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REVIEW

Ocean protection quality is lagging behind quantity: Applying a scientific framework to assess real marine protected area progress against the 30 by 30 target

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Abstract

The international community set a global conservation target to protect at least 30% of the ocean by 2030 ("30 × 30") to reverse biodiversity loss, including through marine protected areas (MPAs). However, varied MPAs result in significantly different conservation outcomes, making MPA coverage alone an inadequate metric. We used *The MPA Guide* framework to assess the the world's largest 100 MPAs by area, representing nearly 90% of reported global MPA coverage and 7.3% of the global ocean area, and analyzed the distribution of MPA quality across political and ecological regions. A quarter of the assessed MPA coverage is not implemented, and one-third is incompatible with the conservation of nature. Two factors contribute to this outcome: (1) many reported MPAs lack regulations or management, and (2) some MPAs allow high-impact activities. Fully and highly protected MPAs account for one-third of the assessed area but are unevenly distributed across ecoregions in part because some nations have designated large, highly protected MPAs in their overseas or remote territories. Indicators of MPA quality, not only coverage, are needed to ensure a global network of MPAs that covers at least 30% of the ocean and effectively safeguards representative marine ecosystems from destructive human activities.

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KEYWORDS
30x30, MPA quality, marine protected areas, conservation outcomes, assessment, decision tree, level of protection, marine conservation

1 | INTRODUCTION

Marine protected areas (MPAs) are a key tool to restore and revitalize ocean health for nature and people (IPBES, 2019). When MPAs are effectively implemented and provide a sufficient level of protection, they can produce positive ecological outcomes (Grorud-Colvert et al., 2021; Lester et al., 2009; Zupan et al., 2018), social and economic outcomes for local communities (Ban et al., 2019; Costello & Ballantine, 2015; Georgian et al., 2022; Grorud-Colvert et al., 2021) and climate benefits (Jacquemont et al., 2022). Yet, many are compromised because they fail to exclude destructive human activities that threaten marine ecosystems (Costello & Ballantine, 2015; Georgian et al., 2022).

The United Nations Convention on Biological Diversity, ratified by 196 parties, aims to increase biodiversity conservation on land and sea. The recently adopted Kunming-Montreal Global Biodiversity Framework (GBF) increases the MPA coverage target from 10% of the global ocean (Aichi Target 11) to at least 30%. In addition to an areal target, it calls for "effectively conserved and managed in ecologically representative, well-connected and equitably governed systems of protected areas and other effective area-based conservation measures" (GBF Target 3) (CBD, 2022). The recently adopted global high seas treaty (United Nations, 2023) will also contribute to this target, if successfully ratified and implemented. It will provide a more comprehensive and streamlined process for MPAs in areas beyond national jurisdiction (ABNJ), roughly 61% of the ocean with little current MPA coverage (UNEP-WCMC & IUCN, 2023).

Which areas count toward these global targets, and when they count, is actively debated. The UN Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) manages the World Database on Protected Areas (WDPA) as part of the Protected Planet Initiative. It compiles reported global MPA coverage as the official measure of progress toward international targets. As of February 2023, the WDPA reported that 8.2% of the ocean is in MPAs (UNEP-WCMC & IUCN, 2023). The WDPA's approach to MPA reporting is necessarily limited for several reasons. The WDPA is mandated to report all designated MPAs submitted by governments, even if they are not implemented and, therefore, not contributing to conservation objectives (Sala et al., 2018). Barriers to implementation include lack of funding and staffing to implement protections (Gill et al., 2017) and failure to collaborate with rights holders or stakeholders (Zafra-Calvo et al., 2019). The International Union for Conservation of Nature (IUCN) publishes extensive guidelines and criteria for submitting protected areas to the WDPA, but adherence to these guidelines is inconsistent (Day et al., 2019; Dudley et al., 2013; UNEP-WCMC, 2019). As a result, MPAs with varying potential biodiversity outcomes are counted equally in the 8.2% coverage reported in the WDPA.

Years of research have linked various human activities in the ocean to biodiversity and human well-being outcomes and identified those that undermine MPAs (Ban et al., 2019; Edgar et al., 2014; Gill et al., 2019; Horta E Costa et al., 2016; Lester et al., 2009; Sala & Giakoumi, 2018; Zupan et al., 2018). Efforts are ongoing to track the effectiveness of MPAs in achieving conservation objectives, in addition to tracking their areal coverage (Geldmann et al., 2021; Jones & Long, 2021). Reporting only total MPA coverage obscures the reality that not all MPAs are designed or implemented to provide a level of protection that achieves their stated biodiversity goals (Claudet et al., 2021; Grorud-Colvert et al., 2021; Horta E Costa et al., 2019; Roessger et al., 2022; Sullivan-Stack et al., 2022). For example, MPAs that are fully or highly protected from fishing activities, where no fishing or only low-impact traditional or recreational fishing are allowed, produce increases in fish biomass, organism size, and species richness (Grorud-Colvert et al., 2021; Lester et al., 2009; Sala & Giakoumi, 2018; Zupan et al., 2018), have been linked to greater food security and higher incomes in nearby communities (Nowakowski et al., 2023), and can provide climate benefits such as enhanced carbon sequestration and coastal protection (Jacquemont et al., 2022). In contrast, partially protected areas with moderate to high levels of fishing fail to increase fish biomass as much as fully protected areas and provide only modest, if any, increase relative to unprotected areas (Giakoumi et al., 2017; Sala & Giakoumi, 2018; Turnbull et al., 2021). In some cases, partially protected areas increase the intensity of artisanal and recreational fishing (Zupan et al., 2018) with outcomes that depend on the extent and impact of the fishing allowed (Zupan et al., 2018). Aggregating diverse MPAs that produce disparate outcomes creates a misleading measure of global protection and an overestimation of the conservation outcomes that can be expected from MPAs. Given the evidence linking fully and highly protected marine areas to biodiversity conservation benefits, the MPA protection level is essential to measuring progress toward global conservation targets.

