



ΠΑΝΕΠΙΣΤΗΜΙΟ ΠΕΙΡΑΙΩΣ

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**Marine Protected Areas as tool for the protection and
conservation of the marine environment**

Marentaki Aglaia

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ABSTRACT

Marine Protected Areas (MPAs) play a critical role in preserving the marine environment, which faces many threats. This scientific paper provides an overview of the current state of the marine ecosystem and the benefits of MPAs¹. The study explores the international and European rules that regulate the creation and maintenance of MPAs, with a focus on the Mediterranean Sea. It explores the relevance of MPAs to the marine ecosystem, including the social and economic benefits and sustainable tourism and fisheries². Examines MPA management and governance, including management incentives, challenges and effectiveness. It also looks at specific management issues such as climate change, pollution, impacts on navigation, unsustainable fisheries and tourism. The example of Greece is used to illustrate the development and management of MPAs in the Mediterranean. This research highlights the importance of stakeholder engagement, multidisciplinary methods and evidence-based decision-making to solve the problems facing MPAs and support successful conservation initiatives³.

Key words: Marine Protected Areas, Conservation, Governance, Management, Mediterranean, Greece.

¹ Zupan et al., 2018

² Di Franco et al., 2020

³ Zupan et al., 2018

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Introduction

The importance of marine protected areas (MPAs) for the conservation of marine biodiversity and ecosystem services has been recognized. The growing global demand for MPAs reflects a growing awareness of the importance of healthy oceans and the need to protect them⁴. However, the creation and management of MPAs faces many challenges, including political, social and economic barriers. Effective MPA planning and implementation requires evidence-based decision-making, stakeholder engagement and multidisciplinary approaches that take into account ecological, social and economic factors⁵.

The maritime environment is essential to the survival of all species on Earth. It offers food, oxygen, and other necessities for human existence in addition to many other ecological services. The maritime ecosystem is, however, seriously threatened by a multitude of human activities, including overfishing, pollution, habitat loss, and climate change⁶. These dangers have altered marine ecosystems and led to a decline in marine biodiversity and ecological services. Given the status of the marine ecosystem today, it is crucial to act right away to safeguard it⁷. The maintenance of the ecological processes and biological variety of the maritime environment is made possible by MPAs. An MPA is defined as any area of intertidal or subtidal land, together with overlying waters, and associated flora, fauna, historical, or cultural features that has been negotiated by law or other effective means to protect part or all of the enclosed environment, according to the International Union for Conservation of Nature⁸. MPAs may range from locations with little to no human population to entirely unlimited no-take zones. Protecting and preserving marine biodiversity and ecological services is the main goal of MPAs. The benefits of MPAs are well acknowledged. They advocate for the preservation of ecosystems and habitats, the defense of marine species under risk of

⁴ Tonin, 2018

⁵ Marcos et al., 2021

⁶ Issifu et al., 2022

⁷ Kelaher et al., 2015

⁸ Tonin, 2018

extinction, and the upkeep of ecosystem services⁹. MPAs can also promote scientific understanding, provide educational opportunities and help sustainable fisheries and tourism.¹⁰ In addition, by storing carbon, maintaining ecological resilience and reducing the vulnerability of the coastal community, MPAs have the ability to reduce and adapt to climate change¹¹.

MPA creation and administration are governed by international and regional treaties and agreements. A significant international agreement that offers a legal framework for the preservation and wise use of the oceans is the United Nations Convention on the Law of the Sea (UNCLOS). The Convention on Biological Diversity (CBD) offers guidance on the creation and maintenance of MPAs and acknowledges the significance of MPAs for the preservation of biodiversity¹². The Barcelona Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean is a regional agreement that aims to protect the marine environment and promote sustainable development in the Mediterranean. The European Union has also passed laws to set up and regulate MPAs in its Member States. The creation and administration of MPAs, however, confronts several challenges¹³. Lack of political will, insufficient money, weak scientific knowledge, problems with already-existing human activities, and insufficient funding are a few of them. The creation and administration of MPAs need the active participation of stakeholders¹⁴. Local communities, fishermen, tour operators, NGOs and government agencies are examples of stakeholders¹⁵. Stakeholder involvement in MPA planning and management can enhance support and promote successful conservation goals¹⁶.

Effective management and governance of MPAs is essential to achieve conservation objectives. MPAs can be established, managed and monitored in a transparent and accountable manner through effective governance¹⁷. Governance style, incentive

⁹ Issifu et al., 2022

¹⁰ Keller et al., 2009

¹¹ Marcos et al., 2021

¹² Keller et al., 2009

¹³ Kelaher et al., 2015

¹⁴ Keller et al., 2009

¹⁵ Marcos et al., 2021

¹⁶ Issifu et al., 2022

¹⁷ Marcos et al., 2021

structures and management effectiveness are just some of the variables that influence how successful governance is. For MPAs to be successful in the long term, effective governance is vital¹⁸. Effective MPA management requires the use of many planning techniques, including connectivity, management and marine spatial planning. Climate change, pollution, impacts on navigation, unsustainable fisheries and tourism are just some of the management issues that need to be addressed¹⁹.

¹⁸ Keller et al., 2009

¹⁹ Marcos et al., 2021

CHAPTER I.

THE CONSERVATION OF THE MARINE ENVIRONMENT:

1.1 CURRENT STATE OF THE MARINE ECOSYSTEM

Comparatively to the usage of protected areas for land conservation and resource management, the preservation of marine regions is a comparatively new global movement. 97% of the water on Earth is found in the seas, which also cover 70% of the planet's surface. In addition, they control temperature, create a huge amount of the oxygen in the atmosphere, absorb a big portion of the carbon dioxide, and replenish land and ocean freshwater supplies via cloud formation. The bulk of life on Earth, including almost all major forms of animals, plants, and bacteria, may be found in the oceans, which make up more than 90 percent of the planet's biologically favorable environment. The ecosystem of aquatic life is essential to the operation of our planet. The seas produce food, offer leisure activities, and boost country economies by billions of dollars.

Significant efforts have been undertaken recently to create marine protected zones all around the globe (MPAs). The necessity to appropriately manage our use of the coastlines, seas, and oceans in order to preserve economic and environmental sustainability is becoming clearer. There is a growing realization that protecting typical marine ecosystems, rather than seeking to save individual vulnerable species or distinctive or picturesque places, is necessary for the successful conservation of the sea (Day and Roff, 2000). This strategy must be used in offshore seas, the open ocean, coastal, and near-shore regions in order to be successful in conserving marine biodiversity.

Marine protected areas should be recognized as essential tools, in particular, to preserve the health of the marine environment and, generally, to prevent and confront the common global problems that threaten it, due to the importance of the

marine ecosystem, its increasing deterioration, and the inadequate management of its resources and habitats. The fact that less than 1% of marine biodiversity is protected inside MPAs and that only a portion of that percentage is adequately maintained draws attention to the ecosystem's fragility.

According to the Global Biodiversity Outlook²⁰, MPAs cover about 0.5% of the total ocean area and 5.9% of the territorial seas (up to twelve nautical miles from the coast), while the high seas and seabed are unprotected and openly exploited, due to the lack of regulation and adequate management of these areas, resulting in an obstacle to the establishment of MPAs outside state jurisdiction.

However, just 18% of the 232 marine ecoregions²¹ have safeguarded at least 10% of their marine ecosystems. In this context, the Parties to the Convention on Biological Diversity (CBD) formed the CBD Strategic Plan with the purpose of effectively preventing the loss of biological diversity to ensure its continued use and exploitation through the conservation and sustainable use of its components. This target was part of the global objective that sought a significant reduction in biodiversity loss by 2010²².

However, the deadline for this target agreed by the States Parties to the Convention on Biological Diversity has been missed²⁰ and even the main pressures causing biodiversity loss are not only constant but, in some cases, continue to intensify. This situation has prompted the international community to rethink the development of a new strategic plan for biological diversity, considering a long-term vision and short-term targets to help achieve it²³. These targets, known as the Aichi Targets, range from promoting the application of an ecosystem approach to

²⁰ Global Biodiversity Outlook is the flagship publication of the Convention on Biological Diversity. Drawing on a range of information sources, including National Reports, biodiversity indicators information, scientific literature, and a study assessing biodiversity scenarios for the future, the third edition of Global Biodiversity Outlook (GBO-3) summarizes the latest data on status and trends of biodiversity and draws conclusions for the future strategy of the Convention. Secretariat of the Convention on Biodiversity. (2010). Global Biodiversity Outlook Three. Montreal: Convention on Biological Diversity.

²¹ World Wildlife Fund (WWF). Available online at: <https://www.worldwildlife.org/biomes>

²² Conference of the parties to the Convention on Biological Diversity at its sixth meeting. The Hague, 7-19 April 2002. Available online at: <https://www.cbd.int/doc/decisions/cop-06/full/cop-06-dec-en.pdf>

²³ Conference of the Parties to the Convention on Biological Diversity, Tenth meeting on the Strategic Plan for Biodiversity 2011-2020, Aichi Targets, Nagoya, Japan, 18-29 October Available online at: <https://japan.iclei.org/wp-content/uploads/2021/08/cop-10-1-23-en.pdf>

the management of the marine environment, the establishment of representative MPA networks and the restoration, where possible, of overexploited fish stocks to their maximum sustainable yield by 2015.

This panorama poses challenges for improving legal tools aimed at the effective protection of marine biodiversity, on a broader, more precise and cooperative scale. For this reason, this Chapter first analyzes the current state of the marine ecosystem based on its social, economic and environmental importance; the threats that hinder its balance and proper environmental protection; and the fragility of the common goods it encompasses. Finally, in the second place, the opportunity to establish MPAs as a necessary protection and conservation technique.

1.1.1 The importance of the marine environment

Marine biodiversity is essential for maintaining the planet's living conditions and the economic activities that have traditionally been the basis of human societies, so that the functions it performs, especially environmental and socio-economic, are intrinsically related²⁴. For this reason, it is of particular interest to address some of the most important functions of the marine environment, namely, environmental, socioeconomic, industrial, commercial, and socio-cultural. commercial and socio-cultural.

From an environmental point of view, the marine environment contributes to the removal of carbon from the atmosphere and the supply of oxygen, which are key factors in climate regulation. This function is performed via a process known as "ecological pumping", which consists of a complete cycle of synthesis and regeneration²⁵. This process, in turn, includes a physical and a biological pumping, both of which have the capacity to temporarily store a large part of the anthropogenic carbon dioxide (CO₂) released into the atmosphere.

The "physical pumping" works through the thermal circulation of the oceans, which starts in the polar regions where seawater cools, increasing its density

²⁴ Deke, 2008.

²⁵ Norse, 1993, pp. 25-29.

and salinity (Figure 1). This causes the formation of ice, which, on the one hand, manages to capture a large amount of CO₂ and, on the other, is submerged to the ocean depths. Once that happens, this "water mass" flow begins a journey of at least 80,000 kilometers towards the intertropical zones, sucking in a fraction of the carbon dioxide gas from the atmosphere²⁶. In the intertropical zones, the seawater warms up, losing density and becoming supersaturated in CO₂, which is released into the atmosphere, and then the water continues its journey to the polar regions where this cyclical process restarts.

The socio-economic function of the marine environment has been perceived since ancient times as a provider of nutrients, in the form of fish and shellfish, being an important part of the human diet²⁷. In addition, the potential of marine products and their enzymes provide multiple benefits for the health of the world population; Therefore, it has been necessary to expand the consumption areas²⁸.

In this regard, the Food and Agriculture Organization of the United Nations (FAO) estimated that more than 110 million tons (77%) of world fish production is destined for direct human consumption, and the remaining is used for the production of oils, flours and cosmetics²⁹.

1.1.2 Threats to the marine environment

The risk of absolute loss of species in the marine environment is a latent problem considering the current and potential uses that generate a series of specific threats derived from pollution due to increased maritime transport, fragmentation and destruction of species and their habitats. due to overfishing, exploitation and exploration of the seabed, coastal industrial development, climate change, lack of knowledge and the scarce application of the ecosystem approach³⁰. The increase in maritime transport, especially on the high seas for economic purposes, promoted by industrial and fishing fleets, and the expansion to other continents under

²⁶ Koslow, 2007.

²⁷ Downes and Fontaubert, 1996.

²⁸ Ibid.

²⁹ FAO, 2009.

³⁰ Sobel and Dahlgren, 2004.

defensive/offensive actions, such as the extension of military activity, constitute one of the most worrying threats to the marine environment³¹.

All these activities directly deteriorate the marine environment, through pollution by persistent waste such as plastic, toxic spills (accidental or deliberate), noise pollution, habitat destruction due to waste sedimentation³² and the introduction of native organisms by ballast water discharges.

Another threat, which contributes to the loss of biodiversity in the marine ecosystem, is the fishing activity. The overexploitation of fishing areas endangers the reproduction of habitual and new species. Intensive exploitation often includes the use of illegal and harmful techniques, such as driftnets and bottom trawls, which increase the fragility of the marine ecosystem³³. In this regard, the FAO indicates that a total of 80% of world fish populations are fully overexploited, and a growing number of marine species are threatened or endangered³⁴.

The physical destruction of the coast and, consequently, of marine habitats is another impact on this ecosystem and is attributed to coastal development, which includes uncontrolled tourist activities and coastal urban development projects and associated infrastructures. The most notorious effects of these activities are the reduction of light penetration and the covering of the seabed with materials that are deposited, whether by urban wastewater or industrial discharges, preventing photosynthesis. These telluric activities negatively affect primary marine production, representing a disturbance to the balance of the marine ecosystem by altering its flora and fauna³⁵.

