# Marine Protected Areas as Tools for Ocean Sustainability

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**Abstract**

Science is clear in showing that we are facing two existential challenges: a climate emergency and a species extinction crisis. These challenges are rooted in the extractive and linear economic model we have globally adopted, in which economic development is intertwined with the destruction of nature. Europe has recently responded politically by adopting the European Green Deal with a set of policies aimed at transforming the EU economy envisaging a future with no net carbon emissions and where economic growth is decoupled from resource use. Despite the dire state of the ocean and the urgency to implement effective solutions, we continue to witness the loss of nature and, with it, the loss of current and future economic and social value. Marine protected areas (MPAs) are one of the most effective solutions to address these challenges. There is, however, the need to clarify what these area-based management tools are, how they can provide benefits, what conditions must be met to ensure they are effective, and how a strategy can be adopted to increase the breadth, speed and success of efficient MPAs to save what is left in the ocean, allow ecosystems to recover, and build sustainable jobs and economic growth.

**Keywords**

Marine protected areas · Ocean governance · Benefits of protection · Science-based decisions · Stakeholder engagement · Government leadership

## 1 Introduction

We have today a solid scientific understanding of the environmental crises facing the ocean, supported by indisputable facts compiled in papers and reports such as those of the Intergovernmental Panel on Climate Change (IPCC) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). Knowledge of the challenges and the science behind them places a demand on decision-makers and society to find solutions that can respond with the speed, scale and breadth needed to face these existential problems. Marine protected areas (MPAs) are known to be one of the most effective tools to protect what is left in the ocean, allow ecosystems to recover, and support nature-based solutions to the climate crisis. However, we currently have too few MPAs, and many do not work, preventing the ecological, social and economic benefits of protection from being fully delivered.

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This chapter will begin with a global assessment of the status of human impacts on the ocean and will identify the main causes of those impacts (Sect. 2). Solutions to those impacts will then be explored, focusing on MPAs and their definition and scope (Sect. 3). Subsequently, some key aspects of the functioning of MPAs will be covered, with emphasis on the conditions needed to guarantee the effectiveness and persistence of these conservation tools (Sect. 4). Next, some standards for designating, implementing and maintaining MPAs are presented, such as those of the International Union for Conservation of Nature (IUCN) and the new MPA Guide, with a view to discussing ways to increase the speed with which they are established, the extent of their protection and the success of their implementation (Sect. 5). Lastly, the chapter will discuss MPAs within the wider context of a 100% managed ocean (Sect. 6).

## 2 Ocean Sustainability: Status and Roots of the Problem

Science is clear in showing us that our societies are facing two environmental existential crises: a climate emergency (Pörtner et al. 2019) and a species extinction crisis (Díaz et al. 2019). Evidence of these crises has been made available to decision-makers, from politicians to business leaders, to ocean stakeholders, to managers and to the wider society, at an ever-increasing pace. Although the ocean is the least studied system on the planet, with a large portion of the seabed and the full extent of ocean biodiversity still unknown to science, an estimated 91% of marine species still undescribed and over eighty percent of the ocean floor as yet unmapped and unexplored (Mora et al. 2011), human impacts on the ocean are indisputable and their magnitude and extent is only now beginning to be understood by society.

In fact, until very recently, the ocean was seen as an inexhaustible source of food, and human activities were not perceived as being able to seriously disturb the functioning of marine ecosystems. We have even used the ocean as a deposit for some of our garbage, including dumping large quantities of radioactive waste in the deep sea, and we continue do to so now, with nutrients from agriculture and our city sewage systems, pollutants from our industries, and plastics and microplastics from our production systems.

The perception that the ocean is too big to fail still persists today in many management and policy contexts. This has consequences for the way we manage biomass extraction (fisheries) and production (aquaculture), non-living resource extraction (sediments and minerals), energy production (oil and gas, and renewables), and essentially any use in the ocean. In fact, in many cases we still consider the ocean to be fundamentally an open access space where our individual and collective "rights of use" should not be limited, forgetting the responsibility to protect and sustainably manage the "commons" that is the ocean space and the ocean life within it. Only now are we beginning to see a consensus on changing this view, which can be encapsulated in a "new narrative for the ocean" (Lubchenco and Gaines Steven 2019): neither too big to fail nor too big to fix, but rather too big to ignore.