In 2020, the IUCN World Commission on Protected Areas (IUCN-WCPA) called for a methodological approach to assess the compatibility of human activities with IUCN protected area management categories and biodiversity objectives (IUCN, 2020). In response, an international working group of scientists, policy experts, and practitioners developed *The MPA Guide* (Grorud-Colvert et al., 2021), a framework synthesized from existing science to categorize MPAs relative to their likely biodiversity outcomes. This framework organizes MPAs along two axes integral to conservation outcomes—Stage of Establishment and Level of Protection—and recognizes the need for key Enabling Conditions in the process of designing and managing an effective MPA. Enabling Conditions such as funding, community support, and stakeholder engagement are critical for an MPA to be effective (Grorud-Colvert et al., 2021). Identifying MPAs according to their Stage of Establishment and Level of Protection contributes to accurately assessing progress toward international marine conservation targets by providing a standardized approach for classifying and reporting MPA quality alongside MPA coverage. A common understanding of the effectiveness and expected conservation benefits will enable a global system of MPAs that meets coverage targets while producing the desired biodiversity conservation benefits.

To establish a baseline Level of Protection and Stage of Establishment for global MPA coverage, we assessed the largest 100 MPAs reported to the WDPA using a standardized metric: *The MPA Guide*. We compared the quality of MPA coverage between countries' exclusive economic zones (EEZs) and ABNJ as well as between countries' mainland EEZs and the distant EEZs of their overseas territories to gain a political perspective on the distribution of MPA quality and coverage. We compared the quality of MPA coverage among Marine Ecoregions of the World (MEOWs) (Spalding et al., 2007) to assess the biogeographical distribution of MPA quality and coverage. These analyses provide a robust baseline measure of the quality of the vast majority of current MPA coverage against which progress toward GBF Target 3 can be tracked.

2 | METHODS

2.1 | World Database on Protected Areas

Countries self-report their protected area data to the WDPA (UNEP-WCMC, 2019; UNEP-WCMC & IUCN, 2023). The WDPA is mandated to compile all MPA records that have been designated, when the corresponding authority officially endorses a document of designation (UN SDG Indicator—Target 14.5) (United Nations, 2023). The WDPA guidelines request that all MPAs submitted meet the IUCN or Convention on Biological Diversity (CBD) definition of an MPA, which asserts that its objective should be "the long-term conservation of nature with associated ecosystem services and cultural values" [IUCN] or "specific conservation objectives" [CBD] (UNEP-WCMC, 2019). As of February 2023, the WDPA reports that 8.2% of the ocean is protected in over 18,000 MPAs (UNEP-WCMC & IUCN, 2023).

At a minimum, a submission must include the protected area's name, designation, location, area, status, and status year. Contributors can also include spatial boundaries, IUCN category of management objective, no-take status, governance type, and management authority. However, these data are not required and do not always adhere to IUCN guidance or definitions (Day et al., 2019; UNEP-WCMC, 2019). IUCN management objective categories are "Not Reported" or "Not Assigned" for over one-third of all WDPA MPA records, and no-take status is "Not Reported" for the vast majority (89.2%) of MPA records, leaving the total amount of no-take area unknown.

2.2 | Identification of the Largest 100 MPAs

We identified the largest 100 MPAs by area reported to the WDPA [accessed Feb 2023] (UNEP-WCMC & IUCN, 2023) and assessed them using *The MPA Guide* framework. MPA zones, defined here as areas separated by internal boundaries that differ in regulation across the horizontal extent of the MPA, were considered part of a single MPA if they shared an MPA ID number (WDPA_ID). In a few cases, zones with different WDPA_IDs were manually grouped because they corresponded to a single zone of an MPA (Table S1). We removed duplicate entries ($n = 5$) and excluded UNESCO Man and Biosphere Reserves ($n = 2$) because the WDPA does not include them in their MPA coverage calculations (https://www.protectedplanet.net/en/resources/calculating-protected-area-coverage). Some of the largest 100 MPAs have smaller MPAs within their boundaries, but these were not evaluated or included in this analysis. The largest 100 MPAs cover 7.3% of the global ocean area and account for 89.2% of global MPA coverage.

As part of the Protected Planet initiative, the UNEP-WCMC also manages the World Database on Other Effective area-based Conservation Measures (WD-OECM). What gets counted as an OECM is debated and inconsistently applied, and only about 200 marine OECMs (accounting for 0.1% of the global ocean) are currently reported (Claudet et al., 2022). None of these individual OECMs are commensurate in size to the 100 largest MPAs, thus no reported OECMs were included in this analysis.

2.3 | MPA Zones

Since the regulations and activities occurring in MPAs may vary by zone, we conducted assessments at the zone level for multizone MPAs. For any zoned MPA with missing or inaccurate zone data in the WDPA, we obtained the geospatial data for the MPA zones from the Marine Protection Atlas (https://mpatlas.org), the MPA management team, or other available sources such as published online maps or information in legal designation documents. The resulting dataset consists of 203 zones representing 100 MPAs (Table S1).

2.4 | Data Collection and *The MPA Guide* Assessments

We evaluated each MPA zone using *The MPA Guide* framework (Grorud-Colvert et al., 2021) to determine its Stage of Establishment and Level of Protection. The four Stages of Establishment are: proposed, designated, implemented, and actively managed. Enabling Conditions such as funding and community engagement are included in a list of key considerations, and these were considered in the evaluation of Stage of Establishment since these contribute to successful implementation and active management. To gather evidence for *The MPA Guide* assessments, we compiled documentation for each of the largest 100 MPAs, such as the legal designation, regulatory documents, and management plan. Next, we consulted relevant scientific literature and other reports that detail the human activities occurring in the MPAs and their impacts. Where information was not available or the impact of activities was ambiguous, we consulted with the management team or other experts familiar with the MPA.

The four Levels of Protection in *The MPA Guide* are: fully protected, highly protected, lightly protected, and minimally protected. Level of Protection was only analyzed for implemented and actively managed MPAs, since most designated and proposed MPAs do not yet have permanent regulations or regulations are not yet enforced. We noted proposed future or interim regulations for designated and proposed MPAs (Table S1) but did not include them in our Level of Protection analysis. The Level of Protection of proposed and designated sites was considered "To Be Determined" (TBD).

The Level of Protection was determined by evaluating the impact of human activities that are allowed and occurring within an MPA zone from seven activity types: mining, dredging and dumping, anchoring, infrastructure, aquaculture, fishing, and nonextractive activities (see Grorud-Colvert et al. 2021, http://mpa-guide.protectedplanet.net for details on how to apply *The MPA Guide* framework). *The MPA Guide* provides a framework to categorize an activity's impact based on the activity type, intensity, scale, duration, and frequency as it relates to biodiversity conservation (Grorud-Colvert et al., 2021). To the extent possible, we evaluated each activity based on its *de facto* presence and impact, rather than strictly by regulations, as outlined in the expanded guidance for *The MPA Guide* (http://mpa-guide.protectedplanet.net). In some cases, activities may not be regulated or occurring because they are not feasible (e.g., anchoring, dredging, or aquaculture in the high seas), and these were determined to be unlikely threats to biodiversity conservation in the area, so we evaluated these impacts as "not applicable" in the MPA. When an external authority with jurisdiction overlapping an MPA regulates or prohibits activities across an entire MPA or an MPA zone, we include those regulations in our protection analysis as it impacts the *de facto* protection an MPA provides.

