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Why Ocean Protection Is Stalling—and How to Regain Momentum

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Abstract:	Global marine conservation is at a critical juncture. Despite the 30×30 target established under the Kunming-Montreal Global Biodiversity Framework, Marine Protected Area (MPA) expansion has slowed, with only 3.8% of the ocean under full protection. Using regulatory-level data from the ProtectedSeas database, we assess the global quality of marine protection from 2000 to 2025, with a focus on five key coastal habitats. We show that recent growth in MPA coverage is dominated by minimally protected areas that deliver limited ecological and social benefits. In contrast, fully protected MPAs are more effective in supporting biodiversity, climate resilience, and long-term economic benefits, but remain underutilized. Our results reveal that strategic upgrading of existing MPAs, especially where enabling conditions are strong, could significantly increase protection of critical habitats. We highlight policy mechanisms and financial tools that could support this transition and propose a framework to prioritize upgrades as a more realistic and impactful pathway toward achieving conservation targets. This approach aligns ecological effectiveness with governance feasibility, suggesting that quality upgrades—rather than continued nominal expansion—should be the priority for global marine conservation efforts.
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Standardized datasets A list of datatypes considered standardized under Cell Press policy is available here. Does this manuscript report new standardized datasets?	No
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computer code, algorithms, or computational models?	

Cover Letter

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Editorial Office for One Earth
Cell Press

Dear Editors,

We are pleased to submit our manuscript entitled “Why Ocean Protection Is Stalling—and How to Regain Momentum” for consideration by One Earth.

While global marine conservation has made notable gains in the past two decades, progress toward effective and equitable ocean protection has recently slowed. Despite increased international commitments to marine protected areas (MPAs), the majority of newly designated areas fall short in delivering tangible ecological and social benefits. Previous research has often focused either on expanding protected area coverage or on evaluating individual MPAs, without fully addressing systemic barriers to achieving protection outcomes at scale.

Our manuscript offers a conceptual synthesis that identifies key bottlenecks hindering MPA effectiveness and highlights policy-relevant solutions to overcome them. We argue that redirecting attention from nominal targets to the quality of protection is essential. Drawing from recent interdisciplinary literature and practical case studies, we outline clear, actionable pathways to accelerate progress—specifically by upgrading existing MPAs, improving enforcement, integrating socioeconomic dimensions, and enhancing local governance.

We believe this work provides a timely contribution that reframes how the global community can operationalize ocean protection under the 30x30 target. Its significance lies in translating research insights into practical strategies that can inform international policy dialogues and national implementation plans.

We respectfully suggest the following experts as potential reviewers due to their substantial contributions to marine conservation policy and practice:

- Prof. Alex Rogers, Director of Science, REV Ocean, Norway (alex.rogers@revocean.org)
- Dr. Barbara Horta e Costa, CCMAR - Centre of Marine Sciences, University of Algarve, Portugal (bhorta@ualg.pt)
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- Dr. Bill Ballantine, Leigh Marine Laboratory, University of Auckland, New Zealand (b.ballantine@auckland.ac.nz)

We greatly appreciate your consideration of this request and look forward to your response.

Warm regards,
Sincerely,

Fabio Favoretto
On behalf of co-authors

Why Ocean Protection Is Stalling—and How to Regain Momentum

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Science for Society

The world has pledged to protect 30% of the ocean by 2030, but not all protections measures are equal. Our research shows that despite the international commitments; the creation of marine protected areas (MPAs) has stalled in the last years instead of increasing. Furthermore, it favored disproportionally the creation of minimally protected areas which still allow for many extractive activities. Conversely, the creation of fully protected areas that prohibit any type of extraction was marginal.

We analyze how just strengthening the regulations within MPAs that already exist is a great opportunity to improve marine conservation globally, more than creating new ones that are minimally protected. By upgrading existing MPAs in places where there is political will, strong institutions, and engaged communities, nations can achieve better ecological outcomes without the costs of starting from scratch. This strategy can also build trust in conservation by aligning promises with visible benefits.

