Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Financing Marine Protected Areas for a Sustainable and Equitable Ocean: A Narrative Review

Ranjith Kumar Modi

ranjithcool1623@gmail.com

Woxsen School of Business

Naveen Siriman

Woxsen School of Business

Research Article

Keywords: Marine protected areas, conservation finance, debt-for-nature swaps, blue bonds, blue carbon, equity, 30x30, ocean governance

Posted Date: November 9th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-11329449/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Abstract

The narrative review attempts to integrate the literature on conservation finance of MPAs and its impacts on the effectiveness and equity of ocean governance. It attempts to bring both traditional and innovative financial instruments under the common analytical framework of conservation-finance, blue-economy, political-economy and decolonial. A total of 100 papers were selected from systematic searches of Scopus, Web of Science and Google Scholar (2000–2025) and additional sources through grey literature and snowball sampling. The literature is categorised under six categories of financing mechanisms, namely public budgetary finance, market-based user finance, official development assistance and philanthropic grants, debt-for-nature swaps, blue bonds, and blue carbon and climate finance along with the wider discussion on blue economy. Governance and management effectiveness, including the 'paper parks' problem, are treated as the condition determining whether finance yields effective protection. According to the literature review, the growth of MPAs in the context of the 30x30 initiative has been faster than the finances and capabilities to manage the increase in MPAs. Small scale fishers, coastal communities and Indigenous peoples have been shouldering the majority of the cost burden. Equity is more commonly stated than studied within the corpus.

1. Introduction

This paper examines literature on the financing of Marine Protected Areas (MPAs) and its consequences on the effectiveness and equitable protection of oceans (Gill et al., 2017). At the international level, the expansion of the protected areas of the world's oceans has been observed due to the efforts to protect thirty percent of the world's oceans by the year 2030 (Sowman and Sunde, 2018). There is a huge variation in the ecology, social structure, and institutional framework of MPAs, which include small community-based MPAs as well as large, remote offshore MPAs (Grorud-Colvert et al., 2021). These arrangements generally benefit society through biodiversity, food security and climate advantages, while imposing costs and constraints on people living adjacent to them (Bohorquez et al., 2022). The recent expansion of MPAs has occurred particularly in response to global policy targets, yet this expansion in coverage has not been matched by a comparable expansion in the finance and management capacity required to make protection real (Gill et al., 2017; Pike et al., 2024). Large-scale marine spatial planning has been proposed as one means of addressing this mismatch between designation and delivery (Agardy et al., 2011).

The emergence of ambitious protection targets points to an increasingly acute gap between the promise and the practice of ocean conservation. An increasingly stark pattern has emerged in which large, newly designated areas appear on maps alongside chronically underfunded management, weak enforcement and limited local benefit. Firstly, MPA has been acclaimed to be the flag bearer of the blue economy and global efforts for biodiversity protection. However, secondly, in the wake of the increasing extent of protected areas, there is another story of unfunded mandate, paper parks, and people who suffer from restrictions while not benefitting (Di Cintio et al., 2023; Sowman & Sunde, 2018). These discrepancies create instances of inefficiency and inequity in marine conservation practices and shed some light on sustainable and equitable aspects of ocean conservation.

In order to organize this literature review, there are three main questions that the review will answer. The first question is regarding how the issue of financing for MPAs has been dealt with in literature and the theoretical approaches that have been used in dealing with this issue. Third, what are the principal research gaps, and what agenda follows for research on finance, effectiveness and justice in ocean protection? These questions are addressed, respectively, in the conceptual and mechanisms sections (Sections 3 and 4), in the equity section (Section 5), and in the concluding assessment (Sections 6 and 8).

This review's contribution lies in the integration it offers rather than in new primary evidence. It brings together, within a single synthesis, financing mechanisms that are usually reviewed separately in isolation from one another, namely conventional public finance, sovereign debt instruments, blue carbon and the blue economy, and it applies an explicit equity, recognition and decolonial lens evenly across all of them, including the long-established mechanisms that are less often subjected to this scrutiny than newer instruments. Section 6 returns to this contribution once the mechanisms have been reviewed in Sections 4 and 5.

This paper uses the term 'MPA finance' as an umbrella descriptor for the dynamics of resourcing ocean protection and its outcomes. A full treatment of the broader concept of conservation finance falls outside the scope of this review; here, the term denotes the raising and use of adequate funding for the creation and maintenance of protection. The financial sustainability of an MPA depends on its sources of income, the costs of managing and implementing its programme, and the governance arrangements through which finance is raised and accounted for (Bohorquez et al., 2022; Balmford et al., 2004).

2. Methods

It is a narrative review, and it adheres to the principles of transparent narrative synthesis while reporting its search process and selection to help the reader determine the foundations of the corpus. The three bibliographic databases used were Scopus, Web of Science, and Google Scholar. 'Financing for marine protected areas' was the search string used along with other keywords such as 'Conservation finance for oceans', 'debt for nature swaps for marine environment', 'blue bonds', 'blue carbon finance', 'Marine protected area equity', 'Marine protected area governance' and 'Marine protected area effectiveness'. All of these strings produced similar result sets. The searches were conducted between March and November 2024, with a final update in May 2025, with no lower date boundary imposed, so that the corpus spans foundational studies from the early 2000s to works published in 2025.

Because an exclusive search focused on funding alone would leave out any literature that addressed the elements necessary for a successful and just protection regime that did not employ any finance-specific vocabulary, the literature search was broadened to the bodies of knowledge related to ocean governance, blue economy, and conservation justice literature (Silver et al., 2015; Bennett, 2022; Kashwan et al., 2021). The grey and policy literature was accessed directly from the OECD, the World Bank, IUCN, the Convention on Biological Diversity and The Pew Charitable Trusts. The search in the databases was supplemented by snowballing, whereby the references lists of the selected articles were scrutinised and the appropriateness of new items was assessed.

Sources have been considered for inclusion where they addressed the issue of finance, governance, equity, or ecological effectiveness of marine/coastal protected areas in peer reviewed journals and policy reports. Purely technical ecological studies were included only where they helped to frame the financing debate. Items were excluded where protection was incidental to the analysis or where a marine focus was absent. The three database searches yielded 1,286 papers; 401 duplicates were identified and discarded, leaving 885 papers for title/abstract screening, of which 662 were excluded as not related to the financing, governance, equity or effectiveness of MPAs. This left 223 papers for full-text review, of which 147 were excluded at this stage using the same substantive criteria applied at screening: papers were removed where full-text reading showed that protection was incidental to the analysis, that a marine or coastal focus was in fact absent, or that the source was superseded by a more comprehensive treatment already retained in the corpus. An itemised disposition of these 147 papers, mapped against these criteria, is maintained in the review's search log and can be made available on request. This provided a total of 76 articles, which were supplemented by 24 additional articles using the snowball and grey literature techniques, leading to an overall sample of 100 articles. The classification of the papers followed a narrative approach using one coder only, whereby each paper was coded into its financing type as identified in Table 1. Articles bearing on more than one mechanism, for example a case study touching on both a sovereign debt instrument and an associated blue carbon component, were discussed under each relevant subsection of Section 4 but tabulated once, under their dominant focus, to avoid double-counting. Governance and equity considerations were coded thematically across the whole corpus, in Section 5, rather than treated as a separate category, since these considerations cut across all six financing mechanisms. It should be noted that the corpus is a curated rather than exhaustive sample, since the aim of the review is a critical mapping of the reasoning on MPA finance rather than an exhaustive census of it.