In some cases, we were not able to find information for all seven activities; however, the impacts of the criteria we could determine were sufficient for assessing the Level of Protection (e.g., the activities' impact would match with a minimally protected area or would be incompatible with biodiversity conservation). In the decision tree for assessing Level of Protection, once a zone moves to a less protected level due to a given impact, it cannot be ultimately scored at a higher Level of Protection. For example, mining is an activity that is considered incompatible with biodiversity conservation (Day et al., 2019). If mining occurs, the MPA is incompatible with biodiversity conservation regardless of other activities.

We asked regional MPA experts to review our *MPA Guide* assessments for accuracy where we could find relevant and willing experts. Eighty-one percent (165 of 203 zones) of the completed *MPA Guide* evaluations were independently reviewed by experts familiar with these MPAs (Table S1). Since *The MPA Guide* framework assesses the currently allowed and in situ activities in an MPA zone, our assessments represent a snapshot in time of *de facto* protection. Assessments will need to be updated as regulations and activities change, or as understanding of how activities impact biodiversity improves.

It is important to note that the term "designated" is used somewhat differently by the WDPA and *The MPA Guide*. The WDPA has a "status" field that can be reported as Proposed, Inscribed, Adopted, Designated, or Established. This field refers only to the legal status of the MPA, where "designated" means the MPA has been legally or formally designated. While many MPAs reported by the WDPA as designated may also be implemented or actively managed, data providers are not required to detail the actual implementation status. *The MPA Guide* uses designated to mean legally designated but not yet in-force or implemented on the water. *The MPA Guide* reports implementation and active management separately to differentiate between when an MPA has been established or recognized through legal means and when it is in-force on the water and likely to achieve conservation benefits. For the rest of the paper, the term "designated" will apply to *The MPA Guide* definition of legally designated but not yet implemented.

2.5 | Data Analysis

Each *MPA Guide* zone assessment was linked to its corresponding geospatial boundary, and all geospatial boundaries were clipped by land boundaries (Natural Earth, 10 m, ver 5.1.1) to include only marine area. The dataset was then analyzed in ArcGIS Pro (GCS WGS 1984) to determine the area coverage of each Stage of Establishment and Level of Protection. To avoid double counting protected areas that overlap, and to best reflect *de facto* protections for a given area of ocean, any area of overlap was assigned the highest Stage of Establishment and Level of Protection found in that location. Global coverage calculations were run with the global ocean area calculated as 361,900,000 km^2 (Eakins & Sharman, 2010). We calculated coverage within EEZs and ABNJ as denoted by each MPA's International Organization for Standardization (ISO) 3-digit country code in the WDPA, with any country code except ABNJ considered to be within an EEZ.

To review the distribution of MPAs, we calculated the assessed coverage in overseas territories and remote areas ("distant EEZs") for 11 countries with extensive remote EEZ area: Australia, Brazil, Chile, Colombia, Costa Rica, Ecuador, France, Mexico, South Africa, United Kingdom, and United States. We defined "distant EEZs" as areas where the EEZ is discontinuous from the primary EEZ or where a land mass beyond the EEZ extends the EEZ well beyond 200 nm from the coastline (e.g., Juan Fernandez Islands off Chile and Cocos Island off Costa Rica). We compared the area of the largest 100 MPAs found in these distant EEZs to the total MPA coverage the country reported to the WDPA. This reveals the minimum proportion of each nations' coverage made up of large, distant MPAs, since there may be additional smaller MPAs in distant EEZs that were not assessed in this analysis. In two cases—Australia and the UK—we manually added the country's reported protection in remote EEZs because they are reported separately to the WDPA. We used the same methodology to evaluate the minimum coverage of fully and highly protected area as a proportion of each country's reported total MPA coverage.

To assess ecological representativeness, we analyzed the coverage provided by the largest 100 MPAs in each realm as classified by the Marine Ecoregions of the World (MEOW) (Spalding et al., 2007). This dataset is a biogeographic classification of the world's coastal and continental shelf waters, following a nested hierarchy by area of realms, provinces, and ecoregions. We opted for realm rather than ecoregion classification since our data on the 100 largest MPAs do not accurately reflect coverage of small ecoregions.

3 | RESULTS

3.1 | Global Coverage

The largest 100 MPAs consist of 203 separate zones that cover 26,382,926 km^2 or 7.3% of the global ocean area and account for 89.2% of MPA coverage reported to the WDPA (Figure 1). These 100 MPAs range in size from 2,064,882 to 34,956 km^2. Full assessment of the remaining set of over 18,000 reported MPAs was beyond the scope of this study (an area equivalent to just 10% of MPA coverage).

The largest 100 MPAs cover 5.4% of the global ocean area in implemented or actively managed MPAs (74.6% of the assessed area; 19,690,390 km^2). The rest of assessed MPA coverage is currently unimplemented (i.e., at the proposed or designated Stage of Establishment), covering 1.9% of the global ocean area (25.4% of the assessed area; 6,692,536 km^2) (Table 1 and Figure 2).

Within the implemented or actively managed MPAs we assessed, 2.6% of the global ocean area is fully or highly protected (35.7% of assessed protected area; 9,427,067 km^2) (Figure 2) and 0.1% of the global ocean is lightly protected (1.9% of assessed protected area; 492,809 km^2) (Table 1). Some implemented or actively managed MPAs have high-impact activities occurring, making them incompatible with biodiversity conservation, and covering 2.7% of the global ocean (36.9% of assessed protected area; 9,722,897 km^2). There was one MPA zone for which we could not find sufficient information to determine its Level of Protection (Common fishery right area/Hokkaido—Japan) (Table 1 and Figure 2).