In addition, indirectly, climate change, the lack of knowledge about the marine environment, the scarcity of economic resources and the absence of an ecosystem approach in the different attempts to protect the marine environment are other threats that increase the alteration of this ecosystem³⁶. In this context, the

³¹ Kirchner, 2003.

³² Molenaar, 1998.

³³ Warner, 2009.

³⁴ FAO, 2009.

³⁵ Cicin-Sain, 2003.

³⁶ Deke, 2008.

forecast increase in global temperature is a cause for concern. A factor that represents a variation in oceanic conditions and processes and, potentially, a rise in sea level, ocean acidification, loss of biodiversity, melting of polar ice, and the increase in number and intensity of natural disasters. The repercussions of these phenomena are serious for marine-terrestrial systems and put at risk not only the territory, but also the economic, social and environmental capital of the region. economic capital, natural resources and human life.

1.2 MARINE PROTECTED AREAS

In 1946, the International Convention for the Regulation of Whaling was signed, and it was the International Whaling Commission's (IWC) founding document. This was the first international environmental law to propose Maritime Protected Areas. Article 5 proposes, among other laws, the delineation of open and restricted regions and the layout of sanctuaries.³⁷ Traditionally, however, in the island countries of the Pacific (Polynesia, Melanesia, Micronesia), for centuries it was customary to close areas for the fishing, especially in areas that were overfished or where breeding grounds were in detected³⁸.

While the use of spatial and/or temporal closure has a long history, the new dynamic behind Marine Protected Areas deviates from traditional logic by focusing on the need to provide protection beyond spawning grounds and areas that are critical to the life cycle of marine populations³⁹. The next years, many scientific papers propose Marine Protected Areas as an alternative and helpful way to preserve and increase fishery production⁴⁰.

The IUCN organized the first conference on marine protected areas in Tokyo in 1975⁴¹. The report of this conference called for attention to the increasing anthropogenic pressures on the marine environment and proposed the creation of a

³⁷ International Convention for the Regulation of Whaling, 1946

³⁸ Johannes, 1978a

³⁹ Sanchirico, 2000.

⁴⁰ Roberts and Polunin, 1991; Sobel, 1996; Roberts, 1997; Lauck, Clark, Mangel and Munro, 1998.

⁴¹ IUCN, 1976.

well-monitored MPA network that represents the world marine ecosystem⁴². By extension, there was a need to define what constitutes a Marine Protected Area. The International Union for Conservation of Nature⁴³, until 1999 used the following definition:

“Any area of intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment”⁴⁴.

This definition was eventually replaced with a less specialized (for marine areas), but clearer:

“A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values”⁴⁵.

Today there are approximately 5,000 Marine Protected Areas worldwide and many fall into one or more categories according to IUCN. Nevertheless, the application of the classification in the marine environment is often inaccurate. In addition, in cases where the protected areas cover both land and sea, objectives for the marine area are often not considered when classifying the area in a category (Dudley, 2008). This results in the existing number of MPAs not covering the needs for the protection and preservation of the environment.

The results of a study⁴⁶ carried out on the MPAs of the Northwest Mediterranean, showed that the success of an MPA and its continuity over time depends on the number of people and the quality of the management team, their ability to work in suitable conditions, as well as by the level of enforcement of the measures⁴⁷. MPAs should be considered in the wider context of the whole ecosystem and their design should take into account the habitat and life

⁴² Committee on the Evaluation, Design, and Monitoring of Marine Reserves and Protected Areas in the United States Ocean Studies Board Commission on Geosciences, Environment, and Resources National Research Council, 2001.

⁴³ IUCN, 1998.

⁴⁴ Kelleher, 1999.

⁴⁵ Dudley, 2008.

⁴⁶ Abdulla, Gomei, Maison and Piante, 2008.

⁴⁷ Francour, Ganteaume and Poulain, 1999.

requirements of the species of interest, as well as the extent to which these habitats interact at larger spatial scales⁴⁸.

1.2.1 Benefits of creating a Marine Protected Area

The potential benefits of creating MPAs are varied. The protected areas are widely recognized for their value in biodiversity conservation⁴⁹. They provide a social safeguard to avoid the "tragedy of the commons"⁵⁰ and enhance the sense of marine resource management among people who rely most on healthy, unaltered coastlines ecosystems⁵¹.

Marine protected areas, compared to open areas, offer significant direct and indirect benefits to fisheries. Direct benefits include⁵²:

- More fish from increasing production and dispersal of eggs and larvae from larger fish and increasing spawning potential in unused stock.
- Transport of juvenile and adult fish biomass beyond the limits of MPAs in fishing grounds (spill-over effect).
- Protection of genetic quality from harmful effects of fishing.
- Insurance against stock collapse due to fishing or inability to recruit due to natural causes.
- Faster recovery in case of inventory collapse.
- Reduction of the annual variability of fishing landings enabling more consistent recruitment.
- Sustainable fishing for vulnerable species (e.g. species that are rare, change sex, or species where reduced adult density has non-linear, negative effects on fertility).

⁴⁸ Forcada, Bayle-Sempere, Valle and Sanchez-Jerez, 2008.

⁴⁹ Brooks, da Fonseca and Rodriguez, 2004.

⁵⁰ Hardin, 1966.

⁵¹ Agardy, 1994.

⁵² Bohnsack, 1999.

Indirect benefits to fisheries are also important⁵³ because marine protected areas provide:

- Reference sites for determining the impact of fishing on marine ecosystems.
- Monitoring to determine natural versus man-made stock effects.
- Experimental areas with minimal human intervention for fisheries investigations regarding behavior, environmental factors and interactions between species and natural mortality.
- Facilitating the enforcement of legal measures and their implementation.

Recreational boating also benefits from the establishment of an MPA. Owners may use their boats to visit the area for recreational purposes or to engage in specific activities, such as swimming and diving⁵⁴. Several studies e.g. at Port-Cross and in Scandola⁵⁵ show that a significant proportion of yachts choose their destinations because of the existence of a protected area, even if certain activities are prohibited there⁵⁶.

The practice of sustainable tourism in protected areas is a long-term commitment⁵⁷. Many people make a direct living from tourism and practice their profession in the vicinity of an MPA. These people earn most of their income from the frequency of tourist visits to the area, or through the indirect returns that MPAs provide⁵⁸.

MPAs provide a last refuge for endangered species, protect habitats and allow natural bio-communities to develop⁵⁹. The reasons for creating protected areas are varied, but include scientific, economic, cultural and ethical factors. A survey of the literature⁶⁰ on the reasons for creating MPAs, revealed the main reason to be the need to protect local marine resources.

⁵³ Bohnsack, 1999.

⁵⁴ Francour, Harmelin, Pollard and Sartoretto, 2001.

⁵⁵ Francour et al., 1999.

⁵⁶ Francour et al., 2001.

⁵⁷ Eagles, McCool, Stephen and Haynes, 2002.

⁵⁸ Francour et al., 2001.

⁵⁹ Abdulla et al., 2008.

⁶⁰ Boersma and Parrish, 1999.

The contribution of marine protected areas to sustainable development lies in:

- maintaining the functioning of marine ecosystems at the time and geographical scales at which ecological ecosystems function,
- contributing to the management and resolution of disputes over the use of natural resources and guaranteeing that sustainable usage may be realized via collaboration and the development of as many shared interests as feasible.
- establishing the conditions for the development of new, sustainable economic and social activities and green professions. The establishment of a network of Maritime Protected Areas allows the effective use of natural resources on a bigger scale and spreads the effort to restore biodiversity over a greater number of locations.

1.2.2. Marine Protected Areas in the Mediterranean

The Mediterranean is a significant biological region due to the unusual variety found in its waters, the large number of endemic species, and the reproductive zones for pelagic species. In recent years, human pressures have increased, and it is now acknowledged that fishing, pollution, tourism, and coastal development, together with the consequences of climate change, have a substantial influence on biodiversity⁶¹.

A vast number of marine species and ecosystems in the Mediterranean are deteriorated or perhaps threatened with extinction as a result of the non-rational exercise of activities⁶². Threats to Mediterranean marine biodiversity tend to be concentrated in coastal areas and the continental shelf, and involve mainly seabirds, fish and invertebrates in coastal areas⁶³.

Until recently the legal framework was limited to the protection of certain mammals and reptiles. Since the 1990s this framework has been extended to include marine macrophytes, invertebrates, species habitats and macrophyte vegetation

⁶¹ Claudet and Frascchetti, 2010; Coll, Piroddi, Albouy, Ben Rais Lasram, Cheung, Christensen, Karpouzi, Guilhaumon, Mouillot, Paleczny, Palomares, Steenbeek, Trujillo, Watson and Pauly, 2012.

⁶² Abdulla et al, 2008.

⁶³ Coll et al., 2012.

formations⁶⁴. The protection of species is, as can be expected, determined by the protection of their habitats. In 2008, 94 MPAs were counted in the Mediterranean Sea⁶⁵. It should be noted that in many of them the structure, composition and conservation status of the biotic communities present have not been studied. A key question is whether these areas constitute a representative network of marine habitats for the Mediterranean. The answer to this is negative, however, as evidenced by the lack of representation of deep-water habitats and coastal areas of the southern and eastern Mediterranean. Of the total of 94 MPAs, 98.9% are located in northern Mediterranean areas, while only 1.1% are located in the southern Mediterranean, including one MPA in Morocco, two sites in Tunisia and one site in Algeria⁶⁶. Therefore, many large areas are not represented by the present network of MPAs. Furthermore, all MPAs are located in shallow continental areas, with the exception of the MPA "Pelagos Sanctuary", which encloses pelagic and deep-water ecosystems⁶⁷.

The total area of MPAs in the Mediterranean is 97,410 km² or about 4% of the Mediterranean Sea. In this total, if not including the Pelagos Sanctuary (87,500 km²), the area covered by coastal MPAs is only 9,910 km², which represents 0.4% of the total surface area of the Mediterranean. The total area of no-take zones (zones in which any fishing activity is prohibited) in MPAs appears to be 202 km², which represents only 0.01% of the total surface area of the Mediterranean⁶⁸. In the Mediterranean region, as well as globally⁶⁹, the type of protection applied in each MPA varies considerably and reflects the cultural and political differences between countries. The majority of them have been classified as multiple-use marine areas⁷⁰. Multi-use marine areas seek a balance between biodiversity protection and sustainable human exploitation. The designation and management of MPAs in the

⁶⁴ Barcelona Convention, Directive 92/43/EEC.

⁶⁵ Abdulla et al., 2008.

⁶⁶ Ibid.

⁶⁷ Ibid.

⁶⁸ Ibid.

⁶⁹ Wood, Fish, Laughren and Pauly, 2008.

⁷⁰ Francour et al., 2001.

Mediterranean is driven by a range of international, regional and national obligations and initiatives⁷¹.

Monitoring both in ecological and socio-economic terms is not a standard procedure in the Mediterranean MPAs. More than half of the MPAs in the Mediterranean are affected by anchoring, overfishing, invasive plants, noise pollution, solid waste, oil pollution, changes in flora and fauna composition due to climate change and urbanization⁷². Currently, management in most Mediterranean MPAs appears to be inadequate. According to Abdulla et al.,⁷³ the main reasons for this are:

- The lack of a management plan, clear objectives and scope,
- The lack of studies of the socio-economic context of the surrounding area.
- The social and economic environment of the surrounding communities,
- The lack of information on the natural resources that the area is intended to protect or the results of management interventions,
- The lack of human resources and training,
- The lack of financial resources, services, equipment and facilities (offices, boats, visitor centers, diving equipment, GIS),
- Low or absent law enforcement.

Particular attention should be paid to the importance of the management planning of the MPA⁷⁴ and, by extension the lack of management plans in many Mediterranean countries and its impact on the overall implementation of MPAs⁷⁵.

In Greece, research on the management of MPAs reveals⁷⁶, that although the citizens are currently not involved in the management of protected areas, there is nevertheless a preference for more participatory management instruments. According to the same research, there is an apparent positive attitude towards the management of protected areas by local authorities and a distancing from central

⁷¹ Abdulla et al., 2008.

⁷² Ibid.

⁷³ Ibid.

⁷⁴ Francour et al., 2001.

⁷⁵ Abdulla et al., 2008.

⁷⁶ Dimitrakopoulos, Jones, Iosifides, Florokapi, Lasda, Paliouras and Evangelinos, 2010.

government management. Moreover, there is a tendency to support the self-sufficiency of protected areas, such as charging a fee to users and visitors of protected areas combined with the promotion of the purchase of local products⁷⁷, while in previous Greek studies, the most accepted scenario was government funding⁷⁸.

⁷⁷ Dimitrakopoulos et al., 2010.

⁷⁸ Papageorgiou and Kassioumis, 2005.

CHAPTER II.

THE INTERNATIONAL AND EUROPEAN REGULATIONS FOR THE DEFINITION AND MANAGEMENT OF MARINE PROTECTED AREAS

2.1 INTERNATIONAL CONVENTIONS

Marine Protected Areas (MPAs) are crucial for the protection of marine biodiversity and the sustainable management of marine resources⁷⁹. MPAs are defined and administered in accordance with international and European rules.

