Maritime Research and Technology

MRT
ISSN 2812-5622

http://dx.doi.org/10.21622/MRT.2023.02.2.108

Toward Implementing The Marine Spatial Planning Approach In The Egyptian Marine Areas

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Received on: 11 April 2023 Accepted on:01 July 2023 Published on: 20 July 2023

ABSTRACT

Purpose: *The concept of Blue Economy focuses on the sustainable utilization of maritime resources. Egypt, with its extensive coastline of approximately 3000 km, has dedicated various marine regions for both traditional activities such as shipping routes and fisheries, and newer sectors like oil and gas exploration and fish farms, leading to conflicts among stakeholders whether among users or between users and the marine environment.*

Design/Methodology/Approach: *This research paper analyses the data collected from peer-reviewed articles, identifies, and examines case studies of real-world applications of the Marine Spatial Planning (MSP) approach, and provides policy recommendations for decision-makers, stakeholders, and academic researchers interested in understanding the possibilities, challenges, and mitigation strategies associated with adopting this approach in Egypt. Due to the absence of an Egyptian MSP and limitation of domestic scientific research in this field, this paper will serve as a valuable source of information on MSP in the country.*

Findings: *The outcomes were summarized as follows: To address the limitations in implementing Marine Protected Areas (MPAs) and Integrated Coastal Zone Management (ICZM), Carbon Capturing and Storage (CCS) in Egypt, adopting the (MSP) approach is proposed as a suitable tool for managing marine ecosystems and resolving conflicts among ocean users. This approach can support decision-makers in achieving sustainable development goals (SDGs). Successful implementation of the MSP initiative in Egypt requires key conditions: stakeholder engagement from the beginning of the process, a legally-binding framework, a designated ministry, and effective monitoring and evaluation.*

Key-words:
MSP, ICZM, MPAs, CCS, SDGs.

MRT
ISSN 2812-5622
http://dx.doi.org/10.21622/MRT.2023.02.2.108

1. INTRODUCTION

The scientific name of the earth is the blue planet because both the sky and sea are blue while the economic idiom of the Blue Economy backs to a sustainable ocean economy (Hazra & Bhukta, 2022). In recent years, the blue economy notion has gained a global popularity and it is a political tool in hand decision-making to achieve strategic planning. In addition, it concerns how to utilize maritime resources in a sustainable way (Hazra & Bhukta, 2022).

The 2008 world economic crisis encouraged countries to rely on strategies and development agendas to promote their economies, so the term green economy appeared, while Small Island Developing States (SIDS) relied on their marine resources to achieve social, economic, and environmental goals. Thus, the Blue Economy notion appeared after the United Nations conference on sustainable development at Rio de Janeiro 2012 in Brazil (Kabil et al., 2022).

The Marine Ecosystem Based Management (MEBM) manages human activities in coastal and marine zones while improving and maintaining marine ecosystem services and social benefits (Gacutan et al., 2022). Moreover, it is the best way to maintain a balance between protecting the maritime environment and achieving sustainable development. Furthermore, it includes various tools such as the (MPAs) (Kriegl et al., 2021), The ICZM, MSP, and activities that support the Carbon Capturing and Storage technique (CCS) (Abd El-Hamid & Hafiz, 2022). In addition, the Ecosystem Based Management (EBM) has developed to achieve the Sustainable Ocean Governance (SOG). Additionally, MSP as an implementation tool has helped EBM to achieve significant improvements in SOG (Alam, 2020).

The MSP Definitions

The MSP approach defines by the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization (IOC-UNESCO) as "Marine spatial planning (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". In contrast, the first mention of the term MSP in European countries was in 2001 (Zaucha & Gee, 2019). In the last decade, the MSP approach has gained global popularity and more than 70 countries have moved toward EBM of the marine environment by adopting the MSP initiatives. It is expected that by 2030 one-third of the globe's EEZ will be regulated by the MSP. In addition, there are only two countries in the middle east namely the United Arab Emirates and Israel as a regional competitive (Patera & Pataki, 2022) See figure (1).

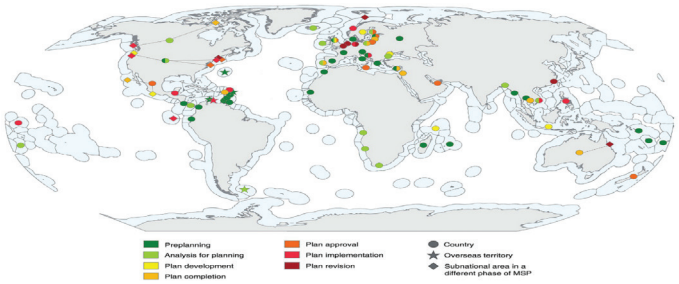

Fig. 1. World Status of the MSP Approach
Source: (Santos et al., 2019).

Egypt's Coastal Regions

Egypt is a developing coastal state with a population of approximately 107 million people and is expected by 2060 to be approximately 174 million people (Chamie, 2022). Furthermore, Egypt owns about 3000 km of coastline:1850 km along the Red Sea coast and 1150 km along the Mediterranean Sea coast (Kabil et al., 2022). In addition, coastal regions have strategic importance because approximately one-third of Egyptian people live in coastal cities; about 35 million people and about 40 % of industrial and tourism activities are located in it (Hegazy, 2021). Egypt has 13.4 million acres of marine areas and lakes. It saves about a quarter of the Egyptian food of protein annually, even though Egypt suffers from a shortage in fish production (Shehata & Eldali, 2022). Moreover, approximately 586,123 people work in the aquaculture sector, and more than one million are directly and indirectly employed in fisheries and aquaculture (Wuyep & Rampedi, 2018).

According to the Egyptian strategy and Vision 2030 toward achieving sustainable development of marine resources, applying coordinated Marine Spatial Planning in sensitive marine areas such as the Gulf of Suez is essential to manage various maritime activities such as oil and gas explorations, coastal tourism activities, shipping, ports infrastructure and development via practical planning, coordination between different sectors, and sustainable exploitation of sea resources.

