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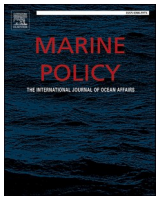

A pathway to protect 30 % of coastal waters by 2030

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ABSTRACT

Nearly 200 countries have committed to protecting at least 30 % of the global ocean by 2030 (30 ×30), a substantial increase from the current 8 % under some form of protection. However, there is no roadmap for achieving this global target. We find that achieving 30 % protection of territorial seas alone will require protecting an additional 1.68 million km^2 (~188,000 coastal MPAs at an average size of 10 km^2). Despite the proven benefits of coastal MPAs to nature and people, MPAs are not being established at the pace required to achieve the global target. We argue that three main obstacles to scaling coastal MPAs are lack of awareness, inadequate governance, and the wrong business models. Here we propose a novel cost-effective and scalable pathway that would enable and equip coastal communities around the world to establish and effectively manage their own local MPAs.

1. Introduction

In December 2022, the countries of the world agreed to protect at least 30 % of our land and ocean by 2030 (30 ×30) at the COP 15 of the UN Convention on Biological Diversity [1]. The 30 × 30 target was based on scientific studies suggesting that thirty percent is the bare minimum needed to restore ocean life and all the benefits it provides to humanity [2–4]. But currently, only 8.2 % of our ocean is in some form of protection – and less than 3 % is in fully or highly protected areas [5], which are the most effective mechanism to replenish marine life [6,7]. We thus need to *quadruple* ocean protection in the next six years.

Despite the urgency of the task, there is no roadmap to achieve the global 30 × 30 target. Marine Protected Areas (MPAs) have been established on an ad-hoc basis until recently, when some nations implemented national ocean policies and marine spatial plans. Some nations have already achieved protection of 30 % of their exclusive economic zones (Table 1), others have commitments and plans to achieve the target by 2030 (e.g., Canada [8], Samoa [9], the EU [10]), and most do not have plans yet.

Currently, 8.2 % of the global ocean is designated as Marine Protected Areas (MPAs), with 90 % of this protection occurring within Exclusive Economic Zones (EEZs) [11] (Fig. 1). Approximately 18 % of the global EEZ area—which comprises 38 % of the ocean—is protected, while 15.7 % of territorial waters (to 12 nautical miles from shore) are under some form of protection (Figure S1). Over the past two decades, significant progress has been made in establishing large MPAs in remote areas of EEZs. Notably, 45 large MPAs, each exceeding 100,000 km^2, cover 6.2 % of the ocean and account for more than three-quarters of the global marine protected area (Table S1).

While these large MPAs contribute substantially to the 30 × 30 target, smaller MPAs within territorial waters are equally critical for safeguarding biodiversity, particularly in areas heavily impacted by human activity [2]. MPAs in territorial waters account for 94 % of all MPAs (n = 11,924) but they are typically very small, with an average size of 91 km^2 and a median size of just 1.1 km^2, collectively protecting only 1.1 million km^2, or 0.3 % of the global ocean (Figure S3). Notably, nearly half of the MPAs are 1 km^2 or smaller (Table S1). Since most biodiversity and human activities are concentrated within territorial waters—along with many global priorities for ocean conservation [2]—there is an urgent need to strengthen and expand MPAs within these nearshore areas.

A key question that has not been fully addressed is "how many additional MPAs are needed to achieve the 30 % protection target"? Here we provide a comprehensive estimate, at national and global scales, of both the total area needed to meet this goal within the exclusive economic zones (EEZs) of coastal nations, and many new MPAs would be required to cover that area. We evaluate different MPA size classes to assess the implications for feasibility and implementation.

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Table 1
Countries that have reached the 30 % ocean protection target as of September 2024. Note that these values are for areas in designated MPAs, regardless of the level of protection or implementation. Sources: [5,11,12]. Overlapping claims and jointly managed areas have been excluded from the analysis. *Note that Palau is currently conducting a marine spatial plan that will change the percentage of their EEZ under protection.

Sovereign state	EEZ area (km2)	EEZ protected (%)	Territorial waters (km2)	Territorial waters protected (%)
Monaco	288	100	76	100
Palau*	616,431	78.2	12,469	29.9
United Kingdom	4085,524	68.5	202,804	45.4
Panama	331,318	50.0	53,857	8.5
Australia	8993,463	48.1	717,035	43.1
Germany	56,831	44.7	24,087	63.1
New Zealand	6712,792	44.0	205,095	21.1
Chile	3668,775	41.2	246,327	22.9
Belgium	3531	37.1	1526	57.7
Colombia	727,967	37.0	65,584	29.0
Seychelles	1341,524	32.6	43,492	87.5
France	9529,864	32.2	416,421	25.6
Netherlands	144,842	31.9	27,057	50.8

Furthermore, we identify roadblocks to scaling up coastal MPAs and propose a cost-effective model to accelerate their expansion within territorial waters.