The root of the challenges we are now facing lies in the fact that the global economic markets built post World War II considered marine natural resources essentially to be a free-to-take asset and regarded the impacts of extraction on ecosystems as an externality (meaning that the costs of those impacts are not being incorporated in the activities that exploit ocean resources). The consequences of this position are now clear to us, and the activity with the largest impact in the ocean is fisheries targeting wild animal species.

Globally, 90% of the world's fisheries are either fully exploited (61%) or overexploited (29%) (FAO 2020) and a mere 13.2% of the ocean can be considered to have intact ecosystems with low impact from human pressures (Jones et al. 2018). Up to a third of catches, worth up to $23 billion, are illegal, unreported, or unregulated (IUU) (FAO 2021). At the global scale, 55% of the ocean area is used for industrial fishing and the fishing fleet increased from 1.7 to 3.7 million vessels between 1950 and 2015. Some fish groups are particularly impacted

by this often unregulated or poorly regulated activity, namely large predatory fish that play a central role in the functioning of marine systems and, in particular, sharks. In fact, since the 1970's, the abundance of shark populations has declined 71% (Pacoureau et al. 2021), with an estimated 100 million sharks being caught each year, and the biomass of many large predatory fish is today only around 10% of pre-industrial levels (Myers and Worm 2003). Even some whale populations, which are often considered safe following the industrial whaling ban agreed in the 1940's, are today a mere fraction of their pre-whaling abundance with some species such as the blue whale, the largest animal ever to occur on Earth, at levels of around 10% their historical size.

On top of this, human activities are also polluting the ocean. 5 to 12 million metric tons of plastic enter the ocean every year, noise and chemical pollution impact many marine species, and nutrient inputs such as nitrogen and phosphorus cause hypoxia, harmful algal blooms and an increase in eutrophication phenomena and dead zones. Several of these impacts have cumulative and synergistic effects on marine live, many of which are still unknown today.[1]

The message is therefore clear and simple: we are destroying the planet and we know why.

## 3 Why We Need Marine Protected Areas to Achieve Ocean Sustainability

Given that the message is clear—we have a problem, and we know what is causing it—the logical question that follows is how to solve that problem. Before we explore solutions, however, it is important to reiterate the facts: our extractive and linear economic model is destroying nature and current regulatory frameworks have not been able to reverse this destruction and degradation of the natural world. If we accept these facts, then we also need to accept that the way we have been attempting to regulate activities in the ocean has not been effective. And this leads to another question: Are the current regulatory mechanisms useless, meaning that we need new ones, or can they work and the problem is only that we have not been using them to their full potential?

Having reached this point, let us now explore potential solutions to the main challenges and impacts on ocean systems. Evidently, this is a complex issue with many different dimensions, from the regulation of each activity—fishing, transport, energy, recreation—to the way different societies and communities use the ocean, to area-based management tools such as marine spatial planning, fishing closures, marine protected areas (MPAs) and other effective area-based conservation measures (OECMs), etc.

Most importantly, we know that to address the challenges of the climate emergency and species extinction crisis, we need to be able to decarbonise the economy and to stop destroying nature. However, it is not enough to identify what we need to do (Duarte et al. 2020); it is critical that we have the capacity to do it at a speed, on a scale and with the effectiveness that is compatible with the challenges we are facing.

Marine Protected Areas (MPAs) are one of the most effective tools to protect what is left of the ocean's natural world and, equally importantly, to restore the ocean blue natural capital to pre-industrial levels, so that a socially resilient and economically healthy society is possible. They are also a key complement to conventional fisheries management, as they contribute to increasing fish stocks and to mitigating climate change by protecting marine carbon stocks (Sala et al. 2021). Without nature there will be no future for our societies.