On the other hand, the Blue Economy in Egypt has many challenges such as unexploited marine resources in the Red Sea such as Hurgada, Safaga, and Al Qussier in terms of marine pollution, habitat loss and the collapse of the marine ecosystem services and goods (Kabil et al., 2022). Thus, the MSP approach is an appropriate management tool in the hand of decision-makers to

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ISSN 2812-5622
http://dx.doi.org/10.21622/MRT.2023.02.2.108

regulate human activities in the marine environment.

Egypt is a signatory to many conventions related to marine environment protection, and the Egyptian environmental regulations are governed by Law No.4 of 1994 and 2015 amendments. Moreover, it granted the Egyptian Environment Affairs Agency (EEAA) the authority to formulate policies and plans regarding environmental protection and to monitor the implantation of such policies and plans.

On the other hand, the current legal framework of maritime environment protection in Egypt has many defects in terms of regulations that need to be more comprehensive with a wide range of enforcement and monitoring for some environmental issues such as marine pollution, marine stakeholders' engagement including private sectors, and facilitating of people's awareness about marine environment issues (Thabit et al., 2022).

Fisheries and aquaculture are highly vulnerable sectors to climate change impacts (E-IRG, 2022), while renewable energy and oil and gas explorations are less vulnerable to climate change impacts. Moreover, the current legal framework does not adopt the MSP approach because the MSP approach is a new notion, and few people are familiar with.

Determining marine stakeholders and their disputes, their engagement in the process, and specifying an authority for their earlier engagement in the approach are rare issues with the beginning of the MSP approach. Furthermore, the MSP approach is an effective management tool to benefit of the coastal marine resources but not at the expense of the marine environment.

This paper provides decision-makers, stakeholders, and academic researchers with why the MSP is relevant to Egypt's marine regions issues, possibilities, challenges, and mitigation strategies associated with adopting the MSP approach in Egypt.

Comparison between Different Marine Ecosystem based Management Approaches in Egypt

The suitable harnessing of marine resources, reducing human activities' impacts on the marine environment, decreasing the impacts of land-based activities, and improving land-sea interactions enable countries to achieve the United Nations Sustainable Development Goals (SDGs). Moreover, to do so, a comparative analysis between MEBM approaches to attain sustainable ocean governance is struck as follows:

The Marine Spatial Planning Approach (MSP)

The concept that became MSP traced its roots to 1976, when the states were given the right to establish their Marine Protected Areas (MPAs) to safeguard the marine environment from degradation caused by human activities. In addition, the Marine Spatial Planning (MSP) approach was initially employed to enhance the management of the MPAs. Moreover, in the 1980s, Australia's Great Barrier Reef Marine Park (GBRMP) was among the best-known examples of an ocean zoning plan used in marine conservation (Johnson et al., 2020).

According to the United Nations Educational, Scientific and Cultural Organization (UNESCO) UNESCO-IOC the MSP is defined as "the use of the sea areas to minimize conflicts between human activities and maximize benefits while ensuring the resilience of marine ecosystems" (Thenen et al., 2021). In addition, it often establishes defined zones that specify allowed uses and limitations within a specified marine region. Moreover, Egypt's Vision 2030 expressed a desire to generate more rigorous management and monitoring approaches concerning maritime environment breaches to ensure that these activities are compatible with international environmental measures, encourage sustainable approaches for fisheries to sustain ecosystems and marine biodiversity, and implement programs for improving the technological and managerial capacities of persons involved in coastal and maritime environment management.

The MSP approach links sectors, individuals, locations, coastal development, and biodiversity. In addition, it plans agendas for long-term ocean governance and is a vital instrument for identifying and operating marine areas. Moreover, it resolves conflicts between stakeholders in the marine environment, attains economic benefits for people, and at the same time safeguards marine environment protection. Besides, the MSP manages marine resources and attains a long-term blue economy (Santos et al., 2019).

The MSP has many names, including ocean zoning, ocean planning, and sea use management (Santos et al., 2019). Therefore, ocean zoning specifies and protects important regions for marine biodiversity, which is identified globally in the Convention on Biological Diversity (CBD) and the UN Agenda 2030 for Sustainable Development (Harris et al., 2022). Ocean zoning is a toolbox or technique to attain a balance between human activities such as tidal power plants and offshore wind farms and safeguard the marine environment from degradation (Lukambagire, 2019). In other words, zoning is a process for executing MSP in specified marine areas.

The main aim of using the MSP approach is to achieve the United Nations Agenda for the SDGs via managing blue economy resources to end poverty and save job opportunities for people (Harris et al., 2022).

Marine Protected Areas (MPAs)

The first national marine protected area established in Egypt was Ras Muhammed in 1983, aiming to protect the most vulnerable marine resources and promote marine ecosystem conservation (Jawad, 2021). Moreover, some national MPAs in Egypt have gained global popularity because they are tourist destinations, such as Ras Mohamed MPA, and they have national importance because of their contribution to the national GDP. In addition, Ras Mohamed MPA is assigned only for tourist diving activities, and it has high levels of control and protection against human impacts such as sewage and fishing (Nour et al., 2022).

The biggest drawback of the MPAs is the failure to address the damage to the marine environment in the adjacent areas (Madarcos et al., 2022). Moreover, there is a high concentration of macroplastics (>5mm) in the national MPAs in the Sallum Gulf as a result of the absence of regional cooperation (Hatzonikolakis et al., 2022) . In addition, the MAPs are not maintaining the entire marine ecosystem's health (Santos et al., 2018).

Integrated Coastal Zone Management (ICZM)

The ICZM concept was first introduced during the 1992 Rio de Janeiro Earth Summit in Brazil. As a result of low-lying, Nile Delta is vulnerable to climate change impacts and sea level rise (Sharaan et al., 2022). Thus, long-term sustainable management calls for implementing the ICZM approach in Egypt. In addition, the government of Egypt implemented the framework program for ICZM in 1996 to enhance readiness, build capacity, and improve coastal elasticity (World Bank Group Report, 2022).

In addition, the ICZM helps in addressing land-sea interactions to mitigate the reasons for water pollution, illogical land usage, the collapse of natural habitats, coastal erosion and flooding, climate change impacts, and SLR. Moreover, at the beginning of applying the ICZM, successful examples have been given, such as the successful exploitation of the Matrouh coastline and the coastal protection from severe impacts of climate change (coastal erosion, flooding, and sea level rise) in the low-lying coastal area in the Nile Delta.