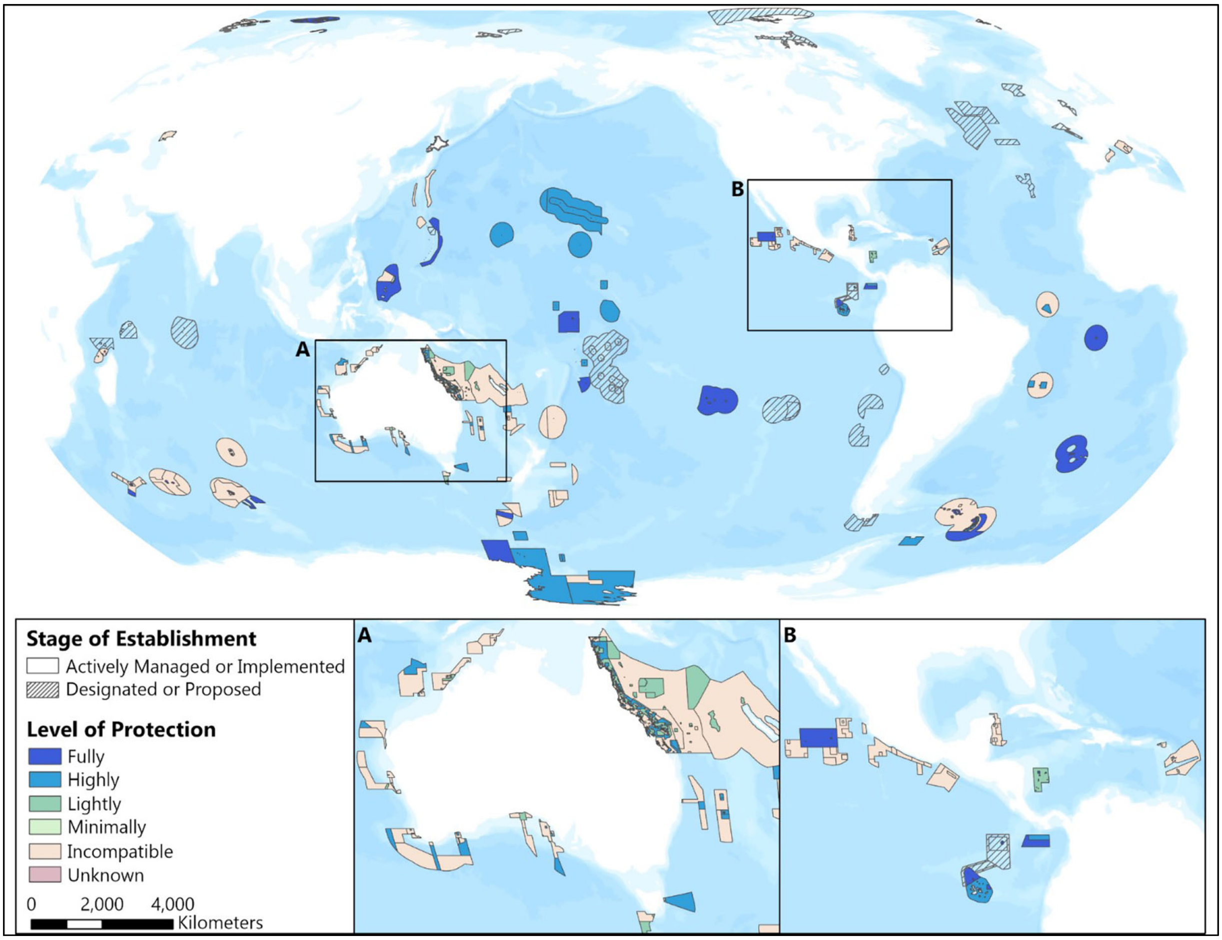

FIGURE 1 Map of the 100 largest MPAs in the World Database on Protected Areas [accessed February 2023] by Stage of Establishment and Level of Protection using *The MPA Guide*.

3.2 | EEZ and High Seas Coverage

The largest 100 MPAs cover 16.4% of the total EEZ area (6.4% of the global ocean). Fully and highly protected area is 31.8% of assessed MPA coverage and contains 5.2% of the total EEZ area (2.0% of the global ocean; 7,377,967 km^2) (Figure 3).

The assessed area covers 1.4% of ABNJ (0.9% of the global ocean). Fully and highly protected area is 64.6% of assessed MPA coverage in ABNJ and contains 0.9% of total ABNJ (0.6% of the global ocean; 2,049,101 km^2).

Eleven countries (Australia, Brazil, Chile, Colombia, Costa Rica, Ecuador, France, Mexico, South Africa, United Kingdom, and the United States) have significant portions of their EEZ area in remote, distant waters. Of the total assessed MPA coverage, 62.4% of fully or highly protected area is in distant EEZs. In fact, three countries have designated nearly all their MPA coverage, including nearly all their fully or highly protected MPA coverage, in distant parts of their EEZ, and three more countries are proposing to implement large MPAs in their distant EEZs in the future. The three countries that have achieved most of their reported MPA coverage in distant EEZs are the UK (92.7% of reported MPA coverage in distant EEZs, 53.0% of which is fully or highly protected), the United States (95.4% and 98.6%, respectively), and Ecuador (96.0% and 69.7%, respectively) (Figure 4). Chile and Costa Rica currently have little distant coverage in fully and highly protected areas (0% and 1.2%, respectively) but this could soon change with the implementation of four designated MPAs in Chile and the expansion of Parque Nacional Isla del Coco in Costa Rica, which is planned to be fully protected (Table S1). Australia also recently designated new, large MPAs (not yet reported to the WDPA) in their distant EEZ areas, Christmas and Cocos/Keeling Islands; once implemented, these MPAs will add 8.8% MPA coverage to Australia's EEZ (Australian Marine Parks, 2023).

TABLE 1 Global MPA area (km^2) and percent of the global ocean in the 100 largest MPAs reported to the World Database on Protected Areas (WDPA) [accessed February 2023], assessed by Level of Protection and Stage of Establishment using *The MPA Guide*.