However, in spite of over 30 years of efforts to implement MPAs worldwide, thus far we have only been able to protect less than 8% of the ocean with these legal instruments, with less than 3% of that area excluding extractive activities such as fishing (The Marine Protection Atlas 2022). Moreover, a large percentage of the global MPAs are not effective, i.e. they are not delivering the benefits for which they were created in the first place, and many of them allow

[1] For a complete overview of the existential challenges see: Oceano Azul Foundation (2021).

fishing and other extractive and destructive activities inside their borders. This has two interrelated consequences: on one hand, nature continues to be degraded and recovery to be compromised, even inside many MPAs; on the other hand, society thinks that progress is being made due to the recent race to scale up marine protection and country's announcements around these protections, creating a false sense of success (Sala et al. 2018).

One of the main problems with the way countries and the international community have been using MPAs is the historical lack of a common approach on definitions, criteria and standards for MPAs. Let us now consider these aspects which are critical to the future success of ocean conservation.

MPAs are defined by the International Union for the Conservation of Nature (IUCN) as: "A clearly defined geographical space, recognised, dedicated, and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values" (Day et al. 2019). This means that, for an area to be considered an MPA, there are a set of conditions that need to be met (all of them) so that the expected benefits of protection can be achieved. The long-term conservation of nature needs to be the main objective, which excludes other areas such as fishing closures and other fisheries management areas, military areas, wind farms, aquaculture sites, etc., that may lead to some conservation benefits but are not designated for the purpose of protecting nature. Also, MPAs need to be permanent and not be vertically zoned. They need to be managed by dedicated teams with enough resources to guarantee their surveillance and monitoring. The clearly defined geographical space requires MPAs to be placed in suitable areas for nature conservation but also guaranteeing that they are sufficiently large to achieve the defined objectives. Lastly, they need to provide conservation outcomes that meet or exceed their conservation objectives and goals (IUCN 2018).

A critical aspect of MPA effectiveness is the level of protection. Often, the number and types of activities allowed inside an MPA are not compatible with the above definition and/or their impacts do not allow the MPA to achieve its goals. Moreover, there is often a mismatch between the stated conservation goals and the regulations of the MPA (Costa et al. 2016).

Thus, we have an instrument that works (see below) and can provide the necessary tools to protect and recover nature and deliver economic and social benefits to society, but that instrument has not been used efficiently. Let us now explore what we mean by efficient and effective marine protected areas and how worldwide use of these can be increased in order to provide the solutions for ocean sustainability that are urgently needed.

## 4 Effectiveness of Marine Protected Areas

Marine protected areas are area-based ocean management tools aimed at protecting and recovering nature. For these tools to be effective they must be designed and managed taking into account the way marine ecosystems function and how they respond to pressures and also how they will respond to the conservation measures to be put in place.

There is often a lack of understanding of the basic ecological and biological characteristics of marine life that need to be taken into consideration when designing MPAs. Since these areas should aim to protect or recover ecosystems as a whole (as even when specific species or habitats are the target, they do not live in isolation), it is critical to consider some key functional aspects in the design and management of MPAs. For example, most marine organisms have a dual life cycle with a pelagic (living in the water column) larval phase and a pelagic or benthic (living associated with the bottom) adult phase. This means that, for example, a species may depend on the dispersal environment where its larvae live, that larvae may associate with floating algae or objects until recruitment takes place, the species may recruit to coastal areas and estuarine habitats such as seagrass beds, spend some variable time there growing as a juvenile, migrate to deeper rocky habitats as an adult and move to specific breeding grounds when it is time for reproduction. In this

single example, a conservation strategy designed to effectively protect and recover the populations of such a species needs to focus attention on all those habitats and areas. Additionally, the life cycles of marine species are variable and different environments are dominated by different strategies, such as those of coastal systems, the open ocean or the deep sea.