To guide policy and investment, we identify where upgrades would be most effective—often in areas home to critical habitats like coral reefs and seagrasses. Global partnerships, community participation, and innovative financing tools like blue bonds can help bridge gaps in capacity. This research supports a shift from paper promises to real protection, showing that quality—not just quantity—matters in the race to save the ocean and sustain the people who depend on it.

Highlights

- Global MPA growth has stalled and is dominated by weak protection levels
- Fully protected MPAs offer stronger ecological and social outcomes over time
- Upgrading existing MPAs is more feasible than creating new effective ones
- Strategic upgrades can advance 30x30 goals while minimizing social disruption

Summary

Global marine conservation is at a critical juncture. Despite the 30×30 target established under the Kunming-Montreal Global Biodiversity Framework, Marine Protected Area (MPA) expansion has slowed, with only 3.8% of the ocean under full protection. Using regulatory-level data from the ProtectedSeas database, we assess the global quality of marine protection from 2000 to 2025, with a focus on five key coastal habitats. We show that recent growth in MPA coverage is dominated by minimally protected areas that deliver limited ecological and social benefits. In contrast, fully protected MPAs are more effective in supporting biodiversity, climate resilience, and long-term economic benefits, but remain underutilized. Our results reveal that strategic upgrading of existing MPAs, especially where enabling conditions are strong, could significantly increase protection of critical habitats. We highlight policy mechanisms and financial tools that could support this transition and propose a framework to prioritize upgrades as a more realistic and impactful pathway toward achieving conservation targets. This approach aligns ecological effectiveness with governance feasibility, suggesting that quality upgrades—rather than continued nominal expansion—should be the priority for global marine conservation efforts.

Introduction

Global momentum for marine conservation has led to increasing commitments to ocean protection, including the widely endorsed post-2020 *Kunming-Montreal Global Biodiversity Framework*, which aims to protect 30% of the ocean by 2030 (30×30)[1]. This target builds upon previous efforts such as the Aichi Target 11, which sought 10% protection by 2020 but fell short of delivering meaningful outcomes[2,3]. While area-based targets remain central, there is now broader recognition that effective conservation requires attention to ecological function, social equity, and enforcement capacity—not just spatial coverage[1,4–6]. Other global assessments have examined progress toward MPA coverage and quality, including analyses based on the World Database on Protected Areas (WDPA) and The MPA atlas[7,8]. These have shown that most MPAs offer limited ecological benefits due to weak implementation and management[7]. Furthermore, the potential expansion of new MPAs according to socioeconomic traits is considered widely unlikely[9]. Therefore, it might be time to reconsider current strategies that are pushing for expansion before consolidation to achieve the 30×30 target numerically, but without concrete ecological outputs.

We propose that strengthening regulations within existing Marine Protected Areas (MPAs) to achieve full protection, thereby reaching 8% of fully protected ocean coverage, is more realistic than expanding coverage. This approach could help MPAs regain momentum by offering clear benefits to communities.

Our analysis builds upon previous studies using published FAIR methods[10] and adds four key contributions:

1. We include regulatory data from the ProtectedSeas initiative[11], offering detailed, rule-based classifications of global MPA protection levels.
2. We conduct a temporal analysis of global MPA expansion from 2000 to 2025, distinguishing between minimally and fully protected areas based on regulatory definitions.
3. We incorporate critical habitat distributions to evaluate conservation potential.
4. We propose a strategic approach to prioritize areas for regulatory strengthening based on governance quality, institutional capacity, and social equity metrics. These metrics, drawn from sustainable blue economy enabling conditions data[12], help identify locations where upgrading MPAs is most practical and likely to succeed.