Principal worldwide and European MPA definition and management regulations:

- **Convention on Biological Diversity (CBD):** The CBD is an international agreement that aims to promote the conservation of biodiversity and the sustainable use of its component elements. The CBD provides suggestions for the establishment and management of MPAs, including the need to address social, economic, and cultural factors.
- **The United Nations Convention on the Law of the Sea (UNCLOS)** is an international agreement that outlines a state's responsibilities in regard to global waterways. The UNCLOS acknowledges the importance of MPAs in maintaining marine biodiversity and provides guidelines for their formation and management..
- **Marine Strategy Framework Directive (MSFD) of the European Union (EU):** This EU regulation intends to improve the environmental condition of EU marine waterways by 2020. To do this, Member States are mandated by the MSFD to create and administer MPAs.
- **The EU Birds Directive and the EU Habitats Directive:** These two directives provide guidelines for the conservation of birds, habitats, and species that are significant to Europe. These regulations mandate the creation and administration of protected areas, including maritime protected areas.⁸⁰ .

⁷⁹ OECD, 2012.

⁸⁰ OECD, 2012.

- OSPAR Convention: the OSPAR Convention is an international treaty that aims to protect the marine environment of the North-East Atlantic. OSPAR provides guidance on the establishment and management of MPAs to protect vulnerable and threatened species and habitats⁸¹.
- Ramsar Convention: The Ramsar Convention is a global agreement with the purpose of protecting wetlands of global significance. Wetlands are a common component of MPAs, and the Ramsar Agreement recognizes their significance for maintaining biodiversity and ecological services.
- Convention on Migratory Species (CMS): The CMS is a global agreement with the goal of protecting migratory animals and their habitats. CMS urges nations to create and administer such MPAs since many of them are developed particularly to safeguard migratory species and their habitats.
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES): CITES is a global agreement that governs the trading of endangered species internationally. Many MPAs are created to save endangered species, and CITES offers a framework for controlling trade in these species internationally⁸².

Guidelines for the creation and administration of MPAs are provided by international and European rules in order to safeguard marine biodiversity and advance the wise use of marine resources. For the purpose of establishing and managing MPAs for the protection and sustainable use of marine biodiversity and ecosystems, these international accords offer a framework for nations.

2.1.1 The United Nations Convention on the Law of the Sea (UNCLOS)

The rights and obligations of governments in the world's seas are outlined in the United Nations Convention on the Law of the Sea (UNCLOS), an international treaty. More precisely, it encourages governments to create and maintain MPAs

⁸¹ Palialexis et al., 2021.

⁸² Kritzer, 2004.

within their national authority by recognizing the significance of MPAs for the protection and sustainable use of marine biodiversity⁸³.

It was adopted in 1982 and came into effect in 1994. It establishes standards for commerce, the environment, and the management of marine natural resources, and it outlines the rights and obligations of states in the use of the world's oceans. Internal waters, territorial waters, contiguous zone, exclusive economic zone (EEZ), and continental shelf are essentially defined as the nautical zones of a state⁸⁴. The protection and preservation of the maritime environment, freedom of overflight and navigation, marine scientific research, and the resolution of international disputes are all included. 168 nations, including all of the permanent members of the UN Security Council, have ratified the treaty. It is sometimes referred to as the "constitution of the seas" and is recognized as one of the most significant international accords ever negotiated⁸⁵. It is essential to remember that UNCLOS has been crucial in settling international conflicts over maritime borders and natural resources. Moreover, it has been used as the basis for the creation of a vast array of international agreements and rules pertaining to ocean usage and protection.

The United Nations Convention on the Law of the Sea (UNCLOS) is an important international treaty for a number of reasons⁸⁶:

- It establishes regulations for the use of the seas: UNCLOS offers a thorough framework for the use and management of the oceans, including maritime borders, navigation, marine scientific research, conservation and preservation of the marine environment, and exploitation of natural resources.
- It fosters cooperation among states in the use and management of the seas, assisting in the avoidance of conflicts and disagreements over maritime borders and resources. Protects the marine environment - UNCLOS recognises the importance of protecting and conserving the marine environment by setting guidelines for sustainable practices in the use and exploitation of the oceans.

⁸³ Parmesan & Yohe, 2003.

⁸⁴ European Marine Board Position, 2013.

⁸⁵ Fox et al., 2006.

⁸⁶ Kritzer, 2004.

- It promotes economic growth: UNCLOS establishes the rights and responsibilities of nations in the use of natural resources in the oceans, including fish stocks, oil and gas reserves and minerals. This promotes economic development and provides the basis for investment in the maritime industries.
- It provides a basis for dispute resolution: UNCLOS provides a framework for the peaceful settlement of disputes between nations over maritime boundaries and the use of ocean resources. This helps to avoid conflict and promote stability and cooperation among nations.

2.1.2 The Convention on Biological Diversity (CBD)

An international agreement known as the Convention on Biological Diversity (CBD) was established in 1992 with the goals of preserving biodiversity, fostering the sustainable use of its elements, and ensuring the just and equitable distribution of the benefits associated with the use of genetic resources. One of the three major conventions that came out of the 1992 United Nations Conference on Environment and Development (UNCED), which was held in Rio de Janeiro, Brazil⁸⁷.

The CBD has three main objectives⁸⁸:

1. Biodiversity conservation: This includes the preservation of ecosystems, species, and genetic variety, as well as the safeguarding of threatened species and habitats.
2. Sustainable use of biodiversity refers to the use of biodiversity in a manner that supports sustainable development and prevents deterioration.
3. Fair and equal distribution of benefits resulting from the use of genetic resources: this entails making sure that all stakeholders, including local communities and indigenous peoples, get a fair and equitable distribution of the advantages resulting from the use of genetic resources.

The CBD is a binding international agreement that comprises 196 Parties, including the European Union and 195 other nations. The CBD Secretariat shall be informed

⁸⁷ Fox et al, 2006.

⁸⁸ Convention on Biological Diversity, 2011.

of the Parties' progress in developing and implementing their national policies and programs for the conservation and sustainable use of biodiversity. The Convention also fosters inter-Party interaction and offers a framework for international cooperation on issues pertaining to biodiversity.

The Convention on Biological Diversity (CBD) is an important international treaty for several reasons⁸⁹:

- acknowledges the value of biodiversity and the need of protecting it. Healthy ecosystems supply humans with a variety of ecosystem services, including clean air and water, fertile soil, and climate control. Biodiversity is crucial for sustaining healthy ecosystems. So, preserving biodiversity is essential for both human well-being and the well-being of other species.
- acknowledges that using biodiversity sustainably may help promote sustainable development. For instance, the utilization of genetic materials from plants and animals may result in the creation of novel treatments, foods, and other goods that are advantageous to society. The biodiversity must not be lost, hence care must be used in how this is done.
- also stresses the importance of ensuring that the benefits arising from the use of genetic resources are shared fairly and equitably among all stakeholders, including local communities and indigenous peoples. This is important to promote social justice and prevent the exploitation of vulnerable communities.
- provides a framework for international cooperation on biodiversity-related issues such as the conservation of migratory species, management of marine and coastal ecosystems and control of invasive species. By working together, countries can address global environmental challenges that cannot be tackled by individual nations alone.

2.1.3 The Barcelona Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean

The European Union and the nations surrounding the Mediterranean Sea signed the Barcelona Agreement for the Preservation of the Marine Environment and the

⁸⁹ Hilty et al., n.d.

Coastal Area of the Mediterranean in 1976. The primary purpose of the Agreement is to safeguard and enhance the maritime environment and Mediterranean coast.

The Agreement offers a legal framework for collaboration between the Parties in order to avoid, mitigate, and regulate Mediterranean Sea pollution. It includes the prevention and reduction of pollution from land-based sources, maritime activities, and atmospheric inputs, as well as a variety of other challenges connected to the preservation of the marine environment. It also encourages sustainable development and the conservation of biological variety in the Mediterranean area⁹⁰. It is supported by a series of protocols and amendments that address specific issues such as pollution from ships, land-based sources and discharges into the sea. These protocols set out measures and guidelines for the prevention and reduction of pollution in the Mediterranean Sea⁹¹. The Barcelona Convention has helped safeguard and preserve the Mediterranean Sea and its coastline. It established a foundation for international collaboration and led to the formation of a number of projects and programs to solve environmental issues in the area.

2.2 EU legislation on marine protected areas

The European Union (EU) has a number of laws concerning maritime protected zones (MPAs). Marine Strategy Framework Directive is the primary EU legal framework for the conservation and management of the maritime environment (MSFD)⁹². The MSFD mandates that EU Member States build a network of MPAs by 2020 in an effort to achieve Good Environmental Status (GES) for Europe's maritime waterways by 2020. GES is described as the condition of the marine environment that ensures the conservation and sustainable use of marine ecosystems and their biodiversity. The MSFD also requires Member States to ensure that their MPAs are effectively managed and monitored. This includes conducting periodic assessments of the effectiveness of MPAs and taking measures to address any shortcomings⁹³. . In addition to the MSFD, there are further EU regulations with MPA-related obligations. The Habitats Directive, for instance, mandates that

⁹⁰ Barcelona Convention, Directive, 1992.

⁹¹ UN, n.d.

⁹² Schofield, 2022.

⁹³ Sciberras et al., 2013.

Member States establish Special Areas of Conservation (SACs) to safeguard and conserve habitats and species of Community significance. a few of these SACs are found in marine areas⁹⁴. The Birds Directive has regulations for marine protected areas. It mandates that Member States create Special Protection Areas (SPAs) to safeguard wild bird species and their habitats. Some of these SPAs are found in maritime environments. The EU has established a number of financial channels to promote the development and operation of MPAs, notably the European Maritime and Fisheries Fund (EMFF) and the LIFE program.

2.3 Problems and perspectives

Marine Protected Areas (MPAs) are designated areas in the ocean where human activity is restricted or prohibited in order to preserve marine ecosystems and biodiversity. While MPAs can provide significant conservation benefits, there are also several challenges and constraints that can affect their effectiveness⁹⁵.

Some of the main problems facing marine protected areas are⁹⁶:

Enforcement: MPAs can be difficult to enforce due to their remote locations and the sheer size of the oceans. Illegal fishing, pollution and other human activities can continue to occur within the boundaries of MPAs if they are not properly monitored and enforced.

Lack of funding: Many MPAs suffer from a lack of funding, which can limit their ability to implement effective management strategies, conduct research and enforce regulations.

Stakeholder conflicts: MPAs can create conflicts between different stakeholder groups, such as fishermen, ecologists and tourism operators, who may have competing interests and priorities.

Climate change: MPAs may not be able to protect marine ecosystems from the impacts of climate change, such as ocean warming, acidification and sea level rise.

⁹⁴ United Nations, 2021.

⁹⁵ Costello & Kaffine, 2010.

⁹⁶ Kriegl et al., 2021.

Climate change may also affect the distribution and abundance of marine species, making it difficult for MPAs to effectively protect biodiversity.

Here are some of the key perspectives on marine protected areas⁹⁷ :

Ecosystem-based management: MPAs can be most effective when integrated into a broader ecosystem-based management approach that takes into account the ecological, social and economic aspects of marine resource use.

Community involvement: MPAs that involve local communities in management and decision-making can help build support and ensure that conservation goals are aligned with local needs and priorities.

Technological developments: Advances in technology, such as remote sensing and underwater robotics, can improve MPA monitoring and enforcement efforts.

Adaptive management: MPAs that use an adaptive management approach, which includes continuous monitoring, evaluation and adjustment of management strategies, can help improve their effectiveness over time.

International cooperation: Cooperation and collaboration between countries can help create larger, more effective MPAs that can protect migratory species and transboundary ecosystems.

⁹⁷ Halpern et al., 2010.

CHAPTER III.

IMPORTANCE OF SEA PROTECTED AREAS FOR THE SEA ENVIRONMENT

3.1 Importance of marine protected areas

Marine Protected Areas (MPAs) are critical tools for conserving, caring for the ecological services and biological diversity of the oceans. MPAs are vital for a variety of reasons in particular they contribute to the conservation of biodiversity⁹⁸. By providing a refuge for a range of marine species, MPAs help to conserve and protect marine biodiversity. In addition, they can help maintain viable populations of important fish and invertebrate species, as well as contribute to the defence of vulnerable or threatened species, nutrient cycling and food production. In doing so, they support the resilience and vitality of these ecosystems, ensuring their ability to continue to provide substantial benefits⁹⁹.

In addition, they help mitigate climate change by protecting vital carbon sinks such as seagrasses, mangroves and coral reefs. By absorbing and storing carbon dioxide, these ecosystems help reduce atmospheric greenhouse gas concentrations¹⁰⁰. By protecting spawning and nursery sites and minimizing the impacts of overfishing, MPAs can help manage fisheries sustainably. As a result, fish populations could help the environment and neighboring communities by remaining robust and healthy. Protected areas are important sites for scientific study, allowing researchers to examine marine ecosystems and understand the impacts of human activity on these systems¹⁰¹.

⁹⁸ Hens, 2010.

⁹⁹ Sink, 2016.

¹⁰⁰ Hilty et al., n.d.

¹⁰¹ Hens, 2010.

3.1.1 Social benefits of marine protected areas

As mentioned above, in order to conserve marine ecosystems and biodiversity, parts of the ocean have been declared as marine protected areas (MPAs) where human activities are restricted or prohibited¹⁰². The social benefits of marine protected areas are varied and relate to different aspects of social life. Primarily, protected areas can help local economies by enhancing opportunities for environmentally friendly travel, recreational activities and fishing, and for nearby areas, this can provide income and jobs¹⁰³.