		Stage of Establishment				
		Proposed	**Designated**	**Implemented**	**Actively managed**	**TOTAL**
Level of Protection	Fully	–	–	844,538 (0.2%)	3,418,010 (1.0%)	4,262,548 (1.2%)
	Highly	–	–	1,385,643 (0.4%)	3,778,876 (1.0%)	5,164,519 (1.4%)
	Lightly	–	–	58,923 (< 0.1%)	433,886 (0.1%)	492,809 (0.1%)
	Minimally	–	–	0 (0%)	0 (0%)	0 (0%)
	Incompatible	–	–	3,052,875 (0.9%)	6,670,022 (1.8%)	9,722,897 (2.7%)
	Unknown	–	–	47,617 (< 0.1%)	0 (0%)	47,617 (< 0.1%)
	TBD	106,668 (< 0.1%)	6,585,868 (1.8%)	–	–	6,692,536 (1.9%)
TOTAL		106,668 (< 0.1%)	6,585,868 (1.8%)	5,389,596 (1.5%)	14,300,794 (3.9%)	26,382,926 (7.3%)

Note: Only implemented and actively managed MPAs were assessed for Level of Protection, since proposed and designated MPAs either do not yet have regulations, regulations are not yet enforced, or regulations are temporary and subject to change.

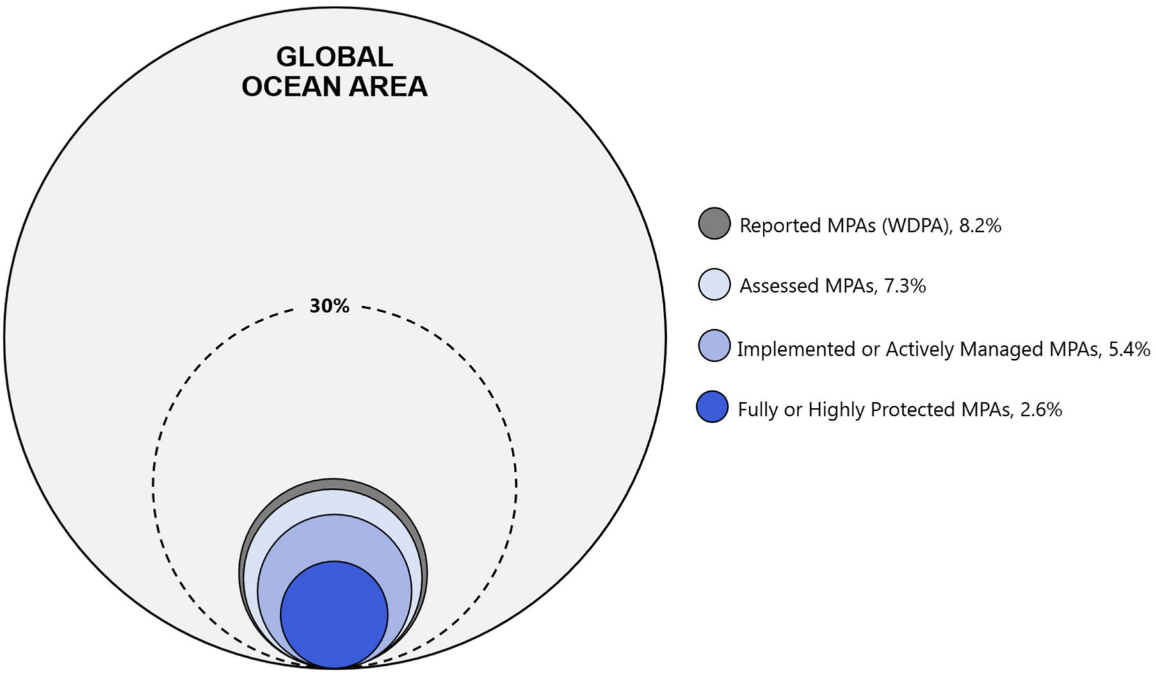

FIGURE 2 Area of the 100 largest MPAs in the World Database on Protected Areas [accessed February 2023] by Stage of Establishment and Level of Protection using *The MPA Guide*.

3.3 | Ecoregion Coverage

Of the total area covered by the largest 100 MPAs, 81.7% is in coastal and continental shelf waters that fall within the Marine Ecoregions of the World biogeographic classification. Most MEOW realms (10 of 12) include some amount of fully and highly protected area; however, only two realms, the Eastern Indo-Pacific and Southern Ocean,

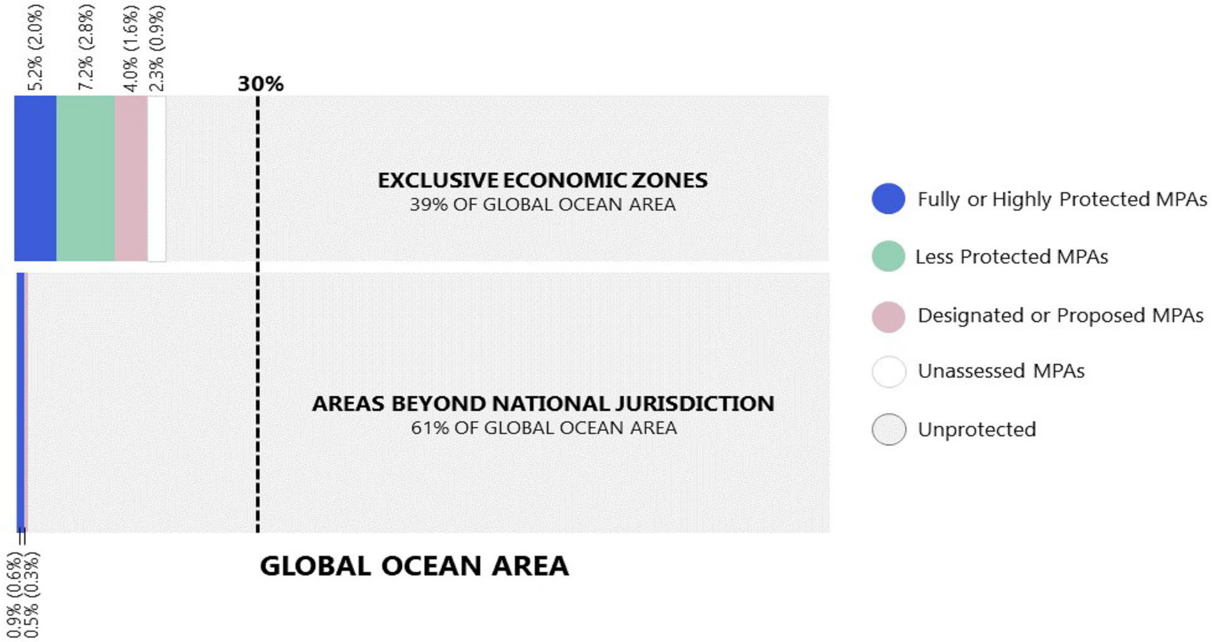

FIGURE 3 Coverage of MPAs in EEZs and areas beyond national jurisdiction (ABNJ) by Stage of Establishment and Level of Protection using *The MPA Guide*. "Less protected MPAs" refers to MPA coverage that is lightly protected, minimally protected, or incompatible with the conservation of nature. The proportion of the global ocean protected in each type of MPA within the largest 100 MPAs assessed is shown in parentheses. Less Protected and Unassessed MPAs are not included for ABNJ because each is < 0.1%.