On the other hand, the Egyptian's ICZM approach has many flaws, including the irregular and short-term nature of the coastline protection efforts and the poorly managed marine plastic waste, where Egypt generates more than 5.5 million tonnes of plastic waste yearly and Egyptian coasts are the source of some 250,000 tonnes of plastic waste dumped into the Mediterranean Sea. While the amount of plastic waste produced along Egypt's Red Sea shore is smaller than that of the Mediterranean (Habib & Thiemann, 2022).

Nowadays, Egypt witnesses severe climate change impacts such as the shoreline of flood risks in Alexandria, and the competent authority seeks to decrease the flood risks by using tough measures on the shoreline infrastructure protection such as dikes, groins, and sea walls without linking the land use plans with coastline protection development plans and without using nature-based solutions such as using hybrid protection by mixing both dikes and mangrove to increase the coastline protection by about one and a half times more than using tough measures only (Heger et al., 2022).

Recently, Egypt has cooperated with the UN development program to develop low-elevation coastline in the Nile Delta to mitigate sea level rise impacts (Sharaan et al., 2022). In addition, Egypt has adopted an initiative to plant mangroves along the Red Sea coastline to protect beaches from coastal erosion and safeguard biodiversity.

Carbon Capturing and Storage (CCS)

According to the Paris Agreement in 2016, Egypt has pledged to increase clean energy usage to decrease carbon emissions. In addition, the Egyptian strategy and Vision 2030 aim to extract renewable energy from wind farms and solar panels, which play a key role in power generation. Moreover, Egypt has an excellent opportunity for establishing CCS hubs (the blue hydrogen) to decrease the climate change impacts of carbon footprints in the Nile Delta (Abd El-Hamid & Hafiz, 2022), from the new exploration of gas fields in the Mediterranean and the Gulf of Suez, and industrial areas in Alexandria and Suez.

Nowadays, Egypt constructs renewable energy sources such as solar panels and wind farms are utilized to obtain green hydrogen through the electrolysis of water, a process which breaks water down into hydrogen and oxygen. While establishing the CCS is costly, it requires a strict regulatory framework and capacity improvement for modern technology (Esily et al., 2022). In addition, Egypt has not yet ratified MARPOL Annex VI.

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ISSN 2812-5622
http://dx.doi.org/10.21622/MRT.2023.02.2.108

Adoption of MSP Approach Procedures

The first step in making the MSP process successful is bridging the gap between dominant economic growth without adversely impacting social and ecological aspects. In addition, the MSP initiatives have already obtained government approval and are currently in effect in 22 countries, accounting for about 27% of the world's (EEZs). Moreover, these include cases where MSP covers the majority of domestic waters in countries such as Belgium, Germany, the Netherlands, and China. While the MSP only covers a small area under national jurisdiction in countries such as the United States, Canada, and Croatia.

The IOC-UNESCO gives a methodological framework for the MSP approach, which contains 10 steps to adopt the MSP (See Figure 2) that can be used in any geographical atmosphere (Pennino et al., 2021):

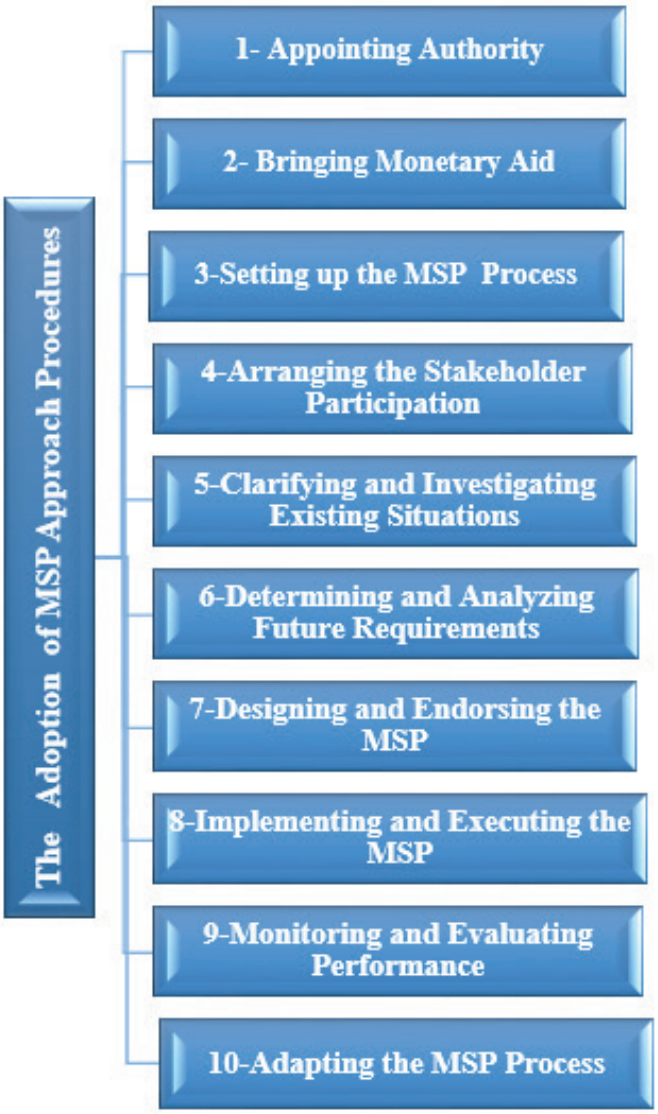

Fig. 2. Adoption of MSP Approach Procedures
Source: (Pennino et al., 2021).

Features and Advantages of the MSP Approach Implementation in Egypt

The MSP approach is characterized by collecting socio-economic and ecological targets in one management technique. In addition, it is a mix between science and management. Furthermore, scientific-based management refers to taking appropriate decisions based on available knowledge about the ecosystem and its dynamics in order to accomplish comprehensive integrated management, which aims to conserve the ecosystem's services and goods of human activities. Moreover, it is a comprehensive and proactive approach dealing with uncertainties and long-term agendas to manage marine resources sustainably, which is why the MSP depends on science and knowledge. (Ryabinin et al., 2019).