Stalling trends in MPA expansion

Our findings reveal that overall MPA expansion has stalled since 2018 (Figure 1A, B). Most of the recent increase in protected area coverage was from Minimally Protected MPAs (hereafter referred to as minimally protected areas, Figure 1A)—which provide little to no ecological benefits[7,8,13–15]. In contrast, the expansion of MPAs with the most stringent regulations, classified as Highly or Fully Protected (hereafter referred to as fully protected areas), has been far more

limited (Figure 1A,B). Ecological representativeness is an explicit part of the 30 by 30 target, which is poorly considered when discussing the target goals[7,16,17]. The percent of fully protected areas is minimal throughout the habitats considered in the analysis, as was the increase of their protected area (Figure 1C,D). Across coral reefs, seagrasses, saltmarshes, mangroves, and cold-water corals, full protection remains minimal, with only marginal increases in recent years compared to our previous assesment[18] (Figure 1C,D). Despite these ecosystems' critical roles in biodiversity, carbon storage, and coastal protection, they remain largely under minimally protected areas. Unless the current approach shifts, the 30×30 target risks becoming another unmet symbolic promise.

Why are we stalling?

The expansion of MPAs has favored politically expedient areas—such as offshore regions, sparsely populated zones, or areas distant from contested fisheries—which often lack strong governance and enforcement[9]. Fully protected areas cause greater short-term social and economic disruption than minimally protected areas because extractive activities are prohibited immediately (Figure 1E). Yet, despite the greater initial disruption, fully protected areas deliver stronger ecological recovery and subsequent social benefits in the long term[19,20]. Once established with proper enforcement and community support, fully protected areas generally produce higher fish biomass, spillover benefits for surrounding fisheries, and diversified local economies, such as ecotourism[21,22].

Over the medium term (5–10 years), fully protected areas typically show strong ecological recovery—such as the 463% increase in fish biomass at Mexico's Cabo Pulmo National Park[23] —rewarding initial sacrifices with spillover benefits for adjacent fisheries and tourism, thus lowering social cost (Figure 1E). As fully protected areas mature, communities diversify livelihoods, and compliance often strengthens[24] and governance generally stabilizes through participatory management. In contrast, minimally protected areas often yield modest ecological outcomes[19], may fall short of expectations, face rising enforcement burdens and funding gaps, and risk becoming "paper parks"[14,25]. This illusion of protection undermines public trust and diverts resources from high-impact conservation, while continuing to favor declarations over management[26].

In fully protected areas, detecting violations is more straightforward since permitted activities are minimal[27,28]. Minimally protected areas, however, require permanent active management. Even decades later, authorities must monitor quotas, seasonal closures, gear types, and zoned use—requiring sustained funding for patrols, observers, and community engagement. When resources decline or political focus shifts, compliance often slips. Underperforming MPAs can also fuel long-term social conflict. Communities may grow frustrated when expected benefits—like increased fish or tourism income—fail to materialize, leading to disillusionment and eroded trust in conservation[29]. These outcomes can make future marine management harder and impose long-term social costs that far exceed the short-term disruptions a stricter MPA might have required to prevent collapse (Figure 1E).

Over the long-term, the trajectories of both types of MPAs diverge sharply (Figure 1E), often reversing the initial social cost balance[13,30,31]. Fully protected areas tend to deliver strong, self-sustaining ecological outcomes[21,32]. These gains translate into spillover productivity, effectively repaying fishers after the initial cost of lost fishing grounds[33]. They also boost tourism and recreation[34], as biodiverse marine life attracts divers, snorkelers, and researchers[22,34]. Fully

protected ecosystems are more climate-resilient; one analysis found six times greater resilience in highly protected areas compared to unprotected ones[35]. These long-term ecological gains support blue economies like ecotourism, sustainable fisheries, coastal protection, and carbon storage.

Ultimately, social acceptance of either approach depends on perceptions of fairness and whether the ecological and economic benefits are shared[36]. Minimally protected areas often aim to include local use and avoid early inequities, but over time, they can entrench others—for instance, when tourism operators or industrial fishers benefit most, while small-scale or subsistence fishers face declining resources[29]. Early investments in strict conservation can yield sustainable resource use and equitable benefits if governments address livelihood transitions and governance inclusivity from the outset[37]. Nations should also strengthen accountability by transparently reporting MPA management effectiveness—not just area—under the 30x30 target[38].

