

Analysis of the Implementation of Marine Spatial Plans

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Abstract: The increasing pressure on marine ecosystems by various economic, social, and ecological activities has led to conflicts and a decline in the ecosystem's ability to provide marine goods. Marine spatial planning has become necessary for the coastal states to establish a more rational organization of marine space that integrates economic exploitation, social benefits, and marine environment protection. The beginnings of marine spatial planning date back to the 1970s, with successful initiatives in countries such as Australia, Ireland, Norway, the United Kingdom, Spain, and Portugal. In southern Europe, initiatives like SHAPE in the Adriatic Sea discuss maritime boundaries and national jurisdictions, whereas in northern and central Europe, licensing requirements for wind energy and other marine activities play a significant role. Conflicts with maritime traffic, fisheries, and protected areas have prompted the initiation of marine spatial planning in Belgium and Germany. The multidisciplinary nature of marine spatial planning allows for the sustainable use of marine resources and the reduction of negative impacts on the environment. Conflicts can be minimized by considering the specific interests and spatial needs of various stakeholders, and the marine space can be utilized more efficiently. This paper examines the implementation of marine spatial plans across various levels, ranging from small national jurisdictions to large areas like Australia. The authors emphasize the significance of utilizing marine spatial plans as a basis for the development of marine spaces. By analysing the factors that define marine spaces and their activities, both present and future, conflicts can be prevented, and incompatible activities can be avoided in the same area. The findings highlight the importance of proactive planning to ensure the sustainable use of marine resources and the protection of marine ecosystems.

Keywords: Pressures, Conflicts, Marine spatial planning, Marine spatial plans.

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1. Introduction

Marine areas are places of many economic activities of specific interests and spatial needs. Marine resources are limited in both space and size, so economic development in many places has been devastating for marine biodiversity. Increased development pressure on the marine environment has led to two types of conflict: use-environment conflicts and use-use conflicts. First, this multitude of human activities, for the most part, uncoordinated across economic sectors, has resulted in substantial and largely irreversible loss and damage to the diversity of life in marine and coastal areas (e.g., habitat loss). Second, not all uses are compatible with one another and/or have adverse effects on each other (e.g., shipping, and offshore wind farms).

Various human activities deplete marine resources that are often not sufficient to meet all the coinciding demands. The lack and/or the overuse of space is becoming an increasing problem for certain sectors and is the cause of conflicts [1]. Although some economic activities can easily coexist in the same marine area, some are incompatible with most other marine uses and, to a greater or lesser extent, have a limiting impact on other activities. Therefore, spatial, and temporal variations between different activities must be considered in marine spatial planning. Timely planning of economic activities that take place at sea (tourism, fishing, maritime routes, wind farms, etc.) helps prevent conflicts and contributes to a more rational use of sea space. It should be emphasized that MSP has a significant ecological and socioeconomic role in Particularly Sensitive Sea Area such as Great Barrier Reef area and sea areas in Western Europe.

The presence of increasing conflicts between different users of marine areas requires a common methodology to establish a balance between marine resources and their users. Marine Spatial Planning (MSP) is a process related to managing the distribution of human activities in space and time to achieve environmental, economic, and social goals and outcomes. MSP is defined as a multidisciplinary instrument to facilitate the implementation of an ecosystem approach to support the rational use of marine resources, harmonize current human activities, minimize the impact on the marine environment, and ensure the resilience of coastal and marine areas to climate change [2].

The paper is structurally divided into six main parts. After the introduction, the second part of the paper highlights the facts that emphasize the necessity of preserving the marine environment. The third part deals with the establishment of the MSP process and its benefits for the environment, economy, and society. Given that coastal countries are

increasingly recognizing the need for a more rational organization of marine space, the fourth part analyses the level of development of MSPs in coastal countries. The significance of the integrated approach in MSPs is presented in the fifth part of the paper.

2. The importance of marine environment protection

Almost all jurisdictions were created long before the boundaries of marine ecosystems were understood. As a result, legal boundaries in the sea do not reflect natural processes or the shared socio-economic interests of humans [3]. Marine ecosystems take place at different scales and are restricted primarily by physical and biological structures. Some places are more essential than others for certain ecosystems, and thus for people. It should be considered that marine ecosystems change over time due to changes caused by pollution, habitat damage, invasive species, and climate change. Some ecosystems or species are more unaffected to disturbance than others. Good marine environmental status indicates the environmental status of marine waters are ecologically diverse and dynamic, cleaned, healthy, and productive oceans and seas within their natural conditions. The sustainable use of the marine environment conserves the potential for uses and activities by current and future generations.

Although comprehension of the cumulative pressures and impacts on the marine environment has increased over the past 30 years, there are still concerns about resource overexploitation, climate change, and biodiversity loss [4]. The marine environment is a precious heritage that must be protected, preserved, and, where practicable, restored with the aim of maintaining biodiversity and providing diverse and dynamic oceans and seas that are clean, healthy, and productive [5]. In this context, MSP has been recognized as a marine area management process that achieves ecological, economic, and social balance.

