "regional profile" for each marine region. The regional profile gives details about the various statutory obligations with regard to nature protection and other marine spatial management measures. It also sets out the objectives for the identification of a network of marine protected areas in the region. The second stage involves development of a "draft plan" that contains a strategic regional assessment of conservation values and current and emerging pressures on the marine environment. The assessment of the draft plan identifies key conservation and heritage priorities for each marine region and the range of legislative and administrative tools available to manage them. The third and final stage involves the development of the "bioregional plan," which is completed after public consultation of the draft plan. It identifies conservation values in the region, priorities and measures for the protection of these values, a network of marine protected areas, and a set of sustainability indicators that will be used to

assess the health of the marine environment into the future [42]. A plan for the South-East Marine Region [43] has been completed and a bioregional profile has been completed for the South-West Marine Region [44]. The other four plans are in development and will be completed by 2012.

Similar efforts are underway in New Zealand where coastal and deepwater classification systems have been developed to identify bio-geographic regions that will underpin the management of ocean spaces. Thirteen coastal bio-geographic regions have been identified on the premise that similar physical habitats and ecosystems, if separated by enough space, will contain different biological communities due to a combination of broad-scale factors, including oceanography, current dynamics, large-scale latitudinal gradients, climate, or barriers to dispersal. A Marine Environment Classification (MEC) with 20 class levels has been developed as a primary tool for classification in the deepwater environments of New Zealand's EEZ [45].

Although in an earlier stage, a similar approach toward marine spatial management is taken in Canada. Five Large Ocean Management Areas (LOMAs) [46] have been identified to address large-scale ocean space issues and provide the context for future spatial management. Canada's marine spatial framework is further developed around 19 ecological units (marine eco-regions) based on scientific criteria delineated to ensure that management areas capture ecosystem-scale features, patterns and trends [47]. Marine spatial management is furthest developed for the Eastern Scotian Shelf where a strategic plan for integrated ocean management has been developed and released [48]. As part of the plan, human uses have been identified and mapped and objectives have been set for future management of ocean space [49].

Finally, although marine spatial management initiatives in Europe are developing within national boundaries, it is promising that the European Commission's approach attempts to focus future efforts on the concept of marine regions and sub-regions. Similar to Australia's and Canada's experiences, these marine regions are defined on the basis of physical and ecosystem characteristics, including hydrologic, oceanographic, and bio-geographic features, rather than simply on the consideration of political boundaries [50].

4. The future of ecosystem-based marine spatial management

Although critical voices about the potential, nature and scope of spatial management exist [51], the fact that ecosystem-based management is place-based and needs a more systematic spatial and temporal approach is generally accepted. What is missing, however, is a clear demonstration of how it can be implemented. As no single, readily applicable best practice of marine spatial management exists, many have expressed the need for better-defined tools, procedures, and guidelines that support the implementation of ecosystem-based, marine spatial management [19].

This assumption has been the main conclusion of the two years of work of the Ocean Zoning Working Group of the National Center for Ecological Analysis and Synthesis (NCEAS), University of California, Santa Barbara [52]. A similar conclusion was drawn from the first UNESCO International Workshop on the use of marine spatial planning as a tool to implement ecosystem-based, sea use management [53]. In its latest communication, the European Commission confirmed that integrated marine spatial management is fundamental and announced its plans to develop a system for the exchange of good practices and guidance to facilitate and encourage implementation of ecosystem-based marine spatial management [54].

Under the auspices of UNESCO's Intergovernmental Oceanographic Commission (IOC) and Man and the Biosphere Programme (MAB), a comprehensive set of guidelines and principles for the implementation of ecosystem-based marine spatial management is under development. In the first phase, at least ten international examples of marine spatial management, at different stages of development, will be analyzed and documented with the objective of providing necessary and fundamental information for applications of ecosystem-based marine spatial management. The analysis and documentation of international examples focus on steps taken during the marine spatial management process that have led to successful implementation and desired outcomes. An indication of crucial steps will allow decision-makers and resource managers to better determine their priorities in implementing ecosystem-based marine spatial management. In a second stage, a draft of the guidelines and principles manual will be tested, fine-tuned, and adapted to the context of specific marine ecosystems through regional meetings and workshops. Two regional meetings are planned in places that are ready for marine spatial management. The final guidelines will be published in May 2009 [55].

5. Conclusion

Ocean resources are limited both in space and abundance. The ongoing industrialization and expansion of ocean uses and the rise of new uses have increased considerably the demand for ocean space. In some areas, combined demand for ocean space exceeds already more then three times the available space. Today, this trend has led to two important types of conflict; conflicts among users as a result of incompatible demands for ocean space, and conflicts between users and the environment resulting from the impact of uses on sensitive ecological areas. During recent years, marine spatial management, underpinned by an ecosystem approach, has been brought forward as a way to deal with these conflicts and to apply an ecosystem approach to the management of the marine environment. Marine spatial management can do this by (a) addressing the heterogeneity of marine ecosystems in a practical manner; (b) focusing on influencing behavior of humans and their activities over time; (c) providing a management framework for new and previously inaccessible scientific information; (d) making conflicts and compatibilities among human uses visible, and therefore, tangible; and (e) guiding single-sector management toward integrated decision-making.

Throughout the world, several countries have begun to move the conceptual work forward and have started to implement marine spatial management successfully. While early plans such as Australia's GBRMP spatial plan or the Florida Keys National Marine Sanctuary management plan were brought forward to establish and manage marine protected areas, more recent attention has been placed on multiple-use of marine space. The Netherlands and Belgium have implemented marine spatial management through which nature conservation requirements and new demands for ocean use were merged successfully. Germany, the United Kingdom and China also have similar multiple-use marine spatial plans underway. A major challenge in Europe is the need to undertake marine spatial management in broader areas, with boundaries drawn on the basis of ecological considerations rather than political ones. This challenge is greatly stimulated by the European Union as part of its newly released Maritime Policy and the introduction of "marine regions" in the context of the Marine Strategy. Systematic attempts to underpin marine spatial management with an ecosystem approach have been taken in Australia, Canada and New Zealand.

Although no parallel can be drawn between the contexts and associated challenges of the GBRMP and the densely-used areas in Europe or China, some very important lessons can be learned about the process of ecosystem-based marine spatial management. The long-standing experience of the GBRMP illustrates the

need to conduct marine spatial management in a continuous manner, one that allows monitoring and evaluating initial plans and adapting them to changing circumstances. It also illustrates that stakeholder involvement and sustainable financing are critical to a successful outcome of marine spatial management. The more recent spatial management initiatives in Europe focus more on resolving conflicts among users and a shared use of ocean space. Finally, ecosystem-based marine spatial plans should be based on sound research and data that addresses the ecological and human dimension of marine spatial management in an equally important way. While biological and ecological information can enable the identification of areas of ecological and biological significance—the ecological dimension, social and economic information should establish the connection of offshore activities with onshore communities, cultures, economies, and constituencies—the human dimension.

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CHAPTER 2
The development of marine spatial planning in Europe

Updated from:
Douvere F and Ehler C. 2009
New perspectives on sea use management:
Initial findings from European experience with marine spatial planning
In: Journal of Environmental Management 90: 77-88

Abstract

While the former chapter discussed the general need and evolution of marine spatial planning (MSP), this chapter will look in more depth at the development of MSP in Europe. Several European countries, on their own initiative or driven by the European Union's Marine Strategy and Maritime Policy, the Bergen Declaration of the North Sea Conference, and the EU Recommendation on Integrated Coastal Zone Management, have taken global leadership in implementing MSP. Belgium, The Netherlands, and Germany in the North Sea, and the United Kingdom in the Irish Sea, have already completed – and some extent implemented - marine spatial plans for marine areas within their national jurisdictions. The chapter starts with an overview of the international and European legal and policy context for MSP and continues with an analysis of MSP initiatives in Europe, both at the national and supranational level. The chapter concludes that, although MSP is furthest developed in this part of the world, some real challenges are looming, particularly in view of applying an ecosystem approach to MSP.

1. Introduction

The results of the 2005 Millennium Ecosystem Assessment (MEA), as well as other global and regional assessments of the marine environment, confirm that biodiversity in the world's oceans and coastal areas continues to decline as a consequence of uncoordinated and unsustainable human activities. Recently a group of leading scientists concluded in Science that 'the loss of marine biodiversity is increasingly impairing the oceans' ability to produce seafood, resist diseases, filter pollutants, maintain water quality and recover from perturbations such as over-fishing and climate change [1].'

The MEA recognizes that people are at the centre of this situation. Ongoing population growth, technological change, and shifting consumer demands all have considerably increased the need for more food, more energy and more trade. An increasingly larger share of goods and services comes from coastal and marine resources. With ocean resources being limited both in space and amount, these developments have proven to be devastating for many marine places. Essentially, increased pressure on the marine environment has led to two important types of conflict. First, not all uses are compatible with one another and are competing for ocean space or have adverse effects on each other (user vs user conflicts). But a larger concern is the cumulative impact of all these activities on the marine environment, i.e., the conflicts between users and the environment (user–environment conflicts).

Traditional concerns about nature included direct impacts such as water quality and habitat loss. More recently, environmental concerns have shifted to the marine life support system or 'ecosystem' that nurtures and sustains important resources that are valued for various reasons. As a result, the traditional sectoral approach to natural resource and environmental management has shifted toward a more holistic ecosystem approach that calls for a comprehensive look at all dimensions of environmental problems [2]. In their jointly adopted vision, two regional commissions for the protection of the marine environment, OSPAR[1] and HELCOM[2], define an ecosystem approach to sea use management as [3]:

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

Today, the ecosystem approach has become widely accepted as a key framework for delivering sustainable development in both the terrestrial and the coastal and marine environment. It provides an important framework for assessing biodiversity and ecosystem services and evaluating and implementing potential responses. Application of the ecosystem approach involves a focus on the functional relationships and processes within ecosystems, attention to the distribution of benefits that flow from ecosystem services, the use of adaptive management practices, the need to carry out management actions at multiple scales, and inter-sectoral cooperation. A number of other established approaches, such as integrated water resources management and integrated ocean and coastal area management, are consistent with the ecosystem approach and support its application in various sectors or biomes The application of ecosystem approaches in the marine and coastal areas builds on the concept of integrated management, already widely used for the management of these areas [4].

An in-depth review of the application of the ecosystem approach, carried out by the Convention on Biological Diversity (CBD), revealed however, that various barriers prevent actual implementation of

[1] OSPAR is the Commission for the Protection of the Marine Environment of the Northeast Atlantic. More information on: http://www.ospar.org

[2] HELCOM is the Baltic Marine Environment Protection Commission. More information on: http://www.helcom.fi

ecosystem-based management. Despite its broad acceptance and wide range of principles, definitions and guidelines, the ecosystem approach is still more a concept, widely discussed at scientific fora, but with few examples of actual practice. It is increasingly clear that governments and stakeholders lack the necessary tools to make an ecosystem approach operational in the marine environment, especially with regard to cross-sectoral integration. In particular, the concept lacks concrete guidance that allows balancing conservation and sustainable use of natural resources.

The CBD review recognizes that the implementation of an ecosystem approach to coastal and ocean management is a complex and demanding process, and that – among other needs – practical tools need to be developed that can make this process more tangible [5]. Other research conducted to evaluate current practice and application of ecosystem-based management, resulted in similar conclusions and confirm the need for more operational tools that can move implementation forward [6]. One way to do this is through the use and application of marine spatial planning (MSP).

2. Marine spatial planning: an essential step toward ecosystem-based, sea use management

A key characteristic of ecosystem-based management is that it is place-based or area-based [7] which is a marked departure from existing approaches that usually focus on a single species, sector, activity or concern [8]. Where sectoral management implies that each sector regulates particular activities or projects taking place at a particular location (or site) within a certain area, ecosystem-based management implies that, after an area has been defined, sustainable development and use will be established for all activities in the whole area [9].

The place-based character of ecosystems, the spatial and temporal development of ocean resource uses, and conflicts among them, together with the need to develop human uses in places that minimize their impacts on ecologically or economically important places in the marine ecosystem, all draw attention to the need to look at the system from a spatial (and temporal) perspective. It is obvious that apart from measures that can control the performance of human activities (for example, a limit on pollution discharges), effective implementation of ecosystem-based management will also require measures that control the spatial and temporal development of human activities in the marine environment. Such measures could be taken through marine spatial planning.

Analogous to land use planning in the terrestrial environment, MSP can provide the analytical basis for identifying and evaluating these measures in coastal and marine environments. Spatial planning is an important tool for managing the development and use of land in many parts of the world. In North America and Europe it is commonly used as a component of land use management. The traditional and incremental, permit-by permit approach has been enhanced by a comprehensive planning approach that lays out a vision to be developed for an area. With only a few exceptions, there is no clearly articulated spatial vision for the use of marine areas, no plan-based approach to management, and consequently, a lack of certainty for marine developers and users. This is exacerbated by the sector-by-sector responsibilities for approving permit applications in the marine environment.

The application of spatial planning in the marine environment would provide a range of benefits, including [10]:

- Applying an ecosystem approach to the regulation and management of development and human activities in the marine environment by safeguarding ecological processes and overall resilience to ensure the environment has the capacity to support social and economic benefits (including those benefits derived directly from ecosystems);

- Providing a strategic, integrated and forward-looking framework for all uses of the sea to help achieve sustainable development, taking account of environmental as well as social and economic objectives;
- Identifying, conserving, or where necessary and appropriate, restoring important components of coastal and marine ecosystems; and
- Allocating space in a rational manner that avoids or minimizes conflicts of interest and, where possible, maximizes synergy across sectors.

In its broadest sense, marine spatial planning can be defined as [11] a process for analyzing and allocating parts of three-dimensional marine spaces to specific uses or non-use, to achieve ecological, economic, and social objectives that are usually specified through a political process. MSP is a sub-activity of the overall planning activity of sea use management. Despite the different contexts, the process for developing marine spatial planning is similar to land use planning in the terrestrial environment. The principal output of MSP is a comprehensive marine spatial plan or alternatively "comprehensive development plan" or "comprehensive master plan". It is a "vision" of the future of the marine region or ecosystem and reflects the output of a process in which stakeholders collectively define their purpose, core values, and perspective for the future. The vision declares common goals, guides regional decision-making, unites stakeholders with a common purpose, and motivates citizens and decision-makers to meet the goals of the vision.

The comprehensive marine spatial plan is usually long-term, general in nature and policy oriented and is implemented through more detailed zoning maps, zoning regulations and a permit system. Individual permit or licensing decisions can then be made based on the zoning maps, that in turn reflect the vision of the comprehensive marine spatial plan. It is important to recognize however, that MSP can only influence the spatial and temporal distribution of human activities. Other measures that can influence the inputs to human activities (e.g., limitations on fishing activity and capacity), the processes of human activities (e.g., requirement for "best environmental practice"), or the outputs of human activities (e.g., tonnage limitations on mineral extraction), need to be taken in conjunction with the spatial planning measures.

While initially the idea of MSP was stimulated by international and national interests in developing marine protected areas, e.g., the Great Barrier Reef Marine Park or the Florida Keys National Marine Sanctuary, more recent attention has been placed on managing the multiple use of marine space, particularly in areas where use conflicts are already clear, for example in the North Sea. Today, various countries have begun to recognize that the time has come for a strategic and integrated plan-based approach for the management of entire marine spaces, instead of the piecemeal view, so that commitments made in a number of important international and national marine policy declarations, including commitments regarding biodiversity and habitat protection, can be fulfilled [12]. The sections below look into more detail at the development of MSP in Europe and its attempts to move toward ecosystem-based management of the marine environment.

3. International legal and policy framework relevant for the development of MSP

During the past decades, international environmental law and policy, especially with regard to the marine environment, has expanded significantly. Some of these international and regional legal and policy documents provide a substantive framework regarding the allocation of marine space. Among the most important are the United Nations Convention on the Law of the Sea (UNCLOS), the CBD, Agenda 21, and the World Summit on

Sustainable Development Plan of Implementation. The following sections give a brief overview of these legal and policy documents. The allocation of marine space has further been specified in international agreements for particular sectors, such as some Conventions and Protocols adopted in the International Maritime Organization, the FAO Code of Conduct for Responsible Fisheries, and the World Heritage Convention among others.

3.1. United Nations Convention on the Law of the Sea (UNCLOS)

At a global scale, UNCLOS provides an overarching framework for the allocation of marine space to national states, the rights and obligations regarding these spaces, and a system for international cooperation regarding the management and conservation of the marine environment. UNCLOS introduced the concept of the exclusive economic zones and defined the limits of the territorial seas, the contiguous zones, the continental shelves, and the high seas. The Convention sets out the international framework for the management of these marine spaces, including a legal basis for the regulation of their sustainable use and protection. Aspects that have an impact on the development of MSP include rights to transit passage, the freedom of navigation, fishing and the laying of submarine cables and pipelines [13].

3.2. Agenda 21, chapter 17

Chapter 17 of Agenda 21, sets out a framework program of action for achieving protection and sustainable development of the marine environment and its resources. The programme areas include [14]:

- Integrated management and sustainable development of coastal areas, including exclusive economic zones;
- Marine environmental protection;
- Sustainable use and conservation of marine living resources of the high seas;
- Sustainable use and conservation of marine living resources under national jurisdiction;
- Addressing critical uncertainties for the management of the marine environment and climate change;
- Strengthening international and regional cooperation and coordination; and
- Sustainable development of small islands.

To achieve the objectives set out for the program areas, in particular the protection of the marine environment and the establishment of an integrated approach to management, Agenda 21 calls for the preparation and implementation of land and water use policies and mechanisms that allow the identification of critical areas, including user conflicts, development patterns or areas for specific management priorities [14]

3.3. The Convention on Biological Diversity (CBD)

The CBD program of work, as well as the principles of the Jakarta Mandate, covers a number of aspects relevant to MSP, including the central role that is given to marine and coastal protected areas. Decision VII/5 of the CBD describes the various elements of an ecosystem-based marine and coastal management framework. Central to the management framework is an integrated network of marine and coastal protected areas, consisting of [15]:

- Marine and coastal protected areas, where threats are managed for the purpose of biodiversity conservation and/or sustainable use and where extractive uses may be allowed. These areas are subject to site-specific controls (for example, controls on fishing methods, controls on the removal of certain species, rotational closures, and controls on pollution and sedimentation) that either have an explicit biodiversity objective, a social or economic objective, or a recognized biodiversity effect; and

- Representative marine and coastal protected areas where extractive uses are excluded, and other significant human pressures are removed or minimized, to enable the integrity, structure and functioning of ecosystems to be maintained or recovered. The key purpose of these areas would be to provide for intrinsic values, to allow better understanding of the marine and coastal environment by acting as scientific reference areas, to contribute toward marine environmental recovery, and to act as insurance against failures in management.

Such a marine and coastal protected area network should be located within a framework of spatial management practices over the wider marine and coastal environment that include general restrictions applied to the entire area and site-specific restrictions imposed for non-biodiversity purposes (for example, trawling restrictions to protect cables, restricted areas for defence purposes, etc.)

3.4. World Summit on Sustainable Development (WSSD)

The commitments made in 2002 at the World Summit on Sustainable Development (WSSD) in Johannesburg have contributed to the development of MSP at the global, regional and national level. In particular, the WSSD Plan of Implementation called for the development of – among others – land use planning tools for coastal and watershed planning as a means to promote the conservation and management of oceans areas. The Johannesburg Summit further included a number of commitments that are relevant to MSP. Among the most important are the need to improve efficient use of water resources, the promotion of resource allocation among competing uses in a way that balances basic human needs with the preserving or restoring of ecosystems, and the establishment of representative networks of marine protected areas by 2012 [16].

Although none of the international legal and policy instruments described above advocate explicitly the need and use of MSP, they provide a basis for the development of spatial planning in the marine environment as a means to advance the implementation of ecosystem-based management. In addition, in the context of other international legal and policy documents designed for the regulation of individual sectors (e.g., fisheries and maritime transport), ocean spaces are delineated for particular purposes, most often conservation. Examples include 'Special Areas' (SAs) and 'Particular Sensitive Sea Areas (PSSAs) under some Conventions and Protocols adopted by the International Maritime Organization (IMO) or World Heritage sites designated in the framework of the World Heritage Convention. Because of the spatial component of these measures taken in the framework of these conventions, they are relevant for the development of MSP. In contrast to the international context, requirements for the development of MSP in Europe are becoming much more explicit, especially in recent policy documents. This, in turn, is a reflection of an increasing need for a more integrated and strategic sea use management in European coastal and marine areas.

4. The increasing need for sea use planning in Europe

For centuries, the oceans have been of major strategic importance to the economic and social development of Europe. The land mass of the European Union (EU) has a coastline of 68,000 km, equivalent to seven times that of the USA and four times that of Russia. Almost half of Europe's population lives within 50 km of the coast. As a result of this close association between European citizens and their seas, European coastal seas are heavily affected by increasing conflicts among competing users [17]. In a recent communication, for example, the EU Commissioner for Fisheries and Maritime Affairs emphasized the strategic importance of aquaculture for global food security, but stressed at the same time that the competition for space in European waters is a critical challenge for the sector when expanding during the coming years [18]

Europe's vision for the future strives to balance the need to stimulate economic growth, employment and welfare with the need to maintain and improve the status of the marine environment and its resources (European Commission, 2006a). As early as in 1999, the European Spatial Development Perspective recognized that all sectoral policies have a territorial (or spatial) impact and that a spatial plan is the most appropriate means of resolving conflicts between sectoral interests and policies [19].

During recent years, the need for MSP has become increasingly more important, as reflected in various legal and policy documents in Europe. The following sections describe the most important documents with regard to MSP.

4.1. The legal and policy context in Europe

4.1.1. Green Paper on the Future Maritime Policy for the European Oceans and Seas

The EU Green Paper 'Towards a Future Maritime Policy for the Union: A European Vision for the Oceans and Seas' (Maritime Policy), launched in June 2007 aims to provide the basis for a future maritime policy for Europe that allows the development of well-balanced and coherent sea-based policies and activities that reassure mutual reinforcement of economic growth and social welfare on the one hand and good status of the marine environment and its resources on the other hand. MSP is seen as a key aspect to managing a growing and increasingly competing maritime economy, while at the same time safeguarding biodiversity.

The Maritime Policy considers the management of marine space a keystone of any maritime policy and essential for efficient sectoral policies and rational use of maritime structures. It further emphasizes that without the development of an ecosystem-based MSP system, it will soon become impossible to manage the increasing, and often conflicting, uses of the oceans. It describes MSP as a means to [20]

- Coordinate the spatial implementation of off-shore renewable energy with other activities;
- Provide financial security for investment decisions;
- Advocate MSP as a tool to enable the management of increasing, and often conflicting, uses of the oceans;
- Manage the competition among various uses (including their multiple objectives) in the marine environment;
- Develop a stable regulatory environment that ensures better and simpler regulation toward the location of economic activity;
- Ensure that individual decision on activities, taken at a national or regional level, but affecting the same ecosystem or cross-border activities (for example, pipelines and shipping routes) are dealt with in a coherent manner;

- Ensure that the future development of offshore activities is consistent with the need to evolve multilateral rules.

The Maritime Policy concludes that a spatial planning system should be conducted through an ecosystem-based approach and established for offshore activities in all waters under jurisdiction of its Member States. The latest communication from the European Commission confirms that integrated MSP is a fundamental requirement for sustainable development and for achieving an integrated approach to marine management.

4.1.2 EU Roadmap for Maritime Spatial Planning: Achieving common principles

In November 2008, the European Commission adopted a roadmap that sets out key principles for MSP that can encourage implementation through a common approach. The common principles as defined by the roadmap include [21]:

- Using MSP according to area and type of activity
- Defining objectives to guide MSP
- Developing MSP in a transparent manner
- Stakeholder participation
- Coordination within Member States – simplifying decision making processes
- Ensuring the legal effect of national MSP
- Cross-border cooperation and consultation
- Incorporating monitoring and evaluation in the planning process
- Achieving coherence between terrestrial and maritime spatial planning – relation with ICZM
- A strong data and knowledge base

During 2009, a series of workshops were hosted to further discuss the content of each of the principles for MSP. A first look at the EU principles for MSP, however, indicates a lack of understanding of the fundamental nature of marine planning. A MSP principle is a basic or essential quality or element that determines the intrinsic nature or characteristic behavior of MSP. Aspects such as "using MSP according to area and type of activity", "defining objectives to guide MSP", "ensuring the legal effect of national MSP", or "incorporating monitoring and evaluation in the planning process" which are identified by the EU as MSP principles, can hardly be seen as principles. They are general statements that refer to the steps of a MSP process rather than essential elements that determine the intrinsic nature of MSP.

4.1.3 The EU Thematic Strategy for the Marine Environment

In 2005, the EU Marine Thematic Strategy (Marine Strategy), which will be the environmental pillar of the Maritime Policy, introduced the principle of ecosystem-based MSP and provided a supportive framework for national initiatives toward spatial planning designed for achieving a good status of the marine environment.

In the context of the Marine Strategy, Europe introduced the concept of 'marine regions' as large, ecologically meaningful, management units for the implementation of the strategy and cooperation between Member States in achieving the objectives of the Marine Strategy [22]. Preparation for the identification of European marine regions was provided through an ICES study in which 11 marine regions, referred to as 'eco-regions', were defined based on bio-geographic features, oceanographic features, and existing political, social and management divisions [23,24] (Fig. 2). This division into eco-regions can be seen as a basic geographical requirement for implementing the ecosystem approach in

European waters and builds further on the condition that ecosystem-based management is inherently place-based or area-based.

4.1.4. The EU Recommendations on Integrated Coastal Zone Management (ICZM)

Although the EU recommendations on Integrated Coastal Zone Management (ICZM), adopted in 2002, do not refer to MSP as such, they do provide a basis for doing so, in particular as part of the requirement of Member States to develop national ICZM strategies. This view was confirmed at the 'First European High Level Forum' on ICZM where the potential to use spatial planning, integrated with sea-use planning and marine resources management, at the national, regional and local level was emphasized as away to apply a holistic and dynamic perspective in ICZM [25]. A recent evaluation of ICZM in Europe now recognizes MSP as one of the priority themes for the further implementation of ICZM in European coastal zones [26].

4.1.5. The European Wildlife Directives

Among the most important drivers for MSP in Europe is the European legislation on nature conservation as part of the EU contribution to implement the 1992 Convention on Biological Diversity. The two most significant are the Birds Directive [27], providing a framework for the identification and classification of 'Special Protection Areas (SPAs)' for rare, vulnerable or regularly occurring migratory species, and the Habitats Directive [28] requiring Member States to select, designate and protect sites that support certain natural habitats or species of plants or animals as 'Special Areas of Conservation (SACs)'. Together the SACs and the SPAs will create a network of protected areas across the EU, known as Natura 2000. Natura 2000 forms the cornerstone of Europe's nature conservation policy [29].

4.1.6. The EU Common Fisheries Policy, the EU Water Framework Directive and the INSPIRE Directive

In addition to those described above, other EU policy and legal documents that are relevant to the development of MSP initiatives, include the EU Common Fisheries Policy [30] and the EU Water Framework Directive [31]. In the context of the EU Common Fisheries Policy and with the attempt to respond to the challenges of closed or semi-closed fishing areas, the Regional Advisory Council for the North Sea recently established a Working Group on MSP [32]. The aim of the EU Water Framework Directive is to establish a framework for the protection of inland surface waters, transitional waters (estuaries and brackish waters), coastal waters and groundwater. The principal objective is that these water bodies should achieve good status by 2015, which includes the establishment of a register of protected areas and the development of a management plan (that could include land use or spatial management measures to reduce, for example, diffuse sources of water pollution) for each river basin. Finally, the EU adopted a new Directive (INSPIRE) that aims to make available harmonised sources of geographical information and link all spatial data to a shared infrastructure [33].