2. Methods

2.1. EEZ and territorial waters

Exclusive Economic Zones (EEZs) boundaries were obtained from the Flanders Marine Institute (2023) Maritime Boundaries Geodatabase, version 12. The dataset includes 285 polygons representing the EEZs of coastal countries and territories around the world. The dataset was processed using the sf package in R [13] to fix any invalid geometries, reproject the data to the Equal Earth projection (EPSG:8857), and calculate the area of each EEZ in square kilometers. The total area of the world's EEZ was calculated at 141 million km2 (38 % of the world's ocean).

Territorial waters (<12 nm) boundaries were created by buffering the global shoreline vector from Sayre et al. (2019) and intersecting it with the world's EEZs. The dataset includes 263 polygons representing the territorial waters of coastal countries and territories around the world. As above, the dataset was processed using the sf package in R [13] to fix any invalid geometries, reproject the data to the Equal Earth projection (EPSG:8857), and calculate the area of each EEZ in square kilometers. The total area of the world's territorial waters was calculated at 14 million km^2 (3.8 % of the world's ocean and 10 % of the EEZs). We excluded from the analysis all overlapping claims or jointly managed areas.

We excluded intact and remote coastal areas from the territorial waters layer [15], such as Canada's Arctic Ocean, Russia's Arctic seas, and Greenland's northern waters, where there are few to no coastal communities. In these regions, small coastal MPAs are unlikely, and large MPAs established by national governments are more plausible. To do this, we calculated the average coastal intactness score for each intersection of the world's territorial waters and the International Hydrographic Organization (IHO) areas (Flanders Marine Institute (2023)). We then performed a spatial difference operation (sf::st_difference()) to remove from the territorial waters, regions with average scores $>= 0.8$. The removed regions include (See Figure S2):

- Canada's part of the Arctic Ocean and Northwestern Passages as well as Beaufort, and Lincoln seas.
- Russia's part of the Arctic Ocean as well as the East Siberian, Kara, Laptev Seas
- Greenland's part of the Greenland Sea and the North Atlantic Ocean.

2.2. Protected areas

The public WDPA dataset [11] (September 2024) was processed to exclude terrestrial areas, Other Effective Area-Based Conservation Measures (OECMs), and degazetted MPAs (e.g., Phoenix Islands Protected Area). Overlapping polygons were removed using the *wdpar* R package and erroneous polygons (e.g., Palau Marine National