The MSP approach deals with time and space to protect biological communities and breeding lands (Ehler et al., 2019). Thus, it attains the EEAA's goals of protecting and safeguarding the marine environment from pollution. The MSP approach is an appropriate tool for managing ocean areas in Egypt because its distinctive biodiversity benefits the country's economy, promotes human welfare and offers regulating and supportive functions. It supports a diverse range of terrestrial and aquatic life forms as well as ecosystems. Egypt is home to a wide variety of ancient plant, animal, and microorganisms. So, the long-term plan could recover endangered or threaten marine species and take appropriate action to prohibit damaging human activities (sewage, heavy metals, shipping routes, and tourists activities) that disturb the marine habitat in the Gulf of Suez (Mohamed et al., 2023).

PRINCIPAL STAGES OF THE MSP APPROACH

The IOC-UNESCO has identified the main stages of the MSP (See Figure 3). Furthermore, for an effective development of the MSP, stages, steps, and tasks should be achieved successfully (Santos et al., 2019) .

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http://dx.doi.org/10.21622/MRT.2023.02.2.108

Fig. 3. 7 Steps of Effective Development of the MSP Approach
Source: (Santos et al., 2019).

Possibilities of Implementing the MSP Approach in Egypt

Egypt has coastlines on the Red Sea and the Mediterranean (Amin et al., 2020). Furthermore, Egypt has the River Nile, and marine areas are suitable breeding grounds for different kinds of fauna and flora. In addition, the Red Sea is a safe refuge for about 209 kinds of coral reefs, and it attracts about 14 million tourists annually, providing about 12 percent of the Egyptian GDP.

The Suez Canal is the link between Europe and Asia, with about 12 percent of the world's seaborne trade passing through it annually (World Bank Group Report, 2022). Furthermore, Egypt's marine areas are divided into traditional areas, such as shipping routes and fisheries and new areas, such as oil and gas explorations, renewable energy, and fish farms.

Egypt seeks to exploit its marine resources to achieve economic growth, especially after many reasons have led to the collapse of the Egyptian economy in the last decades, such as poor planning in the past, the 2008 world economic crisis, COVID-19 (Soliman, 2023) (Batini & Li, 2023), and the Russia-Ukraine war in 2022. Therefore, managing the marine resources under a well-structured MSP approach will enable Egypt to achieve the SDGs and safeguard the marine environment.

The country would secure the necessary funding and resources for implementing the MSP approach, where the majority of governments that implement the MSP rely on direct budgetary allocations from general taxes or fees tokens. Alternative sources of funding can include, among others, grants from foundations, funds from the private sector, collaborations with non-governmental organizations, and grants and donations from international and multinational organizations (Alder et al., 2022).

About 70 countries use MSP as a tool to manage their marine territories. Successful examples include Australia's Great Barrier Reef Marine Park zonation, Germany's North and Baltic Seas plans, and Rhode Island's Special Area Management Plan. Currently, 22 countries have approved the MSP (Johnson et al., 2020).

Egypt has put much efforts into achieving the environmental targets outlined in its 2030 Vision. However, some barriers hinder Egypt from implementing the MSP approach, including financial arrangements and a lack of private sector interest in investing in the marine sector. Moreover, environmental data are scarce due to a lack of enforcement of some environmental regulations and inadequate environmental monitoring along the Egyptian coasts; for instance, marine pollution of some heavy metals near Hurgada, Safaga, Alqusier, and Marsa Allam on the Red Sea (Nour & Nouh, 2020).

THE MSP APPROACH IMPLEMENTATION REQUIREMENTS IN EGYPT

Delimitation of the Egyptian Maritime Borders

The East Mediterranean has nine countries with about 17 maritime boundaries. Additionally, the Suez Canal has gained the East Mediterranean strategic importance due to its key role in facilitating international seaborne trade. In addition, the Eastern Mediterranean has political concerns because of the traditional Arab-Israeli conflicts and the historical Turkey-Greece-Cyprus conflicts. Furthermore, at the beginning of the 2000s, according to estimated figures, the East Mediterranean region had about 122 trillion cubic feet of oil and gas reserves, thus, the Eastern Mediterranean region has transformed to an economic region (Ketenci & Sevencan, 2021).

According to the 1982 UNCLOS Convention, the coastal states have exploitation rights over living and nonliving marine resources in an area extending to 200 nm from the baseline., while delimitating maritime borders in the East Mediterranean is quite complex because the distance between the opposite two countries is less than 400 nautical miles. Furthermore, according to the equidistance principle of the UNCLOS

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ISSN 2812-5622
http://dx.doi.org/10.21622/MRT.2023.02.2.108

1982 convention which regulates marine boundaries, a state's marine boundaries must follow a median line that is equidistant from its neighbours' shores. Egypt signed two agreements, the first with Cyprus in 2003 and the second with Greece in 2020, as a result of new explorations of gas fields and as a result of the memorandum between Libya and Turkey about demarcating their maritime borders in 2019 (Koukakis, 2022) (See Figure 4).

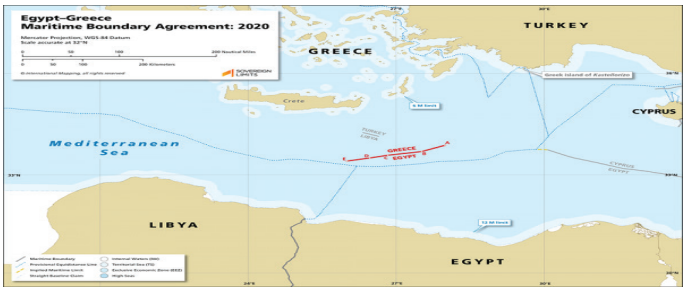

Fig. 4. Egypt and Greece, Equidistance Principle 5 Points (a,b,c,d,e).

On the other hand, Egypt's Red Sea maritime borders are not delimited with any of the Red Sea countries; only Egypt signed an agreement with Saudi Arabia (Tiran and Sanafir Islands) in 2016, but they are still not delimited yet.

Adoption and Implementation of Satisfactory Lawful and Policy Foundations

There is no mention of adopting the MSP initiatives in the EEAA agenda, and there is no clear strategy or set of rules for the MSP approach initiative's implementation in Egypt. As part of the national blue economy strategy, a coordinated MSP is also a priority in the Gulf of Suez to coordinate and manage multiple activities such as oil extraction, coastal tourism, maritime transport, and port infrastructure through effective planning, coordination, and sustainable use of marine resources.