4.1.7. The Fifth Ministerial North Sea Conference

The need for MSP in European waters is also reflected at the regional level. In 2002, the Ministerial Declaration of the 5th North Sea Conference (Bergen) [34] invited the OSPAR Commission to investigate the possibilities of further international cooperation in developing MSP as a tool for an

effective sea use management. The OSPAR Working Group on MSP is currently designing a set of guidelines to implement MSP in the Northeast Atlantic Region [35].

4.2. MSP practices in the North Sea: toward an ecosystem-based approach?

Of all European seas, MSP is furthest developed in the North Sea. Both the Netherlands and Belgium have developed and implemented their spatial plans and are currently working on 'second-generation' versions of their plans. Germany is in the process of implementing its marine spatial plans for the North Sea and Baltic Sea areas under its jurisdiction, while the UK recently adopted a new Coastal and Marine Access Bill that will lay the foundation for a multiple-objective MSP. With the exception of Germany in the Baltic Sea, no other European nation has fully developed MSP, and initiatives toward this end vary widely from country to country [36].

MSP initiatives in the North Sea region are primarily driven by European policy and legislation that is, in turn, a reflection of the discussion and controversy regarding new uses of the sea and the seabed and the increasing need to meet commitments on biodiversity conservation. Especially these new uses (i.e. wind farms, marine protected areas, aquaculture) have triggered a pragmatic approach to the development of MSP. In contrast to other international MSP initiatives, the European examples are directing more attention to identifying and resolving conflicts among different sea uses and users [37], and attempt to include all waters under their jurisdiction.

While these plans also attempt to ensure that environmental conservation objectives are not impaired by human activity, it is uncertain whether environmental concerns are sufficiently addressed to lead toward MSP that is fully underpinned by an ecosystem approach as aimed for in the EU Marine Strategy and Maritime Policy, among others. As discussed above, the EU Thematic Strategy introduced the concept of 'marine regions' and proposed 11 large, ecologically meaningful, management units. Consequently, an ecosystem-based approach in European seas could be achieved by developing MSP at the scale of these marine regions. Similar approaches, for example, are taken in Canada and Australia (areas outside the Great Barrier Reef) where respectively 'large ocean management areas (LOMA's)' and 'bioregions' form the basis for the future development of ecosystem-based MSP.

To date, however, MSP has solely been developed within national jurisdictions, without much consideration for trans-boundary issues. This situation is largely a reflection of the international legal system for marine management, that provides only nations with the rights to develop MSP for areas under their jurisdiction. No regional nor supra-national organization has currently the mandate to develop multiple-objective marine spatial plans. The following sections examine in more depth the MSP initiatives taken in Belgium, Germany, and The Netherlands. For each of the plans, the key objectives, elements of the plan, development process of the plan, and level of implementation of the plan are discussed. In addition, some of the scientific research that has been done to support the development of spatial plans in these countries is described briefly. The section concludes with an overview of recent initiatives that aim to address environmental concerns in a trans-boundary manner in an attempt to move toward ecosystem-based MSP at the scale of the North Sea region as a whole.

4.2.1. MSP in Belgium

Belgium is among the first countries to actually start implementing an operational, multiple-use planning system covering its territorial sea and exclusive economic zone [38]. MSP in Belgium developed on an

ad hoc basis, mainly driven by European environmental protection commitments and an increasing amount of new opportunities for the exploitation of the marine environment.

New activities, the expansion of existing activities, an increasing need for nature conservation, and the goal to integrate the management of marine and coastal ecosystems led to increased conflicts that could not be dealt with by a permit system or an environmental impact assessment only. The need for a more comprehensive approach toward spatial planning for the Belgian Part of the North Sea (BPNS) became particularly urgent in light of new national objectives and associated targets such as the need for offshore energy production (i.e., wind farms) and the development of the European network of protected areas (Natura 2000) [37].

The response to this challenge resulted in the development of a spatial plan, referred to as the 'Master Plan', for the entire BPNS. Despite the lack of a formal legal basis for MSP in Belgium, the 'Master Plan' provides a translation of current and future objectives of various sectors into a spatial vision. The objectives of the spatial plan included the development of an offshore wind farm, the delimitation of marine protected areas, a policy plan for sustainable sand and gravel extraction, enhanced financial resources for the prevention of oil pollution, the mapping of marine habitats, protection of ship wrecks valuable for biodiversity, and the management of land-based activities that have an impact on the marine environment. The 'Master Plan' has been implemented incrementally since 2004. The first two phases of the 'Master Plan' are now operational and focus on spatial delimitations for sand and gravel extraction and a zone for future offshore wind energy projects (Phase 1), followed by the delimitation of marine protected areas as part of the EU Natura 2000 Network (see above) (Phase 2). New actions on spatial planning are being studied and focus on the protection of marine shipwrecks for archaeological, biodiversity and ecological interests, the development of a marine component for existing terrestrial protected areas, and the allocation of a research zone for alternative fishing methods [37].

At the scientific level, the discussions and controversy regarding new uses and requirements of the sea and seabed led to the GAUFRE [39] study that made it possible to anticipate new developments in a balanced and sustainable way. The study started with an extensive analysis of the spatial impacts of each existing use and two expected uses (the establishment of marine protected areas and wind energy farms) in the BPNS, followed by a 'impact analysis' that laid out various types of conflicts among uses and between the uses and the environment. The most innovative part of the study envisaged the creation of scenarios for future use of space expressing an integrated vision for MSP for the BPNS, based on a set of core values. Six scenarios were developed, depending on the relative importance of the key values. The alternative scenarios are referred to as 'a relaxed sea', 'a natural sea', 'a rich sea', 'a playful sea', 'a mobile sea', and 'a sailing sea'. The process of creating alternative scenarios for the future use of marine space was seen as a means rather than an end in itself. Different values were considered and weighted to elaborate a complete spatial structural plan for the BPNS. However, the selection of a desirable structural plan was considered as a political, not a technical nor scientific, decision.

More recently, a scientific study on the biological valuation of the BPNS has been completed. The study resulted in a set of maps showing the intrinsic biological value of different sub-areas within the BPNS. The maps were developed using available spatial data for macrobenthos and seabirds and to a lesser extent data on the spatial distribution of demersal fish and epibenthos. These marine biological valuation maps are considered as a unique but indispensable tool to obtain objective and scientifically sound spatial plans that could provide a basis for the implementation of sustainable management actions in the future [40].

4.2.2. MSP in The Netherlands

Discussions about new and often competing demands for ocean space in the Dutch part of the North Sea (DPNS) have been subject to political debate in The Netherlands for a long time. Some of them go back to 1980s and refer to the creation of an offshore airport, industrial facilities, waste disposal, and land reclamation. As in other North Sea coastal states, the need for comprehensive spatial planning became particularly urgent because of new uses that require ocean space, including wind farms and marine protected areas. In 2005, the Dutch Ministry of Housing, Spatial Planning and the Environment published for the first time a North Sea chapter in their national 'Spatial Planning Policy Document'. The Dutch MSP policy aims at preventing fragmentation and promoting the efficient use of space, while giving private parties the scope to develop their own initiatives in the North Sea. This overall objective is elaborated in more detail in the 'Integrated Management Plan for the North Sea 2015' (IMPNS 2015) where it is translated into: (1) spatial management to foster a healthy sea; (2) spatial management to foster a safe sea; and (3) spatial management to foster a profitable sea [41]. The Dutch government has opted for a MSP approach that defines 'use zones' only where necessary (e.g., shipping routes, military exercise, ecologically valuable areas). This approach allows a considerable amount of freedom to the private sector by giving them the latitude to develop initiatives within certain constraints. Spatial planning is considered as a means of fostering sustainable use while simultaneously allowing as much scope as possible for private sector initiatives.

To form a picture of potential problem areas, an analysis was made of the current use of space in the DPNS and the developments surrounding existing and new activities. This analysis culminated in maps that show the spatial impact of current activities and the future pressure on space, including potential conflicts, in the DPNS [41]. Further research activities have paid particular attention to both the economic and ecological value of the Dutch part of the North Sea. An ecological evaluation of the DPNS was conducted for the designation of areas with special ecological value. Based on the result of the study, opportunity maps for protected areas were designed as part of the IMPNS 2015 [42].

In 2008, the Dutch Spatial Planning Act [43] was extended to the exclusive economic zone which was paralleled with a revision of the existing marine spatial plan for the DPNS. As part of the research for the new marine spatial plan, spatial sea use scenarios were developed that correspond with different levels of expected economic growth and include 'preferred sand extraction zones' as part of the flood protection measures in case of sea level rise. An important feature of the revised marine spatial plan is that it no long stand by itself but is now embedded in the Dutch National Water Plan that also deals with the spatial management of the coastal zone, estuaries, and rivers [44].

4.2.3. MSP in Germany

MSP in Germany is conducted at two levels. The German Länder (states) are responsible for the development of MSP in the territorial sea while the federal government is responsible for MSP in the exclusive economic zone [45]. Through MSP in the territorial sea, Mecklenburg-Vorpommern aims to pay particular attention to the opportunities offered and risks presented by the Baltic Sea region to the Länder. Further, it wants to ensure conflict management between the demands of new technologies (offshore wind energy sites), tourism and nature protection and traditional sectors like shipping, fishing and defense at an early stage. The objectives and principles of the plans are similar to those for the planning of land use and are embedded in the broader context of integrated coastal zone management [46].

MSP in the German exclusive economic zone is still in an early stage. Real interest by the federal government in developing MSP for waters under German jurisdiction started around 2000 and was

particularly stimulated by the shocking effect of new maps displaying the numerous proposals for the development of large-scale offshore wind energy farms. This flood of applications was triggered by a guaranteed subsidy for electricity generated by wind power. Various project proposals were overlapping in space and caused concerns for the effects on the marine environment. Other motives for developing MSP included the different competences for approval of activities in the exclusive economic zone and the difficulties this posed with more intense and diverse uses of oceans and coastal waters and the various conflicts among different users it created.

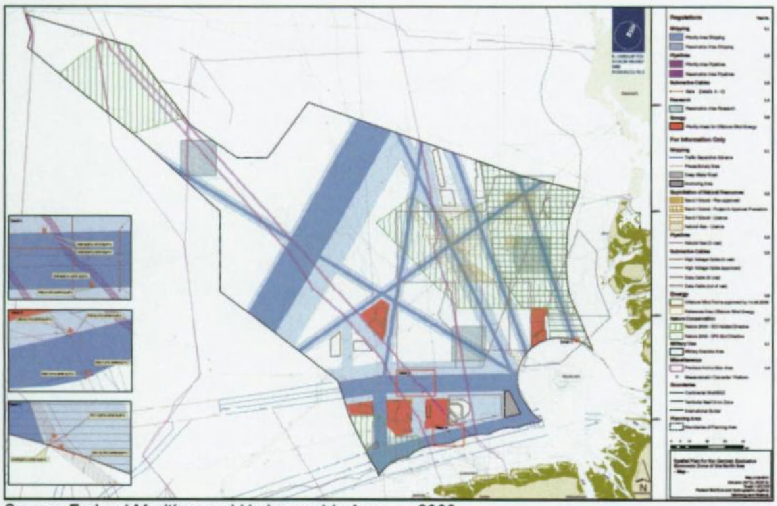
Prior to developing plans, the German government decided to first establish a strong legal basis for the development of MSP. In July 2004 an amendment of the Federal Spatial Planning Act entered into force stating that the Federal Ministry of Transport, Building and Urban Affairs should develop a legal instrument setting out the objectives and principles of spatial planning in the exclusive economic zone [45]. The Federal Maritime and Hydrographic Agency was given responsibility for preparing a spatial plan, and associated environmental report for both the North Sea and the Baltic Sea. The German marine spatial plans are in force since December 2009 [47].

The aim of the spatial plan is to establish sustainable management of space, in which social and economic demands are consistent with ecological functions. The associated environmental report aims to identify and evaluate the likely significant effects on the environment that could result from implementing the spatial plan. Key elements of the plan will include [45]

- Priority areas that are reserved for a defined use in which other conflicting uses are excluded;
- Reservation areas in which defined uses have a priority; and
- Suitable areas in which defined uses are allowed inside, but excluded outside, the designated areas

An important step toward allocation of marine space for specific uses was the designation of 'preferred areas' for wind energy in December 2005 for one area in the North Sea and two areas in the Baltic Sea. These 'preferred areas' turned automatically into priority areas as soon as the spatial plan entered into force. In the context of the development of the plans, no new scientific research initiatives have been taken. The plans are mainly developed based on existing data that were analyzed and synthesized by experts at the Federal Maritime and Hydrographic Agency (Figure 1).

Figure 1: Marine spatial planning in the German North Sea



Source: Federal Maritime and Hydrographic Agency, 2009

4.2.4. Cross-boundary cooperation

As illustrated above, all MSP initiatives in the North Sea aim at achieving multiple-objectives within a national context. All marine spatial plans are developed for areas of which the boundaries coincide with those of the territorial sea and the exclusive economic zones. The interconnectedness of adjacent ocean space, the cross-boundary impact of ocean uses, and the broader scale needed to be ecologically meaningful, however, all require that national marine spatial plans are embedded in a broader context and address the dynamics of the North Sea system as a whole. Some of the most urgent cross-boundary issues in the North Sea include the need to enhance cohesion for large-scale wind energy production, coordination of the security of new infrastructure in relation to other offshore uses, implementation of the EU Marine Strategy Directive, identification and management of Natura 2000 sites and cumulative effects of human use of the marine environment [50].

While none of these marine spatial plans explicitly addresses any of these cross-boundaries issues, some recent initiatives are very promising. At the national scale, a pilot study is being conducted for the protection of the North Sea Dogger Bank. The Dogger Bank is a shallow sandbank in the middle of the North Sea of which the boundaries cross four countries, the United Kingdom, the Netherlands, Germany and Denmark. Both its protection and management requires cooperation among those countries (particularly with regard to fisheries). Its designation, however, would be an important contribution to the implementation of Natura 2000 goals and objectives. Further, the governments of Germany, Belgium and the Netherlands are currently seeking better ways to streamline the spatial interpretation of national priorities in their respective marine spatial plans. Additionally, prior to adopting its marine spatial plan, Germany conducted an international stakeholder consultation round with its neighboring countries the Netherlands and Poland and facilitated cross-boundary cooperation with the latter by translating its marine spatial plan for the Baltic Sea into Polish [50].

Finally, a new EU call for proposals has been launched to develop a concrete set of action that can lead to a better and more sustained cooperation among nations for the future development of MSP. When engaging in this endeavor, it will be important to consider specific ways of cooperation during all steps of

the MSP process, and not only at the stages of science, research and plan development. Although MSP at a regional scale would not necessarily need a new overarching body, it could potentially be beneficial to revise the mandates of existing regional organizations such as OSPAR or HELCOM to strengthen a regional approach for MSP. These organizations, for example, could provide a platform for the planning stages of MSP, while leaving implementation of the respective countries and their existing marine management structures.

5. Conclusion

MSP, compared to land use planning, is a fairly new and emerging area [48]. The MSP initiatives described above are some of the best examples available today, but are nevertheless still at an early stage. This makes it difficult to determine whether particular approaches being adopted will have more effective results and positive outcomes than others in delivering ecosystem-based management.

However, having analyzed the planning processes and considering the broader context of the areas for which the spatial plans have been prepared, some initial conclusions can be drawn. Obviously, the need for MSP is strongly, if not entirely, influenced by the need for a framework that allows management of the increasing demand for ocean space and ecologically responsible decision-making about new uses of the sea. All three MSP initiatives examined above have this as the overall goal. The spatial plans for Belgium, the Netherlands and Germany are significant steps in the direction of applying ecosystem-based management to the marine environment. All three of the spatial planning processes are undertaking science-based efforts to define ecological valuable features of their entire planning area. However although this is important step, it is only a first step. Central to ecosystem-based management is the provision of sustainable use of marine goods and services. Sustainable use requires management that seeks both ecological sustainability and social and economic sustainability. In all three spatial planning approaches, valuation of social and economic aspects of the planning area is not integrated systematically and in a manner consistent with ecological valuation methods. A social and economic valuation, for example, should connect particular offshore activities with onshore communities and economies, and evaluate the importance of the offshore activity to the communities and economy on land [49].

Finally, one of the most important conclusions to draw from these initial MSP initiatives is their lack of international perspective. All three of the countries described have planning and management jurisdiction over ocean spaces that are adjacent to each other. Ocean spaces of all three of these countries are physically connected to each other. Various uses, including shipping, fisheries, cables and pipelines, oil and gas industry have, or can have, impacts across boundaries. In addition, national boundaries are mainly based on political and administrative considerations and obligations and are not necessarily meaningful from an ecological perspective. The interconnectedness of adjacent ocean spaces, the cross-boundary impact of ocean uses, and the broader scale needed to be ecologically meaningful require that marine spatial plans developed at the national level are embedded in a broader, international context and integrate, or at least address, the dynamics of the system as a whole. National marine spatial plans should be translated into international spatial policies in which sea uses and biodiversity protection measures are planned to complement one another on an international, or regional scale. However, none of the three spatial planning initiatives have explicitly integrated or addressed this broader international context nor do they have firm legal or policy framework in place that might allow cooperation in the future. Recently, however, a number of initiatives have been set up to stimulate a cross-boundary approach to MSP – initiatives that are largely encouraged by the European Union. Although all these attempts to cooperate among nations are in an early stage and still largely ad hoc, they will enable to learn valuable lessons on how to underpin MSP with a stronger ecosystem basis and find ways how strengthen and eventually institutionalize it.

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PART III
The concept and essential elements of marine spatial planning

CHAPTER 3
Marine spatial planning: The Belgian case

Published as:
Douvere F, Maes F, Vanhulle A and Schrijvers J. 2007
The role of marine spatial planning in sea use management:
The Belgian case
In: Marine Policy 31:182-191

Abstract

As discussed in the previous chapters, the expansion of offshore activities and the increasing need to meet international and national commitments to biodiversity conservation have led to an enhanced interest in marine spatial planning (MSP). This chapter discusses the Belgian experiences with MSP in more detail. It gives a short historical overview based on legal developments and reviews the implementation process of a 'Master Plan' as a spatial planning policy for the Belgian Part of the North Sea. Additionally, this chapter reflects on the research that has been done in Belgium to apply a land-use planning approach to the marine environment. The MSP process in Belgium shows that a spatial approach to sea use management is possible despite the lack of a legal zoning framework. However, it concludes that a legal basis for MSP, in addition to the current permit system, would provide a more strategic and integrated framework for ecosystem-based marine spatial planning.

1. Introduction

During recent years, various countries have started to use marine spatial planning (MSP) or ocean zoning to reduce conflicts and to use coastal and marine resources more sustainable. One of the best known examples is the zoning system in Australia's Great Barrier Reef Marine Park. Australia's approach allows multiple human activities, including fisheries and tourism, while simultaneously providing a high level of protection for specific areas [1]. Other MSP initiatives include the Florida Keys National Marine Sanctuary in the USA, the Eastern Scotian Shelf Management Initiative in Canada, and the Provincial Resource Management Plan in the Philippines [2]. Most of these examples are primarily inspired by driving forces related to nature conservation issues, and not necessarily by considerations related to the general management of conflicts among uses or users. Several European countries, on their own initiative or driven by European legislation and policy, have taken global leadership in assessing and implementing MSP in a broader context. The Netherlands developed an 'Integrated Management Plan for the North Sea 2015', that includes a 'Spatial Planning Policy Framework' directed toward economically efficient use of their marine space [3].

The coastal Länder in Germany recently extended their spatial planning competencies to the territorial sea (TS), while the Federal Spatial Planning Act has been amended to extend national sectoral competencies (including MSP) to the exclusive economic zone (EEZ) [4]. The United Kingdom is currently considering a 'Marine Bill' that would develop a process and examine the benefits of MSP for its entire marine waters [5]. This article will discuss the Belgian experiences with regard to MSP. It will focus on the legal framework for MSP and the steps being taken toward the implementation of a Master Plan for the sustainable use of the Belgian Part of the North Sea (BPNS). Belgium is among the first to actually start implementing an operational, multiple-use planning system covering its TS and EEZ [6]. Therefore, this article will reflect on the preparation of such a system both from a scientific as well as from a visionary approach. The visionary approach has been developed to provide a basic tool for policy decisions because of the existing deficiencies in scientific knowledge and data. The GAUFRE project is also one of the first systematic attempts to apply and translate land use planning concepts to the marine realm.

2. Belgian marine spatial planning from a legislative perspective

Marine spatial planning in the BPNS, a zone of 3600 km2 encompassing the TS and the EEZ/fishery zone/continental shelf, was previously done on an ad hoc basis. Driving forces for this ad hoc planning were the development of the Law of the Sea and Belgian legislation (legal driving forces) and the increasing opportunities for the exploitation of the resources of the marine environment (economic driving force). As most North Sea states with a maritime tradition, Belgium historically favoured a restricted TS of three nautical miles. Beyond this TS was the high sea, an area in which coastal states have almost no competence and that is governed by the freedoms of navigation, overflight, fisheries, and the laying of submarine cables and pipelines [7]. Beyond the TS the Belgian North Sea policy was focused on safety of shipping, fishery activities, sand and gravel exploitation, prevention of pollution from shipping, and dumping at sea. Conflicting activities at that time were mainly related to pollution from various sources and proposals for building artificial islands. Important national legislation dealing with activities at sea was the Act on the exploration and exploitation of non-living resources in the TS and the continental shelf (Continental Shelf Act of 13 June 1969) [8].

With the adoption of the 1982 United Nations Convention on the Law of the Sea (UNCLOS III), and mainly with the entry into force of this Convention on 16 November 1994, traditional maritime states that

were reluctant to interfere with freedoms of the high seas were given new legal opportunities. In 1987, Belgium expanded its TS from 3 to 12 nautical miles and concluded delimitation agreements with France (in 1990 on the TS and continental shelf), with the UK (in 1991 on the continental shelf) and with The Netherlands (in 1996 on the TS and continental shelf). Belgium ratified the UNCLOS III and the Agreement relating to the implementation of Part XI of the UNCLOS III on 13 November 1998 [9]. During the period leading to the ratification and parliamentary approval of the UNCLOS III in 1998, two important implementing laws were prepared and finally adopted in 1999: the Act concerning the Belgian EEZ in the North Sea (EEZ Act of 22 April 1999) [10] and the Act on the protection of the marine environment under Belgian jurisdiction (Marine Protection Act of 20 January 1999) [11]. Together, these acts provide the legal basis to guide discussions and decide upon new uses of the sea, such as the construction of offshore wind farms, increasing demand for cables and pipelines, new types of recreation, and the establishment of marine protected areas.

The Marine Protection Act (1999) introduced a licence requirement and an environmental impact assessment for the following activities in the maritime areas under Belgian jurisdiction (TS and EEZ): (i) civil engineering works; (ii) the digging of trenches and raising of the seabed; (iii) the use of explosives and high-powered acoustic devices; (iv) the abandonment and destruction of wrecks and sunken cargoes; (v) industrial activities; and (vi) the activities of advertising and trading companies. The following activities are not subject to licensing or authorization under this law: (i) commercial fishing; (ii) scientific marine research; (iii) shipping, with the exception of the activities referred to in article 25, section 1; (iv) the activities referred to in the Continental Shelf Act of 13 June 1969; (v) non-profitable individual activities; and (vi) the activities necessary for exercising the authority of the Flemish Region. However, with regard to the protection of the marine environment, other activities than those listed above can become subject to prior licensing or authorization. For example, in 2001 offshore bunkering was explicitly subjected to the licensing and authorization procedure as an industrial activity [12].

Except for the licences granted under fishing laws and the concessions granted under the Continental Shelf Act of 13 June 1969, any other activity in the BPNS that is subject to licensing or authorization pursuant to either the present Marine Protection Act and its implementing orders or any other legal or regulatory provisions in force, is also subject to an environmental impact assessment by the competent authority, both before and after the licence or the authorization is granted. The environmental impact assessment is intended to allow an evaluation of the effects of these activities on the marine environment. Any person who wishes to carry out an activity referred to in article 25, section 1 must enclose an environmental impact report with his application for a licence or authorization.

After the licence or authorization has been granted, the activity is subjected to monitoring programmes and continuous environmental impact surveys. These monitoring programmes and continuous environmental impact surveys are carried out or commissioned at the expense of the holder of the licence or authorization. If any study reveals new harmful effects for the marine environment, the licence or authorization may be suspended or withdrawn in accordance with the applicable suspension or withdrawal procedure. Two Royal decrees of 2001 introduced the licensing procedure and the environmental impact assessment procedure. Both decrees have been replaced by two new decrees: a Royal decree of 7 September 2003 concerning the procedure for licences and the authorization of certain activities in the marine areas under Belgian jurisdiction (License Decree) [13]; and a Royal decree of 9 September 2003 concerning the rules of an environmental impact assessment in application of the law of 20 January 1999 on the protection of the marine environment in the marine areas under Belgian jurisdiction (Environmental Impact Decree) [14]. Both decrees cover the question of allocation and suitability of, e.g., offshore wind farms, and make ad hoc spatial decisions possible by means of licences and concessions that are required. To construct and operate a wind farm in the BPNS, the

following concessions and licences are required: (i) a domain concession according the Royal Decree of 20 December 2000 on the conditions for granting a domain concession for the construction and exploitation of installations for energy production from water, streams or wind in the marine areas under Belgian jurisdiction [15]; (ii) an environmental licence for the construction and exploitation of the wind farm based on an environmental impact assessment according to the License Decrees of 7 September 2003 and the Environmental Impact Decree of 9 September 2003; and (iii) a licence for the laying and exploitation of submarine electricity cables in accordance with the Royal Decree of 12 March 2002 concerning the laying of electricity cables that enter the TS or national territory or that are placed or used for the exploration of the continental shelf, the exploitation of mineral resources and other non-living resources thereof, or for activities of artificial islands, installations or structures under Belgian jurisdiction [16]. Finally the Act of 29 April 1999 concerning the deregulation of the electricity market, foresees that concessions for wind farms in the BPNS can only be granted for a maximum period of 30 years [17]. Once the exploitation of the wind farms is finished, they have to be fully removed from the seabed at the expenses of the operator.

Concessions granted under the Continental Shelf Act of 13 June 1969, such as for sand and gravel extraction, are excluded from the prior licensing or authorization system and the environmental impact assessment procedure of the Marine Protection Act (1999). Granting of concessions under the Continental Shelf Act was regulated by a Royal Decree of 1974, and amended in 1983 [18]. A new Royal Decree of 1 September 2004 replaces the Royal Decree of 1974 and introduces conditions, a new geographical delimitation, and the procedure for granting concessions for the exploration and exploitation of mineral resources and other non-living resources in the TS and on the continental shelf [19]. Another Royal Decree of 1 September 2004 introduces the environmental impact assessment rules for the exploration and exploitation of non-living resources in the TS and on the continental shelf, under the Continental Shelf Act (1969) [20]. Today most activities in the BPNS are covered by legal rules and procedures allowing or rejecting a licence or concession for the activity.

Other activities, such as navigation, cannot be made dependent on licences from coastal states, while fisheries are governed by the EU Common Fisheries Policy that is primarily based on historic fishing rights. Additionally, however, there is also some difference in administrative culture between an environmentally and an economically inspired administration. This is clearly reflected in the Belgian legislation: licences, concessions and environmental impact assessments for the exploration of the non-living resources of the TS and continental shelf fall under the Continental Shelf Act (clearly economically driven), while licences and environmental impact assessments for other activities are dealt with by the Marine Protection Act (clearly environmentally driven, although not extreme). If we then take into account the small maritime area concerned and the many activities that already take place in this area, it is not a surprise that every new activity or use will limit other existing activities or uses. New activities, expansion of existing activities, as well as nature conservation requirements, will definitely lead to an increased conflict potential that cannot be dealt with by a permit system or an environmental impact assessment only. Therefore, the need for MSP as a tool for an ecosystem-based, sea use management and the implementation of an integrated coastal zone management (ICZM) has become widely accepted in Belgium.