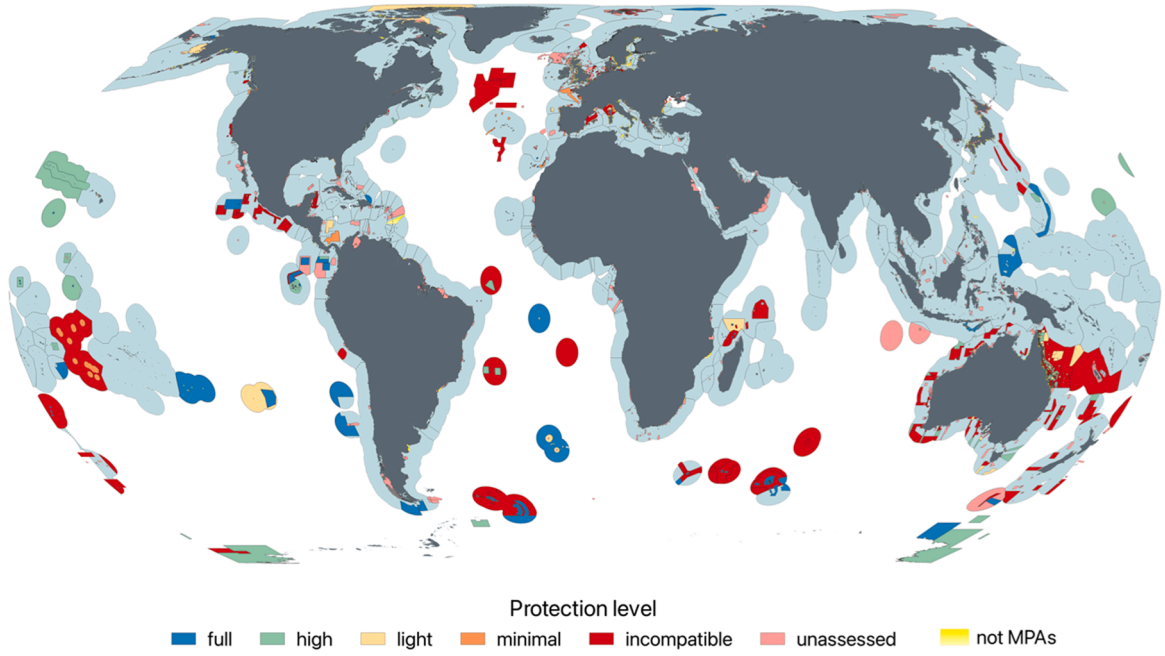

Fig. 1. Marine Protected Areas (MPAs) of the world by protection level based on the MPA Guide framework [7,13,14]. Unassessed areas (pink) were obtained from WDPA [11] and the areas not considered MPAs [12] are highlighted in yellow. Exclusive economic zones are shown in light blue. Incompatible: MPAs that allow industrial extractive activities [7].

Sanctuary) corrected. Land areas [16] were removed, marine areas (km^2) recalculated, and MPAs smaller than 0.01 km^2 or with < 1 % marine area were excluded to reduce noise.

The cleaned WDPA dataset was merged with MPA Guide assessments [17,18], prioritizing spatial features and attributes from the assessments. Protection level and area category were incorporated from Protected Seas [12]. We also separated MPAs that are incompatible with conservation as per the MPA Guide – e.g., zones that include mining or industrial fishing activities [7]. The final dataset contains 12,676 MPAs, with median and average sizes of 1.5 km^2 and 2264 km^2, respectively, covering 29.45 million km^2 (8.18 % of the ocean).

We explored two additional scenarios considering protection quality:

- Scenario 2: Excludes areas incompatible with conservation [17,18] and areas not considered MPAs [12]; includes 10,496 MPAs covering 4.61 % of the ocean.
- Scenario 3: Includes only highly/fully protected MPAs [17,18] and those with the highest protection scores (LFP 4, 5) [12]; includes 1135 MPAs covering 3.1 % of the ocean.

2.3. MPA coverage assessment

To calculate the percentage of each country's EEZ and territorial seas that are protected, we first intersected the EEZ and territorial seas files with a single polygon of MPAs, created by dissolving all individual MPA polygons using the st_union function in R. We then estimated the area of the resulting intersections, representing the protected areas within each EEZ and territorial sea. These protected areas were left-joined with the corresponding EEZ and territorial seas files, and the percentage of protection was calculated relative to the total area of each EEZ and territorial sea.

2.4. MPAs needed to reach 30 % protection

Using the WDPA database as reference we estimated the portion of each country's EEZ and territorial sea that is currently under protection. Then, assuming an equal protection target for both territorial waters (0–12 nm), and EEZ waters (12–200 nm), we calculated the area needed to reach 30 % in each zone. The 30 × 30 target is a global target, not a national target, but this exercise gives us an accurate estimate of the *magnitude* of the gap. Lastly, to evaluate the number of MPAs required to fill the gap, we considered two major MPAs types reflecting observed size distributions: (i) large MPAs (100,000 km^2) in remote areas, typically around oceanic islands or beyond the territorial seas of coastal nations, and (ii) small MPAs (10 km^2) within territorial seas where nearshore human uses and governance constraints limit larger protections. These size classes were chosen because most of the world's protected area is concentrated in a few dozen very large MPAs (100,000 km^2 or larger) in EEZs, while two-thirds of MPAs globally are smaller than 10 km^2 in territorial seas [5]. While the mean territorial MPA size is 91 km^2, the distribution is highly skewed, with a median of just 1.1 km^2—too small to meet most ecological and conservation objectives [19]. We used 10 km^2 as a more ecologically meaningful yet policy-relevant estimate, aligning with conservation guidelines while accounting for real-world constraints. These categories serve to illustrate the scale of the gap to 30 %, not predict exact MPA sizes and numbers.