Also, dispersal distances vary greatly between groups of species (from a few metres in some algae to hundreds of kilometres in some fish and invertebrates) and different species may disperse during the larval phase, adult phase or both. For example, spiny lobsters travel more than 100 km as both adults and larvae, but red coral do not move as adults and their larvae have very short dispersal distances. Some fish can travel 100 km as both adults and larvae while others disperse as larvae but as adults they remain within the same area for their entire life. This means that the larval and adult movements of marine animals and plants require the size of MPAs to be large, i.e. tens of hundreds or tens of thousands of square kilometres, to allow self-replenishment and connectivity with other protected populations of each species. Few existing MPAs are this large (in spite of current designations of very large MPAs), which means that few MPAs are self-sustaining and need to be considered in the context of national and regional networks of MPAs (Gaines et al. 2010).

MPA networks may be defined as "A system of individual marine protected areas operating cooperatively and synergistically, at various spatial scales, and with a range of protection levels, in order to fulfil ecological aims more effectively and comprehensively than individual sites could acting alone. The system will also display social and economic benefits, though the latter may only become fully developed over long time frames as ecosystems recover" (IUCN World Commission on Protected Areas (IUCN-WCPA) 2008, p. 11).

The concept of networks of MPAs is not new but there are very few global examples of effective and ecologically sound networks of MPAs. One of these is the California Marine Protected Area Network (California State MPAs 2022), comprising over 120 science-based protected areas that were defined following an inclusive stakeholder engagement process.

Besides a large size and/or ecologically connected and representative networks of MPAs, there are additional ecological and biological aspects that are important to consider. Some fish species are known to aggregate during breeding in specific areas and fishers know this all too well and target those areas for increased and fast revenues. However, fish aggregations are critical habitats that must be protected since they are the support for the replenishment of populations. Some particular areas may have a disproportionate role as breeding and nursery sites, for example, estuaries or seagrass beds. This means that, in addition to size, the positioning of MPAs is a key feature for effectiveness and, moreover, to fully derive the benefits of protection, MPAs need to be integrated in ecologically representative and connected networks and work together with other management approaches in the wider seascape.

Another important variable for management considerations is the size of fish and its impact on population dynamics. In several species, female reproductive output increases exponentially with fish size. A well-established effect of MPAs is that fish grow larger inside their borders and these fish produce exponentially more young that are also of higher quality (i.e. they have a better survival rate). For instance, in the case of the European seabass, a female of 40 cm produces 250,000 young, in comparison with 1.3 million for 60 cm and 3.3 million for 80 cm (Erguden and Turan 2005). Allowing large females to grow and breed is therefore invaluable in sustaining healthy fish populations and healthy fisheries. Yet, this is often counterintuitive since there is the perception that catching larger fish is more sustainable.

Adopting a science-based approach to the implementation of MPAs, and incorporating the biological and ecological aspects mentioned above, pays off as a strategy since well designed, regulated, implemented and managed MPAs which are fully protected provide benefits that science has named "the reserve effect". In global analysis of marine reserves (those MPAs which are fully protected), biomass increases of more

than 400% on average have been described (Lester et al. 2009). Moreover, since fish do not stay inside these reserves, increased catches and recruitment may occur in the nearby areas (Russ et al. 2004). In some instances, fishers quickly understand the value of these fully protected areas and start increasing their fishing effort right on the limits of these marine reserves, in what has been termed "fishing the line" (Kellner et al. 2007). On the other hand, weakly protected MPAs do not differ from fished areas (Zupan et al. 2018) and, as such, are not able to provide benefits or protect nature.

Time of establishment is also an important consideration to assess the effectiveness of MPAs. In fact, there is always a gap between setting the rules and finding the right conditions to start changing human uses in the ocean, and the biological and ecological responses of marine systems. Indirect effects may occur through cascading trophic interactions and take longer than direct effects on target commercial species. In many cases, the initial effects of protection can occur rather quickly, within 5 years of establishment, namely for exploited commercial species (Babcock et al. 2010). However, this response is species and system dependent and deep-sea species, for instance, may take much longer to recover from impacts. Species grow and mature at different rates and, hence, the benefits of MPAs will be displayed with different time scales. Some fast-growing species may achieve reproductive age at 6 months to a year (for instance squid or octopus), while others may take years (e.g. seabreams 2–4 years, some tuna species 3 years, dusky-groupers 5–12 years and white sharks 9 years). Deep-water species such as the orange roughy fish, may mature at around 30 years and may live up to 150 years. For others, such as deep-water corals, these variables are measured in centuries (Roark et al. 2009).