3. Marine spatial planning and the international scene

The need for MSP is introduced in various documents. The EU recommendations on ICZM (2002) identify MSP as a key ingredient in achieving integrated management of the coastal area and its resources [21]. The EU Marine Thematic Strategy provides a supportive framework for national marine

spatial plans, particularly for achieving 'good environmental status' of EU waters by 2021 [22] while the EU Maritime Policy calls for a system of ecosystem-based MSP for a growing maritime economy aiming to manage the increasingly competing economic activities, while at the same time safeguarding biodiversity [23]. However, among the most important drivers for MSP in Europe is the European legislation on nature conservation as part of the EU contribution to implement the 1992 Convention on Biological Diversity. The two most significant are the Birds Directive [24], providing a framework for the identification and classification of Special Protection Areas (SPAs) for rare, vulnerable or regularly occurring migratory species, and the Habitats Directive [25] requiring member states to select, designate and protect sites that support certain natural habitats or species of plants or animals as Special Areas of Conservation (SACs). Together the SACs and the SPAs will create a network of protected areas across the EU, known as Natura 2000.

Additionally, in the framework of the Common Fisheries Policy [26] (CFP) (2002), the EU seeks to achieve sustainable exploitation of its fisheries resources. Among general measures to limit the overexploitation of fish, seven Regional Advisory Councils (RACs) were established to provide improved consultation with stakeholders on the management of their areas. In an attempt to respond to the challenges of closed or semi-closed fishing areas, the Regional Advisory Council for the North Sea [27] recently established a Working Group on Marine Spatial Planning.

The need for a MSP is also reflected at the regional level. In 2002, the Ministerial Declaration of the 5th North Sea Conference (Bergen) [28] invited the OSPAR Commission to investigate the possibilities of further international cooperation in developing MSP as a tool for an effective sea use management. The OSPAR Working Group on Spatial Planning is currently designing a set of guidelines to implement MSP in the North Atlantic Region [29].

4. Belgian marine spatial planning today

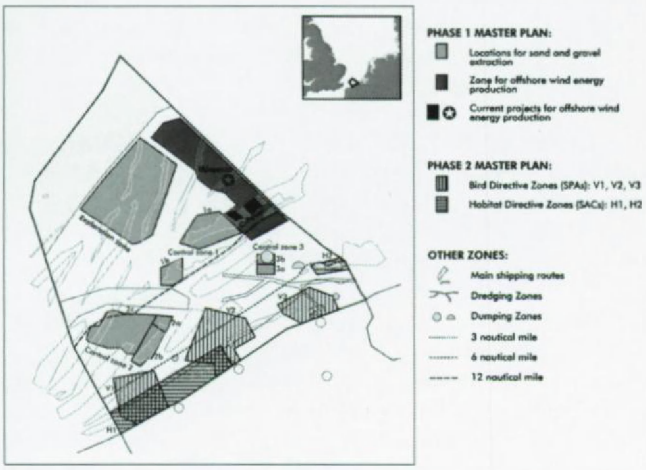
The legislative framework in Belgium has shaped MSP into a continuous process. The North Sea is one of the most exploited marine areas in the world. The BPNS, with its small size and its central location, lies in the centre of these activities [30]. Due to the existence of many uses in a small area, conflicts are inevitable and related to both multiple activities taking place in the same area, and natural resources being limited both in space and quantity. The need for a more comprehensive approach toward spatial planning for the BPNS became particularly urgent in light of new objectives and associated targets such as the need for offshore energy production and the development of a European network of protected areas. In an attempt to respond to these new challenges, a 'Master Plan' for the BPNS has been under development since 2003.

In 2002, a Federal Minister responsible for the management of the BPNS was appointed. The core issues of his policy framework included the development of an offshore wind farm, the delimitation of marine protected areas, a policy plan for sustainable sand and gravel extraction, enhanced financial resources for the prevention of oil pollution, the mapping of marine habitats, protection of wrecks valuable for biodiversity, and the management of land-based activities that have an impact on the marine environment. Together, these objectives provide the basis for a 'Master Plan' that will be implemented incrementally [31].

Despite the lack of a legal basis for MSP in Belgium, the 'Master Plan' provides a translation of current and future objectives of various sectors into a spatial vision. The first two phases of the 'Master Plan' are now operational and focus on spatial delimitations for sand and gravel extraction and a zone for

future offshore wind energy projects (Phase 1), followed by the delimitation of marine protected areas as part of the EU Natura 2000 Network (Phase 2) (see Figure 1).

Figure 1: Phases 1 and 2 of the sustainable Master Plan for the Belgian Part of the North Sea



Since the mid-1970s, sand and gravel extraction in the BPNS was limited to two concession zones and required a comprehensive monitoring programme. However, the allocation of those zones proved to lead to an unsustainable exploitation. Extraction activities were concentrated in the zones closest to the coast due to economic efficiency and the availability of a certain sand quality. Overexploitation of the same area led to serious depressions in the bottom of that part of the sea. Other parts of the concession zones turned out to be important fish spawning areas. In 2003, the Master Plan proposed a more diverse zoning system. The most intensive exploitation areas now include control zones for which a sequential rotation procedure will spread the pressure of extraction and allow restoration in the exploited areas.

In certain other areas, extraction is prohibited during fish spawning seasons. For all areas the composition of the sand has been identified. If no high quality sand is needed, it can be extracted by recycling former dredged material that has been dumped in disposal areas. The introduction of a maximum exploitation quota of 15 million cubic metres during five years assures that a shift from land to sea extraction is limited. All those new requirements have been approved by law in 2004 [32].

In the framework of both climate change and energy supply issues, Belgium has committed to produce 6% of its total energy consumption from renewable resources by 2010 [33,34]. Given the limited available space on land, the "not in my backyard" syndrome, and rigid legislative requirements on land, offshore wind energy production became an attractive option. Furthermore, studies revealed that offshore winds were more stable and last longer than winds on land. Consequently, the best wind areas at sea were identified. Prior to the Master Plan, companies spent resources on developing proposals that risked denial of a permit because of the lack of a spatial framework for wind energy in the BPNS. Now, one zone is defined in which companies can submit proposals for the construction of offshore wind farms. The criteria for the delimitation of these zones were based on the level and value of biodiversity in the area, visual pollution, and its importance for fishery activities. Currently, no wind farm projects are

operational. However, preparations are underway for the construction of a 60-unit wind farm, providing a yearly energy production for approximately 275.000 families. A second project for an additional 30 units will provide energy for another 137.000 families [35].The offshore wind farms might simultaneously host projects on aquaculture, e.g. the production of mussels, bringing new opportunities for the Belgian fisheries sector whose existence has been threatened in recent years [36]. This cross-sectoral, multi-use approach, as foreseen by the Master Plan (e.g., sand and gravel extraction limitations for spawning fisheries periods, and offshore wind farms hosting aquaculture projects) is an entirely new and promising characteristic of the Belgian approach to sea use management.

The second phase of the Master Plan focused on the identification of SPAs for rare, vulnerable or regularly occurring migratory species and SACs to support certain natural habitats or species in the BPNS, as part of the Belgian commitments to implement the Natura 2000 objectives. Before 2000, potential important bird areas, the Ramsar site "Vlaamse Banken", and a Special Conservation Area were identified as special zones, albeit without legal protection status [37]

In 2005, the first fivezones received legal status: three bird protection areas or SPAs located in front of the three Belgian seaports and two SACs as important and valuable natural habitats [38,39]. Prior to their delimitation, the sources of threats and disturbance were analysed. Throughout the whole process, stakeholder participation is considered as an essential ingredient for defining and successfully managing protected areas in the BPNS. Now, it is expected that these consultation rounds will result in user agreements, signed between the Belgian government and the sectors, and containing commitments regarding conservation measures for the areas. In March 2006, a sixth zone received protected status: the waterfront of the marine reserve of the Bay of Heist [40]. Future initiatives concerning spatial planning in the BPNS are being studied. New actions will focus on the protection of marine shipwrecks for archaeological, biodiversity and ecological interests, development of a marine component for existing terrestrial protected areas, and the allocation of a research zone for alternative fishing methods. It is obvious from the above that, while there is no formal legal system for MSP in the BPNS, there are many existing initiatives that seek to manage spatial dimensions of human activities.

5. Belgian marine spatial planning tomorrow

Ongoing international and European legislative interests in MSP and first attempts toward MSP in Belgium coincide with current discussions and controversy regarding new uses of the sea and seabed. It therefore became clear that anticipatory action was needed. The existing framework [41] stimulated a comprehensive study of spatial planning for the BPNS. Using a land-use planning approach, the GAUFRE study envisaged the creation of scenarios expressing a general vision for the BPNS. It was among the first in its kind to actually apply the tools and concepts of land-use planning to the marine environment. Clearly, while the principles of spatial structural planning on land are useful as guidelines, they needed to be adapted to the specifics of the marine realm. The methodology is borrowed from the one used for spatial land-use planning in the Flemish Region [42].

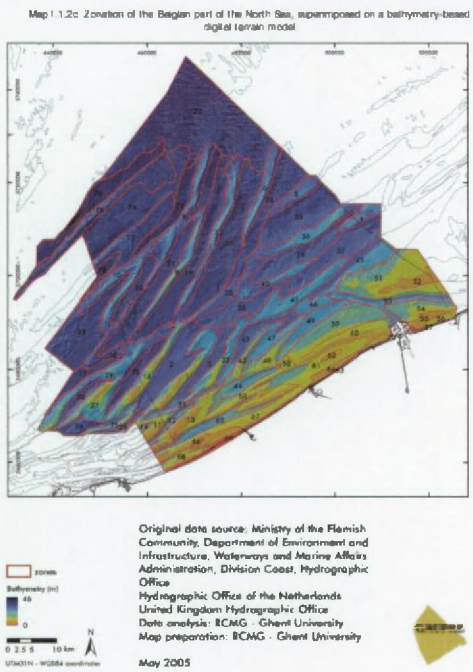
Two steps were taken before developing various scenarios. The analysis of all available scientific data was the first phase. It led to the creation of basic GIS layers, suitability maps, and use interaction maps. Once this analytical framework was in place, it gave way to a structural approach. This structural approach was able—by making use of the results as generated in the analytical approach—to create structural maps. These maps represent a conceptual framework for sustainable spatial content rather than detailed final planning maps.

They reflect a strategic vision of the planning without determining what can and cannot be done on every single piece of space. Structural maps of the actual situation were then shaped into six possible future scenarios by using certain criteria that were considered as key values for a sustainable management of the BPNS.

5.1. The analytical approach

A spatial plan on land is never developed without thorough knowledge of the environment and the existing situation of infrastructure and uses. The small scale of the BPNS and a history of an array of marine projects describing the BPNS helped us to do the same for planning at sea [43]. The basic description of geological, biological and ecological parameters as derived from these studies was then used to create homogeneous zones.

Figure 2: Zonation of the Belgian part of the North Sea, superimposed on a bathymetry-based digital terrain model



Source: Maes et al., 2005.

A zonation of the BPNS was performed using morphologically-homogeneous areas. This resulted in 76 zones that are clearly identifiable (Fig. 2) [44]. For each of these zones, both the infrastructure and the historic, current and future uses on the BPNS were described reflecting related legislation, their existing situation in terms of spatial delimitation and intensity, and their location within these homogeneous zones. These data were collated and entered into a GIS system to create a database of layered marine environmental information. The resulting images of spatial delimitation and—where possible—intensity, formed the first basis for the envisaged MSP. In addition, the GIS layers allowed an analysis of possible compatibilities and interactions among the environment, infrastructure, and uses.

5.1.1. Suitability [45]

Infrastructure and uses not only have an effect on the environment, but the environment also affects their presence. Suitability therefore focuses on the importance of understanding how the environment of the BPNS would affect its use before space is actually allocated to that use in a planning context. This "suitability analysis" indicates to what extent a certain space on the BPNS is appropriate for the allocation of a certain use. It is based on: (i) jurisdictional constraints such as zones and exclusion zones: although Belgium's legislation regarding MSP is minimal, it does prescribe certain regulations as indicated above; (ii) technical constraints such as geophysical, hydrological, bathymetric, chemical and safety-related issues; (iii) socio-economic considerations such as issues related to profitability (distance and technical aspects) and social well-being (health and disturbance); and (iv) ecological considerations such as issues concerning ecological damage.

5.1.2. Interaction between uses and the environment [46]

Current or historic infrastructure and uses have an impact on the capacity of the environment to sustain additional or future uses. A methodology for a rapid assessment of the environmental impact of a certain use was developed. Three main categories of environmental impacts are identified: physical, chemical, and ecological. The size of the environmental impact of each use was qualitatively scored based on available literature and expert judgement, and then summarized in an impact index. The intensity of their occurrence on the BPNS was also scored. Scoring was based on the best available real intensity data and reclassified into four categories. Based on these categories, intensity classification maps were drawn for each use. The impact table together with the intensity maps formed the basis of the environmental impact maps.

5.1.3. Interaction among uses [47]

Individual uses face spatial constraints when trying to occupy a particular area to which other uses have already been allocated. An interaction table tries to explain how the different actual uses would respond to a newly introduced use. This response varies according to complete exclusion or possible management in time, space, overlap, or a combination. This interaction was then visualized in maps.

The interaction among uses, however, can go beyond a purely spatial constraint since it is not a physical but rather a demand-driven interaction. The actual allocation of a certain use to an area triggers a demand or a limitation for another use. The degree of interaction therefore can be negative, positive or neutral.

5.2. The structural approach [48]

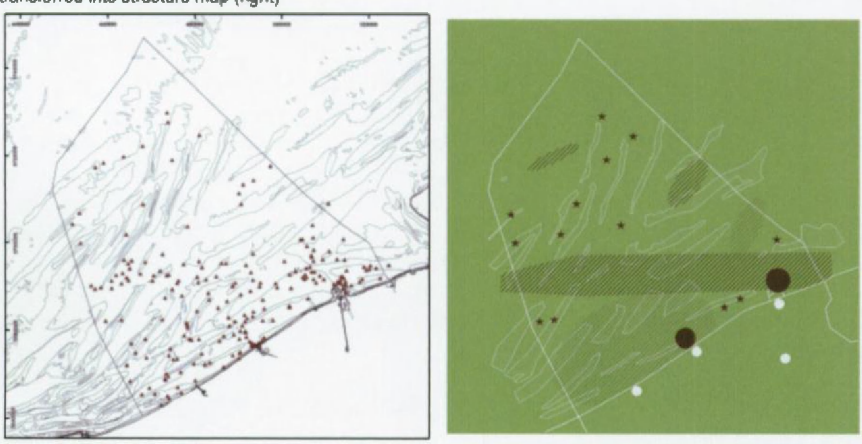
The accumulation of basic scientific information and its analysis is not sufficient to generate possible overall MSP scenarios for the BPNS. It can merely contribute to the search for these scenarios. It can also give feedback on the possible outcome of chosen scenarios. Therefore, a second step, referred to as the structural approach, was taken to develop the various scenarios. In structural planning, space is seen as an area of structural unity, in which spatial decisions need to be balanced against each other. This leads to structural maps.

The GAUFRE study however went further than structurally mapping the actual situation. The aim was to outline specific future possibilities. Consequently, future structural maps were set against a background of key values that determine each use within the North Sea. These key values were then translated in decision rules that allowed for the creation of six scenarios for the future management of the BPNS. Visions, spatial strategies, and preferential areas of use were formulated within each of these scenarios.

5.2.1. Structural maps

In contrast with so-called "end situation planning", structural planning does not determine what can and cannot be done on every single piece of space. It is rather a global and strategic vision of the desired spatial development of a particular area, a framework for the sustainable use of space represented by structural maps rather than detailed final planning maps. It tries to identify interconnected units or "structures" and formulates these into a strategic vision that is relevant within the scope and scale of the area. It is intended to make provision for existing issues and problems as well as potential opportunities, providing flexibility for adaptation and refinement in reaction to societal change. GIS maps, which are geographically accurate, to scale, and show the exact location of existing uses and their impacts, were therefore translated into structural maps. An example of such a translation is shown for ship wrecks in Figs. 2 and 3.

Figures 2 and 3: From GIS to structure maps. Location of shipwrecks in the Belgian part of the North Sea. GIS map (left) transferred into structure map (right)



Source: Maes et al., 2005.

5.2.2. The identification of key values

Well-being, ecology and landscape, and economic value were chosen as key issues for sustainable management of the North Sea. These key values determine each use within the BPNS. Every activity in the BPNS can be correlated to these three key issues. Any future change of structural maps will therefore have to be tested against the key values.

5.2.3. The development of various scenarios for the BPNS

A crucial step in the creation of an overall structural map for future MSP in Belgium was to generate different possible strategic visions, link them with decision rules, and translate these into separate structural maps. Six alternative scenarios were developed for the future of the BPNS. They are based on different combinations of the core values well-being, ecology and landscape, and economic value. Three of the scenarios strongly focus on one of the core values. The other three scenarios are based on crossovers between two of the core values. This led to the following possible visions for the BPNS: (i) the relaxed sea, focusing on well-being; (ii) the natural sea, focusing on ecology and landscape; (iii) the rich sea, focusing on economy; (iv) the playful sea, focusing on both well-being, and ecology and landscape; (v) the mobile sea, focusing on both ecology and landscape, and economy; and (vi) the sailing sea, focusing on both economy and wellbeing.

It is clear that all six scenarios should be consistent with certain specified principles that are difficult or impossible to be changed such as natural value, circulation, shipping routes, and cables and pipelines or regulation implemented through international agreements. But each one of them reflects an unique array of decision rules according to which specific structural maps could be created. Each "use" of the BPNS was considered under each of these six scenarios in terms of its development potential. This array of maps provided a basic tool for discussion about a future decision toward an overall vision and structure for the BPNS.

6. Conclusion and way forward

The evolution of sea use management in the BPNS as described above, reveals that, despite the lack of a formal legal system for MSP in Belgium, there are many existing initiatives that seek to manage human uses spatially in the area. MSP in Belgium developed on an ad hoc basis, mainly driven by international and European legislation and increasing opportunities for the exploitation of the marine environment. Central to the Belgian legislative framework for MSP is a system of permits linked with environmental impact assessments. However, new activities, the expansion of existing activities, an increasing need for nature conservation, and the goal to integrate the management of marine and coastal ecosystems will definitely lead to increased conflicts that cannot be dealt with by a permit system or an environmental impact assessment only. At the policy level, the response to this challenge resulted in the development of a sustainable

Master Plan for the BPNS. The Master Plan aims to serve as a overarching framework for a multi-use planning system covering the entire TS and EEZ, by translating current and future objectives of sea uses into alternative spatial visions. At the scientific level, the discussions and controversy regarding new uses and requirements of the sea and seabed at both the national and international scene led to the GAUFRE study that made it possible to anticipate new developments in a balanced and sustainable way. The study envisaged the creation of scenarios expressing an integrated vision for MSP for the BPNS, based on a set of core values.

The process of creating alternative scenarios of MSP is a means rather than an end in itself. MSP must include an integrated vision of all uses within the North Sea. This approach would place a desirable structural plan for the North Sea somewhere in the middle of the six scenarios. In other words, there should be a consideration and weighing of the different values to elaborate a complete spatial structural plan for the BPNS. However, the selection of a desirable structural plan is a political, not a technical decision. Finally, the development of Belgian MSP legislation and policy, as well as the scientific work

that has been done, reveals two additional but important considerations. First, it is important to understand that people and their natural resource use are at the centre of ecosystem-based, sea use management. The participation of stakeholders in the development and implementation of MSP is therefore essential for its success. Second, it is important to consider the North Sea as a very dynamic system that cannot be delineated by the territorial borders of the BPNS. Accordingly, a good national policy should take an international approach in which the specific issues of the BPNS are considered in the context of the whole North Sea, and perhaps even beyond. National plans should be translated into international policy in which sea uses should be planned to complement one another on an international scale.

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CHAPTER 4
The key elements of marine spatial planning

Submitted as:
Douvere F and Ehler C. 2010
Marine spatial planning: A future for our ocean ecosystems
Ocean and Coastal Management

Abstract

The marine spatial planning (MSP) process in Belgium, as discussed in the previous chapter, illustrates that a legal basis provides for a more strategic and integrated framework for MSP. Analysis of other existing MSP initiatives confirms this conclusion. This chapter, however, goes a step further and shows that other elements, in addition to a legal framework, are essential for the successful development and implementation of MSP. Based on analysis of MSP efforts in Germany, Norway, the Netherlands, the United States and Australia, it is argued that MSP cannot achieve its anticipated results if conducted as a one-time plan, but should instead, be performed as a continuous, adaptive process that is integrative, participatory, future-oriented and ecosystem-based. The chapter illustrates this perspective by pointing out the pros and cons of including these elements in the MSP process. The chapter ends by stating that this research is particularly important now, at a time that many confusing and conflicting viewpoints about the true nature of MSP start to emerge.

1. Introduction

Human use of ocean space is rapidly expanding – a trend primarily driven by the quest for cleaner energy, food security, and the effects of climate change. Offshore renewable energy in Europe could provide 15% of its total energy demand in 20 years[1]. In the US, offshore wind is moving forward in Massachusetts and Rhode Island [1]. While climate change is opening the Arctic ocean to new (and often contentious) proposals for economic development [2], ocean warming is likely to alter the distributions and critical habitats of fish and protected species, such as polar bears or narwhals. Further, proponents of offshore aquaculture are seeking places to meet the rising global demand for healthy seafood in the face of declining stocks of wild fish. Simultaneously, more traditional uses like recreational and commercial fishing, shipping and oil and gas extraction continue to expand their footprint in a recovering global economy [3].

Around the globe, governments increasingly recognize that without more comprehensive and proactive management, the health of ocean resources will continue to decline. Without strong support for the sustainable use of ocean spaces rich in natural resources (wind, waves, oil, fish), opportunities for energy and food security, jobs, and income will remain unexplored. Without protection for ecologically critical places, conflicts between human activities and nature are inevitable, resulting in crucial natural services reduced or lost entirely. Marine spatial planning (MSP) is a pragmatic approach that can help achieve ecological, economic and social objectives simultaneously by placing the spatial and temporal heterogeneity of the ocean at the heart of a legally authorized decision-making process [4].

Both the United States and the United Kingdom have recently taken major steps to allow the development of MSP in their respective marine areas. On 9 December 2009, U.S. President Barack Obama launched a draft framework for effective coastal and marine spatial planning that aims at addressing conservation, economic activity, user conflict, and sustainable use of the U.S. ocean, coastal and Great Lakes resources [5]. The draft framework could result in new authority (which is expected in the short run to take the form of a Presidential executive order) that will allow the development of a nation-wide system for MSP. A month earlier, the United Kingdom passed a Marine and Coastal Access Act that will profoundly change the way its marine areas are used [6]. MSP (shortened in the UK to 'marine planning') is proposed as one of the main tools to deliver the aims of the Act.

While new to some, almost a dozen other countries[2] have already developed some form of MSP, starting in the 1970s in Australia's Great Barrier Reef Marine Park [7]. Recent examples, particularly in Northwest Europe, are strengthening the multiple-objective approach toward MSP while other countries, including China [8] explore innovative ways for financing MSP.

Despite the fact that many governments already employ MSP, little guidance is available that illustrates how MSP can deliver successful results. Countries that currently consider, develop, or apply MSP are doing so on an ad hoc basis, each with different time frames, costs, and results. Most professionals and government officials responsible for the planning and

[1] The European Wind Energy Association estimates that 15,000 offshore wind turbines, each generating 10MW could supply about one-sixth of Europe's current energy demand by 2030; another sixth would be supplied by 75,000 onshore turbines, each generating 2MW. Available at: www.no-fuel.org/index.php?id=241

[2] Countries that are exploring, designing, or implementing MSP include Belgium, Germany, The Netherlands, United Kingdom, Poland, Sweden, Norway, Australia, the United States (Commonwealth of Massachusetts), Canada and China.

management of marine areas and their natural resources usually have scientific or technical training in areas such as ecology, biology, oceanography, or engineering, among others. Few have been trained as professional marine planners and managers. Consequently, many professionals who want or have to develop MSP in their country wind up "learning on the job" and tend to "re-invent the wheel" over and over. This practice is often very expensive and an inefficient way to do business. A lack of understanding about MSP and what it entails, makes it also difficult for governments to define what MSP is really about and what is essential in making sure their efforts will actually lead to the suggested outcomes described in a variety of MSP definitions. The latter is particularly important now, as many confusing and conflicting viewpoints about the true nature of MSP begin to emerge.

2. Marine spatial planning: five essential characteristics

Many advocate MSP as a promising way to achieve simultaneously social, economic, and ecological objectives by means of a more rational and scientifically-based organization of the use of ocean space. Its supporters emphasize the potential of MSP to resolve conflicts among offshore uses and between uses and the environment and stress its marked departure from single-sector management that is currently applied, but largely unsuccessful, in achieving integrated management of our oceans.

Although various MSP initiatives are still in an early stage and will only over time demonstrate how effective they really are, some initial lessons can be drawn from these experiences. When analyzing - and to some extent comparing - MSP initiatives, for example, it is possible to identify at least some important characteristics. In the context of this research, five essential characteristics of MSP were identified. They include (a) adaptation; (b) participation; (c) ecosystem-based; (d) integration; and (e) future-orientated. Although most of these characteristics are common to many other public management approaches, their value and importance is still little – if at all – considered in the context of MSP. This might be caused by the fact that MSP is a relatively young field of expertise but could also be the result of MSP being largely developed and inspired from within the marine and environmental community without many contributions from more traditional planning experts.

The characteristics described in this article have been selected on the basis of a brief review of literature of planning and management practices. More importantly, they are derived from analysis of various MSP practices currently in place in different countries. The analysis included field trips to a number of offices responsible for MSP in the Netherlands, Germany, Massachusetts (United States of America), Australia and Canada. Additionally, the characteristics are partly based on the outcomes of three review meetings that were held with expert groups of marine scientists and MSP practitioners between March 2008-April 2009. They were further refined through two regional 'fine-tuning' meetings, held in the Commonwealth of Massachusetts in the United States of America (from 13-17 October 2008) and Ha Noi/Ha Long Bay in Vietnam (from 1-8 April 2009)[3].

The sections below describe each of the characteristics and illustrate why they are critical to the development and implementation of MSP. The section concludes that even though these characteristics are in place, MSP fails without a clear, legal authority for both its planning and implementation stages.