3. Results

Our analysis indicates that reaching the 30 % marine protection target by 2030 will require the designation of approximately 300 large MPAs and 188,000 small MPAs worldwide, adding 16.5 million km^2 of offshore protection (12–200 nm) and 1.68 million km^2 of territorial waters. The greatest need for MPAs is in East Asia and the Pacific, including the Coral Triangle, where 97 large MPAs and 72,000 small MPAs would be required, covering a total of 8.9 million km^2. This is followed by Europe and Central Asia, with 65 large MPAs and 33,000 small MPAs for a total of 4.8. million km^2 needed under protection. Together, these regions account for 62 % of the total area that needs protection (Table S2; Figures S5–S6). Naturally, countries with extensive coastlines and large Exclusive Economic Zones (EEZs) such as Indonesia, Canada, Russia, and the United States will need to designate the highest numbers of MPAs due to their vast marine areas (See Figure S7 and Table S4 for all countries).

In contrast, several nations—including Australia, Chile, France, and the United Kingdom—have already surpassed the 30 % protection threshold in their EEZs and, within the constraints of this exercise, currently would have no need to create additional MPAs. However, the total protected area of France and the UK encompasses mostly their overseas territories; high protection on their mainland waters is insignificant [20]. Others, like Spain, have exceeded 30 % protection of their territorial waters, suggesting that no additional coastal MPAs are needed, even though they still fall short of the target at the EEZ level. However, these findings can be misleading. Over one-third of the total global area under protection has been classified as incompatible with conservation objectives (that is, including industrial fishing, oil and gas exploration, mining, or other extremely impactful activities), and only 3 % of the global ocean is under the most effective forms of protection [17] (Table S3, Figure S4).

Moreover, thousands of MPAs still lack management plans and have limited conservation impact. For instance, in Spain (and many other European nations), most of the territorial waters under protection fall under the Natura 2000 designation which often lack any management and marginally regulate human activities [20]. Less than 1 % of Spain's protected area (n = 15 MPAs) is classified as highly or fully protected. In contrast, more than 150 MPAs, comprising 40 % of the country's protected area, are considered lightly or minimally protected. Alarmingly, close to 45 % of the protected area (n = 7 MPAs) is deemed incompatible with conservation objectives (Figure S8). This ineffectiveness is widespread across the European Union, where more than 80 % of MPAs confer light, minimal, or no protection from damaging human activities – making these "protected" areas indistinguishable ecologically from unprotected areas [18].

4. Discussion

The challenge of reaching 30 % protection of the world's EEZs by 2030 is undeniably daunting. Using our approach as a thought experiment, this goal would require the creation of approximately 85 MPAs —or the protection of ~1000 km^2 of nearshore areas—every day for six years, starting in 2025. Our analysis uses two size classes for MPAs as a simplified framework and it does not account for the specific constraints of individual coastal nations. For example, a new 100,000 km^2 MPA may not be feasible within the EEZ of some countries, whereas smaller MPAs (10–100,000 km^2) might be more realistic. Despite these limitations, our analysis highlights a stark reality: the current pace of coastal MPA creation falls significantly short of what is required to meet the 30 × 30 target [21].

In addition to creating many more MPAs in the places where they'll deliver the greatest benefits to nature and people [14,22], most existing MPAs must be better protected. The current minimally protected MPAs or MPAs that are incompatible with conservation deliver inferior conservation outcomes than highly and fully protected areas, and in many cases are not different from unprotected areas [7,23,24]. Highly and fully protected coastal MPAs, in contrast, deliver numerous benefits: they restore marine life inside their boundaries, enhance food security, foster climate resilience, support jobs, provide economic benefits, and improve human health in their vicinity [7,25–27]. Local businesses can also thrive, including a combination of responsible tourism inside MPAs and sustainable fisheries outside them – thanks to the spillover of fish from protected areas [25,28,29]. But, if coastal MPAs can work so well

for people and the economy, why is not every coastal town in the world creating its own? We have identified three main roadblocks towards universal adoption and replication of coastal MPAs, and some solutions to overcome them:

1. Lack of awareness about the benefits of MPAs. Although the scientific and economic evidence supporting the benefits of MPAs to climate, marine life, people and local economies is well established, awareness remains low among coastal populations worldwide. *Solution*: Inspire key stakeholders in coastal communities with the benefits of MPAs so they desire their own MPAs.
2. Inadequate governance. Most coastal countries do not have legislation enabling sub-national governments and coastal communities to create their own local MPAs. Instead, MPA creation is often dependent on complex, bureaucratic, and slow-moving national government agencies, which are frequently understaffed, underfunded, and uninterested in implementing new MPAs. *Solution*: Enable local governments and community leaders by reforming national policies and/or fast-tracking local MPA proposals.
3. Misconceptions about the business model: Policymakers tend to see MPAs as a financial burden rather than a benefit. Traditionally, MPA implementation and management have relied on funding from philanthropy and government sources. However, studies indicate that successful coastal MPAs can generate significant economic returns within a few years [28]. Well managed MPAs can generate enough revenue to pay for themselves and generate profits for local businesses. Furthermore, they can also replenish fisheries thereby sustaining a critical local food source and the livelihoods that depend on it. *Solution*: Equip local groups with the tools and resources to implement and manage their local MPAs with seed funding and a peer network – in addition to scaling the current approach that depends on national governments.