Although the science on the benefits of marine protection is clear, and there are currently 16,675 MPAs, only 6.1% of ocean within national jurisdictions is in implemented and fully/highly protected areas and the respective percentage in the high seas is a mere 0.8% (The Marine Protection Atlas 2022). Moreover, 94% of MPAs allow fishing, which prevents them from providing the full benefits of protection as they are not able to protect all their biodiversity components (Costello and Ballantine 2015).

With strong scientific support guiding decisions, clear knowledge of human impacts on the marine environment, and an effective and transformative tool for change (MPAs), what can we do better (and faster) to implement a global network to protect 30% of the global ocean in fully and highly protected areas by 2030 (this is the current target recently approved in the context of the new Post-2020 Global Biodiversity Framework of the Convention on Biological Diversity)?

## 5 What Can Be Done to Increase the Speed of Establishment, Extent of Protection and Success of Implementation of Marine Protected Areas?

A global network of scientists, practitioners, managers, and representatives of civil society and governmental organisations recently published the MPA Guide (Grorud-Colvert et al. 2021). This is the most complete study summarising the scientific information needed to understand how to plan, implement, evaluate, and monitor successful MPAs.

The MPA Guide outlines a recommended procedural framework to be followed as a critical step towards ensuring conservation efforts meet global, regional and national objectives and goals. This is a fundamental charter not only to assess what we are protecting and evaluate the effectiveness of that protection, but mostly to guide decision-making around successfully establishing these area-based management tools.

First and most importantly, it is necessary to accept that the establishment of an MPA must be a science-based process driven by governments and communities (allowing for different models of governance) and that it implies structured and consequential stakeholder engagement procedures.

Science guides the location, size, shape and spacing of MPAs in ecologically coherent, representative, and connected networks. This involves compilation and summarising of existing scientific information about natural values and human uses, and model scenarios for current and future climate realities, finding potential areas of conservation interest that encompass, for instance, intact and pristine ecosystems, species and habitats of conservation interest (e.g. IUCN red list, FAO vulnerable marine ecosystems), areas with restoration potential, climate refuges and corridors, migratory pathways, habitats and species representative of the biogeographic area of interest, populations of species of commercial value, trade-offs and cost-benefit analysis for fishing and other uses, etc.

For each MPA and for the network of MPAs under consideration, principles, objectives and design criteria should be proposed and agreed upon with stakeholders as a basis for systematic conservation planning approaches applied to the whole territorial seas and EEZ of countries (Margules and Pressey 2000). These should be based on a shared common vision for the ocean of that country and/or region, consolidated in legal instruments or frameworks. These approaches are effective only when there is sufficient buy-in, awareness and engagement of whole communities and interested parties. Public participation and effective engagement of not only the different levels of government but also civil society and economic actors, is therefore a key component of any successful process. Examples of principles relevant for the topic are science-based decisions, the precautionary principle, adaptive management, the ecosystem-based approach, transparency and information, stakeholder engagement, integrity of ecosystems.

Objectives (preferably quantitative) should include both natural and social dimensions, such as protecting vulnerable marine ecosystems, protecting relevant habitats and species, protecting pristine areas, including unique areas, species or habitats, integrating climate refuges, protecting essential fish habitats, recovering species and ecosystems, maintaining geographic diversity, maximising conservation outcomes and minimising socio-economic costs, respecting and integrating the rights of coastal communities and Indigenous peoples, etc.

Design criteria are important to frame the size, shape and spacing of MPAs within the network. They may include connectivity, representativity, replication, resilience, etc.