[3] For more information see the Marine Spatial Planning Initiative of the Intergovernmental Oceanographic Commission, United Nations Educational, Scientific, and Cultural Organization at: ioc3.unesco.org/marinesp

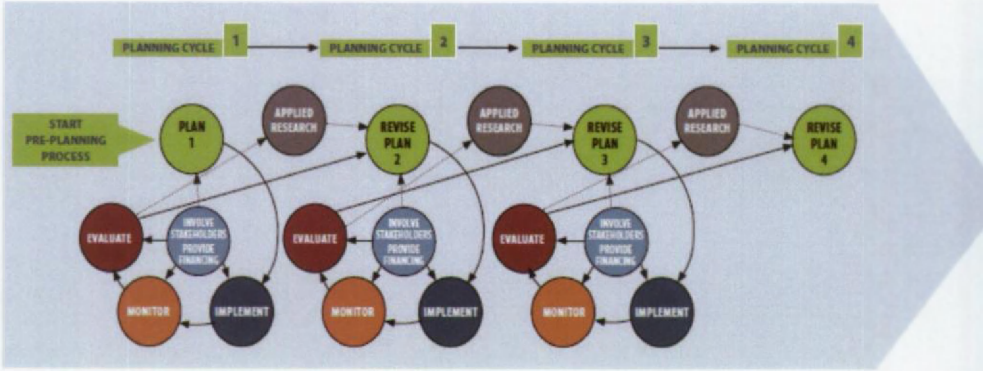
2.1 Adaptation

The phrase marine spatial *planning* is misleading since MSP really is part of a *management process* in which planning, implementation, and adaptation are all equally important components. In general, planning without implementation is sterile, implementation without planning is a recipe for failure. Integrated coastal zone management (ICZM), for example, as any other form of public management, is typically described as a *process* that goes through a number of stages [9]. Cicin-Sain and Knecht [10] define six stages of the ICZM process, including (a) issue identification and assessment; (b) program planning and preparation; (c) formal adoption and funding; (d) implementation; (e) operation; and (f) evaluation. They further emphasize the importance of having ICZM efforts moving progressively beyond planning into implementation, enforcement and evaluation. Similar to ICZM, MSP aims at achieving multiple objectives and overcoming current fragmentation that results from single-sector management and should similarly be conducted as a management process rather than a one-time plan. The following steps are relevant to the development of MSP as a management process [11]:

1. Identifying need and establishing authority
2. Obtaining financial support
3. Organizing the process through pre-planning
4. Organizing stakeholder participation
5. Defining and analyzing existing conditions
6. Defining and analyzing future conditions
7. Preparing and approving the marine spatial plan
8. Implementing and enforcing the marine spatial plan
9. Monitoring and evaluating performance of the marine spatial plan
10. Adapting the marine spatial planning process

These steps are not simply a linear process that moves sequentially from step to step. Many feedback loops should be built into the process. For example, goals and objectives identified early in the planning process are likely to be modified as costs and benefits of different management measures are identified later in the planning process. Analysis of existing and future conditions will change as new information is identified and incorporated in the planning process. Gaining understanding about whether or not the measures taken to implement a marine spatial plan lead to the anticipated results is only possible through monitoring and evaluation of the marine spatial plan. Eventually, adapting the marine spatial plans consistent with the monitoring results leads to the potential to identify new research needs and sets the basis for a new round of MSP planning, implementation, monitoring, etc. (Figure 1).

Figure 1: The Adaptive Marine Spatial Planning Cycle



Source: Ehler and Douvere, 2009.

While well established in many other planning and management contexts [12], the 'planning-implementation-adaptation' cycle is infrequently applied to the development of MSP. Neglecting an adaptive approach to MSP, however, is likely to limit its capacity to achieve successful and sustainable results over time.

MSP practice in Belgium and Germany, for example, illustrates that a one-time plan is unlikely to deliver the anticipated outcomes in the long run. Both governments have opted for the development of a 'Master Plan' (in 2005 and 2009, respectively) - a one-time plan that addresses both economic development and environmental protection, but without any explicit provisions or time frame to adapt the spatial plan to changing circumstances. Change, however, is inevitable and is partly a result of uncertainty or a lack of information both about the functioning of marine ecosystems in space and time and the effectiveness of management measures taken to protect it. Technological improvements such as remote sensing, geographic information systems (GIS), global positioning systems (GPS), and underwater autonomous systems, are rapidly making spatial data more accessible and sophisticated. In Belgium, improved techniques for the valuation of ecological and biological marine areas [13] were developed after the initial Master plan was implemented. These new techniques would allow, for example, better informed and more science-based choices and trade-offs about the future use of the marine environment. Without a concrete framework to adapt initial marine spatial plans, it is difficult to incorporate such new techniques and information into the decision-making processes.

Further, new political or economic conditions can also call for revisions of the marine spatial plan consistent with modified priorities. For example, climate change might modify the location of important biological and ecological areas over the next 50-100 years or require alternative methods for coastal adaptation. As described below, the Netherlands has recently started its second round of MSP by adapting its existing plan to changing circumstances and newly acquired information. An adaptive approach to MSP in the Netherlands, for instance (the Integrated Management Plan for the North Sea 2015 included the requirement for revision every five years), has allowed the effects of sea-level rise to be dealt with proactively through, among others measures, the designation of an exclusive sand extraction zone for beach nourishment to help protect the low-lying country from coastal erosion and flooding in the future.

Without any specific provisions – ideally incorporated in MSP legislation – that require the revision within certain time frames (for example, revision and adaptation of the Massachusetts Ocean Management Plan is required by law at least every five years) [13], marine spatial plans either are not adapted at all, or at best, get adapted on the wings of government officials willing to undertake the task. The lack of an adaptive approach to MSP means that marine spatial plans get outdated very quickly and entirely forego the proactive decision-making power they could have when designed properly.

2.2 Ecosystem-based approach

As proposed by a variety of authors, MSP is a means to alter the declining health of marine ecosystems and maintain key ecosystem services upon which all life, including humans, ultimately depend [15,16,17,18,19]. To do this effectively, however, MSP needs to reflect ecosystem patterns and processes at appropriate spatial and temporal scales [15]. Plans need to address fundamental topographic, oceanographic, and ecological conditions enabling identification and protection of the most ecologically and economically valuable places. This is not a simple task, and many plans have not addressed this issue adequately. During the past seven years, Australia (outside the Great Barrier Reef) has used an ecosystem-based approach to develop marine bioregional plans for its entire exclusive economic zone on the basis of its Environment Protection and Biodiversity Conservation Act of 1999 [20]. It first used an integrated marine regionalization of all Australian waters to define ecosystem boundaries for five large marine regions [21]. Marine planners recently have completed marine bioregional profiles, containing information on biophysical and economic characteristics, key ecological features, and protected species and places that will form the basis for the actual marine spatial plans. Final marine bioregional plans will be completed in 2012.

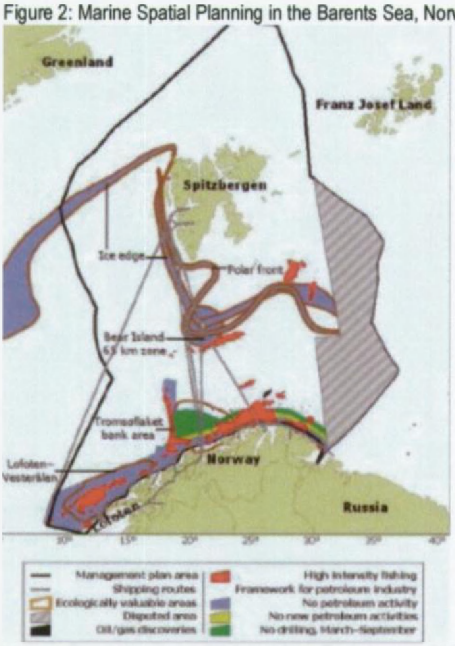
All marine spatial plans in the North Sea, as developed by Germany, the Netherlands and Belgium, currently incorporate spatial and temporal management measures to protect valuable ecological and biological places. However, ecosystem patterns and processes are often not consistent with administrative boundaries. Experiences with trans-boundary protected areas in the North Sea, for example, show that an ecosystem approach should be an essential characteristic of MSP. Most importantly, it would help prevent that MSP remains confined to the limits of administrative and political boundaries that do not reflect the true nature of ecosystem features, and hence prevent MSP to achieve its anticipated ecological objectives.

Following a two-day workshop of academic, governmental and non-governmental representatives, Foley et al. (2010) concluded that MSP should be underpinned by four basic ecosystem principles to enable MSP to achieve ecosystem-based management. These principles include the maintenance of (a) native species diversity; (b) habitat diversity and heterogeneity; (c) populations of key species; and (d) connectivity among ecological attributes. Additionally, both the context of the ocean ecosystem and uncertainty should be addressed in conjunction with the principles to ensure MSP *'adequately addresses the spatial and temporal variability and non-linearity that characterize all ecosystems'* [15] Their research further stipulates that these principles should provide for the scientific foundation of the MSP process, inform the definition of goals for MSP, and be translated into the operational decisions of MSP.

2.3 Integration

MSP addresses multiple objectives and integrates a wide range of uses and issues. Ideally, a marine spatial plan should include all important economic sectors and environmental concerns in the management area. Integration across all sectors is important to ensure that unregulated uses do not undermine the effective performance of the plan. Some countries, however, have been more successful than others in meeting this challenge. One good example is Norway's Barents Sea plan, where all key economic activities—oil and gas development, fisheries, and marine transport— have been integrated with nature conservation objectives [22]. A driving issue for the development of MSP in this area was the proposed expansion of oil and gas extraction into areas critical to seabirds, polar bears, whales, and fisheries. Between 2002-2005, the plan development was led by the Norwegian Ministry of the Environment, in cooperation with the representatives from all other relevant ministries, and included four extensive environmental impact assessments that studied the impact of fisheries, shipping, and oil extraction as well as pressures coming from outside the planning area. To achieve an integrated plan, a shipping lane was moved (in cooperation with the International Maritime Organization) to decrease pollution risks, trawling was limited in sensitive areas, while other ecologically valuable areas were closed to oil and gas exploration and some marine protected areas and fishery closure areas were extended to protect key life history stages of important species or critical ecological processes [23]. The resulting plan has been implemented through existing authorities. The existing management authority for fisheries, for instance, remains responsible for fisheries management, but now has to make its decisions consistent with the Barents Sea management plan (Figure 2). One potential shortcoming of the plan though is the lack of international cooperation with its neighboring country Russia. Such trans-boundary cooperation would allow the plan to cover the entire Barents Sea ecosystem [23].

Figure 2: Marine Spatial Planning in the Barents Sea, Norway.



Source: Royal Norwegian Ministry of the Environment, 2006.

Effective marine spatial plans indeed require more than integration across economic sectors

and individual ocean uses. To be effective, marine spatial plans also need consistency with adjacent planning areas in which other management frameworks might be in place, as well as across state, federal-state, and international boundaries. The primary reason for such consistency is that impacts and effects from adjacent areas might greatly impact the marine area for which the marine spatial plan is in place and consequently undermine its effectiveness entirely. Consistency across adjacent areas and their applicable management frameworks allows that such potential exogenous threats can be address and dealt with properly.

Few countries have made their marine spatial plans consistent with their policies and plans in the coastal zone, estuaries and rivers. In Europe, coastal zones, estuaries, and rivers have separate management regimes, and are dealt with through ICZM and the Water Framework Directive [24] respectively. Again, the Dutch approach to MSP is unique. Since late 2009, Dutch marine spatial plans for the North Sea do not stand by themselves any longer but are now embedded in the National Waterplan [25] for the Netherlands that covers all waters under the jurisdiction of the nation. A huge benefit of this approach is that upstream sources of pollution, for example, that affect the marine spatial planning area, can be identified and dealt with through other management bodies. Additionally, in their quest for an efficient use of marine space, priorities are set for the country as a whole and are only translated to the marine environment if that is the place where they can be best addressed.

Consistency across boundaries is also rarely considered because timing of MSP development is often out of phase across borders. In the United States, two states, Massachusetts [26] and Rhode Island [27], are developing integrated marine plans without initial consultation across their adjoining marine borders. Considering that their marine spatial plans cover 0-3 nautical miles, it is obvious that cross-boundary cooperation is indispensable to achieve MSP at a scale meaningful from an ecosystem perspective. The United States draft framework for coastal and marine spatial planning calls for a regional approach to MSP that is likely to change the way states cooperate with each other and the federal government that is responsible for MSP in all US waters beyond three nautical miles (up to 200 nautical miles) [5].

In Europe, Belgium and The Netherlands also developed their initial marine spatial plans without transnational consultation. To the contrary, the guiding principle from Germany's 2004 Federal legislation [28] is *"development that meets social and economic demands consistent with sustainable ecological functions"*. Authority for MSP in the German territorial sea (0-12 nmi) lies with the three coastal states, each of which have developed spatial plans for their waters in the Baltic and North Seas. The German federal government is responsible for MSP in the exclusive economic zone and must develop its plans consistent with those in the territorial sea. Germany is one of the few countries that also aims at consistency across international boundaries. To this end, it conducted a formal consultation round with its neighboring countries, Poland and The Netherlands, for its respective marine spatial plans for the Baltic and North Sea. Informal consultations with government officials in the Netherlands are now working toward the identification of inconsistencies in their respective marine spatial plans and are trying to find ways to address them. Key issues that have emerged include compatibility between shipping and other uses, primarily wind energy, and consistency among the national plans for nature conservation. Considering and consulting neighboring countries early on in the MSP process would help avoid future problems that often would require additional resources to fix. Through its Marine Strategy [29], Maritime Policy [30] and Roadmap for MSP [31], as well as through a number of large-scale research projects, the European Commission is providing national states with tools and incentives to move toward a better consistency among national marine spatial plans.

2.4 Participation

MSP requires stakeholder involvement in the design, implementation, and evaluation of the entire MSP process. Involving key stakeholders in the development of MSP is essential for a number of reasons. Among these, the most important is because MSP aims to achieve multiple objectives (social, economic and ecological) and should therefore reflect as many expectations, opportunities or conflicts occurring in the MSP area. Stakeholders are individuals, groups, or organizations that are (or will be) affected, involved or interested (positively or negatively) by MSP actions. The scope and extent of stakeholder involvement differs greatly from country to country and is often culturally influenced. The level of stakeholder involvement will also largely depend on the political or legal requirements for participation that already exist in a particular country.

The United States of America, for example, has a long tradition of consulting stakeholders for almost any public form of planning and management. When developing its marine spatial plan in 2009, the Commonwealth of Massachusetts engaged the general public and ocean user groups substantially from the onset of the planning process. In addition to public access through an Ocean Advisory Committee and a Science Advisory Council, the state held 18 public "listening sessions" and conducted 66 interviews with stakeholder groups, that were also used to explore data availability for planning [26]. Stakeholders were also extensively involved during the MSP plan revision for the Great Barrier Reef from 1998-2003. The Great Barrier Reef Marine Park organized several formal opportunities for the general public to provide written comments, initially prior to development of the marine spatial plan and subsequently commenting on the draft plan. Over these two phases, the Authority received over 30,000 written public submissions that led to substantial changes to the final marine spatial plan in comparison to its draft versions [32]. In European examples, stakeholder involvement is often limited to a one-time comment period once a draft plan has been designed by government officials. Although stakeholders are more and more consulted in light of gaining access to better and more detailed knowledge and information, no formal processes are in place yet to include stakeholders in the early phases of MSP, similar to those of Massachusetts or the Great Barrier Reef. Although these plans are still too immature to derive conclusions related to the real success of stakeholder involvement, it can be expected that thorough stakeholder participation is better able to reflect the multiple perspectives on the planning area and therefore might encourage 'ownership' of the spatial plan, engender trust in the process and eventually stimulate voluntary compliance with its rules and regulations.

2.5 Future-orientation

As with any other planning effort, MSP should be a future-oriented activity [33]. Marine places without any visible problems or conflicts today can look very different in another ten or twenty years. One of the purposes of MSP is to help anticipate such conflicts and allow them to be dealt with before they become problems. To this end, MSP can help to envision a desirable future and enable proactive decision-making in the short run to move toward what is desired in the long run. Consequently, MSP should not be limited to defining and analyzing only existing conditions and maintaining the status quo, but should reveal possible alternative futures of how the MSP area could look in another 10, 15, or 20 years. Developing alternative spatial scenarios is important because they can:

(a) Visualize how the area will look if present trends continue without new management

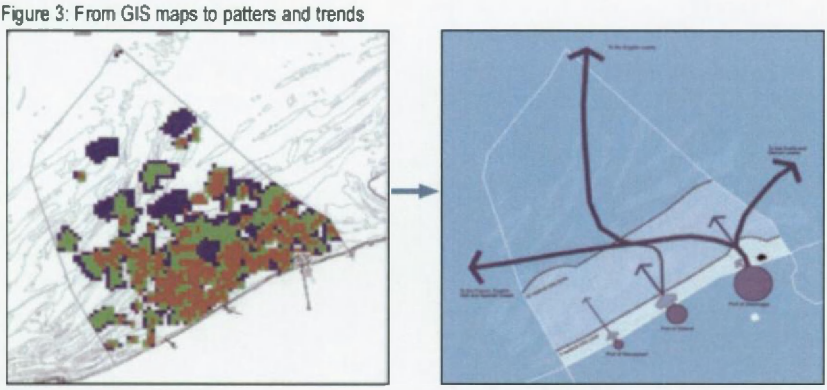
interventions;

(b) Illustrate the spatial and temporal consequences of implementing certain goals and objectives. It can, for example, help in estimating the required marine space to build, for example, 100 offshore wind turbines in the management area and help identify their implications upon other uses and/or the marine environment;
(c) Help anticipate potential future opportunities, conflicts or compatibilities for the area that can guide pro-active decision-making; and
(d) Determine the desired direction the management area should develop and help select the spatial management measures needed to get there.

The development of alternative spatial scenarios is well established in land-use planning. From 2003-2005, the Belgian research initiative, "*Toward a spatial structure plan for sustainable management of the North Sea*" [34] applied such land-use planning methods to the marine environment. The project illustrated that despite the different contexts of land versus water, these techniques could relatively easily be applied to MSP. The project resulted in the creation of six alternative spatial scenarios, each emphasizing a different set of goals and objectives and identified the significance and spatial implications of each scenario for the different functions and activities in the Belgian part of the North Sea.

One of the most important lessons that can be derived from this research initiative is the fundamentally different skills needed to induce a future-orientated, pro-active approach to MSP. Although the project started with an initial 'stock-take' of the area based on available scientific information organized and analyzed through geographic information system (GIS) technology, neither were useful in the design of spatial scenarios. While science tends to disaggregate data to analyze conditions and look at the past in an attempt to understand the present more precisely, spatial planners are more likely to synthesize information and patterns that - instead of trying to be precise - help forecast a desirable future and create alternative spatial use scenarios upon which pro-active decision-making can be based (Figure 3). The development of future spatial use scenarios for MSP clearly demand the skills of spatial planners.

Figure 3: From GIS maps to patters and trends



Source: Maes F. et al. 2005.

Unfortunately, few marine spatial plans have so far identified and evaluated alternative spatial scenarios or visions for the future. It is, in fact, difficult to overstate how little a future-oriented approach is recognized in the actual practice of MSP. One counter-example exists in The Netherlands. The central goal of the Dutch marine spatial plan is the creation of an ocean that

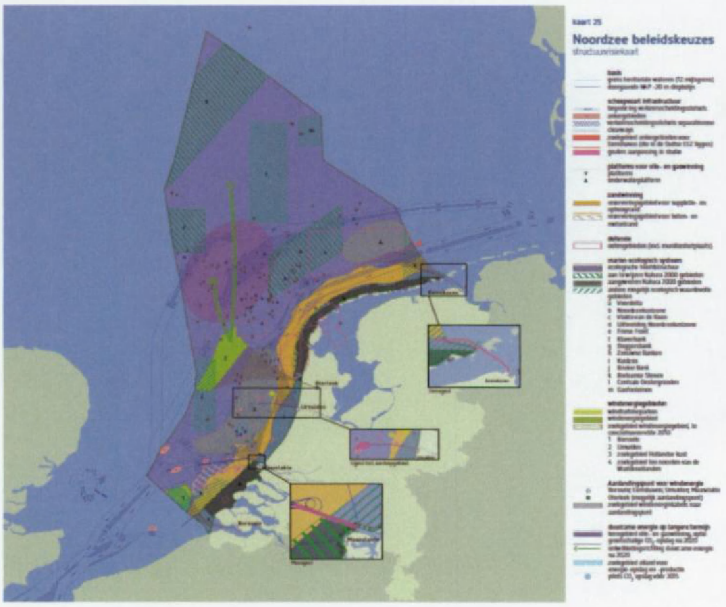
is safe (limiting shipping accidents and reduction of climate change effect), healthy (good water quality and biodiversity conservation) and productive (economic return from oil and gas, wind energy, fishing, and sand extraction). To achieve these goals, the Dutch government prepared three alternative spatial scenarios for a time horizon of 10 years (base year 2005; target year 2015).

As a first step, for each activity (including wind energy, a high government priority) in the management area an estimate was made of (a) what economic developments can be expected; (b) what policy developments can be expected; (c) what technical or operational developments can be expected; (c) what are the spatial requirements until 2015; and (d) what are the spatial requirements after 2015? Secondly, the analysis included an economic valuation (both direct and indirect) for each activity in relation to its demand for ocean space. The economic value was estimated in terms of economic return, added value to the general economy, and employment. On the basis of this information, the three spatial scenarios were developed, each indicating a different level of expected growth, e.g., maximum growth, medium growth, and minimum growth. Thirdly, the spatial and temporal implications of each growth scenario were visualized in maps. These maps further contained information on expected policy developments and estimated technological improvements. By visualizing these scenarios, it was possible to anticipate what opportunities or conflicts could occur when certain objectives (set through the political process) would be implemented. It also allowed drawing initial conclusions about a desired future for the Dutch part of the North Sea. The spatial scenarios were developed through close cooperation with all relevant agencies and steered by an interagency 'Board of Directors'. The estimates for the human uses were mainly developed in cooperation with the sectors themselves. The economic valuations were largely based on economic and financial statistics, historic prices or products, international trade trends and forecasts, and expert opinions [35,36].

Additionally to this work, a State Advisory Committee (Delta Commission) advised the Dutch Government on measures to protect the low-lying country against effects of climate change in the long term [37]. Alternative sea level rise (SLR) scenarios were developed. For the year 2050, relative SLR could be 20-40cm (including 5 cm subsidence of the bottom), in 2100 the maximum plausible SLR could be 1.30m. The Dutch government decided to integrate the SLR into the National Water Plan, and protect the coast through beach nourishment, equal to the actual SLR (acknowledging the maximum SLR as a safety strategy albeit not actually planning for it). Further, the Dutch government intends to explicitly offer space for additional sand extraction for coastal and flood protection measures by reserving space between the 20-m depth contour and the 12-mile zone. The latter is included as a "preferred sand extraction zone" in the National Water Plan [38].

Together, these initiatives now allow the Dutch government to select policy priorities and management measures that actively support protection of the most valuable and fragile places of the marine environment and simultaneously steer the sustainable development of economic use, including oil and gas, fisheries and sand extraction. In addition, it provides them with a vision for the future that preserves areas in case they are needed to protect the country from the effects of climate change (Figure 4).

Figure 4: Dutch policy priorities for the protection and economic development of the North Sea



Source: Ministerie van Verkeer en Waterstaat, the Netherlands, 2009.

3. A clear legal authority for MSP

Although an explicit legal basis for MSP was not available in all countries at the time they began, success in achieving a multi-objective MSP outcome depends on authority that requires all agencies to act consistently with the approved marine spatial plan. Although this may sound obvious, MSP legislation is often drafted in ways that makes a biased MSP outcome inevitable or discontinues MSP once a first plan is in place.

The authority to conduct MSP should be established before the planning process begins, through modifying existing legislation, establishing new legislation, or administrative action that enables a multiple-objective outcome involving all agencies and stakeholders in an inclusive, transparent process. Most countries have relied on existing legislation. For example both Germany [28] and The Netherlands [39] extended their national land use planning acts into their exclusive economic zone (EEZ) in 2004 and 2008 respectively. Australia used its national biodiversity legislation to cover its entire EEZ and Belgium relied on its existing legislation for the protection of the marine environment. The United Kingdom and Sweden are currently developing and implementing new legislation. In 2002 a marine stewardship report by the government of the UK outlined a new approach to managing marine activities, including MSP [40]. The Labour Party's 2005 manifesto committed "through a Marine Act, ...[to] introduce a new framework for the seas, based on marine spatial planning, that balances conservation, energy, and resource needs." [41]. In 2006, a Marine Bill was introduced that included a UK-wide system for MSP, establishment of conservation zones, and establishment of a Marine Management Organization (MMO) that would develop marine spatial plans, streamline permitting, and reduce administrative costs to both government and marine users. The Marine

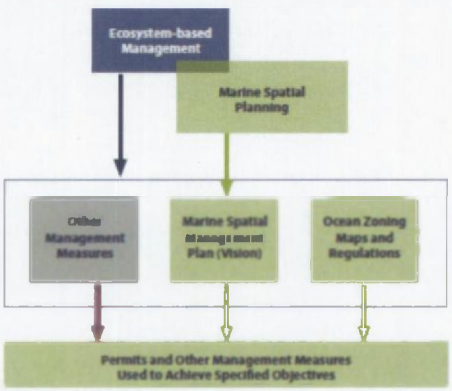
and Coastal Access Bill was introduced in December 2008 and passed at the end of 2009. The formation of a new MMO to develop marine spatial plans is a unique approach in Europe, though it has been done previously in Australia's Great Barrier Reef in 1975 [42]. In other countries marine spatial plans are primarily developed and implemented through existing institutions and agencies. Work is underway on an integrated marine policy for Sweden and new legislation will likely be presented in 2010. A preparatory Inquiry proposed that the National Board of Housing, Building and Planning be given overall responsibility for planning Sweden's sea areas, and specific responsibility for MSP in the exclusive economic zone. Regional agencies would be responsible for MSP within 12nmi [43].

4. Marine spatial planning: What is it not?

Although the rapidly evolving interest for MSP can only be welcomed, debates about it are unfortunately becoming increasingly mis-directed. Of these, the biggest flaw is the misconception that MSP is synonymous with 'ocean zoning'. It is not. For many years, countries have designated special ocean zones for a variety of purposes, including fisheries closures, protected areas, sand and gravel mining, offshore oil drilling, maritime traffic routes and separation schemes, dredged disposal areas, among others. To date, however, most zoning has been done on a sector-by-sector basis, without much consideration of its effects on other sectors or the marine ecosystem. Some authors [44] now promote 'comprehensive ocean zoning' as a means to achieve more integrated, ecosystem-based management of the ocean. Their arguments - although often inspired on recent thinking in the field of MSP - miss an important point.

Zoning is a well-established tool in European and United States land-use planning systems, and is essentially practiced to separate uses that are perceived to be incompatible [45]. Indeed, in the marine environment, zoning is a way to separate conflicts and encourage compatible uses. As illustrated in the figure below, a zoning map will usually form part of a marine spatial plan as a principal management measure for its implementation (Figure 5). Contrary to what zoning supporters proclaim, however, a fixed zoning plan alone cannot deliver social, economic, and ecological in an integrated, ecosystem context – particularly not in a multi-dimensional ocean that is continuously changing both spatially and temporally. In fact, who would want vast ocean spaces entirely zoned for all different uses or non-uses?

Figure 5: The relationship between zoning and marine spatial planning



Source: Ehler and Douvere, 2009.

The crucial point that proponents of ocean zoning miss is that MSP is much more than the mere separation of conflicts and the allocation of ocean space to specific uses or objectives. As illustrated above, MSP not only documents the present or deals with current conflicts but, also, focuses on extrapolating trends and creating spatial scenarios that allow the visualization of how a desirable future could look in another 10, 20, 30 years. This, together with the continuous and adaptive nature of MSP, is what permits governments to be proactive in their decision-making and help estimate what measures are needed today to preserve and protect ecosystem goods and services for future generations. None of this is possible through an ocean zoning plan that is seldom more than a reflection of the existing status quo and prevailing powers at the time.

Additionally, MSP is also often confused with single-sector spatial plans for wind energy or marine protected areas. Both are spatially explicit tools and could form part of marine spatial plan, but again, they are not equal to a MSP process whose aim it is to achieve multiple objectives, and not only economic development or nature conservation. Of course, the variety of terms currently used to refer to MSP does not help avoid the confusion. Maritime spatial planning (European Union), marine planning (United Kingdom), coastal and marine spatial planning (United States), for example, are all used interchangeably throughout the MSP literature. Nevertheless, it has to be noted that despite the different terminology, all terms tend to aim at a more integrated management of ocean space in response to the failures of the current piece-meal approach.

5. Conclusion

Despite the fact that many governments are currently embarking on MSP, little guidance is available that illustrates how MSP can deliver successful results. Although various MSP initiatives are still in an early stage and will only over time demonstrate how effective they really will be, some initial lessons can be drawn from these experiences.

Clear authority is needed before starting any MSP process—without authority, marine spatial plans are likely be ineffective in achieving their multiple goals and objectives. All sectors, including fisheries and oil and gas development, should be fully integrated in the MSP process. Allowing any important sector to opt out of the planning process easily leads to problems when the use of ocean space has been agreed upon and the excluded (or uninvolved) sector is not operating consistently with the approved spatial plan.