4.1. Increase awareness and inspire key stakeholders

Public awareness about ocean issues tends to be vague and vary between countries. In the United Kingdom, for instance, almost 70 % of people see marine litter and plastic pollution as the greatest threats to the marine environment [30]. Although the American public is generally aware of the importance of the ocean, the impacts of global warming on the ocean and the need to protect it, only about a quarter of Americans are well acquainted with the concepts of overfishing and marine protected areas [31]. This indicates a biased perception of marine threats and a lack of awareness of the solutions available, even though there is enthusiasm for increased protection.

We believe the main issue resides in ensuring that the right stakeholders have sufficient information to inspire action. In coastal areas, proponents of MPAs tend to be conservation organizations, marine biologists and ecotourists. Divers, for example, are known to prefer MPAs for their activity [32], and can contribute significantly to the local economies of coastal communities [28]. In contrast, both commercial and recreational fishers often oppose MPAs, viewing them as a threat to their livelihoods, despite strong evidence that they can support local and recreational fisheries through fish spillover and larvae surplus [33–36]. In particular, fishers prefer MPAs designed to support fisheries over those designed to protect biodiversity [37]. This highlights the importance of raising awareness among fishers about how MPAs can sustain their livelihoods, thereby encouraging their support for MPAs.

4.2. Enable local governments

Few nations enable local governments to establish and manage their own MPAs, which significantly hinders the potential for scaling up protection efforts. A notable exception is the Philippines, where the Fisheries Code of 1998 allows local government units to establish MPAs without requiring approval from national government agencies [38]. A typical MPA in the Philippines consists of a core (fully protected) zone and a buffer zone (usually a limited take zone). This devolution of the management authority to local governments has resulted in the creation of over 1800 locally managed MPAs, demonstrating the effectiveness of enabling local governance in marine conservation.

In contrast, Spain presents the typical centralized approach to MPA management. MPAs in Spain's territorial waters can only be established and managed by the national government, specifically through either the Ministry of Fisheries or the Ministry for the Ecological Transition. Regional governments can only designate MPAs within internal waters (the inner waters in the territorial sea, typically found between capes, which occupy a tiny fraction of the territorial sea). Local governments are not authorized to establish or manage MPAs. As a result, there are no MPAs created by coastal towns or local groups in Spain, and the pace of creation of new coastal MPAs via government agencies is glacial, despite several fishing communities having requested the establishment of new MPAs to replenish fish stocks. Nevertheless, it may seem that Spain does not need more MPAs in its territorial seas because it has already protected 39 % of them; but the 30 % of the territorial seas that are designated as "protected" are mostly within Natura 2000 areas that have not been implemented and are de facto unprotected. This is another example of the importance of implementing and increasing the level of protection of current MPAs so that they can deliver conservation outcomes.

The success of the Philippines in establishing 1800 local MPAs, compared to Spain, highlights the importance of empowering *local* governments (i.e., municipalities) rather than higher-level *provincial* governments. A contrasting example is the United States, where close to 30 % of its EEZ is fully protected MPAs, but mostly in two very large Marine National Monuments around remote islands in the Pacific, established by Presidential Proclamation using the 1906 Antiquities Act. However, fully protected MPAs in state waters are relatively few and small [39], partly because U.S. states function with the complexity and autonomy of national governments in other countries. For instance, it took over a decade for California to pass the California Marine Life Protection Act [40]. Yet, coastal counties in the U.S.—the equivalent of the municipalities that created MPAs in the Philippines—lack the authority to establish their own MPAs.

Therefore, if we are to scale and contribute to the 30 × 30 target and its benefits to coastal communities, policy reform in most coastal countries is essential to enable local governments to create locally-managed MPAs.

4.3. Equip local groups

Enabling local governments to establish and manage MPAs is just the first step; equipping local stakeholders with the necessary knowledge and skills is crucial. Relying on conservation organizations and academic experts to drive the process is often time-consuming and inefficient and is not establishing the number of MPAs at the pace needed. To address this, it is essential to aggregate best practices — from identifying key actors to designing, designating, monitoring and managing an MPA – and to train cohorts of local leaders on how to take an idea of an MPA to implementation and active management. However, even with this know-how, the scaling of coastal MPAs cannot possibly be achieved without sufficient financial and human resources.