Coordination and Integration amongst Various Sectors

The MSP approach is a new concept (Papageorgiou, 2016), and only a few developed countries have already implemented it. That is why there is a need to establish a specialized entity responsible for applying the MSP approach. In addition, blue growth is the driving force behind implementing the MSP approach and coordination between various marine sectors is required to bring new ideas for solving issues and increase the exchange of information between different sectors (Alder et al., 2022).

The institutional capacity in Egypt is centralized in a few institutions, such as the ministry responsible for addressing climate change impacts, the Ministry of Environment, and the Ministry of Petroleum, which is responsible for energy efficiency (World Bank Group Report, 2022). While, The MSP's primary goal is to improve cooperation between various sectors, stakeholders, and government institutions in order to enhance ocean governance (Finke et al., 2020) .

Availability of Data and Information to Maritime Resources

The MSP approach is based on science and management. Therefore, decision-making uses strong and trustworthy evidence when dealing with marine spatial policies, while this evidence is generated from a mixture of the most reasonable functional data utilized with the appropriate means for management options (Alder et al., 2022). Moreover, the availability of data plays a vital role in taking appropriate decisions by competent authorities in dealing with marine issues, but the availability of data is limited in Egypt and depends on people's knowledge (Negm, 2022). Thus, the final condition has yet to be fulfilled as competent authorities do not have enough information and limited data regarding marine issues (El-Magd et al., 2021).

LEGAL REGIME FOR THE MSP APPROACH IN EGYPT

The analysis of UNCLOS and other international and regional conventions results in the finding that international law permits coastal states to engage in MSP, subject to many limitations. In addition, the UNCLOS divides the ocean into jurisdictional zones including territorial water, contiguous zone, exclusive economic zone, and continental shelf, and it is not necessary to implement the MSP in each jurisdictional zone. However, the state's right decreases with distance from the shore, and third parties have rights to lay pipelines, cable, and shipping. Moreover, some developed nations, including the UK, Germany, and the Netherlands, have firmly incorporated MSP into their national law systems. In addition, Germany was the first country to extend the federal spatial planning act from the land to the EEZ (Drankier, 2015).

Environmental matters in Egypt are governed by Law No. 4 of 1994 as amended in 2015. This law entitles the Egyptian Environment Affairs Agency (EEAA) to design and prepare the general policy for protecting and promoting the environment and review the implementation of such plans.

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ISSN 2812-5622
http://dx.doi.org/10.21622/MRT.2023.02.2.108

Discharging marine pollutants are not allowed for ships in Egypt's territorial waters. Additionally, the environmental law imposes severe fines on those who violate the regulations and offers incentives to those who implement the environmental protection provisions. While, commercial ships and tankers, oil rigs and other sources of marine pollution have breached the environmental law, due to the absence of satellite monitoring and aerial surveillance in the northern Red Sea region (Elbeih et al., 2020).

The environmental law provisions demand a licence to exploit any marine resources inside Egypt's territorial waters and exclusive economic zone (EEZ). Moreover, if the competent authority is convinced that the permitted processes will not harm marine resources and the environmental impact assessment EIA is approved, authorization is given. In addition, the marine regions regulations specify the specific requirements that must be met for the permission to be granted.

This law demands the implementation of protection standards in the region to guard marine living and non-living resources against indiscriminate exploitation, depletion, or demolitions where reservation areas in the Economic Zone are clarified under the Marine Areas Regulations.

The main targets of the marine environment regulations are to mitigate and prevent pollution. Moreover, the rules of marine environment protection could be extended to include both the protection of the marine environment and the development of the MSP approach because the MSP approach's regulatory system controls human impacts on the marine environment in marine areas either those under national jurisdiction or those beyond national jurisdiction (UNEP-WCMC, 2019).

Egypt showed dedication to establishing environmental sustainability priorities at the national and international levels, but environmental sustainability is still challenging to achieve and calls for a long-term commitment requiring concerted efforts. Egypt created the national committee for sustainable development to carry out the National Environmental Action Plan (NEAP), which sets the country's environmental priorities.

The EEAA can be the driving force behind the development of the MSP approach in Egypt because in some countries, such as Australia and Poland, the environment and energy sector is responsible for its implementation. On the other hand, the current legislative framework for marine environment protection in Egypt has many defects and does not include the MSP approach. While, there are some remedial actions to promote the current legislative framework via establishing a new legislation that is entirely dedicated to the MSP, following the South Africa approach, or by modifying current legislation to accommodate the MSP (Finke et al., 2020). In addition, establishing the MSP initiatives in Egypt should be delegated to a nominated authority via an institutional body.

In order to better support the MSP strategy and make its execution easier, there is a need for a clear legal framework to deal with environmental challenges in marine regions that have been increased from baseline to EEZ. In addition, a regional collaboration is needed to govern surrounding marine areas in light of their social, economic, and environmental conditions. However, it is difficult to reach a joint decision due to differences in national objectives, governance, transparency and regulations. These discrepancies may be mitigated by encouraging stakeholders to share trustworthy data and using technologies for data collection in order to identify future advancements in the marine sectors and spatial requirements. When feasible, regional states may also modify their laws while still acknowledging their differences.

CHALLENGES IN IMPLEMENTING THE MSP APPROACH IN EGYPT

Implementation of the MSP in Egypt faces some current and upcoming challenges (See Figure 5), and they need effective solutions for marine resources sustainability.

Fig. 5. Major Challenges in Implementing the MSP
Source: (UNEP-WCMC, 2019), (Santos et al., 2018).

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ISSN 2812-5622
http://dx.doi.org/10.21622/MRT.2023.02.2.108

STAKEHOLDERS' ENGAGEMENT IN THE MSP IN EGYPT

According to UNESCO, for a successful MSP approach, the stakeholders and their conflicts must be determined. The MSP approach cannot commence without the stakeholders' engagement and the stakeholders are persons or organizations that are involved in or influenced directly or indirectly by activities related to the exploitation of marine resources. One of the three fundamental groups listed below can be used to classify stakeholders (See Figure 6) (Perry, 2019). Moreover, the aim of stakeholders' engagement is to enhance the desired outcomes of the MSP approach through scientific-based decisions and to enhance the efficiency of management levels.