Once a legal basis is in place, other characteristics are critical to the development of MSP. First, MSP is dynamic and should focus on the future, not simply document present conditions. Second, profound and unforeseen changes are inevitable in both ocean ecosystems and ocean industries and could not be dealt with through a one-time plan. Instead, plans should be adaptive as these changes could significantly alter where, when, and how we use the ocean in the future. Third, as MSP is proposed as a means to alter the declining health of marine ecosystems, it should reflect ecosystem patterns and processes at appropriate spatial and temporal scales or, in other words, induce an ecosystem approach. Fourth, the multiple objective nature of MSP requires integration across a wide range of uses and issues not only within the planning area, but also in adjacent areas (across state, federal-state, and international) where both land-based or offshore activities could greatly influence the quality of the marine area and hence undermine the effectiveness of the marine spatial plan entirely. Finally, MSP should reflect as many expectations, opportunities, or conflicts occurring in the

marine area and to that end involve stakeholders at all levels of its development and implementation.

Understanding these characteristics of MSP is of critical importance as more and more governments become convinced of its benefits and are developing new legal and policy arrangements to enable its application. Not only does it prevent new MSP professionals from "re-inventing the wheel" each time over again, it helps avoid misleading interpretations about MSP taking root and eventually derailing the further successful development and implementation of MSP worldwide.

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CHAPTER 5
Marine spatial planning and stakeholder participation

Published as:
Pomeroy R and Douvere F. 2008
The engagement of stakeholders in the marine spatial planning process
In: Marine Policy 32:816-822

Abstract

Due to the interdependency that exists between ecosystem resources and its users, successful implementation of marine spatial planning (MSP) depends on the identification and understanding of different stakeholders, their practices, expectations and interests. Today, many scientists and resource managers agree that the involvement of stakeholder is a key factor for a successful management regime in the marine environment. In the former chapter, five critical elements, including stakeholder participation, were identified for MSP. This chapter focuses on the various types and stages of stakeholder participation in a MSP process, and illustrates how to conduct a stakeholder analysis that allows the involvement of stakeholder in an adequate way that is sustainable over time. The chapter argues that the way stakeholders are involved in the process must reflect, or at least address, the existing complexity of the specific context of the MSP area.

1. Introduction

As defined by Ehler and Douvere [1], "Marine spatial planning (MSP) is a way of improving decision making and delivering an ecosystem-based approach to managing human activities in the marine environment. It is a planning process that enables integrated, forward looking, and consistent decision making on the human uses of the sea." Ecosystem-based, MSP seeks to sustain the benefits of the ecological goods and services that the oceans provide to humans as well as all living organisms on the planet. Spatial management in the marine environment aims to provide a mechanism to achieve consensus among all sectors operating in a particular area.

Thus, in MSP there is a recognition that the marine environment is composed of both natural and human elements and that there are linkages between these elements. Management of the marine environment is a matter of societal choice. It involves decision making in terms of allocating parts of three-dimensional marine spaces to specific uses to achieve stated ecological, economic and social objectives. People are central to this decision-making process and are the agents for change. As such, stakeholder participation and involvement is integral to the success of MSP. Increased stakeholder participation and involvement in the resource management decision-making process has gained acceptance worldwide [2–5]. There are various reasons why it is important to involve stakeholders, including [6]:

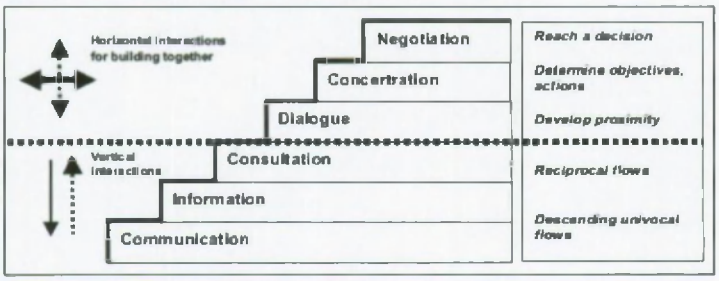
1. Better understanding of the complexity of the ecosystem;
2. Understanding of the human influence on the ecosystem and its management;
3. Examining the compatibility and/or (potential) conflicts ofmultiple use objectives;
4. Identifying, predicting and resolving areas of conflict; and
5. Discovering existing patterns of interaction.

In addition, stakeholder involvement provides an opportunity to deepen mutual understanding about the issues at hand, explore and integrate ideas together, generate new options and solutions that may not have been considered individually and ensure the long-term availability of resources to achieve mutual goals [7]. Stakeholder involvement can increase stability in a complex environment and expand capacity rather than diminish it under changing circumstances. All of these issues are becoming increasingly important in the context of MSP to avoid incompatible uses, resolve conflicts and move toward ecosystem-based management.

2. Stakeholder participation

There is a range of types of potential stakeholder participation in MSP. Different types of participation range from communication, where there is no actual participation, to negotiation, where decision-making power is shared among the various stakeholders. Between these two extremes, different levels of participation are possible (Fig. 1) [8].

Figure 1: Possible types of stakeholder participation in an MSP process



Adapted from: Bouamrane M. 2006.

There should be wide ranging and innovative approaches to stakeholder participation and proactive empowerment of the MSP process and not just undertake a collation of public comments on a completed plan. Stakeholder participation and involvement in the MSP process should be early, often and sustained throughout the process. Stakeholder participation and involvement encourages 'ownership' of the plan and can engender trust among the various stakeholders. Different types of stakeholder participation should be encouraged at the various key stages of the MSP process. The key stages at which the public and stakeholders should be encouraged to engage and be involved in a MSP process are [9]:

1. *The planning phase*: Stakeholders need to be involved and contribute to the setting of priorities, objectives and purpose of the MSP plan(s). The MSP management team can assist in setting priorities and identifying objectives through stakeholder meetings and group discussions. The idea is to identify, group and rank problems, needs and opportunities in order of priority. This can be done through criteria ranking and pairwise ranking. The output should be made available to the stakeholders, and the output should be reviewed and verified with the stakeholders;

2. *The MSP plan evaluation phase*: Stakeholders need to be engaged in the evaluation and choice of MSP plan options and the consequences of different approaches on areas of their interest. In developing the plan, a number of participatory tools and methods can be used including focus group discussions, problem trees and preference ranking. It is important for all the stakeholders to be clear about the goal and objectives and about what can be achieved in order to focus strategies. The more participatory the process of setting goal and objectives, the greater the stakeholder acceptance and legitimacy of the MSP plan. Often the process of arriving at consensus regarding goal and objectives is an effective means of promoting an exchange of information and understanding among stakeholders. If a trained planner is not available, a plan can still be prepared based on the stakeholders' knowledge and participation;

3. *The implementation phase*: Stakeholder involvement in applications of MSP and management measures. A community-based approach to enforcement may be warranted that involves the fishers in the regulatory and enforcement process. When the fishers understand the problems and benefits of taking action, and agree upon the actions to be taken, they will take part in the enforcement—at least to the extent of encouraging compliance. In a co-managed fishery, there is a greater moral obligation on individuals to comply with rules and regulations, since the fishers themselves are involved in formulating, rationalizing and imposing the rules and regulations for their overall well-being. The government will need to ensure that community-based enforcement units are trained and operational, with adequate equipment;

and

4. *The post-implementation phase*: Stakeholder involvement in overall effectiveness evaluation in achieving goals and objectives of MSP plan. A summative or post-evaluation is undertaken after the plan's implementation where the focus is on a deeper analysis of results and outcomes and for determining the level of achievement of objectives and the impact of the plan. The post-evaluation effort should involve all stakeholders in meetings to discuss plan results, hold general evaluation sessions, evaluate results against objectives, and plan for the next phase.

Various scientists and resource managers agree that the involvement of stakeholders is a key aspect of successful implementation of ecosystem-based management. A key question, however, is who are the main stakeholders with regard to a particular area and how to involve them in an effective way. Although a broad range of policy and legal documents hold a strong need for the identification and involvement of stakeholders, neither of them provide a process for doing so in practice [10]. To be effective, the stakeholders that are involved in the process must reflect, or at least address, the existing complexity in reality. A comprehensive method that allows for doing this is by use of stakeholder analysis and mapping. In addition to participating in the MSP process, stakeholders need to be empowered to enable them to be fully engaged in the process. Stakeholder participation and empowerment take both time and resources.

3. Who can be defined as stakeholder: concepts and definitions

Due to the public nature of the marine environment and its many uses, there are numerous potential stakeholders who have an interest or stake in the outcome of the MSP plan. These include commercial fishing, recreational fishing, aquaculture, shipping, military, marine-protected areas (MPAs), energy production, and others. In fact, strictly seen, every individual is a potential stakeholder. There may be different stakeholders depending on their interests, their ways of perceiving problems and opportunities concerning marine and coastal resources, and different perceptions about and needs for management. Not all stakeholders have the same stake or level of interest in the marine environment, and thus may be less or more active and have different entitlements to a role in the MSP process.

Definitions of, and distinctions among stakeholder and community can be found throughout the public participation literature, although the terms are not applied consistently. The term stakeholder is often associated with corporate management and was first recorded in 1708 as 'a person who holds the stake or stakes in a bet' [6]. Freeman defines a stakeholder as 'any group or individual who can affect, or is affected by, the achievement of corporations' 'purposes' [11]. In the context of natural resource management, however, Ro" ling and Wagemakers define stakeholders as 'natural resource users and managers' [6]. In the more specific context of MPA management, stakeholders are described as 'anyone who has an interest in or who is affected by the establishment of a protected area' [12]. Pomeroy and Rivera-Guieb provides a more holistic definition of stakeholders and describes them as [13]:

> *Individuals, groups or organizations who are, in one way or another, interested, involved or affected (positively or negatively) by a particular project or action toward resource us.*

Stakeholders may include groups affected by management decisions, groups dependent on the resources to be managed, groups with claims over the area of resources, groups with activities that impact on the area or resources and groups with, for example, special seasonal or geographic interests. Pomeroy continues by stating that stakeholders often hold considerable political and/or economic influence over the resource, based on their historical dependence and association with it, institutional mandate, economic interest, or a variety of other concerns [13]. Another commonly used term is community. The term 'community' can have several meanings. Community can be defined geographically by political or resource boundaries or socially as a community of individuals with common interests. For example, the geographical community is usually a village political unit (the lowest governmental administrative unit); a social community may be a group of fishers using the same fishing gear or a fisher organization. A community is not necessarily a village, and a village is not necessarily a community. Care should also be taken not to assume that a community is a homogeneous unit, as there will often be different interests in a community, based on gender, class, ethnic and economic variations. Recently, the term 'virtual community' or 'community of interest' has been applied to non-geographically based communities of fishers. Similar to the 'social community', this is a group of fishers who, while they do not live in a single geographical community, use similar gear or target the same fish species or have a common interest in a particular fishery.

Other terms are used interchangeably with stakeholder in colloquial language, but with slightly different connotations. For example, systems analysts refer to an actor as 'a person who carries out one or more of the activities in the system' [6], while others refer to institutional actors, describing them as 'a community, a public entity, a group or an individual who organizes itself, takes action to gain social recognition of its own interests and concerns and is willing to assume some task and responsibility for a given natural resource management unit' or social actors, which include 'governmental and non-governmental institutions, groups and private individuals, local communities and outsiders with entitlements to local resources, bearing important complementary capacities for natural resource management' [14].

4. What is stakeholder analysis and why is it important?

Stakeholder analysis refers to a range of tools for the identification and description of stakeholders, their interrelationships, current and (potential) future interests and objectives [6] and examines the question of how and to what extent they represent various segments of society. More concretely, stakeholder analysis can be defined as:

> *An approach and procedure for gaining understanding of a system by means of identifying the key actors and stakeholders in the system and assessing their respective interests in that system* [15].

The use of stakeholder analysis originated in the management sciences. It has now evolved into a field that incorporates economics, political science, game and decision theory and environmental science [16]. Stakeholder analysis is also a central theme in conflict management [6]. Stakeholder analysis seeks to differentiate and study stakeholders. Stakeholder groups can be divided into smaller and smaller sub-groups depending upon the particular purpose of stakeholder analysis. The identification of key stakeholders should be inclusive and detailed. More groups may mean more problems and discussion, but excluding certain groups could lead to problems in the long run. Ultimately, every individual is a

stakeholder, but that level of detail is rarely required. A key question to be answered in the MSP process is: who are the stakeholders that are entitled to take part in discussions and in management? Seven major attributes are important for stakeholder analysis in natural resource management [6]:

1. The various stakeholders related to the natural resource;
2. The group/coalition and to which they belong and can reasonably be associated with;
3. The kind and level of interest (and concerns) they have in the natural resource;
4. The importance and influence that each stakeholder has;
5. The stakeholders' position toward the use or conservation of natural resource;
6. The multiple 'hats' they wear; and
7. The networks to which they belong.

Once key stakeholder groups are identified, it is important to find out what their interests and concerns are and how they are positioned toward the area and its resources. The interests, concerns and positions of the various stakeholders will differ as a result of factors including tenure, ownership, history of use, social organization, values and perceptions, and pattern or type of use [17]. For example, the creation of the '*W*' Biosphere Reserve, located at the intersection of three countries—Benin, Burkina Faso and Niger—addressed a biodiversity conservation goal at both the national and regional levels. Earlier attempts to conserve certain natural resources in a unilateral way failed and forced the government to establish compatibility between the conservation of spaces in the reserve and the practices and demands of the community that uses the area. The approach used to identify the stakeholders started with a global analysis of the communities (villages) and focused on physical and socio-economic determinants and the flow of exchanges, both internal and external, among the communities. The analysis made it possible to identify the basic territorial organization structures, which explained the strategies for the spatial occupation in the conservation area, the dynamics with the communities, and the relationships (functional or hierarchical) between them. The eco-functional network (a group of communities whose relationship is conditioned by common natural resources) resulting from this analysis leads to the identification of 'homogeneous zones,' where use and management rules could become established on a consensus basis [8].

Although stakeholders must be defined broadly in order to capture a wide range of groups and individuals [11], it is important to note they are also often dangerously simplified, suggesting that interests, experiences, needs and expectations are homogenous among a given group of people. The reality is far more complex, and methods used in stakeholder identification and analysis must accept and reveal this complexity, by describing and interpreting the many differences that exist among certain groups of stakeholders [14]. Moreover, due to the complexity of the ecosystem, some stakeholders can also easily be missed, as for example illegal harvesters [17].

After key stakeholders with interests in the proposed ecosystem are identified, they should be weighted as stakeholders with a primary, secondary or tertiary interest or stake in the area or its resources [18]. Different stakeholders may be distinguished using some considerations and criteria, including [13]:

1. Existing rights to marine and coastal resources;
2. Continuity of relationship to resource (for example: resident fisher versus migratory fisher);
3. Unique knowledge and skills for the management of the resources at stake;

4. Losses and damage incurred in the management process;
5. Historical and cultural relations to the resources;
6. Degree of economic and social reliance on the resources;
7. Degree of effort and interest in management;
8. Equity in the access to the resources and the distribution of benefits from their use;
9. Compatibility of the interests and activities of the stakeholders;
10. Present or potential impact of the activities of the stakeholders on the resource base.

Those who score high on several of these considerations and criteria may be considered 'primary' stakeholders. Secondary and tertiary stakeholders may score on only one or two and be involved in a less important way [13]. Shepherd describes primary stakeholders as 'those who are most dependent upon the resource, and most likely to take an active part in managing it', while secondary and tertiary stakeholders are over-powerful voices that may include local government officials and those who live near the resource but do not greatly depend on it (secondary); and national level government officials and international conservation organizations (tertiary) [18].

While it is important to have a well-represented MSP process, it is important to determine if all stakeholder sub-groups are entitled to be involved in the process. Too many stakeholders can create administrative and resource allocation problems. It is important that the final stakeholders involved be well-balanced; not too many so as to complicate and slow down the process and not too few so as to leave out some key stakeholders. As such, the issue of entitlement becomes a central question: '*Who is entitled to participate in the MSP process?*' It is difficult and is often only accomplished through participation from and negotiation with groups and individuals to ensure equitable representation in the MSP process. All who believe themselves stakeholders should be allowed to argue their case for entitlement. The stakeholders with recognized entitlements may be subdivided between 'primary' and 'secondary', and accorded with different roles, rights and responsibilities. For example, full-time fishers may be recognized as primary stakeholders and seasonal fishers may be recognized as secondary stakeholders.

5. Socio-economic assessment

A reliable stakeholder analysis requires research to provide information about the stakeholders. A socio-economic assessment (SEA) is a way to learn about the social, cultural, economic and political conditions of individuals, households, groups, communities and organizations. There is no fixed list of topics that are examined in a SEA, however, the most commonly identified topics are: resource use patterns, stakeholder characteristics, gender issues, stakeholder perceptions, organization and resource governance, traditional knowledge, community services and facilities, market attributes for extractive use, market attributes for non-extractive use, and non-market and non-use values. SEAs vary in the extent that they cover these topics, and this will depend on the purpose of the assessment. Some SEAs may be a full evaluation of all these topics; others may focus on stakeholder perceptions or resource use patterns [19]. SEAs can be participatory (a broad range of people are involved in data collection, analysis and use) or extractive (outsiders conduct the assessment and take the information with them). They can also be productoriented (report produced for a specific stakeholder group) or process-oriented (the process of collecting information is as important as the information).

One method to collect data on stakeholders and their attributes in a comprehensive and

efficient manner is to conduct interviews with experts knowledgeable about stakeholders or directly with the stakeholders themselves. Such methodology is known as a participatory research approach. This working method is the most commonly used in the field of stakeholder analysis and is considered as the best method for a successful outcome.

However, it is important to note that the use of participatory research does not exclude conventional research methods [13]. For example, the Tortugas Ecological Reserve, a fully protected marine reserve that is currently the largest such area in the United States, is part of the Florida Keys National Marine Sanctuary, a multiple-use MPA that uses marine zoning and spatial management to protect resources while allowing compatible activities. The design and implementation of the reserve are a successful example of collaborative decision making among local communities, government official and scientific experts. As a result of the participation of stakeholders (including the integration of their knowledge), socio-political and economic factors weighed heavily in the outcome of the reserve process while scientists played a crucial role in balancing short-term economic concerns with potential long-term economic and ecological benefits. Ingredients of success were, among others, that scientists were seated at the table with other relevant stakeholders, and that scientific data and research results were considered alongside traditional knowledge provided by the users of the area as equally important input to the reserve design process [20].

In coastal and terrestrial areas, stakeholders are often identified through a period of field research, typically using interviews with local individuals. Relevant literature suggests that stakeholder analysis is best conducted starting with a core group of stakeholders and/or key informants (knowledgeable or important individuals in the community). In practice, the participants of the core group would be asked to identify their own interests and representative characteristics associated with the resource or activity. The core group would also be questioned who they perceive to be the other main stakeholders, and what the relations among different stakeholders are [13]. This exercise should be seen as a first, initiating step in the process of stakeholder analysis, providing a basis for further and broader involvement in the next step. Also, a step-by-step participatory method has the advantage of foreseeing an opportunity to verify the information already collected.

The designation of a MPA may have considered fishing intensity along with other layers of information such as biological diversity, species presence or absence, habitat vulnerability, recreational use, and so on. A suitable location for an MPA may be proposed and may appear to minimally affect commercial fishing. Perhaps it will close only 10% of regionally important fisheries. However, the MPA may represent the entire fishing territory of a particular fishing community that might not be able to fish elsewhere due to distance, custom, safety, etc. In addition to simple dispossession, spatial planning that ignores community territoriality also produces conflict as people move to other locations already inhabited by other users, intensifies resource exploitation in remaining areas, and makes fishing more hazardous as fishers must travel further to catch fish. Neglecting the connection between locations offshore and communities onshore can result in uneven impacts and unforeseen hardships. This problematic raises significant questions about spatial planning methodologies. In particular, it suggests that methods to better document the connections between offshore locations and onshore communities need to be developed along with socioeconomic layers generally. It also points out the need for greater community-level participation in MSP.

A common way to present the results of a stakeholder analysis is by use of a matrix. For all identified resource uses (for example shipping, fisheries, mining and drilling, oil and gas

exploitation), the matrix provides an overview of the various stakeholders, their interests, influence, importance, etc. Such a matrix is the product of a stakeholder analysis and can be referred to as stakeholder mapping as it maps who is doing what and where (Table 1) [10]. Table 1 shows how the information available on the uses of spaces and resources by various types of stakeholders can be organized into a "stakeholder matrix". Such a matrix can facilitate the involvement of stakeholders in a particular area by providing the information necessary for identifying and weighing selected stakeholders for consultation rounds about, or involvement in, the management of ocean spaces and their resources, and MSP in particular.

When all information is compiled and verified in the matrix, it may reveal overlapping interests, conflicts and possibilities for synergies among the various stakeholders. The identification of opportunities for synergies becomes considerably improved by adding a spatial dimension (both vertical throughout the water column, and horizontal from coastal to marine to areas beyond national jurisdiction) to the analysis of stakeholders' interests.

Of course, the actual interest of the various stakeholders can be much more specific than the matrix above shows. On the other hand, it is also important to keep in mind that any stakeholder analysis will have a certain level of uncertainty. Whenever and however the stakeholder analysis is conducted and used for the effective involvement of stakeholders, the participating representatives will always have their own characteristics. Organizations, as well as the individuals who represent them, belong to social networks and have certain personalities that will influence the involvement of stakeholders. This is difficult if not impossible to control.

6. Stakeholder empowerment

Stakeholder participation is critical but not adequate to the MSP process. Stakeholder empowerment, through environmental education, capacity development and social communication, is essential and should be an integral part of the MSP process. The purpose of these activities is to empower people with knowledge and skills in order that, they can actively participate in the MSP process and increase their awareness and understanding of the marine environment and management. While stakeholder empowerment is a continuing activity throughout the MSP process, it should be noted that it is important to start these activities as soon as possible in order to empower people with knowledge and skills so that they can actively participate in the MSP process. Activities aimed at increasing awareness, knowledge, skills and institutional capacity, such as environmental education, capacity development and social communication, are sometimes taken together under the term 'social preparation'.

Social preparation has several functions, including:

1. Reducing social conflict and resource impacts;
2. Creating positive change in values and behavior towards the environment;
3. Gaining support for the MSP plan;
4. Increasing knowledge and skills of stakeholders;
5. Fostering participation;
6. Enabling stakeholders to assert their rights to use and manage the marine environment.

The ultimate goal of social preparation is to achieve behavior and attitude changes so that the MSP process can be sustainable. Social preparation is focused on building a constituency for

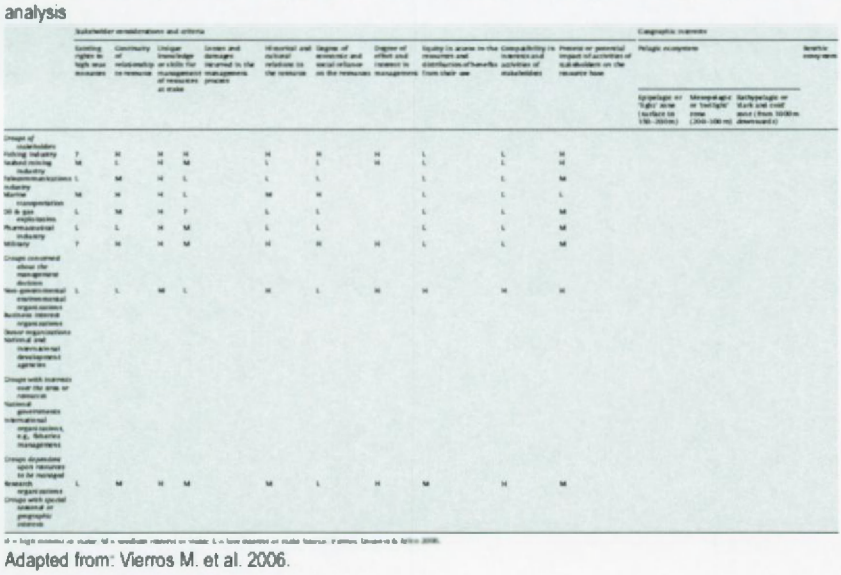
the MSP plan through a critical mass of people in the area who are environmentally literate, imbued with environmental ethics, shared responsibilities, and shared actions towards the sustainable management of the marine environment. It should be noted that social preparation activities alone will not cause people to change unsustainable practices and behavior. There need to be several actions operating concurrently, such as changed community values, availability of alternative behaviors, and possible sanctions for unsustainable activities.

Two examples of social empowerment illustrate its use at national and community levels. The Coastal Resources Management Program, a US Agency for International Development funded program for coastal management in the Philippines, in partnership with the National Commission on Marine Sciences with support from Silliman University, National Museum, and the Department of Environment and Natural Resources Protected Areas and Wildlife Bureau and a host of private sector sponsors organized the 'Our Seas, Our Life' traveling exhibit. The exhibit was launched in Cebu City in February 1998 and traveled to key cities in the Philippines until December 1999, drawing approximately 1.4 million viewers. A huge success, the exhibit proved invaluable in calling national media and public attention to coastal issues. It was also a highly effective social marketing tool, providing a forum for discussion of coastal resource management problems and solutions among a wide range of sectors in the cities visited [21].

The Friends of Nature (FON), a non-governmental organization based in Placencia, Belize, co-manages the Laughing Bird Caye National Park and the Gladden Spit and Silk Caye Marine Reserve, with government. As part of its staff, FON has a full-time environmental educator. In its strategic plan, FON has identified education and outreach as one of its primary activities. FON has specifically identified the following interventions as part of this activity:

1. Student environmental education materials;
2. Environmental education lectures at local schools;
3. Resource user environmental education materials; and
4. Lecture series on marine environmental issues for the general public [22].

Figure 2: Example of stakeholder mapping for marine areas beyond national jurisdiction, based on stakeholder analysis



Adapted from: Vierros M. et al. 2006.

7. Conclusion

As outlined in previous articles in this issue[1], MSP is a key aspect in making ecosystem-based, sea use management a reality. A comprehensive MSP process is directed toward the allocation of parts of three-dimension marine spaces to specific uses with the objective to achieve ecological, economic, and social objectives. People are at the heart of such a process, and both the setting of objectives and the spatial measures that eventually will be chosen to manage the ecosystem are both a matter of societal choice.

Worldwide, scientists, decision makers and resource managers agree that the participation and involvement of stakeholders is a key ingredient for successful ecosystem-based management in general, and MSP in particular. Stakeholder participation and involvement encourages 'ownership' of the plan, can engender trust among all partners, and can reduce conflict. However, stakeholder participation requires an investment of time and resources. It is critical that stakeholders are involved early and continually in all phases of the MSP process, including the planning, plan evaluation, implementation and post-implementation phase, and not just consulted afterwards. There should be wide ranging and innovative approaches to stakeholder participation.

A key question in many stakeholder participation exercises is how to determine which stakeholders are entitled to be involved. The use of stakeholder analysis, usually conducted through a participatory research approach, makes it possible to identify the key stakeholders that need to be involved in the process. In addition, it enables weighing their importance based on a set of criteria that reflects their interest, relationship to, and dependency on the marine space and its resources. A SEA is a way to learn about the social, cultural, economic and political conditions of individuals, households, groups, communities and organizations. A well-conducted stakeholder analysis can eventually lead to the determination of 'homogeneous zones' or spaces in which the resources are managed on a consensus basis, as is the case in the 'W' Biosphere Reserve in Niger. But, although critical to a successful MSP process, stakeholder participation alone is not enough. In addition to participating, stakeholders need to be empowered to enable their full engagement. Activities directed to empower stakeholders, including environmental education, capacity development, and social communication, are primarily focused on building constituency for the MSP plans, and will ultimately aim to establish behavior and attitude changes so that the MSP process can be sustainable over time.

Acknowledgment
Robert Pomeroy would like to thank the Oak Foundation for their support.

[1] This article was published as part of the Special Issue of Marine Policy on 'The role of marine spatial planning in implementing ecosystem-based, sea use management.' Marine Policy 2008, 32:759-843.