3. Conceptual Groundwork for Understanding Marine Protected Areas and Their Financing

The following subsection presents the theoretical framework for the current research, including the definition of the concept of MPA, as well as the framework for analysis that Sections 4 and 5 will use when considering each financing tool separately.

There are different definitions of 'marine protected area,' and the concept itself is controversial. There are three main viewpoints used in literature to describe MPA. According to Grorud-Colvert et al. (2021), the first perspective refers to MPA as a spatial category, while the other two refer to it either as the degree of protection or as a socio-ecological institution. The difference between these perspectives is based on the criterion by which MPA is determined – its territory or performance.

The spatial perspective is more common; in this view, an MPA is a geographical region of the ocean that has been designated for conservation purposes. It is in this perspective that metrics about the amount of global coverage toward the thirty-by-thirty target can be seen (Fox et al., 2020; Flanders et al., 2025). Other names for these regions include marine reserves, no-take zones and other effective area-based conservation measures (OECMs), depending on the level of protection offered.

The degree of protection view takes the opposite perspective by viewing the MPA designation as an indicator of protection levels in a continuous form rather than a categorical one. This means that the designation alone does not guarantee any conservation outcome, but the extent to which destructive actions have been curbed in the region matters (Horta e Costa et al., 2025; Pike et al., 2024). Ecological research shows that reserves provide the maximum biological payoff when they are effectively managed, older, larger, isolated and no-take, and that partial protection results in partial gains rather than complete benefits of an effectively managed no-take reserve (Edgar et al., 2014; Lester et al., 2009; Claudet et al., 2008; Halpern, 2003). The knowledge base here is quite robust although mostly observational and correlational: a major global study by Edgar et al. (2014), for example, which is based on a standardized survey of hundreds of sites and examines the covariates of success, does not prove causality – a point made consistently by most reviews of effectiveness and which recent reviews still emphasize (Dave, 2025). Inconsistencies in performance of protected areas have also been identified in freshwater ecosystems (Mellin et al., 2016), indicating that the gap between establishment and effectiveness is common to area-based conservation in general and not just marine conservation.

As a socio-ecological institution, "MPA" is a useful conceptual lens for the analysis of the interaction between social and ecological elements in the marine environment. This concept highlights the importance of such factors as governance, capacity, and equity in determining outcomes, and the unequal distribution of those (Gill et al., 2019; Ban et al., 2019). In relation to the focus on institutions, financing is also important, as the cost of creating a global MPA network is substantial, and sustainable financing is a necessary condition of success, which, in its turn, depends on management capacity, enforcement and community participation (Balmford et al., 2004; Sala et al., 2013). The recent research highlights MPA financing as a governance problem, not just a technical one, as the manner of obtaining money and its allocation affects both the success of the project and those who benefit from it (Bohorquez et al., 2022; Sumaila et al., 2021).

Based on these three approaches, this review develops an analytical framework drawing upon conservation-finance literature as well as blue economy discourse while incorporating political economy and decolonialism. The framework has four main dimensions, which will be employed in Sections 4 and 5 in analysing each of the financing schemes examined herein: (i) origin, indicating the source of funding, e.g. taxation, user charges, debt re-negotiation, carbon credits or grants; (ii) control, i.e. which party (a governmental agency, independent trust, conservation NGO or community institution) controls and allocates the funding; (iii) conditionality, indicating what policies or governance arrangements accompany the finance; and (iv) distribution, indicating the cost/benefit structure of the ensuing protection regime, including knowledge/authority relations. This consistent application of the framework involves applying the four dimensions equally to traditional public and market finance and the newer sovereign and carbon finance, not only in relation to innovative finance, since a well-known process like a conservation budget from the government can also be as effective at concentrating power, imposing conditions, and creating inequality in terms of benefit distribution as an innovative blue bond. Considering MPAs in terms of their geographical area is useful for goal setting, but does not help much in determining whether the biodiversity is conserved and whether the coastal communities benefit, as the effects of an MPA are

determined by the financing, governance, and power structures surrounding it (Di Cintio et al., 2023; Jones, 2024).

4. Mechanisms for Financing Marine Protected Areas

In literature on the finance of MPAs there are six clear types of financing instruments discussed, as well as a seventh, broader body of discourse within which they are all debated: public budgetary financing; market-based user-financing; development assistance and philanthropic grant funding; debt-for-nature swaps; blue bonds; blue carbon and climate finance; and blue economy discourse (Thur, 2010; Voyer et al., 2021; Reid-Grant and Bhat, 2009; Liu et al., 2024; de Mariz et al., 2023; Jankowska et al., 2022; Macreadie et al., 2022; Bennett et al., 2021b; Sumaila et al., 2021). Notably, unlike the other six, the blue economy is not itself a distinct financing instrument; rather it is a broader policy and investment discourse covering multiple sectors of the ocean economy, within which there are arguments for multiple of the instruments listed above (Section 4.7 distinguishes between these two concepts). A final, cross-cutting dimension that influences how all these financing options are used is governance and management effectiveness, which determines whether finance from any of these six options will turn out to be real protection or only a "paper park" (Section 4.8).

The key characteristic of the research domain, as far as MPA managers are concerned, lies in the constant mismatch between the cost of effective protection and the available funding (Gill et al., 2017; Balmford et al., 2004). The majority of these studies rely on the empirical case experience of small island developing states and Global South countries that suffer the most from the problem of funding deficit and where various instruments have been tried, such as in the Seychelles, Belize, Jamaica and in the Pacific island nations (Liu et al., 2024; Desai, 2023; Reid-Grant and Bhat, 2009; Keen et al., 2018), and there are even some global-level studies on the financing issue in general (Bohorquez et al., 2022; Balmford et al., 2004). The table below provides for the typology of the research area and the criterion used for the classification. Table 2 contains a comparison of the six discrete financing instruments by scale, revenue source, maturity and liquidity, control of disbursement, impact, and equity considerations; both blue economy and governance dimensions are not included in Table 2 as they do not constitute the discrete financing instruments. Every financial magnitude reported below is referenced to its primary source; numbers are approximate

Criterion for classification: Categories 1–6 are distinguished on the basis of the main source of funding (taxes/public budgets, user fees, concessionary funding and grants, sovereign debt restructuring, capital market bonds, and carbon market payments respectively). Category 7 (the blue economy) is an approach to financing, not a particular instrument, but it is classified in this way since a significant proportion of the corpus deals with financing mechanisms within this approach, and hence it must be analytically differentiated from category 6 (blue carbon), which is a specific financing instrument in the carbon markets. Category 8 (governance, effectiveness and ‘paper parks’) is not a financing mechanism, but the cross-cutting issue that determines whether any of the above is actually translated into conservation, and is thus retained in the typology, but not in Table 2.

Table 1
Typology of the MPA-finance literature, with analytical dimensions.