4.4. Funding coastal MPAs

Currently, in most coastal countries, MPAs are implemented and managed by government agencies. The ocean, as a public good, has traditionally relied on public funding to cover the creation and management costs of MPAs, with the expectation that businesses, such as those in tourism and fishing, would benefit from the increased biodiversity within and around the MPAs (Fig. 2) without necessarily

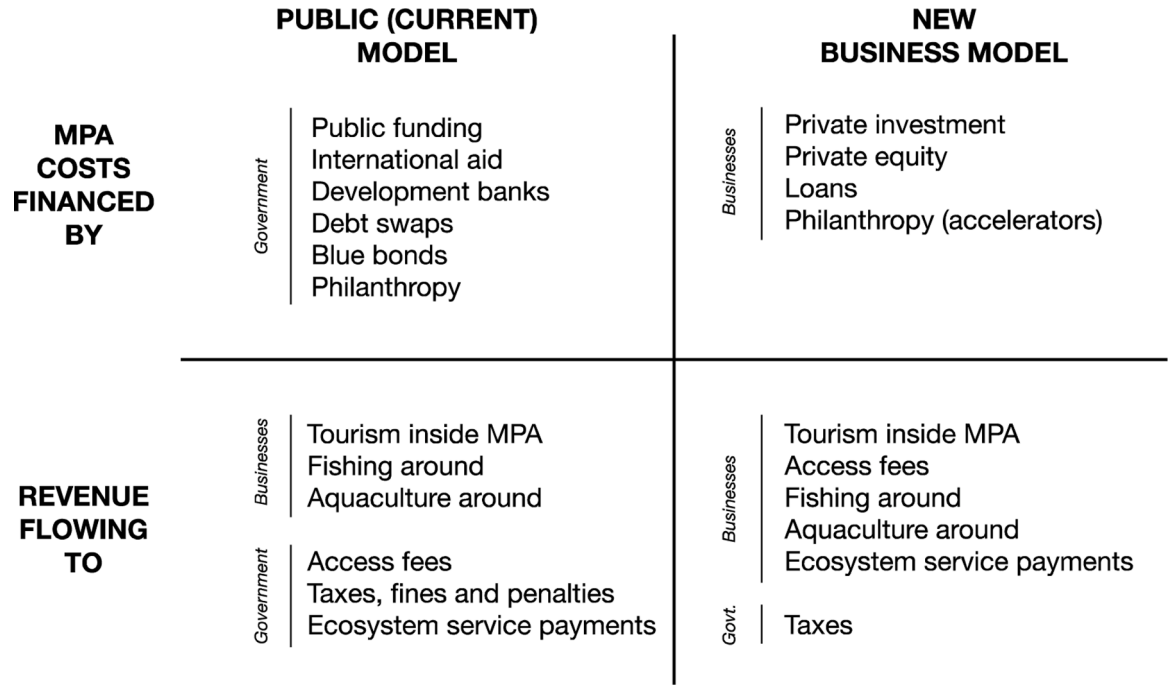

Fig. 2. Financing sources and revenue generated by MPAs under the current model of MPAs established and managed by government agencies (public model), and the proposed model of MPAs as self-sustaining businesses.

reinvesting in them. A study estimated that managing a global network of MPAs covering 30 % of the ocean would cost up to $20 billion annually [41]. Interestingly, this $20 billion is equivalent to the amount governments currently spend each year on subsidies that contribute to overfishing [42]. Thus, there is enough public funding, if distributed equitably, to cover the gross costs of 30 × 30 for the ocean. Moreover, if the right 30 % of the ocean was protected, that could yield a net increase in fish catch [2], create tourism jobs and bring in significant economic revenue [43], and increase the value of the many ecosystem services provided by a healthy ocean. Research has shown that every dollar invested in a marine protected area can generate $10 in economic output [44]. Yet governments and in particular fisheries departments have been highly resistant to redirect harmful subsidies towards regenerative efforts, thus perpetuating overfishing.

Philanthropy has played a significant role in supporting the implementation of some MPAs. While philanthropic funding for ocean conservation has increased from US$430 million in 2010 to US$1 billion in 2022, only 20 % of this funding goes to protected areas [45]. While it is key catalytic capital, it is evident that philanthropic funding is not the long-term solution for funding the implementation and management of the approximately 190,000 new effective and equitable coastal MPAs needed to meet global targets.