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CHAPTER 6
Monitoring and evaluation for marine spatial planning

Accepted as:
Douvere F. 2010.
The importance of monitoring and evaluation in adaptive maritime spatial planning
Journal of Coastal Conservation: Planning and Management

Abstract

In chapter 4 of this thesis, it was illustrated that marine spatial planning (MSP) needs to be conducted as a continuous process that is adaptive to changing circumstances. An adaptive approach to MSP, however, requires monitoring and evaluation of the effectiveness of spatial and temporal management measures to promote understanding and improve planning and decision-making. This chapter illustrates that setting clear, measurable objectives at the onset of the spatial plan development is a prerequisite to enable efficient monitoring and evaluation of MSP. It concludes that, due to the fact that such objectives are largely lacking in current MSP efforts, a truly adaptive approach to MSP is presently not really possible. But without decent monitoring and evaluation, how can we possibly know whether or not MSP is actually achieving its anticipated results? The lack of such understanding might become an important obstacle for the future success of MSP worldwide.

1. Introduction

An adaptive approach to planning and management is indispensable to deal with uncertainty and to incorporate various types of change. With regard to the marine environment, these changes can include environmental change, changes in political priorities or, new economic realities, among others. Climate change, for example, might influence the location of important biological and ecological areas over the next 30-100 years while technological change might considerably alter the exploitation of previously inaccessible marine areas such as the Arctic or the high seas.

Additionally, change can also be inspired through newly acquired information. One of the most cited impediments with regard to integrated marine management is the lack of relevant knowledge, information, and data. Maritime spatial planning (MSP) is not different in this regard. Complete knowledge, data and information are never available at the start of a MSP process. New tools and techniques, such as remote sensing, geographic information systems (GIS), global positioning systems (GPS), and underwater autonomous systems are rapidly making spatial and temporal data more accessible and sophisticated and could considerably improve maritime spatial plans over time.

All of these changes, however, while usually external to the maritime spatial planning process, are likely to affect its desired outcomes. For example, economic conditions can significantly affect the amount of pollution discharged from land-based sources and subsequently alter the environmental quality of certain places in the marine area for which a maritime spatial plan is prepared. For example, the creation of "dead zones" in the Gulf of Mexico or Baltic Sea result primarily from excessive nutrient discharges from land-based sources (primarily agriculture). The discharge of agricultural nutrients could be affected by short-term changes in the weather (more rainfall), in the national economy (down-turns resulting in lower demand for agricultural products), or the rising price of fertilizer, as much as any measure that might be implemented through a management plan to reduce nutrient discharges [1]. Areas that are increasingly "dead" will affect the allocation of marine space for fishing, recreational, and conservation purposes in a maritime spatial plan.

Since MSP seeks to achieve multiple objectives by analyzing and allocating offshore human use in space and time, it is essential to understand whether the spatial management measures taken to implement the plan (Table 1), are actually achieving the desired outcomes. It is possible, for example, that certain spatial and temporal measures such as a fishing closure area, are not realizing the anticipated outcomes either because factors external to the maritime spatial plan are influencing the performance of the spatial measure or because the maritime spatial plan itself did not specify the spatial measure appropriately from the onset. Although external factors of change are mostly uncontrollable through a MSP process, an adaptive approach to MSP can help identify either more effective measures to achieve its anticipated objectives, or increase understanding how objectives should be modified in the context of changing conditions.

Despite the importance of an adaptive approach to MSP, few efforts have been made thus far to define what such an approach really entails. An adaptive approach typically requires monitoring and evaluation of the performance of maritime spatial plans, but little research has been conducted on how such performance monitoring and evaluation can lead to meaningful results and whether current MSP initiatives have the right features to allow it. The latter, however, is crucial as more and more countries attempt to learn from existing MSP practice

and some countries recently commenced their 'second-generation' maritime spatial plans. Without knowing what it is that existing maritime spatial plans are achieving (or not achieving), how will it be possible to improve them the second time around? This article attempts to answer some of these questions by reviewing relevant literature about adaptive management and subsequently by analyzing existing approaches to monitoring and evaluation in the context of maritime spatial planning practice in Norway, Germany, and the United States of America (Massachusetts).

Table 1: Examples of spatial and temporal management measures taken through maritime spatial planning

Management measures that specify **where in space and when in time** human activities can occur in marine areas or zones
▪ *Specification of areas or zones for specific activities, e.g., commercial fishing, indigenous fishing and hunting, oil and gas development, sand extraction, marine transportation, cables and pipelines, military operations—all of the time*
▪ *Specification of areas or zones closed to specific activities, e.g., commercial fishing, oil and gas development, sand extraction, cables and pipelines—all of the time*
▪ *Specification of areas or zones open for specific activities, e.g., commercial fishing, oil and gas development, sand extraction, cruise ships, military operations—during specific times*
▪ *Specification of areas or zones closed to specific activities, e.g., commercial fishing, oil and gas development, sand and gravel extraction, cruise ships—during specific times, seasonal limitations on oil development operations*
▪ *Specification of areas or zones closed to all development—all of the time, e.g., strictly protected areas, research areas, no-take, no impact areas*
▪ *Specification of areas or zones open to all development—all of the time, e.g., multiple use areas*
▪ *Designation of security zones, precautionary areas, safety zones, rights-of-way*
▪ *Designation of critical habitat, environmentally or ecologically sensitive areas, e.g., marine mammal feeding area, fish spawning area*
▪ *Designation of a Particularly Sensitive Sea Area (PSSA)*
▪ *Limiting activities in areas adjacent to cultural, spiritual, and archeological sites*
▪ *Special protection measures for areas of the high seas*

2. Monitoring, evaluation and adaptation: connecting the dots

Although the idea of learning from experience and modifying subsequent behavior in light of that experience has long been reported in the literature, the specific idea of an adaptive approach to natural resources management can be traced back to the work of Holling (forests) [2], Walters (fisheries) [3] and Lee (river basin management) [4]. Concerned with the fact that we usually measure what is, instead of what is likely or what could be made to be, Walters outlined the adaptive management approach as beginning *'with the central tenant that management involves a continual learning process'*. His basic assumptions of adaptive management include (a) knowledge will never be adequate; (b) many questions can only be answered by experience and experiment; (c) analysis gets simplified; (d) nothing is certain; and (e) much of what we know is wrong, we just don't know it [5]. All of these assumptions are relevant to MSP.

Essentially, an adaptive approach allows decision-makers to learn from the successes and failures of their management actions. With regard to MSP, an adaptive approach enables understanding about whether the spatial and temporal measures identified and implemented

through the spatial plan actually lead to the anticipated outcomes and results. Additionally, it can help evaluate if the MSP objectives have been achieved at the least cost, and whether these costs (and benefits) have been distributed in an equitable way. Any adaptive management process will require both monitoring and evaluation and will use a set of indicators to derive meaningful information [6,7]. Monitoring refers *"a continuous activity that uses the systematic collection of data on selected indicators to provide managers and stakeholders with indications of the extent of progress toward the achievement of management goals and objectives"* [8] while evaluation refers to *"the assessment of achievements against some predetermined criteria, usually a set of standards or management objectives"* [9].

It is important to differentiate two types of monitoring and understand how they relate to MSP. Probably the best-known form refers to monitoring that assesses the 'state-of-the-system' or 'state-of-the-environment'. State-of-the-system monitoring focuses on assessing, for example, the status of biodiversity in the marine area, the quality of water, or the overall health of a particular ecosystem [10]. Historically, monitoring has focused on measuring the state-of-the environment – the results of which are documented in numerous local, national, or international reports such as the *State of World Fisheries and Aquaculture* of the United Nations Food and Aquaculture Organization (FAO) [11] or the *Quality Status Reports* published by the OSPAR Commission [12], among many others. Many times new management approaches, including MSP, are brought forward as ways to deal with the deteriorating conditions of the marine environment as documented by such state-of-the-system reporting.

A second form of monitoring entails measuring the actual *performance* of management measures proposed through, for example, a maritime spatial plan. This form of monitoring can be referred to as 'performance monitoring'. In the context of MSP, it addresses questions as *'is the area closed to fishing or oil and gas development included in the marine spatial plan producing the outcomes we desire?'* or *'are the boundaries of the protected area sufficient to conserve the special habitat?'* Both types of monitoring are closely related, and both will be needed for effective MSP. In contract to performance monitoring, however, state-of-the-system monitoring does not directly measure the effects of various spatial management measures, and therefore cannot be used to determine the effectiveness or efficiency of the actions taken through the marine spatial plan. While state-of-the-system monitoring permits the identification of changing conditions in the marine environment (positively or negatively), performance monitoring enables the determination of whether this change is attributable to measures taken through the maritime spatial plan or caused by other factors. Consequently, performance monitoring is a prerequisite for an adaptive approach to MSP.

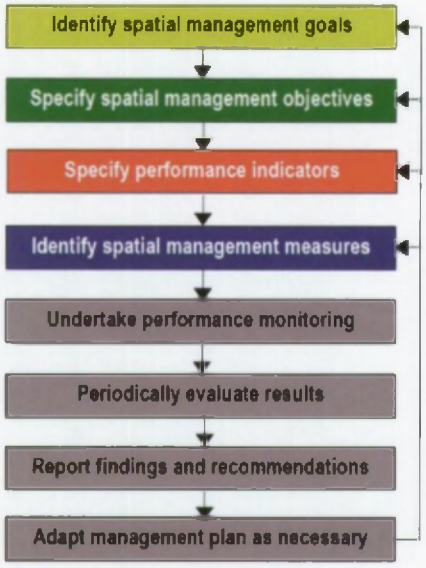
To derive meaningful results, monitoring should use a set of indicators. Indicators can take the form of quantitative/qualitative statements or parameters that can describe existing situations and measure changes or trends over time. Good and reliable indicators will generally have a number of characteristics, including [13]:

- *Readily measurable* on the time scales needed to support management, using existing instruments, monitoring programs and available analytical tools. They should have a well-established confidence limit, and their signal should be distinguishable from background noise;
- *Cost-effective:* Indicators should be cost-effective since monitoring resources are usually limited;

- *Concrete:* Indicators that are directly observable and measurable (rather than those reflecting abstract properties) are desirable because they are more readily interpretable and accepted by diverse stakeholder groups;
- *Interpretable:* Indicators should reflect aspects of concern to stakeholders and their meaning should be understood by as wide a range of stakeholders as possible;
- *Grounded on scientific theory:* Indicators should be based on well-accepted scientific theory, rather than on inadequately defined or poorly validated theoretical links;
- *Sensitive:* Indicators should be sensitive to changes in the aspects being monitoring. They should be able to detect trends or impacts regarding things that are monitored;
- *Responsive:* Indicators should be able to measure the effects of management actions so as to provide rapid and reliable feedback on the consequences of management actions; and
- *Specific:* Indicators should respond to the aspects they are intended to measure and have the ability to distinguish the effects of other factors from the observed responses.

Again here, it is important to distinguish between indicators to measure the state-of-the-environment and indicators that can determine the effectiveness of measures taken through MSP. Only the latter form is relevant when measuring the actual performance of maritime spatial plans. Identifying performance indicators, however, cannot be an end in itself, but needs to be clearly linked to the outcomes being monitored. The desired outcomes (results) of MSP should be specified through clear, measurable objectives set at the onset of the maritime spatial plan. These objectives should specify what the maritime spatial plan is trying to accomplish and therefore cannot be seen separate from indicators that monitor and evaluate the progress toward it. Hence, performance indicators need to be embedded in the MSP process, and, most importantly, need to be derived from the objectives, established at the beginning of the marine spatial plan process (Figure 1) [14,15].

Figure 1: Eight key steps for measuring performance of maritime spatial planning



Adapted from: Day J. 2008.

Since MSP aims at achieving social, economic, and ecological objectives, a range of social, economic, and ecological indicators will need to be identified and used to measure performance of the spatial and temporal measures taken toward achieving them [16]. In reality, ecological and socio-economic outcomes take a long time to accomplish. Therefore, in the short run, it is important that MSP performance is also measured through a set of governance indicators that can demonstrate short-term progress (or lack of progress) of the MSP process itself [17]. Such progress can include, for example, level of stakeholder satisfaction, streamlined permitting procedures, improved integration across government agencies, among others, and essentially illustrates interim accomplishments in anticipation of the actual ecological, and socio-economic outcomes of MSP.

Only by integrating monitoring and evaluation into the overall MSP process, can the benefits of an adaptive approach be fully realized. Based on the evaluation of the monitoring results, progress made through MSP can be reported and shortcomings of the maritime spatial plan can be identified and adapted. When conducted properly, performance evaluation will essentially answer the question *'how have the spatial and temporal management measures performed in terms of achieving the desired outcome of the MSP plan?'*. The answer to this question will be based on at least three evaluation criteria. These include (1) effectiveness (e.g., are the spatial and temporal management measures producing the anticipated objectives or results?); (2) efficiency (e.g., are these results being produced at the least cost?); and (3) equity (e.g., are the cost and benefits of achieving these results equitably distributed among different parts of society?).

The information derived from the performance evaluation can form the basis for adapting the maritime spatial plan. Additionally, though, since the context in which the initial maritime spatial plan was drafted might have evolved as a result of changed socio-economic, environmental, political or technical conditions, this new context should be taken into account when adapting the maritime spatial plan. State-of-the-system monitoring, as referred to above, should enable the identification and interpretation of such changing conditions.

The actual adaptation of maritime spatial plans can either be done by modifying (1) the goals and objectives that specify the desired outcomes and are identified at the start of the MSP process (for example, if monitoring and evaluation results show that the costs of achieving the desired outcomes outweigh the benefits to society or the environment), or (2) the spatial and temporal measures selected to implement the maritime spatial plan (for example, alternative combinations of spatial and temporal management measures, incentives and institutional arrangements could be suggested if initial strategies are determined to be ineffective, too expensive, or without an equitable distribution of the cost and benefits to society) [18]. Finally, evaluation should also allow the identification of gaps in research and information that are necessary or important to fill for the improvement of MSP in future rounds of planning.

3. Adaptation of existing marine spatial planning initiatives

The need for an adaptive approach to MSP has been recognized in various relevant policy documents. One of the 10 principles for MSP, as defined in the European Union Roadmap, for example, includes the *'incorporation of monitoring and evaluation in the planning process'* and recognizes that *'planning needs to evolve with knowledge.'* [19] The United States draft

framework for Coastal and Marine Spatial Planning refers to the need for MSP to be *'adaptive and flexible to accommodate changing environmental conditions and impacts, including those associated with global climate change, sea-level rise, and ocean acidification, and new and emerging uses, advances in science and technology, and policy changes.'* [20]

Consistent with these MSP policy requirements, each of the maritime spatial plans in Germany, Norway and the United States of America (Massachusetts) include references to either an adaptive approach or to monitoring and evaluation essential to such an approach.

The German maritime spatial plan for the exclusive economic zone in the North Sea [21], for example, refers to monitoring as a measure to be taken to assess the impact on the environment. The plan stipulates that in light of *'possible effects, interactions or cumulative effects of certain uses on the marine environment [...] it is necessary to collect marine data in order to increase knowledge of interactions taking place in large ecosystem. This knowledge shall be used to monitor implementation of the marine spatial plan.'* [22] It further indicates that existing national and international monitoring programs in the North Sea will be used to monitor the significant impacts of implementation of the maritime spatial plan. These existing monitoring efforts are state-of-the-environment monitoring programs.

In the case of Norway, the maritime spatial plan stipulates the introduction of an integrated monitoring system, with indicators, reference values, and action thresholds, for the Barents Sea–Lofoten area, including closer monitoring of pollution levels in the marine ecosystems of the area [23]. It further indicates that most of the work of establishing a system of indicators and reference values will be done as part of the existing research and monitoring activity in the marine area. The Institute of Marine Research is expected to carry out most of the proposed additional activity in connection with its existing ecosystem surveys that are also a type of state-of-the-environment monitoring. The plan requires review and adaptation of the maritime spatial plan every five years.

The Massachusetts Oceans Act [24] requires revision and public review of its maritime spatial plan at least every five years. The maritime spatial plan for Massachusetts [25] indicates further that an indicator framework (supported by appropriately temporally and spatially-scaled monitoring) will be developed to assess and improve the effectiveness of management measures and enable improved state-of-the-system monitoring and analysis.

Although all three of the maritime spatial plans refer to monitoring and/or adaptation, it is clear that none of them has a specified method in place to allow monitoring and evaluation of the performance of the spatial and temporal measures taken through the respective plans. How the performance of individual management actions will be determined is not clearly spelled out in the plans. While Massachusetts at least identifies the development of an adequate performance monitoring system as a future action, both Germany and Norway only refer to state-of-the-system monitoring as a way to provide sufficient information for plan adaptation. As described above, this type of monitoring will only partially reveal information needed for the adaptation of maritime spatial plans. While these state-of-the environment monitoring approaches will allow the recognition and interpretation of the changing conditions of the context in which the plan is embedded, it will not be adequate to determine whether or not the spatial and temporal measures taken through the plan are actually achieving their anticipated objectives or results.

Additionally, as illustrated in the previous section, an adaptive approach to MSP ultimately relies on clear, measurable objectives from which indicators can be derived that, in turn, inform monitoring and evaluation of the performance of marine spatial plans. The lack of clear, measurable objectives results in the inability to monitor and review the outcomes of marine spatial plans systematically and prevents the understanding whether MSP is actually successful or not. As illustrated below, the desired outcomes of the German, Norwegian and Massachusetts maritime spatial plans are specified in fairly general terms that prevent the identification of indicators that could measure the performance of the plans.

The Norwegian maritime spatial plan for Barents Sea-Lofoten area [20], for example, formulates nine anticipated outcomes. These include (1) promote sustainable use of the area and its resources to the benefit of the region and country in general; (2) ensure that activities in the area do not threaten the nature resource base and thus jeopardize opportunities for future value creation; (3) facilitate economically viable commercial activities and as far as possible promote value creation and employment in the region; (4) coordinate commercial activities to ensure that that the various industries are able to co-exist and that the overall level of activity is adjusted to take account of environmental considerations; (5) harvesting living marine resources to promote value creation and secure welfare and business development to the benefit of the country as a whole; (6) manage living marine resources sustainably through the ecosystem approach; (7) petroleum activities will promote value creation and secure welfare and business development to the benefit of the country as a whole; (8) facilitate the profitable production of oil and gas on the basis of health, environment and safety requirements and standards that are adapted to environmental considerations of other industries; and (9) provide favorable conditions for safe, secure, and effective maritime transport that takes account of environmental considerations and promotes value creation in the region. In some cases these goals have been further specified into objectives and then into management measures in the plan, for example, for marine transport the implementation of mandatory routing and traffic separation schemes outside territorial waters along the coast to reduce the risk of oil pollution in environmentally-sensitive areas, or restricting the types of bunker oil onboard ships operating inside certain protected areas.

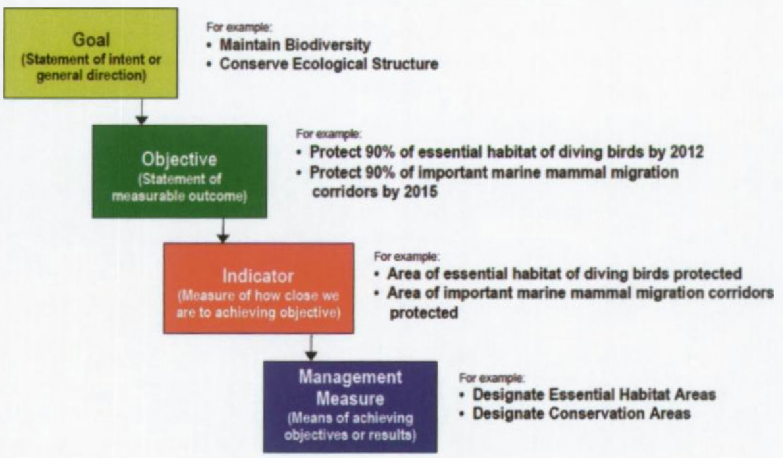
The German Maritime Spatial Plan for its exclusive economic zone in the North Sea identifies five principal outcomes to be derived from the plan. These include (1) strengthening and securing maritime traffic; (2) strengthening economic capacity through orderly spatial development and optimization of spatial use; (3) promotion of offshore wind energy use in accordance with the Federal Government's sustainability strategy; (4) long-term sustainable use of the properties and potential of the EEZ through reversible uses, economic use of space, and priority of marine uses; and (5) securing natural resources by avoiding disruptions to and pollution of the marine environment. No measurable objectives are specified in the plan.

The goals of the Massachusetts maritime spatial plan are derived from its Oceans Act and include: (1) balance and protect the natural, social, cultural, historic, and economic interests of the marine ecosystem through integrated management; (2) recognize and protect biodiversity, ecosystem health, and the interdependence of ecosystems; (3) support wise use of marine resources, including renewable energy, sustainable uses, and infrastructure: and (4) incorporate new knowledge as the basis for management that adapts over time to address changing social, technological, and environmental conditions. Management measures are identified, including the designation of three categories of management areas (prohibited areas, renewable energy areas, and multi-use areas), and performance standards (for example, proposed uses will avoid special, sensitive, or unique marine life and habitats).

As shown in figure 2, the outcomes as specified in these maritime spatial plans are, in general, broad goals rather than clear, measurable objectives. While goals typically refer to broad statements and set the general direction for the maritime spatial plan, they should further be translated into specific objectives that allow deriving indicators from them. Such objectives should have a number of characteristics, including [27]:

1. *Specific*: an objective needs to be concrete, detailed, focused, and well-defined in terms of specifying the outcome;
2. *Measurable*: an objective needs to allow measuring the outcome and is – ideally – expressed as a quantity;
3. *Achievable*: a good objective will be attainable within a reasonable amount of effort and resources;
4. *Relevant*: an objectives will typically lead to a desired goal, either on its own or in conjunction with other objectives;
5. *Time-bound*: an objective should indicate a finish and start date in relation to what is to be accomplished

Figure 2: The connection between goals, objectives and indicators for marine spatial planning



Some evaluation will probably be made in the case of the maritime spatial plans in Norway, Germany or Massachusetts about whether the spatial and temporal management actions taken are successful. However, without more clear, measurable objectives, it will be difficult – if not impossible – to produce defensible information upon which to base the actual adaptation of the maritime spatial plans in the future.

4. Conclusion

As are most other planning approaches, MSP is a 'learning by doing' process and needs the flexibility to incorporate newly acquired information to adapt to changing circumstances. An adaptive approach to MSP requires monitoring and evaluation of the performance of management measures taken through the marine spatial plan. If done well, monitoring and

evaluation serve both as a corrective function during the MSP process, enabling timely adjustments where necessary, and as a guide to structuring future planning activities more effectively and efficiently. It also allows the identification of new research and information needs that can improve the next round of MSP. Effective monitoring and evaluation, however, rely on the use of indicators that allow decision-makers to determine whether their interventions through MSP are achieving the intended objectives. In turn, indicators identified to measure the performance of management actions cannot be separated from the objectives set at the start of the MSP process.

Both the requirement for an adaptive approach to MSP as reflected in various policy documents, as well as the need to better inform new and emerging MSP initiatives around the world, demand an interpretation of the monitoring and evaluation results of existing marine spatial plans. Analysis done for this article, however, indicates a weak basis for evaluation and, in fact, illustrates that many of today's MSP initiatives will be ill-equipped to measure the successes or failures of their efforts systematically.

Maritime spatial plans developed in Norway, Germany and Massachusetts, all include references to monitoring and adaptation and have identified general goals for their MSP plans. However, with few exceptions, none of them has translated these general goals into clear, measurable objectives and outcomes. The lack of specific objectives is an important constraint on an adaptive approach to MSP. This inability should be of great concern because it prevents understanding what spatial and temporal measures effectively lead to anticipated outcomes. Without understanding whether or not existing marine spatial plans are actually achieving their desired results, how can we ultimately know how to improve them?

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PART IV
Marine spatial planning: linkages with other management approaches

CHAPTER 7
Marine spatial planning and integrated coastal zone management

Published as:
Douvere F and Maes F. 2010
The contribution of marine spatial planning to
implementing integrated coastal zone management
In: Green D. (ed.) Coastal zone management. Thomas Telford, London, United Kingdom

Abstract

Generally, the goals of marine spatial planning (MSP) are not very different from those of integrated coastal zone management (ICZM). Both MSP and ICZM propose to tackle problems inherent to single-sector management and the fragmentation in jurisdiction among levels of government and the land-water interface. Ultimately, marine spatial plans should be consistent with plans developed for the coastal zone. It is therefore important to prevent discussing MSP in isolation, but instead explore the linkages between one another. This chapter argues that one such linkage might be the potential of MSP to make ICZM more tangible and through that improve its successful implementation. While ICZM traditionally has focused on a process-oriented approach that emphasizes integration across agencies and across sectors, MSP has used a spatial planning approach as the basis for an efficient and effective allocation of ocean space to economic activities and the designation of areas for nature conservation. This chapter illustrates how various ICZM principles could be made operational by taking a similar approach that defines what they imply in space and time.

1. Introduction

Integrated coastal zone management (ICZM) aims at integrating the land and sea interface through rational planning of activities and better coherence between public and private activities that affect the use of the coastal zone. It should improve decision-making processes between the public authorities at national, regional and local levels by creating structured platforms for cooperation with stakeholders to discuss common policies and new developments. Governance failure and lack of statutory commitments are often cited as barriers for a successful application of ICZM by European Union (EU) member states. Others believe that the ICZM principles recommended by the Economic Community (EC) in 2002 are too vague to be successfully implemented or that ICZM is too much focused on local levels, ignoring the broader marine perspective. In this chapter it is argued that marine spatial planning (MSP) creates a new impetus for further implementing the ICZM principles by making them more tangible and operational.

2. Practice of integrated coastal zone management: fiction or reality in Europe?

In Europe and other countries there is already a long practice to strive to implement ICZM, with varying results [1]. The idea of ICZM, often called integrated coastal and ocean management (ICM) [2] or integrated management and sustainable development of coastal and marine areas, including exclusive economic zones (Chapter 17, Agenda 21) or integrated marine and coastal area management (IMCAM) under the Convention on Biological Diversity [3,4] already gained considerable international attention before the European Community recommended a set of eight principles for ICZM in 2002 [5]. These principles were the result of the Commission's demonstration programme on ICZM that ran from 1996 to 1999, when a thematic expert group evaluated 35 projects.

The ICZM principles are: (1) a broad overall perspective (thematic and geographic) that will take into account the interdependence and disparity of natural systems and human activities with an impact on coastal places (holistic approach); (2) a long-term perspective that will take into account the precautionary principle and the needs of present and future generations (future-oriented approach); (3) a gradual process that will facilitate adjustment as problems and knowledge develop, implying the need for a sound scientific basis concerning the evolution of coastal zones (adaptive approach); (4) local specificity and great diversity of European coastal zones, which will make it possible to respond to their practical needs with specific solutions and flexible mechanisms; (5) working with natural processes, respecting the carrying capacity of ecosystems, and conserving ecosystem structure and functioning, in order to maintain ecosystem services, and making human activities more environmentally friendly, socially responsible and economically sound in the long run (ecosystem approach); (6) involving all the parties concerned (economic and social partners, the organisations representing coastal zone residents, non-governmental organisations and business sector) in the management process (participatory approach); (7) support and involvement of relevant administrative bodies at national, regional and local level aiming at improved coordination; and (8) use of a combination of instruments designed to facilitate coherence between sectoral policy objectives and coherence between planning and management.

McKenna et al. (2008) divide these principles into three groups: (1) 'procedural' principles focusing on methods and procedures to advance ICZM (principles 7 and 8) that can be considered means rather than aims; (2) 'strategic' principles fitting in the sustainability discourse Coastal zone management (principles 1, 2 and 5) and focusing on large spatial or temporal scales or considered as multi-sectoral; and (3) essentially 'local' principles to balance the strategic principles and fitting in the bottom-up approach, participation and consensus-based discourse (principles 3, 4 and 6). After a critical assessment of the ICZM principles, they conclude that the strategic and local principles are the core of

the ICZM Recommendation. Their main critique for the poor functioning of the principles is due to their voluntary nature that leads to a non-prescriptive and non prioritised focus of the principles and the lack of precise language [6].