Category	Representative literature	Typical scale / instrument (source)	Evidence strength	Key equity concern
1. Public budgetary finance	Balmford 2004; Bohorquez 2022; Sumaila 2021	Global network ~ US$5–19 bn/yr (Balmford 2004)	Established but partly dated	Chronic underfunding constrains enforcement and community benefit-sharing alike
2. Market-based user finance (user fees, business models)	Thur 2010; Sala 2013; Reid-Grant & Bhat 2009; Walsh 2021	Recurrent costs via diver fees at Bonaire (Thur 2010)	Case-based; concentrated in well-visited sites	Fees can exclude local/subsistence users; evidence is skewed toward tourism fees, with little coverage of fisheries-sector user fees in the corpus
3. Official development assistance and philanthropic grants	Voyer 2021; OECD 2025; Reid-Grant & Bhat 2009	ODA flows to Pacific ocean sectors, unevenly targeted (Voyer 2021)	Descriptive; few outcome evaluations	Donor priorities may not match recipient needs; the scale and terms of philanthropic funding specifically are not examined in depth in the reviewed corpus
4. Debt-for-nature swaps	Essers 2021; Liu 2024; Cassimon 2025; Muench 2025; Koester 2024; Desai 2023	Seychelles debt restructuring, 2016; Belize debt restructuring, 2021 (Liu 2024)	Case-based; few empirical outcome studies	Conditionality; external influence over national policy
5. Blue bonds	de Mariz 2023; Fontana-Raina & Grund 2024; Gallagher 2023	Cumulative issuance in the single-digit billions of US dollars (de Mariz 2023)	Emerging; only two sovereign issuances to date	Proceeds only partly earmarked for MPA management; standards contested

Category	Representative literature	Typical scale / instrument (source)	Evidence strength	Key equity concern
6. Blue carbon and climate finance	Jankowska 2022; Herr 2022; Thomas 2022; Palacios-Abrantes 2024; Lovelock & Duarte 2019; Macreadie 2022; Wang 2025; Friess 2022; Duarte 2020	Voluntary carbon markets; thin and volatile (Macreadie 2022)	Emerging; accounting contested	Benefit distribution; permanence; unclear allocation of revenue to MPA management
7. Blue economy and ocean-investment discourse (framework, not a discrete instrument)	Ebarvia 2016; Patil 2016; Keen 2018; Silver 2015; Voyer 2018; Barbier 2017; Bennett 2021b; Spalding 2017; Hoegh-Guldberg 2019	Reef tourism ~ US$36 bn/yr, illustrative of the discourse's scale claims (Spalding 2017)	Valuation strong; contested discourse	Growth framing may override coastal peoples' interests
8. Governance, effectiveness and 'paper parks' (cross-cutting condition, not a financing mechanism)	Mast 2025; Jones 2024; Di Cintio 2023; Gill 2017; Relano & Pauly 2023; Edgar 2014; Lester 2009; Zupan 2018; Bergseth 2023	Not an instrument; conditions for delivery	Largely associational/cross-sectional	Capacity and voice unevenly distributed

Source: compiled by the author. Each financial magnitude is attributed to its primary source; values are approximate and of the vintage of the cited study.

Table 2
Comparison of principal MPA-financing instruments.

Instrument	Typical scale and primary revenue origin (source)	Maturity / liquidity	Typical control of disbursement	Documented conservation outcome (source)	Key equity concern
Public budgets	Global need ~ US$5–19 bn/yr; funded from general taxation (Balmford 2004)	Mature: long-established in most jurisdictions; illiquid in the sense that budget allocations cannot readily be resold or transferred	Public authority (national or sub-national government)	Baseline funding for most MPAs (Bohorquez 2022)	Chronically insufficient; access restrictions may still burden local users
Market-based user finance	Bonaire diver fees cover recurrent costs (Thur 2010)	Mature at well-visited sites; illiquid and highly site-specific, since revenue depends on local visitor volumes rather than a tradable instrument	Typically the site-level managing authority	Viable at high-visitation sites; generalises poorly elsewhere	Access fees may burden local/subsistence users; fisheries-sector user fees remain largely unexamined in the corpus
Official development assistance and philanthropic grants	ODA flows to Pacific ocean sectors, described as uneven and sometimes ill-targeted (Voyer 2021)	Established as a funding channel, but individual grants are typically short-term and non-recurring	Recipient government agencies or NGO implementing partners, per grant terms	Descriptive evidence of flows; few systematic outcome evaluations	Donor priorities may not align with recipient needs or community priorities

Instrument	Typical scale and primary revenue origin (source)	Maturity / liquidity	Typical control of disbursement	Documented conservation outcome (source)	Key equity concern
Debt-for-nature swaps	Seychelles (2016) and Belize (2021) debt restructurings (Liu 2024; Fontana-Raina & Grund 2024)	Growing but small in number; illiquid, as each transaction is a bespoke, one-off restructuring rather than a tradable security (de Mariz 2023)	Typically an independent conservation trust fund or endowment created by the transaction, rather than the general government budget	Associated with expanded MPA commitments in both cases, though neither transaction was designed primarily to finance MPAs, and attribution of the conservation outcome to the swap itself is not established (Liu 2024)	Sovereign conditionality; external influence over policy; uncertain citizen benefit (Desai 2023)
Blue bonds	Cumulative issuance in the single-digit billions of US dollars, a minor share of the much larger green-bond market (de Mariz 2023)	Nascent: only Seychelles and Indonesia have issued a sovereign bond carrying the 'blue' label to date; tradable in principle but thinly traded in practice	The issuing sovereign, subject to use-of-proceeds reporting frameworks	Proceeds only partly directed to MPA management costs in either case (de Mariz 2023)	Standards and labelling practices contested
Blue carbon / climate finance	Low; project-scale carbon credits (Macreadie 2022)	Nascent; volatile prices	Variable: a mix of government agencies, conservation organisations and, where ecosystems fall under customary tenure, community or Indigenous landholders	Mainly prospective; pilot restoration (Wang 2025)	Revenue-sharing and permanence unresolved; unclear whether governments would allocate such revenue to MPA management rather than competing priorities

Source: compiled by the author.

Maturity denotes how long an instrument has been used in MPA finance and how many documented transactions exist; liquidity denotes how readily the underlying financial claim can be transferred or converted to cash. The blue economy discourse and the governance/effectiveness dimension are not discrete financing instruments and are therefore not included in this table; see Table 1 and Sections 4.7–4.8.

4.1 Public budgetary finance

The traditional foundation of MPA finance is the public budget, funded from general taxation and allocated through national or sub-national government processes. A comprehensive review of finance sources and instruments shows that most MPAs rely on a narrow and unstable and describes assessment, improvement and sustainability tools for such finances (Bohorquez et al., 2022). Sustainable marine conservation finance itself is an emerging area of research, with its unique needs and scope of application (Bos et al., 2015). Such topic evolved out of global reviews of the issues of sustainably financing of protected areas (Emerton et al., 2006). The estimates from the early global studies still remain relevant in terms of the scale of required investment: managing a representative network covering twenty to thirty percent of the world's seas was estimated at five to nineteen billion US dollars annually while creating up to one million of jobs, but real spending was much lower (Balmford et al., 2004). These estimates are now outdated by two decades and are certainly underestimated compared to the current expenses; however, more recent summaries of researches discuss this issue in terms of the total sustainable ocean economy finance gap (Sumaila et al., 2021). A systematic, instrument-by-instrument accounting of funding needs against actual disbursed flows, including the share of spending directed to surveillance and enforcement specifically, would require primary financial data beyond what a literature-based narrative synthesis can assemble; this is noted as a limitation in Section 7 and as a priority for dedicated follow-up research in Section 6.

4.2 Market-based user finance

Business-model thinking has been applied to marine reserves to place them on a self-sustaining footing (Sala et al., 2013), and user fees have provided a viable revenue stream in well-visited settings such as the Bonaire National Marine Park, where diver fees have covered a substantial share of recurrent management costs (Thur, 2010) - though this is a single, unusually favourable site that generalises poorly to remote or lightly visited areas. The reviewed corpus is weighted almost entirely toward tourism-based user fees; evidence on user fees levied on commercial sectors, such as fisheries, is largely absent from the literature retrieved for this review, and this asymmetry is noted here as a gap rather than a finding that fisheries-sector fees are unimportant.