A strategic action: Upgrading existing MPAs

Socio-environmental modeling shows that the effectiveness of MPAs correlates with strong governance, NGO presence, and low natural resource dependence— but under current global socioeconomic conditions, further MPA expansion is considered unlikely[9]. Therefore, an immediate focus should be towards upgrading existing MPAs rather than creating new ones. We propose targeting upgrades in areas with high enabling conditions for a sustainable blue economy—including strong governance, institutional capacity, and social equity—can maximize ecological gains while minimizing implementation risks (Figure 2). This approach aligns conservation goals with realistic policy pathways, especially in areas where creating MPAs faces political, financial, or social constraints[9].

One study estimated that raising no-take coverage from 5% to 30% could increase fish stock biomass by 5%, while weak protection leads to ongoing declines[35]. Without change, some communities may face environmental collapse—an irreversible social cost that stronger protection could have been prevented. Many minimally protected areas overlap critical habitats and lie in countries with the capacity for stricter protection, strengthening these areas can bridge the gap between ecological representation and effectiveness (Figure 1F). Converting existing MPAs from minimally protected to fully protected could secure nearly 60% of the world's coral reefs, 38% of saltmarshes, 30% of seagrasses, 28% of mangroves, and 14% of cold-water corals (Figure 2). These vital ecosystems remain vulnerable under weak protection regimes despite their importance to fisheries, climate, and livelihoods.

International cooperation and funding can play an important role by providing support. For example, global initiatives could finance ranger programs, satellite and shore-based surveillance for illegal fishing[27,28,39], and community co-management in MPAs where capacity is lacking[40]. Innovative financing—such as blue bonds or debt-for-nature swaps—and local benefit-sharing are critical enablers[41,42]. These are some measures that support equity by ensuring that communities gain from conservation. Where communities co-steward and benefit from ecotourism or fisheries spillover, compliance improves, reducing paper park risks[14,43].

To institutionalize the shift from minimally protected to fully protected areas, nations should adopt MPA Action Plans that raise protection levels, strengthen enforcement, and ensure

transparent reporting. Upgrading existing MPAs—especially those overlapping with key habitats and with strong enabling conditions—offers a pragmatic, equitable, and scalable path forward. The Convention on Biological Diversity's framework clearly states that success depends on more than spatial coverage; it requires sustained ecological function, social equity, and adaptive governance. 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) by 2030[44], presenting an opportunity to rethink the global strategy of just looking at expansion. A vision that prioritizes quality over quantity—from declarations to durable protection—can transform stalled conservation into a long-lasting legacy for climate, biodiversity, and coastal communities.