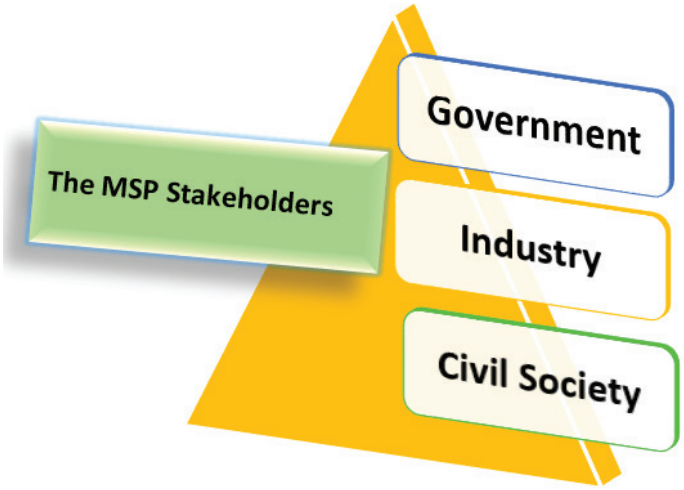

Fig. 6. The MSP Stakeholders
Source: (Perry, 2019).

Civil Societies

The civil society includes people, academics, and non-governmental organisations. Additionally, their involvement in all MSP stages is crucial, especially during stage zero or the pre-implementation, to ensure that social-level plans and political objectives are compatible (Lukambagire, 2019).

NGOs

The NGOs have knowledge and expertise regarding marine environment protection and management, so their engagement in the MSP process can bridge the knowledge gap in developing countries regarding the development and implementation of the MSP approach and mitigate conflicts between stakeholders (government, civil society, and marine industries). Moreover, the representatives of the NGOs are concerned about the people's needs and their future visions, so they provide the government with feedback about potential decisions and alternatives when setting the MSP plan. In addition, there are some NGOs which actively work in marine environment protection in the Red Sea such as HEPCA (Hurgada Environmental Protection and Conversation Association).

The Government

The government develops and implements the MSP process. Moreover, the government saves funds for the MSP process and detects the desired goals when setting the long-term or short-term agenda. Furthermore, citizen benefits and environmental protection are the government's responsibility. The government's role in the MSP approach is to identify the stakeholders and arrange meetings or seminars to encourage them to be involved in the MSP approach. There are two types of conflicts: user-to-user conflict and user-to-marine environment conflict. Therefore, stakeholders' engagement in all MSP stages is essential to resolve these issues. While, potential barriers that government could face, such as finances constrain the government's capacity for planning and implementing the MSP. However, with financial and technical support from foreign partners, government professionals and experts will be encouraged to dedicate their attention and time to MSP as a financed activity.

Industry Stakeholders

Commercial stakeholders include shipping, fisheries, aquaculture, renewable energy, and exploration of oil and gas. Also, industry sectors are crucial to the MSP planning process since they have significant influences on commercial activities in marine zones. Furthermore, their participation in the MSP is crucial for providing the government with essential economic data, demonstrating the scope and breadth of the industry, and aiding in attaining people's welfare and the marine environment conservation (Eliasen et al., 2021). Moreover, they present advice to the government that helps it take appropriate decisions and develop alternative visions (Zaucha & Gee, 2019).

Despite the planners' best efforts, commercial stakeholders can refuse to participate, and they have a preference to look for direct and quick profits and work on entirely different timetables than the MSP process. Since the MSP is an iterative approach that takes time, this emphasizes the necessity to promote the MSP process to the business community well before the planning starts (Eliasen et al., 2021).

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ISSN 2812-5622
http://dx.doi.org/10.21622/MRT.2023.02.2.108

DATA MANAGEMENT FOR THE MSP APPROACH

Available Data in Egypt

The Egyptian Environmental Affairs Agency (EEAA) provides data related to marine regions and stakeholder engagement. Furthermore, some sectors keep and save their data, such as fisheries, aquaculture, marine environment protection, and oil and gas. This, in addition to the Environmental Information System (EIS) used by the EEAA to gather, organize, store, and analyse environmental data. Additionally, it is used for different objectives, for example environmental management and protection.

The MSP Data Management

According to UNESCO-IOC/European Commission (2021), before starting any data collection or subsequent reviews for MSP, the scale of planning must be determined because it directly affects the type and resolution of the data needed. Moreover, the scale of the plan should also consider the following four aspects: the political-administrative structure of neighbouring territories; the distribution and dynamics of marine ecosystems; the international legal framework controlling marine waters; and a variety of maritime human activities such as fish farms shipping lines, and oil and gas explorations.

The World Bank (WB), FAO, IMO, UNESCO, and other regional or specialised United Nations organizations are just a few examples of sources from which data can be gathered. Furthermore, the necessary information can be acquired through sources including academic publications, professional scientific judgement, governmental sources, local knowledge, and real-field measurements. Moreover, several technologies are available today, such as online web-mapping or decision-support tools like SeaSketch that helped marine planning in Canada and Adobe GeoPDF in the Seychelles.

However, developing new marine data systems can be costly and time-consuming. Moreover, in cases where data are scarce, participatory mapping might be a useful and less expensive starting point. Even when plenty of data are available, participatory mapping is typically still necessary.

There are three main types of spatial information that are relevant for the MSP process: the geographic and biological distributions for a specific species or biological community, information regarding human activities in space and time, and ambient physical characteristics related to the ocean (bathymetry, currents, and sediments).

Monitoring and Evaluation

Monitoring and evaluation are crucial to building management skills during the MSP process. So, the MSP process includes creating a body for these tasks. Since then, they have been instrumental in improving the adaptability and efficiency of the (GBRMP)'s MSP implementation (Alam, 2020). In addition, there are two types of monitoring: long-term and short-term. The long-term is useful in sustaining marine resources and addressing the cumulative impacts of unexpected consequences such as climate change and eutrophication. However, it is expensive. While people who work in the fishing, tourism, and petroleum industries can benefit from short-term monitoring of the MSP process (van den Burg et al., 2023).