4.3 Official development assistance and philanthropic grants

In the Global South, financing is both more constrained and more dependent on external sources. An exploratory study of Jamaica illustrates the difficulty of raising sustainable domestic revenue (Reid-Grant and Bhat, 2009), while analyses of official development assistance to Pacific ocean sectors reveal how uneven and sometimes ill-targeted such flows can be (Voyer et al., 2021). Offshore and high-seas MPAs present distinctive additional challenges given their remoteness and scale (Walsh et al., 2021). Guidance from multilateral organisations has focused on directing development cooperation toward a sustainable ocean economy and on overcoming the financing challenges facing protection efforts (OECD, 2025; Schultz et al., 2022). Philanthropic foundations and international conservation organisations are widely understood to be significant funders of MPA establishment in the Global South, including by underwriting the sovereign debt-conservation transactions discussed in Section 4.4, yet the reviewed corpus contains little dedicated empirical analysis of the scale, terms or accountability of philanthropic funding in its own right; this gap is carried forward as a research priority in Section 6. The common thread in all of this is the vulnerability of traditional financing.

4.4 Debt-for-nature swaps

A distinct and rapidly growing strand of the literature concerns sovereign instruments that link debt relief to marine conservation commitments. A debt-for-nature (or debt-for-climate) swap restructures a portion of a country's existing sovereign debt, typically brokered with a conservation organisation or multilateral guarantor, in exchange for conservation commitments; this is a mechanistically distinct transaction from a blue bond, which raises new funds by issuing a capital-market debt security to investors (Section 4.5 discusses this distinction further). Swaps have been promoted as 'killing two birds with one stone' (Essers et al., 2021; Muench et al., 2025).

The evidence base is dominated by two cases. In the Seychelles (2016), approximately US$22 million of sovereign debt was restructured, with a commitment attached to protect about thirty per cent of the country's exclusive economic zone, some 410,000 square kilometres, by 2020 (Liu et al., 2024). In Belize (2021), roughly US$553 million of external commercial debt was refinanced at a discount, committing about US$4.2 million per year to marine conservation and capitalising an endowment of around US$23.4 million, alongside a government commitment to expand ocean protection to thirty per cent by 2030 (Fontana-Raina and Grund, 2024; Liu et al., 2024). It should be noted that marine conservation was a condition attached to a broader sovereign debt restructuring in both cases, rather than the transaction's sole purpose, and that Belize had already designated a substantial share of its waters as protected before the 2021 agreement; the swap is therefore better understood as reinforcing and extending an existing commitment than as the origin of Belize's MPA coverage. These remain the most frequently cited examples of a sovereign debt instrument being linked to a national-scale marine conservation commitment, although neither case offers conclusive evidence of a positive conservation outcome attributable to the instrument itself, and the literature's own framing of these cases has been criticised on this point (see below).

The literature is, however, increasingly critical as well as descriptive, and the balance of evidence is mixed. Reviews call for a move from exploratory to empirical research on the actual conservation and fiscal

outcomes of these instruments (Cassimon et al., 2025), and global analyses point to substantial missed opportunities in their uptake (Koester et al., 2024). Critical accounts of the Belize transaction caution that such deals can entrench external control over national policy and deliver uncertain benefits to citizens, framing the phenomenon as countries 'drowning in debt' rather than being liberated from it (Desai, 2023). The issue of reforming multilateral institutions and creating conditions conducive to a sustainable blue economy has also been raised (Gallagher et al., 2023; Cisneros-Montemayor et al., 2021).

4.5 Blue bonds

A blue bond is a debt capital market instrument that is issued to mobilize investments for ocean-related initiatives from investors; it is different from debt-for-nature swaps because it does not involve restructuring of sovereign debts but new capital is raised. Thus far, the only countries issuing a sovereign blue bond are Seychelles and Indonesia; however, none of the bonds had all its proceeds directed towards the management of MPAs. All in all, the concept of blue bonds as portrayed in the literature is one that facilitates financing of the ocean, although total issuance of such bonds stands at single-digit billions of US dollars, which is insignificant relative to the size of the larger green bonds market.

4.6 Blue carbon and climate finance

Another link between MPA financing and climate change concerns blue carbon, which is carbon held in marine and coastal habitats such as mangroves, seagrasses, and salt marshes. The blue carbon approach in creating MPAs can create dual benefits in terms of climate change and biodiversity protection (Jankowska et al., 2022), while blue carbon itself can be seen as a coastal climate solution, allowing climate finance to be directed towards conservation (Herr et al., 2022). In particular, for small island developing countries, blue carbon can become a tool of valuation of coastal habitats in climate change strategies and post-pandemic recovery plans, as demonstrated in the case of the Seychelles (Thomas, 2022; Palacios-Abrantes et al., 2024). It is the scientific literature and the market discourse that determines the boundaries of the given opportunity and warns against exaggeration. Review studies determine the type of ecosystems that may be considered blue carbon ecosystems and under what conditions (Lovelock and Duarte, 2019; Queiros et al., 2019), and evaluations of blue carbon as a nature-based climate solution note the importance of credible accounting in case of carbon market funding (Macreadie et al., 2022). Conceptual frameworks developed aim at demonstrating how blue carbon financing can support conservation and restoration of these ecosystems (Wang et al., 2025), and there is a suggestion to use global interest in blue carbon finance in order to restore marine ecosystems (Friess et al., 2022; Duarte et al., 2020). Even so, the value of blue carbon to MPA budgets remains largely prospective rather than realised: severe problems in credit design and in developing a market willing to pay for them mean that the market remains thin and prices volatile, and there is no settled answer to how revenue from blue carbon credits would be captured and managed at the national level, nor to whether governments would allocate such revenue to MPA management rather than competing fiscal priorities.

4.7 Blue economy and ocean-investment discourse

The 'blue economy' is not itself a financing instrument in the sense that the preceding five mechanisms are; it is a policy and investment discourse that frames the ocean, across sectors including tourism,

fisheries, shipping and energy, as a source of sustainable growth, and within which arguments for investing in several of the instruments above are made. This is the distinction between the blue economy and blue carbon: blue carbon is a specific financing mechanism with a defined revenue channel, namely the sale of carbon credits tied to a measurable ecosystem service, whereas the blue economy is a broader framing of ocean-based growth that does not itself specify a revenue mechanism. Economic assessments value the ocean's contribution to sustainable development and identify revenue streams, from tourism to ecosystem services, on which protection might draw (Ebarvia, 2016; Barbier, 2017). The global value of coral reef tourism, estimated at around US$36 billion per year, illustrates the scale such assessments attribute to the discourse and offers a potential basis for financing reef protection (Spalding et al., 2017), while the ocean is increasingly framed as a solution to climate change that can attract investment (Hoegh-Guldberg et al., 2019). Regional studies, such as those of the Caribbean, explore how a blue economy might underwrite conservation and growth simultaneously (Patil et al., 2016).

It must be stated, however, that this discourse of the blue economy is an area of dispute where the meanings that it holds have completely different ramifications for governance and equity (Silver et al., 2015; Voyer et al., 2018). Critiques from the Pacific Region argue that the blue economy paradigm can bring 'more ocean, more problems' when the growth perspective overshadows the interests of the coastal communities (Keen et al., 2018). This resulted in a strong push for a sustainable and equitable blue economy in which financial tools would be assessed not just by the amount of money raised but by the degree of distribution of the benefits and costs (Bennett et al., 2021b; Cisneros-Montemayor et al., 2021). Thus, the financing of MPAs cannot be separated from the political dimension of the blue economy itself.