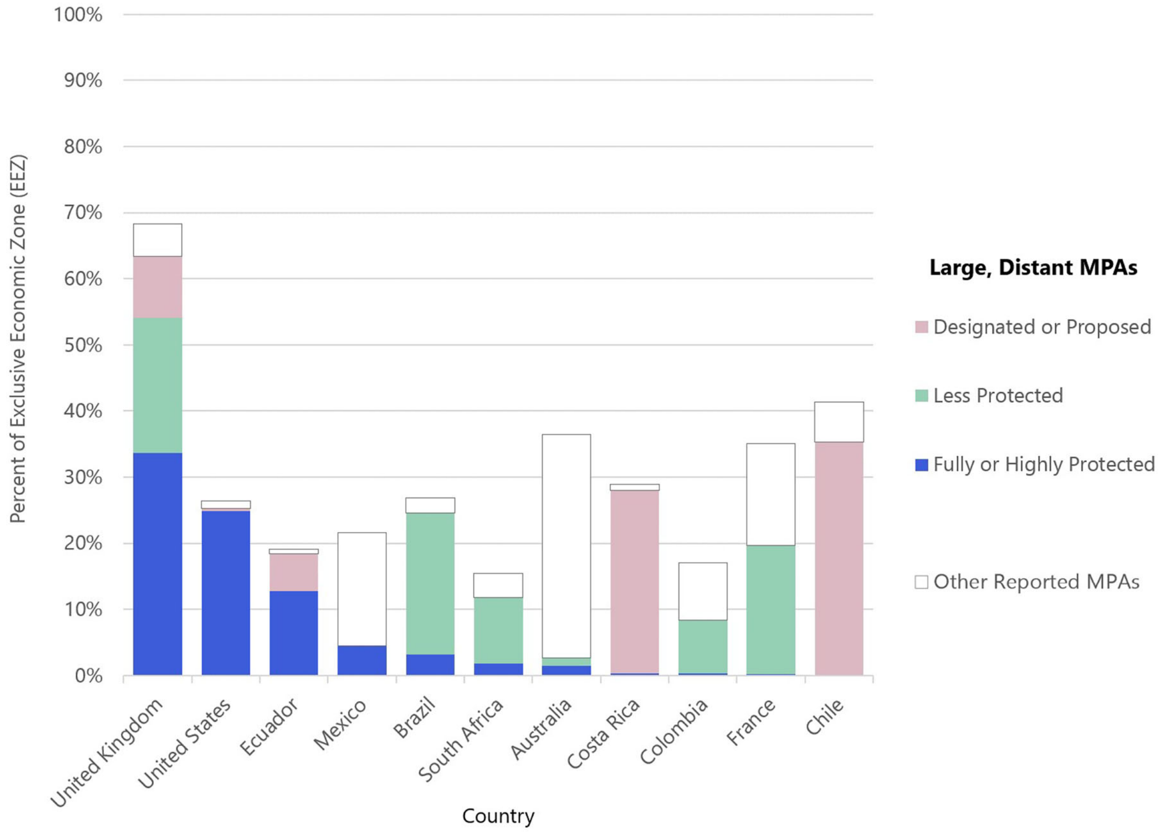

FIGURE 4 Proportion of reported MPA coverage [WDPA accessed February 2023] in large, distant MPAs for 11 countries with significant EEZ area in overseas territories or remote areas ("distant EEZs"). Large MPAs located in distant EEZs are categorized by Stage of Establishment and Level of Protection using *The MPA Guide*. "Less protected" refers to MPA coverage that is lightly protected, minimally protected, or incompatible with the conservation of nature.

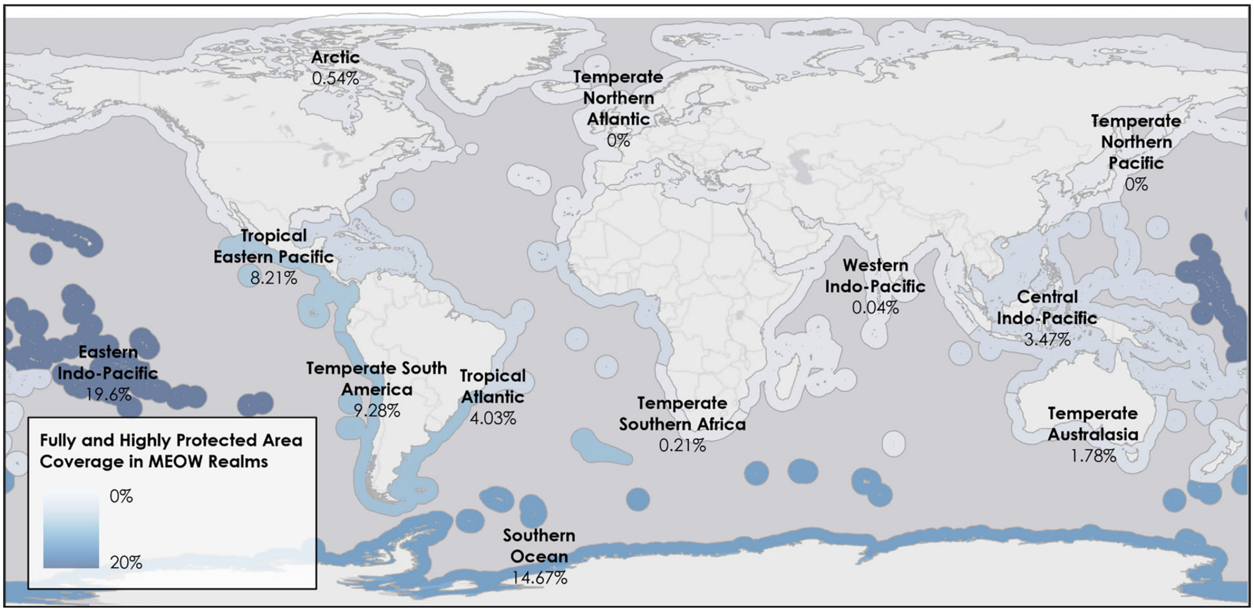

FIGURE 5 Percentage of each Marine Ecoregions of the World (MEOW) realm protected in fully and highly protected areas as assessed using *The MPA Guide*.

include over 10% fully and highly protected area coverage. These two realms contain over half (57.1%) of the fully and highly protected area within the largest 100 MPAs (Figure 5).