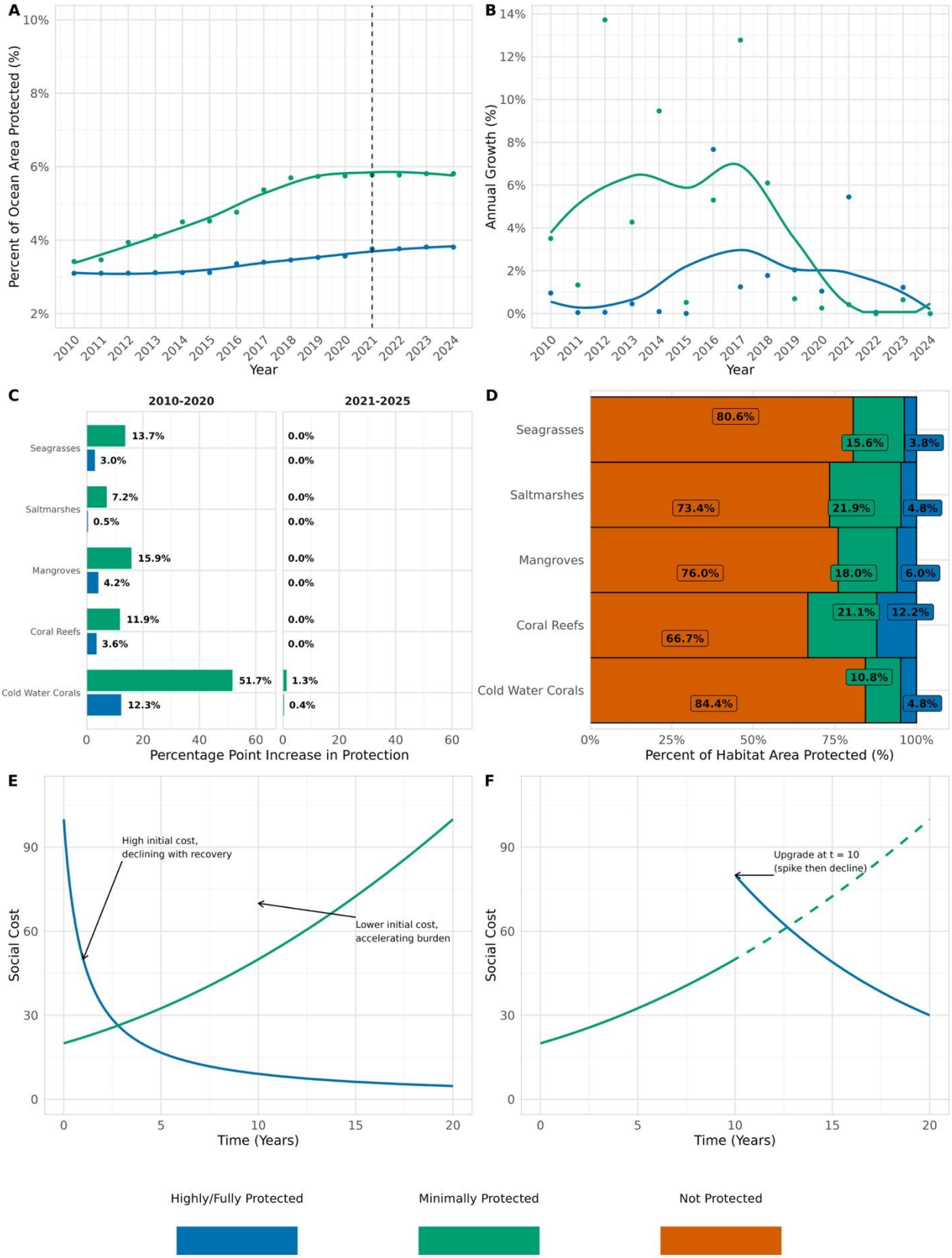
A
Percent of Ocean Area Protected (%)
Year
B
Annual Growth (%)
Year
C
2010-2020
2021-2025
Seagrasses
Saltmarshes
Mangroves
Coral Reefs
Cold Water Corals
13.7%
3.0%
7.2%
0.5%
15.9%
4.2%
11.9%
3.6%
51.7%
12.3%
0.0%
1.3%
0.4%
Percentage Point Increase in Protection
D
80.6%
15.6%
3.8%
73.4%
21.9%
4.8%
76.0%
18.0%
6.0%
21.1%
12.2%
66.7%
10.8%
84.4%
4.8%
Percent of Habitat Area Protected (%)
E
High initial cost,
declining with recovery
Lower initial cost,
accelerating burden
Social Cost
Time (Years)
F
Upgrade at t = 10
(spike then decline)
Social Cost
Time (Years)
Highly/Fully Protected
Minimally Protected
Not Protected

Figure 1. Growth of Marine Protected Areas have stalled. A) The percent of ocean area protected by either a Minimally protected areas or a Highly/Fully Protected MPAs had been increasing up to 2020, but progress was minimal after that; B) the points represent the percent annual growth for Minimally Protected and Highly/Fully Protected MPAs over time; C) The bars represent the growth in percent protected of that specific habitat between 2010 and 2020 and between 2021 and 2025; D) the percent of protected and non-protected habitat extents; E) represents a conceptual measure of social cost for Highly/Fully and Minimally MPAs, where an initial higher social cost of establishment is then offset by the much larger ecological benefits; F) Our proposal is to convert Minimally protected areas into Highly/Fully Protected MPAs to achieve an improved ecological output that offsets the rising social costs of missing out on unmet expectations. Colors represent levels of protection blue is Highly/Fully Protected, green is Minimally Protected, orange is Not Protected.