It contributes to the preservation of cultural heritage as the ocean and its resources have a significant cultural impact on many coastal communities. MPAs can help preserve traditional fishing methods and cultural traditions associated with the sea¹⁰⁴. They also increase opportunities for education and research since they are teaching and research opportunities that can increase public knowledge about marine ecosystems and their protection, and especially in recent years they have been a scientific subject that has attracted the interest of the scientific community¹⁰⁵.

Protected areas support the regeneration of fish populations and provide a sustainable supply of seafood for nearby people. They help defend the rights of indigenous and traditional groups that depend on the ocean for their survival¹⁰⁶.

Finally, they help promote overall well-being for people as they offer opportunities for recreational activities such as swimming, snorkeling and diving, which can improve physical and mental health¹⁰⁷. Ultimately, MPAs have the potential to help both local communities and society in general in a variety of ways . They can support sustainable development and the well-being of both people and the environment by conserving marine habitats and biodiversity¹⁰⁸.

¹⁰² Shkiperova, 2018.

¹⁰³ Sink, 2016.

¹⁰⁴ Mancinelli & Vizzini, 2015.

¹⁰⁵ Shkiperova, 2018.

¹⁰⁶ Sink, 2016.

¹⁰⁷ Mancinelli & Vizzini, 2015.

¹⁰⁸ Shkiperova, 2018.

3.1.2 Economic benefits of marine protected areas

Marine Protected Areas (MPAs) have a number of economic benefits. In particular, they can attract tourists interested in experiencing the natural beauty and diversity of marine ecosystems¹⁰⁹. This can create jobs in the tourism industry and stimulate local economies. Marine Protected Areas (MPAs) are designated areas in the ocean that are managed and protected for conservation purposes. These areas can serve as important habitats for marine species, protect vulnerable ecosystems and conserve biodiversity. Ecotourism, on the other hand, involves responsible travel to natural areas that protect the environment and improve the well-being of local people¹¹⁰.

MPAs and ecotourism can be interlinked and mutually beneficial. Ecotourism can provide economic benefits to local communities near MPAs while promoting the conservation of marine resources. By providing opportunities for tourists to observe and appreciate marine life, MPAs can generate revenue for local economies, which can help support conservation efforts. Ecotourism can also be used as a tool to educate visitors about the importance of MPAs and marine conservation¹¹¹. By learning about the benefits of protected areas and responsible tourism practices, visitors can become advocates for marine conservation and help spread awareness about the importance of protecting our oceans. However, it is important to note that ecotourism can also have a negative impact on protected areas if not managed properly and rationally. Overuse of popular sites, inappropriate waste disposal and disturbance of marine life can all damage the ecosystems designed to protect them. Therefore, it is important for ecotourism to be carefully managed and regulated to ensure that it is sustainable and does not harm the marine environment¹¹².

In addition, the protection of marine habitats and ecosystems can help maintain fish populations and improve fishing yields, benefiting local fishing communities and providing a source of food and income. The relationship between protected areas and fisheries is complex and can vary depending on the specific characteristics of the MPA and the fishery¹¹³. In some cases, MPAs can benefit fisheries by providing

¹⁰⁹ Cognetti, 1986.

¹¹⁰ Convention on Biological Diversity, 2011.

¹¹¹ Hens, 2010.

¹¹² OECD, 2012.

¹¹³ Spalding et al., 2007.

refuge areas for fish growth and reproduction, leading to increased fish populations and higher catches outside the MPA. In addition, MPAs can help maintain the health and diversity of marine ecosystems, which can indirectly benefit fisheries by providing a more stable and resilient environment for fish populations. The impact of MPAs on fisheries is not always positive since in some cases, MPAs can lead to a shift of fishing effort from the protected area to adjacent areas, leading to overfishing and depletion of fish populations in these areas. In addition, MPAs can increase fishing pressure in areas outside the protected area as fishermen concentrate their effort in these areas to compensate for the loss of fishing opportunities within the MPA¹¹⁴. We thus conclude that the relationship between MPAs and fisheries is complex and requires careful management and monitoring to ensure that both objectives are met. Effective management of MPAs should involve consultation with stakeholders, including fishers, to ensure that the needs and concerns of all parties are taken into account¹¹⁵.

It is worth noting that protected areas can provide opportunities for scientific research and monitoring of marine ecosystems, which can help inform management and conservation efforts. This research can also lead to new discoveries and innovations in areas such as medicine, biotechnology and oceanography¹¹⁶. Scientific research plays a critical role in understanding ecological processes and biodiversity within MPAs, as well as in evaluating the effectiveness of management strategies¹¹⁷. Research within MPAs can provide important information on the impacts of human activities on marine ecosystems and help inform policy decisions related to the management and protection of marine resources.

There are many ways in which scientific research can be conducted within, including through monitoring programmes, ecological surveys, experimental manipulations and modelling studies¹¹⁸. However, it is important that research within MPAs is conducted in a responsible and ethical manner, with appropriate permits and approvals, and taking into account the potential impacts on the marine

¹¹⁴ United Nations, 2021.

¹¹⁵ Palumbi, 2004.

¹¹⁶ Russ et al., 2008.

¹¹⁷ Planes et al., 2000.

¹¹⁸ Charton et al., 2000.

ecosystem and local communities. Overall, scientific research in the context of MPAs is vital for understanding and protecting marine biodiversity and ensuring the sustainable use of marine resources.

Climate change is causing a range of negative impacts on marine ecosystems, including warming seas, acidification and sea level rise so protected areas can help protect and conserve critical habitats and species, which in turn can help maintain the health and resilience of marine ecosystems. One way in which MPAs can help mitigate climate change is by acting as carbon sinks. The oceans are a large carbon sink, absorbing about a quarter of carbon dioxide emissions from human activities. By protecting and restoring coastal habitats such as mangroves, seagrasses and salt marshes, MPAs can help increase carbon capture and storage. In addition, MPAs can support the adaptation of marine ecosystems to the impacts of climate change¹¹⁹. By protecting key habitats such as coral reefs and kelp forests, MPAs can help maintain biodiversity and ecosystem functions critical to climate resilience.

Finally, MPAs can help reduce the impacts of other stressors on marine ecosystems that are exacerbated by climate change, such as overfishing and pollution. By protecting vulnerable habitats and species, MPAs can help maintain ecosystem services that are critical to human well-being, such as fisheries and tourism¹²⁰. They can also provide natural protection from storms, erosion, and other coastal hazards by maintaining healthy ecosystems and habitats. MPAs can provide significant coastal protection by reducing the impacts of storms, waves and erosion. The protection provided by MPAs can help maintain healthy coastal ecosystems, which in turn can provide a range of ecosystem services such as coastal protection, fisheries and tourism¹²¹.

Coastal protection can also be achieved by other means, such as building natural structures like sea walls or restoring natural coastal habitats like mangroves, dunes and wetlands. However, these methods can have negative environmental impacts and can be costly to maintain¹²². MPAs, on the other hand, offer a more holistic and

¹¹⁹ Charton et al., 2000.

¹²⁰ Cognetti, 1986.

¹²¹ Charton et al., 2000.

¹²² Stelzenmüller et al., 2007.

sustainable approach to coastal protection by protecting and conserving entire marine ecosystems. While they may not provide the same level of protection as natural structures in the short term, they offer a more long-term and ecologically sound solution for coastal protection. Overall, MPAs can provide significant economic benefits to local communities and society as a whole, while also contributing to the conservation and sustainable use of marine resources ¹²³.

3.1.3 Sustainable tourism

Sustainable tourism is a form of tourism that aims to have a positive impact on the environment, society and the economy of the destinations where it operates. The goal of sustainable tourism is to minimize negative impacts, conserve natural resources and respect local cultures while creating economic opportunities for local communities¹²⁴.

Some of the key principles of sustainable tourism include¹²⁵:

- **Preservation of the environment:** Sustainable tourism seeks to protect natural resources, minimise waste and pollution and reduce the carbon footprint of tourism activities.
- **Economic benefits for local communities:** Sustainable tourism aims to create economic opportunities for local people, providing jobs, supporting local businesses and generating income for the community.
- **Cultural preservation:** Sustainable tourism respects and supports the traditions, customs and values of local communities and promotes cultural exchange and understanding.
- **Community involvement:** Sustainable tourism involves local communities in decision-making processes and seeks to build strong partnerships between the tourism industry and local stakeholders.

¹²³ Stafford, 2018.

¹²⁴ Stafford, 2018.

¹²⁵ Tsikliras et al., 2015.

- Responsible tourism practices: Sustainable tourism encourages tourists to behave in a responsible and respectful manner and minimise their impact on the environment and local communities.

Overall, sustainable tourism aims to create a positive and lasting impact on the destinations it serves, while providing a rewarding and enriching experience for tourists.

Sustainable tourism helps to minimise the negative impacts of tourism on the environment by reducing waste and pollution, protecting natural habitats and wildlife, and conserving resources such as water and energy¹²⁶. It can create economic opportunities for local communities by providing jobs, generating income for local businesses and supporting the development of sustainable industries. It also contributes to the preservation of local cultures and traditions by promoting cultural exchange and understanding, supporting local arts and crafts, and respecting local customs and beliefs¹²⁷. It involves local communities in decision-making processes and seeks to build strong partnerships between the tourism industry and local stakeholders. This helps to ensure that tourism benefits the community as a whole, not just a few individuals¹²⁸.

Sustainable tourism aims to create a positive and lasting impact on the destinations it serves, minimising negative impacts and maximising positive ones. This helps to ensure that tourism can continue to benefit local communities and the environment for years to come¹²⁹. It is worth mentioning that , sustainable tourism is important because it helps to ensure that tourism can continue to benefit local communities and the environment while providing a rewarding and enriching experience for tourists. By promoting sustainable tourism practices, we can help create a more equitable, sustainable and responsible tourism industry. Sustainable tourism and marine protected areas (MPAs) are closely linked, as MPAs play a vital role in conserving marine ecosystems and supporting sustainable tourism practices¹³⁰.

¹²⁶ Sunlu, 2003.

¹²⁷ Tsikliras et al., 2015.

¹²⁸ Watson et al., 2015.

¹²⁹ Khalid et al., 2019.

¹³⁰ Palialexis et al., 2021.

In essence, sustainable tourism in and around protected areas can have a number of benefits, such as¹³¹:

- support the conservation of MPAs by providing financial support for management and monitoring and raising awareness of the importance of protecting marine ecosystems.
- provide economic benefits for local communities by creating jobs and supporting local businesses that provide services to tourists, such as boat trips, diving trips and other ecotourism activities.
- raise awareness of the importance of marine conservation and can help educate visitors about the ecosystems and species protected in MPAs.

In conclusion, it promotes responsible and respectful tourism practices, such as avoiding pollution and minimising impacts on marine life and habitats. They are important partners in promoting marine conservation practices and sustainable tourism. Working together, we can help protect marine ecosystems and support the development of responsible and sustainable tourism industries.

3.1.4 Sustainable fisheries

Sustainable fishing is the practice of fishing in a way that ensures the long-term health and sustainability of fish populations and the ecosystems they inhabit¹³². It involves the use of fishing methods and practices that minimize harm to the marine environment, avoid overfishing and maintain healthy fish stocks for future generations.

The key principles of sustainable fisheries are as follows¹³³:

- **Avoiding overfishing:** This means catching only what can be harvested sustainably without depleting fish populations to the point where they cannot recover.

¹³¹ Lovelock, 2002.

¹³² Kritzer, 2004.

¹³³ OECD, 2012.

- **Habitat protection:** This means minimising the impact of fishing on the marine environment, such as avoiding the destruction of sensitive habitats such as coral reefs and seagrass beds.
- **Fisheries management:** This means implementing effective fisheries management strategies that regulate fishing activity, including the use of quotas, seasonal closures and gear restrictions.
- **Supporting sustainable fishing practices:** This means supporting fishing communities using sustainable fishing practices and promoting sustainable seafood consumption among consumers.
- **Reducing by-catch:** this means minimising the capture of non-target species, such as sea turtles and dolphins, and releasing them intact back into the ocean.

By applying these principles, sustainable fisheries can help ensure the long-term sustainability of fish populations and the ecosystems they inhabit, while also supporting the livelihoods of fishing communities and providing consumers with a sustainable source of seafood.

Sustainable fishing practices help ensure that fish populations are kept at healthy levels and not depleted by overfishing. This helps maintain the diversity of marine ecosystems and ensures that future generations can continue to rely on fish as a food source¹³⁴. On the other hand, unsustainable fishing practices, such as bottom trawling and dynamite fishing, can have devastating impacts on the marine environment, including damage to coral reefs, destruction of seagrasses and harm to other marine life. Sustainable fishing practices help minimize these impacts and protect fragile marine ecosystems¹³⁵.

Fishing practices that are sustainable can help support the livelihoods of fishing communities, particularly in developing countries where many people rely on fishing for their income. By promoting sustainable fishing practices, communities can continue to earn a living while ensuring the long-term health of fish populations¹³⁶. They can also provide economic benefits for both the fishing industry and the wider economy by maintaining healthy fish populations, ensuring

¹³⁴ Parmesan & Yohe, 2003.

¹³⁵ Sciberras et al., 2013.

¹³⁶ Tsikliras et al., 2015.

a stable supply of seafood, which can support jobs in the fishing industry and provide a source of income for seafood-based businesses¹³⁷.