4.8 Governance, effectiveness and the 'paper parks' problem

Efficiency of governance and management are not a means of financing but rather the cross-cutting factor that will determine how finance from one of the six mechanisms listed above will be used for genuine conservation, or will become just "paper parks" – the designation without any protective effect. It has been shown that the problem is not the designation itself but the lack of capacity that limits the efficiency of MPAs (Gill et al., 2017; Di Cintio et al., 2023). An international study reveals that much of the designated area is insufficiently protected (Relano and Pauly, 2023), as protection lags behind designation when countries are striving to achieve their thirty by thirty goals (Pike et al., 2024).

Designing governance is therefore fundamental to the discussion about the financing of marine protected areas. Governance that is shared is more often associated with the effectiveness of MPAs (Mast et al., 2025). According to Jones (2024), diversity of incentives, economic, social, and interpretive incentives is essential for achieving effective and efficient governance. The ecological science points to what makes protection successful (Edgar et al., 2014; Lester et al., 2009; Claudet et al., 2008), and the results of behavioural sciences highlight the significance of reducing compliance gap (Bergseth et al., 2023). The conclusion is obvious – financing that neglects governance and behavioural aspects may lead to financing designation without financing protection. The connection between financing and effectiveness is not automatic but is mediated by the institutions of financing, allocation and accountability.

5. Responding to the Equity Challenge: Justice, Community Governance and the 30x30 Target

The following subsection will discuss the distribution of both the advantages and disadvantages of ocean protection and financing in a way that would make it more equitable. There are many entities involved, such as local coastal communities, indigenous groups, small-scale fisheries, conservation organizations, national governments, and multilateral organizations, and these actors' efforts can complement each other. Ocean protection's governance is rather complicated and increasingly focuses on equity and justice. The body of literature concerned with making equity a key feature of ocean governance and promoting social equity in marine conservation is becoming quite rich (Bennett, 2022; Bennett et al., 2021a; Bennett et al., 2025). This scholarship identifies distributional, procedural and recognitional aspects of equity, within broader perspectives on human well-being in social-ecological research (Sterling et al., 2017), and highlights the ways in which MPAs may produce both favorable and unfavorable impacts on well-being, contingent on their design and governance (Ban et al., 2019; Gill et al., 2019). Literature on ‘blue justice’ conceptualizes the distribution of gains and losses in the blue economy as a problem of justice, not efficiency alone (Jentoft et al., 2022).

On a community and Indigenous people scale, the literature shows that the locally-managed and community-based approach can achieve both conservation and equity, much like the ongoing discussion on the community-based natural resource management (Dressler et al., 2010). In the case of empirical proof for the locally-managed marine areas in the Pacific, it is based on the achievement of multiple outcomes through varied strategies (Jupiter et al., 2014), and at the same time, there is research on the expansion and sustainability of such areas through the means of governance and networks (Govan et al., 2018). The literature with regards to communities and indigenous populations is concerned with the ability of locally managed and community-based approaches to achieve conservation and equity. This is tied in with the debate around community-based natural resource management (Dressler et al., 2010). The empirical justification of locally managed marine areas in the Pacific lies in the fact that they try to pursue various goals through different approaches (Jupiter et al., 2014). There has also been research done in scaling and sustaining locally managed marine areas through governance and network support (Govan et al., 2018). There have also been efforts made in the recognition of other area-based conservation measures through local community stewardship (Corrigan and Hay-Edie, 2013).

In critical and decolonial literature, these issues take their place within a much longer history of conservation injustice. Researchers have examined how conservation efforts have perpetuated racially discriminatory and neo-colonial attitudes, from the exclusion of local knowledge and impoverishment of rural poor people (Kashwan et al., 2021; Brockington and Igoe, 2006; Benjaminsen and Bryceson, 2012; Springer et al., 2023) to the point when recognition of justice should be based on the identity and epistemology of those affected. Studies of conservation outcomes in protected areas indicate that success is achieved when local communities benefit from protection and participate in management of the territories (Oldekop et al., 2016), whereas some more radical critiques have challenged the growth-based and 'half-Earth' perspectives of conservation altogether, pointing out that protection of half the

Earth would involve over one billion people (Buscher et al., 2017; Schleicher et al., 2019; Ertor and Hadjimichael, 2020). All of these points have direct implications for both the 30x30 goal and its financing. The MPA Guide, together with related approaches, offers a way to determine if any claimed protection is indeed real and just or simply notional (Grorud-Colvert et al., 2021; Fox et al., 2020). National reports of contributions show huge variability and often exaggerate the progress (Flanders et al., 2025). There is a danger of abusing OECM in the marine sector (Claudet et al., 2022). Conservation of extensive areas of the ocean could help reach multiple goals including biodiversity conservation, food security, and climate change (Sala et al., 2021); yet doing that in an ecologically representative and locally meaningful way needs special effort and financing (Zhao and Costello, 2025; Costello et al., 2010). Implementation of the Kunming-Montreal Global Biodiversity Framework involves much more than closing the coverage gap only (Li et al., 2023; Secretariat of the CBD, 2022; Teh et al., 2023).

There are shortcomings to these efforts, however. While equity is much more often referenced than put into practice in the reviewed corpus, there are gaps in knowledge concerning the distributional impact of new financial instruments, like debt-for-nature swaps and blue bonds (Cassimon et al., 2025; Desai, 2023). This is a significant absence in the finance-mechanisms literature (see Section 4), which is important in light of the fact that it does not correspond to an absence of knowledge in the broader literature on social dimensions: the role of women in small-scale fisheries, invisible as it may be, is well-documented elsewhere (Harper et al., 2020). It is for this reason that the gendered analysis of financing for MPAs is identified as an area of critical need for future research (see Section 6), since gendered information has not found its way into the finance literature discussed in Section 4. Coastal communities that stand to be most affected by marine protected areas are, at the same time, the ones with least capacity to participate in their planning (Lau et al., 2021; Sowman and Sunde, 2018).

6. Assessment of the Literature, Research Gaps and Way Forward

The literature on MPA finance has tended to concentrate on financing mechanisms and on high-profile cases, such as the Seychelles and Belize, in which innovative sovereign instruments have been deployed. This review's contribution, set out in Section 1 and developed through the classification in Section 4 and the equity analysis in Section 5, is to integrate three bodies of work that are usually reviewed separately: comprehensive finance-instrument reviews (Bohorquez et al., 2022), the 'paper parks' effectiveness literature (Di Cintio et al., 2023; Dave, 2025), and blue-economy scholarship (Bennett et al., 2021b), by reading all of them through the four-dimension equity, recognition and decolonial framework set out in Section 3, applied evenly to established and innovative instruments alike. What is comparatively under-developed, across the reviewed corpus, is systematic attention to community-based finance, to the routine funding of the many small MPAs that make up most of the global estate, and to the distributional consequences of financing.

The literature describes how the expansion of ocean protection has outrun the finance and capacity needed to make it real, producing pockets of well-funded, effective protection amid a much larger expanse of underfunded 'paper parks'. In other situations, there have been outright clashes between local communities and fishers on one hand and conservationists on the other hand; while in still others,

communities have reacted by becoming stewards, co-managing their territories and asserting their rights (Mast et al., 2025; Govan et al., 2018). Equitable and sustainable finance remains a topic with much potential but scant knowledge base for now, while the issue of what systems combine effectiveness and equity versus those that lead to dependency and injustice is even more understudied (Desai, 2023; Jentoft et al., 2022).