Importantly, an understanding of current uses, rights and social considerations is a critical aspect not only when defining the MPA objectives and processes for its designation, but mostly to guarantee that it is implemented respecting those rights and engaging the relevant interest groups.

One of the main barriers to successful MPA designation and implementation are economic considerations, namely in relation to fisheries but also to wider benefits to the community. Economic analysis and considerations including compensation mechanisms for affected activities, reallocation of effort, derived direct and indirect economic benefits and allocation of those benefits, and sustainable finance are also key aspects for MPA success. A variety of tools are available to finance MPA implementation, from more traditional tools such as fees, fines, and taxes, to new mechanisms associated with trust funds, debt-for-nature swaps, blue bonds and carbon markets. In order for these mechanisms to be successful, legal frameworks are essential. There is not a one-size-fits-all solution, and these tools need to be adapted to the socio-ecological realities of the area, placement of the MPA (e.g. coastal vs offshore), intensity of uses, level of impacts, etc.

For an MPA or network of MPAs to be successfully implemented, a set of governance conditions outlined in the MPA Guide should also be taken in consideration. Staffing and funding have been shown to be some of the main drivers of implementation success (Gill et al. 2017). Compliance, enforcement, monitoring, adaptive management, integration of culture and traditions, social justice and empowerment and effective conflict-resolution mechanisms are also examples of relevant aspects to include in implementation strategies that should be designed upfront and committed with all stakeholders engaged.

For an MPA to be effective it needs to be implemented and actively managed (MPA Guide). This means that areas which are only committed and/or designated (even if legal instruments have been approved) are not able to provide a response to the established objectives of MPAs. These are critical first steps, but only once rules exist can enforcement of those rules be assured, and a high level of compliance be attained; a true MPA is one that exists in reality (everything else is what has been termed a "paper park").

In the light of the current climate and biodiversity challenges and the urgent need to reverse the destruction of marine ecosystems and increase climate resilience through nature-based solutions, we also know that the protection levels that need to be implemented in the global network of MPAs are directly linked to the expected results of those levels. Only fully or highly protected MPAs are able to reconstruct a healthy ocean, with all the benefits associated with a thriving nature. Therefore, it is particularly important to understand that several activities are not compatible with nature conservation and, hence, are not compatible with MPAs. Examples include oil and gas exploitation, seabed mining, dredging and dumping, industrial fisheries, large scale and intensive aquaculture, heavy infrastructures, and intensive unsustainable extractive and non-extractive uses.

The framework outlined here follows the best scientific practices and information and constitutes a roadmap for change. However, we will only be able to reverse the current degradation by speeding up and scaling up the implementation of MPAs through structured processes applied at regional or country levels. One example of such an approach is the Blue Azores program (Blue Azores 2022), a collaboration between the Government of the Azores (Portugal), the Oceano Azul Foundation and the Waitt Institute, which engages scientists, fishers, ocean users, non-governmental organisations, and the wider society, to protect, promote and value the blue natural capital of the roughly one million square kilometres of Azorean ocean, protecting 30% of the EEZ and fully protecting 15% in a connected and ecologically coherent network of MPAs. This is a 6-year program that can bring transformative change by protecting what is left of these amazing coastal, open ocean and deep sea ecosystems in a socially integrated and fair way and providing the economic benefits to the region of this added protection. These approaches may be adopted by others, replicating these successes and helping to achieve the global targets in a timely and effective manner.

## 6 What Does a Sustainable Future Look Like and What Is the Role of Marine Protected Areas in That Future?

If we follow the science (e.g. the IPCC and IPBES reports), we know that we have a problem—we are destroying the ocean and the current regulatory mechanisms are not working. We also know that there are solutions to that problem, but those solutions need to be applied in an effective manner. MPAs are tools to achieve ocean sustainability but only if they are implemented following the framework described here.