According to Schwartz-Belkin and Portman (2023), policies that depend on geospatial technologies such as Global Position System GPS, Geographic Information System GIS, and remote sensing in monitoring could be more precise and comprehensive and these monitoring tools such as:

1- Remote Sensing Satellite: it provides large-scale and current data on sea surface height, temperature, salinity, and colour of ocean water which are translated into suspended solids, turbidity, and chlorophyll-a concentration. Moreover, it is used to classify shallow benthic ecosystems like coral reefs and seagrass meadows and to identify regions suitable for aquaculture. Moreover, Visible Infrared Imaging Radiometer Suite (VIIRS) can identify night time fishing, and monitor light pollution. Synthetic Aperture Radar (SAR) satellites offers 24-hour observations regardless of the amount of light or weather. Moreover, it detects objects on water surfaces, for instance ships.

2- Vessel Monitoring Systems (VMS): VMS is a system used only in commercial fisheries sectors to identify, position, and movement of fishing vessels to the nation's fisheries regulatory authorities. In addition, it prevents unauthorized use of commercial fishermen's fishing grounds by other fishers, the VMS data is private. Moreover, VMS transmits a position signal once per 1-2 hours, while, the Automatic Identification System (AIS): the position, course, and speed of the vessel are all included in the AIS message. Furthermore, depending on the ship speed, the

AIS messages are sent every 2 to 3 minutes. The AIS signal travel between ship-to-ship or ship-to-shore within VHF radio range. Moreover, Satellite- AIS (S-AIS) the detection of S-AIS signals have the advantage that they go beyond the VHF range. The European Commission requires all fishing ships more than 12 meters to install VMS and all ships more than 15 meters to install AIS on board. Moreover, the IMO requires installing AIS on all passenger ships and cargo ships engaged in international voyages with a gross tonnage of more than 300. Therefore, data from vessel tracking can be used to identify conflicts and compatibilities with other human activities and environmental concerns.

3- Animal bio-telemetry: tiny tags are attached to the marine species and they track marine species' positions, movements, and transmission of data to distant sites, As a result, they monitor marine species without human interference or modifications. Moreover, delineating conservation zones is made easier and more accurate with the help of telemetry data. Therefore, combining telemetric data with vessel-tracking data can provide a better understanding of the interactions between marine mammals and humans.

4- Passive Acoustic Monitoring (PAM): it monitors marine mammals in all weather conditions and quantifies deep water foraging. Moreover, it targets specific animals for their seasonal habitat, reproduction, and fish population. While, Passive eco-acoustic monitoring detects all physical parameters, biological, and geophysical (wind, rain, and wave). It also compares between marine species in or out the marine protected area over time. Moreover, it identifies all noise from human activities such as seismic surveys or shipping.

5- Active Sonar (Sound Navigation and Ranging): acoustic sonar is used to determine the water's depth and the bottom type (sand, mud or gravel). In addition, it is used extensively to identify fish groups underwater and to keep dolphins away from fishing nets as well as for habitat mapping and exploration, nekton detection, and other purposes. In contrast, passive acoustics are used to find acoustic signals omitted from the marine environment and to monitor fish populations.

6- Unmanned air and sea vehicles: unmanned platform carries Sonar, hydrophones for recording sound, cameras, or sensors for environmental data collection. Moreover, Aerial Unmanned Vehicles AUVs, such as gliders, are equipped with hydrophones to identify marine mammals' communication, and they can monitor and give warning of the location of wildlife. While in Egypt there is no VMS to monitor about 5000 fishing boats (Kamal, 2020) and using the Remote sensing and GIS for monitoring marine habitat and shoreline changes in the Red Sea (Darweesh et al., 2021) and shoreline changes in the Mediterranean (Hammad et al., 2022).

THE BENEFITS OF APPLYING THE MSP APPROACH

According to Alam (2020), the benefits of applying the MSP approach are:

1- It offers an integrated process for managing human activities in the ocean to protect economic, environmental, and social interests. By assigning space and regulating human activities, for instance, the strategic goal behind the Barents Sea Integrated Management Plan is to promote oil and gas production (Bambulyak et al., 2022).

2- It permits various human activities to discover marine resources while maintaining a high environmental protection standard.

3- It provides a strategic and proactive strategy, which enhances maritime management in different socioeconomic, environmental, and administrative ways.

4- It emphasises coordinated networks of institutions at the local, national, and international levels.

5- It provides a foundation for deciding where certain activities can or cannot occur inside a specific zone.

CASE STUDY

The Great Barrier Reef Marine Park (GBRMP) is the world's largest marine ecosystem, with a surface area of 344,400 km2. The GBRMP is also equal to approximately 10% of the total area of coral reefs around the globe. However, in the 1970s, mining, oil drilling, and pollution caused by oil spills and shipping routes caused severe damage to the coral reefs. Thus, the Great Barrier Reef Marine Park Act 1975 (the Act) was established. After that, the Act nominated the Great Barrier Reef Marine Park Authority (GBRMPA)

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to handle management plans such as prohibiting damaging activities and prioritising management and preservation techniques. The GBRMP has adopted the MSP via zoning plans (See Figure 7) to reduce numerous disputes and effectively manage a large marine ecosystem. Moreover, the GBRAP is divided into eight zones, each with a particular set of guidelines for permitted and forbidden activities. In addition, zones may also refer to how activities are conducted, such as fishing activities via commercial or recreational fishing.

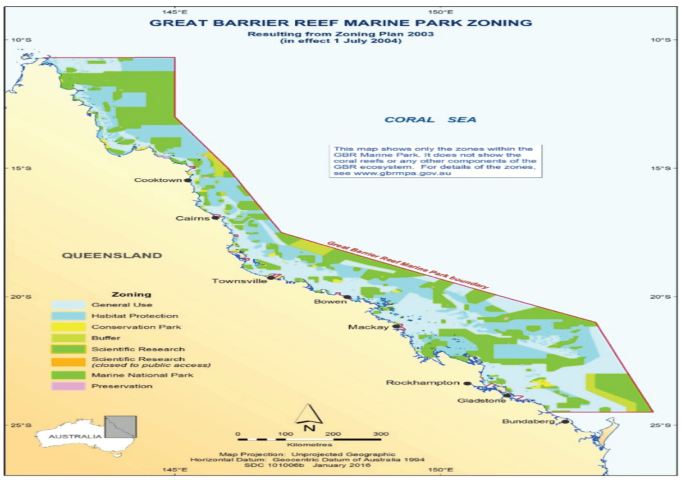

Fig. 7. the Eight Zones of the GBRMP
Source: (Bode & Day, 2020).