The health benefits of these practices for consumers are also significant, ensuring that seafood is free from harmful contaminants and sourced in an environmentally responsible manner¹³⁸. We therefore conclude that sustainable fisheries are vital to ensuring the long-term health of fish populations, protecting the marine environment, supporting fishing communities and providing economic and health benefits for both consumers and the fishing industry¹³⁹. Marine Protected Areas (MPAs) are a key tool for sustainable fisheries. MPAs are areas of the ocean that are protected from fishing and other activities in order to conserve and protect marine biodiversity. MPAs can be established for a variety of reasons, including the protection of important habitats, the conservation of vulnerable species and support for sustainable fisheries¹⁴⁰.

Sustainable fisheries and MPAs are linked in several ways. By protecting areas of the ocean from fishing, MPAs can help maintain fish populations and ensure that they are able to replenish themselves over time. This can benefit both the fishing industry and the marine ecosystem as a whole¹⁴¹. MPAs can help maintain important habitats, such as coral reefs and seagrass beds, that are critical to the survival of many fish species. This can help maintain healthy fish populations and ensure the long-term sustainability of fisheries. Protected areas can help support sustainable fishing practices by providing a source of healthy fish populations that can be harvested sustainably. By allowing fish populations to recover and increase in size, MPAs can support the long-term sustainability of fisheries and the fishing industry¹⁴².

They also serve as important research sites for scientists studying marine ecosystems and fish populations. By studying the impacts of fisheries and other

¹³⁷ Kritzer, 2004.

¹³⁸ Halpern et al., 2010.

¹³⁹ Lovelock, 2002.

¹⁴⁰ Charton et al., 2000.

¹⁴¹ Costello & Kaffine, 2010

¹⁴² Khalid et al., 2019.

activities within MPAs, scientists can better understand how to manage fisheries and protect marine biodiversity¹⁴³.

¹⁴³ Mancinelli & Vizzini, 2015.

CHAPTER IV.

GOVERNANCE OF MARINE PROTECTED AREAS

4.1 Governance of marine protected areas

The administration of marine protected areas entails the management and control of human activities inside the designated area in order to guarantee that conservation goals are realized¹⁴⁴. Various stakeholders are needed for effective governance, including government organizations, local communities, scientists, conservation organizations, and business associations¹⁴⁵.

The procedures in constructing an MPA include identifying locations that need to be protected, consulting with stakeholders, and developing the legal and regulatory framework¹⁴⁶. The method may vary based on the jurisdiction and the desired level of stakeholder involvement. MPAs may sometimes be established by presidential decrees or legislation, as well as occasionally through collaborative procedures involving several stakeholders¹⁴⁷. Once established, an MPA is often split into several zones that permit a variety of activities and may provide differing levels of protection¹⁴⁸. As part of the zoning process, the MPA is mapped, and the level of protection needed for each region is decided. For instance, certain regions can be classified as closed zones, making fishing and other extractive operations illegal, while other areas would only permit specific uses, like tourism or recreational fishing. Management plans are developed to direct the usage of MPAs and their preservation¹⁴⁹. These plans often include a range of management techniques, including as regulations for boating, fishing, and other activities as well as techniques to safeguard threatened species or ecosystems. The management plan is developed via a participatory process with the participation of stakeholders, and it

¹⁴⁴ Cognetti, 1986

¹⁴⁵ Costello & Kaffine, 2010

¹⁴⁶ Hens, 2010

¹⁴⁷ Stelzenmüller et al., 2007

¹⁴⁸ Shkiperova, 2018

¹⁴⁹ Watson et al., 2015

may be modified often to reflect changes in the MPA's social or ecological context¹⁵⁰.

Effective regulatory enforcement of the MPA is essential to ensuring the achievement of conservation goals. Examples of this include the creation of patrols, monitoring tools, and fines or other punishments for non-compliance¹⁵¹. Enforcement activities may be challenging in large or distant MPAs because monitoring and enforcement capabilities may be limited. Effective enforcement requires a variety of strategies, including community-based enforcement and collaborations with regional police organizations¹⁵².

Many different stakeholders must take part in and support MPAs for them to be successful. Participating in and working together with local groups, business associations, and other stakeholders may assist boost support for MPAs and ensure their success in accomplishing conservation objectives¹⁵³. Stakeholder participation may take place in a number of methods, such as public forums, meetings with the community, and team planning procedures. Effective stakeholder engagement calls for dedication to participation, openness, and transparency¹⁵⁴. Every stakeholder should be given the chance to comment on and participate in decision-making processes. Participation of stakeholders may increase trust, information exchange, and the spotting and settling of future problems or disagreements¹⁵⁵.

Continuous scientific research and monitoring are necessary to comprehend the ecological and social effects of MPAs and modify management strategies in response to changing circumstances. Scientific research may be utilized to guide the creation and implementation of MPAs and to assess their success in meeting conservation objectives¹⁵⁶. Programs for monitoring may keep track of changes in significant factors including animal diversity, habitat quality, and human use patterns. Conducting and monitoring scientific research requires a strong data

¹⁵⁰ Badalamenti et al., 2000

¹⁵¹ Kelaher et al., 2015

¹⁵² Khalid et al., 2019

¹⁵³ Lavidas et al., 2020

¹⁵⁴ Europe, 2021

¹⁵⁵ Kriegl et al., 2021

¹⁵⁶ Ahmadi et al., 2015

collecting and analysis program, as well as effective communication and cooperation between scientists, managers, and stakeholders. Key knowledge gaps should be filled by scientific research, which should be conducted in an open, frank, and unbiased manner¹⁵⁷ .

Particularly in regions with competing interests or little resources, MPA governance is complex and difficult at times. The following are some of the major difficulties with MPA governance¹⁵⁸ :

- Limited funding and resources for management and enforcement
- Conflicts between different stakeholder groups
- Limited scientific knowledge of marine ecosystems and biodiversity
- Political and social opposition in the MPAs

Despite these challenges, there are also significant opportunities associated with the governance of MPAs. MPAs can offer a range of benefits , e.g.¹⁵⁹ :

- Protecting marine biodiversity and ecosystems
- Sustainable use of marine resources
- Economic benefits for local communities through tourism and other activities
- Mitigation and adaptation to climate change

To realize these benefits, effective governance of MPAs is critical. This requires a range of strategies , e.g.¹⁶⁰ :

- Cooperation and engagement with stakeholders
- Transparent and inclusive decision-making processes
- Strong scientific research and monitoring programmes
- Adequate funding and resources for management and enforcement
- Adaptive management strategies that can respond to changing ecological and social conditions.

¹⁵⁷ Halpern et al., 2010

¹⁵⁸ Jones et al., 2013

¹⁵⁹ Badalamenti et al., 2000

¹⁶⁰ Pelletier, 2020

In recent years, increased emphasis has been placed on the value of MPAs in attaining larger conservation goals. According to the Convention on Biological Diversity, at least 30% of the world's oceans must be protected by 2030, and several countries and organizations have pledged to establishing new MPAs or enlarging existing ones¹⁶¹. Achieving these objectives will need efficient MPA governance. Marine protected areas must be effectively maintained if marine biodiversity and ecosystems are to be preserved and used sustainably. Stakeholder involvement, scientific research, and the use of adaptive management strategies are only a few of the actions needed for good governance¹⁶². Despite the challenges associated with maintaining MPAs, there is a great deal of room for advancing conservation efforts and promoting prudent use of marine resources. Through ongoing dedication and collaboration, effective MPA governance can contribute to ensuring the long-term resilience and health of marine ecosystems and biodiversity¹⁶³.

4.1.1 Types of maritime governance

Marine governance refers to the processes, institutions, and strategies utilized to manage marine environments and resources. Marine governance comes in a variety of forms, each with its own benefits and drawbacks. Below is a list of some of the most common types of marine governance¹⁶⁴:

- **Top-down governance:** With this approach, all final decisions are made by government organizations or other regulators. Top-down rulemaking and enforcement is effective, but it may not be as attentive to the needs and opinions of local communities and other stakeholders¹⁶⁵.
- **Bottom-up governance:** Involving local stakeholders, communities, and resource users in decision-making is a key component of this method. While bottom-up governance may promote more social inclusion and fairness, it can also be less effective at establishing and enforcing norms¹⁶⁶.

¹⁶¹ Shkiperova, 2018

¹⁶² United Nations, 1982

¹⁶³ Tonin, 2018

¹⁶⁴ Garcia-Rubies et al., 2017

¹⁶⁵ Cerna, 2013

¹⁶⁶ Fox et al., 2006

- Co-management is a practice in which local communities or resource users and governmental organizations collaborate to manage resources and make decisions¹⁶⁷. However, co-management may need a significant investment in institutional growth and capacity building, which may enable more fair and efficient decision-making¹⁶⁸.
- Ecosystem-based management: Ecosystem-based management emphasizes managing marine resources and ecosystems as linked systems, as opposed to concentrating on particular species or sectors¹⁶⁹. Although it could need more complicated institutional and decision-making frameworks, ecosystem-based management can promote the more sustainable use of marine resources¹⁷⁰.
- Adaptive management: Using an iterative decision-making process, adaptive management continuously assesses and modifies strategies in light of new information and evolving conditions¹⁷¹. Adaptive management may provide more resilience and response to change, even if it would need a sizable investment in monitoring and research¹⁷².
- Market-based mechanisms: These tactics make use of financial incentives to promote the prudent use of marine resources. Examples include certification schemes or tradable permits¹⁷³. Market-based systems may be more successful at fostering innovation and efficiency, but they may be less effective in fostering social inclusion and equality.

There is no one-size-fits-all method of marine administration since each has its own benefits and difficulties¹⁷⁴. In order to create and execute successful plans, stakeholders must be committed to taking into account local circumstances and contexts and working together.

¹⁶⁷ Williams & Brown, 2013

¹⁶⁸ Halpern, 2014

¹⁶⁹ (Tonin, 2018)

¹⁷⁰ Garcia-Rubies et al., 2017

¹⁷¹ Watson et al., 2015

¹⁷² Tsikliras et al., 2015

¹⁷³ Stafford, 2018

¹⁷⁴ Watson et al., 2015

4.1.2 Governance incentives for marine protected areas

Through governance incentives, stakeholders are urged to take part in MPA governance and advance the preservation and sustainable use of maritime resources. Effective governance incentives may promote better regulatory compliance, more stakeholder involvement, and fairer and more sustainable MPA management.

The key governance incentives for marine protected areas are¹⁷⁵ :

Environmental benefits: By boosting ecosystem resilience, safeguarding marine species, and mitigating climate change, MPAs may benefit the environment¹⁷⁶. These advantages, particularly for individuals whose livelihoods rely on marine resources, may be a powerful inducement for stakeholders to support MPA governance¹⁷⁷ .

Benefits for society: By fostering social fairness, cultural variety, and community resilience, MPAs may also be advantageous to society. These advantages may serve as a significant inducement for stakeholders that respect these objectives and are motivated to support MPA governance as a means of accomplishing them¹⁷⁸ .

Compliance with regulations: Effective MPA governance may lessen the possibility of fines or other punishments for non-compliance, help assure compliance with rules, and assist guarantee compliance¹⁷⁹ . Users of resources and other stakeholders may be strongly motivated to support MPA governance and abide by its regulations.

Commitment and participation: Opportunities for stakeholder involvement and participation in decision-making processes may be provided by effective MPA governance. This may be a strong motivator for stakeholders who appreciate the chance to take part in governance and have a voice in decisions that impact their lives and livelihoods¹⁸⁰ .

¹⁷⁵ Cockerell & Jones, 2020

¹⁷⁶ Badalamenti et al., 2000

¹⁷⁷ Katsanevakis, 2013

¹⁷⁸ Jones et al., 2013

¹⁷⁹ Lavidas et al., 2020

¹⁸⁰ Badalamenti et al., 2000

International commitments: A large number of countries and international organizations have committed to preserving marine biodiversity and ecosystems under the Convention on Biological Diversity and the United Nations Sustainable Development Goals¹⁸¹. If governments and other stakeholders are aware of these obligations, they may have great incentives to support MPA governance and maintain their responsibilities.

The incentives for successful MPA governance will vary according on local conditions, stakeholder interests, and governance frameworks. Good MPA governance requires careful consideration of these factors as well as the development of incentive programs that may promote stakeholder involvement and support for marine resource protection and sustainable utilization¹⁸².

4.1.3 Governance challenges

MPAs (marine protected areas) are essential for preserving marine biodiversity and promoting the wise use of marine resources, but they are also plagued by a number of governance challenges.

One of the biggest governance challenges MPAs have is enforcing laws to curb illicit activities like overfishing, poaching, and pollution¹⁸³. Due to a lack of political will, weak governance structures, and insufficient monitoring and enforcement resources, it may be challenging to accomplish effective enforcement and compliance. For MPA governance to be successful, a number of stakeholders, including local residents, resource users, governmental organizations, and NGOs, must be involved and engaged¹⁸⁴. However, achieving meaningful stakeholder involvement and participation may be challenging, particularly when there are conflicting interests or limited resources. Additionally, resources are needed for setup, management, and monitoring. Effective MPA governance, however, may be challenging to implement, particularly in regions with limited resources or conflicting interests¹⁸⁵.