4 | DISCUSSION

While there has been a rapid increase in global MPA coverage over the last two decades (Lubchenco & Grorud-Colvert, 2015), our analysis shows that current tracking methods are overestimating the quantity and quality of protection. Two factors contributing to overestimation are (1) reporting MPAs that have no regulations or management in place, and (2) counting MPAs in which high-impact human activities are occurring without regard for quality of protection. MPAs that are not implemented or regulated to deliver biodiversity conservation benefits should not be counted toward GBF Target 3 or other conservation goals. Furthermore, the largest 100 MPAs are unevenly distributed across marine ecoregions, in part due to large MPAs disproportionately placed in remote areas and overseas territories. This leaves key ecosystems closer to population centers under-protected and compromises the associated benefits for communities in under-protected regions.

4.1 | Global MPA Coverage Reporting

Our analysis revealed that one-fourth of the area in the largest 100 MPAs is unimplemented. The most common reason that MPAs failed to be classified as implemented was that they lacked enforced regulations. The Cook Islands (Marae Moana) and Seychelles (Amirantes and Aldabra MPAs) are both undergoing years-long marine spatial planning exercises that have not yet resulted in management plans, zones, or final regulations. The Chagos MPA was assessed as designated but unimplemented due to unresolved human rights issues regarding the displacement of Chagossians and their ongoing exile from the island (De Santo et al., 2011). While many of the very large, and often remote, MPAs in this analysis benefit from low levels of prior use, they do require investment and capacity to enable ongoing management and avoid becoming "paper parks." Lack of investment risks MPAs that serve merely as geopolitical strategies to meet coverage targets and are ill-equipped to protect marine ecosystems from current and future threats (Leenhardt et al., 2013; Rife et al., 2013).

One-third of assessed MPA coverage was incompatible with the conservation of nature due to industrial activities, primarily industrial fishing, as defined by the IUCN (IUCN, 2020). Industrial fishing is the leading driver of biodiversity loss in the ocean (IPBES, 2019), resulting in extensive overfishing, biomass reduction (Pauly et al., 2005; Thurstan et al., 2010), and destruction of the seafloor and benthic habitats by bottom-contact gears (Althaus et al., 2009; Eastwood et al., 2007; Eigaard et al., 2017). In only 70 years, industrial fishing has expanded to ABNJ as a result of overfished EEZs, increased demand, government subsidies, and technological innovation making fishing possible in previously unreachable places (Milazzo, 1998;

Sala et al., 2018; Swartz et al., 2010). *The MPA Guide* follows IUCN guidance that any type of industrial extraction is incompatible with biodiversity conservation (Day et al., 2019). Lightly or minimally protected areas were not common in our analysis of the largest 100 MPAs because our sample included many large offshore areas where existing fishing is often industrial-scale fishing. This result highlights a need for additional research on the impact of industrial fishing in large, remote areas such as ABNJ. Further research and improved data collection could increase our understanding of these impacts, but there is currently no evidence to support the compatibility of any industrial fishing with positive biodiversity outcomes.

Implemented or actively managed MPAs that are fully or highly protected cover 2.6% of the global ocean, or approximately one-third of the assessed area. These MPAs are expected to yield the greatest biodiversity conservation benefits (Gill et al., 2019; Horta E Costa et al., 2016; Lester et al., 2009; Sala & Giakoumi, 2018; Zupan et al., 2018) and net-positive human well-being outcomes (Ban et al., 2019; Nowakowski et al., 2023; Turnbull et al., 2021). While not invulnerable to the effects of climate change, evidence indicates that well-protected, intact ecosystems may be better equipped to resist and recover from discrete climate-driven disturbances, such as intensified storms, compared to unprotected areas (Mcleod et al., 2009; Roberts et al., 2017). Beyond resilience, fully and highly protected areas can provide a broad range of climate benefits that include climate change mitigation and adaptation (Grorud-Colvert et al., 2021; Jacquemont et al., 2022). Although some studies use IUCN protected area management categories Ia, Ib, and II as a proxy for fully or highly protected MPAs (Agardy et al., 2003; Cockerell et al., 2020; Costello & Ballantine, 2015; Jones, 2006; Kuempel et al., 2019; Zafra-Calvo et al., 2019; Zhao et al., 2020), they were never intended to evaluate MPA protection levels or indicate the degree of biodiversity conservation benefit conferred by MPAs (Dudley et al., 2013). In our dataset, only about one-third of MPA coverage reported as category Ia, Ib, or II was classified as fully or highly protected. The use of these management categories to indicate protection level is further complicated by their inconsistent application and reporting (Ban et al., 2014; Horta E Costa et al., 2016). No-take status has also been used as a proxy for Level of Protection (Wood et al., 2008), but this information is also inconsistently reported to the WDPA. Beyond no-take, there are many forms of partial protection that *The MPA Guide* identifies according to the ecological impacts of the occurring activities. Knowing both what an MPA was intended to protect (IUCN Categories) and the likelihood that the MPA will deliver biodiversity benefits (*The MPA Guide*'s Stage of Establishment and Level of Protection) provides a more nuanced view of MPA coverage; they are not interchangeable.

4.2 | MPA Coverage in Distant and Remote EEZs

Our analysis found that very large fully and highly protected areas established in distant and remote portions of the EEZs of 11 countries (the United States, France, Australia, UK, South Africa, Chile, Ecuador, Mexico, Costa Rica, Colombia, and Brazil) account for 62.4% of the assessed fully or highly protected area. This finding builds upon recent national-level *MPA Guide* analyses that found 99% of US fully and highly protected areas (Sullivan-Stack et al., 2022) and 80% of French fully and highly protected areas (Claudet et al., 2021) are in distant waters. Large, remote MPAs have ecological, social, and economic benefits (Edgar et al., 2014) and contribute disproportionately to global conservation targets (Toonen et al., 2013). Opportunistic protection far from population centers, such as the British Overseas Territories and the US Pacific Remote Islands, has enabled the safeguarding of large swaths of the ocean that are rich in biodiversity and where extractive activities have not already heavily impacted ecosystems (Devillers et al., 2015; Toonen et al., 2013; White et al., 2020). Yet, the focus on remote areas to achieve targets risks diverting focus and resources away from urban coastal areas in ecoregions where human activities are more intensive (Jones & De Santo, 2016; Sullivan-Stack et al., 2022), demand for ocean-based food and livelihoods may be highest, and where restricting harmful human impact becomes more challenging. Fully protected or highly protected areas with only low-impact activities like subsistence fishing are vital in these urban coastal areas to reach global targets, protect key habitats, and bring the benefits MPAs provide to local communities.