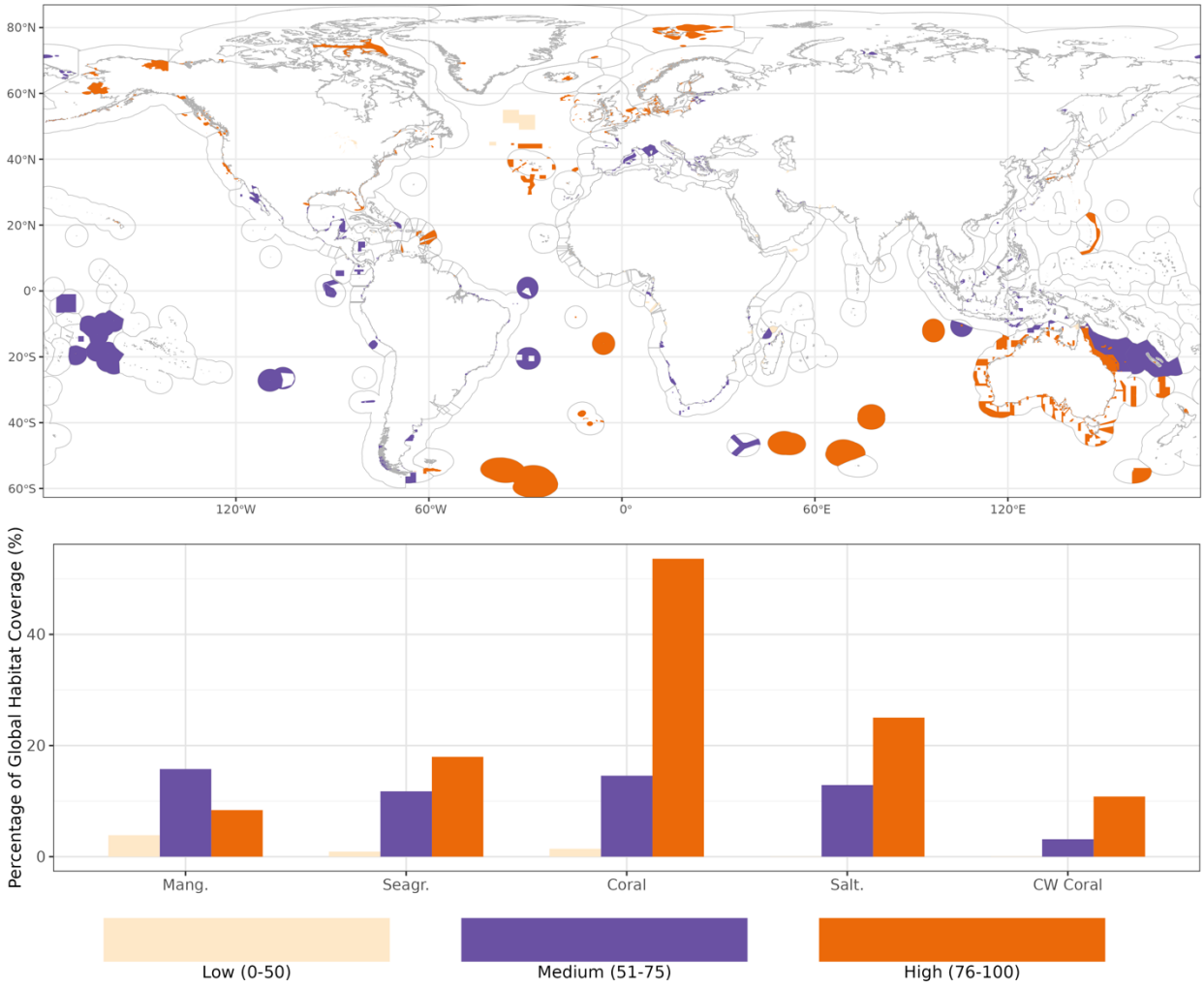

Figure 2. MPAs that could be upgraded to Fully protected areas having high enabling conditions for the development of a sustainable blue economy[12] and would contribute to an important amount of marine critical habitat coverage.

Methods

Marine Protected Area Data Processing

We analyzed global Marine Protected Areas (MPAs) using spatial data from the Protected Seas Navigator database. Data is available by request through the public portal: https://map.navigatormap.org/. In the Protected Seas dataset, MPAs are categorized according to their Level of Fishing Protection (LFP) on a scale of 1-5[45]. Here, for simplicity we joined LFP 1-3 to represent minimally protected areas and LFP 4-5 represent highly/fully protected areas. This classification aligns with established protection standards in marine conservation literature[8,45]. The MPA polygon data was rasterized at 1km resolution using an equal-area projection (EPSG:6933) to ensure accurate area calculations globally. For temporal analysis, we incorporated MPA establishment dates to create annual snapshots of global marine protection from 2000 to present, allowing assessment of protection growth rates over time.

MPA Statistics

We conducted spatial analysis to quantify MPA coverage within each country's Exclusive Economic Zone (EEZ). This process accounted for parent-child relationships between MPAs to prevent double-counting of protected areas. For each country, we calculated: Total protected area (km^2) by protection level (LFP 1-5); Percentage of EEZ under protection; Number of distinct MPAs. These metrics were calculated using spatial intersection between MPA polygons and EEZ boundaries, with careful consideration of overlapping protection designations. For both overall MPA coverage and habitat-specific protection, we used the establishment year to calculate: Annual protection status from 2000 to present; Year-over-year growth rates; Cumulative protection trajectories. This analysis distinguished between Minimally Protected (LFP 1-3) and Highly/Fully protected (LFP 4-5) areas, allowing assessment of not just total protected area but the quality of protection being implemented globally.