3. MSP Process

The sea area is a three-dimensional space that consists of the seabed, the water column, and the sea level. Consequently, instantaneous use as well as use in different periods or seasons is possible. Also, it is probable to have different activities occurring in the same zone, at the same time, at different depths. In this context, the real challenge for successful policy on spatial planning lies in fitting all the pieces of the puzzle together and bringing reconciliation between scientific research and practical solutions [6]. Possible activities and interests may include aquaculture areas, fishing areas, research facilities and infrastructure, exploitation, and extraction of

oil, gas, ores, and other energy resources, as well as renewable energy production, maritime shipping routes, and traffic flows, military training areas, nature and species protected areas, submarine pipelines, tourism, underwater cultural heritage [7]. Therefore, MSP must consider the economic activities of specific interests as well as spatial needs.

3.1 The launching of Maritime Spatial Planning

Marine ecosystems are sensitive to human activities, and planning helps in their preservation. The establishment of MSP plays a key role in the conservation and sustainable management of marine ecosystems and resources.

MSP does not lead to a one-time plan. It is a continuing, iterative process that learns and adapts over time. The development and implementation of MSP involves several steps. The steps and results to be delivered are shown in Figure 1.

Step 1 Identifying need and establishing authority	A preliminary list of specific problems you want to solve through marine spatial planning A decision about what kind of authority you need for developing marine spatial planning	Step 6 Defining and analyzing future conditions	A trend scenario illustrating how the MSP area will look if present conditions continue without new management interventions Alternative spatial sea use scenarios illustrating how the management area might look when human activities are redistributed based on new goals and objectives A preferred scenario that provides the basis for identifying and selecting management measures in the spatial management plan (Step 7)
Step 2 Obtaining financial support	A financial plan that: a. Estimates the costs of your MSP activities b. Identifies alternative means to obtain financing for those MSP activities	Step 7 Preparing and approving the spatial management plan	An identification and evaluation of alternative management measures for the spatial management plan Identification of criteria for selecting alternative management measures A comprehensive management plan, including if needed, a zoning plan
Step 3 Organizing the process through pre-planning	Organization of a marine spatial planning team with the desired skills A work plan that identifies key work products and resources required to complete the outputs of planning on time Defined boundaries & time frame for analysis and management A set of principles to guide development of the marine spatial management plan A set of goals and objectives for the management area	Step 8 Implementing and enforcing the spatial management plan	Clear identification of actions required to implement, ensure compliance with, and enforce the spatial management plan
Step 4 Organizing stakeholder participation	A plan indicating who, when and how to involve stakeholders throughout the marine spatial planning process	Step 9 Monitoring and evaluating performance	A monitoring system designed to measure indicators of the performance of marine spatial management measures Information on the performance of marine spatial management measures that will be used for evaluation Periodic reports to decision makers, stakeholders, and the public about the performance of the marine spatial management plan
Step 5 Defining and analyzing existing conditions	An inventory and maps of important biological and ecological areas in the marine management area An inventory and maps of current human activities (and pressures) in the marine management area An assessment of possible conflicts and compatibilities among existing human uses An assessment of possible conflicts and compatibilities between existing human uses and the environment	Step 10 Adapting the marine spatial management process	Proposals for adapting management goals, objectives, outcomes and strategies for the next round of planning Identification of applied research needs

Fig. 1 - Steps in the process of MSP development.

Source: authors as cited in [8]

These 10 steps do not follow a strict linear progression from one to the next. Instead, the process should incorporate multiple feedback loops. For instance, the goals and objectives established at the beginning of the planning process may undergo adjustments as the costs and benefits of various management measures become clearer at later stages. The analyses of current and future conditions will also develop as new information are included into the planning process. The stakeholder involvement will shape the planning process as it reveals. Planning is a dynamic process, and

planners need to be approachable for adapting changes as the process develops.

3.2 The benefits of maritime spatial planning

Some of the most important benefits of MSP are shown in Figure 2.

Ecological/ Environmental Benefits	<ul style="list-style-type: none"> Identification of biological and ecological important areas Biodiversity objectives incorporated into planned decision-making Identification and reduction of conflicts between human use and nature Allocation of space for biodiversity and nature conservation Establish context for planning a network of marine protected areas Identification and reduction of the cumulative effects of human activities on marine ecosystems
Economics Benefits	<ul style="list-style-type: none"> Greater certainty of access to desirable areas for new private sector investments, frequently amortized over 20-30 years Identification of compatible uses within the same area of development Reduction of conflicts between incompatible uses Improved capacity to plan for new and changing human activities, including emerging technologies and their associated effects Better safety during operation of human activities Promotion of the efficient use of resources and space Streamlining and transparency in permit and licensing procedures
Social Benefits	<ul style="list-style-type: none"> Improved opportunities for community and citizen participation Identification of impacts of decisions on the allocation of ocean space (e.g., closure areas for certain uses, protected areas) for communities and economies onshore (e.g., employment, distribution of income) Identification and improved protection of cultural heritage Identification and preservation of social and spiritual values related to ocean use (e.g., the ocean as an open space)

Fig. 2 - Examples of MSP benefits.