¹⁸¹ Malak et al., 2019

¹⁸² Jones et al., 2013

¹⁸³ OECD, 2012

¹⁸⁴ Otero et al., 2013

¹⁸⁵ OECD, 2012

It is also essential to have access to credible information on maritime ecosystems and resources. Unfortunately, there is a dearth of knowledge and comprehension in many sectors, particularly in developing countries or isolated locations¹⁸⁶. It is crucial to have clear legal frameworks and procedures for making decisions, planning, and enforcing them if MPA governance is to be successful. Effective MPA governance may be hampered in many locations, nevertheless, by weak, antiquated, or poorly administered legislative frameworks. But due to climate change and other environmental stresses including pollution, sea level rise, and ocean acidification, MPAs may have major governance challenges¹⁸⁷. It can be difficult to properly manage and conserve marine ecosystems and resources as a result of these pressures¹⁸⁸.

It is necessary to address these problems in order to manage MPAs effectively. Some strategies to do this include enhancing institutions and governance structures, raising funds and resources, enhancing data and knowledge systems, and adjusting to the effects of climate change and other environmental pressures¹⁸⁹. Collaboration and coordination between stakeholders at all levels of government and across sectors, as well as ongoing commitment to governance reform and capacity development, are necessary for effective MPA governance¹⁹⁰.

4.1.3.1 Maritime governance boundaries

MPAs are often implemented in fragments without a coordinated strategy for network design, space planning, or ecological connectedness. This may result in protected areas being fragmented and isolated, which would impair their capacity to meet conservation goals and preserve ecological services¹⁹¹. Additionally, they are often modest in scale or restricted in scope, which may make it challenging to accomplish conservation goals or address more significant ecosystem-level challenges. Small MPAs might potentially be at risk from external dangers like pollution or overfishing in the neighborhood¹⁹². They still need a lot of money to

¹⁸⁶ Palialexis et al., 2021

¹⁸⁷ Palumbi, 2004

¹⁸⁸ Pascual et al., 2016

¹⁸⁹ Palialexis et al., 2021

¹⁹⁰ Palumbi, 2004

¹⁹¹ Roberts et al., 2020

¹⁹² Sciberras et al., 2013

set up, run, and keep an eye on. Effective MPA governance, however, may be challenging due to financial and resource limitations, especially in regions with little resources or conflicting objectives¹⁹³ .

Enforcing rules and ensuring compliance with them to halt unlawful activities like overfishing, poaching, and pollution is a significant governance challenge for MPAs¹⁹⁴. Effective enforcement and compliance may be difficult to obtain owing to a lack of political will, weak governance structures, and insufficient resources for monitoring and enforcement¹⁹⁵ . In MPAs, disputes often develop between stakeholders including local residents, resource users, and governmental organizations that may impair their effectiveness. Stakeholder engagement and involvement may be challenging to acquire, particularly when there are conflicting interests or limited resources available¹⁹⁶ .

Improved MPA network planning and design, increased funding and resources, strengthened governance structures and institutions, improved stakeholder participation and engagement, improved data and knowledge systems, and improved enforcement and compliance mechanisms are just a few of the strategies needed to address these constraints. Collaboration and coordination between stakeholders at all levels of government and across sectors, as well as a persistent commitment and investment in governance reform and capacity development, are necessary for successful MPA governance¹⁹⁷.

4.2 Management of marine protected areas

To fulfill conservation goals and permit the sustainable use of resources within the limits of protected areas, a range of measures are carried out as part of marine protected area (MPA) management¹⁹⁸. Effective MPA management requires an integrated plan that incorporates ecological, social, and economic issues.

¹⁹³ Spalding et al., 2007

¹⁹⁴ Stafford, 2018

¹⁹⁵ Watson et al., 2015

¹⁹⁶ Stafford, 2018

¹⁹⁷ Roberts et al., 2020

¹⁹⁸ Estradivari et al., 2022

Additionally, a range of stakeholders at various levels of governance must be included in this plan.

Effective MPA management is built on careful planning and design, which includes formulating conservation goals, evaluating the physical and socioeconomic circumstances, and creating distinct limits and restrictions¹⁹⁹. This strategy, which should include stakeholder engagement and input, should be guided by the best available scientific data as well as customary knowledge. MPAs may include a number of zones with various levels of protection and permitted uses. For MPA management to be successful, clear regulations based on socially relevant conservation goals must be applied via compliance monitoring and enforcement methods²⁰⁰. Monitoring and evaluation are crucial components of MPA management because they enable continual assessment of biological and socioeconomic conditions, progress toward conservation goals, and the efficacy of management strategies²⁰¹. This method should include regular monitoring of crucial indicators including biodiversity, fish populations, and ecosystem services, as well as assessment of management activities and stakeholder feedback²⁰². Effective MPA management requires a fluid, adaptive approach that enables ongoing learning, adaptation, and development. As a result, management goals and objectives must be periodically reviewed, and rules and management actions may need to be changed as a result of new information and evolving conditions. Because it encourages resource sustainability, ensures that local knowledge and opinions are taken into consideration, and helps raise support for conservation goals, effective MPA management relies on stakeholder engagement²⁰³. This process should provide stakeholders with opportunities for active participation in decision-making and for ongoing communication and consultation²⁰⁴.

In order to effectively manage MPAs, stakeholders at all levels of governance must cooperate, coordinate, and maintain a continuous commitment. To address new risks and challenges and to guarantee that conservation goals are accomplished

¹⁹⁹ Davies et al., 2018

²⁰⁰ Estradivari et al., 2022

²⁰¹ Estradivari et al., 2022

²⁰² Davies et al., 2018

²⁰³ Lucrezi et al., 2019

²⁰⁴ Gutierrez et al., 2023

while encouraging sustainable use of marine resources, it also needs ongoing research, innovation, and adaptation²⁰⁵.

4.2.1 Marine spatial planning and management planning

Marine spatial planning (MSP) and management planning procedures (MPAs) are used to manage marine resources, including marine protected zones. Although some of these tactics are similar, they have different focuses and end goals²⁰⁶. maritime spatial planning (MSP) is the process of identifying and assigning maritime area for multiple purposes, including conservation, fisheries, energy development, shipping, and leisure. MSP works to balance competing demands for marine resources while promoting the protection and sustainable use of the maritime environment. The primary guiding principles for MSP are ecosystem-based management principles, which seek to preserve ecosystem structure, function, and resilience while promoting sustainable resource use²⁰⁷. As designated areas where conservation objectives are prioritized, MPAs are often a critical part of the MSP²⁰⁸. Alternatively, management planning specifically focuses on managing MPAs to accomplish conservation goals. The establishment of focused strategies and activities to attain conservation goals is often included in management plans, along with a more detailed evaluation of the biological and socioeconomic circumstances inside the MPA²⁰⁹. Adaptive management, which adjusts plans in response to fresh information and changing circumstances, and constant evaluation of MPA performance are other components of management planning.

As part of efficient management planning, the MPA should establish precise goals and objectives based on the best available scientific evidence and traditional knowledge²¹⁰.

- Evaluation of the MPA's social and ecological circumstances, including the biodiversity, ecosystem services, and human activities.

²⁰⁵ Gutierrez et al., 2023

²⁰⁶ Halpern, 2014

²⁰⁷ Hens, 2010

²⁰⁸ Estradivari et al., 2022

²⁰⁹ Halpern, 2014

²¹⁰ Tonin, 2018

- Establish different zones and regulations in accordance with social and conservation goals.
- Establish efficient monitoring and evaluation procedures to assess the accomplishment of conservation goals and adjust management strategies as necessary.
- Promote stakeholder engagement and participation in MPA management, including contacts with local people, resource users, and governmental organizations.
- Offer programs to create capacity and teach people in managing MPAs, including ecological monitoring, resource sustainability, and conflict resolution.

Both MSP and management planning are essential elements of efficient MPA administration as they support the sustainable use of marine resources while ensuring that conservation goals are accomplished. In order to meet new risks and problems, these strategies need cooperation and coordination amongst stakeholders at all levels of governance as well as a dedication to ongoing learning, adaptation, and innovation.

4.2.2 Marine connectivity in conservation planning

Marine connection is an important consideration when planning the protection of marine protected areas. "Marine connectivity" refers to the flow of individuals, genes, and ecosystem services across various maritime ecosystems and populations, both within and outside MPAs²¹¹. Maintaining connection is essential for the resilience and long-term sustainability of marine ecosystems as well as the promotion of resource sustainability²¹².

The MPA conservation planning process often begins with the identification of places with high ecological value and the decision to conserve them. The efficiency of conservation efforts might be hampered by concentrating just on one site without

²¹¹ Balbar & Metaxas, 2019

²¹² Williams & Brown, 2013

taking into account its connectedness to other locations. Marine habitat fragmentation may have a number of detrimental effects, such as decreased genetic diversity, changed species distribution, and decreased ecosystem performance²¹³. To address these concerns, marine connection should be a key component of MPA conservation strategy. This requires locating critical biological corridors and migratory routes, identifying and protecting them, and creating MPA networks in strategically placed areas to promote connectedness²¹⁴.

Marine connectivity can be included in MPA conservation planning using a variety of strategies, such as²¹⁵ :

- The most important habitats and migratory routes for marine species should be identified and conserved based on connectedness, biodiversity, and ecosystem services²¹⁶. Conservation planners can maintain connectivity and promote strong marine ecosystems by prioritizing the protection of these sites.
- MPA network design entails putting together several MPAs and tying them together using biological corridors and bridging zones. The goal of these networks is to promote physical connectedness while providing chances for resource sustainability and other human endeavors.
- Include dynamic oceanographic phenomena: Currents, anodes and eddies are just a few examples of oceanographic processes that can have an impact on the distribution and movement of marine animals²¹⁷ . Managers can identify areas where species are expected to concentrate, move, or disperse and create MPAs that maintain these areas by incorporating these activities into conservation planning.
- Integration of social aspects: Planning for conservation that is effective must also include the social and economic implications of how marine resources are utilized. By collaborating with these organizations, conservation planners may identify areas where conservation aims are compatible with social and economic issues and develop MPAs that are supported by the local community²¹⁸ .

²¹³ Balbar & Metaxas, 2019

²¹⁴ Hens, 2010

²¹⁵ Balbar & Metaxas, 2019

²¹⁶ McLeod et al., 2009

²¹⁷ McLeod et al., 2009

²¹⁸ McLeod et al., 2009

Marine connection may be challenging to include into MPA conservation planning because it requires a full knowledge of natural processes, human activities, and social interests. However, by promoting connectivity and supporting sustainable resource use, conservation planners may assist in maintaining healthy and productive maritime environments for future generations.

4.2.3 Resilience and marine risk management

Marine Protected Areas (MPAs) are used to protect marine biodiversity and ecological services. There are several dangers and threats as well, however, including overfishing, pollution, habitat loss, and climate change²¹⁹. To maintain the long-term sustainability and efficacy of MPAs, resilience and risk management strategies must be included into planning and management²²⁰.

Ecosystems' resilience is defined as their capacity to tolerate stress, adapt to change through time, and recover. By using robust design and management practices, MPAs will be more resistant to external threats and disturbances. To protect crucial biological components including keystone species, biodiversity hotspots, and essential habitats, MPAs should be constructed²²¹. Since these characteristics are the foundation for ecosystem function and resilience, it is crucial to prioritize their conservation. Fishing, tourism, and shipping are a few examples of human activities that may have a substantial impact on MPA ecosystems²²². Resilience-based management regulates these actions to lessen their effects and guarantee their long-term sustainability. MPA habitats need regular monitoring to spot changes and disturbances and take necessary action in response²²³. Adaptive management is the process of using this data to change management strategies over time in response to emerging risks and changing environmental circumstances.

Risk management for MPAs includes identifying, analyzing, and devising ways to mitigate and address hazards. Risk assessment entails identifying and assessing the

²¹⁹ Hoppit et al., 2022

²²⁰ Kriegl et al., 2021

²²¹ Mizgajski, 2016

²²² Kriegl et al., 2021

²²³ Hoppit et al., 2022

risks posed by MPAs based on many factors, such as the severity and probability of possible consequences and the sensitivity of MPA ecosystems²²⁴. Risk mitigation is the development of methods to lessen the possibility and effect of adverse events. This can include lowering human activity levels, establishing buffer zones around crucial ecosystems, and putting rules in place to lessen pollution and habitat damage²²⁵. Risk response is the process of developing strategies to deal with prospective effects that cannot be prevented or lessened. This might include creating methods for monitoring and reacting to disease outbreaks or invasive species, as well as creating contingency plans to deal with catastrophes like oil spills and other crises²²⁶.

By including resilience and risk management strategies into their design and management, MPAs may become more resilient and sustainable even in the face of severe obstacles and disruptions²²⁷. By preserving significant natural characteristics, limiting human activity, and addressing rising hazards, MPAs can continue to offer crucial protection for maritime biodiversity and ecosystem services²²⁸.

4.2.4 Marine management problems

The efficiency of marine protected areas (MPAs) in preserving marine biodiversity and ecosystem services is threatened by a variety of management issues.

4.2.4.1 Climate change

Climate change is a major management issue for marine protected areas (MPAs), as it can affect biodiversity and ecosystem services designed to conserve²²⁹. The effects of climate change on marine systems include fluctuations in temperature, sea level rise, ocean acidification, and changes in the frequency and intensity of severe

²²⁴ Ahmadi et al., 2015

²²⁵ Cognetti, 1986

²²⁶ Ahmadi et al., 2015

²²⁷ Hoppit et al., 2022

²²⁸ Katsanevakis, 2013

²²⁹ Weiskopf, 2020

weather events like storms and heat waves²³⁰. These changes in marine ecosystems may have a substantial impact on species distribution and abundance, ecosystem resilience and function, and the capacity to offer ecosystem services like carbon sequestration and fisheries production²³¹. The effectiveness of MPAs may be damaged by these impacts, resulting in adaptation measures being required to maintain this effectiveness²³².