Funding for coastal MPAs is a fraction of the $20 billion estimated as the annual management costs of a global network of MPAs covering 30 % of the ocean [41], but it seems unlikely that government efficiencies will be created in time to achieve the global target. This indicates that funding for coastal MPAs will continue to be a major gap impeding the scaling necessary to achieve widespread protection. Therefore, a new model for implementing and managing coastal MPAs is essential, one that enables fast replication, efficient management, and sustainable financing. We need a combination of financing instruments, including revenue-generating mechanisms that will offset the costs.

A growing body of research shows that the combined economic benefits of coastal MPAs (tourism, fisheries, and ecosystem services) often outweigh the costs of their creation and maintenance [43,46,47]. This suggests that, under the right conditions, MPAs could be financed entirely by the revenue they generate [48]. The revenue streams will vary depending on the socioeconomics of each location, but three major potential streams are ecotourism, fishing, and carbon markets. Any location can be placed within a spectrum along these three revenue streams (Fig. 3).

An example of MPA co-financed by revenue generated exclusively by diving tourism (Fig. 3A) is the Misool Marine Reserve in Indonesia, which is privately managed by the Misool Foundation, founded by the Misool Eco Resort. The resort generates revenues through high-end ecotourism with an emphasis on dive tourism, with US$464,219 in expenses, and US$808,436 in revenue and support, confirming the financial success of their model [49]. To achieve formal recognition and legal endorsement, Misool has a leasing agreement with the local community.

An example of a MPA financed by ecotourism revenue that also generates additional revenue for local fishing (Fig. 3B) is Chumbe Island

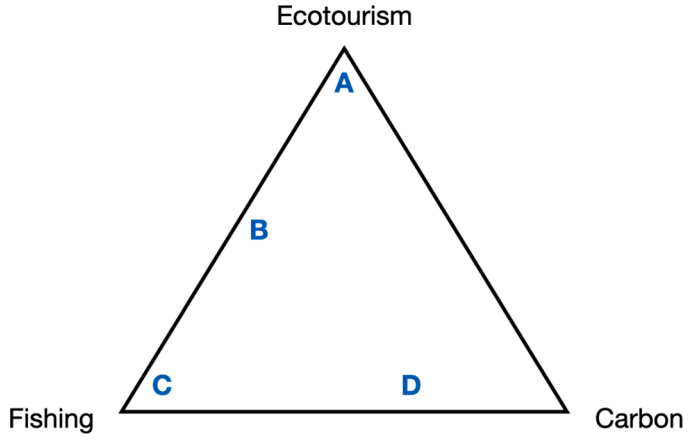

Fig. 3. Major revenue sources generated by coastal MPAs. The letters denote example localities where the main sources of revenue from a MPA are diving tourism (A), diving tourism with enhanced local fishing (B), enhanced local fishing in an area with unlikely tourism opportunities (C), and sale of carbon credits from protecting a habitat that will help avoid carbon emissions or sequester carbon while enhancing local fisheries (D).

Coral Park (CHICOP) in Zanzibar, Tanzania. Established in 1991 as Tanzania's first managed marine park, CHICOP revenues are generated from the island's eco-lodge and associated activities, and it has achieved financial self-sustainability. Though revenue is earmarked specifically for CHICOP's operational budget, local fishers have benefitted, shown in 2004, when 95 % of interviewed fishers noticed yield increase through the spillover effect [50]. In Chumbe's business model, CHICOP acts as a non-profit in mission but applies for-profit strategies to generate income, which is reinvested into its MPA management budget, conservation initiatives, and environmental education programs. Chumbe Island's roadmap ranged from initially securing private investment and small grants to building a sustainable business to reinvesting proceeds in the MPA, a regenerative model since 2000.

In 2016, a new model to scale MPAs was proposed whereby a coastal MPA could be implemented as a private business, managed by a joint venture of stakeholders turned shareholders [25]. That business model demonstrated that, if fishers and tourism operators partnered in the creation and management of a coastal MPA in the Mediterranean, both could obtain economic profit as early as year two after protection.

An example of a MPA that generates new fishing revenue thanks to the spillover of fish from the MPA (Fig. 3C) is the Papahānaumokuākea Marine National Monument, which has increased the catch and profit of tuna fishing around its boundaries [29,51]. The fishing fleet receives these benefits from the MPA for free, but it has been suggested that fishers could pay and offset the management cost of MPAs that demonstrably improve their business, to maintain this ecosystem service [25].