Marine Habitat Protection Assessment

We analyzed protection status for five critical marine habitats: - Mangroves - Seagrasses - Coral reefs - Saltmarshes - Cold-water corals. Here we used the same code and methods from Kumagai et al[18], but adapting the workflow to ProtectedSeas data instead of the World Database on Protected Areas (WDPA) that was used by Kumagai. Each habitat's global distribution was obtained from the UN Environment Programme - World Conservation Monitoring Centre (UNEP-WCMC) which provides global distribution data for various marine and terrestrial habitats. Direct links to the habitat layers can be found in Kumagai. Habitat polygons were rasterized to 1km resolution. Some habitats distributions were represented by points instead of polygons, in that case both point and polygon data were incorporated, with 1km area buffering applied to point data based on habitat characteristics[18] . We then quantified habitat protection by overlaying habitat distributions with MPA boundaries for each year, generating time series of protection status. This allowed us to track changes in the proportion of each habitat under various levels of protection over time.

Enabling Conditions Analysis

We incorporated data on enabling conditions for sustainable blue economies based on the framework developed by Cisneros-Montemayor et al.[12]. Data is available in the supplementary of the original manuscript[12], and at the dryad repository[46] . These conditions, which include governance indicators, institutional capacity, and socioeconomic factors, were spatially distributed and interpolated to create a continuous global raster of enabling conditions scores. MPA-specific enabling conditions scores were derived through zonal statistics, providing a metric for each country's capacity to implement and maintain effective marine protection. We then classified minimally protected areas (LFP 1-3) between different enabling conditions scores: from Low (0 to 50), Medium (51-75) and High (76-100). Then we assessed the area of critical habitats within those categories to identify their contribution to the global extent of the habitats.

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