On the basis of gaps that were noted in the introduction, there is a prioritized research agenda for future research that emerges. First, research should relate financing mechanisms to the actual outcome of protection, shifting from studying the gaps in financing to assessing what kinds of mechanisms actually lead to sustainable and legitimate conservation, requiring an assessment of the funding requirements and disbursements on a case-by-case basis, which is impossible for the current review based purely on literature. Second, research should focus on the under-studied regular financing of small-scale and community-managed MPAs, where most of the unreported costs and potentials of marine conservation lie, and on the scale and accountability of philanthropic funding in particular, which the current reviewed corpus of literature barely touches upon. Third, it should examine the distributional consequences of blue bonds and blue carbon, user fees levied on commercial sectors such as fisheries, and the coexistence of contradictory financing logics, philanthropic, market-based, sovereign and community-based, for accountability and equity, and should assess emerging instruments such as conservation outcome bonds and parametric insurance mechanisms, which fall outside the search strategy adopted here. Fourth, it should investigate the gendered and Indigenous dimensions of MPA finance specifically and their intersection with class and geography (Harper et al., 2020; Vierros et al., 2020), building on evidence of these dimensions in the wider social-impacts literature that has not yet been carried into the finance literature (Section 5), and ask under what conditions external finance strengthens rather than displaces local stewardship. Fifth, it should make fuller use of participatory and community-led research methods, which remain underexploited in MPA-finance contexts.

The broader ocean science and biodiversity research literature provides deeper insight into the stakes involved in getting conservation right, whether the biological gains of good marine reserve design or the potential of such protected areas as a means of mitigating and adapting to climate change (Edgar et al., 2014; Roberts et al., 2017; Costello and Connor, 2019). These impacts, however, will be channeled through social and power relations, and the diversity of the MPAs and the societies in which they occur warns against any one-size-fits-all approach to financing or governance; a range of approaches would serve conservation and equity alike (Gill et al., 2024). It is research informed by the particularities of the Global South, through an equity, recognition and decolonial justice perspective, that will provide the nuance required.

7. Limitations of This Review

First, being a narrative review of selected literature instead of a systematic review, the corpus is subjective to the opinions of the authors and is not a complete enumeration of the literature available; publication and language biases could have occurred due to the fact that the search was limited to English literature and to high-visibility sources. Second, although the review is a synthesis of the findings from primary

literature, it acknowledges the fact that there is a predominance of observational and cross-sectional literature concerning the effectiveness and governance issues but does not carry out an assessment of the quality of each of the included studies. Third, the numerical figures cited are rough estimates, come from different sources, are based on varying accounting methods, and in the case of the global costs estimate, are now outdated.. Fourth, this review does not carry out a systematic, instrument-by-instrument analysis of finance needs compared to disbursement flows and expenditures by function, like surveillance and enforcement; a financial analysis of this kind cannot be performed without primary financial information, which is beyond the scope of this literature-based narrative review, although it is highlighted as one of the key areas of follow-up research in Section 6. Fifth, the search method used in this review (described in Section 2) does not include some new instruments, such as conservation outcome bonds and parametric insurance instruments for reef and coastal protection; their exclusion from the analysis is not connected with a conclusion about their irrelevance but is related to the limited nature of the search itself, and they are identified as an area of focus for future reviews in Section 6. These weaknesses do not weaken the validity of the results but certainly do not refute the core argument.

8. Conclusion

This review set out to answer three questions about the financing of marine protected areas. On how the issue has been addressed in the literature, and from what theoretical perspectives, it finds that MPA financing has mostly been analysed instrument by instrument, with equity and decolonial critique concentrated on the newest sovereign and carbon instruments rather than applied evenly across the field; this review's response has been to apply a single four-dimension framework, origin, control, conditionality and distribution, evenly across six financing mechanisms, from public budgets to blue carbon. Concerning the financing instruments described in the academic literature, as well as how well their effectiveness and distribution effects have been studied, the review identifies a well-researched evidence base concerning conventional public and private finance but a less-well-evidenced one with regard to debt-for-nature swaps, blue bonds, and blue carbon, and it identifies the crucial role that effective governance and management play in converting finance into actual conservation. Concerning research gaps and future priorities, the review identifies the tendency for equity issues to be mentioned rather than analyzed in the literature reviewed, and identifies five priority areas: relating instrument design to outcomes; routine finance for small-scale and community-managed MPAs; distributional effects of blue bonds, blue carbon, and commercial user fees; gender and Indigenous perspectives on finance; and participatory methodologies.

The key contribution made by this review is this process of bringing these different types of funding together into one conceptual framework and proving that the increase in MPA coverage due to the thirty-by-thirty initiative still exceeds the capacity to fund and govern these areas properly. Several of the questions this review raises, particularly the scale of actual financial flows relative to need, the role of philanthropic funding, and the place of emerging instruments such as conservation outcome bonds, cannot be answered from the literature-based corpus assembled here and are left as an explicit agenda for future research.

Declarations

Author contribution statement

The author confirms full responsibility for the conception, design, literature review, analysis, interpretation, drafting, revision and final approval of the manuscript.

Conflict of interest

The author declares no conflict of interest.

Funding

This research received no external funding.

Ethical approval

This study is based on secondary/published literature and does not involve human participants, animals, clinical data or primary data collection; therefore, ethical approval was not required.

Author Contribution

R.K. conducted the study, analysed the data, and drafted the manuscript. S.N. supervised and validated the research. Both authors reviewed and approved the final manuscript.

Acknowledgements

The author would like to acknowledge the comments and feedback received during the development of this manuscript, and the researchers, institutions and communities whose work forms the basis of this review.

Data availability statement

No new datasets were generated or analysed during this study. All sources used are cited in the manuscript.

References

1. Agardy et al (2011) Mind the gap: Addressing the shortcomings of marine protected areas through large scale marine spatial planning. Mar Policy. https://doi.org/10.1016/j.marpol.2010.10.006
2. Balmford et al (2004) The worldwide costs of marine protected areas. https://doi.org/10.1073/pnas.0403239101. PNAS