With nearly 90% of all marine protection concentrated in only 100 large MPAs, an uneven responsibility falls to countries or territories leading in large-scale biodiversity conservation. Many of the islands where nations have designated large MPAs are home to Indigenous Peoples with diverse political relationships to their respective colonizing countries; they often lack the legal right to participate in choosing leaders who make these conservation decisions (Wyatt & Weare, 2018). Our study provides a sobering analysis of who carries the conservation burden to meet global biodiversity protection goals—and illustrates the need for fair, diverse, and equitable representation and inclusion in marine conservation decisions (Zafra-Calvo et al., 2019).

4.3 | MPA Coverage in Areas Beyond National Jurisdiction

The largest 100 MPAs located outside national jurisdictions cover only 0.9% of the global ocean, and nearly two-thirds are fully or highly protected. All of the assessed fully or highly protected area outside national jurisdictions comes from two Antarctic MPAs where the alignment of governance systems through the Antarctic Treaty System (ATS) has enabled the creation of the South Orkney Islands Southern Shelf MPA and some highly protected zones of the Ross Sea MPA (Brooks et al., 2021; Nocito et al., 2022). While this process has resulted in a large swath of fully and highly protected high seas area, a small number of global actors has limited CCAMLR's ability to achieve its conservation aims of additional MPAs, favoring fisheries access that only benefits a small number of States and fishers, does not provide food security, and threatens the fragile Southern Ocean ecosystem (Brooks et al., 2022). GBF Target 3 cannot be achieved by 2030 without rapidly increasing protection in ABNJ. The ATS example of cross-sectoral governance could provide guidance for implementing the new treaty to protect biodiversity beyond national jurisdictions (i.e., the High Seas Treaty) (Gjerde et al., 2022; United Nations, 2023). The High Seas Treaty needs to be quickly ratified and implemented to enable the designation of more high seas MPAs, which are crucial to achieve global conservation targets.

4.4 | MPA Coverage and Ecoregions

Our analysis found that the current global network of large MPAs is not representative across marine ecoregions; nearly a quarter of assessed MPA coverage and over a third of fully and highly protected area is in the Eastern Indo-Pacific Realm. Concentrated biodiversity protection in remote areas leads to uneven global distribution of biological and social benefits as well as failure to meet biogeographical representation targets (Jones & De Santo, 2016). To correct this uneven coverage and inform future priorities and resource allocation, numerous studies have identified key biomes, coastal areas, seafloor and benthic features, and ABNJ in need of protection (Ceccarelli et al., 2021; Fischer et al., 2019; O'leary et al., 2012; Visalli et al., 2020; Zhao et al., 2020). Representativity is a key part of global targets. The best available science and traditional ecological knowledge are important to identify priority locations for effective biodiversity conservation across the full suite of coastal and marine ecosystems. A biogeographically representative network of MPAs contributes to a more equitable distribution of the benefits that MPAs provide to people (Jones et al., 2020; Sala et al., 2021).

4.5 | Policy Recommendations

This analysis revealed that although the 100 largest MPAs include almost 90% of the global MPA coverage, one-quarter of that area is actually unimplemented, and one-third of that area is incompatible with the conservation of nature due to the occurrence of highly destructive activities. Global action is critically needed to improve the quality of MPAs alongside coverage as we aim for the GBF 30 × 30 target:

1. MPAs that are classified as unimplemented or incompatible with conservation should not be counted toward MPA targets. More attention and resources are needed to implement and manage these MPAs, and they need to exclude the most harmful human activities, such as industrial fishing (IUCN, 2020) and mining, to enable them to deliver their intended conservation benefits.
2. Global MPA reporting for the GBF should include Level of Protection as a component indicator. GBF Target 3 specifies that MPAs should be effectively conserved but does not yet have an indicator for biodiversity outcomes (Lefebvre, 2023). *The MPA Guide*'s Level of Protection provides a science-based estimation of the conservation benefits MPAs are likely to produce. Fully and highly protected areas, those likely to provide the greatest benefits, should be the focus of efforts to achieve GBF Target 3.
3. MPA planning should include considerations of ecosystem and biogeographic representativity and ensure procedural and distributional equity. Particular emphasis should be placed on coastal areas and ecoregions near mainland waters that endure significant impacts as opposed to distant and remote EEZ areas where most fully and highly protected MPA coverage is currently concentrated. Coherent national and international plans for well-designed and sited, effective MPA networks are crucial for achieving equitable conservation at the scale needed to meet conservation goals and address biodiversity loss.
4. The High Seas Treaty needs to be ratified and implemented as soon as possible to catalyze strong protection for ABNJ. High seas MPAs are critical to meeting GBF Target 3, and they should prohibit industrial-scale activities.

The past 10 years have seen a notable increase in the coverage of MPAs. To achieve GBF Target 3 and equitably and effectively conserve at least 30% of the ocean by 2030, it is critical to achieve the quality and representativeness components, in addition to the quantity target, for MPAs. Ultimately, a network of MPAs that prioritizes biodiversity in a representative system covering at least 30% of the ocean is needed (Jones et al., 2020; Sala et al., 2021). *The MPA Guide* provides a valuable framework for tracking MPA progress in terms of quality, and it can be used as an accountability metric for national MPA commitments to GBF Target 3. This standardized method for assessing the likely biodiversity benefits of an MPA enables us to measure not only how much of the ocean is protected, but also how well it is protected, revealing the current status of marine conservation efforts and what is still needed to safeguard biodiversity for future generations.

AUTHOR CONTRIBUTIONS

All authors contributed to the conceptualization and design of this study. EPP, JMCM, and NH collected data and completed *The MPA Guide* assessments. JMCM conducted geospatial analysis and prepared data visualizations. EPP and JMCM drafted the paper, and all authors contributed to revisions and approved the submitted version.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are all available in the article and its Supplementary Materials (Table S1). Additional data are available at the Marine Protection Atlas (MPAtlas.org) or directly from the authors upon request.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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