An evaluation in 2006 of the ICZM practice in the EU revealed successes in progress toward ICZM, as well as failures. Major failures were: (1) not all member states have implemented an ICZM national strategy or have an agreed ICZM policy; (2) unsatisfactory involvement of stakeholders; (3) threats to coastal areas are often seen on a local scale while they can be more effectively approached on a global scale, preferably a regional seas approach. Successes toward implementation of ICZM within the EU are: (1) new awareness and increased level of preparedness regarding long-term coastal challenges; (2) rethinking of traditional planning approaches by promoting sustainable management; (3) local ICZM-based processes created pressure to increase participation in decision making; (4) ICZM is considered the instrument to link terrestrial to marine legislation; (5) the proper implementation of ICZM can improve the livelihood and employment in coastal areas. Although governance failure is considered a major obstacle in ICZM progress, the conclusions of the review also recognise that the principles of ICZM need to be made more operational and better communicated [8].

Traditionally, ICZM focuses on a process-oriented approach that emphasises integration across agencies and across sectors. It has rarely addressed allocation of coastal space to achieve efficient economic development and effective protection of valuable ecological and biological areas. Meanwhile, marine spatial planning (MSP) has taken a different approach. While acknowledging the need for interagency and cross-sectoral integration, it has focused on determining a basis for the efficient and effective allocation of ocean space to economic activities and the designation of areas for conservation and protection. ICZM could use this new approach, with a focus on spatial planning, to produce more meaningful results. This viewpoint was largely confirmed at the EU 'First European Highlevel Forum' on ICZM in 2002. The forum emphasised the possibility of using 'spatial planning integrated with sea-use planning, at the national, regional and local level, as a way to apply a holistic and dynamic perspective in ICZM in order to create a common vision of the sustainable development in the coastal zone and ensure dialogue and participation of local and regional stakeholders' [9]. The evaluation of ICZM in Europe, mentioned above, recognises MSP as one of the priority themes for the further implementation of ICZM in European coastal zones.

3. Marine spatial planning: concept and application

3.1 Defining marine spatial planning

Despite numerous academic discussions and the application of MSP in various countries, no official or commonly accepted definition for MSP exists. Definitions and terms such as 'ecosystem-based marine zoning' [10] 'marine spatial management' [11] 'maritime spatial planning' [12,13] 'integrated maritime spatial planning' [14] or 'marine planning' [15] can be found throughout the spatial planning literature and are not used consistently.

Essentially, MSP is a public process through which parts of three dimensional marine spaces are analysed and allocated to specific uses or non-uses, to achieve ecological, economic and social objectives that are usually specified through the political process [16]. It aims at 'creating and establishing a more rational organisation of the use of marine space and the interactions between its uses, to balance demands for development with the need to protect the environment, and to achieve social and economic objectives in an open and planned way' [15]

Marine spatial planning differs from current practice of allocating space in marine environments. Most countries already designate ocean and coastal space for certain uses or non-uses, such as exploitation of natural resources, marine protected areas, etc. This, however, does not necessarily lead to integrated management. Typically, current allocation of ocean space is done on a sector-by-sector basis, without much consideration of conflicts or compatibilities toward other sectors or the environment. Marine spatial planning, on the contrary, proposes a more comprehensive approach to the development and allocation of ocean space by considering the area as a whole and enabling governments to: (1) incorporate the heterogeneity of marine ecosystems into decision making in an operational manner; (2) influence the behaviour of humans and their activities in time and space; (3) make conflicts and compatibilities among human uses and between human use and the environment visible, and therefore tangible; and (4) guide single sector management toward integrative decision making by visualising and projecting possible futures [11]

3.2 Use and application of marine spatial planning

Practice and interest in MSP have risen considerably in the last years. Marine spatial planning, particularly its multi-objective approach is a new paradigm for the management of activities at sea. Early forms of MSP were used to manage marine protected areas. Some well-known examples include Australia's Great Barrier Reef Marine Park (GBRMP) [17] and the Florida Keys National Marine Sanctuary in the United States [18]. Both have a long-standing experience in the application of MSP, in which different spaces with varying levels of access for use are identified, ranging from multiple-use zones where most offshore activity is allowed, to 'no-use zones' where virtually no use is permitted. The focus of these early plans was mainly to ensure that conservation objectives were not impaired by human activities.

Recently, a more multiple-objective approach to MSP has been taken, particularly in Europe. Belgium implemented a MSP system that covers both its territorial sea and exclusive economic zone [19]. Marine spatial planning in Belgium aims at achieving economic, social and ecological objectives (sustainable management) for human activities taking place at sea and for the protection and conservation of biological diversity. These objectives, together with past and ongoing research projects [19,20,21], provided the basis for a Master Plan for MSP that has been implemented incrementally since 2003 [22,23].

A similar approach has been taken in the Netherlands, Germany and Norway, and is underway in the United Kingdom and Sweden. In 2005, the Netherlands developed an overarching spatial policy for the Dutch part of the North Sea. The primary objective of the spatial policy was to enhance the economic importance of the North Sea and maintain and develop its ecological and landscape features. Implementation of the spatial policy is further defined and described in the 'Integrated Management Plan for the North Sea 2015' [24] where the aim of MSP is translated into the need for a healthy, safe and profitable sea. Currently, the Dutch MSP initiatives are being revised to adapt to the effects of sea level rise and to provide a better legal basis for MSP in the future.

In April 2006, the Norwegian government launched its integrated management plan for the Barents Sea and the sea areas off the Lofoten Islands [25]. The management plan aims to establish holistic and ecosystem-based management of the activities in the area. It sets the overall framework for both existing and new activities in these waters to facilitate the co-existence of different industries, particularly the fisheries industry, maritime transport and petroleum industry [26]. Similar plans are being developed for the Norwegian Sea and the Norwegian part of the North Sea.

In 2007, the German Federal Maritime and Hydrographic Agency drafted multiple-use marine spatial plans for the German exclusive economic zones in the North Sea and the Baltic Sea. The multiple objective approach to MSP in Germany is largely reflected in the guidelines that form the basis for spatial development in these zones. They include: (1) securing and strengthening maritime traffic; (2) strengthening economic capacity by orderly spatial development and optimisation of the use of space; (3) promotion of offshore wind energy use in accordance with the Federal Government's sustainability strategy; (4) long-term safeguarding and use of special characteristics and potential in the exclusive economic zone through reversibility of uses, economic use of space and priority for marine-specific uses; and (5) securing natural resources by avoiding disruptions to and pollution of the marine environment [27].

Both the United Kingdom and Sweden are preparing a statutory basis for the development of MSP. On 3 December 2008, HM the Queen of the United Kingdom announced that the current Parliamentary session, ending in autumn 2009, will include a Marine and Coastal Access Bill (formerly known as the Marine Bill released in April 2008). This announcement is a great stimulus for the necessary parliamentary procedures toward final approval of the Bill [28]. The Bill introduces a statutory basis for marine plans for the English, Scottish, Welsh and Northern Ireland inshore and offshore regions and identifies marine planning authorities. Maintenance and protection of ecosystems are considered key components of future spatial planning initiatives, but are part of the broader aims of obtaining best value from different uses of marine resources [28]. The UK planning system will encompass all activities and will be directed to deliver sustainable development by facilitating proactive decision making.

Recently, the Swedish government published the findings of its inquiry on how the planning and management of the Swedish marine environment can be improved, both nationally and together with other countries. The inquiry proposes the introduction of a new planning system, based on marine spatial plans, similar to the comprehensive plans for land areas. [29]. Multiple-use MSP is also emerging in other parts of the world, including in the context of Australia's marine bioregional planning [30,31]. Canada's 'Eastern Scotian Shelf Management Plan' [32]. China's Sea Use Management Act [33] and recently in the USA as part of a newly released Presidential memorandum that requires the development of coastal and marine spatial planning framework [34]

4. Making ICZM operational through marine spatial planning

Generally, the goals of MSP are not different from those of ICZM. Both MSP and ICZM propose to tackle problems inherent to single-sector management and the fragmentation in jurisdiction among levels of government and the land-water interface.

By focusing on the spatial and temporal aspects of management, MSP has been more pragmatic in its approach to tackle such problems. Despite variations in detail and inclusiveness, marine spatial plans typically identify and visualise where offshore uses occur and how they relate to the physical, biological and ecological composition of the planning area. Often, such plans also indicate conflicts and compatibilities among offshore uses and between uses and the environment in the planning area. The development of such spatial plans for an entire region enables the visualisation of the use of space and its implications, which, in turn, provides guidance to a range of decision makers, each responsible for a particular sector, activity or concern. Fisheries managers, for examples, will gain insight in the conflicts and compatibilities their management plans have with plans for offshore renewable energy initiatives, marine protected area management plans, and vice versa.

This experience of using spatial planning for ocean management, as applied in MSP, seems to provide a feasible method that could help making at least some of the principles of ICZM more operational. The strategic principles of ICZM, for example — as defined by McKenna et al. (2008) [6] and described earlier in this chapter — could be made more operational by defining what they imply in space and time. Below, a short analysis is given of how this is being done in MSP.

4.1 A 'holistic approach' in marine spatial planning

The concept of a 'holistic approach' is often used in medical disciplines where it refers to the treatment of a disease by taking into consideration every part of the body to bring the full body into balance. In general terms, a holistic approach relates to, or is concerned with, complete systems rather than with the details or parts that make up the whole. When applied to ocean and coastal management, a holistic approach refers to taking a broad overall perspective, both geographic and thematic.

Geographically, a holistic approach implies that the boundaries of the management area are not based on political or administrative considerations only, but instead are also meaningful from an ecological perspective, e.g. consider the system as a whole. It also implies that the boundaries do not delimit the influences of exogenous marine processes on the management area. Both Australia's future 'Marine Bioregional Plans' [31,48] and Canada's 'Eastern Scotian Shelf Integrated Management Plan' [32] apply a holistic approach in this sense. Both countries have defined marine regions or, alternatively, ecologically based planning and management units, on the basis of physical and ecosystem characteristics, including hydrographic, oceanographic and bio-geographic features, rather than relying on political or administrative boundaries only. To date, exogenous influences are incorporated only in the 'Great Barrier Reef Marine Park Zoning Plan' [35,49] and the 'Florida Keys National Marine Sanctuary Management Plan' [18]. Both plans specify where activities occur outside the management area that are likely to influence the success of MSP within the area.

On the contrary, European MSP initiatives have set their boundaries on the basis of political and legal considerations, not ecological ones, and should, therefore, not be considered holistic from a geographic standpoint. In European seas, coastal states are closely bordered next to and in front of each other. Consequently, applying a holistic approach based on ecosystem considerations automatically requires trans-boundary cooperation that complicates the process of MSP. In the context of the EU Marine Strategy Directive [36] and EU Maritime Policy [12] discussion is ongoing how to facilitate such trans-boundary cooperation.

Thematically, a holistic approach implies that management is not focused on a single concern, sector, activity or species, but instead considers the interdependence and disparity of the system as a whole, including all human activities affecting it. From a thematic perspective, most MSP initiatives apply a holistic approach in the sense that they do not focus on a single sector, activity, species or concern. As discussed in the previous section, marine spatial plans in Europe are established to achieve multiple objectives, not to tackle just one concern such as, for example, nature protection or aquaculture only. In all four countries previously mentioned (Belgium, the Netherlands, Norway and Germany), MSP started with an analysis of the current conditions of the area that included ecological and biological features as well as human use and its impact in the area. This 'stocktake' of current conditions provided the necessary basis to determine how, where and when multiple objectives could be achieved. Essentially, through spatial planning, a range of multiple objectives — usually set through political processes — have been translated and interpreted in time and space. By doing so, they have been made operational and tangible.

A closer look at the focus of the plans illustrate that some differences can be emphasised. First, although marine spatial plans tend to be holistic they are not necessarily all-inclusive. Fisheries activities, for example, are often not addressed in current MSP initiatives. One explanation might lie in the way authority for fisheries management is distributed in various countries. For example, fisheries management has become an exclusive domain of the EU and is regulated through the Common Fisheries Policy (CFP) [37]. No unilateral actions from member states are possible with regard to fisheries management that affects other member states [38]. Other interpretations refer to the difficulties to incorporate fishing activities, needs and impacts into MSP because of their dynamic nature [39] and lack of data. The latter might only be a temporary problem since new data sources (e.g. VMS) will contribute in identifying principal areas for fisheries [40]. Second, some spatial plans give a larger focus to some components or concern. The German spatial plans have been designed with the attempt to achieve multiple objectives while giving a top priority to a few uses: offshore wind energy and maritime transport. This priority is largely reflected in the Act upon which the German spatial plans are based. The Act provides the German Maritime Transport and Hydrographic Agency the authority to develop spatial plans for the exclusive economic zone, while providing only a non-binding advisory role to other agencies, including the ones responsible for nature conservation [41].

4.2 A 'long-term perspective' in marine spatial planning

Spatial planning is, in general, a future-oriented, proactive exercise that focuses on planning for activities in the future, not simply documenting present activities and conditions, and extrapolating current trends [7]. Achieving sustainable development of sea uses is a key component of coastal and ocean management, while establishing a long-term vision is considered as one of the major functions [2]. A proactive planning approach is necessary for a variety of reasons. Many coastal and ocean places face common challenges, such as potential impacts of climate change. At the same time, coastal and ocean areas have become significantly attractive for the development of some form of renewable energy that can contribute to the reduction of CO2 emissions. Both climate change and renewable energy, along with growing coastal populations, are likely to have a considerable impact on the allocation of ocean space in the future [8]. Renewable energy, for example, increases claims for ocean space and potential conflict between uses and environmental protection. Climate change, on the other hand, is likely to affect the distribution of living species, and thereby influence locations and spaces needed for protection. The added value of MSP in this regard is its ability to create sea use scenarios that incorporate such assumptions and specify the spatial implications of alternative visions that are produced on the basis of certain goals and objectives.

A comprehensive method for developing alternative 'spatial sea use scenarios' has been proposed in Belgium to set the stage for a spatial structure plan for the Belgian part of the North Sea [20,21]. The concept of 'spatial sea use scenario' can be defined as 'a vision that projects the future use of ocean space based on a core set of goals and objectives and assumptions about the future'. By developing spatial sea use scenarios, future possibilities and conditions of the sea area are visualised in a clear way, in order to make well-grounded choices for the future. The method defined six steps, essential for the development of alternative MSP scenarios, including (1) defining current trends and demands for space and conditions; (2) defining key values of the marine area; (3) defining strategic objectives and goals for the marine area; (4) identifying general spatial and temporal constraints (e.g., on the basis of existing regulation, physical characteristics or political opportunities); (5) developing alternative spatial use scenarios, each reflecting a priority set of goals, objectives and values; and (6) defining the significance and implications of each spatial scenario for the different functions and activities in the marine area [20,21]. Two additional steps are necessary for this alternative spatial use scenario to guide a long-term and pro-active MSP process, e.g. (1) an evaluation of each scenario that interprets the

costs and benefits of each scenario; and (2) the selection of a desired spatial use scenario and the measures to implement it.

In the context of the Dutch 'Integrated Management Plan for the North Sea 2015', efforts are made to underpin new decision making about the future use of space with a better, scientifically sound, basis. This is being done through an initial analysis of current and projected economic values of offshore activities (for a period of 2005—15) and its consequences in terms of spatial demands and impacts [42]. Additionally, three alternative estimates have been made of the potential impact of sea level rise in the Netherlands until the year 2100. Results of this work will be incorporated in the evaluation and adaptation of existing spatial plans and guide future management decisions about the use of space in the Dutch part of the North Sea.

4.3 An 'ecosystem approach' in marine spatial planning

The Convention on Biological Diversity defines the ecosystem approach as 'a strategy for integrated management of land, water, and living resources that promotes conservation and sustainable use in an equitable way. The ecosystem approach is based on the application of appropriate scientific methodologies focused on levels of biological organisation, which encompass the essential processes, functions and interactions among organisms and their environment' [43]. Although the ecosystem approach means different things to different people, it essentially requires working with natural processes in ways that respect the carrying capacity of ecosystems and conserve ecosystem structure and functioning to maintain ecosystem services.

Australia is developing a comprehensive process to apply an ecosystem approach through MSP, called marine bioregional planning (MBP) [48]. Australia introduced the concept of MBP to enable better protection of the marine environment, conserve biodiversity and deliver greater certainty for industry and decision makers on marine conservation priorities [30,31]. The MSP process, bioregional plan identifies: (1) conservation priorities for the regions; (2) appropriate measures available to address conservation priorities; (3) sites to include in a network of representative marine protected areas (MPAs) for the region; and (4) social and economic implications of proposed conservation measures, including MPAs. The development of the bioregional plan contains three steps: (1) the compilation of a bioregional profile that reflects the understanding of the ecology of the planning area and provides the necessary ecological and biophysical information base for the bioregional plan; (2) the compilation of a draft bioregional plan in which assessments are made of threats posed by current and emerging activities, and guidance for future decisions regarding threats; and (3) the development of the bioregional plan itself that identifies priorities for action and strategic guidance for decision makers.

The process to underpin MSP with an ecosystem approach is best illustrated in the bioregional profile that forms the basis of the bioregional plan. It includes four key steps. The bioregions are identified on the basis of their: (1) geomorphology; (2) oceanography; (3) biological communities; (4) ecosystem processes, including benthic productivity, recruitment and food web interactions for a range of species; and (5) key ecological features, including resident, breeding and nursery areas for protected species. Second, for each of the bioregions, components of marine biodiversity and heritage were identified and recognised as 'conservation values' by the Australian government.

Conservation values refer to elements that are either specifically protected under Australian law (mainly listed marine species, but also historic shipwrecks) or key ecological features that were identified in the region through analysis. These conservation values form the underlying basis for decision making about proposed economic development or ongoing activities. Particularly, the key ecological features guide

decisions about whether an action is likely to have a significant impact on the marine environment or whether the site needs to be included in a network of MPAs. Key ecological features of the marine environment are determined on the basis of criteria such as: (1) species, group of species or community with a regionally important ecological role (e.g. a predator, prey that affects a large biomass or number of other marine species); (2) species, group of species or community that is nationally or regionally important for biodiversity; (3) an area or habitat that is nationally or regionally important for enhanced or high productivity, aggregations of marine life, biodiversity and endemism; or (4) a unique seafloor feature with known or presumed ecological properties of regional significance. Third, a set of goals and principles is developed to guide the identification of a representative system of MPAs. These goals and principles aim to maximise conservation outcomes and refer to components of the coastal and marine environment (depth ranges, benthic/demersal biological features, types of seafloor features, etc.) that need to be part of the MPA network. Fourth, an analysis is made of the nature and scope of human activities that take place in the region. Special attention is paid to Aboriginal people and their relationship with offshore activities in the region. Efforts are also made to encompass the socioeconomic value of human activity in the region [31,44].

A somewhat similar approach has been taken in the Canadian 'Eastern Scotian Shelf Integrated Management Plan'. Prior to the development of Canada's plan, analysis and mapping of physical characteristics (e.g., circulation patterns, temperature, salinity, etc.), biological features of the Shelf, significant natural areas in the region, and the potential impacts of human activities (in particular fisheries and oil and gas exploitation) has been undertaken [45,46].

Also in Europe, initiatives to underpin decisions with an ecosystem approach have emerged. In Belgium, for example, a scientific study on the biological valuation of the North Sea was completed. The study resulted in a set of maps showing the intrinsic biological value of different sub-areas within the Belgian part of the North Sea [47]. The maps were developed using available spatial data for macro-benthos and seabirds and, to a lesser extent, data on the spatial distribution of demersal fish and epi-benthos. These marine biological valuation maps are considered a unique and indispensable tool to develop objective and scientifically sound spatial plans. Although they have been developed after the 'Master Plan for the Belgian part of the North Sea' had been implemented, it is likely these biological valuation maps will provide a basis for spatial management actions in the future. As mentioned earlier, however, a more challenging task at hand in Europe is to connect marine spatial plans adjacent to one another. In various cases, plans developed at the national level are not embedded in the broader perspective of the North Sea ecosystem as a whole.

5. Conclusion

In Europe, ICZM has been practised with varying results. Although governance failure and lack of statutory commitments are often cited as barriers for successful implementation of ICZM, a number of assessments also recognise that the ICZM principles, recommended by the EC in 2002, are too vague and need to be made more operational and better communicated.

Since its inception, ICZM has focused primarily on a process-oriented approach, emphasising integration across agencies and sectors. It has rarely addressed allocation of coastal space to achieve its goals. Meanwhile, management in the marine environment has taken a different approach through the use of MSP. By focusing on the spatial and temporal aspects of management, MSP has been more pragmatic in tackling similar problems as those encountered in ICZM.

Multiple-use MSP, as is currently developing in Europe, Australia and Canada, seems to use at least certain ICZM principles. Application of the strategic principles of ICZM, e.g. those related to a holistic approach, long-term perspective and an ecosystem approach, could learn from the current experience with MSP. A holistic approach, for example, could be made specific and operational by determining what it implies in time and space. Examples can be found in Canada's Eastern Scotian Shelf Integrated Management Plan and the multiple-use marine spatial plans in Belgium, Norway, the Netherlands and Germany. A long-term perspective in MSP has been proposed in Belgium through the concept of 'spatial sea use scenarios' and is currently further evolving in the Netherlands. Such spatial sea use scenarios visualise future possibilities and conditions, and provide the basis and guidance for well-grounded decision making. Australia is developing a comprehensive process to apply an ecosystem approach through MSP. Results start to be apparent in the form of its bioregional profiles that are being designed for its marine regions.

ICZM could take a similar approach and use spatial planning to make its principles more tangible and operational by better defining what they imply in space and time.

Acknowledgements

Acknowledgement is expressed to Charles Ehler, co-principal investigator of UNESCO's Marine Spatial Planning Initiative (Intergovernmental Oceanographic Commission), for his insightful comments on earlier drafts of this text. Fanny Douvere expresses her grateful acknowledgement to the Gordon and Betty Moore Foundation and the David and Lucile Packard Foundation for their support to the UNESCO initiative on Ecosystem-based Marine Spatial Management. Dr Frank Maes is grateful to the Belgian Federal Science Policy (BELSPO) for the financial support of the GAUFRE research project 'Towards a Spatial Structure Plan for the Sustainable Management of the Sea' (2003—05).

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PART V
General conclusions

Both the expansion of traditional ocean uses such as fisheries or maritime transportation, and the recent rise of new ones, in particular renewable wind and wave energy and offshore aquaculture, have led to an unprecedented demand for ocean space. With ocean resources being limited in space and amount, these developments have been devastating to many places and are essentially resulting in two types of conflict. First, not all uses are compatible with one another and result in user-user conflicts. Second, the cumulative impact of all these uses together pose increasing pressures on the health of the marine environment, leading to conflicts between ocean uses and the environment.

Today, the management of the ocean and its resources is still largely done on a sector-by-sector basis. Management decisions for fisheries management, for example, are still taken without much consideration of their effect on other ocean uses or the functioning of the ecosystem as a whole. As the failures of the prevailing single-sector approach are becoming increasingly clear, many have advocated ecosystem-based management as the key framework to deal with this sprawl in ocean use and its associated cumulative pressures. But despite its broad acceptance, ecosystem-based management is still more a concept, widely discussed within the scientific community, but with few examples of actual practice.

In recent years, a number of countries – particularly those in the densely-used ocean areas of Northwest Europe – have developed a more practical approach to resolving ocean conflicts and allocating ocean space for multiple objectives. Both the quest for offshore renewable energy facilities and European legal and policy requirements for the protection of the marine environment urged the need for a more pragmatic approach – an approach that is called marine spatial planning (MSP).

In essence, MSP is 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. When applied at an ecosystem level, MSP is a practical way to make ecosystem-based management operational. MSP does this by addressing the heterogeneity of marine areas in a practical manner, focusing on influencing the behavior of humans and their activities over time, providing a management framework for new and previously inaccessible scientific information, making conflicts and compatibilities among human uses and the environment visible, and therefore, tangible, and guiding single-sector management toward integrative planning and decision-making.

Today, MSP is furthest advanced in The Netherlands, Norway, Germany, Belgium, Massachusetts (United States of America), and Australia. Other countries are currently establishing the basis for developing MSP. The United Kingdom, for example, recently passed a new Marine and Coastal Access Act while the United States plans to issue a new framework for MSP for all marine waters under its jurisdiction. Still others, including Canada and Sweden, are exploring how their existing ocean legislation and policies could be implemented through MSP.

While most of the MSP initiatives are still in an early stage (most are less than 10 years old) and will only over time demonstrate how successful they really are, some initial lessons can be drawn from these experiences.

First, it is possible to detect an evolution in the development of MSP. Early forms of MSP clearly focused on achieving nature conservation objectives as a priority. Starting in the 1970s, both Australia's Great Barrier Reef Marine Park and later on, the Florida Keys National Marine

Sanctuary, for example, influence the spatial and temporal distribution of human activities to minimize their impact on nature conservation. About ten years ago, countries around the North Sea started to employ a multiple-objective approach to MSP aimed at achieving social, economic, and ecological objectives simultaneously. Only recently, emphasis in MSP efforts lies on trying to achieve an ecosystem-based approach to the management of marine areas. Both the EU Maritime Policy and associated roadmap for MSP, as well as the United States draft framework for MSP, endorse a regional approach that strives for MSP development at a scale that is more meaningful from an ecosystem perspective. Not only do these MSP efforts try to achieve multiple objectives simultaneously, they are now embedded in a broader ecosystem context that takes into account the functioning of the marine ecosystem, as well as the goods and services it provides.

Second, when analyzing and comparing existing MSP practice, it is possible to identify some of the key elements that can help ensure MSP delivers its anticipated results and therefore should be inherent to any MSP process. A multiple-objective outcome of MSP, for example, depends on authority that requires all agencies to act consistently with the approved marine spatial plan. Although this may sound obvious, MSP legislation is often drafted in ways that makes a biased MSP outcomes inevitable or discontinues MSP once a first plan is in place. A detailed study of the development of MSP in Belgium, for example, illustrates that although new legislation for MSP is not necessary to get started, it does allow for a more strategic and integrated approach to MSP in addition to the existing permitting system.

Once adequate authority is in place, several other elements will be critical to a successful outcome. They include (a) adaptation; (b) participation; (c) ecosystem-based; (d) integration; and (e) future-orientation.

Adaptation: MSP is most useful as a continuous, adaptive process, not a one-time plan. As technology advances, new science and information becomes available and, economic realities or political priorities change over time, marine spatial plans should be flexible enough to adapt to such changing circumstances. MSP practice in The Netherlands illustrates the need and advantages of an adaptive approach to MSP. Adequate adaptation of marine spatial plans, however, is a challenging task that requires monitoring and evaluation of the performance of MSP measures and incorporation of those results in the next round of planning. Research of an adaptive approach to MSP in Norway, Germany, and Massachusetts illustrates that meaningful monitoring and evaluation of current MSP initiatives might proof difficult – and in some cases impossible – due to the lack of clear and measurable objectives at the onset of the marine spatial planning process.

Participation: Involving key stakeholders in the development of MSP is essential for a number of reasons. Of these, the most important is because MSP aims to achieve simultaneously social, economic and ecological objectives and should therefore reflect as many expectations, opportunities, or conflicts occurring in the MSP area. Effective stakeholder participation should enable involvement throughout the various phases of the MSP process, including the planning, implementation, monitoring and evaluation, and the adaptation phases. However, it is not only important to identify when stakeholders will be involved, but also who should be involved and how. Stakeholder analysis is one way to identify key stakeholders who should be involved in all the various stages of the MSP process. Although most plans are still too immature to derive firm conclusions about the success of stakeholder participation, it is expected that stakeholder participation is better able to reflect the multiple perspectives about the planning area and

therefore encourages 'ownership' of the spatial plan, engenders trust in the process and eventually stimulates voluntary compliance with its rules and regulations.