3. Ban et al (2019) Well-being outcomes of marine protected areas. Nat Sustain. https://doi.org/10.1038/s41893-019-0306-2
4. Barbier (2017) Marine ecosystem services. Curr Biol. https://doi.org/10.1016/j.cub.2017.03.020
5. Benjaminsen & Bryceson (2012) Wildlife management, protected areas, and the poor in sub-Saharan Africa. Geoforum. https://doi.org/10.1016/j.geoforum.2012.01.004
6. Bennett et al (2021a) Advancing Social Equity in and Through Marine Conservation. Front Mar Sci. https://doi.org/10.3389/fmars.2021.711538
7. Bennett et al (2021b) Towards a sustainable and equitable blue economy. Nat Sustain. https://doi.org/10.1038/s41893-020-00639-2
8. Bennett (2022) Mainstreaming Equity and Justice in the Ocean. Front Mar Sci. https://doi.org/10.3389/fmars.2022.873572
9. Bennett et al (2025) Ocean equity: from assessment to action to improve social equity in ocean governance. Front Mar Sci. https://doi.org/10.3389/fmars.2025.1473382
10. Bergseth et al (2023) Closing the compliance gap in marine protected areas with human behavioural sciences. Fish Fish. https://doi.org/10.1111/faf.12740
11. Blythe et al (2021) Strengthening the social equity dimensions of small-scale fisheries governance in Southeast Asia. Fish and Fisheries. https://doi.org/10.1111/faf.12616
12. Bohorquez et al (2022) A New Tool to Evaluate, Improve, and Sustain Marine Protected Area Financing. Front Mar Sci. https://doi.org/10.3389/fmars.2021.742846
13. Bos et al (2015) Marine conservation finance: The need for and scope of an emerging field. Ocean Coastal Manage. https://doi.org/10.1016/j.ocecoaman.2015.05.001
14. Brockington & Igoe (2006) Eviction for conservation: A global overview. Conserv Soc. https://doi.org/10.4103/0972-4923.201640
15. Buscher et al (2017) Half-Earth or Whole Earth? Radical ideas for conservation, and their implications. https://doi.org/10.1017/S0030605316001228. Oryx
16. Cassimon et al (2025) Current perspectives on debt-for-nature swaps: moving from exploratory to empirical research. Curr Opin Environ Sustain. https://doi.org/10.1016/j.cosust.2025.101490
17. Cinner et al (2020) Meeting fisheries, ecosystem function, and biodiversity goals in a human-dominated world. Science. https://doi.org/10.1126/science.aax9412
18. Cisneros-Montemayor et al (2021) Enabling conditions for an equitable and sustainable blue economy. Nature. https://doi.org/10.1038/s41586-021-03404-7
19. Claudet et al (2008) Marine reserves: Size and age do matter. Ecol Lett. https://doi.org/10.1111/j.1461-0248.2008.01166.x
20. Claudet et al (2022) Avoiding the misuse of other effective area-based conservation measures in the wake of the blue economy. One Earth. https://doi.org/10.1016/j.oneear.2022.09.007
21. Cohen et al (2019) Why is small-scale fisheries governance so difficult? Fish Fish. https://doi.org/10.1111/faf.12416

22. Corrigan & Hay-Edie (2013) COMPACT: Supporting custodians of natural and cultural heritage to seek OECM status. IUCN/UNEP. [Grey Literature]
23. Costello et al (2010) The potential for systematic conservation planning to yield large dividends for marine biodiversity. PLoS ONE. https://doi.org/10.1371/journal.pone.0010909
24. Costello & Connor (2019) Marine protected areas would have a large impact on marine biodiversity. Nat Ecol Evol. https://doi.org/10.1038/s41559-019-1013-3
25. Dave (2025) Marine Protected Areas: A Literature Review of Their Conservation Effectiveness. https://doi.org/10.53623/sein.v2i2.778. Sustainable Environmental Insight
26. de Mariz et al (2023) The blue bond market: A catalyst for ocean and water financing. J Risk Financial Manage. https://doi.org/10.3390/jrfm16030184
27. Desai (2023) Drowning in Debt: Understanding Debt-for-Climate Swaps Through a Case Study of the Belize Blue Bond. J Environ Dev. https://doi.org/10.1177/10704965221134820
28. Di Cintio et al (2023) Avoiding 'Paper Parks': A global literature review on socioeconomic factors underpinning the effectiveness of marine protected areas. https://doi.org/10.3390/su15054464. Sustainability
29. Dressler et al (2010) From hope to crisis and back again? A critical history of the global CBNRM narrative. Environ Conserv. https://doi.org/10.1017/S0376892910000044
30. Duarte et al (2020) Rebuilding marine life. Nature. https://doi.org/10.1038/s41586-020-2146-7
31. Ebarvia (2016) Economic assessment of oceans for sustainable blue economy development. J Ocean Coastal Econ. https://doi.org/10.15351/2373-8456.1053
32. Edgar et al (2014) Global conservation outcomes depend on marine protected areas with five key features. Nature. https://doi.org/10.1038/nature13022
33. Emerton et al (2006) Sustainable Financing of Protected Areas: A global review of challenges and options. IUCN, Gland. [Grey Literature]
34. Ertor & Hadjimichael (2020) Blue degrowth and the politics of the sea: rethinking the blue economy. Sustain Sci. https://doi.org/10.1007/s11625-020-00772-x
35. Essers et al (2021) Debt-for-climate swaps: killing two birds with one stone? https://doi.org/10.1016/j.gloenvcha.2021.102407. Global Environmental Change
36. Flanders et al (2025) Achieving 30x30: How different nations report their contributions to international marine conservation targets. https://doi.org/10.1038/s44183-025-00177-8. npj Ocean Sustainability
37. Grund (2024) Debt-for-nature swaps: the Belize 2021 deal and the future of green sovereign finance. Capital Markets Law J. https://doi.org/10.1093/cmlj/kmad024
38. Fox et al (2020) Reframing how the world measures ocean protection. One Earth. https://doi.org/10.1016/j.oneear.2020.11.001
39. Friess et al (2022) Capitalising on the global financial interest of blue carbon. One Earth. https://doi.org/10.1016/j.oneear.2022.04.005
40. Gallagher et al (2023) Reforming Bretton Woods institutions to achieve climate change and development goals. One Earth. https://doi.org/10.1016/j.oneear.2023.09.009

41. Gill et al (2017) Capacity shortfalls hinder the performance of marine protected areas globally. Nature. https://doi.org/10.1038/nature21708
42. Gill et al (2019) Social synergies, tradeoffs, and equity in marine conservation impacts. Annu Rev Environ Resour. https://doi.org/10.1146/annurev-environ-110718-130032
43. Gill et al (2024) A diverse portfolio of marine protected areas can better advance global conservation and equity. https://doi.org/10.1073/pnas.2313205121. PNAS
44. Govan et al (2018) Locally managed marine areas: Multiple objectives and diverse strategies. https://doi.org/10.1007/s13280-018-1070-3. Ambio
45. Grorud-Colvert et al (2021) The MPA Guide: A framework to achieve global goals for the ocean. Science. https://doi.org/10.1126/science.abf0861
46. Halpern (2003) The impact of marine reserves: Do reserves work and does reserve size matter? Ecological Applications. https://doi.org/10.1890/1051-0761(2003)013[0117:TIOMRD]2.0.CO;2
47. Harper et al (2020) Valuing invisible catches: Estimating the global contribution by women to small-scale marine capture fisheries. PLoS ONE. https://doi.org/10.1371/journal.pone.0228912
48. Herr et al (2022) Blue carbon: A framework for coastal climate action. Conserv Lett. https://doi.org/10.1111/conl.12832
49. Hoegh-Guldberg et al (2019) The Ocean as a Solution to Climate Change: Five Opportunities for Action. World Resources Institute. https://doi.org/10.46830/wrirpt.19.0042
50. Horta eC et al (2025) Marine protected areas stage of establishment and level of protection are good predictors of their conservation outcomes. Cell Rep Sustain. https://doi.org/10.1016/j.crsus.2025.100345
51. Jankowska et al (2022) Climate benefits from establishing marine protected areas targeted at blue carbon solutions. PNAS. https://doi.org/10.1073/pnas.2121705119
52. Jentoft et al (2022) Blue justice: distributing benefits and burdens in the blue economy. Maritime Stud. https://doi.org/10.1007/s40152-021-00243-0
53. Jones (2024) Incentive diversity is key to the more effective and equitable governance of marine protected areas. Front Mar Sci. https://doi.org/10.3389/fmars.2024.1412654
54. Jupiter et al (2014) Locally-managed marine areas: multiple objectives and diverse strategies. Pac Conserv Biology. https://doi.org/10.1071/PC140017
55. Kashwan et al (2021) From racialized neocolonial global conservation to an inclusive and regenerative conservation. https://doi.org/10.1080/00139157.2021.1924574. Environment
56. Keen et al (2018) A 'Blue Economy' for the Pacific: more ocean, more problems? Pac Rev. https://doi.org/10.1080/09512748.2017.1308885
57. Koester et al (2024) Analyzing global utilization and missed opportunities in debt-for-nature swaps with generative AI. Front Environ Sci. https://doi.org/10.3389/fenvs.2024.1342446
58. Lau et al (2021) Environmental justice in coastal systems: Perspectives from communities confronting change. https://doi.org/10.1016/j.gloenvcha.2020.102208. Global Environmental Change