However, the effective implementation of the MSP needs political and financial support, participation of stakeholders from the outset of the process, and the availability of data (Alder et al., 2022).

Climate change impacts, particularly ocean acidification, runoff, overfishing, and coastal development, all of which cause severe damage to the GBRMP ecosystem. Thus, new tools are required to thoroughly understand the spatial and temporal dynamics of marine species and ecosystems in order to apply EBM in the GBRMP. These instruments include telemetry, modelling, genetic techniques, geographical analysis, remote sensing, and quantitative analysis (Hassan & Alam, 2019). However, due to the disparities in socioeconomics conditions and marine ecosystems, the GBRMP management plan cannot be immediately used in other countries (Flannery & McAteer, 2020).

Moreover, the MSP is being implemented in some developing countries such as Seychelles for three main reasons: to develop the Blue Economy, address climate change adaptation, and enhance the percentage of protected marine waters to 30%. However, there are scepticism and concerns that may exist regarding the MSP approach's implementation because, in actuality, it is more focused on fundamental ideas in ecosystem management than it is on environmental challenges.

On the other hand, the Gulf of Suez (GOS) extends for 300 kilometres. Moreover, this region has abundance of coral reefs and marine life adds to its economic significance. In addition, 85 percent of Egypt's total crude oil production comes from the GOS, the country's principal source of crude oil. However, the marine environment, coral reefs, islands, coastal regions, and beaches in Egypt are seriously threatened by shipping activities and offshore oil and gas development and production (Abdallah & Chantsev, 2022). Therefore, applying the MSP approach in such sensitive marine areas will solve the conflicts between stakeholders of various sectors, and achieve sustainable ocean governance. Furthermore, protecting marine species and biodiversity that benefits people in the Gulf of Suez is necessary for a sustainable blue economy.

DISCUSSION AND RECOMMENDATIONS

For the practical and operational implementation of MSP in Egypt, it is better to promote existing plans rather than construct a new special authority. However, MSP is a continuous and comprehensive approach that should be evaluated regularly depending on its outcomes. The MSP must be evaluated every five years in most conditions to examine the desired outcomes in different ways and assure the engagement of stakeholders in the planning process from the beginning.

The MSP approach is like ICZM regarding incorporation between different sectors such as marine protection, aquaculture, fisheries, the army, oil and gas exploration, and renewable energy, so they are not designated for only a single sector. Moreover, they deal with human activities, mitigate their impacts, and resolve conflicts either between users or between users and the marine environment (Santos et al., 2019). While the marine area covered by the ICZM is limited and does not cover open-seas areas, territorial waters, or the EEZ,

The MSP approach is a tool like the MPAs dealing with the future sustainability of the marine environment. Moreover, their plans depend on climate change impacts, government policy and agenda, economic growth, and marine stakeholders.

Sound governance is an essential part of succeeding in the MSP process. Thus, the institutional framework must support the MSP approach via a strong legislative policy for it to be a continual process. Moreover, a

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ISSN 2812-5622
http://dx.doi.org/10.21622/MRT.2023.02.2.108

marine zoning plan is important in specifying marine regions for economic benefits or conservation.

Some recommendations that can help decision-makers in Egypt manage the maritime borders excellently are:

- Installation of a dedicated authority for the MSP: it is a way to change the current laws via modifying or a new interpretation of the existing legislations to provide a foundation for the MSP. Moreover, in some countries, such as Australia and Poland, the implementation of the MSP is charged by the Ministry of Environment and Energy, so in Egypt, the EEAA can be the driving force behind implementing the MSP.

- Coordination among multi-sectored bodies especially offshore marine activities such as fishing, wind farms, and shipping lanes.

- Improving institutions' and individuals' competence in marine research will raise public awareness and support MSP implementation.

- Regional collaboration or mutual strategic environmental assessment is needed to identify and address transboundary issues.

- Ensuring a mediation mechanism is available if it becomes necessary to resolve disputes over an area of common interest.

- The formation of a technical and scientific committee to offer guidance and technical support for decision-making, and to review procedures on issues essential to the MSP process.

- The scientific and technological committee could serve as a data repository, guaranteeing the quality and availability of data for the appropriate stakeholders.

- Stakeholders can participate in the MSP process through meetings, seminars, conferences, or consultations.

- Political will may mitigate the lack of financial, technological, and human capacity. Countries' supporting of MSP procedures will ensure the long-term sustainability of the process. If more money is required, it can be obtained from alternative sources.

CONCLUSION

a. In conclusion, the discovery of oil and gas fields in the early 2000s has transformed the Eastern Mediterranean region into an economically significant zone. This prompted the Egyptian government to delineate maritime borders with Cyprus in 2003 and Greece in 2020, underscoring the need for efficient ocean management to harness its blue economy.

b. The MSP approach offers an effective strategy of action for attaining the SDGs, including ending poverty and creating jobs for young people, and marine environment conservation. It serves as a multidimensional management tool for decision-makers, offering a way to address conflicts between users and the marine environment.

c. However, Egypt has yet to fulfil the requirements for implementing the MSP approach in its marine zones. Despite considerable efforts by the EEAA to implement international and national environmental laws, a dedicated authority is necessary to apply the MSP approach in the Egyptian's marine areas successfully.

d. Effective implementation of the MSP initiative hinges on sound policy and a robust institutional framework to resolve disputes among ocean users. Engagement of stakeholders from the outset, demarcation of critical marine areas, and continuous monitoring and evaluation of marine ecosystem components are all integral components of this approach.

e. While ICM is typically applied to marine areas within 2 km of the shoreline, MSP can be extended to broader regions like the EEZ and even ABNJ. In contrast to MPAs, which fail to address the damage to the marine environment in adjacent areas, and the high-cost CCS tool, MSP aims to use the oceans more sustainably and ensure resource efficiency.

f. As such, proactive adoption of the MSP approach is critical to achieving the SDGs and preserving marine resources for future generations.

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