More broadly, MPAs need to be placed in a wider context of a 100% managed ocean, where these nature conservation tools are the "banks" of natural capital. With more nature, there will be a better qualified economy, for instance more sustainable and nature-centred tourism, and more sustainable small-scale fisheries which will benefit from the biomass increases exported from MPAs and from enhanced fisheries management rules. Also, MPAs imply that destructive activities are excluded and therefore countries will need to address the trade-offs of continuing to support those activities. Industrial large-scale fisheries are an example of such a trade-off. By protecting nature, MPAs are also the powerhouses for biotechnological applications of the bioeconomy. It is clear today that future sustainable materials, foods, medicines, etc. will come from the ocean and that if we continue to lose biodiversity value at the species, genetic and ecosystem levels, we will continue to degrade a critical natural economic asset for the future.

The global community has now committed to protecting at least 30% of the ocean by 2030. MPAs are a proven effective tool in preserving and restoring biodiversity and recovering biomass in the marine environment, but also in helping address climate change by increasing carbon capture and in increasing social and economic value. The Kunming-Montreal Global Biodiversity Framework recently approved at the Conference of the Parties of the United Nations Convention on Biological Diversity, included the 30 by 30 goal in the agreement. It is critical that beyond area targets, such as the 30% protection, the quality of that protection (fully or highly protected MPAs) and of the implementation mechanisms to be established, is also part of the implementation strategies. The European Union has adopted this target under the Biodiversity 2030 Strategy (European Comission 2030), aiming to protect 30% of land and sea by 2030. Of this, at least 10% should be strict protection, although the definition of this is yet to be agreed. We are however very far from these targets and, in particular, very far from adopting an integrated and effective framework, such as that presented in this text. For example, more than half of the European MPAs have not been implemented, and 50% of the areas are less than 30 $km^2$ (the majority of these being less than 5 $km^2$), thus being limited in representativeness and effectiveness. Recent assessments (European Court of Auditors Special Report 2020; European Environment Agency Report 2020) demonstrate that EU policies have not restored the seas to a good environmental status, fishing in Europe has not yet reached sustainable levels, and marine biodiversity remains under threat in Europe's seas.

We need therefore to do more, faster and differently. MPAs are part of a broader new blue framework based on an economic model to achieve 100% sustainable ocean management and departing from an unsustainable, linear and extractive economy to a resilient, nature-based economy that supports thriving societies and a healthy planet. MPAs can deliver significant benefits and help reconcile human development with nature. To do so, the right scientific, legal and procedural frameworks need to be adopted.

## 7 Conclusion

The current environmental existential challenges of the climate emergency and species extinction crisis demand a response that, without delay, applies the right fixes that go to the root of the problems. And the root of these problems is our unsustainable relationship with nature where our current economic systems require nature to be destroyed in order for societies to have economic development and derive human wellbeing. This is an unsustainable model that has no future and the current discussions on policies and targets to be achieved in the next couple of decades are seeking to address this problem.

In the ocean, the wide and deep degradation of marine ecosystems, and the inefficient regulatory frameworks currently in place, require a faster, wider and more efficient set of management and governance mechanisms to be established. Marine protected areas have been shown to be a very effective tool in protecting and recovering nature and providing social and economic resilience and wealth to societies, but only when they are established by structured and effective programmes following the best available scientific guidelines and standards.

The updated standards compiled and addressed in the MPA Guide, complementing the existing framework of the International Union for the Conservation of Nature (IUCN), are a critical tool for managers, practitioners and decision-makers and should be widely used in guiding conservation efforts at national, regional and international levels.

Whatever we do in the next decade to address these challenges will have a profound effect on the state of the planet we will pass on to future generations. The time to act is now but we know there are different possible futures ahead of us. Business as usual will result in a continuously degraded ocean with fewer economic revenues and larger social impacts. A system maintaining and perpetuating the current misery of a degraded ocean due to a lack of capacity to implement the needed measures will not be able to reverse degradation or allow restoration. The way forward,

then, has to be a vision of a healthy ocean with thriving nature, where well designated, located, managed and implemented MPAs inserted in a wider 100% managed ocean are the basis for a new sustainable blue economy, with social sustainability at its core and including fair sharing of benefits and effective governance systems that respect the rights of communities.

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