When constructing MPAs, the effects of climate change such as altered species distribution and habitat loss should be considered²³³. Planning MPAs to account for changes in species distribution and make sure they are big enough and well-connected might increase ecosystem resilience²³⁴. In order to promote resilience and flexibility to climate change, management practices should be implemented. Among the ways to do this is to lessen stresses on marine ecosystems, such overfishing and pollution, and to encourage ecosystem-based management strategies that increase ecosystem resilience²³⁵.

Monitoring the effects of climate change on marine ecosystems via surveillance and research may also assist in the discovery of management strategies that promote adaptation and resilience²³⁶. Effective stakeholder involvement may help to increase resilience to climate change and build adaptive capacity. Two examples of what this may involve include increasing local ability to use adaptive management strategies and including stakeholders in planning for climate change adaptation²³⁷.

In general, managing marine protected areas has substantial problems due to climate change. In order to guarantee the ongoing protection of marine biodiversity and ecosystem services in the face of climate change consequences, effective adaptation techniques will be essential²³⁸.

²³⁰ Keller et al., 2009

²³¹ Weiskopf, 2020

²³² Keller et al., 2009

²³³ Kriegl et al., 2021

²³⁴ Otero et al., 2013

²³⁵ Kriegl et al., 2021

²³⁶ O'Regan et al., 2021

²³⁷ Keller et al., 2009

²³⁸ O'Regan et al., 2021

4.2.4.2 Pollution

For marine protected areas (MPAs), pollution is a major management challenge as it threatens ecosystem services, degrades habitats and reduces biodiversity²³⁹. Marine pollution may come from a variety of sources, including land-based ones like agricultural runoff and urban rainwater as well as ocean-based ones like ships and oil spills.

- **Habitat degradation:** Pollution may harm crucial ecosystems inside MPAs, including coral reefs, seagrass meadows, and mangrove forests. This might make it harder for many species to survive and reproduce while also making it harder to find suitable habitat for them.
- **Contamination and toxicity:** Pollution may bring pollutants like toxins into the marine environment, which might be harmful to marine life's health and well-being²⁴⁰. This can impact their ability to reproduce, feed and maintain thriving populations.
- **Change of nutrient cycles:** Nutrient cycles in marine ecosystems may be disturbed by pollution, which can change the primary production and abundance of certain species²⁴¹. This can have an impact on the overall performance of the ecosystem and reduce the ecological services it can provide.
- **Changes to the structure of the community:** The species composition and community structure of marine ecosystems may alter as a result of pollution, often favoring species that are more resilient to environmental deterioration. As a result, marine ecosystems may be less resilient and may lose some of their biodiversity.

Effective management strategies for pollution in MPAs may include:

- **Reducing pollution at source:** For maritime pollution to be properly controlled, the source of the contamination must be stopped. In order to do this, laws and regulations may need to be put in place that restrict fertilizer inputs, regulate maritime activities, and prevent oil spills.

²³⁹OECD, 2012

²⁴⁰ Pascual et al., 2016

²⁴¹ Stafford, 2018

- Supporting sustainable practices: Sustainable fishing and aquaculture methods, for example, may reduce pollution and promote ecosystem health in MPAs²⁴².
- Enforcement and monitoring: Regularly measuring the pollution levels within MPAs may assist pinpoint pollution sources and evaluate the efficacy of management measures. Enforcing rules and procedures firmly might also help deter polluting conduct²⁴³.
- Restoration and rehabilitation: By repairing damaged habitats inside MPAs, such as coral reefs and seagrass beds, restoration and rehabilitation programs may aid in the recovery of marine ecosystems.

In conclusion, pollution is a significant management challenge for MPAs, but sensible management practices may lessen its effects and support the ongoing preservation of marine biodiversity and ecosystem services.

4.2.4.3 Navigation Impact

Impacts on navigation may also provide a significant management problem for marine protected areas (MPA). Marine traffic and recreational boating may have a range of effects on marine ecosystems²⁴⁴. Navigational issues can lead to habitat degradation and destruction, especially in shallow areas where seagrass beds and coral reefs are present²⁴⁵. Operations like dredging and anchoring might ruin important marine ecosystems and alter habitats under the water. One especially significant method in which maritime operations may contribute to marine pollution is the discharge of trash, such as sewage and oil. This may harm the marine environment's biodiversity and lower water quality²⁴⁶.

Increased vessel traffic may lead to injuries or fatalities from collisions with marine creatures like sea turtles. Navigating may generate a lot of noise pollution while

²⁴² Weiskopf, 2020

²⁴³ Tonin, 2018

²⁴⁴ Marcos et al., 2021

²⁴⁵ Mancinelli & Vizzini, 2015

²⁴⁶ McLeod et al., 2009

utilizing sonar and other audio equipment²⁴⁷. This can alter the behavior of marine animals and affect their ability to communicate and find food.

Effective management strategies for navigational impacts in MPAs may include²⁴⁸ :

- **Bring to life:** The danger of habitat damage and disturbance may be reduced by establishing zoning restrictions, which can assist restrict navigation operations in vulnerable regions like seagrass meadows and coral reefs.
- **Education and awareness raising:** Educating shippers and shipping operators on the effects of shipping operations on marine ecosystems may help encourage the use of sustainable practices²⁴⁹ .
- **Monitoring and enforcement:** Consistent surveillance of navigation activities inside MPAs may assist identify problem areas and verify that laws and regulations are being observed.
- **Alternative technologies:** The effect of navigation operations on marine ecosystems may be minimized by using alternate navigation technologies, such as electric propulsion and satellite-based positioning systems²⁵⁰.

Overall, affects on navigation may provide a serious management challenge for MPAs, but sensible management practices can lessen these effects and support the preservation of marine biodiversity and ecosystem services.

4.2.4.4 Unsustainable fishing

Another significant management issue for marine protected areas is unsustainable fishing. Overfishing and unethical fishing practices may harm marine ecosystems and biodiversity in a variety of ways. Unsustainable fishing practices may lead to fish supply depletion, which may have repercussions for the whole marine ecosystem²⁵¹. This might potentially impact other species that rely on the target

²⁴⁷ Marcos et al., 2021

²⁴⁸ Ahmadi et al., 2015

²⁴⁹ Sullivan-Stack et al., 2022

²⁵⁰ Sullivan-Stack et al., 2022

²⁵¹ Stafford, 2018

species for sustenance. Two fishing methods, trawling and dredging, have the potential to physically harm bottom habitats and destroy important marine ecosystems. Bycatch, or the unintended capture of species that are not the intended target, is a significant issue in many fisheries. This may cause non-target species to perish and aid in population decline. Unsustainable fishing practices have the potential to alter marine food webs and ecosystems, which might have a severe impact on the abundance and variety of other species²⁵².

Effective management strategies for unsustainable fishing in MPAs may include²⁵³ :

Fishing quotas and seasonal closures are two examples of fishing restrictions that can be put in place to reduce fishing pressure and encourage sustainable fishing methods.²⁵⁴

Gear restrictions: by banning harmful fishing methods such as trawling and dredging, for example, gear restrictions can protect important marine ecosystems and reduce by-catches²⁵⁵ .

Monitoring and enforcement: Consistent observation of fishing activity within MPAs can help identify problem areas and ensure that rules and guidelines are followed²⁵⁶ .

Community involvement: Promoting sustainable fishing methods and supporting conservation efforts can be achieved by working with fishing communities and incorporating their views and traditional knowledge²⁵⁷ .

Unsustainable fishing practices are a significant management problem for MPAs as a whole, however sound management practices may encourage the use of sustainable fishing techniques, preserve marine biodiversity, and promote ecosystem services.

²⁵² Stafford, 2018

²⁵³ Watson et al., 2015

²⁵⁴ Balbar & Metaxas, 2019

²⁵⁵ Cognetti, 1986

²⁵⁶ Balbar & Metaxas, 2019

²⁵⁷ Costello & Kaffine, 2010

4.2.4.5 Unsustainable tourism

Unsustainable tourism is a significant management concern for marine protected areas. Tourism may affect marine ecosystems and biodiversity in both positive and negative ways²⁵⁸. But if tourism is not handled sustainably, it may have a number of negative effects. Unsustainable tourism activities, particularly in sensitive areas like coral reefs and seagrass beds, may affect the ecosystem. These practices include building infrastructure and developing tourist attractions²⁵⁹. One way that the tourist sector may help to pollute the ocean is by releasing waste products like sewage and chemicals. This may harm the marine environment's biodiversity and lower water quality²⁶⁰. Recreational activities like scuba diving, snorkeling, and boating may harm the natural marine habitats, including coral reefs²⁶¹. Unsustainable tourism may also disturb marine life, especially in regions where there is a lot of tourist activity, altering their behavior and perhaps even causing stress.

Effective management strategies for unsustainable tourism in MPAs may include²⁶² :

Bring to life: By enacting zoning laws, you can help limit tourism-related activities in vulnerable areas, reducing the risk of habitat disturbance and damage²⁶³ .

Environmental requirements: Implementing environmental requirements for tourism-related activities, such as waste management and ethical tourism practices, can help reduce levels of pollution and other adverse impacts²⁶⁴ .

The use of visitor management techniques, such as regulating tourist behavior and visitor numbers, can help reduce physical damage and disturbance to marine life²⁶⁵ .

²⁵⁸ Pham, 2020

²⁵⁹ Kriegl et al., 2021

²⁶⁰ Sunlu, 2003

²⁶¹ Pham, 2020

²⁶² Pham, 2020

²⁶³ Fox et al., 2006

²⁶⁴ Halpern, 2014

²⁶⁵ Gutierrez et al., 2023

Community involvement: Working with local stakeholders and communities can help increase support for sustainable tourism practices and guarantee that tourism is beneficial to the local economy and the environment²⁶⁶.

Overall, unsustainable tourism is a major management problem for MPAs, but effective management strategies can help promote sustainable tourism practices and conserve marine biodiversity and ecosystem services.

4.2.5 Management effectiveness

It is crucial to assess the efficiency of management in marine protected areas (MPAs), regardless of whether conservation goals are achieved and planned management strategies are put into action. The most important factor to consider when assessing the success of MPA management is if conservation goals are satisfied²⁶⁷. This involves monitoring changes in fish populations, habitat quality, biodiversity and other ecological indicators²⁶⁸. Good governance is crucial for managing MPAs. This comprises clear policies and procedures, capable management and leadership, and sufficient resources for administrative work. Collaboration with local residents, fishermen, and other stakeholders is essential for efficient MPA management. Stakeholders may give meaningful information on the area context and aid in building support for conservation efforts.

MPA management activities must be routinely evaluated and appraised to identify opportunities for development, track progress toward conservation objectives, and adjust management strategies as necessary²⁶⁹. Enforcing regulations inside MPAs is essential for achieving conservation objectives. This necessitates having the means to impose fines for noncompliance²⁷⁰. Key components of adaptive management are adaptability and reactivity to changing environmental

²⁶⁶ Halpern et al., 2010

²⁶⁷ Hansen et al., 2011

²⁶⁸ Hoppit et al., 2022

²⁶⁹ Bennett & Dearden, 2014

²⁷⁰ Garcia-Rubies et al., 2017

circumstances, new hazards, and new information. This approach enables ongoing learning and management plan adaption to meet conservation objectives²⁷¹ .

Combining these elements is necessary for effective MPA management, and their effectiveness is determined by how effectively they are put into practice and how much they aid in attaining conservation goals. Monitoring and assessing the MPA's efficacy is continuous, and it should be done on a regular basis to make sure that management tactics stay current and efficient throughout time²⁷² .

4.3 Management of marine protected areas in the Mediterranean

The Mediterranean area has a considerable number of Marine Protected Areas (MPAs), which are crucial for preserving biodiversity and assisting local communities²⁷³. Effective MPA management is essential in the Mediterranean to make sure that conservation goals are realized and to promote sustainable resource use²⁷⁴ .

Removing particular regions from fishing, tourism, and conservation helps close gaps in opportunity and ensures responsible resource management²⁷⁵. Cooperation with regional inhabitants, fishermen, and other stakeholders is necessary for effective MPA management in the Mediterranean. Stakeholders may give meaningful information on the regional framework and aid in building support for conservation efforts²⁷⁶. MPA management activities must be routinely evaluated and appraised in order to pinpoint potential areas for improvement, track progress toward conservation objectives, and adjust management strategies as necessary. Enforcing regulations inside MPAs is essential for achieving conservation

²⁷¹ Bennett & Dearden, 2014

²⁷² Bennett & Dearden, 2014

²⁷³ Keller et al., 2009

²⁷⁴ Sardá et al., 2017

²⁷⁵ Bennett & Dearden, 2014

²⁷⁶ Keller et al., 2009

objectives. This necessitates having the means to impose fines for breaking the law²⁷⁷ .

By integrating MPA management with broader regional and national management frameworks, it is feasible to guarantee that conservation aims are congruent with other priorities and that management activities are adequately coordinated²⁷⁸. Promoting sustainable tourism inside and next to MPAs may boost local economy by reducing negative effects on marine organisms and ecosystems. Promoting sustainable tourism inside and next to MPAs may boost local economy by reducing negative effects on marine organisms and ecosystems²⁷⁹ .