Ecosystem-based approach: Effective MSP should reflect ecosystem patterns and processes at appropriate spatial and temporal scales. Marine spatial plans need to address fundamental topographic, oceanographic, and ecological conditions enabling identification and protection of the most ecologically and economically valuable places. The use of bioregional profiles as developed for all Australian waters (outside the Great Barrier Reef) is a promising way to underpin MSP with an ecosystem approach. The application of an ecosystem-based approach is also strongly embedded in the European Union's (EU) Maritime Policy and the EU roadmap for MSP, but actual practice is still in its infancy.

Integration: MSP addresses multiple objectives and should ideally integrate all economic sectors and environmental concerns in the region. Some countries have been more successful than others in meeting this challenge. In Norway's Barents Sea plan, for example, all key economic activities – oil and gas development, fisheries, and maritime transportation – have been integrated with nature conservation objectives. Additionally, functional marine spatial plans require consistency across state, federal-state, and international boundaries. Analysis of MSP initiatives in Belgium, the Netherlands and Germany illustrates that the interconnectedness of adjacent ocean spaces, the cross-boundary impact of ocean uses, and the broader scale needed to be ecologically meaningful require that marine spatial plans developed at the national level are embedded in a broader, international context and integrate – or at least address – the dynamics of the system as a whole.

Future-orientation: MSP, as any other planning effort, is a future-oriented activity. Marine places without any visible problems or conflicts today are likely to look very different 20 years from now. Part of the purpose of MSP is to help envision and create a desirable future and enable pro-active decision-making in the short run to move toward what is desired. Consequently, MSP should not be limited to just documenting the present and maintaining the status quo, but should help reveal alternative futures of how the area might look in another 10, 15 or 20 years. While common practice in land-use planning, few MSP initiatives have applied such a future-oriented approach. The Netherlands, however, developed a future-oriented marine spatial plan, during which planners estimated expected offshore economic development through 2015, mapped its associated spatial requirements and included an economic valuation for each ocean use in relation to its demand for ocean space. Based on this information, The Netherlands could identify priorities for the future development of the Dutch part of the North Sea, allowing pro-active decision-making when new opportunities arise.

Third, it is not only important to identify key elements that can lead to successful development and implementation of MSP, attention also needs to be paid to its relationships with other management approaches, in particular integrated coastal zone management (ICZM). Generally, the goals of MSP are similar to those of ICZM, but by focusing on the spatial and temporal aspects of management, MSP has been more pragmatic in achieving these goals. The experience of using spatial planning for ocean management, as applied in MSP, provides a feasible method that can help make at least some of the principles of ICZM more operational and through it help advance its implementation.

Finally, despite the considerable work that has been done already to define the concept and critical elements of MSP, a number of research gaps remain. These research gaps largely

reflect challenges that lie ahead and could potentially impede the successful implementation of MSP in the future.

First, while MSP aims at achieving multiple objectives through a more sensible organization of the use of ocean space, few methods have been developed to date on how trade-offs are made when conflicts do occur. Inevitably, when two ocean users aim for the same ocean space or their use conflicts with the protection of the marine ecosystem and/or its inhabitants, priorities will need to be set and choices will need to be made. Questions will arise whether '*a spawning area is more valuable than a wind farm?*' or '*a wind farm is more important than a sand mining area?*'. Today, the economic value of an ocean use is still often the predominant factor when choices are made. MSP, however, aims at achieving multiple objectives simultaneously, and will therefore need a framework that incorporates not only economic valuation methods, but also ecological and social ones. Such framework should also consider the cost and benefits of the trade-offs being made to allow MSP to develop in an effective (e.g., achieving the anticipated results), efficient (e.g., achieving these results at the least cost), and equitable (e.g., the cost and benefits being distributed in an equitable manner).

Second, a number of countries, including the Netherlands and Norway, are currently in their second round of MSP. Both countries have developed marine spatial plans and are now revising them to adapt them to changing circumstances. A crucial question here arises as how to evaluate the success of 'first-generation' marine spatial plans. Identifying meaningful indicators to measure their success is a quintessential research question. Such indicators, however, should not only concentrate on measuring the state of the marine environment, but more importantly, should focus on the performance of the spatial and temporal management measures implemented through MSP.

To conclude, it is also important to recognize the potential of MSP to help identify and protect valuable marine ecosystems in areas that are prone to rapid economic development, but are currently not under the jurisdiction of one nation. Both the high seas (areas beyond national jurisdiction) and the Arctic ecosystem are areas where MSP could help identify and protect biologically and ecologically vulnerable places while simultaneously help steer economic development to where it least conflicts. While conflicts are perhaps less relevant today because of the enormous size of the high seas and the still relatively low economic development in the Arctic, reality is likely to be very different in another 20-30 years. Currently, the Law of the Sea Convention provides only national states with the authority to develop marine spatial plans for areas under their jurisdiction, e.g., the territorial sea and the exclusive economic zones. Nevertheless, a vast majority (over 60 %) of the ocean lies outside these areas and cannot be claimed by any one nation. To make MSP reality in these areas, nations will need to cooperate with one another. New research, however, is needed to identify either how the international legal framework for these places could be changed, or alternatively, to identify what incentives (e.g., economic, legal, educational) could help stimulate nations to cooperate and plan for a desirable future of these truly unique but vulnerable marine areas.

Dutch summary

Tijdens de afgelopen jaren is het belang van ruimtelijke planning op zee sterk toegenomen. Verschillende landen, waaronder België, Nederland, Duitsland, Noorwegen en Australië hebben ondertussen reeds ruimtelijke planning op zee ontwikkeld en geïmplementeerd. Een aantal andere landen, waaronder het Verenigd Koningrijk, de Verenigde Staten en Zweden, werken momenteel aan een nieuw beleidskader of een nieuwe wetgeving die de basis zal vormen voor de ontwikkeling van ruimtelijke planning op zee in de toekomst. Verder is er zich ook op internationaal niveau een sterke interesse aan het ontwikkelen voor ruimtelijke planning op zee, onder meer binnen de Europese Unie en tussen de landen die bevoegd zijn voor het beheer van het Arctische gebied.

Het belang van ruimtelijke planning op zee is vooral geïnspireerd door de sterk toenemende druk van het ruimtegebruik in mariene gebieden. Terwijl traditionele gebruiken zoals scheepvaart, visserij en zandwinning steeds verder uitbreiden en daardoor meer ruimte in beslag nemen, zijn het vooral nieuwe gebruiken, zoals windenergie, aquacultuur en beschermde gebieden, die de vraag naar ruimtegebruik op zee exponentieel hebben doen groeien. Dit is niet zonder gevolgen voor het mariene ecosysteem. In essentie leidt deze trend tot twee types van conflicten. Enerzijds zijn niet alle gebruiken compatibel met elkaar en resulteren daardoor in conflicten tussen de gebruikers onderling. Anderzijds hebben de cumulatieve effecten van al deze gebruiken samen een negatieve impact op het mariene ecosysteem, wat resulteert in verlies of degradatie van de mariene biodiversiteit of de goederen en diensten waarin het mariene ecosysteem voorziet.

Tot nu toe wordt de zee nog steeds in grote mate beheerd op basis van een sector-per-sector benadering. Visserijmaatregelen, bijvoorbeeld, worden nog steeds grotendeels genomen zonder veel inspraak van andere sectoren of aandacht voor de mogelijke effecten van deze maatregelen ten aanzien van andere activiteiten of het mariene ecosysteem op zich. Doordat het failliet van deze benadering steeds duidelijker wordt, wordt reeds geruime tijd het concept van een ecosysteem benadering gepromoot dat toelaat om de menselijke activiteiten op zee te beheren op een meer holistische wijze en waarin het functioneren van het mariene milieu centraal staat. Hoewel het belang van een ecosysteem benadering reeds een groot draagvlak kent en de principes zijn ingeschreven in tal van nationale en internationale verdragen, blijft deze benadering nog steeds grotendeels een concept met weinig voorbeelden van daadwerkelijke toepassing. Het is in deze context dat verschillende landen gestart zijn met een meer pragmatische aanpak om de conflicten op zee te beheren. Deze aanpak heet 'ruimtelijke planning op zee'.

In essentie kan ruimtelijke planning op zee worden omschreven als een publiek proces waarbij de ruimtelijke en temporele distributie van menselijke activiteiten op zee worden geanalyseerd en georganiseerd met het oog op het bereiken van economische, ecologische en sociale objectieven. Wanneer toegepast op een ecologisch relevante schaal, kan ruimtelijke planning op zee een praktisch middel zijn om een ecosysteembenadering in de praktijk te brengen. Ruimtelijke planning op zee doet dit door (a) de ecologische, economische en sociale heterogeniteit van het mariene ecosysteem in kaart te brengen en deze vervolgens centraal te stellen in de ruimtelijke organisatie van menselijke gebruiken op zee; (b) een beheerskader aan te reiken voor nieuwe en voordien ontoegankelijke informatie betreffende de ruimtelijke verspreiding van ecologische waarden en menselijke activiteiten op zee; (c) conflicten en compatibiliteiten tussen menselijke gebruiken en het mariene milieu te visualiseren en ze daardoor beheersbaar te maken; en (d) individuele, sector-per-sector maatregelen te sturen in de richting van een meer geïntegreerd beheer van de zee.

Niettegenstaande de toenemende interesse wereldwijd voor ruimtelijke planning op zee is tot nog toe slechts weinig onderzoek gevoerd naar het concept en de evolutie van ruimtelijke planning op zee,

welke kernelementen het dient te omvatten om tot succesvolle resultaten te komen en hoe het zich verhoudt tot andere relevante beheersbenaderingen die van toepassing zijn in aangrenzende mariene gebieden, zoals ondermeer geïntegreerd kustzonebeheer.

Wetenschappelijk onderzoek naar deze aspecten biedt niet alleen het voordeel dat landen die nu ruimtelijke planning op zee opstarten - of nieuwe wetgeving ontwikkelen om hiertoe te komen - beter kunnen definiëren hoe ruimtelijke planning op zee het best kan uitgevoerd worden, het brengt ook een betere coherentie in de discussie rond ruimtelijke planning, zowel academisch als in de praktijk. Dit laatste wordt vooral nu van steeds groter belang omwille van de vele tegenstrijdige en verwarrende opvattingen rond ruimtelijke planning op zee die recentelijk het daglicht zien.

Hoewel de meeste initiatieven rond ruimtelijke planning op zee nog vrij jong zijn (minder dan 10 jaar) en daardoor slechts op termijn zullen aangeven in welke mate ze werkelijk succesvol zijn, kunnen toch reeds een aantal lessen getrokken worden uit deze ervaringen.

Ten eerste is het mogelijk om een evolutie te schetsen van de ontwikkeling van ruimtelijke planning op zee. Onderzoek toont duidelijk aan dat initiële initiatieven tot ruimtelijke planning op zee hoofdzakelijk de bescherming van het mariene milieu tot doelstelling hebben. Zowel de *Great Barrier Reef* in Australië en *Florida Keys National Marine Sanctuaries* in de Verenigde Staten zijn hiervan voorbeelden en kunnen als voorlopers worden gezien van de 'multiple-objectieven benadering' tot ruimtelijke planning op zee zoals het zich heeft ontwikkeld in Europa, en de Noordzee in het bijzonder, tijdens de afgelopen 10 jaar.

België, Nederland, Noorwegen en Duitsland hebben allen de trend gezet naar ruimtelijke planning op zee, met de expliciete doelstelling om zowel sociale, economische als ecologische doelstellingen te bereiken. De meest recente initiatieven rond ruimtelijke planning op zee leggen duidelijk de klemtoon op het bereiken van een ecosysteem beheer van mariene gebieden. Zowel het maritieme beleid en de principes voor ruimtelijke planning op zee, zoals ontwikkeld door de Europese Unie, als het nieuwe ontwerpbeleidskader voor ruimtelijke planning op zee in de Verenigde Staten, hebben duidelijk het bereiken van een ecosysteem benadering in mariene gebieden als centrale doelstelling. Deze laatste leggen een sterke klemtoon op transnationale samenwerking die ervoor moet zorgen dat individuele, sociale, economische en ecologische doelstellingen voor ruimtelijke planning op zee zijn ingebed in de bredere context van het mariene ecosysteem en de goederen en diensten die het aanlevert.

Ten tweede is het ook mogelijk om een aantal essentiële elementen te identificeren die noodzakelijk zijn om de geanticipeerde doelstellingen van ruimtelijke planning op zee te bereiken. Analyse van de Belgische ontwikkelingen op het vlak van ruimtelijke planning op zee bijvoorbeeld, toont aan dat nieuwe wetgeving waarin expliciet de basis wordt gelegd voor ruimtelijke planning op zee geen voorwaarde is om ermee van start te gaan. Niettemin kan toch geconcludeerd worden dat een allesomvattende wetgeving - in aanvulling van het bestaande systeem van licenties en vergunningen - een veel coherentere basis verschaft voor de verdere ontplooiing van ruimtelijke planning op zee. Eenmaal een wetgevende basis is voorzien zijn een aantal andere aspecten belangrijk voor het ontwikkelen van ruimtelijke planning op zee. Vergelijkend onderzoek naar de verschillende goede praktijken in de wereldwijde ontwikkeling van ruimtelijke planning op zee illustreert dat vijf kernelementen essentieel zijn, inclusief (a) participatie; (b) integratie; (c) adaptatie; (d) toekomst gericht perspectief; en (e) ecosysteem benadering.

Participatie: stakeholder participatie is belangrijk om een aantal redenen. De voornaamste hiervan is het feit dat ruimtelijke planning op zee terzelfdertijd economische, sociale en ecologische doelstellingen tracht te bereiken en daarom zoveel mogelijk verwachtingen, opportuniteiten en conflicten die zich in het

mariene gebied voordoen dient te reflecteren. Een geslaagde stakeholder participatie vereist dat deelnemers bijdragen tot de verschillende etappes van het ruimtelijke planning proces, waaronder de planning, implementatie, monitoring en evaluatie, en aanpassingsfases. Een goede participatie vereist echter niet alleen inzage wanneer stakeholders dienen deel te nemen, maar vergt eveneens een stakeholder analyse die aangeeft wie als stakeholder kan worden aanzien en hoe deze kunnen deelnemen in de ontwikkeling, implementatie en aanpassing van het ruimtelijke plan voor de zee.

Integratie: via de organisatie van menselijke activiteiten in tijd en ruimte beoogt ruimtelijke planning op zee om verscheidene doelstellingen (sociale, economische en ecologische) gelijktijdig te realiseren en dient daarom idealiter alle mariene economische sectoren en ecologische aspecten met elkaar te integreren. Dit is een bijzonder complexe ondernemning en sommige landen zijn hierin beter geslaagd dan andere. In het ruimtelijke plan voor de *Barents Sea* dat ontwikkeld werd door Noorwegen bijvoorbeeld zijn alle economische kernactiviteiten - waaronder olie en gas exploitatie, visserij en maritiem transport - zo georganiseerd dat ze niet conflicteren met het opzetten van een netwerk van mariene beschermde gebieden. Daarenboven vereisen functionele ruimtelijke plannen op zee ook consistentie met het beheer van aangrenzende gebieden en op andere schalen, hetzij nationaal, regionaal als internationaal. Analyse van de ruimtelijke plannen ontworpen in België, Nederland en Duitsland illustreert duidelijk dat de connectiviteit tussen aangrenzende mariene gebieden, het transnationale effect van verschillende mariene activiteiten, en de grotere schaal noodzakelijk om tot een ecosysteem benadering te komen, vereist dat ruimtelijk plannen ontwikkeld binnen nationale grenzen geïntegreerd worden in een bredere internationale context, waarbij de dynamiek van het marine ecosysteem in zijn geheel wordt behandeld.

Adaptatie: ruimtelijke planning op zee functioneert het best als een continu, adaptief proces in plaats van een eenmalig plan. Ruimtelijke plannen op zee dienen voldoende flexibel te zijn om zich te kunnen aanpassen aan wijzigende omstandigheden die ondermeer het gevolg kunnen zijn van technologische vooruitgang, nieuwe wetenschappelijke informatie en data, herziene politieke prioriteiten of economische realiteit. Initiatieven in Australië, en meer recent in Nederland, tonen duidelijk de voordelen aan van een adaptieve benadering ten aanzien van ruimtelijke planning op zee. Niettemin is betekenisvolle adaptatie een complex proces dat vergt dat de uitkomst en performantie van het ruimtelijke plan op zee op een systematische manier worden gemeten via een adequaat monitoring- en evaluatiesysteem. Onderzoek naar de ontwikkeling van ruimtelijke planning op zee in verschillende landen toont echter aan dat het gebrek aan specifieke en meetbare objectieven een betekenisvolle monitoring en evaluatie in de weg staan en daardoor momenteel een obstakel vormen voor een adequate adaptatie van ruimtelijke planning op zee.

Toekomstgericht perpectief: ruimtelijke planning op zee is, net als eender welke andere vorm van planning, een toekomstgerichte activiteit, die ondermeer kan gebruikt worden voor het creëren van alternatieve visies die aangeven hoe een bepaald marien gebied er idealiter kan uitzien over 10, 20, 30 jaar. Dergelijke alternatieve toekomstvisies zijn op hun beurt essentieel in het tot stand brengen van de nodige shift naar een proactieve besluitvorming als alternatief tot het huidige, nog grotendeels reactief, beheer van de zee. Niettegenstaande het belang van een toekomstgericht perspectief, en het veelvuldig gebruik van ruimtelijke planning op het land, staat de implementatie ervan op zee nog in zijn kinderschoenen. Tot nog toe heeft enkel het ruimtelijke plan voor mariene gebieden in Nederland een uitvoerig toekomstgericht perspectief. Het plan omvat ondermeer inschattingen van de verwachte economische ontwikkelingen op zee tot 2015, het vermoede ruimtegebruik dat hieraan gekoppeld is, en een economische evaluatie voor elk van de economische sectoren in relatie tot hun vraag voor mariene ruimte. Deze informatie stelde Nederland in staat om prioriteiten vast te leggen betreffende de toekomstige ontwikkeling van de mariene ruimte en laat nu toe om een proactieve besluitvorming te hanteren wanneer nieuwe opportuniteiten of conflicten zich voordoen.

Ten derde is het niet alleen belangrijk om de kernelementen te identificeren die noodzakelijk zijn voor een succesvolle ontwikkeling van ruimtelijke planning op zee, maar ook om na te gaan wat de relatie is met andere relevante beheerspraktijken, in het bijzonder geïntegreerd kustzonebeheer. Algemeen gezien zijn de doelstellingen van ruimtelijke planning op zee vrij gelijklopend met die van geïntegreerd kustzonebeheer. Beiden trachten sociale, economische en ecologische objectieven te bereiken en beogen een alternatief te bieden voor het falende sector-per-sector beheer van de zee. Onderzoek toont echter aan dat ruimtelijke planning op zee - door de temporele en ruimtelijke aspecten van het beheersproces centraal te stellen - een veel grotere pragmatische aanpak heeft tot het bereiken van deze doelstellingen. Er kan ondermeer worden vastgesteld dat door een aantal van de principes voor geïntegreerd kustzonebeheer te interpreteren in ruimte en tijd, ze beter operationeel kunnen worden gemaakt, waardoor hun verdere implementatie bevorderd kan worden.

Tot slot kunnen uit de voorliggende studie ook een aantal nieuwe onderzoeksvragen en lacunes worden afgeleid. Deze onderzoeksvragen reflecteren uitdagingen die in de nabije toekomst een obstakel kunnen vormen voor de verdere ontplooiing en verdieping van ruimtelijke planning op zee en daardoor een geslaagde implementatie in nieuwe gebieden in de weg kunnen staan.

Hoewel ruimtelijke planning op zee de ambitie heeft om via een meer rationele organisatie van het gebruik van mariene ruimte tezelfdertijd economische, ecologische en sociale doelstellingen te bereiken, zijn er zo goed als geen methodes beschikbaar die aangeven hoe afwegingen dienen te worden gemaakt indien conflicten zich voordoen. Uiteindelijk is het onvermijdelijk dat prioriteiten en keuzes moeten gemaakt worden wanneer meerdere menselijke activiteiten het gebruik van dezelfde ruimte ambiëren of wanneer een bepaald gebruik een negatieve invloed heeft op het marien milieu. Vragen zoals *"Is een paaigebied waardevoller dan een windenergiepark?"* of *"Is een windenergiepark op zee belangrijker dan een gebied voor zandwinning?"* zijn op termijn onafwendbaar. Tot op heden is het nog voornamelijk de economische waarde van de menselijke activiteiten op zee die een dominante rol spelen wanneer dergelijke keuzes worden gemaakt. Omwille van het feit dat ruimtelijke planning op zee evenzeer ecologische en sociale doelstellingen nastreeft, is het essentieel dat een nieuw afwegingskader wordt uitgewerkt waarin ook ecologische en sociale waarderingen zijn opgenomen. Een dergelijk afwegingskader dient verder echter ook de verspreiding van "kost en voordeel" op te nemen, om toe te laten dat ruimtelijke planning op zee niet alleen de vooropgestelde doelstellingen bereikt, maar deze ook bereikt op de meest efficiënte (e.g., tegen de laagste kost) en gelijkwaardige (e.g., kost en voordeel is gelijkwaardig verspreid in de samenleving) wijze.

Een tweede onderzoekslacune is de nood aan een mechanisme dat toelaat om op een betekenisvolle wijze het succes (of het falen) van de huidige ruimtelijke plannen op zee te meten. Terwijl meer en meer landen nieuwe ruimtelijke planningsinitiatieven opzetten, zijn andere landen ondertussen reeds begonnen aan een herziening van de initiële plannen. Een evaluatie van de 'eerste generatie' ruimtelijke plannen op zee is van essentieel belang om het verdere succes van ruimtelijke planning op zee te verzekeren in de toekomst. De centrale vraagstelling hierbij is *"behaalt het ruimtelijke plan effectief de gewenste resultaten en zijn deze resultaten ook daadwerkelijk aan het van kracht zijnde ruimtelijke plan toe te schrijven?"* Een dergelijk onderzoek dient zich in grote mate toe te spitsen op het identificeren van relevante indicatoren die de performantie van de ruimtelijke plannen op zee kunnen monitoren en evalueren in plaats van de huidige concentratie op indicatoren voor de monitoring en evaluatie van de toestand van het mariene milieu.

Tenslotte is het ook niet onbelangrijk om onderzoek te verrichten naar de mogelijkheden om ruimtelijke planning te ontwikkelen in gebieden die momenteel niet onder de jurisdictie van één staat vallen. Zowel de volle zee (zeegebieden buiten nationale jurisdictie omvatten meer dan 60% van alle oceanen) als het

Arctische gebied bijvoorbeeld, kennen momenteel een ongekende snelle economische ontwikkeling. Hoewel conflicten in deze gebieden momenteel nog gering zijn, zal deze realiteit wellicht geheel anders zijn over 20-30 jaar. Ruimtelijke planning zou in deze zeeën eveneens een kader kunnen bieden waarbij waardevolle ecologische en biologische gebieden worden geïdentificeerd en waarbij economische ontwikkelingen gestuurd worden daar waar ze de minste conflicten voortbrengen. Het huidige zeerechtverdrag geeft echter enkel staten het recht om ruimtelijke planning te ontwikkelen in gebieden onder nationale bevoegdheid. Bijgevolg is transnationale samenwerking onontbeerlijk om ruimtelijke planning in de volle zee of in het Arctische gebied tot stand te brengen. Nieuw onderzoek zou zich aldus ofwel kunnen toespitsen op de vraag hoe het huidige internationale wetgevend kader voor het beheer van de zee kan herzien worden om ruimtelijke planning toe laten in gebieden buiten nationale jurisdictie, ofwel kan het zich richten op het identificeren van concrete drijfveren (economische, wetgevende of educatieve drijfveren), die landen ertoe aanzetten daadwerkelijk samen te werken in de ontwikkeling van een toekomstvisie voor deze gebieden.

Curriculum vitae

Since October 2009, Fanny Douvere is Coordinator of the Marine Programme at the World Heritage Centre of the United Nations Educational, Scientific and Cultural Organization (UNESCO) in Paris, France. A key priority of the programme involves enhancing the application of an ecosystem-based approach to the management of marine World Heritage Sites.

Between October 2005 and September 2009, she co-initiated and led the Marine Spatial Planning (MSP) Initiative at UNESCO's Intergovernmental Oceanographic Commission. The majority of her work during this time focused on documenting and analyzing existing MSP practices with the aim of bringing MSP beyond the conceptual level through the development of a comprehensive methodology for practical application. In 2006, she co-chaired the first international workshop on MSP; the results were published in the UNESCO report, *Visions for a Sea Change*. As a follow-up to the workshop, she co-edited the first special issue dedicated to MSP for the international peer-reviewed journal, *Marine Policy*.

In July 2009, she co-published the UNESCO guide *Marine Spatial Planning: A step-by-step Approach toward ecosystem-based management*. The content of this publication was the culmination of a 18-month research initiative during which she, among other things, visited over 15 offices in ten countries[1] that practice some form of MSP. These visits have provided a first-hand insight in the successes and gaps in the current thinking and practice of MSP in a variety of different cultural settings. In both New Zealand and Canada, for example, First Nations rights play an essential role in the development of MSP, while in the United States and Europe trans-boundary cooperation (at local, national and international levels) is a major issue of concern. Additionally, she co-led two regional reviews (Hanoi/Ha Long Bay, Vietnam and the Commonwealth of Massachusetts, United States) of the steps for MSP identified in the guide.

The guide has set a precedent in that it for the first time provides a comprehensive, but practical, ten-step approach toward development and implementation of MSP. The guide clearly filled a gap. Almost 4,000 copies of the guide have already been distributed, and it is currently being translated in Spanish, Russian, Chinese, French, and Vietnamese. The guide has inspired numerous new MSP efforts and publications around the world and, has most recently, also been used as the basis for a conceptual discussion on MSP in the Arctic region.

During this time, she also authored or co-authored 17 articles in internationally peer-reviewed journals, gave more then 40 presentations at international meetings all over the world, and co-built and maintained the first MSP portal website that brought all relevant references and information on MSP together. The website still functions as the international reference site for MSP[2].

In addition to her work at UNESCO, she served as an advisor to the United States Executive Office of the President (Council of Environmental Quality) on the development of the US Framework for Coastal and Marine Spatial Planning and co-led a one-week series of lectures on MSP for executive and senior staff of the National Oceanic and Atmospheric Administration (NOAA) in September 2009. Other relevant initiatives include the development of a WWF-International roadmap on integrated sea use management for the Baltic Sea and her role as

[1] Countries include: Canada, United States, Australia, New Zealand, Japan, Belgium, the Netherlands, Germany, Sweden, the United Kingdom

[2] Website address: ioc3.unesco.org/marinesp

co-chair of the two first United States regional workshops on science for MSP for the non-governmental organization The Nature Conservancy. She also co-wrote the basis for the WWF-International *2009 Baltic Sea Scorecard* on integrated sea use management in the Baltic Sea and provided advice on MSP to OSPAR, the European Commission (DG Mare) and the Canadian government (ESSIM and PNCIMA large ocean areas), among others.

Finally, she maintains an informal advisory role to the Gordon and Betty Moore Foundation project on the implementation of the Oceans Act through MSP in British Columbia (Canada) and the development of trans-boundary MSP in New England (east coast of United States) and chairs the Belgian *think tank* on the potential development of the second phase of MSP in Belgium, an initiative led by the Flemish Office for Integrated Coastal Zone Management.

Before joining UNESCO, she started her career at the Maritime Institute of the Ghent University, Belgium, where she contributed to various marine project in the capacity of research assistant and was part of the coordination team for the GAUFRE project that aimed at developing a marine spatial plan for the future conservation and development of the Belgian part of the North Sea.

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