Source: authors as cited in [8]

It is possible to conclude that an interdisciplinary approach is imperative for MSPs, and it must rely on the knowledge of different disciplines. An interdisciplinary approach contributes to the efficient management of marine resources and ecosystems and ensures the sustainable use of marine space.

4. Analysis of marine spatial planning implementation

Certain coastal states have a developed system of marine spatial planning in the areas under their jurisdiction. Each country implements a different management system within its marine area, depending on natural characteristics, institutions, history, and practices. Given that the establishment of a more rational organization of the marine space is no longer a privilege but a necessity, efforts are being made to integrate economic exploitation and social benefits together with the protection of the marine environment.

The beginnings of MSP date back to the 1970s as a management approach aimed at nature conservation in Australia in the Great Barrier Reef area. The Great Barrier Reef has an economic, social, and icon asset value of \$56 billion. It supports 64,000 jobs and contributes \$6.4 billion to the Australian economy [9]. The Australian Government enacted the Great Barrier Reef Marine Park Act, 1975 (the Act) for the conservation and sustainable management of the Reef. The Act adopted zoning as a practical strategy to eliminate conflicting human activities in the park. The Act incorporated MSP in 2003. MSP in the Park has achieved significant progress in minimizing conflicting human activities, conservation of biodiversity, and maintaining a balance between economic and environmental interests [10]. The effective management of such a vast and complex area requires a balance between reasonable human use and maintenance of the integrity of the natural and cultural area [11].

In the European context, for many countries, such as Ireland, Norway, Great Britain, Spain, and Portugal the national maritime boundaries are becoming increasingly important since most of their territorial area lies at sea rather than on land [12]. Important aspects of the MSP initiative in Southern Europe, such as SHAPE, the cross-border MSP initiative in the Adriatic Sea, have introduced the idea of establishing maritime boundaries and national maritime jurisdictions while in Northern and Central Europe, licensing requirements for wind energy and other marine uses play an important role [13]. The choice of offshore wind farm locations and possible conflicts with maritime traffic, fisheries, and important natural areas was the reason for launching the MSP process in Belgium and Germany. The Belgian Master Plan is one of the first in Europe, and its implementation began in 2003 with gradual zoning. Zoning took place in two phases. In the first phase, the main industrial zones were allocated, and special emphasis was placed on renewable energy sources such as offshore wind farms. The second phase referred to the location of the marine protected areas (5 natura 2000 areas by Belgian Royal Decree, 3 Special Protection Areas (SPAs) under the Birds Directive. Two sites (Trapegeer-Stroombank and Vlakte van de Raan) were designated as Special Areas of Conservation (SACs) under the Habitats Directive. Royal Decree of 2005 prohibited the following activities: all building activities, industrial activities, and activities of commercial and advertising enterprises. In Trapegeer-Stroombank which was proclaimed as a Special Area of Conservation (SAC) the dumping of dredged material and inert materials of natural origin was also forbidden. In Special Protection Areas (SPAs) the following species are protected: common tern, sandwich tern, little gull, and great crested grebe. During winter, helicopter flights at altitudes of less than 152,4 metres (500 ft), the passage of high-speed

vessels, and offshore water sports are also forbidden. In these areas, only activities that have no harmful impact on the environment are allowed or are allowed under strict conditions.

Belgium adopted its first legally binding Maritime Spatial Plan, the Maritime Spatial Plan for the Belgium Part of the North Sea, via Royal Decree on 20 March 2014. Belgium's second Maritime Spatial Plan, covering the period 2020-2026, was adopted through Royal Decree on 22 May 2019. The MSP for the Belgian Part of the North Sea covers the following uses: nature protection, offshore renewable energy production, shipping, ports, mineral extraction, fishing, aquaculture, underwater cultural heritage, military, scientific research, coastal protection, cables and pipelines and zones for commercial and industrial activities. Every activity and its use have been assessed through three key questions: economic, ecological, and landscape well-being taking into consideration the precautionary principle, principle of sustainability, and principle of security.

One of the biggest challenges in Norway was harmonizing the fishing industry with the growing maritime traffic and hydrocarbon extraction activities. The plan for the Barents Sea is one of the few that takes into consideration the impact of fishery along with other economic branches that perform their activities in marine areas. It has achieved the goals of sustainable use of the ecosystem within acceptable levels of pollution, with a reduced risk of accidental spills and sufficient capacities to deal with accidents, by consuming food from the sea that is safe for consumption while the biological diversity is being preserved [14].