59. Lester et al (2009) Biological effects within no-take marine reserves: a global synthesis. https://doi.org/10.3354/meps07842. Marine Ecology Progress Series
60. Li et al (2023) Challenges to implementing the Kunming-Montreal global biodiversity framework. Land. https://doi.org/10.3390/land12112166
61. Liu et al (2024) Implementing the debt-for-nature swaps for marine protected areas: case studies from Seychelles and Belize. https://doi.org/10.1057/s41599-024-02855-3. Humanities and Social Sciences Communications
62. Lovelock & Duarte (2019) Dimensions of Blue Carbon and emerging perspectives. Biol Lett. https://doi.org/10.1098/rsbl.2018.0781
63. Lubchenco & Grorud-Colvert (2015) Making waves: The science and politics of ocean protection. Science. https://doi.org/10.1126/science.aad5443
64. Macreadie et al (2022) Blue carbon as a natural climate solution. Nat Reviews Earth Environ. https://doi.org/10.1038/s43017-021-00224-1
65. Martin et al (2019) Justice and conservation: The need to incorporate recognition. Biol Conserv. https://doi.org/10.1016/j.biocon.2019.07.035
66. Mast et al (2025) Shared governance increases marine protected area effectiveness. PLoS ONE. https://doi.org/10.1371/journal.pone.0315896
67. Mellin et al (2016) Effectiveness of protected areas in conserving tropical freshwater fishes. Conserv Biol. https://doi.org/10.1111/cobi.12597
68. Muench et al (2025) Attracting More Capital for Biodiversity Finance: The Case of Debt-for-Nature Instruments. https://doi.org/10.3390/su17041480. Sustainability
69. OECD (2025) Promoting Sustainable Ocean Economies: Guidance for Development Co-operation. OECD Publishing. https://doi.org/10.1787/72055d7f-en
70. Oldekop et al (2016) A global assessment of the social and conservation outcomes of protected areas. Conserv Biol. https://doi.org/10.1111/cobi.12568
71. Palacios-Abrantes et al (2024) Blueprint for Blue Carbon: Lessons from Seychelles for Small Island States. https://doi.org/10.3390/oceans5010006. Oceans
72. Patil et al (2016) Toward a Blue Economy: A Promise for Sustainable Growth in the Caribbean. World Bank. https://doi.org/10.1596/25061
73. Pike et al (2024) Ocean protection quality is lagging behind quantity. Conserv Lett. https://doi.org/10.1111/conl.13020
74. Queiros et al (2019) Connected macroalgal-sediment systems: blue carbon and food webs in the deep ocean. Ecol Monogr. https://doi.org/10.1002/ecm.1366
75. Bhat (2009) Financing marine protected areas in Jamaica: an exploratory study. Mar Policy. https://doi.org/10.1016/j.marpol.2008.05.004
76. Relano & Pauly (2023) A global assessment of the ecological effectiveness of marine protected areas. Ocean Coastal Manage. https://doi.org/10.1016/j.ocecoaman.2023.106560

77. Roberts et al (2017) Marine reserves can mitigate and promote adaptation to climate change. PNAS. https://doi.org/10.1073/pnas.1701262114
78. Sala et al (2013) A general business model for marine reserves. PLoS ONE. https://doi.org/10.1371/journal.pone.0058799
79. Sala et al (2021) Protecting the global ocean for biodiversity, food and climate. Nature. https://doi.org/10.1038/s41586-021-03371-z
80. Schleicher et al (2019) Protecting half of the planet could directly affect over one billion people. Nat Sustain. https://doi.org/10.1038/s41893-019-0423-y
81. Schultz et al (2022) A framework to identify barriers and levers to increase the levels of protection of marine protected areas. One Earth. https://doi.org/10.1016/j.oneear.2022.08.007
82. Secretariat of the CBD (2022) Kunming-Montreal Global Biodiversity Framework. Convention on Biological Diversity. [Policy Document]
83. Silver et al (2015) Blue economy and competing discourses in international oceans governance. J Environ Dev. https://doi.org/10.1177/1070496515580797
84. Sowman & Sunde (2018) Social impacts of marine protected areas in South Africa on coastal fishing communities. Ocean Coastal Manage. https://doi.org/10.1016/j.ocecoaman.2018.10.002
85. Spalding et al (2017) Mapping the global value and distribution of coral reef tourism. Mar Policy. https://doi.org/10.1016/j.marpol.2017.05.014
86. Springer et al (2023) Why human rights matter for marine conservation. Front Mar Sci. https://doi.org/10.3389/fmars.2023.1089154
87. Sterling et al (2017) Advancing human well-being and equity in social-ecological research. Curr Opin Environ Sustain. https://doi.org/10.1016/j.cosust.2017.06.008
88. Sumaila et al (2021) Financing a sustainable ocean economy. Nat Commun. https://doi.org/10.1038/s41467-021-23168-y
89. Sunde (2021) Fishing rights, human rights, ocean justice: The case of small-scale fishers in South Africa. Maritime Stud. https://doi.org/10.1007/s40152-021-00214-5
90. Teh et al (2023) Closing the gap between ambition and action in biodiversity conservation. Biol Conserv. https://doi.org/10.1016/j.biocon.2023.110011
91. Thomas (2022) Valuing the contribution of blue carbon to small island developing states' climate change commitments and Covid-19 recovery. Environmental Science & Policy. https://doi.org/10.1016/j.envsci.2022.01.007
92. Thur (2010) User fees as sustainable financing mechanisms for marine protected areas: an application to the Bonaire National Marine Park. https://doi.org/10.1016/j.marpol.2009.09.001. Marine Policy
93. Vierros et al (2020) Considering indigenous peoples and local communities in governance of the global ocean commons. Mar Policy. https://doi.org/10.1016/j.marpol.2020.104075
94. Voyer et al (2018) Shades of blue: what do competing interpretations of the Blue Economy mean for oceans governance? J Environ Planning Policy Manage.

https://doi.org/10.1080/1523908X.2018.1473153

95. Voyer et al (2021) How blue is the Blue Economy? Overseas development assistance flows to ocean sectors in Pacific Island Countries. Mar Policy. https://doi.org/10.1016/j.marpol.2021.104706
96. Walsh et al (2021) Funding the Big Blue: Offshore and High Seas Marine Protected Area Finance. The Pew Charitable Trusts. [Grey Literature]
97. Wang et al (2025) How blue carbon financing can sustain blue carbon ecosystems protection and restoration: A proposed conceptual framework. Ocean Coastal Manage. https://doi.org/10.1016/j.ocecoaman.2025.107301
98. Whyte (2020) Against crisis epistemology. Handbook of Critical Indigenous Studies. https://doi.org/10.4324/9780429440236-13
99. Zhao, Costello (2025) Ecologically representative Marine Protected Area planning can think globally and act locally. Trends Ecol Evol. https://doi.org/10.1016/j.tree.2025.05.007
100. Zupan et al (2018) Marine partially protected areas: drivers of ecological effectiveness. Front Ecol Environ. https://doi.org/10.1002/fee.1823