Effective management of MPAs in the Mediterranean requires a mix of these strategies, ongoing stakeholder contact, and adaptive management. Numerous issues, including unsustainable fishing practices, pollution, and climate change, make it difficult to maintain MPAs effectively in the Mediterranean. A coordinated and cooperative approach that includes all stakeholders and promotes resource sustainability for the benefit of both people and the environment is needed to address these difficulties.

²⁷⁷ Bellanger et al., 2020

²⁷⁸ Sardá et al., 2017

²⁷⁹ Bennett & Dearden, 2014

CHAPTER V

MARINE PROTECTIVE AREAS IN GREECE

5.1 The case of Greece

Greece boasts one of the largest coasts in the Mediterranean Sea and some of the most biodiverse marine habitats²⁸⁰. The nation's various islands and the mainland together make up about 15,000 kilometres of coastline. Greece has also ratified many regional and global treaties and agreements aimed at preserving the marine environment²⁸¹. This chapter will discuss the present state of Greece's marine protected zones and their significance for the preservation of the maritime environment.

5.2 Marine Protected Areas in Greece

Marine Protected Areas (MPAs) are parts of the ocean and shoreline that have particular protection because of their ecological, scientific, cultural, or recreational importance. For the preservation of the nation's marine biodiversity, the protection of endangered species, and the development of sustainable fishing, Greece has designated a number of regions as MPAs²⁸². One of the first MPAs in Greece was created when the National Marine Park of Zakynthos was established in 1999. Its overall area in the Ionian Sea is 1,880 km², which includes the island of Zakynthos and other nearby islands²⁸³. There are several threatened species in the region, including the loggerhead sea turtle (*Caretta caretta*) and the Mediterranean seal (*Monachus monachus*). Boating, fishing, and hunting are prohibited within the park's limits, and visitor activities are strictly regulated. Greece has a significant MPA in the Northern Sporades National Marine Park, which was established in 1992. Its overall size, which includes the smaller islands of Alonnisos and Peristeras, is 2,260 km² and it is situated in the Aegean Sea. There are several threatened species in the region, including the Mediterranean seal and the gull

²⁸⁰ Sourbes, 2012

²⁸¹ Syrou & Botetzagias, 2022

²⁸² Sourbes, 2012

²⁸³ Sourbes, 2012

(*Ichthyæetus audouinii*)²⁸⁴. Within the boundaries of the park, boating, fishing and hunting are not allowed and tourist activities are closely controlled. Greece has declared several Natura 2000 sites in its marine seas in addition to these national MPAs. The European Union created the network of protected areas known as Natura 2000 in order to preserve biodiversity²⁸⁵. The network includes sites of particular importance for the conservation of ecosystems and species covered by EU directives on ecosystems and birds. In its marine waters, Greece has declared 241 Natura 2000 sites, covering a total area of 72,414 km²²⁸⁶.

5.3 Importance of Marine Protected Areas in Greece

Greek MPAs are vital for the conservation of the country's marine biodiversity, the protection of endangered species and the promotion of sustainable fisheries. Through environmentally friendly tourism initiatives, MPAs also significantly strengthen local economies. Several endangered species, such as the Mediterranean seal and the loggerhead sea turtle, can be found in Greece's MPAs²⁸⁷. Numerous challenges, such as habitat loss, pollution and overfishing, affect these species. These animals can breed and rebuild their numbers because of the protection offered by MPAs. By maintaining spawning and nursery habitats for fish and other marine species, MPAs in Greece also support sustainable fisheries²⁸⁸. Fish populations can reproduce and increase in numbers when these areas are protected, which is beneficial for the environment and fishing activity²⁸⁹. In order to support the long-term survival of fish stocks, MPAs also encourage sustainable fishing techniques, such as selective fishing and the use of non-destructive fishing gear²⁹⁰. Through environmentally friendly tourism initiatives, MPAs in Greece also significantly strengthen local economies²⁹¹. Visitors who enjoy the outdoors and outdoor activities such as hiking, diving and snorkeling flock to MPA. To reduce negative environmental impacts and maintain the long-term sustainability of MPAs, tourism activities are strictly monitored. The development and management of MPAs in

²⁸⁴ Syrou & Botetzagias, 2022

²⁸⁵ Sourbes, 2012

²⁸⁶ Syrou & Botetzagias, 2022

²⁸⁷ Sourbes, 2012

²⁸⁸ Sourbes, 2012

²⁸⁹ Syrou & Botetzagias, 2022

²⁹⁰ Sourbes, 2012

²⁹¹ Syrou & Botetzagias, 2022

Greece has made tremendous progress, but there are still a number of obstacles to overcome²⁹².

5.4.1 Lack of enforcement

One of the biggest problems with the Greek management of marine protected zones is a lack of enforcement. Even though there are laws and regulations in place to safeguard the maritime environment, pressure from illicit fishing, pollution, and coastal development is considerable in many protected areas. Lack of finance, personnel, and government support for marine conservation are the causes of the lack of enforcement.

5.4.2 Inadequate monitoring and research

In order to assess the performance of conservation efforts, comprehend ecological dynamics, and recognize emerging threats, monitoring and research are crucial for the efficient administration of marine protected areas²⁹³. Greece, however, finds it difficult to make informed management choices in many sectors due to a lack of sufficient monitoring and research. Marine protected zones need financing for monitoring and research operations to be sustained over the long term.

5.4.3 Conflicting interests

Because diverse stakeholders have various aims and purposes, Greece's maritime protected zones sometimes deal with conflicting interests. For instance, whereas owners of tourism-related businesses could think that marine protected areas restrict their capacity to provide recreational activities, fisherman might think that same areas restrict their access to fish stocks²⁹⁴. It is important and difficult to find a balance between conservation efforts and the demands of nearby companies and communities.

5.4.4 Climate change

Climate change poses a major threat to marine ecosystems, particularly those found in marine protected zones. The marine ecosystem and animals may be significantly

²⁹² Syrou & Botetzagias, 2022

²⁹³ Syrou & Botetzagias, 2022

²⁹⁴ Syrou & Botetzagias, 2022

impacted by ocean acidification, sea level rise, and heat. Climate change is most likely to be felt in the Mediterranean area, where temperatures are predicted to climb faster than the world average²⁹⁵. Greece's marine protected areas face a huge challenge in terms of adapting to the impacts of climate change and taking measures to reduce these impacts.

5.4.5 Lack of public awareness and engagement

If Greek marine protected zones are to engage and enlighten the public, they must be successful. The public often lacks knowledge about the value of marine conservation, the purpose of marine protected zones, and the advantages they provide²⁹⁶. Increase public engagement and understanding via education and awareness-raising programs to support marine conservation efforts²⁹⁷.

The preservation of marine protected areas (MPAs) is crucial for maintaining Greece's unique marine biodiversity, which is characterized by high levels of endemism and a particular mix of species from the Atlantic and Mediterranean. Greece's MPAs are also of significant economic and social value since they encourage ecologically responsible travel while also providing essential habitats for commercial and recreational fishing²⁹⁸. In the analysis of this chapter, the background, current state, and management strategies of MPAs in Greece will be discussed. Greece has a long history of marine conservation, beginning with the creation of marine reserves to save dolphins, turtles, and other aquatic life in antiquity²⁹⁹. Greece's first marine protected area was formally established in 1966 with the creation of the National Marine Park of Zakynthos. Greek Marine Protected Areas (MPAs) today include a variety of marine habitats, including seagrass meadows, stony reefs, and deep-water canyons³⁰⁰. Over 16,000 square kilometers, or roughly 6% of Greece's maritime waters, are covered by MPAs. The Ministry of Maritime Affairs and Insular Policy, the Ministry of Rural Development and Food, and the Ministry of Environment and Energy are just a few of the organizations in

²⁹⁵ Sourbes, 2012

²⁹⁶ Syrou & Botetzagias, 2022

²⁹⁷ Sourbes, 2012

²⁹⁸ Sourbes, 2012

²⁹⁹ Syrou & Botetzagias, 2022

³⁰⁰ Sourbes, 2012

charge of managing MPAs. Different MPAs use various management techniques³⁰¹. Some focus heavily on conservation, while others allow commercial fishing and tourism.

One of the main problems the administration of the MPA of Greece is dealing with is a lack of personnel and financial resources. Greece has several marine protected areas (MPAs), but a lot of them are understaffed and underfunded, making it challenging for them to effectively administer and monitor the maritime environment³⁰². Greater coordination and communication are also required amongst the different Greek authorities in charge of managing MPAs in order to guarantee that management practices are standard and efficient³⁰³. Greece's MPAs have contributed significantly to maritime conservation and sustainable development despite these challenges. Along with the protection of significant maritime ecosystems and species, MPAs have supported sustainable fishing and tourist practices, which are crucial for the local population's way of life³⁰⁴. As threats to marine biodiversity grow, the significance of MPAs in Greece and throughout the globe will rise, underscoring the need for ongoing investment in their management and conservation. Although there are still a number of challenges, Greece has made tremendous progress in developing and managing marine protected zones³⁰⁵. Continued investment in money, human resources, and research are required to properly enforce, monitor, and preserve marine protected areas. In Greece, marine protected zones' long-term viability also rests on striking a balance between preservation and the needs of the community's people and enterprises³⁰⁶.

³⁰¹ Syrou & Botetzagias, 2022

³⁰² Sourbes, 2012

³⁰³ Syrou & Botetzagias, 2022

³⁰⁴ Sourbes, 2012

³⁰⁵ Syrou & Botetzagias, 2022

³⁰⁶ Sourbes, 2012

Conclusion

Marine Protected Areas (MPAs) are an essential tool for conserving marine biodiversity and ensuring the vitality and health of marine ecosystems³⁰⁷. The current state of the marine environment is at a critical stage, with the world's seas facing a multitude of risks from human activity. MPAs offer a system for controlling marine resources and can reduce the impact of these risks. In this essay, we examined the importance of MPAs, the international and European laws governing their management, and the difficulties in effectively controlling and managing MPAs³⁰⁸. It is impossible to overstate the value of MPAs. Numerous key ecosystem services, such as carbon sequestration, nitrogen recycling and climate regulation, are provided by marine ecosystems. They are also essential to the food security and economic well-being of many coastal communities, as well as a variety of other economic activities, including tourism and fisheries. However, a variety of anthropogenic stressors, such as overfishing, pollution, habitat destruction and climate change, pose a risk to these ecosystems³⁰⁹. By providing protected areas where ecosystems can recover and thrive, promoting sustainable use of resources and enhancing ecosystem resilience, MPAs can help combat these challenges³¹⁰.

We looked at the advantages of MPAs, which include social, economic and environmental benefits. From an ecological perspective, MPAs can help restore damaged ecosystems, save important habitats and promote biodiversity. Economically, MPAs can promote tourism, support sustainable fisheries and help local communities by creating jobs and money³¹¹. Socially, MPAs can promote community involvement and understanding of marine conservation concerns, while providing opportunities for research and teaching. Effective governance and management of MPAs continues to be a serious difficulty despite these

³⁰⁷ Sullivan-Stack et al., 2022

³⁰⁸ Trouillet & Jay, 2021

³⁰⁹ Sullivan-Stack et al., 2022

³¹⁰ Sink, 2016

³¹¹ Sink, 2016

limitations³¹². The limitations of maritime governance, governance incentives and governance problems were some of the main issues we looked at. These challenges are exacerbated by the dynamic and complex character of marine ecosystems, the need for stakeholder involvement, and the challenges of managing resources across international borders³¹³. The significance of management planning was also covered, along with connection and resilience in the maritime environment, risk and climate change management, implications on navigation, pollution, unsustainable fishing, and tourism³¹⁴.

The management of MPAs in the Mediterranean presents both obstacles and opportunities, as demonstrated by the example of Greece. Greece hosts a wide range of marine environments, including coral reefs, deep-sea habitats and seagrass beds. In order to preserve important ecosystems and promote sustainable fisheries and tourism, the nation has established a number of MPAs, including the Zakynthos National Marine Park and the Northern Sporades Alonissos National Marine Park. However, the management of these MPAs faces several difficulties, such as lack of funding, stakeholder participation and the requirement for better enforcement and monitoring.

The study first emphasizes the value of marine protected areas for maintaining marine biodiversity and advancing long-term economic and social advancement³¹⁵. Fish populations have increased, marine protected zones have benefited species and ecosystems, and they have fostered environmentally friendly travel. The fourth item in the list emphasizes the possible advantages of marine protected zones for local communities³¹⁶. While protecting marine biodiversity, promoting sustainable fishing and tourism, and supporting the lives of neighboring people. The research also emphasizes how marine protected areas might serve as a platform for environmental education and awareness³¹⁷.

³¹² Sullivan-Stack et al., 2022

³¹³ Trouillet & Jay, 2021

³¹⁴ Sullivan-Stack et al., 2022

³¹⁵ Zupan et al., 2018

³¹⁶ Sink, 2016

³¹⁷ Trouillet & Jay, 2021

The report underlines significant challenges and the need for more research related to the creation and maintenance of maritime protected zones. Additional study on the social and economic effects of marine protected areas is required, as well as better monitoring and evaluation of marine protected areas, enhanced integration of marine protected areas into wider marine and coastal management systems, and more³¹⁸. The study's overall findings emphasize the significance of marine protected areas in fostering the preservation and sustainably harvested use of marine resources. By providing a framework for efficient administration and management, marine protected areas may be a crucial instrument for attaining conservation goals and fostering sustainable economic and social development³¹⁹.

³¹⁸ Trouillet & Jay, 2021

³¹⁹ Zupan et al., 2018

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