The North Sea Management Plan was developed from 2007 to 2009 and it was based on the integrated ecosystem-based management plan for the Barents Sea. The plan covers about 1.2 million km² of sea surface. 11 ecological areas were defined, the main criterion being biological biodiversity or biological production that determines the choice of measures for the area management. The secondary criteria for the selection of areas were economic importance and social and cultural significance. The chapter on possible conflicts also includes the future development of activities in the sea area (wind farms). The impact of external pressures on the marine environment, such as transboundary pollution, climate change, and invasive species, was also evaluated. The plan was revised in 2014. The overall revision of the Plan is planned for 2025.

Coastal tourism, port activities, and recreational activities are the most important sectors of marine activities in Portugal. 76% of the Portuguese population lives in coastal areas. In order to resolve the conflicts arising from numerous overlapping uses and to ensure the sustainable development of all sectors, it was necessary to analyse conflicts and make an assessment of

potential future benefits. Compatibility matrices were developed in the 2011 Plano de Ordenamento do Espaço Marítimo.

Germany has extended its Land Planning Act and thus federal powers for MSPs to the exclusive economic zone [15]. For the German exclusive economic zone (EEZ), MSP has mainly been adopted for the purpose of designating Natura 2000 sites under the EU Birds Directive (79/409/EEC) and the EU Habitats Directive (92/43/EEC) and preferential areas for offshore wind energy farming, but not for fisheries despite its high economic importance and long cultural tradition [16]. Regulatory plans for the North Sea and Baltic area are in force. National and international monitoring is carried out for the North Sea area.

The Trilateral Wadden Sea Plan is an example of the use of MSPs in an international context. The plan includes Denmark, Germany, and the Netherlands. The guiding principle of the trilateral policy is to achieve a natural and sustainable ecosystem in which natural processes continue unhindered [17]. The Plan puts an emphasis on the following: sea water and sediment, tidal areas, offshore areas, estuaries, beaches and dunes, salt marshes, landscape and culture, rural areas, birds, and marine mammals.

Marine spatial initiatives indicate a strong need for a more rational use of marine space. The presented Plans try to harmonize the spatial influence of different users so as to focus their activities on sea protection.

5. Integrated Maritime Spatial Planning

The integrated approach in MSP is based on the principles of cooperation and coordination between different sectors, stakeholders, and government bodies that are involved in activities in the maritime space. This includes considering various interests such as fisheries, tourism, energy, maritime transport, environmental protection, underwater cultural heritage, and other aspects of the marine space. The integrated approach brings sustainability into focus. This means ensuring that activities in the marine space do not threaten the long-term survival of ecosystems and marine resources. Today, when exposure to marine threats and pressures is increasing, an integrated approach becomes essential to ensure a sustainable future for marine spaces.

Marine space represents complete resources necessary for development. At the same time, it is significantly affected by human activities in that area. Therefore, an integrated approach is a necessity. Analogous to land-use planning in the terrestrial environment, MSP aims to identify a balance between social and economic demands for development, while protecting the health and resilience of ecosystems [18].

An integrated approach in MSPs helps to preserve the marine environment, promotes sustainable development, and reduces conflicts between sectors. It also contributes to more efficient management of marine resources and ensures that marine ecosystems remain vital and functional for future generations.

If integration is effective, then MSP is more likely to succeed [19]. However, it should be taken into consideration that the process of decision-making requires compromises that may inevitably affect the interests of one or more users of the sea space.

6. Conclusion

Various activities, whether economic, cultural, ecological, or social, place a burden on the marine ecosystem thus emphasizing the necessity of considering a new approach to the sustainable exploitation of the marine area. The challenge is in establishing a balance between the protection of marine ecosystems and different activities, given the growing demand for marine space.

MSP provides a promising tool for the regulation and protection of the marine environment and offers a new framework for managing the potentially conflicting benefits coming from the sea. Detailed marking of marine areas as well as all activities that compete for the use of this vitally important space enables recognition of overexploitation, potential risks of pollution, and threats to frequently endangered and rare marine habitats.

Information on conflicts between economic activities should be put in focus when considering effective management of the marine area. Impacts should be minimized to achieve the greatest possible preservation of the quality of the environment. Therefore, the implementation of the integrated MSP becomes the key to achieving a balance between economic activity, environmental protection, and social needs in light of the growing challenges arising from increasing pressures on the marine area.

Marine spatial plans enable different activities to take place and minimize conflicts between competing uses of the same area. Given that they direct and determine the planning of all economic contents, marine spatial plans represent the basis of the marine areas' development. Therefore, they must be planned and managed in the long-term respecting the principles of sustainable development.

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