Revenue streams from an MPA may also include payments for ecosystem services such as carbon storage (Fig. 4D) [25,52] if a coastal "blue carbon" habitat such as a mangrove forest was protected or restored and in turn enhance local fisheries yields [53]. Or, in a place like the North Sea, reduction of bottom trawling effort in MPAs (without relocation) would avoid significant carbon emissions and potentially help restore some of its fisheries [54]. A MPA could be financed partly by the sale of carbon credits from the avoided CO_2 emissions [55].

Therefore, if national governments were to devolve the authority to implement coastal MPAs to local governments, and if MPAs could be financed using revenues generated by the MPAs, it could significantly enable the replication and scaling needed to meet global targets. Under the right circumstances, coastal MPAs could even be managed privately as businesses. Despite legal constraints and challenges to private management, many MPAs successfully adopt key business strategies, exemplifying how business practices can be replicated globally, particularly in tourism and the dive sector. While it is not privately managed, the Bonaire National Marine Park can sustain its operations based on entry fee revenue after reevaluating and raising prices in 2019 [52]. In Fiji, the Namena Marine Reserve's dive tag program requires that divers and snorkelers purchase annual tags for FJ$30 to gain access to the marine reserve, as well as a token to wear on their gear. Annually, over 1000 tags are sold, generating substantial revenue, which is then reinvested in enforcement patrols, mooring maintenance, community development projects, and a scholarship fund [56]. In Belize, the Turneffe Atoll Sustainability Association was formed to co-manage their Marine Reserve with Belize Fisheries department under a legal framework passed by the Non-Government Organization Act of Belize. The NGO reported revenue from ecotourism experiences to over 7000 visitors in their first year, generating close to US$250,000 to continue building out their robust business plan which seeks to achieve self-sustaining Marine Reserve [57]. These examples illustrate the potential for MPAs to evolve into sustainable and dependable business ventures. By accurately valuing ecosystem services, establishing infrastructure for revenue collection, and reinvesting earnings to enhance both the business and local stakeholder interests, MPAs can achieve long-term financial and environmental success.

The economic benefits of marine reserves can be further enhanced by additional management strategies around their borders. One such approach is "Managed Access with Reserves" (MA+R), where local fishers are given exclusive rights by local governments to fish in designated areas with established limits and fishing regulations surrounding fully protected MPAs [58]. These access rights help ensure that the benefits of protection, such as fish spillover, directly benefit the local communities, providing strong incentives for compliance. Another mechanism to foster financial self-sustainability of protected areas in certain coastal nations is the "Conservation Finance Area" (CFA). This approach involves leasing fishing zones around fully protected MPAs, which are sustained by spillover, to finance the monitoring and enforcement of the MPAs [48].

5. Conclusions

The 30 × 30 target addresses not just the quantity but also the quality of marine protection, by prioritizing "areas of particular importance for biodiversity and ecosystem functions and services", including those where protection from fishing can enhance food production and support climate mitigation [2]. Currently, only 8 % of the global ocean is under some kind of formal protection, and a mere 3 % is in highly or fully protected MPAs. It is therefore imperative to both create new highly/fully protected MPAs to close the gap toward the 30 % target, and to elevate the protection levels of existing lightly and minimally protected MPAs, as these higher levels of protection deliver the greatest benefits to marine life, climate and people [7].

We argue that a key solution for the rapid and extensive scaling necessary to achieve the global 30 × 30 target in territorial seas is to shift the conservation mindset. National governments should enable local governments to designate coastal MPAs and manage them as self-financed conservation businesses, with shared benefits for the tourism and fishing sectors within their communities. This nationally devolved, localized business-oriented approach could replicate successful models in a decentralized way, free from the constraints of limited governmental and conservation organization resources.

CRediT authorship contribution statement

Rechberger Kristin: Conceptualization, Funding acquisition, Investigation, Project administration, Supervision, Writing – original draft, Writing – review & editing. **Enric Sala:** Conceptualization, Funding acquisition, Investigation, Methodology, Project administration, Supervision, Writing – original draft, Writing – review & editing. **Mara Booth:** Writing – original draft, Writing – review & editing. **Juan Mayorga:** Data curation, Formal analysis, Investigation, Methodology, Software, Visualization, Writing – original draft, Writing – review & editing.

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Declaration of Competing Interest

We have nothing to declare.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.marpol.2025.106773.

Data availability

Data will be made available on request.

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